MANAGING KNOWLEDGE ACROSS THE BOUNDARIES OF A VIRTUAL ORGANIZATION

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This paper examines the knowledge-sharing and knowledge-management behaviors exhibited in a field study of the eCommerce systems group of a global service firm. The study demonstrates the mixture of virtual and physical mechanisms employed for distributed knowledge management, when these cross functional and organizational boundaries. The contribution of this paper is to provide a framework for how such groups manage distributed knowledge in practice and to suggest a fifth type of boundary object in addition to the four forms originally identified by Star (1989). The findings of the study have significant implications for how we design virtual systems for distributed management collaboration, as they suggest that many knowledge-sharing forms are not amenable to support within a computer-based system environment. Formal knowledge-sharing systems may only be defined within context of informal, social networking and information exchange.

1. Introduction

Information systems (IS) and social networks that span organizational boundaries create special problems for management. This is especially true in global organizations, where multiple cultures and local goals add to the problems of geographically and temporally distributed management. Boundary-spanning teams, where knowledge is distributed across functions and disciplines require different forms of management and leadership than traditional teams (Carlile, 2002). Leadership and team processes may be viewed as intertwined. New social networks are created by the needs of virtual teams and new forms of leadership are required to span the organizational boundaries that these networks encompass. However, the nature of virtual teams requires a certain amount of local autonomy and it can be argued that leadership is distributed in highly-dispersed organizations (Dutfield, 2005). We may adopt a constructivist view of leadership as the management of meaning for other management team members (Smircich and Morgan, 1982). In a distributed organization, the management of meaning may itself be distributed. Organizational knowledge may be seen as the end product of multiple

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processes of translation and transformation, across boundaries between the knowledge domains of collaborating work-groups (Carlile, 2002; Cook and Brown, 1999).

This has consequences for collaboration across organizational boundaries that have not been explored. This paper discusses findings from a longitudinal study of a global management team, responsible for the operation of eCommerce network systems in a distributed service organization. We examine the different forms of collaboration exhibited during this study, across different types of distributed organizational network boundaries. In the first section, the management of meaning and its relationship to knowledge management are discussed from a conceptual perspective. Then the findings of a case study are presented, to illustrate the nature of knowledge management in a globally-distributed organization. A discussion of findings highlights relevant constructs and presents a framework of distributed knowledge management, derived from the findings. Finally, the implications for research and practice are discussed.

2. Conceptual Background

Carlile and Rebentisch (2003) argue that existing theories of information processing in organizations do not scale well to the complex forms of knowledge integration required at the boundary between the diverse groups found in global organizations. Such groups rely on a shared language and methods for knowledge exchange that develop over time in stable organizational forms. This entails knowledge transformation and transfer. Transformation is required to provide a common language across groups with different cultures and practices before transfer can take place. This takes the form of a knowledge-integration cycle of storage, retrieval and transformation. When novelty is low, knowledge from previous cycles can be reused. But in conditions of change and uncertainty that are typical of many modern organizations, stored knowledge acts as a constraint on the retrieval of effective knowledge for dynamic decision-making (Carlile and Rebentisch, 2003). Organizations increasingly rely on human interpretive processes to supplement and select stored knowledge. To define effective technology support for knowledge management, we need to investigate and understand these processes.

2.1. *A Boundary-Spanning View of Organizational Knowledge Sharing*

Sensemaking within organizations and groups appears to be guided by the "management of meaning" (Smircich and Morgan, 1982), where influential leaders and managers interpret events and phenomena for others. Each of us constructs an individual perspective of "reality", that allows us to make sense of our work and its organizational context (Weick, 1995). Cultural values, language, and norms frame our notions of professionalism, defining work within a professional community of practice, that in turn reinforces a set of expectations values and norms that guide how we interpret our experience of work (Brown and Duguid, 1991; Lave and Wenger, 1991). A manager communicates an interpretation of a situation that will result in a positive outcome for the company (Smircich and Morgan, 1982). For example, a manager may present a downturn

in business as “a chance for us to demonstrate our ingenuity in meeting new challenges”. As management structures become more fluid and dynamic, members within and across organizational groups must interact and collaborate for global firms to operate effectively (Carlile and Rebentisch, 2003). Yet IT-supported knowledge management typically reverts to the scientific management model of “one best way” to manage ambiguity, equivocality and uncertainty (Zack, 2001). Best practices may be diverse and fragmented and organizations may respond by employing market-specific knowledge base systems. But this approach does not help with reconciling relevant local knowledge from various communities of practice. Our research question is therefore: *How do distributed, global, collaborative groups of managers develop interpretive processes that deal with ambiguity and equivocality within an organization and across the boundaries?*

2.2. *Forms of Knowledge and Communication Mechanisms*

At the core of the tension between specific local knowledge, practices and expectations and global forms of shared practice is a distinction between explicit and tacit knowledge (Polanyi, 1958). Tacit knowledge is equated with *know-how*, knowledge that we acquire through our experience of acting in the world, while explicit knowledge is related most strongly to *know-what*, knowledge about facts and undisputed events. Tacit knowledge is embedded in an individual’s understanding of how to act in a specific situation. It is difficult “transfer” this knowledge without social interaction and apprenticeship-type learning (Brown and Duguid, 1991; Lave and Wenger, 1991). But *know-why* and know-who (or *who-knows-what*) are equally important in real-world, contingent knowledge use and transfer (Johnson et al., 2002). In diverse and distributed organizations, experts increasingly need to combine and negotiate knowledge from multiple knowledge-domains, to produce hybrid solutions (Engestrom et al., 1995). Expertise is a synthesized form of knowledge, that requires the individual to act according to the contingencies of the situation. *Know-why* represents a knowledge of rationale that is cumulative and situationally-dependent. The rationale of know-how is made meaningful through relating it to wider organizational practices and shared interpretations, for example by explaining or demonstrating how a process exemplar used in one situation may be adapted to another situation (Blackler, 1995; Lave and Wenger, 1991). *Who-knows-what* is critical for collaboration when knowledge is distributed across multiple communities of practice, as it allows a collaborating group to predict each other’s perspectives, to locate sources of information, and to allocate tasks based on the distribution of expertise (Cannon-Bowers and Salas, 2001; Moreland, 1999). Cook and Brown (1999) suggest four communication mechanisms through which knowledge is shared: c*oncepts*, s*tories*, s*kills*, and g*enres*. Each form is employed to communicate a different type of knowledge. We supplement these with the mechanisms required to communicate who-knows-what: examples of best practice (process exemplars), claims to expertise and shared genres of communication that reinforce a shared cultural perspective of work (Engestrom et al., 1995; Lave and Wenger, 1991). We present our taxonomy of knowledge-forms in Table 1.

Table 1. Taxonomy of Knowledge Forms

Category	Communication Mechanisms	Knowledge included in category
Know-what	Concepts	Explicit knowledge relating to organizational facts and conventions.
Know-why	Stories	Explicit knowledge relating to global rules and models of behaviour; Tacit knowledge, relating to local and socially-situated, normative practice.
Know-how	Individual Skills and Shared Genres	Tacit knowledge relating to accumulated internalization and interpretation of the skills and professional expertise.
Who-knows-what	Process exemplars; Expertise; Shared Genres	Explicit knowledge relating to individuals' wider social networks of local and global knowledge sources.

2.3. *Mechanisms for Knowledge Mediation and Transfer*

Collaboration between work-groups operating within different knowledge-domains employs "boundary objects" (Star, 1989): shared artifacts and representations that permit different groups to collaborate without possessing a clear understanding of how the other group performs their work. Carlile (2002) suggests that various forms of boundary object are used to mediate knowledge in different ways, depending on how collaborating groups view the knowledge-sharing problem. These modes of use are summarized in Table 2.

Table 2. Modes of Use For Boundary Objects in Mediating Distributed Understanding

Boundary Object Class (Star, 1989)	Mode of Use (Star, 1989)	Form of Mediation (Carlile, 2002)	Boundary Object Characteristics (Carlile, 2002)	Integrative Nature of Boundary Object (Carlile, 2002)
Repositories	Permit differences in unit of analysis used by various groups.	*Syntactic* – based on the existence of a shared and sufficient syntax at the boundary.	Representing differences and dependencies at the boundary.	*Assumes people understand meanings in the same way.* Integration across boundaries is accomplished through simply transferring knowledge.
Standardized forms, methods, and procedures	Enforce common work practices across boundary, to provide shared problem-solving format.	*Semantic* – People interpret words & events differently, so multiple perspectives exist or emerge.	Representing and Learning about differences and dependencies at the boundary.	*Shared method enforces a shared view.* Integration is accomplished through processes or methods that permit translation and through learning about differences and dependencies at boundary.
Models and ideal-type objects	Provide an abstraction that works for all knowledge domains.	*Pragmatic* – recognizes that knowledge is embedded in local practices and meanings.	Representing, Learning, and Transforming.	*Diverse perspectives require negotiation and synthesis.* Integration accomplished by jointly transforming existing, local knowledge into novel forms of shared knowledge.
Terrain with coincident boundaries (Maps)	Provides common scope of collaboration but different internal contents.	*Pragmatic* – recognizes that knowledge is embedded in local practices and meanings.	Representing, Learning, and Transforming.	*Diverse perspectives require negotiation and synthesis.* Integration accomplished by jointly transforming existing, local knowledge into novel forms of shared knowledge.

Typical boundary objects include physical artifacts, shared representations, documents and models or maps, that allow people to share required knowledge while not concerning themselves with knowledge that is not shared. For example, a transit map may allow a platform attendant to provide directions without understanding the purpose of the traveler's journey. Analyzing the use of boundary objects allows us to understand the nature of knowledge exchange at the boundary between different organizational entities and how stakeholders in that situation perceive their knowledge-sharing problem.

3. Research Site and Method

3.1. *Research Site*

The subject of this research was the global eCommerce group at eServCorp Inc.[1]. eServCorp had been acquired by a multinational company only a few months prior to the start of this study. The setting provided an excellent example of complex knowledge management where diverse cultures must find a basis for collaboration across workgroup and organizational unit boundaries. Prior to the acquisition, eServCorp had operated a global eCommerce organization that spanned four major geographical regions: North America (USA and Canada), South America, the Asia Pacific region, and Europe. The company prided itself on its ability to compete by maintaining state of the art operational and client-facing systems. This technical edge, coupled with a culture of rapid response to problems and customer requirements, gave them a significant advantage in their service industry and an established base of major, multinational client companies. When eServCorp was acquired by the parent company, the culture of the eCommerce group was maintained by its Executive VP. He expanded his informal management meetings into a global virtual meeting, supported by telephone conference calls and email. The company's network facilities provided support for the exchange of project or product-specific information, but the primary mode of communication was the morning conference call. Regular participants in the daily conference are given in Table 3.

Table 3. Regular Participants In Daily Management Conference.

Job Title	Pseudonym	Job Function/Location
EVP, eCommerce	Mr EVP	eCommerce Exec VP, USA
Director, Tech Ops	Mr Network	Network Mgmt., USA
Director, Info Systems	Ms Applications	Corporate Systems Mgmt, USA
VP, eCommerce	Mr Business	Client-facing Systems Mgmt, USA
Sr VP, European Ops	Ms Europe	eCommerce Project Mgmt., Europe
Manager Cust. Support	Mr Support	eCommerce Client support, Europe
Sr Project Mgr, VendorCo	Mr VendorPM	Outsourced Sys. Devt. and Data Center Operations, USA
Technical Lead, VendorCo	Mr VendorTech	Outsourced Systems Development, USA

[1] Names of the organization, its departments, members, services, and products have all been disguised.

While managers participating in the daily conference were primarily located in the USA or the UK, the operations, products and services discussed in these meetings ranged across the entire global organization. The pseudonyms given in Table 3 are used to identify managers of various functions in the meeting extracts reported below. Regular participants were selected by the Executive VP for eCommerce, who ran the group that we observed, mainly on the basis of their scope of responsibility. Occasional participants included senior managers from eServCorp Inc. and their controlling company, as well as a diverse set of technical or marketing managers.

3.2. *Research Method*

Our study followed the team activities of the global eCommerce group over a period of nine months, from soon after the company's acquisition to the present time. The study is ongoing: this paper presents some initial findings as an investigative study. The focus was on understanding the process of knowledge-sharing: what knowledge was exchanged, with whom, and how it was effected through interactions between various managers over time. The method emphasized an interpretive, naturalistic inquiry (Lincoln and Guba, 1985). Data were collected through an ethnographic field study conducted via observations of conference call interactions and meetings with participant managers (Van Maanen, 1988). Two researchers attended, but were not active participants in, daily management conference-call meetings which took place on Monday to Thursday of each week. Although we were attending the meeting remotely (by telephone), this was true for many of the participants, who constantly traveled and had to deal with business while they were away from the main office, or who were located in geographically dispersed offices. We conducted formal interviews with managers at the start of the study and after three months, to understand the how the group and the wider organization functions, who does what and why. We recorded interactions between organizational managers, actors and external participants, to understand knowledge-sharing processes, in 150 half- to one-hour telephone conference meetings, over a period of nine months. We held monthly interviews with eCommerce managers to discuss significant events, people, and roles mentioned in the conference calls. The longitudinal design of the study has permitted constant comparison of data samples across time (Barley, 1990; Strauss and Corbin, 1998). Data were coded qualitatively, with the two researchers collaborating in defining coding schema and ensuring a consistent interpretation scheme. Because this study focused on understanding knowledge-sharing processes, data collection and interviews were focused around the practices, people, and artifacts involved in daily work. The unit of analysis here is the global eCommerce group and its interactions with other organizational groups, business units and organizations.

4. Findings

During the analysis, several major boundaries emerged as significant, with distinct forms of knowledge-exchange and boundary-object mediation that communicated distinct

assumptions about the knowledge-transfer problem. These are described in detail below with the analysis summarized in Table 4.

Table 4. Observed Cross-Border Knowledge Sharing Mechanisms

Boundary Object Mechanisms	**Knowledge Sharing Form**			
	Know-What	***Know-Why***	***Know-How***	***Who-knows-what***
Repositories	Communicate financial targets	Articulate elements that make the group successful. (4.34.3.)	Reference specific work practices in discussions. (4.3)	Involve diverse set of managers in discussions.
Standardized Forms, Methods, Procedures	Clarify project expectations and requirements (4.1)	Make eCommerce group performance drivers explicit. (4.4)	Make work practices explicit through discussion and debate. (4.1, 4.4)	Identify managers responsible for: vendor oversight, financial drivers.
Models		Generalize successful problem resolution from prior cases.	Share exemplars and analogies from prior experience of situation (mis)management. (4.5)	
Maps		Establish virtual boundaries of eCommerce group. (4.2)		Identify relevant stakeholders and problem solvers in other groups (4.1)

The summarized findings demonstrate the diversity of knowledge-sharing forms and mechanisms, but also illustrate the core role of who-knows-what in communicating knowledge that is situated, even when this knowledge is to be transferred to another global location or culture. Numbers in parentheses refer to the section in which a specific example is presented for this form of knowledge-transfer.

4.1. *Managing Work Practices*

The culture of the daily conference meetings was relaxed and informational. The EVP for eCommerce (Mr EVP) led each meeting at which he was present, introducing a clear agenda and leading the discussion. When he was not present, one of the two local Directors would lead the meeting: it was noticeable that they adopted a similar style of meeting management. There was a clear emphasis on learning across the team. Issues were introduced in a roundtable manner, sometimes preceded by an important or urgent issue on which Mr EVP needed rapid action. It was possible to track issues across many meetings, as new information emerged and was acted upon, leading to new consequences requiring further action, and so on. The next sections provide insights into how various forms of knowledge transfer took place and the rationale behind these mechanisms.

Given the diversity of global operations, a major need for knowledge sharing between members of the eCommerce group was the need to manage a uniform and informed quality of service. This was achieved by making work-practices explicit in discussions, so that a set of standardized forms, methods and procedures could be defined for use globally. The major occasion for uniformity was in response to technical operations, as these directly affected the revenue-generating capability of the company

(the ability to sell further products and services to clients). In communicating and defining best practice for group operations, Mr EVP mostly took the lead, based on his experience across technical and commercial operations. But definition of appropriate procedures was also defined collaboratively, as in the following example:

> *Ms Europe:* Mr Support and June visited the French vendor, so I have asked them to do a write-up for us, so that we understand what the issues are etc. and if there is an opportunity to take some of the stuff like the product site, like the project bank for Europe, since it's already built. But we need to look at the how we host it, where we do it – so I have asked them to write it up for us.
> *Mr EVP:* OK, let them write it up. Then let's talk about it – you, me and Mr ClientSys. …The reason I want to discuss this other stuff - you, me and Mr ClientSys - is that I want to make sure that whatever they put together, you have vetted. With a broader understanding of the global perspective than they might have. Because what happens is that they come back to Mr ClientSys – and they might end up not having the most productive discussion, off the bat. So I'd rather have the discussion with you first, before we get into the more detailed discussion.
> *Ms Europe:* OK
> *Mr EVP*: OK - good. And I'm fine with you and Mr ClientSys doing that without me as well. I think that will help transition this whole process – we'll figure out how we're going to work it.
> *Ms Europe:* Yeah - we probably want Mr ClientSys here earlier rather than later, as well.

Here the group is establishing know-how related to the process of assessing vendors, but also defining who-knows-what, and who are the relevant stakeholders to be involved in the process as they work across multiple internal and external organizational boundaries.

4.2. *Managing Strategy*

The group spent much time in defining and clarifying global eCommerce group strategy:

> *Mr ClientSys:* It turns out that a vendor that the EU office have – is one that everyone else uses.
> *Mr EVP:* Yes and develops stuff for everyone else and shares the information. It depends whether we consider that a system for … constitutes a competitive advantage,
> *Ms Europe:* I think that outcome analysis and project sourcing has to become a strategic area.
> *Mr EVP:* The question is, do we do it in such a way that we give the ability to everyone else, to do things the same way. So the question is, do we pay more, given that the minute we do it, everyone else will be doing it as well, scrambling after, or do we do this and give everyone else the ability to do it the same way?
> *Mr ClientSys:* Yes. OK, I have a meeting with <the local vendor>, later.
> *Mr EVP:* Yes, and Ms Europe, we'll bring you more into the loop as well, because of the two hats that you wear.

It is clear that group strategy was closely tied to who-knows-what as well as know-why. As individuals communicated their partial knowledge of the situation, they were empowered by being given knowledge about to whom they should speak, to find out more, as well as developing a clearer idea of what elements drove group finances.

4.3. *Managing The Response To Operational Problems*

A second global management problem was to provide a uniform and informed response to dispersed operational problems. These tended to arise suddenly, and the US technical staff often lacked the local knowledge of the situation required to resolve them. So the

group focused on defining standardized and explicit work procedures and methods that would permit resolution by remote staff:

> *Ms CorpSys:* I think the training that's going on for <product package> in Switzerland is commencing in the second day. We've temporarily resolved the regional settings issues, so *(to Ms Europe)* we'll have to get together and get this thing scheduled out, so we don't have Mr Support sitting there trying to get things to work in the middle of training.
> *Ms Europe:* Yeah, I think he's still got an invoice template problem.
> *Ms CorpSys:* Yes, I had her try to test another one. I think we made all the changes but it never got copied up yesterday to the acceptance server, so -- *<to Mr VendorTech>* I just sent a note to your colleague to see if that invoice template was the one on acceptance and I don't think it was and he put it up on acceptance.
> *Mr VendorTech:* I sent an email there to Ms CorpSys yesterday asking her if everything was OK. And er for whatever reason, I don't think I got a response back.
> *Ms CorpSys:* Yes, I'm kind of beside myself on that one – I'm kind of beside myself on that one – I'll take care of that -- that was sloppiness on our part.

In this case, the team jointly develops an understanding of the problem (know-what) the relationship to training that made it important (know-why) independently of Mr EVP.

4.4. *Managing Vendor Relationships*

In defining new products a great deal of effort was expended in exploring product requirements, but much more of the knowledge exchange was spent on determining coordination problems between eServCorp and the vendor:

> *Ms CorpSys:* Some system reports have problems.
> *Mr VendorTech:* This was fixed in acceptance, but it didn't move with the release.
> *Mr EVP:* How many times does this happen? About 50%. Why are we paying <the vendor> for the same mess up 50% of the time?
> *Ms CorpSys:* We go through a rollout plan after every test. Moving code over always catches us.
> *Mr ClientSys:* There should be some established best practice.
> *Mr EVP:* I'm sure there's a best practice 'cause it's been going on since the 1960s.
> *Ms CorpSys:* Is it because there's more than one person?
> *Mr EVP:* Are we doing something that's keeping you from doing the job correctly.
> *Mr VendorPM:* Can't dispute numbers. One thing that causes problems is bundling and unbundling fixes when some are accepted and some aren't.
> *Mr ClientSys:* Are we relying on people to remember what they developed three months ago, two weeks ago, 2 days ago?
> *Mr EVP:* We gotta leave a longer gap for customer acceptance testing. We assume it's going to go through smoothly. It never does. We'll have to do acceptance testing one and acceptance testing two, so it can all go through together.

In this way, contractual responsibilities were clarified by ensuring that the vendor and the people overseeing the vendor relationship adopted standardized methods and procedures for ensuring that software product deliveries were made effectively.

4.5. *Managing The Relationship With The Parent Company*

The group spent a good deal of time trying to understand what drove success and how to evaluate this, in reporting to the parent company and projecting future financial performance. Despite the extensive experience of Mr EVP in managing competitive

advantage for this group, he often deferred to other team members, to build up a complex, collective model of how performance was reflected in reporting statistics:

> *Mr EVP:* <to Mr ClientSys> We're double-checking the performance numbers to make sure they're accurate. The client completion times look long relative to the universe. I think it's the industry. Looks like an extended high tech slump. We need more data before we go back to the client. We are looking at projects we have already closed where we were successful.
> *Mr ClientSys:* <Talks about quirks of client project>. We are measuring different things, when we assess success for them.
> *Mr EVP:* I missed the conclusion. Nice. That'll explain the difference, but won't make the client numbers look any better.
> *Mr ClientSys:* We're only tracking successes.
> *Mr EVP:* I need to look more closely at the universe. We need to discount these figures and then we can talk about comparing apples to apples, not apples to pears.

Responding to an increased emphasis on business metrics from the parent company, the eCommerce team takes a fresh look at the implications of existing data – and creating a new element of know-how in the process.

5. Synthesis of Findings

The findings above demonstrate the diverse nature of leadership in boundary-spanning meaning and knowledge-management. The most significant finding seems to be the centrality of *who-knows-what* to every form of knowledge transfer. Who-knows-what appears key to communicating knowledge that is situated and distributed, even when this knowledge is to be transferred to another global location or culture and the individuals involved are not personally familiar with each other. Who-knows-what is used as a way of managing the meaning of group knowledge in multiple ways: to define the legitimacy of knowledge-sources, to frame the politics of action, to define best or worst practices, or to interpret information in terms of trustworthiness, global application, or completeness.

Another interesting finding from this investigatory analysis is that many forms of diverse knowledge sharing across very different organizational boundaries are performed in very similar ways, as shown in Table 4. The same boundary-spanning knowledge sharing mechanisms come into play repeatedly, whether the eCommerce group is engaged in managing corporate coordination with the parent company, managing projects and relationships with external vendors, or managing internal relationships across the diverse set of functions represented by group members. Every single boundary required the definition of standardized forms and procedures to reflect the groups understanding that they needed a shared method to enforce a shared view of operations across the boundary (Carlile, 2002). But equally, every single boundary required the definition of models and maps, that permitted diverse perspectives to co-exist (Carlile, 2002). It appears that this diversity was prized within the eCommerce group, so that a shared view of the collaboration objectives could be constructed from all relevant knowledge, rather than limited to the partial knowledge possessed by individual group members. A repository boundary object (indicating that the actors assume similar interpretations of knowledge) was only used for intra-group boundaries across functional responsibilities.

A final insight is the need for a new type of boundary object, to manage issues relating to a combined *who-knows-what* and *whom-I-want-to-deal-with* perspective. We need a group-membership boundary object, in addition to the four types defined by Star (1989). This form of boundary object establishes the basis for collaboration It is distinct from the standardized forms and procedures, in that it does not impose a common method or a common perspective at the boundary. But it establishes a set of parameters for collaboration – a scope of operations and ways of working – by identifying people with whom the core group feel comfortable in collaborating. Selection of collaborators and project group members is known to be the way by which managers ensure that collaboration is viable. This is a critical boundary object that has so far been overlooked.

6. Conclusions

This study has reported on an investigative study of global collaboration within and across the boundaries of a diverse eCommerce group in a service organization. The findings demonstrate that formal knowledge-sharing is only meaningful within a context of informal, distributed social networking and information exchange. Ambiguity, equivocality and uncertainty are dealt with through defining a scope of meaning, relating new information to previous work-situations in multiple ways, depending upon the collaboration objectives desired by the group manager or a delegated individual. Many forms of knowledge were communicated through the combination of oral communications and email that could not have been communicated via a computerized information system alone. Formal knowledge-sharing would not have been appropriate.

The contributions of this paper are to provide a framework for how boundary-spanning groups manage distributed knowledge (Table 4), and to suggest a fifth type of boundary object in addition to the four forms originally identified by Star (1989). The framework provides rich insights into how we may employ technology to support boundary-spanning knowledge in distributed organizations. The findings have implications for how we design virtual systems for distributed management collaboration, as they suggest that many knowledge-sharing forms are not amenable to support using a computer-based system environment alone. The communication of who-knows-what to enrich knowledge transfer has been exposed as a rich and complex process that relies on many elements: politics, perceptions of best practice that are based on personalities, timeliness of work, and willingness to delegate or prioritize issues. It is therefore unsurprising that managers predominantly select richer media than email or virtual collaboration-spaces to support these communications. Our findings have significant implications for research. Much of the research into media richness and knowledge transfer relates to the form of interface and interpersonal interactions, rather than the forms of knowledge being transferred. In contrast to the familiar effort to codify and make knowledge available on a permanent basis, we conclude that there are many forms of knowledge – including with whom managers wish to deal and why – where knowledge exchange is enhanced because it is not committed to a more persistent form.

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