Networks of Practice and Bridging Mechanisms In Global IS Change Projects

Susan Gasson,
College of Computing & Informatics,
Drexel University,
Philadelphia USA

Abstract

The purpose of this work is to develop a systematic understanding of how organizational knowledge is brokered and becomes embedded in the network communication structures of boundary-spanning change projects. Drawing on a longitudinal study of major IS change projects in a global consultancy organization over two years, we identify the mechanisms by which knowledge is defined, legitimized, and communicated across virtual networks of practice.

The findings suggest that knowledge is problematized in ways that relate to the network topology – that combination of network span and structural complexity presented by the change problem – of a change project. In locally-coordinated projects, knowledge creation and negotiation was relatively centralized, providing standardized participation frameworks. In delegated projects, the management of group meaning and knowledge were less centralized, with individual knowledge specialists providing contextualized knowledge acquired from the wider network. In distributed projects, knowledge coordination was truly distributed, with group leaders acting more as political facilitators than meaning managers. These projects involved a more diverse set of knowledge mediators, who bridged Network of Practice boundaries and who translated knowledge deriving from remote participation frameworks into locally-meaningful practices and change requirements.

We that four aspects of change projects affect how organizational IS change projects should be managed: social network coordination need, the domain boundaries spanned, project knowledge coordination needs, and system concept coordination. We propose a framework for organizational enactment that explains the emergent knowledge processes involved in the mediation of organizational change across a global Network of Practice.
Networks of Practice and Bridging Mechanisms In Global IS Change Projects

Introduction

Organizational change projects typically engage a variety of organizational actors, who have an interest in the outcomes of change. This is especially true of global information system (IS) change projects, which involve business managers, knowledge workers, and potential IS users in a series of negotiations that explore and define solutions to a more or less well-defined problem. Changes to the use and configuration of information technology must be aligned with changes to systems of coordinated work practice and emergent knowledge processes (Markus et al., 2002). To achieve this, knowledge workers in various communities of practice must coordinate and share their knowledge, to define new modes of practice (Brown & Duguid, 2001). But this depends upon the management of meaning – the agreement of shared interpretations and responses, that are coordinated across diverse knowledge domains so that practice may be coherent and consistent across the organization. We know that, in co-located organizational groups, influential leaders coordinate and manage communications, providing interpretive schema that allow group members to determine how to act. They achieve this through stories and myths that indicate how information resources underpin successful practice (Balogun & Jenkins, 2003; Smircich & Morgan, 1982). But in global organizations, organizational discontinuities such as geographical or time separation, national culture, or language differences create barriers to project success, as do processual variables such as effective virtual communication channels, project controls and task standardization, or shared beliefs and knowledge (Espinosa et al., 2006; Watson-Manheim et al., 2012). The result is that organizational change projects are governed by emergent networks of practice – social networks that integrate existing organizational communities of practice with dispersed and often virtual networks that emerge around specific products, markets, or governance issues management across global organizations (Brown & Duguid, 2000). IS change project groups in global organizations must find ways to bridge these organizational boundaries, by negotiating effective information resources and knowledge sharing mechanisms.

This paper explores how organizational boundaries and discontinuities are bridged to coordinate effective knowledge creation and exchange in a global, virtual organization. It examines the role of epistemic objects – material instantiations of embedded knowledge that are partially-defined and emergent in practice – in creating and communicating organizational knowledge. We present findings from an longitudinal, exploratory field study of the operations and interactions of the eCommerce systems group of a global, distributed service organization. We explore how knowledge and expertise are coordinated and managed across organizational group boundaries in major IS change projects.
Conceptual Background

Organizational Networks of Practice

Organizational Communities of Practice are characterized by a shared domain of endeavor, interactions and relationships that allow members to build a joint identity, and a shared practice, indicated by a common and shared repertoire of resources - experiences, stories, tools, and ways of addressing recurring problems (Wenger, 1998). We can contrast Communities of Practice (CoPs), which form around local conventions and systems of meaning, to Networks of Practice, which span multiple CoPs. Brown and Duguid (2000) describe a Network of Practice as a loosely-affiliated network of epistemic inquiry:

“The name “networks of practice” helps us to emphasize what we see as the common denominator of these groups – practice – elsewhere they go by the name of “occupational groups” or “social worlds.” People in such networks have practice and knowledge in common. Nevertheless, most of the members are unknown to one other. Indeed, the links between the members of such networks are usually more indirect than direct ... Members coordinate and communicate through third parties, or indirectly. Coordination and communication are, as a result, quite explicit.” (Brown & Duguid, 2000, p. 142)

The conceptual underpinnings of a Network of Practice (NoP) have not been sufficiently developed to explain situated practice boundaries in global organizations. While Brown and Duguid (2000) explain that the 25,000 reps working for Xerox constitute a network of practice, because their common practice makes indirect communication mechanisms viable for the coordination of distributed work, it is clear that shared sociocultural practice in the sense of a common social world is unrealistic in distributed organizations (even for the network of Xerox reps). The equation of a Network of Practice with a social world (Strauss, 1978; 1983) may be defensible in terms of a shared organizational culture, but to equate this with the shared practice and interpretations suggested by Strauss is not. A Community of Practice operates by means of a set of socio-cultural values, norms, beliefs, language, shared practices, and common resources that allow the group to coordinate their work without the need for extensive explanations (Lave & Wenger, 1991). These elements constitute a participation framework, or participation framework, that allows group members to make sense of tasks in specific ways that are meaningful only within the local group (Engeström et al., 1995).

Contemporary organizations are characterized by a tension between local participation frameworks and global knowledge frameworks (Weick, 1995). Global organizations in particular have diverse local variations in practice and culture, as their members affiliate with the practices of their local community over remote groups. Actors and their decisions cannot be seen merely as the responses of rational individuals or as the effect of the organizational structures within which they operate. Instead, their actions and decisions are filtered through and situated in a system of social relationships (Granovetter 1985). We cannot understand organizational change in terms of a homogeneous culture or shared social world. Instead, we conceptualize a Network of Practice as a set of interlocking social worlds.
(Strauss, 1978; 1983), each of which is defined around shared commitments to specific types of activity, shared resources and goals, and a collective ideology about how to perform activities:

“Through extended communication, participants in social worlds characteristically generate, adopt, or adapt ideologies about how their work should be done and debate about both their own activities and others’ actions that may affect them.” (Clarke, 1991, pp. 131-2).

The meaningful communication of knowledge across distributed organizations relies on the emergence of appropriate mediating resources – information systems, shared genres of virtual communication, and epistemic objects – that support polycontextual knowledge. Boundary-spanning coordination relies on the ability of individuals and mediation channels to bridge the diverse participation frameworks that constitute a Network of Practice. The embeddedness of professional work in wider networks of knowledge introduce a variety of information resources, that underpin distributed knowledge work and epistemic modes of practice that permit emergent knowledge processes (Nerland & Jensen, 2012). While a Community of Practice is organized around a unifying, local participation framework, a Network of Practice may be conceptualized as a nexus of interlocking participation frameworks and knowledge resources, that is mediated by means of bridging mechanisms.

**Boundary-Spanning and Bridging Across Organizational Networks of Practice**

Knowledge workers may be viewed as organized around fields of activity, that characterize organizational groups by shared interests and a communal identity based on who shares, or does not share, these interests (Levina & Vaast, 2005). When groups of people collaborate across knowledge domain boundaries, understanding is stretched across the actors involved, rather than shared between them (Lave, 1988). Knowledge is created and shared by means of complex trajectories of interaction. Organizational actors interpret how various actions or interactions have led to specific outcomes, developing individual cognitive frames that set future expectations of how to act (Goffman, 1974; Weick, 1979). Joint participation frameworks are developed as group members interact, developing intersubjective (cognitively shared) knowledge that relates to local practices. Intersubjective knowledge is transformed into generically subjective knowledge (organizational knowledge that is commonly accepted outside the group in which it originated) by means of *bridging operations*, the mechanisms by which organizational reality is enacted (Weick, 1995):

“Organizing is a mixture of vivid, unique, intersubjective meanings and understandings and understandings that can be picked up, perpetuated, and enlarged by people who did not participate in the original, intersubjective construction. ... organizational forms are the bridging operations that link the intersubjective with the generically subjective.” (Weick, 1995, pg. 72)

Organizational actors thus coordinate distributed knowledge by adopting well-defined work-roles that allow others to understand what information they need, rather than how they do their work (Faraj & Xiao, 2007). In change projects and other contexts where knowledge is distributed, rather than shared, individuals with polycontextual expertise become important as boundary-spanners (Engeström et al., 1995; Levina & Vaast, 2005). These individuals bridge the participation frameworks relating to individual Communities of Practice, to interpret work goals and mechanisms across social networks of practice,
providing a conceptual toolbox for boundary-spanning change projects. Successful bridging appears to
depend upon an ability to enact organizational forms that make sense of the tangle of group interests
that constitute the social network of practice. Boundary-spanners perform multiple roles in enacting
bridging operations. They may act as information gatekeepers, buffering and managing information
dissemination both within and outside the project-group (Ancona & Caldwell, 1992). They may act as
external-internal information gatherers, idea scouts who trawl for knowledge and information not
available within the usual organizational network and who collaborate with other knowledgeable idea
scouts in sharing and translating information to be relevant to internal groups (Whelan et al., 2010).
They may collaborate with boundary-spanners from other groups, to create new joint fields of
collaborative practice (Levina & Vaast, 2005). There may be other roles, that are concerned with their
ability to bridge social network boundaries, but we know little about the mechanisms employed, or how
these bridging roles come into being.

**Research Site And Method**
We have very few empirical studies of knowledge-mediation processes across organizational Networks
of Practice. Those that do exist tend to focus on contextual variables, or call on abstractions from
secondary research, rather than examining situated phenomena within the complex context of a
distributed organization. We therefore employed a grounded theory approach, where a theory is
inductively derived from the study of the phenomenon it represents, to guide data collection and
analysis (Glaser, 1978; Glaser & Strauss, 1967). Grounded theory is suitable when there is no extant
theory to explain contextual situations or when theories are not supported by empirical studies (Gasson
& Waters, 2013). This was the case here – the bridging mechanisms that support global IS change
projects across Networks of Practice are not well researched or understood, requiring an in-depth,
exploratory method of investigation.

The unit of analysis for this research study was the cross-functional IS change project group. We set out
to explore how organizational knowledge is created, shared, and negotiated across organizational
groups and Networks of Practice in global IS change projects. The study focused on IS change projects
undertaken by the eCommerce Group at eServCorp Inc., the main IS change group in this global
consultancy. The eCommerce group is responsible for developing and supporting global IS 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 global
corporations in multiple business sectors. Their dominant market-position is maintained by focusing on
state-of-the-art IS applications to provide flexible service-configurations to customers and to evaluate
the impact of their services on customer performance. The eCommerce Group was increasingly tasked
with providing IT systems with which the company could manage dispersed, global operations at the
enterprise level.

---

1 Names and job-titles of all organizations, departments, members, services, and products have been disguised.
The study followed projects coordinated by the eCommerce Group over a period of two years, starting soon after the company’s acquisition by a major multinational organization, “ParentCo”. The group had several new members, who were learning about eCommerce systems and technologies. We were thus in a position to observe inter-group communication and coordination during adaptation to major organizational changes. IS change projects were coordinated via a variety of information and communication technologies. The primary mode of management coordination across the eCommerce Group 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 1; these included managers from VendorCo, a systems development company based in the USA, who ran the group’s main data center and to whom the majority of eServCorp application development (code implementation) 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 eCommerce support in other regions were managed via local agents who reported to US managers. Managers would attend remotely by telephone from regional offices, trains, hotels, and airports, when attending meetings with other divisions or vendors, or coordinating IS change projects.

![Image of Table 1]

Table 1. Regular Participants In eCommerce Group Coordination Meetings*

<table>
<thead>
<tr>
<th>Job Title and Role</th>
<th>Pseudonym</th>
<th>Freq.</th>
<th>Experiential Background</th>
<th>Loc.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>eServCorp Managers:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Chief Information Officer &amp; Executive VP, eCommerce</td>
<td>CIO</td>
<td>Daily</td>
<td>Data comm; Software engineering; Business management</td>
<td>USA</td>
</tr>
<tr>
<td>Director, Information Systems – Oversight of IS Project Mgt.</td>
<td>InfoSysDir</td>
<td>Daily</td>
<td>Accounting, finance &amp; management</td>
<td>USA</td>
</tr>
<tr>
<td>Director, Network/data management</td>
<td>NetworkDir</td>
<td>Daily</td>
<td>Data comm</td>
<td>USA</td>
</tr>
<tr>
<td>VP, eBusiness - Client-facing project-oversight</td>
<td>VP-Clients</td>
<td>Daily</td>
<td>Marketing</td>
<td>USA</td>
</tr>
<tr>
<td>Director, Technical Development Management</td>
<td>TechDir</td>
<td>Daily</td>
<td>Software engineering</td>
<td>USA</td>
</tr>
<tr>
<td>Senior VP, European Ops. – European project oversight</td>
<td>VP-Europe</td>
<td>Weekly</td>
<td>Systems engineering</td>
<td>Europe</td>
</tr>
<tr>
<td>Manager eSolutions – European customer support &amp; training</td>
<td>EU-Support</td>
<td>Frequent</td>
<td>Client support &amp; systems engineering</td>
<td>Europe</td>
</tr>
<tr>
<td><strong>Primary Vendor Managers:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior Project Manager, VendorCo. – regional projects</td>
<td>V-ProjMgr</td>
<td>Daily</td>
<td>Software engineering</td>
<td>USA</td>
</tr>
<tr>
<td>Technology Development Services Director, VendorCo. – software development</td>
<td>V-TechDevMgr</td>
<td>Daily</td>
<td>Software engineering</td>
<td>USA</td>
</tr>
<tr>
<td>Senior Dev. Mgr, VendorCo. – Data Center &amp; Software Dev.</td>
<td>V-DevTech</td>
<td>Daily</td>
<td>Database admin</td>
<td>USA</td>
</tr>
</tbody>
</table>

*Plus additional staff reporting to these directors and managers and managers of external groups (e.g. global sales director), as required for coordination of individual projects.

Data were collected through an interpretive, ethnographic field method conducted via observations and interviews (Schwandt, 1998). We observed eCommerce Group meetings, interviewed core group members to understand their processes, then observed and transcribed 338 group management
conference-calls over the two-year period of the study, to provide longitudinal data on how operations and projects related to the eCommerce management group were conducted.

We identified 37 IS change projects that involved significant IS change. We extracting data relevant to each project from our meeting and interview transcripts, organizing these in time-series order for analysis. We defined our core category as knowledge-coordination across various types of project, analyzing the data for each project separately. Our initial analysis identified two key dimensions of the project that appeared to affect the group’s knowledge-coordination practices: the locus of control for the project structure – whether this was contained within the local eCommerce Group (including primary vendor staff or negotiated across a number of organizational groups and influential decision-makers, and the degree of requirements emergence – whether IS project goals and organizational requirements for change were well-defined, or emerged over time. We continued our analysis, producing *theoretical memos* to capture our emerging understanding of the data (Glaser, 1998) and *process memos*, to act as a form of reflexive journaling (Lincoln & Guba, 1985). We identified four dimensions of knowledge-coordination, related to boundary-types, activities, project-characteristics, and boundary-spanning mechanisms. At this point, we determined that the two initial dimensions of project structure appeared to be related, so we combined these around three types of project topology:

(i) **Local projects** (14 projects) where responsibility for defining project goals, scope, timescales, deliverables, and rationale lay wholly within the eCommerce Group. Boundaries spanned were functional knowledge-domain boundaries within the core eCommerce management group (which included managers from the group’s primary outsourcing vendor). Projects tended to be relatively well-defined.

(ii) **Distributed projects** (18 projects) where the core eCommerce Group controlled scope and requirements, acting as a controlling hub to the project’s network of practice, managing changes but eliciting expertise from other organizational divisions, external vendors, and consultants. Boundaries spanned included functional knowledge-domain boundaries and organizational boundaries. Projects tended to be less well-defined than for local projects, involving emergent requirements discovery.

(iii) **Global projects** (4 projects) where the core eCommerce Group was part of a web of collaborating organizational groups in the project social network, negotiating and jointly implementing IS product and business-process changes. Boundaries spanned included multiple organizational groups from eServCorp, ParentCo., its associated companies, or external vendors. Projects tended to be undefined, involving considerable negotiation and multiple iterations.

As our theoretical coding proceeded, we distinguished project network management roles and behaviors that appeared to affect project mediation across boundaries. As a result, our core category was redefined as network-bridging practice, which we divided into social network roles and bridging mechanisms. We also employed a social network analysis to explore sample projects that were considered typical of the three forms of project network topology. The social network was modeled by identifying knowledge-transfer or exchange interactions over project coordination discussions, for example when one person asked another for key knowledge relating to the project, or when one person
was tasked with discovering knowledge or obtaining expertise from another group. The group coordination meetings from which these interactions were obtained obviously provide only a partial picture of the network, but the visual social network analysis provided rich insights on knowledge bridging roles that allowed us to understand the findings from the grounded theory analysis in new ways and deepened our theoretical insights.

Findings
Four specific aspects of bridging across the multiple knowledge domains of IS change projects emerged from the data analysis: social network coordination, domain boundary types, project knowledge coordination, and system concept coordination. Collectively, these practices were seen by organizational managers and change agents as instrumental to their ability to bridge the multiple knowledge domains of IS change projects. They are dealt with in turn, below.

Social Network Coordination

Networks of Practice in Local Change Projects
This span of coordination pertained when domain-managers and subgroups within the eCommerce Group collaborated on tasks that require the negotiation of knowledge across domains within the core group. The majority of projects within this category had low requirements emergence. Typical projects that employed centralized control were those concerned with applications of new or evolving information technology to well-understood business domains. A typical project of this type was the initiative to migrate data storage for global eCommerce operations to a centralized data warehouse facility. The project evolved over a period of six months – its social network is shown in Figure 1, where the vertex size indicates degree centrality – the extent to which a person interacts with other people in the network – and the line-thickness indicates edge weight – the relative knowledge-exchange interactivity between two people. This involved interactions with two external vendors, the primary vendor who performed IT systems development for the group and a secondary vendor who supplied data warehouse software for the migration, plus an external consultant (PS-Tech).

Because local coordination projects tended to focus on software development and were generally understood in terms of both scope and change requirements, the main network bridging roles were occupied by the group leader (the CIO), the Information Systems Director, and the project domain expert (the Technical Development Liaison Manager employed by the primary vendor who performed all software development work and whose managers were therefore considered core eCommerce Group members). This form of social network, with one or two people spanning subdomain boundaries who became the domain expert, was common for projects which were coordinated locally by the eCommerce Group (which included managers from their local software development vendor, for coordination purposes).
The key social network coordination role in all locally-coordinated projects was that of the group leader in defining knowledge domains relevant to the project and identifying group members to take domain-coordination roles in the project network. Group members would be actively mentored in these roles, to develop new areas of expertise. What was notable about this span of project coordination was that the individual identified to acquire knowledge related to this type of functional, technical expertise was not necessarily an individual with related experience, but would be chosen because of their role in the network of practice assembled for the project. The main knowledge-domain bridging role in the data warehouse project network shown in Figure 1 was played by the Vendor’s Technology Development Services Director (V-TechDevMgr). While one would expect him to become a key boundary-spanner because of his position as liaison between vendor software development staff and eCommerce staff, it was surprising that he became the key knowledge coordinator across all domains – project accounting and cost structures, data management, technology infrastructure management, as well as the systems configuration planning and execution for which he was formally responsible. At the start of the project, he simply spanned between the vendor’s technical systems development staff and the eCommerce Group. By the end of the project, his direct social network for knowledge exchange spanned all knowledge domains relevant to the project (he had the highest betweenness-centrality index) and he had become an expert in data warehouse technologies – an area in which he previously had little exposure.
A second key social network role was to relate requirements across group projects. This role was taken by the Information Systems Director, one of whose main responsibilities was to manage project scope and definitions, so that technologies and requirements were compatible for multiple systems.

**Networks of Practice in Delegated Change Projects**

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, but delegating some of the work to external groups. Projects with this type of network topology tended to be those concerned with changes to eCommerce systems supporting global eServCorps business processes. This introduced an additional level of complexity: as well as bridging functional knowledge-domain boundaries, which were concerned with areas of technical knowledge or expertise within the eCommerce Group, the group also had to bridge organizational boundaries, which were concerned with the participation frameworks used by each group to interpret *project collaboration* work-goals and activities.

A typical project of this type was the initiative to integrate, develop and incorporate a customized, off-the-shelf (COTS) software product favored by ParentCo into the eServCorps applications portfolio. The project evolved over fifteen months, starting as we joined the group for our study. Initially, the CIO disparaged the COTS software product and vendor, expressing disbelief that ParentCo would support it on technical merit. As other senior managers, in particular the new eServCorps CEO and the CFO became convinced of its strategic centrality, the CIO – who was also EVP for eCommerce – and his senior managers moved to own the product, so that they could control its development trajectory and ensure its stability (as well as owning any income from the product deployment). Eventually, as the product was stabilized it was spun off into its own division, to create a new consultancy area for eServCorps.

The social network for the COTS project is shown in Figure 2, where the vertex size indicates degree centrality – the extent to which a person interacts with other people in the network – and the line-thickness indicates edge weight – the relative knowledge-exchange interactivity between two people. This project involved interactions between eCommerce Group members, employees of the primary software vendor, external vendors including the COTS product vendor <ProdVendor>, the primary vendor who performed IT systems development for the group and a secondary vendor who supplied middleware, ParentCo representatives who had experience with the product, plus a variety of eServCorps external groups and regional managers who would be promoting or using the COTS product in their area of operations.

It is noticeable that bridging interactions are much more widely distributed than in locally-controlled projects. Various individuals in the core group and in other business divisions would volunteer or be delegated to become key coordinators and domain-translators for different areas of project knowledge. This would be coordinated by the CIO, who had the final say in who should take which areas of knowledge discovery or acquire what expertise. As with local coordination projects, individuals were most frequently selected to investigate a specific domain because of their network contacts, rather than their experiential background. It was common for someone who only appeared to have a passing acquaintance with a technical area to become a boundary-spanning “expert” by the end of one or more projects relevant to that area.
In the COTS project, the senior project manager at the eCommerce Group’s primary vendor (V-ProjMgr) was tasked by the CIO to first evaluate and then coordinate technical development of the COTS software product. This was a natural progression – as senior staff of the primary vendor were so closely involved in eCommerce Group operations and planning, it was natural that a primary vendor manager would be tasked with investigating a product that might, or might not be central to group strategy.

The VP for European operations was also tasked with a key project coordination role. Originally, he was selected to explore the requirements of the eServCorps organizational managers responsible for the variety of European national operations, in France, Belgium, Netherlands, etc. As it became clear that ParentCo had plans for eServCorp to deploy the COTS product in other parts of the world, VP-Europe was delegated to explore the requirements of senior managers in various Asia-Pacific countries. He was required to gather knowledge from and coordinate deployment work across COTS-vendor specialist consultants in these countries. Because of this, he became the configuration expert for the product and was able to explain how the client-matching models underlying the COTS software provided an improved service.

As the product was deployed in pilot studies to various global regions, addressing client issues became central to stabilizing the product. This led to a prominent role for the VP for eBusiness (VP-Clients), who was tasked with resolving client-facing issues. VP-Clients became the COTS expert on region-specific customization. Determining what menu and user-interface elements required translation, to which
languages, and by whom, became a major area of the project for three months. What had initially been designed as a small software package, intended for use by a very specific national population, now had to be developed to be usable across a variety of national cultures, with differing language conventions, expectations, and success criteria. This was a major expansion of expertise for someone who had previously worked in North American product marketing.

The final expansion of domain expertise was achieved by the Technical Director. From his background in maintaining data communication networks and computing infrastructure in the US, he was suddenly required to troubleshoot networks and infrastructure globally. This led to “more understanding than I ever wanted” of internet issues in the Asia Pacific countries. As the CIO observed, this meant that he could be deployed on a wide variety of project coordination roles in the future.

**Networks of Practice In Distributed Change Projects**

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 eCommerce Group, but required negotiation with external organizational groups. As well as bridging functional knowledge-domain boundaries and organizational domain boundaries concerned with the participation frameworks used by each group to interpret project collaboration work-goals and activities, the need to negotiate project scope and requirements across groups required boundary-spanners to bridge the participation frameworks used by each group to interpret application domain (project) goals and activities.

A typical project of this type was the initiative to upgrade the eServCorps Enterprise Resource Planning (ERP) system to integrate this with the ParentCo ERP system. As we started our research project soon after the takeover, we were able to see the project unfold from its conception to near completion over the two years that we followed group operations within this organization. The social network for this project is shown in Figure 3, where the vertex size indicates degree centrality – the extent to which a person interacts with other people in the network – and the line-thickness indicates edge weight – the relative knowledge-exchange interactivity between two people.

The network interactions of Figure 3 are typical for this type of “external facing” project, involving a lot of negotiation around project scope, change requirements, appropriate solutions, and the responsibilities of various organizational groups in implementing these. Typically, the CEO would negotiate the business and organizational scope of the project, overall budget allocations, the responsibilities of various groups in implementing the project, and project decisions which affected IS strategy across the company. The IS Director would manage negotiations around technical system goals, requirements, the application domains to be served, and development/deployment budgets. They coordinated their work continually – and constantly interacted with other eCommerce Group and primary vendor managers, to coordinate a rapid response to what was usually an emergent project definition. The company would also employ a variety of software consultants and external vendors on such systems and interact with ParentCo business and technology managers, financial specialists and
auditors, plus the managers of other eServCorps divisions or regional technology management groups who would be required to support external customers, contained key system users, or who needed to integrate the new IS into their work. It can be seen that the CIO and the IS Director are much more central to projects involving this type of distributed negotiation, while the role of other group “experts” is diminished relative to these central negotiation roles.

The initial phase of the ERP system enhancement project was concerned with deploying the ERP system across the European arm of the organization. This raised many financial management issues, which naturally led to its coordination by the IS Director (InfoSysDir), who had a background in corporate finance. He continued as the main project network coordinator because the wide dispersion of responsibilities for the management of distributed agency projects required a much more formal project management approach than for other projects. But also, his explicit role was higher profile as the CIO appeared to conduct so much negotiation “off stage” because of the politics of this project. This type of project seemed almost to be managed using a vendor model, where the eCommerce Group was acting like a consulting vendor to other groups. Either the CIO or the IS Director would attend and coordinate project meetings held at corporate headquarters or at the office of other divisions or global regions. It fell to the IS Director to coordinate requirements discovery with managers from other divisions and to
track project budgets. Budget breakdowns appeared to be debated between group members in much more detail than for other types of project – often because who-would-pay-for-what across multiple organizational divisions became a key point of contention in distributed projects.

It was noticeable that people occupying domain bridging roles were identified on the basis of pre-existing experience or perceived expertise, rather than because of their social network position. There were several areas of this project where the nature of the project requirements – what various clients or organizational stakeholders expected of the system and updates that needed to be made to existing system applications – emerged over time. For these operational domains, various group members would offer to undertake “problem discovery” – a term that seemed to combine the investigation of system requirements with an exploration of client expectations and revenue projections. Problem discovery areas were allocated according to the group member’s experience - it appeared that distributed projects were too politically sensitive for individuals to develop new expertise. In these distributed projects, interactions with other groups were centrally managed, with individuals briefed carefully on what to say and how to act, so that the group presented a coherent front to others.

Domain Boundary Types

Local Projects
The domains bridged in local projects were the various functional knowledge domains required to develop a solution to mainly technology problems. Individuals would be mentored by the CIO, who would involve other group members with related experience, to develop an individual’s domain knowledge. For example, at the start of the data warehouse project, V-DevTechMgr was recruited to replace an eCommerce Group technology manager who was leaving and therefore had the most fluid role definition of all the group and vendor collaborators. His position in the social network, at the intersection between the eCommerce Group and the primary vendor who performed their systems development meant that he was very quickly assigned the role of “sorting things out” for various projects, including the data warehouse project, by the CIO – despite the fact that he had very little knowledge of data warehouse technology. The CIO constantly questioned his current model of the requirements, guided him to interact with others, including an external vendor who was supplying the data warehouse software, and enculturated him in group values.

As a result of these interactions, this vendor manager became the group’s main data warehouse expert. He then became a key knowledge coordinator, acting as a center for interactions on all aspects of data management and technologies, across multiple projects.

Delegated Projects
In addition to specialist functional knowledge, knowledge domain bridging for delegated projects required boundary-spanners to translate project plans to accord with the participation frameworks employed by collaborating groups to interpret what needed to be done – and how – on the project. While the CIO took much of this in the early months of the project, as other group members developed more experience with external groups, they were able to engage in the same type of translation. Here, the vendor project manager is explaining how the COTS vendor personnel works:
V-ProjMgr: They’ve got a Sales and Marketing group that slams everything that moves and they have a Financial control apparatus that doesn’t have the discipline to say no, so they slam technology into the middle and they do the best they can with the tools they’ve got. And they’ve got their own flat sides and the result is a less than perfect product.

By explaining the way in which the other group works, the vendor project manager is communicating the COTS participation framework – in effect, warning group members that the COTS vendor is disorganized, that their Financial Control Group don’t control project costs, and that they don’t understand how to develop a stable software product. This links the external vendor’s participation framework to a new understanding of project scope. It provides others in the group with the understanding that the COTS implementation will require more requirements analysis, stability testing, and additional development work than was originally planned.

Distributed Projects

A further type of domain knowledge was bridged for distributed projects. In addition to functional domain knowledge and knowledge relating to the participation frameworks used by collaborators, distributed projects also required that knowledge relating to the participation frameworks used by organizational groups managing the IS application domain. This bridging took various forms. For example, the VP for European Operations reframed project activities around how the European Business Group manages systems deployment in France, communicating not only what needed to be done, but also why it needed to be done (how the French legislative framework required Help systems to be implemented) and the sociocultural framework within which the system must work (the unknown expectations of other foreign nationals).

Project Knowledge Coordination

Local Projects

In local coordination projects such as the data warehouse implementation, the eCommerce Group had complete control over project definition, scope, and solution evaluation. So the Group leader (the CIO) interpreted and framed project goals and rationale for the group. Shared knowledge about how to understand and deal with projects was coordinated by the CIO, who would interpret novel (to them) 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 the data warehouse project:

   CIO: A model of outsourcing hurts us a lot with <Software Vendor> applications because of the 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. Over time, that will save us a lot of our budget.

These discussions were open to the whole group, as part of daily coordination meetings, to produce shared understanding of how various technology domains work. When the CIO was absent from the coordination meetings, the Information Systems Director or the Network Director would adopt these behaviors in the daily group coordination meetings, even though they did not do so if the CIO were
The CIO encouraged these behaviors, explicitly telling whoever would be managing the meeting on a specific day that they should allocate someone to take X, or explain to the group how to pursue Y – without actually nominating someone for X, or explaining the details of Y himself. This conceptual delegation seemed to keep the group tightly bound around explicit knowledge sharing and coordination.

**Delegated Projects**

People occupying network boundary-spanning roles were frequently asked to identify suitable people from external groups who could contribute knowledge to a project, based on their contacts in the wider social network. The CIO would ask who might be a contact in external groups and explore their background and role in the organization, to ascertain whether their perspectives would be helpful. For example, the CIO would suggest whom to include in project discussions and whom to contact about the strategic business importance of the COTS system deployment in Europe.

As a result, although it was clear that not all group members understood all aspects of the collaborative scope or requirements, they did demonstrate a remarkably shared understanding of who-knows what. Knowledge transfer by both functional and organizational group experts was achieved through discussions and explanations in the daily conference call, supported by emailed explanations and models of the situation under discussion. A functional knowledge domain expert to produce a diagram of information or technology resource uses in other groups, or to provide an organizational chart that identified key people who needed to be included in project discussions. These would be distributed to the group via email, providing a set of local knowledge resources that were maintained and updated frequently, by a variety of individuals. Similarly, an expert in the participation frameworks used by other groups might provide a Powerpoint presentation explaining the project prepared by managers in another division, or provide a budget breakdown from another group that would be contrasted with the eCommerce Group’s planned budget. These resources were central to ongoing knowledge management and frequently referenced in ongoing discussions, when relevant domain experts would be asked by the CIO or the IS Director to add to or update one of these resources for planning purposes.

**Distributed Projects**

Because the project was so wide ranging, spanning global operations for both eServCorps and ParentCo, the IS Director managed functional scope negotiations, budget issues, and operational changes required by the new system – which mainly concerned accounting procedures in non-US offices – rather than passing this to one of the more technology-oriented project managers. The CIO’s role in project coordination lay in negotiating wider organizational roles and responsibilities that affected project scope. They tended to frame project issues collectively, collaborating on translating what had been communicated to them from other divisional managers and debating how to manage negotiations that spanned organizational boundaries.

The CIO or IS Director acted as a group framer for external groups’ participation frameworks, explaining these in such a way as to make this knowledge meaningful to group members unfamiliar with the group or its managers. For example, when discussing the impact of the ERP enhancements and rollout to other regions, the CIO compared the ParentCo technology consolidation strategy to the eCommerce Group’s strategy, to explain how eServCorps was changing under ParentCo:
CIO: ParentCo has grown independent operations in every country. From a global perspective, that’s not a good thing. Mick is consolidating as much as it makes sense. They do the same thing everywhere, so he’s going to shut down all but three data centers. US, UK, and maybe Singapore. We don’t do that anywhere. We’re in the US and we’re outsourced here. This whole consolidation thing is going to affect our hub strategy. We spent $4 million on the UK hub. We know that finance and accounting is duplicated. The EU Financial Director’s operation is redundant now that we have <ERP software>. The CFO is getting a lot of pressure. But our folks in the field shouldn’t have to worry, with maybe a few exceptions.

This meant that group members were familiar with aspects of external strategy and with senior managers whom they might not meet in the course of their work. One junior manager commented that:

“I’ve never met <the CFO> but I know how he thinks. I don’t think I’d want to work for him after hearing <the CIO>’s stories!”

System Concept Coordination

Local Projects
The responsibility for coordinating group practice in these projects centered on the CIO, who interpreted, translated and reframed lessons learned from other projects as a form of conceptual apprenticeship in relevant domains. Individuals who were experienced in other domains or specialisms were mentored by the CIO to become familiar with the issues of eCommerce projects and technologies by constructing models of the system concepts to be followed. For example:

CIO: <following up on a regional variant of data management with the Vendor > If it’s going to be different, let’s make it somewhat better. OK? If we can eliminate the redundant data store and the maintenance I’d be willing to spend some money on that, it’s worth it. Better customer service and less to worry about. That’s the way we saved money in the long term with our first ERP implementation. We need to improve remote access to the OS. Decide what data warehouse is going away. So potentialized storage and virtual access, that’s the model I’d like to go forward with. Everyone OK with that?

In local coordination projects, the ties to external organizational groups were weak – more a matter of fielding inquiries and fault reports from external groups than discovering knowledge for the group. So local group coordination could focus on proceduralization of “how-to” knowledge. This was achieved by other group members with brief explanations of how to approach a specific task.

Delegated Projects
A key element of system concept coordination was achieved by explicit exploration of external social network contacts (who-to-involve and who-knows-what). The CIO and the IS Director often exchanged stories of past projects, to explain how people were involved to the wider group:

CIO: The other thing that worked well here, was that we leaned on our relationship with regional managers to get client insights. <US Sales Director> went around the country making
sure that managers were brought in. All around the country people felt like they had been consulted. Then we leaned on the Mid-Atlantic group. They sent 6 people in all roles. We watched them take the system through its paces. We learned a lot from that.

It can be seen that such ritualized stories of how the eCommerce Groups has involved members of external groups on other projects are a way of providing contextual patterns for how to coordinate system concept definition across the multiple participation frameworks that the group encounters.

**Distributed Projects**

Distributed projects such as the ERP system enhancements required delicate negotiation across a wide network of senior managers and stakeholder groups located in multiple organizational divisions and split across geographical regions. This meant that system concept coordination required the eCommerce Group to have contacts in multiple organizational groups, both for concept elicitation and for concept dissemination once decisions had been taken on system scope and requirements. The following extract demonstrates these dispersed influences:

*InfoSysDir:* The European Financial Director reported that our General Manager in the Netherlands wants the ERP system not the European Financial System. He wants some additional facilities that are not available in their system.

*EU-Support:* there are some complexities that stemmed from how they work as an organization. They work as a complex organization that has no checks and balances, so there is no control over who does what. The problem is that the various parts of the organization do not talk to each other. One problem was that we may have started with them too soon. This was early last year, just as they went through a major reorganization. The local management team is now in charge and they are very resistant to using the European Financial System.

Here the IS Director communicates a system concept requirement for the Netherlands that has reached him via the Financial Director based in the UK. The EU Support Manager places this in context by explaining how the participation framework of the Netherlands Management Office is constraining their ability to use the systems that they have. This led into a debate on the ERP system requirements and deployment plans.

The CIO was focused on nurturing contacts across the wider organizational network, so that he could call upon politically-friendly managers to support eCommerce Group interests when this was needed. He spent a great deal of time and effort identifying people who would be allied politically with the eCommerce Group, as this type of system concept took a great deal of collaboration to define.
Discussion of Findings

Summary of Bridging Roles and Mechanisms
The form found in any specific project depended on the network topology governing the project, which in turn depended upon the degree to which the scope of the project was under the local control of the eCommerce Group responsible for global IS deployment, under central control but dependent on work performed by other divisions or groups (delegated projects), or subject to distributed negotiation of scope, project-goals and system requirements across divisions and groups. Table 2 summarizes the various mechanisms employed for different project network management topologies across the four aspects of project bridging identified in this study.

It is clear that the project “topology” – that combination of network span and structural complexity presented by the change problem – dictated different modes of communication and coordination across the organizational Network of Practice. In locally-coordinated projects, knowledge creation and negotiation was relatively centralized, reinforcing the eCommerce group identity and providing standardized participation frameworks. In delegated projects, the management of group meaning and knowledge were only partly centralized. While the group leader provided contextualized network knowledge, domain boundaries across the organizational Network of Practice were bridged by individuals, who acted as delegates to remote groups for the purpose of acquiring specialist expertise and knowledge. They explained this knowledge back to the group in ways that related to local participation frameworks. Various individuals separately bridged knowledge domain boundaries within the e-Commerce group, defining knowledge resources such as the diagram of information or technology resource uses in other groups, to coordinate activity across the eCommerce group knowledge domains. In distributed projects, knowledge coordination was truly distributed, with group leaders acting more as political facilitators than meaning managers. These projects involved a more diverse set of knowledge mediators, who bridged Network of Practice boundaries and who translated knowledge deriving from remote participation frameworks into locally-meaningful practices and change requirements.
| Table 2. Bridging Roles and Mechanisms Across Three IS Change Project Topologies |
|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| **Local Projects** (Project scope, goals, & reqs. controlled by core group, with little external interaction) | **Delegated Projects** (Core group acts as hub to external groups, with centralized project control) | **Distributed Projects** (Core group is part of web of org'l groups who negotiate project scope, goals & requirements) |
| **Social Network Coordination** | Group leader identifies one or two group members to develop knowledge-domain-spanning functional expertise, based on their position in the project network of practice. These individuals are actively mentored in required knowledge domain expertise, so that they can bridge functional groups in this role. | Group leader coordinates division of labor. A variety of individuals are identified to work with organizational divisions and domain-specific experts, based on work experience and background. Roles are allocated on the basis of pre-existing expertise. Distributed projects are considered too politically sensitive for people who are not knowledge domain experts. |
| **Domain Boundary Types** | Bridging knowledge domain boundaries focuses on individuals acquiring expertise in specialist knowledge domains (e.g. data storage approaches) that span organizational boundaries (e.g. network management vs. hardware support vs. software development teams). | Two forms of domain bridging: (i) bridging knowledge domain boundaries – individuals acquire expertise in specialist knowledge domains (e.g. technology); (ii) bridging organizational group participation frameworks for collaboration. |
| **Project Knowledge Coordination** | Group leader frames project goals, scope, and mechanisms for less experienced group members, mentoring them in the group procedures and participation frameworks that they need to understand specific domains (areas of expertise). Individuals translate domain-knowledge across functional specialisms. |
| **System Concept Coordination** | Group leader explores social network with individuals with knowledge of other groups, to develop a group understanding of who-knows-what. He asks people about external groups with which they have contacts: who does what, what they know, and how they work. In addition to functional group bridging, individuals translate other groups’ participation frameworks to provide a shared understanding of project scope and requirements. |
| | Group leader provides contextual patterns on who to involve and how, in different types of collaboration. Individuals produce knowledge resources to coordinate practice across groups: models, documents, budget spreadsheets and plans, that explain external participation frameworks or structure project reqs. for external consumption. | Distributed practice is coordinated by means of effective social network ties, rather than specific procedures. Group leaders work hard at ensuring that politically friendly collaborators are identified in external groups and that boundary-spanners communicate participation frameworks as system requirements are defined. |
Theoretical Development

Studies of global IS change projects have viewed participant dispersion and diversity as causes of project failure, that However, such studies have focused on the project as technology-development group, working in isolation, rather than viewing the project in the context of an organizational network of business and technology managers, stakeholders, change agents, and technology developers who collaborate to implement IS change. Examined as a complex network of practice, IS change projects naturally span multiple types of boundary, introducing discontinuities that are bridged routinely by skillful and knowledgeable individuals. While translation and interpretation are critical bridging activities, this study extends that understanding by explaining how these activities are performed and how they vary for different project network topologies. The findings indicate the significance of organizational roles in coordinating distributed practice, 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 eCommerce 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 & Morgan, 1982), but are managed collectively by a distributed group working in concert across multiple sub-networks of practice. We have exposed the mechanism by which domain experts derive sufficient social capital to become boundary-spanners-in-practice (Levina & Vaast, 2005), relating this to their ability to manage external social network connections, rather than their perceived domain expertise.

An additional contribution to the rich insights provided by our findings is that we identify how different types of boundary become salient for different networks of practice. Boundaries are generally categorized as discontinuities in social network coordination that are physical, administrative/functional, or related to experiential-knowledge domains (Watson-Manheim et al., 2012). Most studies have focused on the links between such discontinuities and the tendency of project groups to fracture along sub-group “fault lines” (Cramton, 2001; Espinosa et al., 2006). Prior studies have argued that effective knowledge management enables members of boundary-spanning groups to develop new practices and knowledge forms to deal with discontinuities at the boundary (Carlile, 2004; Engeström et al., 1995; Watson-Manheim et al., 2012). Our findings explore the boundary conditions, the group formations and types of boundary-spanning practice breakdown that enable groups to transcend the breakdowns introduced by network discontinuities. We have demonstrated the mechanisms by which social networks of practice may be managed to coordinate and innovate practice across boundaries, under different project configurations that relate to the span of control.

Our analysis has identified how the structural and social contingencies of organizational networks of practice combine to enact the framing, negotiation, and implementation of technology-as-concept. The centrality of bridging mechanisms to managing these contingencies is the key contribution of our study. The resultant conceptual model is shown in Figure 4. We propose a framework for organizational enactment that explains the emergent knowledge processes involved in the mediation of organizational change across a global Network of Practice. We identified four aspects of network bridging mechanisms, that relate to the enactment of technology-as-concept. We explored how roles in the social network of
practice vary according to the perceived pressures and priorities of the project network topology. We categorized three types of domain boundary-type, which come into play for various social network topologies. These explain the increased complexity of managing more distributed projects. We link project knowledge coordination modes to system concept coordination. Taken together, we would argue that these four aspects of social network bridging underpin the enactment of IS change.

![Diagram](image)

**Figure 4. Conceptual Model of Enacted Knowledge Processes in IS Change Project Networks of Practice**

Studies that explore organizational enactment processes have said little about the social network coordination and bridging activities that are required to coordinate knowledge creation and negotiation across complex change projects. We believe that our conceptual model presents an original perspective that explains how organizational change is enacted, through bridging mechanisms that coordinate knowledge across complex Networks of Practice.

**Conclusions**

This study investigated how the social networks of practice that facilitate IS change projects in a global organization are mediated by network bridging mechanisms. We found that different network topology were found to require different bridging mechanisms. These were directed by means of network roles and connections, that were actively managed and facilitated by senior managers in the organizational group that we observed.

The main contribution of this paper is to explore the bridging mechanisms by which IS change project groups coordinate expertise, communicate problem-structures, and negotiate knowledge across geographically, functionally, and practically diverse organizational networks of stakeholders and to suggest the concept of bridging as the key determinant of complex organizational enactment. Table 2
provides a framework that summarizes the key bridging mechanisms observed. We that four aspects of change projects affect how organizational IS change projects should be managed: social network coordination need, the domain boundaries spanned, project knowledge coordination needs, and system concept coordination. We propose a framework for organizational enactment that explains the emergent knowledge processes involved in the mediation of organizational change across a global Network of Practice. This was presented in Figure 4.

These findings have significant implications for how we manage the meaning of collaboration in distributed virtual organizations, as they suggest that many of the required bridging operations are not amenable to digital reporting and management system technologies. 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, mediators, social network relationships which rely on informal channels of communication. We would suggest that many of the bridging mechanisms observed here are not currently recognized as distributed and so management systems focus on information distribution to communicate decisions, rather than systems that support emergent and distributed decision-making and problem negotiation.

References


