

Knowing in Practice: Enacting a Collective Capability in Distributed Organizing

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Abstract

In this paper, I outline a perspective on knowing in practice which highlights the essential role of human action in knowing how to get things done in complex organizational work. The perspective suggests that knowing is not a static embedded capability or stable disposition of actors, but rather an ongoing social accomplishment, constituted and reconstituted as actors engage the world in practice. In interpreting the findings of an empirical study conducted in a geographically dispersed high-tech organization, I suggest that the competence to do global product development is both collective and distributed, grounded in the everyday practices of organizational members. I conclude by discussing some of the research implications of a perspective on organizational knowing in practice.

(Distributed Competence; Geographically Distributed Organizing; Knowing; Organizational Knowledge; Organizing Practices)

With the intensification of globalization, acceleration in the rate of change, and expansion in the use of information technology, particular attention is being focused on the opportunities and difficulties associated with sharing knowledge and transferring "best practices" within and across organizations (Leonard-Barton 1995, Brown and Duguid 1998, Davenport and Prusak 1998). Such a focus on knowledge and knowledge management is particularly acute in the context of global product development, where the development and delivery of timely and innovative products across heterogeneous cultures, locales, and markets are critical and ongoing challenges. Dealing effectively with such challenges requires more than just good ideas, strong leaders, and extensive resources; it also requires a deep competence in what may be labeled "distributed organizing"—the capability of operating effectively across the temporal, geographic, political, and cultural boundaries routinely encountered in global operations.

What constitutes effective distributed organizing in

global product development? In this paper, I wish to explore a possible explanation—an explanation which rests on and elaborates on the premise that effective distributed organizing is an enacted capability constituted in the everyday practices of global product development activities. Such an explanation leads away from the focus on organizational knowledge occupying much of the contemporary discourse on knowledge management, and towards a focus on organizational knowing as emerging from the ongoing and situated actions of organizational members as they engage the world. It is an explanation grounded in what it is people *do* every day to get their work done.

My focus on organizational knowing rather than knowledge is informed by the sociological work of Giddens (1984) and the anthropological studies of Lave (1998), Hutchins (1991, 1995), and Suchman (1987). In these accounts, individuals are understood to act knowledgeably as a routine part of their everyday activity. They are seen to be purposive and reflexive, continually and routinely monitoring the ongoing flow of action—their own and that of others—and the social and physical contexts in which their activities are constituted. As Giddens notes, such activities suggest an "immense knowledgeability involved in the conduct of everyday life" (Giddens and Pierson 1998, p. 90). My intention here is to use the lens of organizational knowing to understand how members of global product development organizations generate and sustain knowledgeability in their distributed operations.

The conceptual argument developed here was elaborated through an empirical study I conducted into the product development activities of a large, globally dispersed, high-tech organization which I call Kappa. In what follows, I first lay out the key elements of current perspectives on knowledge before developing my perspective on organizational knowing. I then explore this perspective on knowing in terms of the field study I conducted within Kappa. While organizational knowing appears particularly relevant to the distributed organizing of

global product development, such a capability may also be salient in many other organizational activities. I thus conclude the paper by examining the broader implications for organizational research of a perspective on organizational knowing.

Perspectives on Organizational Knowledge

The question of knowledge has long occupied philosophers and sociologists of science, but it is only relatively recently that organizational researchers have become interested in this topic. Indeed, "knowledge" has become the watchword of contemporary organizations, and research interest in knowledge, knowledge-based organizations, and knowledge management has accelerated (Kogut and Zander 1992, Starbuck 1992, Nonaka and Takeuchi 1995, Tsoukas 1996, Teece 1998). Two distinct perspectives on organizational knowledge are currently discernable. One proposes that organizations have different types of knowledge, and that identifying and examining these will lead to more effective means for generating, sharing, and managing knowledge in organizations. Tsoukas (1996, p. 13) characterizes such a perspective as "taxonomic," with researchers developing classifications of knowledge and then using these to examine the various strategies, routines, and techniques through which different types of knowledge are created, codified, converted, transferred, and exchanged (Nelson and Winter 1982, Leonard-Barton 1992, Hedlund 1994, Nonaka 1994, Nonaka and Takeuchi 1995, Winter 1987, Teece 1998, Hansen 1999). Many of these knowledge classifications take as their starting point the distinction made by Polanyi (1967) between tacit and explicit knowing. This classic distinction is then typically used to elaborate additional knowledge dichotomies, for example, local vs. universal, codified vs. uncoded, canonical vs. noncanonical, procedural vs. declarative, and know-how vs. know-what.

Some researchers have been critical of a purely taxonomic perspective, arguing that it reifies knowledge by treating it as a stock or set of discrete elements. Furthermore, Tsoukas (1996, p. 14) observes that a taxonomic perspective does not recognize that "tacit and explicit knowledge are mutually constituted . . . [essentially] inseparable." In particular, he argues that tacit knowledge "is the necessary component of *all* knowledge; it is not made up of discrete beans which may be ground, lost or reconstituted." Along with others (Boland and Tenkasi 1995, Davenport and Prusak 1998, Cook and Brown 1999), he argues instead for an integrated approach that affords a view of organizational knowledge as processual, dispersed, and "inherently indeterminate" (1996, p. 22).

Brown and Duguid (1998), while they share with Tsoukas (1996) a view of knowledge as emergent, depart from his integrationist focus by retaining a distinction between types of knowledge. In particular, they adapt Ryle's (1949) articulation of "knowing that" and "knowing how" to argue that "know-how" is different from "know-what" in its dispositional character. Thus, know-how is "the particular ability to put know-what into practice" (Brown and Duguid 1998, p. 91). As such, it is a capability embedded in particular communities of practice (Brown and Duguid 1998, p. 95). This allows know-how to be easily moved within and among communities with similar practices, but makes it "sticky" or difficult to move across communities of practice (Brown and Duguid 1998, pp. 100–102). Recognition of the "stickiness" of know-how has led to various proposals for facilitating knowledge sharing across communities of practice, such as: developing boundary practices (Wenger 1998), engaging knowledge brokers (Brown and Duguid 1998), using boundary objects (Star 1989, Henderson 1991, Carlile 1998), and participating in cross-community communication forums (Boland and Tenkasi 1995).

Much has been learned, and much will continue to be learned, from the two perspectives on organizational knowledge discussed above. Significant portions of this work, however, treat knowledge as either a thing (to be captured, stored, transmitted, etc.) or a disposition (whether individual or collective) resulting in "objectivist reification" on the one hand or "subjectivist reduction" on the other. Taylor makes a similar point about rules (1993, pp. 57–58, emphasis added):

In its operation, the rule exists in the practice it 'guides.' . . . [T]he practice not only fulfills the rules, but also gives it concrete shape in particular situations. . . . In fact, what this reciprocity shows is that the 'rule' lies essentially *in* the practice. The rule is what is animating the practice at any given time, not some formulation behind it, inscribed in our thoughts or our brains or our genes or whatever. That is why *the rule is, at any given time, what the practice has made it.*

Substituting "knowledge" for "rule" in the above quote highlights the difference between a view of knowledge as separate entity, static property, or stable disposition embedded in practice, and a view of knowledge as "at any given time, what the practice has made it." The latter view sees knowledge as enacted—every day and over time—in people's practices. It leads us to understand knowledge and practice as reciprocally constitutive, so that it does not make sense to talk about either knowledge or practice without the other. It suggests there may be value in a perspective that does not treat these as separate or separable, a perspective that focuses on the knowledgability

of action, that is on *knowing* (a verb connoting action, doing, practice) rather than *knowledge* (a noun connoting things, elements, facts, processes, dispositions).

The increased interest within organizational studies in social theories emphasizing practice provides some conceptual grounding for the development of a practice-based perspective on organizational knowing. I develop one such possibility here, and then elaborate it by drawing on my empirical study of a global product development organization. I see this perspective as complementing, not substituting for, the perspectives on organizational knowledge discussed above. I believe it can highlight some aspects of organizational knowledgeability that may be overlooked in our tendency to privilege knowledge at the expense of knowing.

A Perspective on Knowing in Practice

Both Ryle (1949) and Polanyi (1967) emphasize *knowing* in their writings. While the distinction between knowing and knowledge may seem like a subtle and inconsequential lexical shift, I believe it has substantial conceptual implications. In particular, it may lead us to miss a fundamental aspect of Schön's (1983, p. 49) observation—based on his field work but informed by Ryle and Polanyi—that “our knowing is *in* our action.” Schön examined the practice of five professions and argued that the skillful practice exhibited by the professionals did not consist of applying some a priori knowledge to a specific decision or action, but rather of a kind of knowing that was inherent in their action. As he puts it (1983, p. 49):

When we go about the spontaneous, intuitive performance of the actions of everyday life, we show ourselves to be knowledgeable in a special way. Often we cannot say what it is that we know. . . . Our knowing is ordinarily tacit, implicit in our pattern of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is *in* our action.

What is highlighted in Schön's observation is the essential role of human agency in knowledgeable performance. Maturana and Varela (1998, pp. 27, 29) similarly define knowing as “effective action,” and write that “all doing is knowing, and all knowing is doing.” When we focus primarily on knowledge, we lose the centrality of action in knowledgeability. Schön (1983) suggests that the tendency to slip from a focus on knowing to that of knowledge is deeply rooted in our theoretical enterprise as we attempt to develop (and test) theories that make sense of (or predict) effective action. He cites the example of researchers studying how children learn to play with wooden blocks, observing that as the researchers viewed the children's actions they were “compelled to invent a

language . . . [which] converted the child's *knowing-in-action* to *knowledge-in-action*” (1983, p. 59).

In a recent paper, Cook and Brown (1999) introduce the notion of knowing into the discourse on organizational knowledge, while maintaining the conventional distinction between tacit and explicit forms of knowledge. While this recognition of knowing is helpful, it nevertheless assumes that tacit knowledge is distinct and separable from knowing, and thus action. The perspective I adopt here rests on an alternative assumption—that tacit knowledge is a form of “knowing,” and thus inseparable from action because it is constituted through such action.

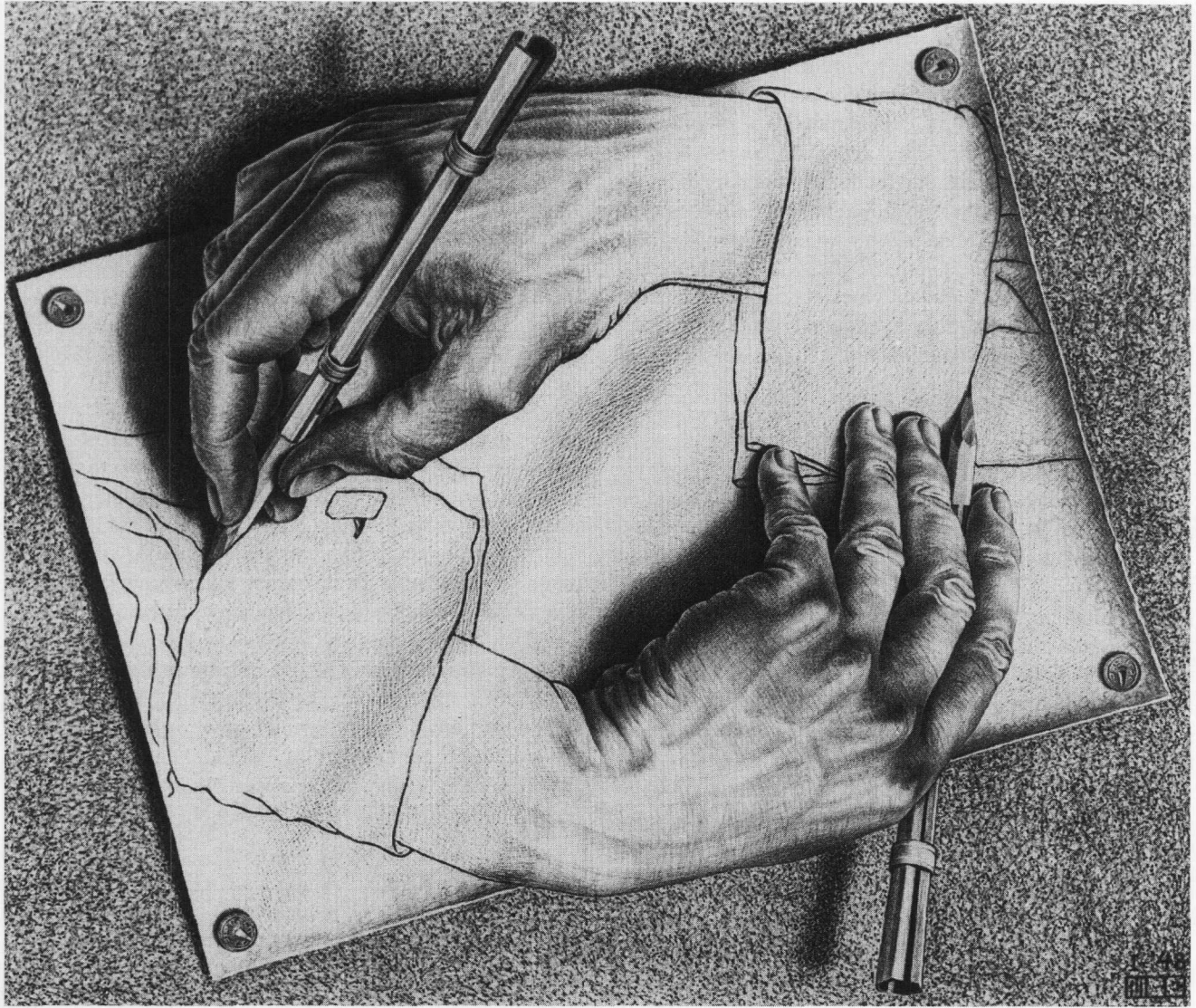
The primary role of action in the process of knowing is evident in Ryle's (1949) claim that knowledge is essentially a “knowing how,” a capacity to perform or act in particular circumstances. Using an example of a boy playing chess, he suggests that the boy can be said to “know how” to play chess if his action displays the rules of chess, even if he cannot recite them. Similarly, Polanyi (1967) points to the tacit knowing that is evident in our ability to recognize faces in a crowd or to ride bicycles even as we cannot articulate precisely how it is that we do these. Thus, we recognize the “knowing how” (the capacity to play chess or ride a bicycle) by observing the practice (chess-playing or bicycle-riding). However, the practice has no meaning apart from the “knowing how” that constitutes it. Remove the “knowing how” of playing chess from the practice, and we no longer have anything recognizable as chess-playing practice. The two are inseparable as Ryle (1949, p. 32) notes:

. . . ‘thinking what I am doing’ does not connote ‘both thinking what to do and doing it.’ When I do something intelligently . . . I am doing one thing and not two. My performance has a special procedure or manner, not special antecedents.

This mutual constitution of knowing and practice—while hard to conceptualize in our conventional theoretical frameworks—is a key premise underpinning Giddens' (1984) theory of structuration, Maturana and Varela's (1989) notion of autopoiesis, and Lewontin's (1995) constructionist biology. It is also effectively depicted in Escher's (1948) lithograph *Drawing Hands* (see Figure 1), where the right hand draws the left hand even as the left hand draws the right hand.

Recent work in cognitive anthropology has reinforced the essentially mutual constitution of knowing and practice. Based on extensive field work, Lave (1988) and Hutchins (1991, 1995) have found that cognition in practice (or “in the wild” as Hutchins evocatively puts it) is a culturally situated and ongoing social activity. In a series of studies that examined math-problem-solving activities in adults, Lave (1988) persuasively shows that

Figure 1 M. C. Escher's "Drawing Hands"



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competence in math is not some abstract knowledge that individuals either do or do not have, but a "knowledge-in-practice," a situated knowing constituted by a person acting in a particular setting and engaging aspects of the self, the body, and the physical and social worlds (Lave 1988, pp. 180–181). Based on her studies, Lave writes that "knowledge is not primarily a factual commodity or compendium of facts, nor is an expert knower an encyclopedia. Instead knowledge takes on the character of a process of knowing" (1988, p. 175). Spender (1996b, p. 64) similarly observes that: "knowledge is less about truth and reason and more about the practice of intervening knowledgeably and purposefully in the world."

Giddens (1984, p. 4) defines human knowledgeability as "inherent within the ability to 'go on' within the routines of social life." Such ability to "go on" is inseparable from human agency, where agency is the capacity of humans to "choose to do otherwise." Knowledgeability or knowing-in-practice is continually enacted through people's everyday activity; it does not exist "out there" (incorporated in external objects, routines, or systems) or "in here" (inscribed in human brains, bodies, or communities). Rather, knowing is an ongoing social accomplishment, constituted and reconstituted in everyday practice. As such, knowing cannot be understood as stable or enduring. Because it is enacted in the moment, its existence

is virtual, its status provisional. Knowing how to ride a bicycle, recognize faces, play basketball, make fine flutes (Cook and Yanow 1996), or launch and recover planes on an aircraft carrier (Weick and Roberts 1993) are capabilities generated through action. They emerge from the situated and ongoing interrelationships of context (time and place), activity stream, agency (intentions, actions), and structure (normative, authoritative, and interpretive). Because these capabilities are continually generated in recurrent action, continuity is achieved and preserved as people interpret and experience their doing as "the same" over time and across contexts (Lave 1988, p. 187). Thus, as we bicycle to work every day, we begin to take for granted that we "know how" to ride a bicycle, and lose sight of the way in which our "knowing how" is an active and recurrent accomplishment.

People's ongoing engagement in social practices, and thus their reproduction of the knowing generated in those practices, is how they reconstitute knowledgeability over time and across contexts. Continuity of competence, of skillful practice, is thus achieved not given. It is a recurrently but nevertheless situated and enacted accomplishment which cannot simply be presumed. The status of competence is more provisional—because it is always to be achieved—than we tend to assume when we treat it as given. This is made clear in the accounts of deadly or expensive accidents described by Weick (1993, 1996) and Weick and Roberts (1993), where apparently competent practitioners (firefighters, pilots, and aircraft carrier crew) were unable to reproduce skilled performances in certain circumstances. It is also evident in the example recounted by Weick (1987) of the Hungarian soldiers lost in a snowstorm in the Alps who eventually found their way back to camp by discovering a map of the Pyrenees. Before they found the map, the soldiers could not be said to "know how" to get out of the Alps. As they themselves reported: "we considered ourselves lost and waited for the end" (Weick 1987, p. 222). Yet, once they had found the map, the soldiers were able to enact a collective competence that got them out of the Alps. As an officer described: "And then one of us found a map in his pocket. That calmed us down. We pitched camp, lasted out the snowstorm, and then with the map we discovered our bearings. And here we are" (1987, p. 222). The "knowing how" to find their way back to camp which the soldiers displayed after their discovery of the map was a situationally enacted capability—constituted through reading the map, using it to calm themselves and make sense of their surroundings, and then beginning to take purposive action towards finding a way out of the mountains.

As people continually reconstitute their knowing over time and across contexts, they also modify their knowing

as they change their practices. People improvise new practices as they invent, slip into, or learn new ways of interpreting and experiencing the world. For example, Schön (1983) shows that situated practice often involves reflection and experimentation, and how through such in-the-moment reconstruction of thought and action, knowing may be altered. Similarly, Barrett (1998) and Weick (1993) argue that improvisation in practice is a powerful means of increasing organizational innovation, learning, and change. Thus, when people change their practices, their knowing changes. From such a perspective, people learn to know differently as they use whatever means, motivation, and opportunity they have at hand to reflect on, experiment with, and improvise their practices. The Hungarian soldiers did this once they found a map and began to use it.

While examinations of knowing have examined a variety of settings, most have focused on the work practices of individuals (Suchman 1987, Lave 1988, Orr 1996) or that of focal groups proximate in time and space (Weick and Roberts 1993, Hutchins 1995, Pentland 1995, Cook and Yanow 1996). Little is known about the process of knowing in complex organizations that are also geographically distributed. In such contexts, knowing in practice is constituted by the ongoing activities of diverse and distributed individuals. The inherent complexity, multiplicity, and dispersion of such settings complicates how we think about and study organizational knowing. It suggests the importance of examining how people in their ongoing practices constitute knowing how to engage in distributed organizing.

Existing approaches to studying distributed organizing tend to focus on the importance of knowledge transfer across boundaries, and the value of generating a set of "best practices" that can be propagated through the dispersed operations. A view of knowing as enacted in practice does not view competence as something to be "transferred," and suggests that the very notion of "best practices" is problematic. When practices are defined as the situated recurrent activities of human agents, they cannot simply be spread around as if they were fixed and static objects. Rather, competence generation may be seen to be a process of developing people's capacity to enact what we may term "useful practices"—with usefulness seen to be a necessarily contextual and provisional aspect of situated organizational activity.

In the research study described below, I explore the globally dispersed, product development work of a large and successful multinational organization (Kappa). The empirical insights suggest a central role for practices that produce and sustain a collective and distributed knowing within the global organization. Such a focus on practices

has not been central to current research on either global product development or organizational knowledge. Because it may be a valuable perspective for understanding a range of organizational activities, it is the focus of my attention here.

Research Setting and Methods

Kappa is a large software company headquartered in The Netherlands, and producing a small range of sophisticated and highly integrated systems software products.¹ In 1998, it earned \$8 billion in revenues, these revenues having grown nearly 15% on average since 1990. One of its primary products is a specialized operating system (VOS) installed on the mainframe computers of about 200 major customers around the world. Kappa holds close to 40% share of this market. Given increasing competitive pressures, changing customer requirements, and continuing technology advances, new releases of the VOS product are produced every two to three years. These product development efforts are accomplished through temporary global project groups (known as Product Organizations or POs) lasting from 18 to 24 months in duration, and each involving the dedicated services of a few hundred software engineers. Because of the complexity of the product development effort and the need to ensure continuity of customers' operations in the meantime, there are at any one time within Kappa multiple temporary project groups managing different versions of the company's products. For example, when I was conducting my study in 1998, there were three POs in place to manage the VOS product: one to maintain the currently installed version (PO-97), one to complete development and testing of the next version of the product (PO-98), and one to plan the design and development of the after-the-next version of the product (PO-99).

Kappa's product development activities are distributed across multiple local Development Units (known as DUs). These DUs are located in 15 different locations spread over five continents. One senior executive explained the rationale for Kappa's highly distributed product development as follows:

Doing product development from a distributed perspective—this is a strength of Kappa. I think it is something we have managed quite well. . . . the advantages are obvious. There are several ones: first of all, you get access to resources wherever it is. Holland is a pretty small country and our universities just don't turn out the number of engineers that Kappa needs of the right quality. So you get access to good people if you choose your locations wisely. Another advantage is proximity to the markets. The DUs work with our local companies and sit close to the marketing people. They can provide technical sales support, can influence the sales process, and in doing so they also

soak up our customers' needs, get a bit closer to the end user. That way they can influence the direction our development takes by having that knowledge. So those are the two main advantages, I think—the sourcing of competence and the proximity to the markets that we sell in.

Not only are the units globally dispersed, but many of the engineers working in product development embody this geographic and cultural diversity. One subproject manager pointed to himself as an example of Kappa's globalization: "My situation is quite typical for Kappa engineers—I am a Greek working in Finland for a Dutch company and using English to do my work." In total, some 2,000 engineers work in these 15 DUs, with each DU employing on average 150 software engineers (the smallest unit employs 15 engineers, the largest 800). Each DU is organized in terms of a matrix, with each engineer participating in both a local development structure (e.g., the Palo Alto DU), as well as a global product management structure (e.g., the PO-98 organization developing the VOS-98 product). Each DU operates as a cost center with its own cost structure, and every year product managers in each PO contract for the engineering talent located within the DUs.

At the time of my study, Kappa had an enviable record of completing projects on time and generally satisfying customer requirements. However, recent mergers in its sector were increasing competitive pressure to reduce the time-to-market of new products, and accelerating demand for more customizable features in the software. While switching costs for customers of the VOS products were high, customers were becoming increasingly interested in capabilities that utilized the Internet and the Java language. VOS, written in a proprietary software language, was not compatible with the Internet, and Kappa was under some pressure to find ways to bridge existing functionality to the Internet, even as it attempted to develop a new generation of Internet-based VOS products.

My field study focused on the everyday work practices of Kappa's temporary product organizations and was conducted during six months in 1998. I spent time at five local development units as well as Kappa's headquarters, interviewing a range of players associated with the VOS product: software engineers (involved in planning, design, development, testing, and maintenance); DU staff (involved in quality assurance, career development, project budgeting, and infrastructure support); DU managers, project managers working for POs; and senior Kappa executives (see Table 1 for details). I conducted 78 interviews in total, representing approximately 10% of all Kappa personnel involved with VOS product development activities. Interviews lasted from 45 minutes to over three hours in length, and were conducted one-on-one

Table 1 Number and Type of Interviews Conducted Within Kappa

PARTICIPANTS	DU-1	DU-2	DU-3	DU-4	DU-5	HQ	TOTAL
Software Engineers	6	3	4	4	4	—	21
Support Staff	5	4	4	1	2	1	17
Local Unit Managers	2	2	2	2	2	—	10
Project Managers	4	3	3	6	3	—	19
Senior Executives	2	—	2	—	2	5	11
TOTAL	19	12	15	13	13	6	78

with participants, either in their private offices if they had one or in a meeting room when they did not. Almost all the interviews were taped and transcribed verbatim. I also spent time talking to project participants informally, usually joining them for lunches and dinners during my time at the different locations.

In addition to interviews and observation, I collected data by reviewing some of the extensive documentation generated by the activities of product development, including project plans and schedules, product specifications, technical diagrams, and meeting minutes. I also had access to selected portions of the global Kappa intranet (the organization's internal web sites), where organizational, procedural, and technical information was posted. This provided important contextual information on DU and project-organizing structures, training and development programs, HR policies and evaluation criteria, project planning models, methodologies, and technical standards, as well as details on existing computer platforms and anticipated technological developments.

My data collection and analysis focused on the work practices of the Kappa members and was exploratory in nature. Participants were asked to describe their everyday activities (in a "Day in the life of . . ." format), as well as to talk about their project, its organization, flows of communication, and key challenges. In response, participants almost invariably grabbed a sheet of paper or jumped to a whiteboard to draw one or more pictures of their project's complex and shifting interaction structure. In addition, participants were asked to discuss their regular use of artifacts (software tools, communication media, project plans, methodologies, standards, etc.) in conducting their ongoing project work.

I was unable to participate in or observe project activities directly, thus my understanding of practices comes primarily from interview data and from the traces of work evident in project documentation. This is clearly a limitation of my study, and ethnographic data would offer more grounded accounts of work practices. Nevertheless,

the findings of this initial study offer an interesting starting point for understanding what it is that Kappa members say they do everyday as they engage in their product development activities. In this, I follow Giddens' (1984, Giddens and Pierson 1998) insistence that people are knowledgeable and reflexive, and that they tend to know more about (and can give a reasonable account of) what they do than researchers give them credit for.

My orientation to data collection and analysis was exploratory, intended to generate insights into the practices and conditions that constitute effective global product development work of the sort engaged in by Kappa. The process of data collection and analysis proceeded iteratively, with the early stages being more open ended than the later ones. This allowed for some flexibility in data collecting, allowing themes to emerge and then be examined more deeply as relevant. My initial time at Kappa was spent in unstructured interviewing, general observation, and review of background materials about the company, its products, and industry. Early stages of the research focused on understanding the activities of product development and how these were shaped by Kappa's global dispersion, the VOS product's technical complexity, and the temporary structure of the VOS product organizations.

As I came to better understand the context and complexity of Kappa's product development, I became particularly aware of the importance of boundaries that Kappa members routinely traverse in their daily activities. In their descriptions of their distributed product development work, Kappa participants repeatedly referred to a number of different boundaries that shaped and challenged their everyday work. I discerned at least seven boundaries in such descriptions: *temporal* (19 time zones and a variety of weekly, monthly, and quarterly schedules), *geographic* (15 global locations), *social* (hundreds of participants engaged in joint development work), *cultural* (30 nationalities), *historical* (three different versions of the same product), *technical* (complex software system running on a variety of different computer infrastructures, and accommodating a variety of standards), and *political* (different functional interests, product criteria, and local vs. global priorities). Because of the obvious salience of these boundaries to the distributed work of the Kappa participants, I began to focus the data collection more explicitly on boundaries. Thus, in later stages of the research, I became more strategic in my choice of participants and more directed in the interviews, seeking to engage them in a discussion of the nature, role, and consequences of boundaries in product development work.

I used inductive qualitative techniques to analyze the

data (Agar 1980, Eisenhardt 1989, Glaser and Strauss 1967, Strauss and Corbin 1990), informed by my focus on practices and knowledgeability while remaining alert to emerging ideas. Analysis consisted of multiple readings of the interview transcripts, field notes, and documentation, and the identification of activities and issues that related to everyday product development work. The literature on organizational knowledge and knowing focused some of my analysis here. For example, Kogut and Zander's (1996) discussion of "what [firms] know how to do" highlighted the importance of such conditions as shared identity, convergent expectations, common communication codes, and situated learning.

The empirical success of Kappa suggests that a host of elements—strategic, technological, financial, political, and cultural—are central to its ongoing accomplishment of effective product development. Indeed, the data revealed the critical role of a number of these. I could not focus on all of them here, and instead chose to explore the theoretical thesis that knowing is an enacted capability. Consequently, in analyzing my data I paid careful attention to how members of Kappa described and made sense of the activities they engaged in to accomplish their work. By the word "activities," I mean what members actually *did* every day as part of their complex and distributed product development work. Because these accounts of everyday product development work revealed the salience of a multiplicity of boundaries that Kappa members deal with daily, I concentrated my data analysis on those specific activities that Kappa members associated with their descriptions of boundaries.

This analysis generated a set of recurring themes that referred to the activities engaged in to traverse the boundaries of time, space, culture, history, technology, and politics which Kappa members routinely encountered in their work. I then reexamined the data in terms of these sets of activity themes, paying particular attention to how they comprised particular practices associated with boundary work. The unit of analysis in these considerations was social practice, defined as recurrent, materially bounded, and situated social action engaged in by members of a community—in this case, the members of Kappa's VOS product development operations. Practices are engaged in by individuals as part of the ongoing structuring processes through which institutions and organizations are produced and reproduced. They are thus both individual (because performed by actors in their everyday action) and institutional (because they shape and are shaped by organizational norms and structures). I aggregated and clustered activities into what may be seen as a repertoire of practices routinely performed by Kappa members in their globally distributed product development work.

I shared my preliminary findings on the repertoire of practices with a broad sample of Kappa members—engineers, unit and product managers, executives—and these discussions generated additional details which elaborated and sharpened my interpretations and yielded additional insights.

Knowing How to Do Global Product Development in Kappa

In terms of conventional measures of profitability and market leadership, Kappa is, and has been for a number of decades, a highly successful organization. Part of Kappa's success clearly depends on its technical creativity, its strategic positioning, its leadership, and its customer relations. However, I argue here that another important aspect of Kappa's success is grounded in the everyday practices through which Kappa members constitute a collective competence in knowing how to deliver innovative yet complex products in a timely fashion. We can begin to understand this aspect of Kappa's "knowing how" to do global product development work by examining the everyday practices of its members as they recurrently enact ways of dealing with the temporal, geographic, political, cultural, technical, and social boundaries they routinely encounter in their work. In particular, they deal with these boundaries through knowing how to navigate (i.e., articulate, attend to, engage with) as well as negotiate (i.e., redefine, reconstruct) them.

Through the data analysis I identified a repertoire of practices that when engaged in by Kappa members can be seen to constitute, dynamically and recurrently over time, what we may call Kappa's competence in distributed organizing (see Table 2 for an overview of these practices and their associated activities). The first two of these practices—*sharing identity* and *interacting face to face*—constitute a knowing of the organization and the players in it. For Kappa members, these two kinds of knowing generate a knowing how to be coherent, committed, and cooperative across a variety of spatial, temporal, and political boundaries. The next three practices—*aligning effort*, *learning by doing*, and *supporting participation*—constitute knowing how to coordinate on complex projects, knowing how to develop capabilities for doing product development, and knowing how to innovate within global operations. For Kappa members, these three kinds of knowing generate a knowing how to be consistent, competent, and creative across a variety of technical, geographic, historical, and cultural boundaries.

As Kappa members draw on and use this repertoire of

Table 2 Repertoire of Practices, Activities, and Knowing Within Kappa

Practice	Activities Comprising the Practice	Knowing Constituted in the Practice
Sharing identity	Engaging in common training and socialization Using common orientation to do development work Identifying with the organization	Knowing the organization
Interacting face to face	Gaining trust, respect, credibility, and commitment Sharing information Building and sustaining social networks	Knowing the players in the game
Aligning effort	Using common model, method, and metrics Contracting for expertise annually Using standard metrics	Knowing how to coordinate across time and space
Learning by doing	Investing in individual development Mentoring employees in their careers Rewarding not punishing effort	Knowing how to develop capabilities
Supporting participation	Globally distributing product development work Involving participants in project decisions Initiating and supporting overseas assignments	Knowing how to innovate

practices over time and across situations, they generate and sustain a collective competence in distributed organizing. The enactment of such a collective knowing, however, is not without negative consequences. Kappa's knowing is also a not-knowing. While its collective competence in distributed organizing is enabling, it is also inhibiting when (as I show below): sharing identity becomes organizational groupthink, interacting face to face leads to burnout, aligning effort discourages improvisation, learning by doing is lost through turnover, and supporting participation is immobilizing because of conflicts and time delays.

The five practices discussed below should not be seen to be either exhaustive or exclusive. They do not operate independently of each other, but overlap and interact at the same time and over time. Their discussion below as standalone and separate is an analytic convenience only. Similarly, the discussion below of practices and the knowing constituted in practice is complicated by the fact that our language implies an ontological separation when this is neither intended nor warranted. The recursive constitution of knowing and practice should be continually borne in mind.

Sharing Identity: Knowing the Organization

A consistent challenge experienced in distributed work is maintaining coherence, commitment, and continuity across the multiple locations, priorities, and interests of the hundreds of people involved in the collaborative effort. Kappa's large size and widespread geographic dispersion ensure this challenge is faced on all VOS product

development projects. Kappa members deal with this challenge by actively and recurrently producing a distinctive and shared Kappa identity with which most of them identify and through which they orient their work (Table 3 provides additional data on these activities). This process of shared identity construction affords Kappa members a localized yet common orientation to each other and to their product development work across geographic locations and different versions of the VOS product. Thus, software engineers in, say, Holland or Spain have—and know they have—a similar orientation to software development work as do software engineers in, say, India or Australia.

This knowing about the organization and how it works is generated through the initial training and socialization workshops that all new employees participate in. It is subsequently reinforced when Kappa members appropriate the common orientation and use it to inform their everyday product development activities. Talk to any Kappa employee, and very quickly she/he will mention the "Kappa way" as a critical element of how work is accomplished across the distributed locations of their operations. The "Kappa way" is seen to generate the common ground on which distributed product development work is structured, and is for many a means of local and global identification within their daily activities. It is understood by Kappa members as the ongoing activity of calibrating and connecting with a set of shared values, goals, and expectations about what is important in Kappa and why. A senior executive explained:

Table 3 Sharing Identity Within Kappa

Knowing in Practice	Activities	Data from Kappa
Knowing the organization through sharing a Kappa identity	Creating a common orientation through participating in common training and socialization workshops	"We all learn the Kappa way of doing things."
	Appropriating and using a common orientation to getting global product development work done	"I really see that I am working for Kappa and not with this DU or this product. We have the same way of working everywhere. Of course, here we do it in the German way, but it is the same. Kappa has managed somehow to do, to create, a common spirit among all the units."
	Reinforcing one's connection to Kappa by identifying with the organization	"I think what Kappa has managed to do is that everyone feels connected. Everyone feels that they belong to Kappa, . . . that you're a part of this big family."

The way we work in Kappa is the same across locations because we're always shooting for the one goal, and that is to have a successful project. That's the bottom line. And people strive for that. We may differ sometimes on how to get to that goal. But the common goal of a successful product and a good product so our customer doesn't holler at us, is pretty much, I think, viewed by everybody as really important. And so whether the Americans want to go, you know, A, B, C, D to get there, or the Germans want to go A, F, E, D—as long as they come to that common goal, that's fine. And they do. It's the Kappa way.

The sense of participating in a "Kappa way" of doing things was widely shared across all levels of the organization, from senior executive to recent recruit, and across all Kappa locations. Belief in and ongoing engagement in a common way of doing things shaped engineers' expectations and actions towards each other and their product development tasks, thus helping to constitute and reconstitute the common Kappa way of doing product development work over time and space, history and locale. This is evident in the comments of a software engineer:

When I travel to different DUs and participate in different meetings, I know everybody has the same frame of mind that we are working on. Eventually in the end we are all working for Kappa. Of course, in some cases you want to have the best for your local organization. But in the end, we always keep in mind the overall picture—that we are working for Kappa. I see that everywhere.

Common identification by members of the "Kappa way" provides the basis for a continued and evolving sense of trust, respect, and loyalty that is evident throughout the organization and which significantly facilitates the conduct of complex and distributed product development work. One PO manager noted:

Very few companies can compete with Kappa for one simple reason, and that is the loyalty of its people to the company. And that you can't buy.

Kogut and Zander (1996), as well as Dutton et al. (1994, p. 254), note that strong identification with an organization increases cooperation among members and directs additional effort towards tasks contributing to co-workers and the organization. Such a positive relationship was quite evident in Kappa's product development activities. Through enacting a shared identity and a common orientation to their work, Kappa members constitute an ongoing and collective knowing how to do global product development work within their distributed organization. By continuing to engage in these ongoing practices, Kappa members reinforce the value of their shared identity, which further helps them to establish connections with and orientations to each other, however distant in time or space they may be.

While the ongoing enactment of a shared identity is critical to the conduct of global product development work, it is not without risks. The "same frame of mind" quoted above may also lead to an organizational form of groupthink with less flexibility around change. Kogut and Zander (1996, p. 515) note that shared identity "also imposes the weighty costs of ruling out alternative ways to organize and to exploit new avenues of development." Indeed, Kappa is currently faced with having to migrate many of its products and approaches to a new form of software development (object-oriented) utilizing a new technology platform (the Internet). This change is proving quite difficult for Kappa, given its considerable past successes with an established approach. A senior executive commented:

The biggest challenge is changing from how we are currently working, and that feeling of security in what we are doing. With

the persons we have in the organization, it is quite hard to give up something that has worked now for 20 years. It is a paradox, isn't it, that people have to give up what they feel most secure about to in fact secure their future.

A shared identity has the dual nature noted by Geertz (1973)—that a *model of* reality is also a *model for* reality. In Kappa's case, ongoing enactment of a shared identity, even as it enables a particularly powerful understanding and way of acting in the world, may constrain movement away from such understanding and acting when it becomes the exclusive source of motivation, identification, attention, and action.

Interacting Face to Face: Knowing the Players in the Game

Kappa's projects typically involve the participation of hundreds of software engineers located around the world. Moreover, the participation of individuals on a project is not fixed or static, but decided through a series of work assignment contracts that are negotiated annually between a product organization and the distributed design units. There is thus a considerable social boundary to be dealt with as engineers and managers work jointly with hundreds of different people located in many different parts of the world.

Everyone I talked to within Kappa commented that one of the ways they deal with this challenge is by engaging in extensive social interaction—despite the highly distributed nature of their product development operations. Such engagement in recurrent face-to-face interaction seems particularly useful in this context because it enacts an ongoing and evolving knowing of the shifting set of players in the game, thus building and sustaining important social networks that support the doing of distributed work. It is by working with and through such social networks that Kappa members navigate and negotiate many of the challenges of working across temporal, geographic, cultural, and political boundaries (Table 4 provides additional data on these activities).

Kappa members emphasized the importance of face-to-face communication for establishing and sustaining social relationships which are seen to be essential in global product development work within Kappa. One senior PO manager noted:

The easiest way to get things done in Kappa is to have a good network. If you have a good network, you can get anything done. If you don't have that, you are going to have a tough time in our distributed environment. A lot of influence happens in the network. So moving around and meeting people extends the network, and that is promoted within Kappa, and that is good.

Another PO manager gave an example of how face-to-face contact affords learning about other projects while

also building the social connections that facilitate distributed working:

These face-to-face meetings are very effective for letting us hear about the other subprojects. So we see what their risks and their problems are, to see if that may apply to us. . . . It is also very effective in building relations between the subprojects, in case we need a favor, or something like that. That is helpful.

Comments by project managers from all three of the POs dealing with the VOS products echo the view that face-to-face interaction generates a knowing of each other and each others' commitments that helps to get things done across distance. Two project managers noted:

You can't resolve everything over the phone. It is important to have that personal relationship as well, which you achieve by meeting each other, and then it makes it a lot easier when you communicate through e-mail or the phone.

Once you have face-to-face meetings—and we have them once a month, rotating them around: United States, Canada, Mexico, Holland, Japan—you begin to form these relationships . . . and that helps to cement commitments. I mean, if somebody tells me on the phone 'I am going to make it on time,' this has a different level of quality than if I meet this person and he tells me in front of my face 'I am going to make it.' So the level of commitment that you get is totally different.

One Kappa executive gave an instance of how face-to-face interaction afforded a knowing of each other that was critical when particularly difficult decisions needed to be made:

For example, on a project, we will have one view in Holland, and one view here [in Australia]. And we will be talking on the phone, and talking about lots of stuff, but we will not come to a conclusion. To come to a conclusion, someone needs to stand up in front of the group and say, 'Here is the deal, here is why it is important, we need this function, and we are going to do it.' And then people will back down, and everyone will agree that it is important. If you don't see the person talking, you don't see the idea. People send a message with their face and everything. If you see the person, you see the power in that person, and that helps to create a frame that you can make sense in. I don't see that we can do it the same way on the phone.

The ongoing practice of face-to-face interaction allows Kappa members to constitute a sense of knowing their colleagues, of knowing their credibility in and commitment to specific issues, and of knowing how to collaborate with them to get things done in a globally dispersed and complex product development environment.

However, this practice of face-to-face interaction in a globally distributed organization does not come without consequences. One cost—as a project manager put it—is "tons of travel," and the accompanying need to justify considerable travel expenses. A DU staff member gave

Table 4 Interacting Face to Face Within Kappa

Knowing in Practice	Activities	Data from Kappa
Knowing the players in the game through interacting face to face	Gaining and assessing trust, respect, credibility, and commitment	"A big upfront effort of any project is to get to know the people. I am not a believer in videoconferencing. So we spent a good week in the United Kingdom getting to know each other. We had our differences, but it became a very open relationship. And that is what we try to do, keep a very open relationship. From a work perspective that is very important." "Meeting people, for instance, is a key to understanding them."
	Sharing information	"Ours is a very complicated product, so you have to ask about things, and discuss things, and negotiate things, and for that you need a face-to-face meeting. It is always easier to exchange information eye to eye, as I like to say."
	Building social relationships with others	"I think in this complicated world, when you build such big and complex systems, I think that physical presence is a must . . . even for engineers. If you think that engineers can go without wining and dining, you are wrong. You have to have that for team building. You can't replace that with videoconferencing." "We are very distributed by nature and so you need to make personal contact. I have found personal contacts essential. I have always experienced that the communication is then much more open, and the people dare to say what is going on. So, there is simply no choice but to go there personally and make the contacts."

an example of how Kappa's commitment to having people get to know each other face to face created a problem with Kappa's external auditor. One project had experienced a change in leadership midway through the product development effort. As soon as the new project manager took over, he went on a trip to all the development units where work on his project was being done, so that he could "meet all the people working on the subprojects." The auditor, however, had difficulty accepting this reason for the travel:

This auditor kept wanting to see a report of the work done on the trip. And we tried to tell him 'No, these were not working meetings, but meetings to get to know the people.' But in his view, this was travel on company expense, and if it was on company expense, there should be a visible benefit. And we said, 'Yes, there is a visible benefit—the project manager now knows all those people.' He simply couldn't accept that the only purpose for the travel was communication. But that's what we do, even though it's sometimes difficult to explain to outsiders.

While travel expenses are an obvious cost, what is less obvious is the physical and emotional wear and tear on Kappa members who do such extensive travel to maintain face-to-face interaction. HR managers are particularly concerned about the risk of individual burnout incurred by the toll of ongoing travel. Many VOS project members reported increased stress and decreased family time. One United States-based project manager noted that:

I travel a lot, and it's tough to keep going to Europe. For a long time [in the early phases of the project] I would be like, you know, gone for a week every month. That was tough, especially as I have a wife and kid.

Another project manager recounted a period where he temporarily relinquished some of his responsibilities as a way to cope with his emotional exhaustion:

We started ramping the project up in June. We got to full speed by August and then the stress got to me, and I got out in October because I wasn't sleeping at nights. So I became a deputy project manager, and Beth and me, we kind of swapped positions. I was still on the project but she did all the traveling and took on the pressure of the project. This continued on until about May, and then in June the next year I was back as project manager.

While knowing one's colleagues in the dispersed arena of global product development operations is a tremendous advantage to the organization, it is only achieved with some not inconsequential negative consequences for members. Managing the discrepancy between organizational benefit and individual cost is an important challenge for Kappa's form of distributed organizing.

Aligning Effort: Knowing How to Coordinate Across Time and Space

Kappa's products are highly complex and integrated technical systems that involve millions of lines of software code and thousands of modules. These systems need to

work seamlessly with each other, reflect evolving technical standards and customer requirements, and be compatible with the previous generation of products that are still operating on customers' computers. Developing such systems successfully demands effective and ongoing coordination.

Within Kappa, such aligning of products, projects, and people across time and space is accomplished through two key activities: the consistent and widespread use of a proprietary project management model, its planning tool, and structured systems development methodology; and the annual contracting for work via standard metrics ("kilomanhours") between product organizations (POs) and local development units (DUs). Through their ongoing use of such models, tools, methodologies, contracts, and metrics, Kappa members constitute a knowing how to coordinate their global product development activities across the multiple boundaries of time, space, technology, and history that characterize Kappa's VOS product development effort (Table 5 provides additional data on these activities).

A senior executive commented on the role of project

planning and methodology tools in facilitating distributed work:

[Distributed development] is a challenge, and it's a lot of coordination and everything is based on a number of basic principles. We use a common process methodology which everyone knows because it's part of the basic educational package when software engineers start to work here. And then we have coordination within this framework, done at all levels of the project to get all the different software pieces together for the system at the same time. There are the technical standards and coordination documents where you describe impacts on different parts of the system and all the different organizations inspect those documents and agree to them. And then each different subproject can plan their work accordingly and implement the solutions. And in the overall project coordination, you plan on specific dates when what functions should be available, so the different subprojects go ahead and design and test their function by a specific date. And then everything comes together.

On an annual basis, product managers of each PO negotiate with the DUs for the work (planning, development, maintenance) its software engineers will perform that year on each product. A senior PO-99 manager explained what this entails:

Table 5 Aligning Effort Within Kappa

Knowing in Practice	Activities	Data from Kappa
Knowing how to coordinate through aligning effort over time and space	Using a common project management model, planning tool, and structured software development methodology	"This project management model really works quite well. It is a good umbrella, a good foundation for doing this work. And all the DUs use it along with the common processing methodologies. So if I said, here's the content of a project coming out of feasibility study, and here is my project spec, everyone will know what I am talking about. It's a unifying process and methodology that helps us run projects."
	Negotiating and contracting for engineers to work on projects via annual assignment contracts	"The assignment of people to work is contracted every year. So someone decides that there will be this new release of software. And then all the different DUs that own people are asked to give, at each level, people to be involved in the project. So DUs have given project managers to the project to work at a very high level to coordinate all the activities across Kappa. At a lower level, this department here receives an assignment from a project to do a certain amount of work here. And then we add people here to do that project. So at each level, the assignment of people gets lower, and lower, and lower. And people are added by the line to whatever work needs to be done at that level."
	Using a standard metric ("kilomanhours") for assigning and allocating personnel to project work	"What happens is that on an annual basis we work with the product manager to make a kind of agreement, . . . this is the amount of kilomanhours you get for this amount of money. . . . It's based on expectations of work that is coming in. And based on that you make a plan for the year because we know that we have this requirement for new project assignments and that requirement to maintain an ongoing project." "Once we have agreed the contract for manhours with each DU each year, then that is the rules for how we work."

Every year we make a plan, what we call an operational plan, and there we state what is our vision and mission, and our strategies and goals for the product. . . . So the operational plan is one controlling document for us. The budget is another one. When we have the budget then we make agreements with the different international DUs. We say, OK, we want the French DU to do this many manhours—yes, we call it *manhours*, unfortunately—and that's what we would like to buy from the French with this competence and in this time period.

From the perspective of a DU manager, the annual negotiation over work is experienced as follows:

What a PO does is they send down an assignment—it's called an assignment spec. And the assignment spec specifies exactly the dates and functions they want delivered. And then what we return back is a project spec. This is all documented in Kappa's methodology for managing projects. And in the project spec we specify whether we can deliver all these functions by the dates. We look at things like what competence we have available, the other projects going on, the complexity of the functions, and that type of thing. And there are times that we actually have to write an assignment out to other DUs if we don't have all the resources here. Like, for example, we may borrow resources from India or Spain. So we're responsible for trying to find the resources if we don't have it all in our organization.

Most of the VOS product development efforts extend for a duration of 18 to 24 months. The scope of each of the projects is typically defined in the range of 300 to 400 kilomanhours, and involves hundreds of software engineers across the 15 distributed DU locations. The division of work across these locations is accomplished through a hierarchical decomposition of the project into subprojects, with each DU usually taking responsibility for one or more subprojects. For example, one project manager for the VOS-98 product explained:

For VOS-98, we have 12 subsystems. And the people are not co-located. So, Germany develops one part, France another, here in Holland a third part, Canada the fourth, Spain the fifth, Japan the sixth, and so on. Each of these subprojects specializes in something, a specific function or feature . . . and with one exception, each subproject resides within a DU. The exception is [name of function] which itself has three subprojects, two in India, and one in the United States.

This project manager went on to explain how important use of Kappa's project management model and methodology were in aligning these subprojects:

All these subprojects are running in parallel and we need to coordinate the results from all of them. The project model and methodology helps a lot. It helps us to write documents and build models in a more structured way so that we can share these across the locations and get comments on them. . . . We develop requirement specs, development sketches, implementation proposals, technical reports, everything that tells us at an

early stage, this is the scope, this is feasible, this is what we are going to do, and this is what it costs now. Then we can execute on this.

Ongoing use of the project management model, the planning tool, and common systems development methodology, as well as the negotiated assignments and contracts, allow Kappa project managers and software engineers to collectively and repeatedly align themselves with their dynamic and distributed product development work. These activities enact an ongoing and evolving knowing how to coordinate product development work over time (both of the current product and past generations), politics (the different and dynamic technical standards and customer requirements), and geography (the distributed locations where engineering work is actually done).

Plans, methodologies, tools, contracts, and metrics facilitate coordination by reducing uncertainty and variability. Such use, however, can also dampen improvisation. When Kappa members use the plans, methods, and metrics to focus their attention and guide their work activities, they also inadvertently discount ideas and activities not expressible in the vocabulary of the plans, methods, and metrics in use. This makes Kappa vulnerable to shifts in software development paradigms. Indeed, as mentioned, such a shift is currently underway within the industry, and Kappa's dependence on its proprietary suite of project management and software development approaches is constraining its shift to a new generation of software platforms which rely on a different infrastructure (the Internet), a different programming language (Java), and different software development methodologies (object-oriented, agent-based, and parallel development). One project manager commented about Kappa's current project management model:

I think it helps us, but the drawback is that the limit has been hit now of the capacity of that model. And our model is not today suitable for the future. It is what we call here a waterfall model of software development. It is sequential. But what we need now is a new model and a new methodology for parallel development.

As is well known, organizational success and familiarity tend to breed complacency (Starbuck 1989). While Kappa is not immune to these dangers, the need for change was recognized by Kappa members throughout the organization and at all levels. The challenge remains to change work and management practices effectively without undermining the ongoing coordination of complex product development activities over time, geography, history, and politics.

Learning by Doing: Knowing How to Develop Capabilities

Given the nature of Kappa's technically complex products and strongly competitive environment, Kappa managers want to stay on the leading edge of product development so as to retain and increase their customer base and highly skilled and marketable high-tech employees. Kappa accomplishes this through three primary activities: investing in individuals and their ongoing skill development, mentoring individuals and creating opportunities for their advancement, and rewarding developers' effort. Through engaging in such activities, Kappa members recurrently enact a knowing how to develop capabilities which generates a steady supply of skills and capabilities for both the individuals themselves as well as the particular units for which they work. It also ensures that Kappa's product development work is conducted by people with strong and up-to-date skill sets (Table 6 provides additional data on these activities).

Kappa invests extensively in its employees. One brochure handed out to new recruits describes their careers at Kappa as a "Lifetime of Competence Development," and employees are told that they will develop "capabilities" in three areas: "technical/professional competence"

(skills in computing, Kappa's suite of technical products, as well as the specialized language, methodology, and platform used in the development of those products), "business competence" (skills in project management, customer orientation, and the strategic issues of Kappa's current and future marketplace), and "human competence" (skills in intercultural communication, negotiation, and proficiency in the English language).

My interviews suggest that these descriptions about the development of "individual capacities" are not simply ideological rhetoric. A senior executive commented about the organization's HR activities:

We pay a lot for competence development. Not only in training, but also in overseas assignments. It is our life, so we believe in paying a lot for it. We invest in the individual. And we need that to balance out that we are not the highest payer. We do not pay as well as some of our competitors, especially in the United States where they buy loyalty with options and things like that. We build loyalty through investing in the people. We have a different culture.

Investing in the individual was not just an espoused principle, but actively enacted through what people did (or did not do) every day. For instance, one senior executive

Table 6 Learning by Doing Within Kappa

Knowing in Practice	Activities	Data from Kappa
Knowing how to develop capabilities through learning by doing	Investing in individual skill development through ongoing training	"A project organization can burn up people, so who is going to take care of them, and plan their careers with them. Today, it is not widgets we are making. If we want to keep the talent that is so scarce, we'd better be good guidance counselors. A manager today in this industry has to be an HR person."
	Mentoring employees and advancing their careers	"Kappa is also a company where you really have a lot of opportunities to do things, and also to change what you are working on. So, if you want to do some kind of line management, you can do that. If you want to do some technical work, you can get some technical responsibility. . . . so you have many possibilities, even to go abroad if you want. I mean you really can do anything you want."
	Rewarding the effort and not criticizing or punishing errors	"I think that Kappa does care about their people. I mean, they really do try to take care of their people. And then there is the opportunity to travel, the opportunity to move from job to job, and to have your manager actually very supportive of you doing that. And I really like that." "I would say that we keep a high level of respect throughout the company. I mean, there's not too many people that come off as being arrogant. Because here the culture is that of design, so when we look at documents, we know that this is just ink on a paper. It's not a person. We are reviewing the document, we are not criticizing a person here. So, we know that these are not comments to be taken personally. We are trying to improve the quality of the document by either making it more understandable, or correcting its faults, and once we focus on the document, not the person, things just kind of take off."

noted that there was no policy within Kappa to lay off employees:

In Kappa, we don't have the mentality to hire and fire. We care for our employees quite a bit. We are not just seeing them as producers, but they are people we also want to care for.

This commitment to employees is widely acknowledged by Kappa members, as a software engineer noted:

Here I know I have job security. . . . Kappa is a good company. . . . They don't treat you like they do in [name of competitor], where you can be kicked out the next day.

A large component of line managers' regular duties involved working with individuals to assist their career planning and guide their skill development. An HR manager explained that because an overemphasis on project goals may come at the expense of the employees' interests, Kappa engages in a separate process of employee development and mentoring:

If I'm a project manager, I may be grinding this person down to work 70 hours per week so as to get the project done on time. So I couldn't care less after this project is over if this person leaves. But from our organization perspective, that is a critical factor. So we have to have competence managers who will look out for the person because the traditional project managers may not do it.

Employees participate in such development and mentoring activities as: meeting with designated "competence managers" to plan and develop their careers, promoting their advancement through requesting challenging and/or overseas assignments, and electing not to leave the organization even in the face of (often multiple and lucrative) offers from Kappa's competitors. Software engineers clearly value the career opportunities that are made available to them within Kappa, as evident in the following comment by a United States software engineer:

[Kappa] has a tendency to build up its people. . . . they are really interested in continuing your education, I mean not in clay pottery, but as far as technology is concerned. If there is emerging technology in your area, or there is a growth ladder in the area, they will train you to move up this ladder, or train you to take in this new technology, instead of saying, 'OK, you have worked ten hours today, now go home and go to Barnes & Noble and buy a book, and read about this new technology stuff on your own.'

Within Kappa there is also a strong emphasis on promoting learning by doing through providing supporting environments within which people can experience new activities. A DU manager noted that:

We always say that to manage a new subproject, you at least have to have the experience once as a designer in the project.

So, last year we had one person that was recommended from another DU who wanted to come on an ex-pat contract. . . . And we took him but we said, 'We will consider you for subproject leader, but first you have to run through the project cycle in design, so that you know what you are talking about.' And he did. He did design and testing on a subsystem for VOS-98. And he is now that subproject leader for VOS-99, and it has turned out to be very good. Because now he really exactly knows what he's talking about, and what has to be done.

Reinforcing this supportive learning environment is an attitude of tolerance towards unanticipated or unavoidable errors, as a project manager observed:

I think it is important that we allow people to make mistakes without killing them. Kappa is very good at doing that. We reinforce positive behavior and don't kill negative accomplishments.

One DU had instituted a campaign they labeled "steal with pride" as a way to increase the reuse of software modules and to defend against the "not invented here" syndrome. This campaign included both incentives and procedures that enabled software designers to learn from each others' (and their own) prior work, rather than always trying to invent something new (a common value in the broader software design culture). One project manager noted that "we have to counter the hero mentality where everybody wants to put his personal stamp on the system, to put his own little Cadillac in the code." And they do so by creating incentives for sharing software modules with others, supporting the reuse of software modules through the creation of guidelines, templates, and repositories, and awarding annual prizes to the group that displays the most "inventiveness" in reusing existing software.

Through a series of activities that comprise training, developing, mentoring, and rewarding individuals, Kappa members enact a knowing how to develop skills and experiences that advances both their own capabilities as well as those of the organization. One potential negative consequence of this learning practice is that despite Kappa's efforts, talented employees leave the organization and take with them years of invested development, experience, and expertise. This risk of losing personnel is becoming more acute in the current technological environment where Internet startups are offering lucrative compensation packages and ownership options. A PO manager explained the issue:

We are in a situation with a ferocious market demand for good software people, who can get much better paid elsewhere. So how do we keep them? In my view it is values. We have to be really explicit, what are the values we have at Kappa.

A senior executive similarly commented that:

A key challenge for us is how do we recruit and retain top talent in a large company like Kappa. There will always be smaller companies that will pop up like a cork above us, so we have to find other ways and other things with which to attract and keep good people—like leading-edge technology, creative environment, participative culture, truly global company. You also have to pay a salary that is fair and equitable, but I think it is difficult for us to survive just by paying very high salaries.

While Kappa has traditionally succeeded in recruiting and retaining skilled individuals by investing in them, it remains an open question whether this strategy will work equally effectively in the new Internet-based technological environment and the opportunities proffered by an entrepreneurial business context.

Supporting Participation: Knowing How to Innovate
Producing technically complex products, while essential, is not sufficient for success in the fast-paced and competitive environment in which Kappa operates. The products also have to be innovative. Generating and sustaining a high level of innovativeness in product development is a significant challenge for any organization; it is even more so in the case of a highly distributed organization such as Kappa with its multiple constituencies, priorities, and interests.

This challenge is addressed within Kappa through the deliberate dispersion of product development activities to geographically distributed parts of the world, accompanied by the active integration of the distributed expertise and experience through ongoing project participation and overseas work assignments. These three activities are seen by Kappa members to significantly foster innovation and creativity (Table 7 provides additional data on these activities).

The first activity is the distribution of Kappa's product development work around the world. One senior executive explained the organizational benefits of distribution:

It costs 5 to 10% more to work in a distributed organization, but it means you will also be exposed to new ideas all the time. It is easy to get blind to your paradigm. Being distributed and diverse avoids that. . . . Also, being distributed is beneficial because you can have smaller units, and they can be a little more efficient. So, instead of this massive elephant that has a hard time to turn, you have lots of small units that can move quickly. It allows us to be flexible and to jump in any direction.

This view was echoed by DU managers, as one commented:

In terms of our distributed organization and the way we operate it is that we are working with a very valuable structure being in so many different cultures and having so many different perspectives and ideas coming in. So working like this gives you

the ability to change because you have to constantly adapt to a slightly different perspective.

Engaging the participation of hundreds of people from around the world requires activities that support such participation, and product development work within Kappa is premised on including project members in design decisions and giving them a voice in project deliberations. A software engineer and project manager observed, respectively:

People have a possibility to cooperate here, contribute to the decisions. So that it's not just managers who sit in a locked room, and then the only thing you get is the white smoke to say we have a decision. No, people can actually contribute to, take part in, the decision-making process here.

There is a lot of dialogue and open communications, involving people in decisions, not just dictating this is the way it is, but engaging people in discussions and dialogue, and talking to people, which in some case drags out the decision process, but it gives them the buy-in and the loyalty to the company.

Kappa members understand that such dialogue and inclusion requires being able to deal with the cultural and language boundaries that arise when people representing 30 different nationalities work on a single project. They attend to and engage with such boundaries by activities that include holding seminars on cross-cultural communication, rotating meeting locations so people can experience each others' environments, and endeavoring to use a single language (English) in project communication—whether conducted face to face, on the phone, via paper, or in electronic channels.

Another activity that facilitates distributed innovation is the opportunity offered to employees to take overseas work assignments, or what is known as going "on contract" or "expatriate." Such overseas assignments involve members living and working in other Kappa locations for periods ranging from three months to a few years. From the organization's perspective, overseas assignments are expensive, both financially and logistically. Initially, they involve an elaborate and often complex matching process to find an appropriate assignment for the employee based on his/her experience and requests as well as the opportunities and requirements of the various DUs. Then, they require the actual relocation of the employee and his/her whole family to the new site, as well as support for securing work permits, transportation, accommodation, schooling, and annual trips back to the home location. Despite the effort and cost, Kappa executives clearly see overseas assignments as a critical investment in building the innovative capacity of their organization. As one explained:

Having people on contract is very expensive, but we justify the cost through competence development. Every experience, any-

Table 7 Supporting Participation Within Kappa

Knowing in Practice	Activities	Data from Kappa
Knowing how to innovate through supporting broad participation	Distributing product development work globally	"A distributed organization, I think is very beneficial. First of all, we get different market views, we can do easy benchmarking with the different [DU] organizations. We don't have one organization doing the same thing it has been doing for 10 years. It is hard to change an organization that has worked the way it has always done. If you get a distributed organization, you get a lot of competition amongst the design units in terms of who has the best quality and the highest productivity." "One advantage from a DU point of view of being distributed is that we are working with many different product development units. If each DU was only working within one product unit, then cross-fertilization wouldn't happen. This way helps creativity, helps exchanging best practices, helps create this Kappa culture in a very strong way."
	Involving all participants in design decisions on projects	"Basically in Kappa, everything is negotiated. . . . It is very important that dialogue happens, that we understand what you are missing, so we can deal with the issues. But there has to be a dialogue. That's really where the trust issue comes in, so you can have that dialogue."
	Initiating and supporting overseas work assignments	"I've just finished this project, so I'm kind of moving on. I'm actually going to Holland on contract for a year and a half. And that will help me change my focus, because I'll be focusing more on software quality for the project. And that's different from what I was doing here." "I think what attracts and maintains our people is more than money. I think Kappa, being a global company, has a lot to offer, and you can move from Australia to Hungary and it is basically the same culture, the same tools, it's the same way of working. So you will hit the ground running if you move from one DU to another, and people like that."

where in the world is something that builds up the competence within Kappa, even though it is costly. For you to go anywhere, it will broaden you, it will make you more knowledgeable, more experienced, and so we pay for it. We believe that when you share with me and I share with you, then we both become more knowledgeable than we were before. That is the culture we have in Kappa, and it is one of our strengths.

Kappa encourages expatriate work as a way for individuals to share resources and expertise across the organization. For example, someone going to a DU as an expatriate may bring with her/him skills and techniques to share with the local engineers. One DU manager explained that he was sent as an expatriate to Mexico for a year to help open up a small local development unit there. In other instances, people become expatriates so as to learn new skills and techniques that they can take back to share within their local DUs. One project manager noted:

We develop a competence in one location and then we ask people to come there to learn. So they come to the one project for a couple of months or something like that, and work together in one place. So then when they go back home, they have the

basic knowledge of the competence and they can bring it back there.

A software engineer explained why she had chosen to take an overseas assignment:

I applied to come on assignment here as I wanted to do something different. I had been working in maintenance for a long time and I needed a new challenge. And it has been very challenging here because I never had to deal with real customers before, and now I have to talk to them all the time. I'm learning a lot.

Through the variety of activities that allow them to work inclusively with, within, and across geographic locations and cultural differences, Kappa members constitute a knowing how to innovate by leveraging the global dispersion and diversity of the organization. However, this also has its downside, in that the effort to be inclusive runs the risk of fragmentation, time delays, and conflict over priorities. A senior executive observed:

The fundamental thing about the design organizations is that they are located in different places. And as much as it is very nice to have these organizations that are diverse, they also sometimes pull in different directions. And the big challenge is to bring them together.

A project manager noted the temporal cost of making decisions in a diverse and dispersed organization:

There's a lot of negotiation and discussion, so it takes time before the decisions are made. And I think it can take sometimes longer to make decisions in the project.

A subproject manager expressed a concern about managing conflicts across units:

Any change in requirements is always evaluated against the needs of all the subsystems, so we may get into fights about priorities. For example, we may be trying to decrease lead times while another unit may be worrying about quality. So they may not feel the same sense of urgency that we do. But quality in a product that no one buys has no value.

while a senior DU manager observed:

Our diversity is an asset to this company, because the value it brings is that each unit has its own way of innovating. They each have their own ideas. Now, that's a positive and a negative. The positive is, we get a lot of different ideas which is very important. . . . But sometimes when you have multiple ideas, you also need to be ready to accept the fact that, yes, we have to choose from these ideas, and sometimes things will not go the way you want. So you also have to be compromising. It has to be a give and take. And sometimes we get refusal to accept some positions from a few people.

Kappa members strongly believe that their dispersed organization and its attendant diversity is an invaluable strength. To date, these benefits appear to outweigh the costs of inefficiency and risk of fragmentation. Nevertheless, as the industry experiences a technological shift and competition increases, it is unclear whether the negative consequences of extensive dispersion and diversity will remain a controllable consequence of doing globally distributed product development work.

Discussion

I have suggested that the empirical success of Kappa indicates a collective competence in knowing how to deliver timely, innovative, and complex products in a global organization. Spender (1996a, p. 58) has observed that the core competencies of a system "emerge from its activity." In my data analysis and discussion above, I have attempted to show that this is the case for Kappa, where the knowing how to do complex global product development is not attributable to any one thing such as a particular technology or infrastructure, or any particular strategy or leader, or any specific set of design or production skills. All of these are important of course, but so is the knowing that is enacted through the everyday and ongoing work of Kappa members. This aspect of Kappa's competence is an ongoing accomplishment, a

situationally enacted capability inseparable from the practices that constitute it recurrently over time. I articulated a repertoire of five such practices—sharing identity, interacting face to face, aligning effort, learning by doing, and supporting participation—that allow Kappa to routinely and repeatedly enact a collective competence in complex and distributed product development work. And to do so effectively.

This repertoire of practices is not proposed as exclusive or exhaustive. On the contrary, the practices should be understood as interdependent—overlapping and intersecting through the specific activities engaged in by individuals. For example, when Kappa members engage in specialized training, they are developing their individual capabilities, building their social networks through face-to-face interaction while also participating in the reproduction of Kappa's shared identity. Similarly, the repertoire of practices identified here is not exhaustive, as there is always the potential for new practices to be added or existing ones to be modified over time. While the current repertoire must be seen as open-ended, the particular practices articulated here offer interesting insights into why these five practices should be especially relevant to the accomplishment of distributed organizing. In particular, I argue that the salience of these practices lies in their capacity to help Kappa members navigate and negotiate the multiple boundaries through which they constitute their distributed product development work.

Consider first the *practice of sharing identity*. The ongoing generation and reinforcement of a strong Kappa identity and "Kappa way of doing things" allows members to internalize and identify with a common way of thinking about and engaging in their product development work. This facilitates the communication and coordination of hundreds of product developers across time (19 time zones) and space (15 geographic locations). It allows these developers to share a common vocabulary despite their 30 different nationalities and to have a common framework for making sense of each others' technical requirements and political priorities. Knowing the organization through the process of shared identity construction does not guarantee that all the temporal, geographic, technical, cultural, and political boundaries will be effectively crossed. However, it does offer some guidelines for articulating, attending to, and engaging with (i.e., navigating) these boundaries, while also providing some common ground if any redefinition or reconstruction (i.e., negotiation) of boundaries is deemed appropriate. For example, a senior project manager explained how some of these boundaries in the form of deadlines, functional requirements, and technical priorities are dealt with:

In general, we try to be flexible and satisfy everybody, but part of it is also for us to try to understand their needs. How critical

is the time frame? How far do we really have to stretch to add some functionality? Can it wait six months? Because of the resources we have, we need to have overlap between the projects so that we are running parallel projects at the same time. And that means that very often, if you stretch one project and add on some extra functionality, it means that the next project cannot start up as expected. So it's very much compromising, trying to understand what is needed from all the points of view, how critical things are for these different projects, and then trying to satisfy everybody's needs in the best way that's possible.

The *practice of interacting face to face* allows Kappa members to get to know each other through the building and maintenance of strong social networks that generate trust, respect, and commitment. This builds Kappa's social capital, which provides the foundation for ongoing interaction and sharing of information. The strong ties generated by such a knowing of the players in the game facilitates the doing of product development work across various technologies, geographic regions, multiple time zones, and ethnic differences. It allows for product developers to call on each other for help, advice, or ideas at any time and in any place. Because they trust and respect each other, these developers know they can depend on one another, regardless of the situation. Consider these comments by two PO managers:

I have been in many hotspots over the years, but I have always been able to find guys that would put more than 150% to help out, and that you will not see in most North American companies.

I know one of the subproject leaders in Palo Alto, and he called me because he needed a resource here in Amsterdam. And he needed an assignment specification very quickly. And so I just wrote him the standard assignment spec that our resources person here would be used to receiving. I just filled it out for him, and then sent it to him so he could add his specific information. I was just making it easier for him to get it done quickly.

In these observations, we see that the social network sustained through Kappa's practice of face-to-face interaction enables members to deal effectively with some of the technical, geographic, temporal, and political boundaries they encounter in their work.

The *practice of aligning effort* allows the Kappa members and their managers to coordinate their activities and allocate their resources across time, geography, project phase, and product version. By using common project management models and methodologies, and relying on standard contracts and metrics to annually assign developers to work on projects, Kappa members are able to make sense of (and modify if necessary) who is working on what part of which system, where, when, and how. The common language of the project management model as well as the standard resource assignment contracts and

metrics allow for the initial attending to and engaging with the boundaries of history (three versions of product), time (various phases of the system development project), geography (multiple locations of product development activity), and technology (different standards that need to be accommodated in the product). It also allows for flexibility in negotiating these boundaries if deadlines, priorities, technologies, or resources should change. For example, a DU manager noted that modification to assignments was an ongoing effort:

Here in our DU we have a pool of resources and you discuss and negotiate with the competence managers on what people will work on which projects. And that's an ongoing activity, you can say, because it's dynamic. It's not the case that all these resources are assigned at the beginning of the year and that during the year it will always be the same persons. The people can change. We do extra work if something new comes in, or other people are off sick or on holiday, for instance, or if we hire new people, or people go off to other jobs, like management positions, or they leave. Those things happen.

In this example we see how the recurrent practice of aligning effort through a common plan, method, and metrics allows for the flexible movement of people and reassignment of their effort to various projects and products, and across time and technologies.

The *practice of learning by doing* within Kappa generates a knowing how to develop the capabilities of product developers (and thus, collectively of Kappa) by providing individuals with ongoing education and development, actively mentoring their careers, promoting from within, and offering rewards (not punishments) for work done and risks taken. This extensive and intensive investment in employees strengthens Kappa's human capital and provides the basis for Kappa's capacity to navigate social, historical, and technical boundaries. By developing the software development expertise of its employees, it allows their participation and collaboration on large distributed product development efforts. It further develops their depth of experience, thus generating the organizational memory needed to manage three different versions of the same product. This accomplishment is technically complex (because of the need to preserve the integrity of all three versions separately while accommodating evolving technical standards), and historically challenging (because of the need to retain backward compatibility and interoperability across the versions).

The *practice of supporting participation* ensures that a multiplicity of voices and ideas is represented in discussions, deliberations, and decision processes. This generates a knowing how to innovate because of the creativity that is promoted through allowing a diversity of ideas and

experiences to be expressed and then shared. This diversity is leveraged through deliberately distributing product development work across the world, engaging the participation of dispersed members in ongoing product development work, and sharing disparate experiences by facilitating personnel reassignments across global locations. Such a practice enables the crossing of temporal, geographic, technical, and political boundaries, because it provides for the distribution, and then the integration, of ideas and experiences. Kappa members believe this allows the whole to be greater than the sum of the parts. As one senior executive explained:

This is one of the tenets of what we believe in—that our diversity is our strength. When it comes to product development, we strongly believe that by having these diverse organizations come up with their own initiatives and innovative ideas and putting them together, that that is our strength. And it also keeps the people interested because they have an opportunity for a lot more thinking and innovation.

A PO manager similarly noted that their distributed organization engendered the flexibility to change and be flexible in the face of changing technology and competitive challenges:

The way we as design organizations operate in so many different cultures gives us an opportunity in terms of being able to change at quite a fast pace. Because it gives you the constant mode of thinking that you must constantly adapt to different ideas and different technologies and different requirements that change. So that gives us a valuable structure.

Through engaging in these practices, members of Kappa are able to knowledgeably navigate and negotiate the multiple boundaries that they routinely encounter in their daily work—boundaries of time, space, culture, technology, history, and politics. However, navigating and negotiating these boundaries, as we saw, also has the potential to generate unanticipated negative consequences—"the brighter the light, the darker the shadow." So, even as Kappa focuses so intently on developing and sustaining its collective competence in distributed organizing, it also incurs a variety of risks that could lead it to fail. Through its ongoing practices, Kappa will need to develop additional capabilities to preclude or dilute such negative consequences as organizational rigidity, emotional and physical exhaustion, limited improvisation, loss of skilled talent, fragmentation, time delays, and conflicts in priorities and interests.

Implications

Kappa is, and has been for decades, a highly successful and innovative organization. Much of this success is certainly attributable to powerful leaders, competitive strategies, sophisticated technological and production infrastructures, and excellent engineering skills. However, to

stop there is to miss an important aspect of Kappa's organizational success, and that is that every day, thousands of Kappa software engineers around the world go to work and knowingly do what they do to get the complex job of distributed product development done. Their skills, their leaders, the infrastructure, the corporate mission—these are all essential ingredients, but they are not sufficient. To be successful, Kappa also has to collectively *know how to do* distributed product development and repeatedly enact this competence over time. I have argued that this capability for effective distributed organizing is both a collective and distributed competence, grounded in the everyday practices of global product development activities. As such, it can usefully be understood as an enacted capability—not a static property or stable disposition—but a situated and ongoing accomplishment that emerges from people's everyday actions.

I have emphasized the enacted aspect of knowing how to do global product development because it has not been well represented in much of the current organizational literature. To the extent that the organizational literature examines knowledge in global product development, it has emphasized one of two perspectives: how knowledge can be captured, represented, codified, transferred, and exchanged; or how knowledge that is distributed among individuals and embedded in their work practices can be integrated and shared with others. Despite their differences, both perspectives share a common focus on organizational *knowledge*, whether this is seen as a stock or resource to be created and managed, or whether it is seen to be a product of dispositions and collective practice. While these perspectives on organizational knowledge have provided and continue to provide important insights, what tends to get overlooked by such perspectives is the importance of ongoing and situated action. I believe a perspective on organizational knowing complements the existing perspectives on knowledge by insisting on the essential role of human agency in accomplishing knowledgeable work.

A perspective on organizational knowing has allowed us to understand how distributed global product development work is accomplished through the everyday practices of an organization's members. This perspective further suggests that because knowing is constituted and reconstituted every day in practice, it is necessarily provisional. Recognizing knowing as an enacted and provisional capability means that it is inappropriate to treat knowledgeable as given and stable, as always ready-to-hand. In particular, it suggests that continuity of competence—whether individual or collective—is never given, only achieved. This has important implications for how we think about organizational capabilities, as well

as activities such as distributed work, knowledge sharing, and transfer of best practices.

A view of organizational knowing as an enacted capability suggests that core competencies or capabilities of the organization are not fixed or given properties, embodied in human resources, financial assets, technological artifacts, or infrastructural capital. Rather, they are constituted every day in the ongoing and situated practices of the organization's members. This offers an alternative interpretation of competence. The conventional view is that competencies are stable properties of particular individuals or units that can be invoked as needed in different situations. Thus, when skillful performance does not ensue, commentators seek explanations in the failure of those properties ("human error") or breakdowns in the system ("equipment malfunction"). If, however, skillful performance is seen as an active accomplishment, its presence is not presumed and its absence is not sought in the failure of the parts. In contrast, when skillful performance is seen to lie in the dynamic engagement of individuals with the world at hand at a particular time and place, both its presence and absence are understood as emerging from situated practices. The focus then is on understanding the conditions (e.g., human, social, structural, financial, technological, infrastructural) under which skillful performance is more and less likely to be enacted.

The focus on skillful performance resonates with the rich examples of machine design, flute making, and paper handling offered by Cook and Brown (1999). Their explanation for the success of the designers, craftspeople, and engineers is grounded in what they see as the dynamic interaction of the knowledge (both explicit and tacit) possessed by the actors and the knowing that is an aspect of their work. As suggested earlier, such a separation of tacit knowledge from knowing in action is different from the perspective I propose here. I would suggest instead that it is through their recurrent practices that the designers, craftspeople, and engineers constitute and reconstitute their knowledgeability in machine design, flute making, and paper handling. Take away the practice of doing machine design, flute making, and paper handling, and there is no tacit knowledge and no collective competence in these areas. Cook and Brown (1999, p. 397) end their paper by noting that "we need radically to rethink what is needed to create and support 'core competencies.'" The knowing in practice perspective articulated here may offer a starting point for such a reconceptualization.

The perspective on organizational knowing locates the capability for effective distributed organizing in the everyday practices of global product development work. As

such, it is a socially constituted competence, and thus collective, distributed, and emergent. This view resembles Tsoukas (1996, p. 13) constructionist claim that because firms are "decentered systems," their knowledge "is not self-contained; it is inherently indeterminate and continually reconfiguring." For Tsoukas, such a view raises the question of how organizations integrate their distributed knowledge and deal with its continual emergence. The findings from the Kappa study suggest that the answer may lie at the level of situated practices. Tsoukas' (1996, p. 16) acknowledges the importance of human action for organizational knowledge, but does not explicitly locate agents' emergent and distributed knowledgeability in their recurrent practices. The perspective on organizational knowing may thus offer additional insights to Tsoukas' notion of the firm as a distributed knowledge system.

In their discussion of a knowledge-based view of the firm, Kogut and Zander (1996) highlight the central role of shared identity. They argue that "Firms provide a sense of community by which discourse, coordination, and learning are structured by identity" (1996, p. 503). Dutton et al. (1994) similarly argue that members' attachments to and identification with their work organizations significantly enhances their willingness to cooperate with others, perform at a higher standard, and contribute more frequently and more freely towards organizational goals. The study of Kappa's distributed knowing suggests some interesting overlaps in my empirically grounded conditions for effective distributed knowing and those identified by Kogut and Zander, and Dutton and colleagues. In particular, seeing knowing as an ongoing accomplishment raises an important question about the link between knowing and identity. Organizational identity has been proposed as the shared set of beliefs about what the organization is (Dutton et al. 1994). But to the extent that knowing "what the organization is" is enacted in practice, we might usefully begin to think about identity as an ongoing accomplishment, enacted and reinforced through situated practices. Contemporary work on identity construction and reinvention (Albert et al. 2000, Gioia et al. 2000, Schultz et al. 2000) has much to offer a perspective on organizational knowing, presenting opportunities for exploring the recursive relationship between identity and knowing as both emerge through practice.

Kogut and Zander (1996, p. 509) pose the additional problem of "how to communicate from highly specialized bases of expertise to provide instructions and tools that are employable by large numbers of people." The perspective on organizational knowing has implications for this problem and for the general interest in "knowledge transfer" and the sharing of "best practices" in a variety

of contexts, including global product development. As noted, because knowing is inseparable from its constituting practice it cannot be "transferred" or moved. At best, what can be transferred or moved here is data or information, and even then, as Kogut and Zander note, such transfer necessarily "entails innovation and disagreement" (1996, p. 509). Similarly, "best practices" cannot simply be shared or transferred. Leaving aside the problematic notion of who decides what "best" means, practices are, by definition, situationally constituted. They are not discrete objects to be exchanged or stable processes to be packaged and transported to other domains. Practices are generated through people's everyday action. It thus may be more effective to think about the problem posed by Kogut and Zander as a problem not of transfer but of developing people's capacity to enact—in their own particular local situations—"useful" rather than "best" practices. The notion of "useful practices" suggests the necessarily contextual and provisional nature of such practices and the organizational knowing that they constitute. It is a reminder that our knowing cannot be assumed, only ongoingly achieved.

There is currently considerable interest in facilitating knowledge sharing across communities through the use of various intermediaries such as boundary objects (Star 1989, Henderson 1991, Carlile 1998), translators and knowledge brokers (Brown and Duguid 1998), boundary practices (Wenger 1998), and cross-community communication forums (Boland and Tenkasi 1995). Such intermediaries—whether humans or artifacts—are seen as necessary because these scholars view knowledge, particularly know-how, as "embedded in" or "stuck to" particular situated practices. A focus on organizational knowing, however, suggests that the notion of stickiness, at least as it applies to "knowing how," may need revision. The "knowing how" that is constituted in practice is not effectively understood as "stuck" in or to that practice. That would be like saying that the words of this sentence are "stuck" to it, when in fact they constitute it. Instead, I have proposed that "knowing how" and practice are mutually constitutive. Thus, sharing "knowing how" cannot be seen as a problem of knowledge transfer or a process of disembedding "sticky" knowledge from one community of practice and embedding it in another—with or without the mediating help of boundary objects, boundary practices, brokers, or forums. Rather, sharing "knowing how" can be seen as a process of enabling others to learn the practice that entails the "knowing how." It is a process of helping others develop the ability to enact—in a variety of contexts and conditions—the knowing in practice.

The existing perspectives on organizational knowledge

make a number of important contributions to our understanding of knowledge as an organizational asset and as embedded in human resources. However, these perspectives also appear to privilege knowledge-as-object or knowledge-as-disposition over knowing-as-doing. In contrast, I have argued that paying attention to organizational knowing might complement our understanding of organizational effectiveness by highlighting the essential role of situated action in constituting knowing in practice. In particular, we might learn some useful insights about capabilities if we also focus on what people do, and how they do it, rather than focusing primarily on infrastructure, objects, skills, or dispositions. Understanding organizational knowing in practice may get us closer to an understanding of organizational life as "continually contingently reproduced by knowledgeable human agents—that's what gives it fixity and that's what also produces change" (Giddens and Pierson 1998, p. 90).

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Endnote

¹Names of the firm, its organizational units, products, and locations have all been disguised.

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