

HOW IS AN IT INNOVATION ASSIMILATED

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Abstract: The concept of organizational assimilation of information technology (IT) innovations is under-explored in the research literature. Here we rethink the concept, focusing on assimilation in use, in particular. Taking an organizational learning perspective, we propose that experimentation in use serves as the assimilative engine, driving the innovation's interpretation and routinization, leading in turn to its eventual conceptual sublimation and taken-for-grantedness. From this model, several new opportunities for research are identified.

1. INTRODUCTION

Innovating with information technology (IT) has in the last decade become a popular research subject (see, e.g. Fichman, 2000; Gallivan, 2001). Studies have been particularly inspired by the broader literature on innovation diffusion, with its focus on early versus late adoption (Rogers, 1995). Among practitioners, firms that adopt an IT innovation earlier than others are characteristically viewed as the more "innovative," earning admiration where they are successful. Research has understandably sought to explain what enables firms to become innovators and early adopters of IT (see, e.g., Cooper and Zmud, 1990; Grover and Goslar, 1993; Grover, et al, 1997; Kauffman, et al, 2000).

But while important, research focused on the IT adoption decision can be myopic. In innovating with IT, mere adoption does not get it done. More specifically, IT implementation is characteristically problematic (Lucas, 1981; Markus, 1983; Swanson, 1988; Klein and Sorra, 1996). Accordingly, research has also sought to assess what enables firms to be successful in their IT implementations (see, e.g., Leonard-Barton and Deschamps, 1988; Orlikowski, 1993; Fichman and Kemerer, 1997). Whether earlier or later

adopters will find implementation to be easier has been raised as an interesting research question, for instance (Swanson, 2003). And so the research literatures on IT innovation and implementation, each with their separate histories, have also been cobbled together (Kwon and Zmud, 1987).

Beyond implementation, the IT innovation literature has yet to achieve a coherent focus, even though important research has been done (see, e.g. DeSanctis and Poole, 1994; Tyre and Orlikowski, 1994; Orlikowski, 1996; Orlikowski, 2000; Majchrzak, et al, 2000). Successful implementation has remained the primary dependent variable of research interest, although Zmud and colleagues have identified additional stages to the process that commence with IT innovation in *use*, specifically, those of adaptation, acceptance, routinization, and infusion (Kwon and Zmud, 1987; Cooper and Zmud, 1990; Zmud and Apple, 1992; Saga and Zmud, 1994). More recently, researchers have addressed the organizational *assimilation* of IT innovations, a concept given broad and various interpretations, as we shall see. In principal, one would think that assimilation of IT innovations would be understood to result substantially from their use, but this notion has been little engaged, notwithstanding substantial evidence of assimilative problems subsequent to implementation with innovations such as ERP (Ross, 1999; Markus and Tannis, 2000).¹

In the present paper, we reconsider the question of how an IT innovation comes to be organizationally assimilated. Taking an organizational learning perspective (Levitt and March, 1988; Huber, 1991; Crossan, et al, 1999; Robey, et al, 2000), we examine IT innovation assimilation in use, in particular. We begin in the next section with a brief review of the key research literature. We then introduce a framework within which we identify the “learning mechanism” underlying IT innovation assimilation. We follow with an extended discussion. Our broad purpose is to provide a new focus for research into IT innovation beyond implementation, in the context of use, rather than prior to use, where past research has mostly focused.

2. LITERATURE DEFINITIONS

The concept of organizational assimilation of an IT innovation is under-explored in the research literature, even while it has attained some

¹ Ross (1999) observes that business performance often dips when ERP is first implemented. The performance improvements promised by ERP are usually achieved only with considerable time and effort.

prominence. Table 1 summarizes articles that have featured the concept (in their titles). From these, we can identify several strands of interpretation.

Table 1. Organizational Assimilation of Innovations as Defined in Literature

Article	Assimilation Definition	Remarks
Meyer and Goes (1988)	“Assimilation is defined here as an organizational process that (1) is set in motion when individual members first hear of an innovation’s development, (2) can lead to the acquisition of the innovation, and (3) sometimes comes to fruition in the innovation’s full acceptance, utilization and institutionalization.” (p. 897)	Decision-making stages in assimilation of medical innovations include: knowledge-awareness (apprehension, consideration, discussion), evaluation-choice (acquisition proposal, medical-fiscal evaluation, political-strategic evaluation), adoption-implementation (trial, acceptance, expansion). The assimilation of 12 innovations by 25 hospitals is studied.
Agarwal, Tanniru, and Wilemon (1997)	“...adoption connotes the development of the ‘first’ successful system using a new information processing technology, while diffusion is concerned with a transfer of this success to other relevant applications, i.e., the spread of the innovation through the target system. The term assimilation is used to refer collectively to both the adoption and diffusion phases of innovation.” (p. 347)	“Generic” assimilation strategies include: support, advocacy, total commitment. Experiences of several organizations are described.
Fichman and Kemerer (1997)	“Following Meyer and Goes (1988), assimilation is defined as the process spanning from an organization’s first awareness of an innovation to, potentially, acquisition and widespread deployment.” (p. 1346)	Describes the assimilation of object-oriented programming languages (OOPs) by 608 IT organizations. Employs a six-stage model of software process innovation: awareness, interest, evaluation/trial, commitment, limited deployment, general deployment. Theory draws from Attewell(1992).
Armstrong and Sambamurthy (1999)	“...we define IT assimilation as the effective application of IT in supporting, shaping, and enabling firms’ business strategies and value-chain activities.” (p. 306)	Surveys business executives from 153 companies as to their self-rated performance in applying IT to logistics, marketing, and business

Article	Assimilation Definition	Remarks
Fichman and Kemerer (1999)	“For this study we define the assimilation gap as the difference between the pattern of cumulative acquisitions and cumulative deployments of an innovation across a population of potential adopters. Although this definition is made in reference to two particular events- acquisition and deployment- in principle, any two assimilation events could be used to define an assimilation gap...” (p. 258)	strategies. IT infusion and routinization are presumed, rather than directly assessed.
Fichman (2000)	“Diffusion is the process by which a technology spreads across a population of organizations, while assimilation refers to the process within organizations stretching from initial awareness of the innovation, to potentially, formal adoption and full scale deployment.” (p. ?)	Follows Fichman and Kemerer (1997). Compares assimilation gaps for three software process innovations: relational database management systems (RDBs), general purpose fourth generation languages (4GLs), and computer aided software engineering tools (CASE), finding a pronounced gap for CASE.
Gallivan (2001)	“Once secondary use occurs, it is meaningful to consider the organization’s assimilation stage. (This) describes how deeply the innovation penetrates the adopting unit (e.g., the company, division, or workgroup).” (p. 62)	Provides an overview of basic concepts, theories and research concerned with IT innovation diffusion and assimilation. See too Fichman and Kemerer (1997, 1999). Substantial review. Drawing from Cooper and Zmud (1990), assimilation includes: initiation, adoption, adaptation, acceptance, routinization, and infusion (extended use, integrative use, and emergent use).
Purvis, Sambamurthy, and Zmud (2001)	“Assimilation is defined as the extent to which the use of the technology diffuses across the organizational projects or work processes and becomes routinized in the activities of those projects and processes.” (P. 121)	Surveys organizational assimilation of CASE tools. Examines effects of management championship and knowledge embeddedness within CASE platform. Routinization not directly assessed.
Cho and Kim (2001-2002)	“Assimilation of innovation is the process spanning from an organization’s first awareness of an innovation to its potential acquisition and widespread deployment. The process consists of awareness, interest, evaluation, trial, commitment, and finally, deployment of the new technology.” (p. 133)	Relies upon Fichman and Kemerer (1997). Surveys object-oriented programming language assimilation in 220 Korean firms.

The leading interpretation stems from the research of Meyer and Goes (1988), and may be characterized as *extensive* over the organization's innovation life cycle. Assimilation begins with first awareness, well before adoption, while it "comes to fruition" with "full acceptance, utilization and institutionalization." The work of Fichman and Kemerer (1997, 1999) follows this interpretation, although it takes a more *abbreviated* view, with assimilation culminating in the innovation's "full scale deployment" (Fichman, 2000). Absent here is any notion of assimilation in use. Cho and Kim (2001-2002) follow the Fichman interpretation.

Agarwal, Tanniru, and Wilemon (1997) take a different view, offering a *strategic* interpretation of assimilation as purposeful organizational action. Here the focus is on "transfer," or facilitating adoption and diffusion among sub-units within the firm. The innovation's assimilation is essentially "pushed" by management, and leadership is a key research focus² Again, there is little notion of assimilation in use.

Armstrong and Sambamurthy (1999) offer what might be termed a *value-added* perspective of assimilation. Emphasis is placed on achieving business value from the innovation. According to the authors, this requires that the "implicit functionality" of the IT innovation be "assimilated within the ongoing actions of individuals and teams." Here, assimilation in use is clearly suggested. However, it is arguably also conflated with achieving successful business outcomes.

Purvis, Sambamurthy, and Zmud (2001) more directly address assimilation in use. Their definition incorporates both the spread of use (internal "diffusion") within the enterprise, as well as routinization of this use. However, their study of CASE tool assimilation focuses more on the former than the latter. They define assimilation operationally as "the proportion of an organization's systems development projects where the technology is being used to support systems development work activities." (p. 121)

Gallivan (2001) attempts a theoretical synthesis. Organizational assimilation is conceived as stemming substantially from individual ("secondary") use. Assimilative stages go beyond initiation and adoption ("early stages") to include adaptation, acceptance, routinization, and infusion ("later stages"), as suggested by Cooper and Zmud (1990). The notion of *infusion* (Cooper and Zmud, 1990) refers to the elaborated use of an

² See also Martinsons and Schindler (1995) who argue, "Inspirational leadership and a needs-driven organizational vision are crucial for the effective assimilation of a new or emerging technology" (from the abstract). For additional perspectives on IT transfer, see McMaster, et al (1997).

innovation, whereby the innovation is increasingly embedded in the organization's work and managerial systems (Zmud and Apple, 1992). But Gallivan's detailed model does not differentiate analytically among the later assimilative stages.³

In sum, while the notion of assimilating an IT innovation has been featured in the literature, interpretations have varied. While organizational learning is arguably a theme in these interpretations, it has received little explication. Most importantly, assimilation *in use* has received surprisingly little attention. Here we lack integrative theory and studies of the assimilative and learning mechanism. In the next section, we take up the question of how through learning an IT innovation comes to be assimilated in its use.

3. RETHINKING THE CONCEPT

The term "assimilate," from its definitional roots, suggests that something is taken in and absorbed by a system, such that it is no longer distinct from it (i.e. dissimilar to it).⁴ We shall want to rethink the concept of assimilating IT in these terms. The "something" assimilated will be the IT innovation. The "system" absorbing it will be the organization and its work systems. Our premise will be that the innovation process is purposeful. The firm's work systems are to be renewed by the IT innovation, such that they better serve the enterprise. Once assimilated, the IT innovation is no longer distinct as such from the work systems. It becomes "taken for granted" in practice. However, the renewed work systems are likely to be (indeed, are usually intended to be) discernibly altered. In the extreme, the work systems may be *transformed* (Orlikowski, 1996; Robey and Sahay, 1996).⁵

The process by which the IT innovation is absorbed by an organization's work systems may be characterized as one of *organizational learning*, in particular, *by doing* (Levitt and March, 1988). Basically, the organization

³ Cooper and Zmud's (1990) rationale for these stages (adapted from Kwon and Zmud, 1987) is founded on Lewin's (1952) classic change model. Thus interpreted, assimilation would presumably conclude with the "refreezing" of changed organizational processes.

⁴ See, e.g., Webster's 3rd New Int. Dictionary. The term "assimilate" is widely applied, e.g. to the incorporation or conversion of nutrients by plants and animals, to the adaptation of adjacent sounds in spoken languages, and to the absorption of one social culture by another.

⁵ We thus allow for innovations that may be either incremental or radical in their effects (Dewar and Dutton, 1986; Orlikowski, 1993). Whatever old competencies are to be displaced, we presume that new competencies are intended to be superior.

innovates so as to attain new capabilities, embodied in new *routines* (Nelson and Winter, 1982). Such capabilities can't simply be bought in the marketplace. Rather, each firm has some *absorptive capacity* for new capabilities, which is largely a function of its prior related knowledge (Cohen and Levinthal, 1990). Many IT innovations are made popular by *organizing visions* that describe what the innovation is all about and what it is good for (Swanson and Ramiller, 1997), but while widespread adoption may be motivated by these visions, implementation and organizational assimilation can be highly problematic (Attewell, 1992). Here each firm in achieving its new capabilities must inevitably rely heavily upon its own resources, even while it may draw from the expertise of intermediaries such as vendors and consultants.

But how in such circumstances will learning actually occur? Beyond implementation, how are IT innovations assimilated *in use*, in particular, such that new capabilities are achieved?⁶ Drawing from a long tradition suggesting that *attention* is fundamental to organizational behavior (Simon, 1947; Cyert and March, 1963; Nelson and Winter, 1982; Ocasio, 1997), we propose that an analysis of work-situated *attention to the innovation* provides insights as shown in Figure 1. Here a two-dimensional framework is suggested. On one dimension we distinguish between attention to the innovative concept (in coordinative communication) and attention to the innovative practice (in performance of the task). That is, we distinguish between attention to saying and attention to doing where innovative work is concerned.⁷ We are inspired here by Weick's (1995) work on organizational sensemaking, whereby firms and their decision makers are theorized to learn by making retrospective sense of their collective actions (see too Weick and Roberts, 1993). In the same vein, we argue that attention to the innovative concept is motivated largely by attention to the innovative practice, where organizational *learning with use* is concerned. In achieving new

⁶ Robey, et al (2002), provide an illustrative study focusing on ERP implementation, as distinct from use. They report, "Assimilation was a challenge not only for users, but also for core team members and other stakeholders such as customers. Before users could use an ERP system effectively, they needed to learn the business processes that were revised following system implementation. Firms addressed the need for users to learn new systems by providing *formal training* for users and by taking an *incremental approach* to systems implementation." (p. 32) In the present paper, by focusing on use, we seek to get *beyond* such an implementation perspective.

⁷ Both communication and task performance are regarded to be forms of action. Because task performance is typically a social activity, it is often accompanied by, indeed, often requires, communication. While certain of this communication may be integral to "doing", other will serve the broader role of organizational sensemaking (Weick, 1995) and management of the coordinative task apart from its direct performance.

organizational capabilities, what the firm knows how to *do* is what is of central discursive concern.

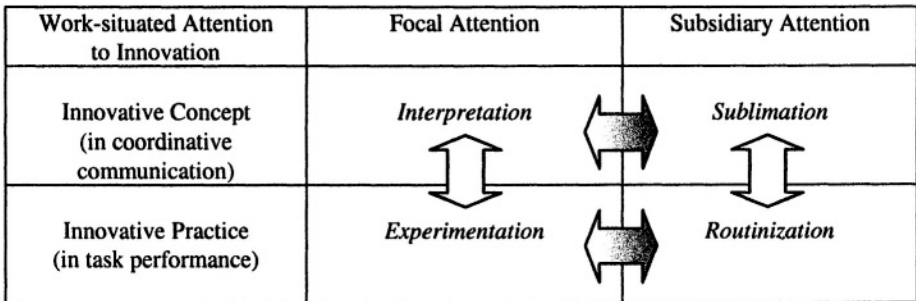


Figure 1. How are IT Innovations Assimilated in Use?

Notes: Double-headed arrows indicate dual relationships. Shaded arrow-heads indicate primary assimilative direction over time, with subsidiary attention gradually displacing focal attention.

On the framework's other dimension, we distinguish between focal attention and subsidiary attention, as suggested originally by Polanyi (1958).⁸ By focal attention, we mean conscious attention as commonly understood.⁹ By subsidiary attention, we mean attention, conscious or not, to certain *means* for achieving focal attentive *ends*. Such means are characteristically attended to as extensions to the purposeful individual, as Polanyi (1958, p. 59) beautifully describes:

“Our subsidiary awareness of tools and probes can be regarded ...as the act of making them form a part of our own body. The way we use a hammer or a blind man uses his stick, shows in fact that in both cases we shift outwards the points at which we make contact with the things that we observe as objects outside ourselves. While we rely on a tool or probe, these are not handled as external objects. We may test the tool for its effectiveness or the probe for its suitability, e.g. in discerning the hidden details of a cavity, but the tool and the probe can never lie in the field of these operations; they remain necessarily on our side of it, forming part of ourselves, the operating persons. We pour ourselves out

⁸ Polanyi (1958) uses the terms “focal awareness” and “subsidiary awareness” in introducing the basic theoretical distinction (p. 55). However, he also refers in subsequent discussion to “focal attention” and “attending subsidiarily.” We will presume that in interchanging these terms, he means that awareness of a kind requires equivalent attention.

⁹ Ocasio (1997, p. 187) quotes James (1890, pp. 403-404): “Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others ...”

into them and assimilate them as parts of our own existence. We accept them existentially by dwelling in them.”

Extrapolating from this notion, we shall be interested here in the focal and subsidiary attention given to an innovation by a purposeful organization. Following Occasio (1997), we define organizational attention to be the socially structured pattern of attention by the organization’s decision makers. Such attention is collectively focused, contextually situated, and structurally distributed according to the firm’s rules, resources, and social relationships (Occasio, 1997, p. 188). Where organizational innovation is concerned, we argue that focal and subsidiary attention are directed both to the innovative concept and to the innovative practice.

From an organizational learning perspective, four processes are suggested to comprise assimilation in use, as mapped in the two-dimensional framework. In *experimentation*, focal attention is given to carrying out the innovative practice, to confirm and discover what works, as part of the practice itself. Trial-and-error experimentation is well understood to be fundamental to learning by direct experience (Levitt and March, 1988; Cyert and March, 1963). In *interpretation*, focal attention is given to the innovative concept, which is shaped, elaborated, and communicated in coordinating the organization’s work. As with experimentation, interpretation of experience is also known to be important to learning, as “people in organizations form interpretations of events and come to classify outcomes as good or bad” (Levitt and March, 1988, p. 323, citing Thompson, 1967). In *routinization*, subsidiary attention displaces focal attention to the innovative technology in practice, now understood from experience to function acceptably (in the absence of new evidence to the contrary). The organization learns from its history, encoding its successful experiments into routines guiding future behavior (Levitt and March, 1988). The IT becomes a tool attended to subsidiarily; as an object it becomes “invisible.”¹⁰ Finally, in what we will term *sublimation*, subsidiary attention displaces focal attention to the innovative concept, now increasingly taken-for-granted and largely subsumed within (and inseparable from) the broader everyday discourse.¹¹ Decision makers speak in terms of the innovation, but largely without being

¹⁰ Weiser (1991, p. 94), in speculating on “ubiquitous computing,” remarks, “The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.”

¹¹ The root notion of sublimation involves the conversion of something base (here the innovative concept) into something of higher worth (here the notion of the broader enterprise).

aware of it. The organization's cognitive resources are freed to be directed to learning elsewhere, completing the assimilative process.

A basic dynamic to assimilation in use is therefore suggested (note the arrows in Figure 1). Learning in use is posited to arise most fundamentally through experimentation, undertaken out of necessity to perform the unroutinized task. Experimentation in turn motivates interpretation and provides the basis for eventual routinization. It drives the assimilative process; it serves as its engine. When the need for experimentation diminishes, so does the need for related interpretation. The need for routinization continues, but now to reinforce what has already been learned. Learning in use is "completed" with sublimation, absent further interpretation, but present the continually reinforced routine, every execution of which reinforces the institutional order (Barley and Tolbert, 1997). Through sublimation, the innovation becomes "taken for granted" in discourse. Notwithstanding this overall pattern, there are dual effects (feedback) among the processes as shown in Figure 1. In particular, ongoing experimentation may be guided by the interpretation of outcomes as well as by failures in routinization. The four processes may all be active at any one time, in particular, where the innovation has been implemented in stages, to provide for gradual infusion more easily assimilated over time (as illustrated by an ERP system implemented by stages according to functional modules and/or organizational sites, to control the depth and/or breadth of the system's infusion).

Broadly, then, we conceive assimilation in use over time to involve ongoing communicative sensemaking from the innovative practice (as indicated by the upward pointing arrow-heads in Figure 1), as well as the gradual displacement of focal attention by subsidiary attention to the innovation (as indicated by the shaded rightward pointing arrow-heads in Figure 1).

4. DISCUSSION

In this section, we elaborate briefly on our learning model of IT assimilation in use. As a reminder, we assume that the firm has already adopted and implemented (at least in usable part) the IT innovation. The technology has been deployed. Users have been trained. A "switch" has been thrown and the firm is now "live" with its newly IT-supported work practices. Whatever assimilation has already taken place in the firm's adoption and implementation of the IT innovation (and there may have been

extensive and elaborate preparations), the assimilative focus turns now to everyday hands-on use.¹²

We revisit each of the component processes identified in our model as shown in Figure 1. We discuss each in further detail and illustrate our points by drawing from the existing research literature.

4.1 Experimentation

As already mentioned, our model is anchored in a learning-by-doing perspective. The assimilative process (in use) originates with focal attention given to carrying out the innovative practice. We term this activity “experimentation,” recognizing that initially upon implementation the organization can’t be said to have effective knowledge of the new practice, i.e., knowledge confirmed through experience.¹³ Until the firm executes the practice and discovers that it functions satisfactorily, every task action constitutes a kind of experiment. It calls for focal attention to following a particular new procedure, for instance. Or, it requires conscious improvisation in the absence of such a procedure. Essentially, every task performance is ungoverned by an organizational routine (Pentland and Reuter, 1994). It is an experiment that can go well as intended (the outcomes will after all be “for keeps”), or badly, but, either way, the firm learns from it.¹⁴

In the long run, we note, experimentation will lead to *adaptation* of the innovation to the enterprise (Leonard-Barton, 1988; Tyre and Orlikowski, 1994). That is, the learned work practice as a set of routines will come to be specific to the organization in certain important aspects. No two firms will undertake the same sequence of experiments. They will take different *experimental paths*. Regardless of their implementation approaches, no two

¹² Again, implementation activities may not be complete even as everyday use begins. Implementation may be ongoing, in particular, where it has been staged, or where the IT undergoes subsequent improvement (see, e.g., Kling and Iacono, 1984), even in “maintenance” (see, e.g., Hirt and Swanson, 2001). Too, should things go very badly in use, even the adoption decision may come to be reconsidered. In sum, assimilation in use does not imply that other innovation activities have ended (Swanson, 2003).

¹³ Obviously, much may be learned about the IT innovation prior to assimilation in use, especially in the course of implementation, where more formal testing and experimentation may be undertaken, without risks to organizational outcomes. But, we suggest, no amount of such testing and training substitutes for the learning that inevitably takes place when the firm goes live with its system and organizational actions are “for keeps.”

¹⁴ Such learning can in part be superstitious; that is, the inferred connections between actions and outcomes can be mis-specified (Levitt and March, 1988).

firms will discover the identical functionality in the innovation. They will learn differently from their usage experiences. Thus, while two firms may become more similar to each other by adopting the same innovation (reflecting mimetic isomorphism as described by DiMaggio and Powell, 1983), in their assimilations of the innovation they are likely to again become different (although not so different as before).

Similarly, it is through experimentation that the innovation is likely to be *reinvented* (Rice and Rogers, 1980), for example, through the discovery of unanticipated uses. While some of these uses may be specific to the firm, others may prove to be widely imitable. Beyond such new “features,” certain “work-arounds,” initially devised to cope with problematic aspects of the innovation, may come to be essential to the learned work practice (Gasser, 1986). Broadly, such adaptations may occur entirely in the context of use, or they may feed back into continued development of the technology, suggesting the provisioning of new features. They will also motivate the innovation’s interpretation among participants, to be discussed below.

Experimentation can also contribute to the innovation’s *infusion*, where increasingly sophisticated use is made of the new IT, with new functionality often introduced in stages (Cooper and Zmud, 1990). Achieving this desired usage requires experimental initiatives, not just advanced training. But experimentation is also effortful and may wane prematurely, leaving the new IT under-explored and the firm’s routines much the same as before. The more advanced features of the new IT may not be used at all and the firm may find itself simply “paving over the cow-paths,” rather than purposefully changing its work practices. For the innovation’s benefits to be achieved, the firm may need to push on the experimental frontier, so as to engage and leverage the full functionality offered by the new IT.

4.2 Interpretation

In interpretation, the firm gives focal attention to the innovative concept in its coordinative communications, a process that originates long before the firm puts the innovation to use. Indeed, the firm’s initial encounter with an IT innovation is likely to be an interpretive one, as it attempts to grasp the associated organizing vision (Ramiller and Swanson, 2003). Similarly, in choosing to adopt the innovation, the firm typically articulates the know-why for its decision, making a further interpretive effort (Swanson, 2003). This know-why is further reconstructed and reinterpreted as the firm moves forward, first in implementation, then in use, where the innovative benefits are presumably to be found. The firm asks again, “Why are we doing this? Where are the benefits?”

Once the IT innovation is put to use, its interpretation is substantially driven by the experimentation described above. As the firm experiments, it interprets and evaluates outcomes. It organizes itself and initiates coordinative activities, both formal and informal, to bridge interpretive gaps. It establishes cross-functional teams and liaison roles. It engages in coordinative meetings of all kinds. It undertakes progress reporting, policy setting, information dissemination, and propagandizing on behalf of the innovation. All of this serves the interpretive and coordinative effort and aids the firm in dealing with the uncertainties of its experimentation.

Broadly, the identification of successful outcomes also reshapes the notion of the innovation and what it is good for, in a way more specific to the firm. As a concept, the innovation is not reinvented through experimentation alone, as described above, but by the closely linked interpretive process. Thus, two firms that have made substantial use of the “same” innovation, having taken different experimental paths, are likely to arrive at somewhat different notions of what the innovation is in practice all about. In some cases, through professional interactions, these interpretations may come to influence the broader community’s notion of the organizing vision.

For the firm itself, interpretation will also be important to the innovation’s local *institutionalization* (Scott, 1995).¹⁵ The prevailing institutional order will of course strongly condition this discourse. Even ostensibly radical interpretations may be couched so as to reproduce this order. Scripted patterns of interaction can therefore persist, notwithstanding change rhetoric suggesting otherwise. Still, in some instances, institutional change may be entertained. Organizational members may seek to make changes in their scripts (Barley and Tolbert, 1997). They may choose to interpret the innovation as altering the organization’s status quo, and argue that a new context for action prevails. Thus, while the discourse itself reflects current institutional arrangements, it is also the occasion for renegotiating these arrangements. The firm that has implemented an ERP system, for instance, may struggle to achieve improved cross-functional coordination, breaking down the authority structure of its old functional “silos” (Davenport, 1998). Much talk, reflective of different contesting interests, may be expended toward this end.

¹⁵ We understand institutionalization to take place simultaneously both within the enterprise, i.e. “locally,” and more broadly among firms, i.e. “globally.” The former is substantially shaped by the latter, especially to the extent the innovation is widely diffused (Tolbert and Zucker, 1983). Even so, local institutionalization will reflect firm-specific regulative, normative, and cognitive forces (Scott, 1995).

4.3 Routinization

As firms carry out task experiments as described above, they will gradually encode their successful performances into organizational routines. That is, they will gradually identify sets of possible performances governing organizational tasks, where individual actors know what “moves” they can make (Pentland and Reuter, 1994). The new IT will over time pose fewer puzzles in this respect. Attention to the IT innovation will be increasingly undifferentiated from attention to the routines and their moves; it will be increasingly subsidiary to the focal routines.

Routinization describes not only the initial encoding process for the production of new organizational routines; it describes too how organizational routines are maintained, namely through their repeated execution. What the firm knows how to do via its routines, it “remembers” only by executing the routines again and again. The firm’s routines are much like their employees’ skills; both routines and skills can become rusty and both are honed primarily in repeated execution (Nelson and Winter, 1982). Both are also associated with the building of tacit knowledge into the firm’s capabilities.

Routinization will thus also be the basis for performance improvements in task execution, likely to be necessary to achieving the innovation’s promise. With repeated executions, the firm comes up the “learning curve” associated with the innovation. It becomes more efficient and wastes less of its efforts. It achieves the desired “continuous improvement” in this regard. Routinization thus incorporates further learning (Feldman and Pentland, 2003). However many times a task has been executed, improvisation under the governing routine may be needed the next time around. Small experiments are likely to persist.¹⁶

Finally, routinization does not necessarily mean that task performances meet nominal standards (set by management or process engineers). Rather, it is likely to reflect a “stable accommodation between the requirements of organizational functioning and the motivations of all organization members” (Nelson and Winter, 1982, p. 108). In short, the firm’s routines rest upon a political resolution of multiple interests. Moreover, every performance of the routine tends to re-affirm this resolution. Routinization thus supports the normative and regulative aspects of institutionalization (Scott, 1995).

¹⁶ Small experiments under a governing routine are very different, we suggest, from experimentation in the absence of a governing routine.

4.4 Sublimation

As experimentation and novel outcomes wane, so too does the interpretation effort. Routinization takes over, and focal attention is displaced by subsidiary attention to the innovation. The firm now makes “sense” of the innovation by turning its terminology to other interpretive ends. The innovation is not so much absent as it is “sublimated” in the broader organizational discourse. Focal discursive attention is directed elsewhere, as the IT innovation becomes taken-for-granted, even while its terminology lingers, invoked in subsidiary roles. Much like the new IT becomes “invisible” as a tool in the innovative practice, it becomes “invisible” as an idea in coordinative communication. Organizational members “speak the language of ERP,” for instance, in their local dialect, without focusing on ERP as such.¹⁷

The IT innovation is now *accepted* in that political resolution of multiple interests is reflected in the innovation’s routinization as just described.¹⁸ The innovation is itself no longer a focus of contending interests in the firm’s discourse. To the extent that problems persist, they are likely to bubble up elsewhere. Thus, for example, where an IT innovation leads to certain deskilling, while this issue may be resolved in this context, it may surface in another guise elsewhere in the firm’s labor relations.

Because organizational discourse no longer focuses on the IT innovation as such, the firm’s verbal memory of it is likely to atrophy. At the same time, certain stories associated with the innovation may take hold and be passed along over the years, entering into the firm’s *mythology*. The organizational lessons drawn from these stories may serve as reminders of the firm’s assimilative struggles.

¹⁷ To illustrate further, advocates for CRM (Customer Relationship Management) foresee the day when “CRM will take its place in mainstream American business and will be practiced as seriously as financial management.” (Dver, 2003, p. 64) In this circumstance, the language of CRM would be identifiable, but would blend with that of management more broadly. In our terms, the CRM concept would be sublimated to the extent it permeated the broader discourse, without calling special attention to itself.

¹⁸ The traditional literature on user acceptance of IT takes individual, voluntary use to be definitive of acceptance (Venkatesh, et al, 2003). We make no such assumption. Rather, we take usage of the IT as the context within which to evaluate acceptance.

5. CONCLUSION

To summarize, we have argued in this paper that IT innovations are assimilated substantially in their use, beyond their implementation. The current literature on IT innovation assimilation has until now had relatively little to say about this. Here we have sought to open some new doors. Taking an organizational learning perspective, we have introduced a framework that suggests the particular mechanism by which an IT innovation is assimilated in use. In our discussion, we have sought to tie this notion back to related concepts and research results reported elsewhere in the literature.

Several opportunities for future research may be identified. These include, first of all, longitudinal case studies of IT assimilation in use within enterprises, to further explore the assimilation mechanism suggested here. Of particular interest would be studies that illuminate experimentation and its role in facilitating the innovation's routinization. We have argued here that experimentation is crucial to the establishment of routines, and thereby to assimilative outcomes, but it remains to subject this notion to careful empirical examination.

Of equal interest would be case studies that focus on the role of interpretation in the firm's assimilative process. Here we have argued that interpretation is fueled substantially by experimentation, but that with routinization, focal attention is displaced by subsidiary attention, enabling the innovation to become taken-for-granted in discourse. Again, this notion requires empirical examination. Opportunities exist, in particular, for situated discourse studies (Phillips and Hardy, 2002) in tandem with observational studies of collective task performance.¹⁹

Comparative case studies of different firms' assimilation of the same IT innovation offer additional research opportunities. Here we note, firms may bring very different strategies, structures, and innovation histories to their assimilations. How do these affect assimilative outcomes? Ocasio (1997) suggests, for instance, that the purposeful organization of communications and procedures can channel decision makers' attention, with important consequences for a firm's learning. How might structural differences of this kind guide or otherwise affect innovation assimilation, in particular?

¹⁹ See Rose and Kraemmergaard (2003) for a study of the discourse in implementing one ERP system. Interestingly, this study includes the period of the system's first use. The authors suggest that the term "implementation" may be inappropriate for large ERP projects; rather the experience is more like a never-ending journey.

Lastly, a few caveats. First, we note that the completion of the firm's assimilative process, as we have described it, should not be conflated or confused with the amount of innovation achieved. Consider, for instance, that two firms may take different assimilative paths with the same innovation, with one firm choosing to transform itself, while the other tailors the innovation more to existing practice. Here both firms may "complete" their assimilations, while achieving very different innovative outcomes.²⁰

We note too that while organizational assimilation of IT innovations may be important to achieving desired outcomes, it is not in itself necessarily a good thing. Organizational learning with new IT may eventually result in the setting of *competency traps* (March, 1981; Levitt and March, 1988) that impede further innovation. Certain of these traps may in effect be technology traps, where the firm is disadvantageously "locked in" to a particular IT solution (Shapiro and Varian, 1999). Finally, the political resolution of different interests achieved through routinization, an essential aspect of assimilation, in our view, does not necessarily advance *social justice*. Thus, the different consequences of IT innovation assimilation are also an important subject of research and critical study.

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²⁰ More broadly, firms may undertake the same innovation, beginning from very different positions, with respect to their capabilities. They may adopt the innovation for different reasons. They may take different approaches to implementation. Their assimilative paths may be different, and, of course, they may achieve very different outcomes. I'm grateful to Ping Wang for this important observation.

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