DISTRIBUTED KNOWLEDGE COORDINATION ACROSS VIRTUAL ORGANIZATION BOUNDARIES 1

Knowledge Management

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Abstract

This paper examines boundary-spanning knowledge-coordination in the definition of information systems by the e-Commerce systems group for a global service consultancy. We report on the findings of an eighteen-month field study to investigate distributed and virtual knowledge coordination across organizational boundaries. Our study reveals multiple ways in which knowledge is coordinated by means of a web of functional and domain-expert roles, distributed knowledge-resources, and imposed or negotiated procedures. We identify a “problem-coordination distance” that relates to the organizational-span of coordination and the type of problems to be resolved. We observe that different forms of group memory are used to manage boundary-spanning collaboration according to three degrees of problem-coordination-distance. These findings are related to the potential use of knowledge management systems to support boundary-spanning coordination for enterprise managers in virtual organizations.

Keywords: Distributed knowledge coordination, boundary-spanning collaboration, knowledge management, group memory, bridging operations, wicked problem-solving.

Introduction

The problem of knowledge coordination in distributed organizations is complex, as they employ multiple, uncoordinated information and communication technologies (ICTs) – e.g. telephones, email, data-centers, internets, and portals – to engage in collective decision-making and coordinated action across geographic boundaries. But knowledge-coordination is further complicated in virtual organizations. These go beyond geography-spanning in their use of ICTs. Virtual organizations employ business processes that rely on technology for their inputs, operation, coordination, or delivery (Shao et al., 2000; Travica, 1998). This has consequences for the definition of information systems that support enterprise-wide knowledge management (KM) that expose a contradiction between the two streams of “knowledge management” theory reflected in IS literature.

The organizational KM literature views knowledge processes as embedded within a localized context. These depend on an understanding of the social and cultural rules of the local community of practice – a specific group, engaging in shared practices to achieve a common purpose (Lave and Wenger, 1991). But the successful use of knowledge management systems (KMS) depends on knowledge being captured, codified, and transferred between people located in many different places and between different communities of practice. Knowledge codification has a reductionist tendency (Johnson et al., 2002). But boundary-spanning collaboration requires an expansionist approach. It involves the discovery and translation of knowledge across multiple domains of action (Carlile, 2002; Levina and Vaast, 2005). This dichotomy results in a design theory that views organizational procedures as emergent knowledge processes, involving an unpredictable group of actors who are supported by adaptive knowledge-resources and systems (Markus et al., 2002). To provide effective KMS support, we need to understand how organizations manage these tensions in practice.

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The research question that guides this study asks:

*How are different forms of knowledge managed and coordinated across the boundaries of a virtual, global organization?*

This paper presents findings from an exploratory field study of the global management team responsible for the operation of an e-Commerce systems group in a distributed service organization. We relate various spans of boundary-spanning collaboration to a range of organizational problem-solving categories, to explore how knowledge is coordinated and managed across organizational group boundaries.

**Conceptual Background**

**Knowledge Coordination and Group Memory In Boundary-Spanning Collaboration**

We have little evidence to explain how virtual organizations manage the diversity of interests involved in eliciting, using, and sharing organizational knowledge (Zigurs, 2003). The increase of virtuality in organizations appears to be associated with decreasing bureaucracy and decentralization of operational processes, with a counter-prevailing tendency towards centralization of strategic management processes (Travica, 1998). Virtuality creates new organizational forms with poorly-defined group boundaries and business processes. As management structures and roles become less well-defined, coordination-processes are less visible (Shao et al., 2000). Knowledge must be coordinated across multiple communities of practice, each with their own definitions of relevant expertise, local knowledge-resources, management values, and business goals (Wenger, 2002). So organizations increasingly rely on distributed human agency to provide the interpretive structures that support global management decision-making (Dutfield, 2005). It has been argued that the meanings ascribed to significant events and organizational phenomena are managed by influential leaders, through the use of stories, myths, and analogies that proactively shape a specific organizational culture (Denning, 2000; Pettigrew, 1990; Smircich and Morgan, 1982). But this theory of action assumes that the resultant knowledge of how to act is shared between group members.

Theories of distributed cognition argue that understanding is “stretched over” and coordinated between people and the knowledge-resources that they use (Hutchins, 1995; Star, 1998). Individuals coordinate their work through intersecting role-definitions that define how they interact and exchange information, coordinated through the use of shared artifacts and information-systems (Hollan et al., 2002; Hutchins, 1995). A distributed form of group memory, transactive memory, accumulates through interactions between individuals. Transactive memory involves two elements: information about the areas of knowledge and skill possessed by each group-member (domain-expertise), and information about the location of knowledge (who-knows-what) (Wegner, 1987). Computer-supported transactive memory systems enable group-members to benefit from each others’ knowledge if they can formalize their understanding of who-knows-what (Hollingshead and Brandon, 2003; Moreland, 1999).

A less formal view of organizational knowledge argues that individuals possesses only a partial understanding of organizational business-processes, so they coordinate their work by means of a distributed understanding of who-knows-what (Boland et al., 1994). Groups of people who regularly collaborate develop an adaptive group memory, that is maintained through “heedful interrelating”, where individuals constantly monitor and coordinate their actions with those of others (Weick and Roberts, 1993). This form of group memory is facilitated by metaphors, stories, shared language, and common practices – providing a repertoire of tacit understandings or “knowledge-resources” (Wenger, 2002).

Experts in various knowledge-domains act as boundary-spanners, converting the meaning of knowledge-resources in one community to the conventions used by another (Carlile, 2002; Levina and Vaast, 2005). Increasingly, boundary-spanners must deal with polycontextuality, adapting knowledge across multiple domains of application by means of a wide knowledge of local frameworks for action (Engestrom et al., 1995). These tacit knowledge-resources are not amenable to codification; their translation relies on “bridging operations” (Weick, 1995), interlocking routines and interpretations that are constructed and affirmed through repeated interactions with others. Bridging operations resolve the conflict between local and generalizable knowledge, so that people can act automatically rather than engaging in prolonged deliberation every time a decision needs to be made (Weick, 1995). Group practices are bridged across a diverse set of contexts by means of various objects, which we will refer to as “bridging objects”: stories and metaphors that define shared value-systems and goals (Pettigrew, 1990), shared frameworks for action (Engestrom et al., 1995), boundary objects such as business-flowcharts, that are plastic
enough to be interpreted in different ways by various groups but convey sufficient common meaning for collaboration across boundaries (Carlile, 2002; Star, 1989), IT systems acting as boundary-objects (Levina and Vaast, 2005), or cognitive artifacts such as group to-do lists, that permit coordination across domain-boundaries without the need to understand how others work (Hollan et al., 2002; Hutchins, 1995). We can analyze bridging operations and objects to understand knowledge coordination mechanisms across functional and group boundaries – and to determine how group memory is maintained at the boundary.

**Modes of Organizational Problem-Solving**

We propose that organizational knowledge-processing challenges may be differentiated according to the structure of organizational problems encountered in different modes of collaboration. Simon (1973) distinguishes between well-structured problems, where requirements and evaluation-criteria for a solution are communicated by the problem definition, and ill-structured problems that present no obvious solution-requirements or evaluation-criteria. Ill-structured problems require investigation to define the problem-structure and to clarify the goals for change, while well-structured problems are amenable to rational analysis. Human-beings are incapable of understanding all of the complexity of real-world problems, so they develop a simplified model of the situation, subjectively "bounding" the number of problem-elements that they consider when defining solution-criteria, until they can reach a satisficing ("good-enough") solution (Simon, 1981). For example, a car-buyer might only consider tradeoffs between price, features, and "coolness" when making their decision, choosing to exclude performance, reliability, availability, or safety-rating.

The analysis of both types of problem requires familiarity with the knowledge-domains(s) within which a solution may be discovered. Many organizational problems involve high degrees of ambiguity, equivocality, and situational complexity, especially when they span multiple knowledge-domains. These constitute “wicked problems”, that:

(i) are unique -- and therefore unfamiliar to the problem-solver,
(ii) lack any definitive formulation or boundary;
(iii) have many, often incompatible potential solutions each of which is only ‘better’ or ‘worse’ than others (as distinct from right or wrong solutions);
(iv) possess no tests of solution correctness -- as there is no objective problem-definition, there can be no optimal solution;
(v) tend to be interrelated with many other problems -- one problem can be seen as a symptom of another problem and its solution will formulate further problems (Rittel, 1972).

Problem characteristics are related to the knowledge-coordination challenges presented by each type of problem in Table 1. Well-structured problems, communicate their own solution through their definition. Ill-structured problems are capable of being defined and decomposed in a “rational” (if not entirely objective) manner following investigation. Wicked problems require a more subjective and negotiated approach to definition and resolution. Rittel advocates ‘second-generation design methods’ to replace the rational model of design in wicked problem-solving. Second-generation problem-solving methods include argumentation, which Rittel sees as “a counterplay of raising issues and dealing with them, which in turn raises new issues and so on”. Stakeholders share a “symmetry of ignorance” about which knowledge or expertise is relevant and what are the requirements for a solution (Rittel, 1972). Because of this, wicked problems are truly emergent, requiring iterative problem-solving methods and evolutionary knowledge management system design. Knowledge-coordination mechanisms will vary according to the type of problem, number of stakeholders, or the extent to which goals for change can be defined. This provides us with a framework by which to examine different modes of collaboration. In the next section, we discuss the method by which knowledge coordination mechanisms in a boundary-spanning, virtual group, confronting these three different forms of organizational problem were explored.
Research Site And Method

This research studied the global e-Commerce group at eServCorp Inc.\(^2\), which had been acquired by a multinational company only a few months prior to the start of this study. They develop and support global e-Commerce systems that span four major regions: North America, South America, Asia-Pacific, and Europe. A diverse set of company products and services are delivered via the Internet to a large customer base that includes major corporations. Their dominant market-position is maintained by focusing on state-of-the-art system applications to provide flexible service-configurations and to evaluate the impact of their services on client performance. They are a highly virtual company, at least on the operations side. The study followed the coordination activities of the e-Commerce group over a period of eighteen months, starting soon after the company’s acquisition by a major multinational organization, “ParentCo”. We were in a position to observe inter-group-coordination during adaptation to cultural and structural changes, reflecting the dynamic challenges faced by global organizations.

eServCorp used website applications to provide services to and communicate with clients and remote system users. The primary mode of management coordination at the enterprise level at which the e-Commerce group operated was a daily conference call, supplemented by emails in which schedules, plans, documents, spreadsheets and scanned diagrams were exchanged. Regular meeting participants are listed in Table 2; these included managers from VendorCo, a local systems development company, who ran the group’s data center and to whom the majority of eServCorp system development was outsourced. Occasional participants included senior managers from other eServCorp business-units and regional project managers. Although operations, products and services ranged across the global organization, participants in the daily conference were primarily located in the USA or Europe. Technology and e-Commerce support in other regions were managed via local agents who reported to US managers. Managers would often attend remotely by telephone from regional offices, trains, hotels, and airports.

\(^2\) Names of the organization, its departments, members, services, and products have all been disguised.
Data were collected through an interpretive, ethnographic field method conducted via observations and interviews (Schwandt, 1998). Two researchers observed and transcribed 338 management conference-call meetings over a period of eighteen months and conducted 4 collective interviews with the e-Commerce management group, 6 interviews with the Executive Vice President (EVP) for e-Commerce, and occasional ad hoc interviews with individual e-Commerce group managers, to understand events, people, and projects discussed in the. Conference calls took place from Monday to Thursday of each week (Friday was considered a “tie-up day”), and lasted from 15 minutes to one-and-a-half hours, with an average duration of 36 minutes. Data analysis focused on ways in which knowledge-management was coordinated for different types of problem-solving, decision-making, and virtual collaboration. Using a grounded analysis (Strauss and Corbin, 1998), we developed a categorization schema that indicated three dimensions of knowledge-coordination:

(i) the geographic and functional span of project-related problem investigation,
(ii) the mode of problem-solving (see Table 1), and
(iii) the bridging mechanisms and objects through which group meanings were managed and coordinated.

We employed computer-supported, qualitative coding that was continually discussed, compared, and evaluated between the two authors. Co-coder agreement was a constant focus of this reflexive process, with the two researchers evaluating the other’s categorization schemes independently, then collectively agreeing a common interpretation of analysis categories. We analyzed discussion-threads relating to 33 projects in e-Commerce group coordination meetings, over 18 months. A “project” was defined as a sequence of activities related to changes to an identifiable product or business-process, while a discussion-thread consisted of a sequence of statements reporting or debating project activities and status. We categorized modes of collaboration by analyzing the knowledge-resources, mechanisms and objects employed in threads of discussion relating to a single problem within each project. A problem-related discussion thread might be concluded in a single meeting or might span many weeks. For example, the group discussed setting up a “webinar” platform (a set of applications to support interactive seminars via the internet) over a period of five weeks, in response to a request by the CEO for this technology. The ongoing discussion was categorized as a single knowledge-coordination instance, as it focused on the same change-problem, involving the same group of people, over a defined period of time. However, discussions over a period of thirteen months to define system requirements for data privacy regulation changes were categorized as belonging to three separate knowledge-coordination modes and multiple problem-instances, as the project focused on three separate regional implementations, each of which involved different stakeholders, different spans of collaboration, and a different set of problems.
Our analysis revealed consistent, discernable mechanisms for managing the meanings attributed to the selection of group projects sampled or for enabling distributed meanings to be coordinated for their successful completion. We identified boundary-spanning activities that could be categorized according to three spans of collaboration:

(i) **Local coordination** of projects where changes were defined and managed within the core e-Commerce group (across geographic and formal management-role boundaries). Responsibility for defining project goals, scope, timescales, deliverables, and rationale lay wholly within the e-Commerce group. Boundaries spanned were functional domain-boundaries – for example between areas of work managed by Ms-Network, Mr-Applications, Mr-Business, and Ms-Europe (see Table 2). The core group of eServCorp managers who attended the daily conference represented all of these internal knowledge-domains.

(ii) **Conjoint agency**, where the core e-Commerce group acted as a hub, managing changes requiring expertise from or action by external groups or vendors. Decisions on project goals, scope and responsibilities lay with the e-Commerce group but change was coordinated and evaluated in collaboration with external groups. Boundaries spanned included those with external vendors (including the vendor managers listed in Table 2, who performed the majority of e-Commerce systems development and data-center maintenance), and various regional systems-management and client projects groups.

(iii) **Distributed Collaboration**, where the core e-Commerce group was part of a web of collaborating groups, negotiating, implementing, and evaluating product and business-process changes. The e-Commerce group was subject to joint or external project-leadership and the final decision on project goals, boundaries, timescales, deliverables, rationale, and implementation strategy was negotiated across multiple organizational groups from eServCorp, ParentCo., its associated companies, or external vendors.

### Research Findings

The relative incidence of problems identified for each span of coordination is shown in Figure 1. It can be seen that far fewer local coordination problems were discussed than problems in other spans of collaboration, possibly because local problems were more amenable to local resolution and did not merit extensive debate, or possibly because the majority of effort in global e-Commerce management was spent on virtual, distributed projects. From the incidence of each knowledge-coordination mode, it appears that problems on the diagonal-axis of the framework provide the majority of the group’s knowledge-coordination challenges.

![Figure 1. Relative Incidence of Problems by Span of Coordination and Problem-Type](image)

Table 3 summarizes the bridging-operations employed for knowledge-coordination for different problem-types and spans of collaboration.
The sections below provide examples of each category of bridging-mechanism, that provide extracts from meeting discussion-threads. These are not intended to be exhaustive, but to provide the reader with a flavor of how knowledge-coordination works in practice across multiple boundaries. Where names are shown, these are pseudonyms. Identifiers in square brackets provide organizational role or product descriptors. Comments in angle brackets provide additional information. Role-identifiers (pseudonyms) are listed above in Table 2.

**Local Knowledge Coordination**

This span of coordination pertains when the core group collaborates on tasks that require the negotiation of knowledge across the functional boundaries managed by e-Commerce group members. Typical projects that required local knowledge-coordination were those concerned with outsourcing (e.g. vendor selection) or technology integration (e.g. provision of the webinar discussed above), where the e-Commerce group had complete control over project definition, scope, and solution evaluation.

**Well-structured Problems**

Shared knowledge about how to identify and deal with well-structured problems was coordinated within the e-Commerce group by creating, evoking or reinforcing a collective group memory of similar situations. The EVP

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**Table 3. Bridging Operations For Knowledge Coordination**

<table>
<thead>
<tr>
<th>Boundary Spanning Scope</th>
<th>Local Coordination (Core group, internal knowledge boundaries)</th>
<th>Conjoint Agency (Core group acting as Hub to external groups)</th>
<th>Distributed Collaboration (Core group part of Web of coordinating groups)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Well-structured problems</strong></td>
<td>Situation Interpretation: Group leader articulates decision-making rules and evaluation-criteria, communicated through stories and analogies that create a shared resource to help members identify similar problems.</td>
<td>Scope interpretation: Group leader articulates decision-making rules, evaluation-criteria, and scope of responsibility in stories and analogies. Inter-group coordination achieved by imposing standardized procedures at boundary.</td>
<td>Coordinating Division of Labor: Functional domain-experts coordinate work in their domain across multiple groups. Leader clarifies organizational roles and monitors extended social network, coordinating knowledge-exchange and negotiation of responsibilities.</td>
</tr>
<tr>
<td><strong>Ill-structured problems</strong></td>
<td>Group identity construction: Leader relates group procedures to group values &amp; identity (&quot;how we do things here&quot;). Result is often group checklists, training procedures and plans to record group procedural memory.</td>
<td>Delegated knowledge-leadership: Group identified domain experts and problem clarification procedures. Coordination is achieved by formalizing external roles, locating knowledge resources, and defining rules &amp; procedures at group boundaries.</td>
<td>Managing external networks of influence: Functional domain-experts, delegated to conduct knowledge-discovery, jointly formulate problem and negotiate distributed task responsibilities with other groups. Leader maintains social network of influential decision-makers to support group interests.</td>
</tr>
<tr>
<td><strong>Wicked problems</strong></td>
<td>Framing collective strategy: Group members define problem adaptively and agree evolving goals of change, to clarify approach to problem investigation and relevant knowledge domains. Leader maintains adaptive group memory of available knowledge resources.</td>
<td>Defining a collective response: Group members pool knowledge about external context of change then nominate local domain-expert to manage inter-group coordination. Delegated boundary-spanner locates knowledge resources and controls evolving procedures at the boundary with other groups.</td>
<td>Collective knowledge networking: Leader negotiates goals of change and problem scope with global network of influential decision-makers. He negotiates and formalizes group role in problem-resolution. Group members debate evolving scope of action, becoming expert in an evolving set of knowledge-domains, and acquiring knowledge from emerging external stakeholders.</td>
</tr>
</tbody>
</table>
would interpret commonly-encountered situations for the group through the use of stories and analogies that evoked their memory of similar problems. The example given here deals the decision whether or not to outsource a project:

_EVP_: When you think about we’ve done compared to every other company in the world, we’ve done very, very well. Especially when you think we had to pick up the business, pick up the responsibilities when SoftVendor Consulting messed up. So I’m very proud of what this group has done – I don’t care what anybody else says. But at the same time, a model of outsourcing hurts us a lot with Peoplesoft applications because of the DBA <database administrator> resources needed. It doesn’t make sense for us to continue in this way. Now we’ve got an action where ParentCo have got the DBA, they’ve got the data center, they’ve got the software, the hardware to run it on. We should take full advantage. Over time, that will save us a lot of our budget.

In this example, the e-Commerce EVP communicates the structure of risk-assessment for outsourcing decisions and clarifies the criteria used for data-center outsourcing. This problem is well-structured as it is familiar to the group -- the EVP is merely articulating the problem to communicate its similarity to previous problems. In this example, he communicates the structure of outsourcing risk-assessment and clarifies the criteria used to evaluate outsourcing decisions by evoking memories of a heroic episode when the e-Commerce group retrieved a disastrous situation caused by an outsourcing vendor.

This approach conveys the structure of outsourcing decisions in a way that will motivate other managers to retain this structure in a situational group memory.

**Ill-structured Problems**

Ill-structured problems were formulated at the local level by the EVP in terms of “this is how we do things here”, creating a group memory that guided procedures for problem-clarification. In this example, Mr-Applications has just communicated that he accepted a client request for system-change without approval from the EVP. He claims that the additional work will not affect the system delivery date. This is an ill-structured problem as Mr-Applications has obviously bounded the problem to exclude some elements of risk and so has overlooked the implications of his decision. The EVP suggests a different set of elements that should be included in assessing client change-requests, restructing the problem in a new way:

_EVP_: Are the data conversions done?
_Mr. N-America_: This is one of the elements to be discussed on Wednesday. But we don't have to have all of the data done by Wednesday, just a representative sample of existing and new systems.
_EVP_: When I, as a hybrid sales/delivery person, show up for training <in two weeks>, will my data be there?
_Mr. N-America_: Good point! <he laughs>
_EVP_: You can't go into customer acceptance unless data is 98% correct. I haven't heard anything about data conversion. I have zero appetite for any additional risk about getting this done.
_Ms-Europe_: That's on the Wednesday meeting [agenda].
_EVP_: Take off your rose colored glasses. Assume the worst and tell me what's going to happen. Don't assume that things will fall into place. That's how Andy < sounds contemptuous> does it. We have nothing to gain and everything to lose.

He explains how he would structure the approach to problem-solving faced by Mr-Applications, while Mr-Applications suggests an alternative problem-structure (that data-requirements do not need to be part of the decision to accept change-requests). The EVP suggests different evaluation criteria to that used by Mr-Applications (“when I show up for training, will my data be there?”), restructing the problem to add data-conversion to the decision-making criteria. Ms-Europe attempts to argue that this element has been considered (“that’s on the Wednesday meeting”). But the EVP uses an “us vs. them” example, to compare their last-minute planning procedures with those of another group. Andy is considered to be an inept manager: his name has been mentioned frequently in connection with planning disasters.

Local, ill-structured problems were managed through the construction of a group identity, communicated through conventions that included problem-investigation procedures and solution-evaluation-criteria. These would often be recorded in the form of checklists, budget-spreadsheets, plans, or training procedures, to formalize the group procedural memory of how to approach similarly ill-structured problems.
Wicked problems

For locally-coordinated wicked problems, group members would collectively assemble information about the situation and debate aspects of the problem, goals for change, alternative solutions, and what knowledge-domains require further investigation. In this example, the group is discussing whether to use an outsourcing software-development vendor who develops software for eServCorp’s competitors. This rapidly turns into a debate exploring company policy and business strategy:

**EVP:** You and Ms-Europe raised some concerns about this project.

**Mr-Business:** It turns out that a vendor they have - is one that everyone else uses.

**EVP:** Yes and develops stuff for everyone else and shares the information. It depends whether we consider that a system for <product-market> constitutes a competitive advantage.

**Ms-Europe:** I think that <product-market> has to become a strategic area.

**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 us or do we use this vendor and give everyone else the ability to do it the same way?

**Mr-Business:** Yes, OK <thoughtful>. I have a meeting with Mr. V-Data later.

**EVP:** Yes -- and Ms-Europe, we'll bring you more into the loop as well, because of the two hats that you wear. What's fascinating is that we just saw a ton of internal research that [consultant] did last year, that no-one else has seen yet. He has some very interesting information about markets. We have to work through this.

**Mr-Business:** One piece is that apparently France has to report all their profit to a country industry group. We could use that data to find out where we are in relation to everyone else.

**EVP:** So we need access to that data, to look at market-size and market-share.

**Mr-Business:** Yes, I think we're about 3rd or 4th at the moment in France.

**Ms-Europe:** I think Belgium has that sort of data as well.

**EVP:** Does it allow us to estimate market size and market share as well?

**Ms-Europe:** Not sure.

**EVP:** An interesting thing, <Consultant> was reporting on the breakdown of the industry. They have two of our top markets, but the third thing was a completely new business area. It seems that the average fee paid in the US is $4000 - between $4000 and $4500. So far, what he has pulled externally totally matches what we came up with from a different direction.

**Ms-V-Tech:** <lists what information is included in consultant's report>

**EVP:** This stuff does not include pure projects, this is just programs. So this study does not include all the other stuff, but I don’t see how we could get that data, or how anyone else could either.

The discussion petered out as group-members pondered how to locate knowledge-resources in response to the EVP’s comment (the discussion-thread was picked up two weeks later, as group members reported their progress in identifying these). This example shows how the group debate what they know about the problem, based on their functional knowledge-domains. The EVP structures a problem of how to approach vendor selection by arguing that this decision should relate to whether acquiring a system to provide service in a product-market that is new to eServCorp “constitutes a competitive advantage”. Group members realize that they do not understand the strategic value of the product-market to eServCorp and debate ways of discovering this information. The problem is not resolved during this debate. The group merely exposes more aspects of the problem to be investigated. The role of the EVP appears to be to reframe the problem as they debate, defining a collective strategy for problem-investigation and resolution (“does it allow us to estimate market size and market share as well?”). When the vendor consultant lists the information available, this exposes a gap in group information that raises another problem to be resolved.

The group memory of how to resolve wicked problems appeared to retain information about which knowledge-resources were available and where these could be located. This aspect of group memory was constantly adapting, as new aspects of the problem emerged.

Conjoint Agency In Knowledge Management Across Group Boundaries

This span of coordination pertained when the core group acted as a hub to external groups, defining problems, relevant knowledge-domains, and coordinating shared action. Typical projects that operated primarily in the collaboration-span of conjoint agency were those concerned with changes to e-Commerce systems supporting global business processes. While the e-Commerce group had control over system-related problem-definitions and the
implementation of system changes, they needed to act as a coordination “hub” in investigating requirements for, coordinating, and evaluating changes to business-process systems support for other organizational groups.

**Well-structured problems**

Knowledge-coordination for the resolution of well-structured problems that required coordination across group boundaries focused on problem-communication and coordinating a collective response. In this extract, managers are discussing how to prevent a French operational group project from turning into a disaster by imposing standard procedures by which they must work:

**Ms-V-Tech:** I have a concern. Jean-Claude [French Customer-Service VP] has developed operational rules and protocols that we haven’t seen yet. My concern is that Max [French Operations EVP] seems prepared to take the risk and sign off on this.

**EVP:** My feeling us that Jean-Claude is trying to throw Max under a bus. If he can distance himself from this, he’s going to -- and he’ll let Max take the fall. But he’s not going to be able to distance himself. What can we do, proactively, to make sure that these operational protocols that they are signing off on will work?

**Ms-V-Tech:** We work out what their operational protocols are and we work with them to walk them through a complete rollout, to show them how to do a validation test. But if we do that, they will not make a February rollout.

**EVP:** We have to give them the information that they need to make that decision. Then they are responsible.

The example shows how the e-Commerce group leader provided an interpretation of the problem (“Jean-Claude is trying to throw Max under a bus”, i.e. sacrificing another group-manager to excuse his failure). that both structured it for the group and clarified their scope of responsibility (“We have to give them the information … then they are responsible”). These appeared to build into a repository of knowledge-resources that allowed the group to identify how to manage similar situations. For example “the situation with Jean-Claude and Max” and “X is trying to throw Y under a bus” were used as analogies for blaming failure on another group in subsequent discussions. For example:

**EVP:** [The Operations Director] caught me in the hallway and I just threw the Finance people under the bus. “Ms-Europe did me an analysis. She came up with the answer that I know is the right answer. … If you’re concerned about timing go talk to the Finance people.”

Internal group memory for well-structured problems appeared to be formed of a set of stories and analogies that indicated procedures, and criteria for success (as for local coordination) but also indicated the scope of group responsibility. Inter-group memory was maintained by imposing standardized rules and procedures at the boundary with groups (e.g. “walk them through a complete rollout, to show them how to do a validation test”). This mechanism was used because what was a well-structured problem to the local group was perceived as an ill-structured problem by other groups (who lacked the familiarity with similar situations).

**Ill-structured problems**

When the group acted as a hub for other groups in resolving ill-structured problems, the key knowledge management task appeared to lie in delegating knowledge-discovery to knowledge-domain experts within the group. In the following extract, Mr-Applications has been delegated to attend strategic management meetings on the impact of the Sarbanes Oxley (corporate accountability) legislation. Here he reports back from a meeting with eServCorp’s auditors to determine system delivery control changes:

**Mr-Applications:** Sarbanes Oxley changes – we are still in the void that [eServCorp auditors] left. The auditors really fell short, we’re going to ask for a rebate. I have all the info I requested yesterday. Pass thanks down to your guys <directed to the vendor-consultant>. The security section is the one we have to get ready for Monday. I have completed one section. The other sections are [...] and [...].

**EVP:** Are there other resources that you need?

**Mr-Applications:** No. We’re going to have to get 30 samples of change-reports for ParentCo auditors.

**EVP:** Are we going to have a backlog of cleanup tasks when they come? We don’t want a backlog.

**Mr-Business:** Our guys need to document what they’re doing, cause they’re going to have to do it again next year.

**EVP:** OK -- you like flogging yourself, go to it. Talk to [Finance EVP] about the implications and make sure that these are recorded.

… one month later …
Mr-Applications: I’m preparing for Sarbanes Oxley testing. I met with [Finance EVP], as you suggested, about project tracking. He suggested Terry as the lead on this.

EVP: Terry could do it.

Mr-Applications: He has the time to do it.

EVP: How do the finance people have time to do all this stuff?

Mr-Applications: They stack them in layers.

EVP: It’s nice to know we won’t run out of finance people!

Ill-structured problems requiring conjoint agency depended upon an intra-group memory of who-knows-what (functional knowledge-domain experts) and problem-clarification procedures (“our guys need to document what they’re doing, cause they’re going to have to do it again next year”). The latter element employed similar types of checklists and procedures to those used to coordinate local problems. But they also required an inter-group memory of formal coordination roles (“He suggested Terry as the lead on this”), knowledge-resources, and procedures for knowledge-discovery at the boundary between groups (“Talk to [Finance EVP] about the implications and make sure that these are recorded.”). The role of the group leader was to facilitate access to an external social network of domain experts and to formalize rules for action at the interface.

Wicked problems

When confronted with wicked problems for projects the group acted as a hub for other groups, group members spent their time pooling information and dividing the labor of external knowledge-discovery. In the following extract, the group discusses their integration-plan for ProductX, a software-package that will permit eServCorp to provide services in a potentially-strategic business-area:

EVP: About ProductX. Ms-Europe, I’ll keep you involved because Andy [European Operations EVP] is interested. Mr. V-Mgr, you’re involved for documentation review. We just got a load of garbage. I plan to go as slow as possible without generating criticism. I need Mike [Finance EVP] on the call but there’s some medical thing that he has to handle. So I’ll get his take later.

[8 days later]:
EVP: We had a meeting with ProductX company - they seem fairly amateurish - but today they are going to demo their app.

Ms-Europe: Chris [European ParentCo VP] mentioned this at our ParentCo meeting yesterday. If ParentCo were really serious about something like ProductX, we should give it away and make it an industry standard.

EVP: What would that do for ParentCo?

Ms-Europe: It would establish ParentCo as a market leader and stop people frittering away their effort, because at the moment there are too many different standards.

EVP: Give it away - that’s interesting!

Mr-Business: They do have about 200 visitors a day, at the moment.

EVP: But our stuff does not scale up to zillions of visitors. If I were doing a global system, I would not use Access and local systems. Our stuff would need to scale up to Unix servers.

[6 weeks later]:
EVP: ParentCo has pitched this huge proposal to China. It includes ProductX services. Since we, to all intents and purposes own ProductX, in all but writing, there’s technology implications. …. There’s technology around the assessments, the assessments around the mail systems, and who’s working on this damn thing in China? How they’re communicating. So I forwarded a note to you all, just to be aware. MickeyX is the Asia Pacific guy involved - he looked a pretty nice guy when I met him last year. I want to get a better understanding of what the this proposal actually is. I’m not going to read a 105 page proposal. So somebody send me a reader’s digest version of what it means. At some point we’ll have to get together, with MickeyX, the account team, the delivery team, to understand what the implications are, based on what we’re contracting. So - just be aware.

Ms-Network: Probably going to be porting this to their Singapore data center.

EVP: I don’t know what they’re going to do with their Singapore data center.

Ms-Network: That’s just one of their other projects

EVP: But what are they doing to, relative to this engagement? I don’t know what the engagement entails. I know at a real high level, but I just need specifics. You probably saw that Pete [ParentCo-sales-group VP] is copied on that message. So when you talk to him, you might want to see what his understanding is. We have to get a common front on this one.

Over time, each group member is identifying and discussing issues related to their functional knowledge-domain, as they debate a collective problem-understanding and strategy for problem-investigation. The EVP’s initial report communicates his lack of knowledge about ProductX (“We just got a load of garbage”). Eight days later, Ms-Europe
argues that ProductX could establish a standard for this product-market. Her argument that this would give eServCorp a competitive advantage is supported by Mr-Applications, at which point the EVP questions the fit of ProductX with their technical infrastructure (“But our stuff does not scale up to zillions of visitors”). Six weeks later, the EVP has accepted the need to support and integrate ProductX into eServCorp’s systems, but needs group managers to investigate the implications of selling ProductX into the Chinese market (“Since we, to all intents and purposes own [ProductX] … there’s technology implications”). He asks for someone to nominate themselves as the knowledge-domain expert for this application (“somebody send me a reader’s digest version of what it means. At some point we’ll have to get together … to understand what the implications are”). Ms-Network appears to volunteer and the EVP suggests a social-network contact for this project. Project strategy and goals were reframed as new information emerged that clarified the coordination required with subordinate groups (in this case, Finance, ParentCo. Sales, and ProductX vendors). Definition of an appropriate response was distributed across group members, over time.

Intra-group memory was maintained by delegating someone to become a knowledge-domain expert for this problem and act as a boundary-spanner. The domain expert reported back to the group regularly, to discuss change-goals and coordinate problem-investigation strategy. Inter-group memory appeared to be adaptive, producing shared knowledge-resources (e.g. the ProductX integration plan) and ensuring that external group problem-solving strategies reflected e-Commerce group strategy by ensuring that the domain-expert agreed a common approach with knowledgeable social-network contacts (“We have to get a common front on this one”).

Leadership For Distributed Collaboration

This span of coordination pertained when the core group was part of a web of collaborating groups, but did not have primary responsibility for coordinating projects and responsibilities across groups. Typical projects tended to relate to global challenges such as the implementation of new global service-offerings, or support for new product-markets. The scope, goals and timescales of such projects were not controlled by the e-Commerce group, but required negotiation with external organizational groups.

Well-structured problems

For distributed collaboration, well-structured problems focused on the division of labor across various organizational and vendor groups, to achieve a specific goal. In the following example, group members discuss the procedures required to manage software-integration and training for a new product, ProductY, that is being implemented in response to a request by ParentCo. management:

Mr-Business: Last week was the delivery training for ProductY. We did the second morning by phone to show the web site. We talked about the administration requirements. They got the message.
EVP: Who was on?
Mr-Business: The master trainers for ProductY, about 12 of them. They were pumped up.
EVP: I’d love to see ProductY take off and make money.
Mr-Business: The Finance support-guy ran his tests last week. We’ll have [Sales] people run through the conference room and test it for an hour.
[5 weeks later;]
EVP: I might grab Mr-V-Mgr to have an offline discussion with the new Operations Director out of [ProductY vendor], as Ms-Europe was the final author of the technology assessment for ProductY. I may call this guy up - what’s the time difference between here and Tel Aviv – anybody know?
Mr-Applications: 5 hours – or is it 6?
EVP: I may ask him to call in once a week to this meeting. I’m gonna check in with him today - I’m gonna ask him for a 30, 60, and 90-day plan. Then I’m going to ask him to check in once a week, so we can see how he’s doing.
Ms-Network: Did you hear from him?
EVP: He did call - he emailed me over the holidays.
Ms-Network: Yeah, well I think he’s got something going on. I think he needs something verified over here, some employment record.
EVP: Then call HR.
Ms-Network: He did call and ask if you were around, but you were late in for some reason. He said he was going to call you later today.
EVP: OK. So my target is coordination.
This project involved a number of groups in coordinating software integration with current systems, vendor-training, evaluation by various user-groups, and operational support by the vendor. Procedures for dealing with external group boundaries were not formalized, as timescales and boundaries were not under the control of the e-Commerce group (“We’ll have people run through the conference room and test it for an hour”). A variety of functional domain-experts coordinate various aspects of these projects, even for well-structured problems, as the problem requires cooperation from multiple groups. In this example, Ms-Europe performs the technology assessment (handling knowledge-discovery from the vendor), Mr-Applications coordinates system evaluation and training (handling knowledge-discovery from proxy-users in Finance and Sales groups), and Ms-Network coordinates technology integration planning (handling personnel visa problems). The EVP coordinates planning for a diverse set of group activities. He is also attempting to manage the uncertainty of relying on an external group for global project implementation by bringing the external vendor management into the e-Commerce group conference call (“I’m gonna ask him for a 30, 60, and 90-day plan. Then I’m going to ask him to check in once a week”).

As the required tasks were clear for well-structured problems, the intra-group memory required to manage distributed collaboration appeared to be maintained through the functional delegation of task-coordination at the boundary. Inter-group memory was maintained by establishing a clear set of organizational roles among collaborating groups (who is responsible for what), coordinated through regular meetings between group-representatives.

**Ill-structured problems**

In projects where the group part of a web of collaborating groups, knowledge-coordination for ill-structured problems focused on managing external networks of influence. In the following example, the group is exploring an announcement from ParentCo., that eServCorp will be providing consultancy services to China for the first time:

**EVP:** We have another management cluster forming in China. <laughter> You know how ParentCo works. When the CEO wants something, they just frenzy. But I haven’t seen anything about China, nothing is signed yet. No one knows what’s on the table. They’re out there talking about technology implications. No one knows what they need to be doing. I said that if someone would tell me what we’re doing, that I’ll talk to the Asia Pacific General Manager about it. I asked the ParentCo and eServCorp senior managers to tell me what’s going on. I hear that at some point in the plan they introduce eServCorp to do part of this. I don’t know the scope. I don’t know the account team. There are a lot of implications that we just can’t anticipate.

[3 weeks later]:

**Mr-Applications:** The Asia Pacific operations group have requested three new offices to be set up, that are in China. Beijing, Shanghai and another one that I can’t remember.

**EVP:** Probably part of that big ParentCo thing.

**Mr-Business:** <City> – that’s the third one.

**Mr-Applications:** Yes. So I guess we’re going to be doing some business there.

**Mr-Business:** Acquiring offices, that means we are physically leasing space to do business?

**Mr-Applications:** Well it’s offices in terms of data for doing [project], they are going to be doing a physical transaction.

**Mr-Business:** So we’re going to have a service office. We’d also like to add that to the website. Who is the person there?

**Mr-Applications:** XiaHu.

**Mr-Business:** So I’ll have to contact her to coordinate the web space.

**Mr-Applications:** And I’ll have to talk to the client to make sure if we already have those offices or if we are going to have them.

**EVP:** And talk to Sarah [ParentCo-international-service-coordinator], right? Make sure it will happen for us.

**Mr-Applications:** Right.

The group attempts to make sense of the ill-structured problem of how they will provide familiar services to an unfamiliar market. The EVP’s initial announcement mobilizes group managers to discover what they can about the problem. Three weeks later, they pool their knowledge, engaging in collective problem-definition and then sharing knowledge about the social network of managers from other groups that will be required to accomplish the project. The EVP influences the selection and maintenance of the social network, suggesting influential decision-makers who will ensure that the negotiation of responsibilities will favor e-Commerce group interests.

Intra-group memory is maintained through functional domain-experts who define the goals of change and the distributed tasks required to resolve the problem, then coordinate their external social network-contacts to ensure that all required tasks are covered. Inter-group memory is maintained by role-allocation at the boundary, with
functional domain-experts delegated to negotiate task scope and responsibilities with external group-members, and by ensuring that social network contacts in external groups are sympathetic to e-Commerce group goals and interests.

Wicked problems

For wicked problems involving distributed collaboration, a “web” of experts, internal and external, advised the group and acted as a conduit to influential managers and decision-makers on their behalf. The problem appeared to be reframed improvisationally through a set of evolving strategies adopted by boundary-spanning-domain experts within the group. In the following extract, group members are attempting to understand what financial-system changes are required in response to a new ParentCo business intelligence initiative:

Mr-Applications: Max put together some business intelligence metrics and showed them to CEO. CEO gave it back to him as his project. We need to talk to EVP about what we need to get started.

[6 days later):
Ms-Europe: Do we need to prepare for the business intelligence call this afternoon?
EVP: No. We just have to have agreement on the metrics underneath the model. I'm not convinced that we have the right ones. CEO is not confident in what we have. It was Max, Ted, Andy. CEO isn't confident that we have the key set yet. He won't be confident until his boss says it's right. But, we have to do something. So assume that what we come out with is the right set. Then, what do we deliver? what are the physical deliverables? Who defines the management processes? Who defines the thresholds? I plan to just listen. I'm not taking a leadership role at all.

[1 day later]:
EVP: Ted had a meeting about the business intelligence model. … I realized when I sat down that his focus was not the business intelligence model but was the kick-off meeting where he had to present something. So I realized that his goal was what you people can put together, so that I can present, so he doesn't look stupid. The model needs to drive the behaviors of the company, from the CEO down to the lower sales admin. The issue is that he doesn't get it. … He kept on saying, why can't we have reports? … They laid down a bunch of metrics and probably 90% of what was used was core but they haven't defined what are the levers. … Do you want to look at this data point by product class, do you want to look at it by line of business, do you want to look at them over time as a trend, do you want to compare the performance of an individual with the larger group that you belong to and the average within the country? … So I explained to them nicely what they needed to do. I said you need to sit down and create mockups of the core data - how that will be used, for every level. By doing those mockups, you'll be forced to think of the dimensional aspect of how data should be displayed. Of the core data and how it will be used. Until you do that, you won't understand what you need. I'm the computer guy, telling the other guys this stuff! Isn't that scary?

[Two months later]:
Ms-Europe: What's the plan on the business intelligence model?
Mr-Applications: ParentCo are supposed to have a meeting this week about how they want to organize the reporting. … The first problem is that we have inconsistent reporting because we have inconsistent financial groups.
EVP: The developers over time followed different approaches to do similar things.
Ms-Europe: Are they working on Product1 software?
EVP: No, just CRM. We did talk about forming a data warehouse with bridges to CRM, but we worked through piece by piece and decided we could do commissions and project tracking without a warehouse. If we’re going to do client sales reporting we need a warehouse. We’re looking at what [vendor] would charge us to do the work.

The example demonstrates how the resolution of wicked problems in distributed collaboration dealt with partial problem-definitions as these emerged. Mr-Applications tells the group that the company is about to focus on a business intelligence initiative (analyzing corporate data to report on performance and trends in various business areas). Group-members attempt to understand the requirements for change over a long period of time. They discuss which external stakeholders are likely to have knowledge of the project [“Max, Ted, Andy”] and exchange conjectures on what is required, as well as what is known (“I realized that his goal was what you people can put together.”). The EVP frames goals for the group (“The model needs to drive the behaviors of the company, from the CEO down to the lower sales admin.”) and identifies key collaboration problems (e.g. that a key problem-stakeholder cannot formulate his goals for change). As the problem emerges, their perspectives evolve. When it is discussed two months later, Mr-Applications argues that e-Commerce systems have inconsistent reporting because of inconsistent Finance-group requirements. But the EVP responds that the problem is internal, explaining partial-solutions that have been explored with ParentCo. managers.
Group members developed expertise in multiple knowledge-domains, as discovery proceeded. These cross-domain-experts collectively maintained an evolving intra-group memory through debating what was known about the problem, widening debate beyond their individual, functional specialisms. As knowledge was partial and emergent, e-Commerce group-members constantly pooled knowledge obtained from external stakeholders to clarify internal group change-goals and the scope of action required. These discussions could be highly political and subjective. The group-leader maintained inter-group memory through meetings with influential decision-makers at which he clarified and contributed to their distributed understanding of project goals and scope and negotiated the group’s role in problem-resolution. Distributed, wicked problems did not tend to be resolved. They just moved in and out of group focus over time, as other problems took precedence.

Discussion

Table 4 summarizes the forms of group memory that resulted from each of the nine boundary-spanning collaboration challenges that we identified.

<table>
<thead>
<tr>
<th>Table 4. Knowledge Management Strategy For Various Modes of Collaboration</th>
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</thead>
<tbody>
<tr>
<td><strong>Well-structured problem-solving</strong></td>
</tr>
<tr>
<td><strong>Intra-group memory</strong></td>
</tr>
<tr>
<td>defines how to identify similar problems through situation analysis.</td>
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<tr>
<td><strong>Intra-group memory defines scope of responsibility for problems.</strong></td>
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<tr>
<td><strong>Inter-group memory</strong></td>
</tr>
<tr>
<td>maintained through standardized procedures imposed at the boundary.</td>
</tr>
<tr>
<td><strong>Intra-group memory maintained through division of labor across groups.</strong></td>
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<tr>
<td><strong>Inter-group memory maintained through local group-leader negotiating &amp; coordinating roles at boundary.</strong></td>
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<tr>
<td><strong>Ill-structured problem-solving</strong></td>
</tr>
<tr>
<td><strong>Intra-group memory</strong></td>
</tr>
<tr>
<td>defines how to resolve similar problems by formalizing roles and procedures.</td>
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<tr>
<td><strong>Intra-group memory</strong></td>
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<tr>
<td>who knows what and problem-definition procedures.</td>
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<tr>
<td><strong>Inter-group memory</strong></td>
</tr>
<tr>
<td>defines formal roles, knowledge resources, &amp; procedures at the boundary.</td>
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<tr>
<td><strong>Inter-group memory</strong></td>
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<tr>
<td>maintained by functional experts who negotiate &amp; coordinate tasks at boundary.</td>
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<tr>
<td><strong>Intra-group memory maintained by functional experts who negotiate &amp; coordinate roles at boundary.</strong></td>
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<tr>
<td><strong>Wicked problem-solving</strong></td>
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<tr>
<td><strong>Intra-group memory</strong></td>
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<tr>
<td>maintained through delegated boundary-spanners becoming domain-experts.</td>
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<tr>
<td><strong>Inter-group memory</strong></td>
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<tr>
<td>maintained via domain-expert who locates resources and directs evolution of roles/procedures across boundary.</td>
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<tr>
<td><strong>Intra-group memory</strong></td>
</tr>
<tr>
<td>discovery of problem scope and change goals achieved by web of individuals who become experts in an evolving set of knowledge-domains through interaction with external stakeholders.</td>
</tr>
<tr>
<td><strong>Inter-group memory maintained by group leader, who interacts with influential decision-makers to negotiate goals for change, problem scope &amp; group role in coordinating change.</strong></td>
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We identified two key criteria in determining a boundary-spanning knowledge-coordination strategy: the knowledge-coordination span (the span of control and access to relevant knowledge-domains) and the degree of goal emergence (the extent to which the group must resolve well-structured, ill-structured, or wicked problems). From the relative incidence of problem-solving modes (Figure 1), we conclude that the key tasks of maintaining group memory for boundary-spanning knowledge coordination lie on the diagonal-axis of these two dimensions and suggest the term “problem-coordination distance” to combine the dimensions.

As problem-coordination distance increases, group knowledge-coordination mechanisms evolve from a focus on defining collective situation interpretation, to delegating responsibility for coordinating knowledge from external
group-domains, to delegating responsibility for polycontextual expertise. Polycontextual expertise permits boundary-spanners to translate meanings across multiple domains and to establish strong ties with external boundary-spanners to facilitate collaboration across a web of organizational domain-experts. We present the three axial problem-coordination distance foci in Figure 2. We observe that other mechanisms for each coordination spans have a similar focus, but employ variations in the problem-resolution mechanisms that are employed.

The group focus for boundary-spanning with low problem-coordination-distance maintains a situational group memory of how to recognize similar problems. For a group to operate cohesively across multiple boundaries, the group leader needs to manage group identity, and rules-for-action, enforcing the argument that knowledge is situated in socio-cultural norms and expectations (Lave and Wenger, 1991). In this type of well-structured problem-situation, use of a transactive memory system might be appropriate (Hollingshead and Brandon, 2003; Moreland, 1999). But group members coordinate their work through intensive “heedful interrelating” (Weick and Roberts, 1993), indicated by the widespread use of stories and analogies to maintain a collective memory of similar situations. This type of interrelating, once started, is easy to maintain and more effective as a knowledge-coordination mechanism than the use of formal knowledge management systems (KMS).

Situations with intermediate problem-coordination-distance focus on shared use of negotiated knowledge-resources for collaboration at the boundary. Key knowledge-coordination tasks maintain inter-group coordination memory, by establishing a set of boundary-spanning domain-expert roles, coupled with shared procedures and rules for collaboration, that define group responsibilities. A transactive memory system would be helpful where there is a potential turnover in group members (Moreland, 1999). But we observed that managers showed a great aversion to recording their knowledge formally as they debated ill-structured problems. Much of this knowledge is dynamic: the daily coordination meeting provided an effective way of discussing changes to the group understanding of the situation.
The key focus in situations of high problem-coordination-distance is to maintain both inter-group collaboration memory. This is akin to the improvisational form of sensemaking observed by Weick (1995). A distributed group understanding of organizational rules and procedures external to the group – is held by a “web” autonomous knowledge-domain experts, who acquire expertise across external domains (Engestrom et al., 1995). With input from the group-leader, who negotiates the group role in change with influential organizational decision-makers, these boundary-spanning domain-experts maintain the external social network that is critical to a successfully negotiated outcome. Here, there is potential for the use of transactive memory systems (Hollingshead and Brandon, 2003; Moreland, 1999). Boundary-spanners spent a great deal of time identifying external domain-experts and locating collaborators in other groups who would be sympathetic to their own change objectives. Many of these decisions were political: there was a dislike of formalizing such knowledge. But we did observe that group-members revisited the same ground repeatedly in identifying suitable collaborators and knowledge-resources. A transactive memory system would resolve this problem if it could be employed and secured in such a way that managers were comfortable with its use.

6. Conclusions

This study investigated how knowledge is managed and coordinated across the boundaries of a virtual, global organization. Tensions between the reductionist tendencies of knowledge-codification and the expansionist approach required for problem-investigation approach appear to be managed through various forms of bridging operation (Weick, 1995) that require group members to maintain different types of domain-expert role, depending upon the problem-coordination distance of the collaboration. At this enterprise-spanning level of organizational management, collaboration across functional and organizational boundaries appear to be mediated by informal bridging objects. Through an exploration of which forms of knowledge-transfer may be amenable to KMS support, we have explored the constraints of IT systems as boundary-objects-in-use (Levina and Vaast, 2005). While an analysis of these is beyond the scope of this paper, they appear to be supplemented by more formal resources (e.g. spreadsheets, plans, and models) that are seldom static for sufficiently long to be committed to a formal KMS. It is only when a problem is sufficiently resolved for it to move out of the wicked problem category (Rittel, 1972) that these resources are formalized. The findings indicate the significance of organizational roles in coordinating distributed cognition, but not in the sense of the formalized, functional work roles as described by Hutchins and colleagues (Hollan et al., 2002; Hutchins, 1995). Knowledge-expert roles permit an organizational community of practice such as the e-Commerce group to improvise goals and strategies in their interactions with other communities and groups, based on an evolving but collectively held core identity. Organizational meanings do not appear to be managed solely by an influential leader (Pettigrew, 1990; Smircich and Morgan, 1982), but are managed collectively by a distributed group working in concert.

The main contribution of this paper is to suggest a framework for how such groups manage leadership tasks in practice and to suggest the concept of problem-coordination-distance as the key determinant of knowledge-coordination strategies. Figure 2 summarizes different mechanisms for the group memory required to coordinate knowledge across functional and organizational group boundaries. A second contribution is to observe that our highly-virtual organization operated in ways that were far from virtual, with managers preferring to use face-to-face collaboration channels to discover tacit knowledge and to gain access to external knowledge-resources. This finding indicates where virtual support for knowledge-coordination has the potential to succeed and where it may fail. It may explain why virtual organizations have so far been more prevalent at the operational than at the strategic level of management decision-making (Travica, 1998).

These findings have significant implications for how we design knowledge-management systems for distributed management collaboration, as they suggest that many of the required bridging operations are not amenable to codification, storage or electronic communication. Useful and relevant knowledge is continually evolving in a dynamic global business and even dispersed groups appear to manage this through a complex web of domain experts and social relationships. We would suggest that many of the knowledge-coordination mechanisms observed here are not currently recognized as distributed and so management systems focus on information distribution to communicate decisions, rather than to support multi-way decision-making. This study has demonstrated how complex, boundary-spanning collaboration requires dynamic and informal mechanisms for knowledge-sharing.
References


