LEARNING TO BE SITUATED: A THEORY OF PORTABLE INTEGRATION EXPERTISE AND ITS IMPLICATIONS FOR PROCESS KNOWLEDGE MANAGEMENT AND ORGANIZATIONAL FLEXIBILITY

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ABSTRACT

I develop theory about two kinds of individual level integration expertise, portable and local. I discuss the implications of the difference between these kinds of expertise for the management of knowledge in complex integrative processes, and for the development of organizational flexibility. I define portable integration expertise as re-deployable from problem to problem, even though the problems are different, while local expertise is bound to the problem where it develops. I examine the use of high involvement interpersonal integration mechanisms in relation to the development of both kinds of integration expertise. I argue that organizations can manage the development, retention and diffusion of portable integration expertise by adopting a set of management practices that extend beyond the normal information systems base of knowledge management.

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1. INTRODUCTION

In this paper I explore the differences between two types of integration expertise that some people acquire as they participate in complex integrative projects. The important distinction made in this paper is between local and portable integration expertise. Integration expertise at a general level involves process knowledge: knowing how to bring together multiple technologies, practices and points of view into an outcome such as a product or solution. Integration expertise is process expertise: the who, how, where, when and why of 'spatial, temporal, and causal relationships' within integration projects (Dooley , Skilton & Anderson, 1999).[1] <u>Local</u> integration expertise is tied to the project or context in which it develops. In order to be <u>portable</u>, integration expertise must be transferable from project to project. At the same time, expertise cannot be entirely divorced from its contexts, which suggests that awareness of context is a critical element in portable integration expertise. To be portable, integration expertise must include skill in recognizing, navigating and configuring a variety of contexts. Portable integration expertise therefore has a component of explicit 'situatedness' that will be missing from local integration expertise, where the situatedness of integration expertise will be tacit. When integration expertise is local, the expert will not be aware of how his or her expertise is constrained by context. Local expertise views the solution to the specific problem as the end. When expertise is portable, the expert will have an explicit awareness of the structure of context and its relationship to his or her integration expertise. The expert will see how problems and solutions connect, and will explicitly address those interfaces.

I focus on integration expertise because it is critical to organizations competing in fast paced environments. In highly dynamic environments, organizations are likely to confront unexpected, unfamiliar complex problems with greater frequency than they would in more placid times and places (Hitt, Keats & DeMarie, 1998; ; Illinitch, D'Aveni & Lewin, 1996; Sanchez, 1997). Not only do contemporary organizations face hypercompetitive shifts in globalizing product markets, they also face rapid change in changes in capital markets, business models, customer preferences, supplier capabilities, competitor behavior, alternative technologies, human capital and regulation. In order to solve all the different problems arising from such change, both the organization and its people need to be flexible. They should be able to configure and manage a wide variety of problems and integrative solutions. Organizations confronting fast moving environments have begun to move toward flexible forms of organizing that depend on integration expertise rather than routine (Ciborra, 1996; Dougherty, Borelli, Munir & O'Sullivan, 1998; Hitt, et al. 1998 Sanchez, 1997; Volberda, 1996).

Integration expertise is thus central to organizational flexibility. Managing it should be one of the foremost issues for strategic knowledge management when competitive environments are highly dynamic. While process knowledge in many areas is mature (Bohn, 1994; Dooley et al., 1999; Jaikumar & Bohn, 1994), process knowledge in

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[1] In this paper I will use the term 'integration projects' to mean all types of complex, non-routine, multi-party integrative projects and processes.

integration projects is not. By making the distinction between portable and local expertise we move toward understanding and identifying the types of knowledge critical to integration projects. My focus on the unpredictable complex pluralism of integration projects suggests that it will be hard to draw tight domain limits around a knowledge base for integration expertise. Management of integration expertise must be concerned with the practices of knowing as well as with packaging, storing and representing knowledge. Drawing the distinction between local and portable expertise helps to highlight practices not usually considered in knowledge management. For example, one practice invoked by the distinction is the fact that organizations should manage the decommissioning and replacement of local expertise, rather simply focusing on its production and retention. Management of portable expertise must be directed toward the organizational practices that produce it, and practices that facilitate its retention and re-use.

In this paper I develop theory about the relationships between local and portable integration expertise, and between portable integration expertise and an organization's ability to manage its integrative knowledge processes. I first discuss the concept of the interpersonal integration mechanism as the locus for the development and application of integration expertise. I then describe the differences between local and portable integration expertise in terms of content and acquisition processes. I show how organizations can manage the development, retention and diffusion of portable integration expertise by understanding the processes and biases that tend to make most integration expertise local. The intended contribution of the paper is first, to extend our understanding of the relationship between different types of integration expertise, and their relationship to organizational practice; second, to show how portable expertise at the individual level can contribute to organizational flexibility; and third, to understand the implications of the above for knowledge management.

2. INTERPERSONAL INTEGRATION MECHANISMS AND INTEGRATION EXPERTISE

Many authors, from Thompson (1967), Lawrence and Lorsch (1976), and Van de Ven, Delbecq and Koenig, (1976) onward, have argued convincingly that integration projects are best managed with interpersonal integration mechanisms (Grant, 1996; Hitt et al. 1998). Impersonal mechanisms such as routine, standard operating procedure, role structures, and hierarchy (Van de Ven et al., 1976) are not flexible enough to deal effectively with the complex, unfamiliar problems that present themselves with such frequency to contemporary organizations. Instead interpersonal integration mechanisms that depend on close personal interactions between participants (such as formal or informal project teams, boundary spanning roles, task forces and the like) have become dominant features of organizational landscapes (Grant, 1996). Many organizations have begun to institutionalize the use of interpersonal mechanisms, to such an extent that the project oriented organization has been recognized as a new form (Bowen et al., 1994; Volberda, 1996).

While the process knowledge required in routine and other impersonal integration mechanisms is relatively well defined (Bohn, 1994; Dooley et al., 1999; Jaikumar & Bohn, 1994; Lawrence & Lorsch, 1976; Thompson, 1967; Van de Ven et al., 1976) process

knowledge for interpersonal integration mechanisms is necessarily at a much less advanced state (Dougherty et al. 1998; Griffin & Hauser, 1996; Nelson & Winter, 1982; Nonaka, 1994). The tremendous increase in research in this area in the last decade has made significant advances in our understanding of integrative processes at the project level, but the fact remains that we have few effective general prescriptions. Each project is relatively unique in terms of content and configuration, so that solutions are usually local. This paper is an attempt to frame the management of process knowledge and knowing at the next level: the project stream, the career and the organizational practices that frame them. It is at this level that knowledge will be managed and organizational capabilities will emerge, rather than within the single project.

Interpersonal integration mechanisms are often microcosms of the complex organizations and environments they occur in. They are characterized by distributed specialized knowledge, all of which is necessary and none of which is sufficient for solving the complex problem at hand (Tsoukas, 1996). Not only are most of the problems arising from rapid change too extensive in time, space and content for an individual to solve single handed, they often involve a web of interdependencies between elements that requires the coordination of many forms of expertise to untangle. The integration task goes beyond simply configuring a distributed knowledge base into a series of knowledge modules, linked through a well defined interface (Sanchez, 1997). Integration in interpersonal mechanisms is also inherently political. Participants in complex projects bring with them diverse thought worlds: sets of beliefs, practices and methods. All of these thought worlds are more or less legitimate; each has something to contribute to the problem and solution. Because different participants believe that different things matter, and that different practices are central, the integration task must involve a reconciliation of these differences. In a flexible organization, even one that is modularized, the interfaces must be negotiated rather than imposed, and hence the process of managing knowledge is neither simple nor static.

Interpersonal integration mechanisms are also like complex organizations because they are open. The participants who constitute a problem solving collective are neither a static group nor a closed one. Problem solving collectives are often open in two ways. First, the membership of problem solving collectives is often fluid as members come and go, either through assignment, or through the creation or dilution of interest in the project. Second, the members of collectives are exposed to the pressures of their own stakeholders, so that external pressures bear on the decision process indirectly. Configuration and reconciliation of problems and solutions in such open, distributed systems is unlikely to be a tidy process. To quote Star (1989):

> "Problem solving in the contexts described above produces workable solutions that are not in Simon's terms, well structured. Rather they are ill structured: they are inconsistent, ambiguous and often illogical. Yet they are functional and serve to solve many tough problems..." (p. 51)

Solutions to integration projects, based on interpersonal integration mechanisms are thus unlikely to be neat, or permanent or wholly effective. Instead they will be the subject of on-going negotiation, adaptation and integration: the solutions themselves will be open.

Interpersonal integration mechanisms are collective and personal. It matters very much who takes part in them, unlike standard operating procedure and routine, which are essentially depersonalized (Grant, 1996; Van de Ven et al., 1976). Interpersonal integration mechanisms succeed or fail primarily through the skills and knowledge of the individuals participating in them. At the same time, integration is not a process that happens to and by individuals in isolation. Interpersonal integration mechanisms depend on the judgement and expertise of individuals, formed and directed by their participation in the organization and its belief systems (Dougherty et al., 1998; Hitt et al., 1993).

The skills and knowledge that matter in interpersonal integration mechanisms extend beyond expertise in the different domains that are to be integrated into the solution. Trying to understand how different areas are brought together to produce workable solutions leads me away from the traditional view of the expert as a domain specialist possessing vertical depth within a specific domain. (Lord & Maher, 1990; Johnson, 1983). It leads me to see integration expertise as skill in understanding and configuring the relationships between the elements of complex problems, and skill in drawing on distributed knowledge and resources to solve them (Engeström, Engeström & Karkkain, 1995; Leonard-Barton, 1995). Integration expertise is essentially horizontal and process oriented, cutting across domain boundaries to understand, negotiate and manage spatial, temporal and causal relationships. Cross cutting expertise is critical in the pluralistic, often contentious environment of interpersonal integration mechanisms.

In some research (Leonard-Barton, 1995; Weick & Roberts, 1993) successful interpersonal integration mechanisms are viewed as creating distributed integration skills among the people participating in the project. This shared problem solving approach is appealing in that it permits us to view integration expertise as an emergent property of the collective. As the members of a problem solving collective share the process, they begin to make sense together (Nonaka, 1994; Weick & Roberts, 1993). This does not mean a surrender of difference, but rather that differences are overlaid with common language, image, beliefs, and goals that supersede participants' "native" belief systems in the context of the project (Dougherty, 1992; Hitt, Hoskisson & Nixon., 1993; Hutt, Walker & Frankwick, 1995; Jassawalla & Sashittal, 1999; Kahn, 1996; Nonaka, 1994). The result is a shift from a collective to a community dynamic. As community develops, the contentious differences that block integration are eroded, worked around (Wenger, 1998) and reconciled, allowing the community to arrive at a solution. However, emergent, distributed integration skills are likely to be local, bound to the context of the particular integration project, because they are unlikely to survive the dissolution of the group.

My own theorizing has led me to believe that integration expertise can also be understood as the result of individual experience within interpersonal integration mechanisms. Working inside an interpersonal integration mechanism is not merely a socialization process that builds community. It is also an individualization process (Van Maanen & Schein, 1979) that involves the creation and appropriation of roles, responsibilities and tasks. Some of these roles, responsibilities and tasks are integrative. There are two ways to develop integration expertise through interpersonal integration mechanisms. First, expertise can be acquired though a history of participation in a variety of integrative projects. Such expertise may be portable but is not necessarily so. Such experience derived expertise may, for example, permit people to understand how different areas fit together and translate between them (Leonard-Barton, 1995). The challenge in this

case is for the individual to extract <u>portable</u> skills and insights from the series of projects, rather than simply dwelling in the most recent. That is, the individual must learn to learn (Argyris & Schön, 1972; Bateson, 1972) and continue to do so. The alternative path to portable integration expertise is to acquire skills that are not specific to a particular project. This can occur through processes as concrete as learning traditional project management methodologies, and as amorphous as learning to manage metaphor and other creative processes (Bateson, 1972; Nonaka, 1994). The complexity and variety encountered in interpersonal integration mechanisms make such learning far more likely than it would be in a homogenous functionally specialized environment.

In this environment, process knowledge management is unlikely to be a matter of modular knowledge repositories and lessons learned. Instead it is much more likely to be concerned with developing, retaining and diffusing portable process knowledge through the establishment and support of integration practices on one hand, and with producing, using and decommissioning ephemeral, local instances of problem solving on the other. The end goal for knowledge management in this area should be a process knowledge base consisting of multiple methods for representing, analyzing and evaluating time, space and cause in complex integration problems (Dooley et al., 1999).

2.1 Local integration expertise

The common type of integration expertise is local. Local integration skills have therefore been widely studied (Dougherty, 1992; Hitt et al., 1993; Hutt et al., 1995; Jassawalla & Sashittal, 1999; Kahn, 1996; Leonard-Barton, 1995; Nonaka, 1994). Local integration learning consists of the development of skill in problem specific integration practices; the development of shared meaning systems through the use of jargon, stories and local practice; of system knowledge specific to a problem type (such as architectural knowledge of a specific product platform); and the development of interpersonal trust between the members of the problem solving collective. The resulting expertise is bound to the local problem solving context.

Expertise in problem specific integration practices is often local because such skills are unlikely to be useful in other contexts. An example of a problem specific integration practice would be a method for integrating a particular set of technologies into variations on a platform. This is not simply because the skill would be out of place in another context, but also because practice is 'sticky' for several reasons. Members of problem solving collectives are often not receptive to practices developed in another context. Such practices may be viewed as illegitimate (Dougherty & Hardy, 1996), unreasonable or ineffective (Leonard-Barton, 1995) or evoke 'not invented here' reactions (Cohen & Levinthal, 1990). Further, problem specific practices are likely to depend on tacit assumptions that may not be realized in dissimilar contexts (Smith, 1998; Von Hippel & Tyre, 1995). The individual who becomes expert in problem specific practices may view them as the end or goal, rather than as one possible means for integration. If so, he or she will not be aware of the situatedness of the problem and solution within a larger context of integration problems.

The development of shared systems of meaning is widely recognized to be critical to solving complex integration problems (Dougherty, 1992; Hutt et al., 1995; Leonard-

Barton, 1995; Weick & Roberts, 1993). Equally widely recognized is the problem that shared systems of meaning tend to be sticky and hard to re-deploy to new contexts (Dougherty, 1992; Nelson & Winter, 1982; Polanyi, 1966; Szulanski, 1996; Weick & Roberts, 1993; Zander & Kogut, 1995). The development of shared systems of meaning, consisting of beliefs, concepts, jargon, stories, and vocabulary, is local in three ways. First, peripheral participants (Lave & Wenger, 1991) (such as outsiders or newcomers) do not have access to the unvoiced shared history that is essential to sharing meaning. Individuals who come late to a problem solving effort often feel marginalized because they do not share history with the core group. In the open system view of interpersonal integration mechanisms, stakeholders may view the products and processes of a community as illegitimate because they do not conform to the expectations of participants' "native" communities. Second, even when a core group of individuals stays together from problem to problem, shared meaning developed in one problem may be inappropriate for the next problem. Existing shared meaning may actually be misleading in terms of the way it frames problem solving efforts, possibly leading the community to solve the wrong problem. Third, the opposite effect is also possible. Participants in problem solving efforts may fall victim to the fallacy of uniqueness (Martin, Feldman, Hatch & Sitkin, 1988). If they perceive subsequent problems to be unique (when they may not be), they may fail to perceive similarities and opportunities for re-deploying learning.

This said, it is critical to emphasize that the emergence of shared systems of meaning is perhaps the most widely recognized determinant of successful integration processes. Solutions to integration problems are much more likely when collectives become communities by developing shared sense through shared problem solving. What we argue here is that shared systems of meaning are important for integrative problem solving and simultaneously local. The challenge is to manage localness- to exploit its virtues for the immediate project and overcome its defects with respect to the long run.

The development of system specific knowledge is local learning because problems involving different systems or different parts of systems seldom share configurations. Not only are the relationships between individual elements of problems likely to vary, the overall architecture of problems is also variable. Integration problems that seem very similar in terms of the elements they involve may be configured very differently, or admit of many configurations. Thus what Henderson has called architectural knowledge is, as she has demonstrated, likely to be closely bound to its context and history (1996). Christensen (1997) has argued convincingly that responsiveness to external pressures (the tyranny of the installed base) increases commitment to locally optimal system specific knowledge, even when competitive alternatives are present. Levitt and March (1988) describe this phenomenon as a 'competency trap', where the investment represented by expertise in an obsolete or inappropriate solution prevents search for or the adoption of a better solution.

The development of interpersonal trust and strong interpersonal relationships is sometimes (often) local learning. This is because trust and strong relationships between specific individuals may bias future problem solving efforts. Strong feelings of trust developed in one context may prevent necessary strong relationships with other people from developing in a later context. Trust may bias the selection of individuals to be involved in future problem solving efforts. Even when it is appropriate for the collective to stay together from problem to problem, interpersonal trust that facilitated the solution of one problem may interfere with the solution of the next. Trust is quite as likely to be a

strong feature of core rigidities (Leonard-Barton, 1992) and competency traps as it is to be an element in project success (Kahn, 1996; Jassawalla & Sashittal, 1999).

Local integration expertise can form the basis for a limited (but still valuable) integration capability. Especially in large organizations with ample slack resources, a wide range of problem solving efforts may produce a very rich base of local integration expertise. The capability that results will be limited for several reasons. First, large organizations notoriously have a hard time knowing what they know. Second, some kinds of local expertise will tend to influence future problem selection more than others through core rigidity processes. There is good evidence that organizations and individuals learn to favor both problems and solutions they have recognized as successful before (Levitt & march, 1988; March & Olsen, 1976; Smith & Zeithaml, 1996). This permits the organization to exploit the present learning of its members by re-using and refining it. Third, the composition of future problem solving collectives is likely to be influenced by local expertise, so that the variety of expertise may be more apparent than real. If participants are kept close to a single type of problem, they are less likely to develop portable skills or an awareness of larger context. Local learning thus tends to create a bias in favor of familiar problems and solutions using familiar methods and familiar people. To the extent that these are the right problems, local learning can generate an efficient (but not flexible) exploitation oriented integration capability. To the extent that selecting for particular types of problems reduces the variability of the stream of problems, local learning tends to lock organizations out of flexibility.

2.2 Portable integration expertise

Portable expertise is less common. The primary outcomes of portable learning are skills in understanding the configuration of problems; skills in resource acquisition and network management (such as the ability to identify and access knowledge and knowledgeable partners); boundary management skills (such as translation, creative abrasion, the management of boundary objects); and skill in ensuring inclusive decision processes. These skills are all concerned with process, with the spatial, temporal and causal relationships among elements of integrative projects. These skills do not bind the individual, collective or organization to a particular set of problems or problem solving practices. Instead they are re-deployable from problem to problem, even though the problems are different.

At the same time, portable expertise cannot be wholly divorced from its contexts. This suggests that to be portable, integration expertise must include skill in recognizing, configuring and navigating a variety of contexts. Portable integration expertise therefore has a component of explicit 'situatedness' that will be missing from localized integration expertise, where the situatedness of integration expertise will be tacit. When expertise is portable, the expert will have an explicit awareness of the structure of context and its relationship to his or her integration expertise. The expert will see how problems and solutions connect across the organization and its environment, and will explicitly address those interfaces (Dougherty et al., 1998; Engeström et al., 1995; Klein & Maurer, 1995; Leonard-Barton, 1995). The expert will view solutions as means to the goals of the particular project and as contributing to distant goals and objectives.

The development of skills in understanding the configuration of integration problems is portable learning. The development of skill in understanding the configuration of problems is one of the hallmarks of expertise even in the vertical model of domain expertise (Dörner & Schölkopf, 1992; Engeström et al., 1995; Lord & Maher, 1990). In the context of integration problems, understanding and configuring problems involves understanding not only the elements of the problem, but also the temporal, spatial and causal relationships and interdependencies between those elements. Because we are concerned with complex, dynamic problems, we expect that expertise in configuring problems will be to a very large degree, skill in simplifying and organizing interpretations of problems. As we noted earlier, one critical element of this skill is an explicit awareness of the situatedness of the problem. To be skillful at understanding and configuring problems, it is very useful to be able to put the problem into a larger context in order to better understand the internal relationships of the problem elements and the relationships the problem has to its contexts. To some degree, understanding and configuring integration problems is a meta-skill, and thus a prerequisite for skill in acquiring resources, boundary management and ensuring inclusive decision processes.

The development of skill in resource acquisition and management is portable learning because all problem solving efforts must compete for resources. The political and power processes involved in acquiring resources are not bound to particular problems. Instead skill in resource acquisition processes is usually re-deployable to many contexts. These skills include skill in presenting interpretations of the problem that do not conflict with the economic needs and belief system of the organization (Dougherty & Hardy, 1996). For the purposes of this paper we include network skills among resource acquisition skills. Good network skills, such as knowing where to look for resources or who (and how) to ask for help are invaluable in acquiring resources (Anand, Manz & Glick, 1999; Cohen & Levinthal, 1990; Leonard-Barton, 1995. Learning where, when and how, and for how long to acquire resources implies learning how the problem solving effort is situated. The resource acquisition aspects of portable integration learning have a good deal in common with the theory of heavyweight project leadership (Clark & Wheelwright, 1992): the successful leader is in large part the one who can acquire the resources necessary to solve the problem. This is an expertise that is self enhancing; a track record in solving problems is a widely recognized element in the resource acquisition success of heavyweight leaders.

The development of boundary management skills is portable learning because complex collective problem solving efforts all share the problem of multiple, contending interpretations of both problem and solutions. As the literature on cross functional teams has often noted, participants from different functions, backgrounds and organizations come to the process with divergent views of both problem and solution (Dougherty, 1992; Griffin & Hauser, 1996; Hutt, Walker & Frankwick, 1995; Jassawalla & Sashittal, 1999). Boundary management skills involve skill in the direction and reconciliation of specialized meaning systems, local goals and communication between members of diverse communities (Gerson & Star, 1986; Nonaka, 1994; Star, 1989). This requires expertise in making explicit the positions of contending parties and skill in the process of reconciling them into a coherent whole through negotiation, shared experience and community building. Boundary management skills also involve managing the creative abrasion (Leonard-Barton, 1995) that takes place as different thought world meet and challenge each others' assumptions and monopoly positions in knowledge domains. This abrasion can involve not only the political task of establishing domains of responsibility within the task -

- it can also involve managing the creative processes of knowledge exchange, appropriation of ideas between domains, help seeking and colloquy.

Skillful boundary management produces social order (Barley, 1986) by helping collectives produce the 'new mediating concepts' (Engeström, et al., 1995) that characterize systems of shared meaning. The ability to translate ideas and requirements between diverse thought worlds, to manage creative abrasion where contending points of view meet, and the ability to manage boundary objects (Gerson & Star, 1986; Smith, 1998) such as plans, schedules and prototypes (Leonard-Barton, 1995) are all elements of boundary management skills that contribute to social order and shared sensemaking. It is critical to note that boundary management skills are distinct from the mediating concepts they produce. Expert boundary management should help communities produce local shared systems of meaning that help solve particular problems. The system of meaning that results is bound to the problem it helps solve; the skills that facilitate it are not.

The development of skill in ensuring inclusive decision processes is related to but distinct from both resource acquisition and boundary management skills. Developing skill in ensuring inclusive decision processes is portable learning because all complex collective problem solving efforts should benefit from the consideration of multiple alternative solutions (Anand et al. 1999). We include skill in ensuring inclusive decision processes because organizations and collectives are often pre-disposed to value solutions of a particular type (Levitt & March, 1988) or originating with a particular group (Leonard-Barton, 1992). These are often expressed as competency traps or core rigidities. In a pluralistic collective where multiple, contending and legitimate points of view are present, biased decision processes present a critical barrier to effective integration problem solving (Dooley et al., 1999; Jassawalla & Sashittal, 1999; Purser, Pasmore & Tenkasi, 1992). Expertise in ensuring inclusive decision processes is important because it challenges the biases established through prior local learning.

All four of these types of expertise are context oriented. Configuration, resource acquisition, boundary management and inclusiveness skills all require the individual to consider the larger context within which the collective is situated. Compared to the expertise that results from local learning, portable expertise is far more likely to consider consequences and possibilities outside the narrow definition of the problem, and to develop effective solutions that take these things into consideration. The key to portable learning is its explicit situatedness. Learning is always situated (Lave & Wenger, 1991), but learners often take situation for granted (Bateson, 1972). Without going in to the question of types or levels, the development of portable integration expertise is in large part learning about situations and their relations to the problems embedded in them. Connections, relationships and assumptions that a problem solving community can, may or even should take for granted, will be of critical interest to participants whose expertise is portable.

3. TOWARD MINIMAL REQUIREMENTS FOR MANAGING INTEGRATIVE PROCESS KNOWLEDGE

The most interesting prior research into the management of integrative process knowledge has focused on its development over a career (Bowen, Clark, Holloway &

Wheelwright, 1994; Brown & Eisenhardt, 1999; Clark & Wheelwright, 1992; Purser et al., 1992). This research is interesting for its insight that what matters is the work history, rather than the individual problem to be solved. A key element in managing integrative process knowledge is to manage careers in such a way as to promote experience in a variety of complex projects, without penalizing the individual for not following a more traditional functional career path (Bowen et al., 1994; Brown & Eisenhardt, 1999).

Organizations must manage projects like careers, as a stream rather than one project at a time. For portable integration expertise to develop, there should be many opportunities for acquiring, developing and deploying integration skills over a work history (Bowen et al., 1994; Dörner & Schölkopf, 1992; Johnson, 1983; Lord & Maher, 1990). This is because one important way that portable integration expertise develops is through practice across projects. Portable integration expertise emerges over time as individuals learn as through a series of collective problem solving efforts. While the typical example of this is a series of formal development projects (Bowen et al., 1994), integration expertise can develop in unpredictable or rapidly changing environments that are not formally structured into projects.

Because integration expertise can be acquired through practice, prolonged problem solving efforts will be more likely to facilitate integration learning than brief efforts. On the other hand, problem solving efforts that are unduly prolonged will tend to reduce the number of problem solving efforts attempted. As the number of problems attempted decreases, integration learning will be biased toward local expertise. Both portable and local learning will occur in problem solving efforts of moderate duration, while it is likely that neither will occur when problem solving efforts are very brief.

Proposition 1: The development of portable integration expertise is more likely in careers that include multiple episodes of moderately prolonged collective problem solving.

As a counterpoint to managing careers for the development of integration expertise, organizations must also attend to the specific skills employees acquire in collective problem solving projects. As we noted earlier, the relevant skills are: skills in understanding the configuration of problems; skills in resource acquisition and network management; boundary management skills; and skill in ensuring inclusive decision processes. These skills may be partially acquired through instruction, but they will become expert only through practice. Ideally the collaborative use of portable integration skills would lead to promotive learning, where all the collaborators learn more together. In order to encourage the practice of these skills, organizations need to recognize and reward these skills as a central part of the knowledge management process for integration expertise (Dooley et al., 1999). By rewarding the application of portable integration expertise, organizations can encourage not only the development of the skills, but also their retention and diffusion.

Proposition 2: Organizations that recognize and reward the development of portable integration expertise are more likely to retain and diffuse such expertise.

Beyond rewarding the development and use of portable integration skills, management can pursue other practices that facilitate the development, retention and diffusion of these skills.

Knowledge Management. Knowledge management includes a key set of organizational practices that facilitates skill in portable learning. Managing the acquisition, creation, packaging and application of knowledge of any kind helps ensure the later re-use of that knowledge. We address the effects of three components of knowledge management:

1. the development of knowledge content through the creation and management of knowledge repositories and directories;

2. the promotion and support of analytic integration methods that assist in knowing;

3. decommissioning or de emphasis of obsolete local integration expertise.

Knowledge repositories and knowledge directories can help individuals identify internal and external knowledge resources (Anand et al., 1999; Davenport & Prusak, 1997; Sackmann, 1992), and to understand how similar problems and solutions have been configured in the past. Learning how to 'work' the knowledge network means that individuals are more likely to know which resources are available, and to recognize more ways to configure them. Knowledgeable individuals should be better able to acquire the resources needed for successful projects when they are required. In practice it is difficult to know in advance, in detail, which knowledge or resources are relevant to a problem and how it should be configured (Nonaka, 1994; Smith 1998). Working from structured repositories or directories can clarify the range of resources available, and help individuals and collectives avoid configurations that have not been successful in the past.

Knowledge repositories and directories can make inclusiveness easier by providing pointers to people with different types of knowledge (and different points of view) (Anand et al., 1999; Boland, Tenkasi & Te'eni, 1996; Dooley et al., 1999). Knowledge management can also legitimize differences interpretation of problems and solutions, and lead individuals to value multiple perspectives. Valuing and realizing inclusiveness are separate components of skill in promoting inclusiveness. In order to actually promote inclusiveness, individuals must be able to bring people with alternative points of view into the problem solving process.

Finally, knowledge repositories and directories can support the development of boundary management skills because they put individuals in the position of recognizing multiple points of view, gives them opportunities to organize and allocate complex tasks, and produce objects that invoke multiple interpretations, which then must be reconciled (Dooley et al., 1999; Gerson & Star, 1986). I therefore propose that:

Proposition 3a: Organizations that implement strong knowledge repository and directory programs are more likely to facilitate portable integration skills among their employees than organizations that do not implement such programs.

Practice with analytic tools and methods for integration also contributes to the development of portable integration expertise. The use of analytic tools and methods is intended to structure the otherwise unruly integrative processes by helping members of the collective know how the problem and its solutions may be structured. Learning and applying analytic tools and methods permits participants to understand temporal, spatial

and causal relationships within the product, project and its contexts, and therefore contributes to knowing rather than directly to knowledge. Applying analytic tools and methods on behalf of the collective, enhances its ability to efficiently integrate and coordinate the knowledge available to it. Because tools and methods are not specific to single projects, analytic tools and methods skills can be re-deployed to future projects.

When we address the question of analytic tools and methods, we face the question of diffusion: Who should learn them? Everyone?, or should some members of the collective apply analytic tools on behalf of the team? Both propositions have merit. When generalized integration skills are learned and applied by only some participants, other participants can continue to focus efficiently on relatively narrow specializations (Grant, 1996; Klein, 1994; Leonard-Barton, 1995). Alternatively, Nonaka (1994) and Klein (1994) argue forcefully that the redundancy of formal integration skills among team members is a key component in the superior creativity that often characterizes self managing work teams. This superior creativity may be a function of shared meaning related to the redundancy of integration skills, or it may be the result of multiple different types of analytic integration expertise (Dooley et al., 1999) interacting in an environment where 'knowledge cannot be surveyed as a whole.' (Tsoukas, 1996: 13). As a practical matter, participants are sometimes selected to participate in problem solving efforts because they are expert in analytic integration methods that the team will need. There is no reason to suppose that one individual must possess and apply all such skills on behalf of the team, nor any reason to believe that all such skills must be widely shared.

The use of formal analytic tools and methods for integration promotes skills in understanding the configuration of problems especially when multiple tools and methods are used. Using several ways of framing and understanding a problem draws attention to assumptions and myopic oversights based on strongly held beliefs, and encourages attention to the situatedness of problem and solution. Even using a single appropriate analytic method can overcome naive assumptions and lead to a more useful configuration of the problem (Dooley et al, 1999). The use of analytic integration tools and methods can also improve skills in resource acquisition and network management by providing persuasive means for defining the levels of resources required, and the particular types of knowledge and support required. Some analytic tools and methods provide support for boundary management skills. Examples are project management techniques, scheduling and prototyping methods. These define the spatial, temporal and causal relationships between elements of the solution, and provide a framework for creative abrasion to work toward viable alternative configurations. Organizations can help individuals become expert in identifying other points of view by promoting analytic and organizational practices that demand inclusiveness. Some examples of knowledge oriented analytic practice that invoke inclusiveness are multi-level risk analysis and quality function deployment.

Proposition 3b: Organizations that support the use of analytic tools and methods for integration are more likely to facilitate portable integration skills among their employees than organizations that do not implement such programs.

In addition to these positive takes on to knowledge management, organizations that manage the decommissioning of obsolete or overly local integration expertise will have an advantage in producing portable integration expertise. It is important to understand that local knowledge should not be disposed of. Rather it should be mothballed - taken out of

active service and stored until another occasion makes it useful. Local knowledge should not be carried forward mindlessly. The more dynamic and unpredictable an organization's environment is, the more important it will be for individuals and collectives to unlearn (Levitt & March, 1988; Walsh & Ungson, 1995) local integration expertise. Otherwise success with a particular type of problem or a particular type of solution may lead to a bias in favor of that type of problem or solution. Such a bias would lead the organization attempt to solve only some of its problems, perhaps not the most critical ones, or to use a limited set of solutions for a wide range of problems. These competency traps might well lock an organization out of the expertise it needs to succeed or survive. Oddly enough, when it comes to local integration expertise, organizations need to forget what they have been good at. It may be no bad thing that complex organizations don't know what they know.

While forgetting process are often unintended, I think they should be intentional. The conscious process of recognizing that prior expertise is not useful in the current context and putting it aside is an important milestone in the development of portable integration expertise. Consciously unlearning local expertise is a preliminary step toward awareness of the situatedness of problems. Realizing that some elements of integration expertise are tightly bound to the local context implies a recognition of context as an important criterion in deciding which problems to solve and how. Discarding techniques and meaning systems that have been successful is not easy but it is possible. It opens the way for being expert across projects, for knowing not only what did and did not work in the last project, but also a wider range of things that may or may not work in the future. Portable integration expertise thus emerges in part from local expertise, especially when local expertise is recognized as local, and intentionally discarded.

Several options exist for organizations to support intentional unlearning of local integration expertise. Organizations can encourage problem solving collectives to surface and make explicit their assumptions and beliefs, in order to understand how they are bound to context. Not only does this help participants detach from local practice, it also has been argued to increase the inclusiveness and creativity of problem solving across projects (Nonaka, 1994). Organizations can debrief members of project teams on exit in order to surface and confront assumptions, meanings and beliefs that team members have come to take for granted during the course of the project. By calling conscious attention to local integration expertise and situating it in a larger context, the organization can help its members confront the situatedness of their experience. Finally, local integration expertise that is decommissioned from active memory can be retained in knowledge repositories for possible future use.

Proposition 3c: Organizations that adopt mechanisms for debriefing and decommissioning local integration expertise are more likely to facilitate portable integration skills among their employees than organizations that do not.

Organizational vision and long term orientation. An important element of organizational frameworks for facilitating the development of portable integration expertise is the organizational emphasis on solutions as steps toward an organizational vision or goal (Bowen et al. 1994; Dougherty et al., 1998; Prahalad & Hamel, 1990). Members of organizations that view solutions to individual problems as means to achieving long term goals will have incentives to understand how a project is situated, unlike members of

organizations that view solutions as ends in themselves. Understanding solutions as means rather than ends helps to develop situational awareness of both the problem and the range of potential solutions as embedded in a larger context. In many respects this is an aspect of organizational culture (Cook & Yanov, 1993; Fiol, 1991; Sackmann, 1992). Organizations that value objectives over a particular technology or method will also be less biased in terms of the solutions and problems they recognize (Brown & Eisenhardt, 1999; Volberda, 1996).

Proposition 4: Organizational values that emphasize achieving distant objectives are more likely to facilitate portable integration skills among employees than organizational values emphasizing problem solving as an end in itself.

Organizational receptivity to external knowledge. Finally, an important element of organizational frameworks for facilitating the development of portable integration expertise is organizational receptivity. Organizational receptivity is the tendency of the organization to be receptive to ideas and practices that originate outside the organization (Anand et al., 1999; Hamel, 1990; Inkpen & Crossan, 1995). As such it sets the boundary within which knowledge management practices operate, as well as increasing the scope of un-managed knowledge that is available to the individuals and collectives engaged in problem solving efforts. Receptivity is increased when local integration expertise is decommissioned.

Organizational receptivity promotes the acquisition of expertise in problem configuration by expanding and legitimizing the pool of possible sources and interpretations of problems and solutions. At the gross level, organizational receptivity promotes boundary management expertise when individuals in contact with outsiders must manage both receptivity to outside influences, and their own and the organization's transparency in terms of outward flows of knowledge (Anand et al., 1999; Hamel, 1990; Inkpen & Crossan, 1995). Boundary management expertise is also enhanced by the greater differences in belief systems, jargon and interests between organization members and outsiders, which cannot be ignored or written off as easily as the concerns of intra-mural partners.

When organizations are truly receptive, expertise in promoting inclusiveness is also enhanced. The individual is confronted with a wider array of choice about who to include, and motivated by organizational values that support expanded participation. This is an opportunity for individuals to become more expert at identifying and acquiring the knowledge and perspectives needed for an effective solution process. Finally when organizations are receptive, the scope for resource acquisition expands greatly. Individuals have more opportunities to evaluate and adopt different technologies, relationships and partners than they would if the organization was closed to outside influences.

Proposition 5: Organizations that are receptive to external influences are more likely to facilitate portable integration skills among their employees than less receptive organizations.

4. IMPLICATIONS AND CONCLUSION

This brief sketch moves us toward a minimal set of requirements for the development of portable integration expertise. While it is by no means a complete description, we believe that it will suffice to begin to improve the development, retention and diffusion of portable integration expertise within an organization. By managing careers and rewards, developing and valuing long term goals and objectives, managing knowledge and being receptive to outside influences, organizations can help their employees develop portable integration expertise.

These practices are not sufficient to <u>guarantee</u> organizational flexibility based on portable integration expertise. We have not considered individual level factors which might also influence the acquisition and use of portable integration expertise. Personality factors, individual intelligence and creativity are all likely to play a role in the acquisition of integration skills. In the logic of portable integration expertise, organizations must attract and retain the right kind of people, and keep them in jobs where they can contribute to problem solving efforts. This might mean developing career paths for creative, intelligent, motivated people that do not lead into upper management, a trade-off many organizations may be unwilling to make. Future research into the relationship between these concepts and portable integration learning is critical to the development of integrative process knowledge management and strategic human resource management in rapidly changing environments.

Second, we have not yet considered how local learning occurs within frameworks designed for portable expertise. To sustain organizational flexibility, organizations must continually induct new individuals into the portable learning process. As we noted earlier, portable learning emerges, in part, from local learning in work histories that span multiple integration projects. Newcomers, therefore, pass through a local expertise phase before their expertise becomes portable. The base of expertise will always be mixed as a result. Moving newcomers into critical problem solving roles may lead to the deployment of local expertise at the expense of portability. This is especially hazardous when new employees are more expert in new technologies and methods than their supervisors. Unless individual work histories are carefully managed, these skill inversions suggest that local expertise could easily become the dominant mode. Future research into the development of careers to enhance integration learning is likely to be critical to process knowledge management in rapidly changing environments.

Third, local learning can occur even when individuals already have portable expertise. Experts can 'fall in love' with successful technologies or solutions. Especially in organizations where integration efforts have been successful, portable expertise may erode into local expertise as prestige and reputation become invested in particular solutions. Avoiding this competency trap requires the organization to continually define success in terms of its long term goals and vision. More than any other framing practice, long term goals and objectives must be the basis for theory in use, rather than simply espoused (Argyris & Schön, 1978). Organizations that see themselves as not fully succeeding are more likely to stay flexible than those that view themselves as at the top of their game.

In summary, while our theory development makes it clear that portable integration expertise can be developed, retained and diffused, it is also clear why organizational flexibility based on it is rare. Developing and maintaining portable integration expertise

requires organizations to avoid the traps of local learning while continually being un-biased, visionary, self-aware and receptive to influences from outside. This is a challenge that we think is far beyond most organizations, most of the time. Are we then theorizing about a moot point? I think not. This theory makes it clear that portable integration skills can give organizations an edge in terms of integrative problem solving. While managing these skills on a sustained basis may be difficult, it is not impossible.

Even more critically, organizational flexibility based on portable integration skills is most desirable if the environment is highly dynamic. If we relax the assumption that organizations confront a sustained, rapid, unpredictable flow of integration problems, the need for portable integration expertise is diminished. When the flow of integration projects is intermittent, organizations may be more likely to flourish if they can <u>occasionally</u> exhibit flexibility based on portable integration expertise. Our theory then becomes one of episodic change, of metamorphosis, rather than of sustained capability. Organizations would develop, retain and diffuse portable integration expertise in order to re-invent themselves <u>when necessary</u>. The challenge for knowledge managers and researchers may be to understand how portable integration expertise can be facilitated when local expertise is the dominant mode. This may mean managing portable integration expertise as a latent capability, as a means for enhancing and occasionally disrupting local learning, rather than as a primary goal. While we do not propose a theory of latent flexibility in the present study, it is certainly an interesting avenue for future study, one that would transform theories of dynamic and sustainable competence.

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