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COMMUNICATION TOOLS AND PROJECT SUCCESS IN COMPLEX OUTSOURCED IT PROJECTS

Complete Research

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Abstract

Web 2.0 technologies, such as shared documents, Wikis, and virtual social networks, are increasingly used for communication in complex IT projects. In this study, we apply the boundary spanning theoretical perspective and Carlile's (2002) model of boundary complexity to investigate how these tools relate to projects' outcomes, and analyze the characteristics of the projects and organizations where these tools are adopted. The analysis is based on post-hoc field data collected from client side project managers through an online cross sectional survey. We observed higher level of reflection on communication practices among adopters of Web 2.0 tools. We also found that, along with reflection, the freedom to choose and alter communication tools, strong leadership and approaching client-vendor communication as negotiation of new knowledge (the "pragmatic" level of Carlile's model) are strongly associated with project success for Web 2.0 adopters; this is not the case for projects where Web 2.0 tools have never been tried.

This work provides evidence of the value of the boundary spanning conceptual approach to communication and particularly to Carlile's model of boundary complexity. Practitioners will gain a better understanding of how tools that support higher levels of communication complexity contribute to a project's success.

Keywords: Web 2.0 tools, complex IT projects, outsourcing, boundary spanning, knowledge management

1 Introduction

Complex IT projects, especially those outsourced to an external vendor, pose a significant challenge for their managers. As the technical complexity of the projects increase and the organizational design of outsourcing relationships becomes more complex (e.g., with multiple vendors and geographies involved), the number of project stakeholders increases as well. It follows that a main focus of contemporary literature on IT outsourcing and IT project management, both academic and practitioner- oriented, is on communication among the project's stakeholders, building trustful client-vendor partnership and effective knowledge management (Cram, 2009; Hätönen & Eriksson, 2009; Lacity et al., 2009).

A variety of communication practices and tools are used in complex IT projects for communicating technical, organizational (users' needs) and administrative (status and interdependencies) information among numerous project's stakeholders both inside and outside the client organization. The introduction and growing popularity of Web 2.0 tools, such as shared documents, blogs, forums, Wikis and virtual social networks, adds rich and potentially very powerful options for communication and information management in complex IT projects.

In this paper, we use the boundary spanning theoretical approach to analyze the impact of selected communication tools on an outsourced IT project's outcomes. We draw on the rich literature on boundary spanning, which introduces the notions of *boundary objects* and *boundary spanners*, and

discusses the process of a tool enactment which creates *boundary objects in use*. Furthermore, we argue that an organization's approach to client-vendor boundary complexity plays an important role in successful enactment of communication tools as boundary objects. Carlile (2002, 2004) identifies three incremental levels of boundary complexity: syntactic, semantic, and pragmatic.

We propose that in order to affect a project's outcomes, a choice of communication tools (boundary objects) should match the range of boundary spanning activities in the project. When crossing organizational boundaries, as is the case in IT outsourcing arrangements, it is particularly important to include tools that allow team members to negotiate new knowledge (i.e. spanning organizational boundaries at the highest, pragmatic level).

Our research question, therefore, is:

Is the use of tools capable of supporting the most complex level of boundary spanning (per Carlile) associated with better outsourcing project outcomes?

The paper is structured as follows. In the next section, we provide a short overview of the boundary spanning paradigm and the boundary complexity framework. We then present our hypotheses and the research methodology, followed by report on findings. The paper concludes with discussion and conclusion.

2 Boundary Spanning in Outsourced Projects

The main challenge of an outsourcing relationship is the need to collaborate across a variety of boundaries that may be organizational, geographical or cultural. In addition, studies on intra-organizational communication argue that people within the same organization are also divided by boundaries, created by their professional specialization and by the organization's internal structure. The boundary spanning approach to information exchange and management views communication among people who do not work together on an everyday basis as spanning the boundaries between communities of practice - groups of people engaged in a joint enterprise and characterized by a shared repertoire of concepts, stories and tools (Wenger, 1998). Boundary spanning is essential for information diffusion, and should be viewed as a key organizational competence (Carlile, 2002; Grant, 1996; Schwab et al., 1985).

Prior research acknowledges the importance of boundary spanning during outsourced projects (Levina & Vaast, 2005), and its effect on the quality of client-vendor communication, which subsequently affects the project's outcomes (e.g., Grover et al., 1996; Lee, 2001). Various authors focus on different aspects of boundary spanning and boundary spanning activities (e.g., Shwab et al., 1985; Orlikowski, 2002; Carlile, 2004). Most often, however, boundary spanning process is conceptualized through analysis of boundary spanners' behavior (e.g., Ancona & Cadwell, 1992) and adoption and use of boundary objects. Boundary spanners are people who play an important role in diffusion of ideas within the organization (e.g., Schwab et al., 1985), or "serve as …facilitators in information transmittal between an organization and its environment" (Pawlowski & Robey, 2004, p.648). Boundary objects (BOs) are artifacts, abstract or concrete, that are used on both sides of a spanned boundary to establish shared language and syntax, foster learning about differences and dependencies across boundaries, and facilitate the process of knowledge transfer (Carlile, 2002). BOs may have different meanings in different communities of practice. They are, however, "plastic enough to adapt to local needs and constraints of the several parties employing them yet robust enough to maintain a common identity across sites" (Star, 1989, p.46). Artifacts which may serve as BOs in different situations range from standardized documentation (Star, 1989) and outsourcing contracts (Gal et al., 2008) to "terms, concepts and other forms of reification" (Wenger, 1998).

Levina and Vaast (2005) argue that not all appointed boundary spanners become boundary spanners in practice, and not all proposed boundary objects are accepted as boundary objects in use. The success of boundary spanning is not inherent in characteristics of people or artifacts, but rather in the

boundary object's enactment by boundary spanners. It is important that the boundary spanners are known and well respected among the project participants, and that communication objects and practices are reflected upon and altered when needed (Ibid.).

The organization's ability to recognize the need for boundary spanning, select suitable BOs, identify good candidates for boundary spanners and support them in this role leads to more intensive and more successful boundary spanning activity. The literature suggests a distinction between the number of boundary spanners and BOs (which we refer to as intensity) and boundary spanning in practice, characterized by challenging and adoption of proposed BOs, reflection on boundary spanning practices and attributing social capital to boundary spanners (which we refer to as quality).

Hence our first two propositions focus on the impact of intensity and quality of boundary spanning in an outsourced IT project on the project's outcomes:

Proposition 1: The intensity of boundary spanning in outsourced IT projects is associated with better project outcomes.

Proposition 2: The quality of boundary spanning in outsourced IT projects is associated with better project outcomes.

The literature further suggests that different organizations have different everyday knowledge sharing needs and develop different understanding of these needs. Representation of complex and volatile information on the boundary is essential for knowledge intensive processes such as new product development. It is of little value, however, in stable industries with simple and routine processes (Schwab et al., 1985; Tiwana, 2004). Therefore, the boundary complexity level should be taken into account when defining the approach to boundary spanning, along with boundary spanning intensity and quality.

Carlile (2002, 2004) argues that the conceptual approach to sharing knowledge across boundaries dictates perceived boundary spanning needs, and consequently boundary spanning behavior and selection of BOs with certain characteristics. Drawing on concepts from the classic theory of communication, he proposes a theoretical framework for knowledge management across boundaries, which is specifically tailored to information novelty contexts such as complex IT projects. The framework is briefly summarized below.

As more information novelty is introduced in communication, knowledge boundaries become metaphorically thicker and harder to span. An organization views its knowledge boundaries as *syntactic ("information processing")* when it is mostly concerned with information difference at the boundaries. This approach implies that people across boundaries understand and interpret information in a similar way, and it is enough to organize effective knowledge *transfer*. Document repositories are one example of a BO supporting this level of boundary complexity.

The syntactic approach can be sufficient for an organization's everyday needs, especially in stable environments where shared understanding and interpretation do not change over time. Introducing novelty on one side of the boundary requires explaining it to the other. Hence the more complex s*emantic ("interpretive")* approach to knowledge at the boundaries recognizes that in most cases knowledge exchange among people with different backgrounds requires explanation to avoid differences in interpretations and the possibility of misunderstanding and ambiguity. It is not enough to transfer the knowledge, it needs to be *translated*. It is still implied, however, that the parties across the boundaries have shared goals and interests. Project management and issues tracking tools are semantic level boundary objects that are widely used in IT projects, outsourced or not.

The most complex *pragmatic* (or *political)* approach to boundaries recognizes that introducing novelty at the boundary may create a conflict of interests. Efficient communication at a pragmatic boundary should provide a capacity for *transforming* the knowledge through negotiation of interests.

Complex IT projects often involve integration of different organizational processes, which may

uncover incompatibilities among requirements of different actors (Pan et al., 2007), or as stated by Carlile, "the knowledge developed in one domain generates negative consequences in another" (2004, p.559). Communication with an external organization, such as outsourcing vendor, also involves conflict of interests (Levina, 2005; Gal et al., 2008). When entering a complex outsourced IT project, a client organization may need to re-conceptualize its approach to boundaries and adapt its boundary spanning practices and objects, even if they successfully serve the company's internal needs. This is essential for effective integration of new knowledge (Pavlou & El Sawy, 2006).

Proposition 3: The client's approach to boundary spanning in outsourced IT projects in support of the highest, "pragmatic" complexity level, is associated with better project outcomes.

Efficient boundary spanning on the pragmatic level requires tools that support representation of different functional interests and facilitate their negotiation. Carlile (2004) suggests models, prototypes and maps as suitable pragmatic level boundary objects. A decade later, participants of complex projects increasingly turn to Web 2.0 tools, "the web applications that facilitate interactive information sharing, user-centered design, and collaboration" (VitoDiBari.com, 2014). Proponents of using Web 2.0 tools in IT project management emphasize the ability of these tools to support discussions, transparent documentation, knowledge exchange and collaborative development environment, which make them a good choice for efficient communication across boundaries at the pragmatic complexity level (e.g., Storey et al., 2010; Lanubile et al., 2010). It is expected that the use of tools supporting pragmatic complexity level leads to more effective communication and consequently improves the project's outcomes.

Proposition 4: The use of tools capable of supporting the pragmatic level of boundary spanning is associated with better project outcomes.

We expect that project teams approaching client-vendor communication at the pragmatic level of boundary spanning, also demonstrate a high level of boundary spanning intensity and quality.

Proposition 5: The use of tools and practices capable of supporting the pragmatic level of boundary spanning is associated with higher intensity and quality of boundary spanning.

Finally, we submit that the use of Web 2.0 tools for client-vendor communication is able to leverage the client's boundary spanning culture to achieve better project outcomes. Hence our final proposition:

Proposition 6: The use of tools capable of supporting the pragmatic level of boundary spanning is associated with higher impact of boundary spanning intensity and quality on project outcomes.

3 Research Methodology

Post-hoc field data for this study were collected through an online cross sectional survey created with Qualtrics software. Respondents were recruited through the Project Management Institute (PMI), the world's leading non-profit membership association for the project management profession. After the approval of the PMI Research Review Committee, a special invitation was send to fourteen thousand members of PMI's IS Community of Practice. The participants were offered an incentive in the form of Professional Development Units – credits required to maintain PMI's professional certification. The survey was accessible online for three months, from June 1 to September 1, 2011. No reminders were sent and no signs of non-response bias were found in the data set.

The data set covers use of various tools use in client-vendor communication, perceptions of different aspects of this communication, and satisfaction with the project outcomes. The instrument was pre-tested on two experienced project managers using the cognitive interviewing technique (Willis, 2005), and pilot tested on a convenience sample of twenty- six project managers. The final survey was offered to project managers of recently completed or close to completion outsourced IT projects. 266 valid responses from project managers representing outsourcing clients are used for analysis.

3.1 Demographics

We collected demographics about study participants, client organizations and projects. The sample is well balanced in terms of participants' gender, age, education and experience, and in terms of the industries represented by the client organizations. 239 (91%) of the projects are at least 6 months long, and 259 (97.4%) reported at least one type of complexity (i.e., involve technical, organizational or environmental uncertainty (Bosch-Rekveldt et al., 2011)). 147 (56%) of the projects are complete; others are close to completion or ongoing. Studying only advanced stage projects ensures that communication practices in the projects are already established.

3.2 Boundary Spanning Intensity

Boundary spanning intensity was operationalized as the number of different tool categories used for communication during the project. A short list of tools commonly used for communications in IT projects was developed after a thorough examination of the literature, informal conversations with practitioners and the pilot survey. The study participants were presented with twelve tools divided into six categories, and asked to identify those that they use for communication in their project (Figure 1).

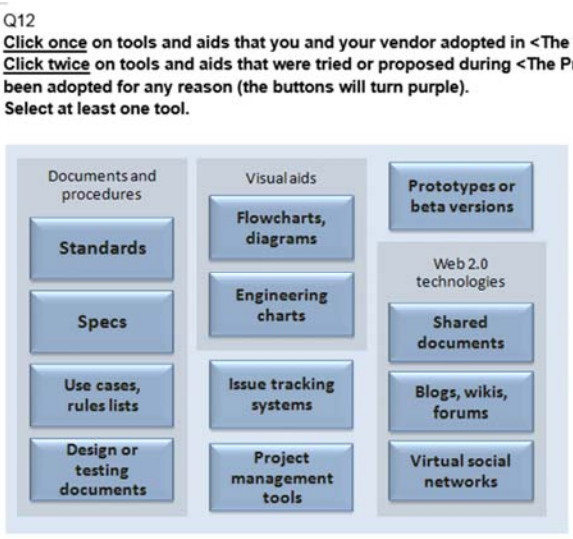

Figure 1. Six categories of communication tools (screenshot of the online survey)

We use the count of various tool categories as an indicator of boundary spanning intensity. Further, we take a deeper look into the usage of Web 2.0 tools as they support the process of new knowledge negotiation, making them the most suitable for boundary spanning at the pragmatic level.

3.3 Boundary Spanning Quality

The quality of boundary spanning may not be directly connected to the number of tools used. One project may rely on many simpler BOs while another may use fewer tools that are better tailored to the needs of the company and the project as a result of a wise tool selection, reflection on the tool's usefulness and adoption by key people in the team (Levina & Vaast, 2005; Volkoff et al., 2002, 2004).

The criteria for the quality of boundary spanning used in this study are based on findings and recommendations from qualitative studies on boundary spanning, in particular, on the work of Levina and Vaast (2005). Boundary objects in use are those that facilitate knowledge exchange and make sense to all participants. To become a boundary spanner in practice, an appointed boundary spanner needs to be a legitimate participant and negotiator in both fields, have a personal inclination to do so, and possess "capital" (economic, cultural, social or symbolic). Being known and respected in the client organization is therefore a necessary condition for an appointed boundary spanner to

become boundary spanner in practice. Finally, reflections of boundary spanners on the usefulness of BOs and the freedom to choose or abandon communication tools when it is deemed reasonable are important characteristics of successful boundary spanning (Ibid.). These criteria were used for developing measures of boundary spanning quality provided in Table 1.

3.4 Perceived Boundary Complexity

Following Carlile's (2002, 2004) claim that the level of boundary complexity is defined by conceptual approach to the boundary, we asked project managers how important certain knowledge exchange and negotiation objectives are for communication in their projects. The four boundary complexity variables are based on Carlile's work and summarized in Table 1.

3.5 Project outcomes

Project outcomes metrics were adapted from Gopal and Gosain (2009). Two items capture the *process performance* - meeting time and budget constraints; two other items reflect the *product performance* - client's satisfaction with quality and functionality of the final product. An additional, fifth, item captures overall satisfaction with the project results.

Variable	Survey questions	Scale
Boundary complexity level Question: How important are the following aspects of working together for you and your vendor?		
LVL1	Effective coordination of efforts	5-point Likert scale (1 – "not at all important", 3 – "somewhat important", 5 – "very important")
LVL2	Clear understanding of each other's tasks and responsibilities	
LVL3	Helping and supporting each other	
LVL4	Creating opportunities for people with different perspectives to work together on complex problems	
Quality of boundary spanning Question: How much do you agree or disagree with the following statements about your communication with the vendor during <The Project>?		
SPNR	The client representatives in the project are well known and respected in the company	7-point Likert scale (1 – "Strongly disagree, 4 – "Neither agree nor disagree", 7 – "Strongly agree")
MGT	Top management encourages communication	
V1	Most communication practices used in <The Project>were proposed or required by the vendor	
BO1	The tools and aids that we use facilitate knowledge exchange between us and the vendor	
BO2	Using the tools in the project helps us explain our point of view and understand the vendor's point of view	
BO3	(Recoded from BO3R) Not all involved people are comfortable with technical documentation and computer applications; this impedes communication between our organization and the vendor (only for complex BOs).	
REF1	During <The Project>, we and our vendor reflected on our communication practices and changed them as needed	
REF2	We have the freedom to decide on the best ways to manage communication with the vendor	
Project outcomes Question: Compare the performance of <The Project> so far to your initial expectations		
PBudget	The project is within budget	7-point Likert scale (1 – "Much worse", 4 – "As expected", 7 – "Much better")
PSched	The project is within the planned schedule	
PQual	The expectations for product quality have been met to date	
PFunc	The expectations for product functionality have been met to date	
POverall	Overall satisfaction with the project	

Table 1. Definitions of variables used in the study

4. FINDINGS

The data analysis for this study is based mainly on correlations and means comparisons. Study participants reported using a variety of different tools and tool types for communication in IT projects. Table 2 summarizes the average number of various tools and tool types used by the study participants. 110 of the 266 participants (41.4%) reported trying at least one communication tool that ultimately was not adopted. Table 3 reports on the frequencies of successful and attempted adoption of specific tools.

	Minimum	Maximum	Mean	Std. Deviation
Total tools used (out of 12)	1	11	6.28	2.063
Total tools abandoned (of 12)	0	9	.76	1.432
Various tool types used (of 6)	1	6	4.62	1.083

Table 2. Count of tools and tools types used

		Did not use		Used		Tried and abandoned	
		N	%	N	%	N	%
Documents	Standards	70	26.3	184	69.2	12	4.5
	Specifications	42	15.8	216	81.2	8	3.0
	Use cases & business rules	114	42.9	132	49.6	20	7.5
	Design and testing documents	44	16.5	209	78.6	13	4.9
Visualizations	Flowcharts and diagrams	70	26.3	187	70.3	9	3.4
	Engineering charts	210	78.9	37	13.9	19	7.1
Issue tracking systems		47	17.7	206	77.4	13	4.9
Project management tools		41	15.4	208	78.2	17	6.4
Prototypes and beta versions		132	49.6	112	42.1	22	8.3
Web 2.0	Shared Documents	99	37.2	147	55.3	20	7.5
	Wikis, blogs and forums	216	81.2	24	9.0	26	9.8
	Virtual social networks	236	88.7	8	3	22	8.3

Table 3. Frequencies of use for all tools. N=266

4.1 Boundary spanning intensity and project outcomes

Correlations between the number of communication tools and satisfaction with project outcomes are summarized in Table 4. All correlations are low; no statistical significance is observed. Proposition 1, therefore, is not supported. There is no direct association between the intensity of boundary spanning in terms of number of various communication tools and the outcomes of the project.

N= 249	Tools types (Max 6)		Tool count (Max 12)	
	Pearson Corr.	Sig. (2-tailed)	Pearson Corr.	Sig. (2-tailed)
PBudget	-.007	.910	.588	.034
PSched	.027	.676	.080	.207
PQual	-.075	.235	-.046	.473
PFunc	-.058	.360	-.051	.420
POverall	-.020	.757	-.003	.964

Table 4. Correlations between the metrics of project's outcome and the number of communication tools

4.2 Boundary spanning quality and complexity and project outcomes

Correlations between metrics for boundary quality, complexity and project outcomes are presented in Table 5. They show that product-based outcomes of the project (the quality and functionality of the

final product) are affected by boundary spanning activities more than process-based outcomes (staying within planned budget and schedule). The presence of respected leaders who can become boundary spanners in practice (SPNR) has the strongest influence on project success, with the highest correlations across all five metrics of project outcomes. Reflection on communication practices (REF1) and the freedom to select or alter them (REF2) are also deemed important. Further, successful enactment of communication tools as BOs in use (BO1 and BO2) and the conceptual approach to boundaries at the pragmatic level (LVL4) are associated with higher satisfaction with the final product and with the project in general.

N= 249		LVL1	LVL2	LVL3	LVL4	SPNR	MGT	BO1	BO2	BO3	V1	REF1	REF2
PBudget	Pearson Corr.	-.008	.033	.115	.052	.221*	-.008	.091	.043	.046	-.105	.159*	.198*
	Sig. (2-tailed)	.898	.599	.071	.417	.000	.899	.151	.495	.466	.099	.012	.002
PSched	Pearson Corr.	.005	.081	.087	.072	.208*	.009	.150*	.091	.024	.087	.151*	.198*
	Sig. (2-tailed)	.932	.203	.173	.258	.001	.884	.018	.151	.707	.171	.017	.002
PQual	Pearson Corr.	.049	.139*	.040	.157*	.216*	.102	.153*	.147*	.054	-.046	.159*	.151*
	Sig. (2-tailed)	.439	.028	.529	.013	.001	.109	.016	.021	.396	.474	.012	.017
PFunc	Pearson Corr.	.138*	.197*	.111	.198*	.227*	.055	.213*	.157*	.027	.011	.245*	.191*
	Sig. (2-tailed)	.029	.002	.080	.002	.000	.383	.001	.013	.673	.867	.000	.002
POverall	Pearson Corr.	.040	.099	.079	.213*	.283*	.031	.233*	.173*	.036	-.003	.232*	.228*
	Sig. (2-tailed)	.529	.120	.214	.001	.000	.627	.000	.006	.572	.966	.000	.000

Table 5. Correlations between the metrics of project outcome and boundary spanning metrics

Propositions 2 and 3 are therefore fully supported for the product-based project outcomes and partially supported for process-based outcomes. The quality of boundary spanning and conceptualization of boundaries on the pragmatic level are associated with higher quality and functionality of the final product and with higher overall satisfaction. Only presence of potential boundary spanners in practice and reflection on communication practices affect the process based outcomes of the project – its match with the planned budget and schedule.

4.3 Tools usage and project outcomes

60.2% (160 of 266) of study participants used at least one of the three Web 2.0 tools included in the questionnaire - shared documents; blogs, Wikis and forums; or virtual social networks. The details on the use of each of the three Web 2.0 tools are shown in Table 3 above.

Comparison of projects that use Web 2.0 tools to projects where these tools were never tried shows higher satisfaction with all project outcomes for Web 2.0 users. These differences are statistically significant for project's schedule, quality of the final product, and overall satisfaction (Table 6).

	Did not try Web 2.0 (89)	Adopted at least some Web2.0 tools (160)	t-test significance
PBudget	3.51	3.76	.119
PSched	2.93	3.36	.015*
PQual	3.47	3.86	.020*
PFunc	3.49	3.80	.065
POverall	3.51	3.90	.026*

Table 6. Mean satisfaction with project outcomes by Web 2.0 tools usage

Proposition 4, therefore, is supported. The use of tools capable of supporting the pragmatic level of boundary complexity, in particular, Web 2.0 tools, is positively associated with the project's outcomes.

4.4 Tools usage and boundary spanning intensity and quality

The number of different types of communication tools (not including Web 2.0) in the project is used as a proxy for boundary spanning intensity. We performed means comparisons of the number of used tools (excluding Web 2.0 tools) between projects where Web 2.0 tools were never tried and projects where at least some Web 2.0 tools were adopted. The results are presented in Table 7.

	Did not try Web 2.0 (89)	Used at least some Web 2.0 tools	t-test significance
Total tool types used (max 5)	3.42	3.85	.003**
SPNR	5.36	5.44	.598
MGT	5.16	5.61	.006**
BO1	5.49	5.54	.747
BO2	5.20	5.43	.134
BO3	4.06	4.21	.522
REF1	4.44	5.03	.003**
REF2	5.29	5.46	.356
LVL1	4.46	4.58	.203
LVL2	4.35	4.51	.101
LVL3	4.07	4.21	.182
LVL4	3.33	3.52	.188

Table 7. Boundary spanning intensity and quality indicators for projects by Web 2.0 tools usage

We see that adopters of Web 2.0 tools tend to use a higher variety of communication tools which suggests higher boundary spanning intensity. Web 2.0 adopters also report significantly higher support of project communication from company management and higher level of reflection on their communication practices.

This corroborates proposition 5, which states that the use of tools capable of supporting the pragmatic level of boundary spanning is associated with higher intensity of boundary spanning. Proposition 5 is therefore upheld in part: using tools capable of supporting the pragmatic level of boundary spanning is associated with higher boundary spanning intensity and with some aspects of boundary spanning quality, namely reflection on the boundary objects. The stronger involvement of management suggests that Web2.0 tools are more often proposed as boundary objects by management than other tools.

4.5 Tools usage and the effect of boundary spanning on projects outcomes.

We started our analysis by looking at correlations between the metrics of project success and boundary spanning quality and complexity. After learning about the differences between projects where Web2.0 tools were adopted and those where these tools were never tried, we then check correlations separately to distinguish between Web 2.0 adopters and those who did not try Web 2.0 tools. The results are shown in Tables 8a and 8b.

These correlations provide strong support to Proposition 6 and weaken the previous support of Proposition 2. There is only very modest association of the project outcomes with boundary spanning quality, and no association for boundary complexity, for projects who did not try Web 2.0 tools. On the contrary, in the projects where Web 2.0 tools have been adopted, the project outcomes are associated with well-developed boundary spanning.

		LVL1	LVL2	LVL3	LVL4	SPNR	MGT	BO1	BO2	BO3	V1	REF1	REF2
PBudget	Pearson Correlation	-.039	-.073	.093	.056	.254*	-.067	.108	.106	.040	-.108	.203	.146
	Sig. (2-tailed)	.715	.496	.387	.601	.016	.534	.313	.322	.707	.312	.057	.173
PSched	Pearson Correlation	-.098	-.096	.092	.025	.090	.000	-.061	.061	-.014	.016	.053	.067
	Sig. (2-tailed)	.360	.371	.393	.818	.404	.997	.571	.572	.900	.881	.624	.530
PQual	Pearson Correlation	.094	-.008	-.019	.011	.125	.011	.056	.215*	.120	-.052	.099	.085
	Sig. (2-tailed)	.380	.941	.862	.915	.243	.916	.599	.043	.261	.627	.354	.430
PFunc	Pearson Correlation	.128	.022	.116	.078	.175	-.067	.058	.201	.091	.070	.150	.053
	Sig. (2-tailed)	.232	.838	.278	.466	.101	.535	.586	.059	.397	.518	.161	.620
POverall	Pearson Correlation	.043	-.067	.104	.100	.224*	-.091	.124	.244*	.017	-.001	.102	.133
	Sig. (2-tailed)	.689	.535	.334	.351	.035	.396	.247	.021	.873	.990	.340	.214

Table 8a. Correlations between metrics of project success and metrics of boundary spanning quality and complexity. Projects that did not try Web 2.0 tools (N=89).

		LVL1	LVL2	LVL3	LVL4	SPNR	MGT	BO1	BO2	BO3	V1	REF1	REF2
PBudget	Pearson Correlation	-.004	.077	.118	.037	.203*	-.006	.081	-.002	.044	-.099	.112	.219**
	Sig. (2-tailed)	.957	.331	.137	.638	.010	.944	.307	.981	.582	.214	.157	.006
PSched	Pearson Correlation	.038	.153	.066	.077	.259**	-.026	.241**	.086	.034	.132	.163*	.253**
	Sig. (2-tailed)	.631	.054	.410	.331	.001	.740	.002	.278	.668	.096	.039	.001
PQual	Pearson Correlation	.009	.200*	.059	.216**	.255**	.111	.194*	.095	.011	-.036	.154	.174*
	Sig. (2-tailed)	.911	.011	.460	.006	.001	.163	.014	.234	.895	.656	.051	.028
PFunc	Pearson Correlation	.132	.275**	.096	.245**	.247**	.083	.279**	.122	-.012	-.012	.268**	.250**
	Sig. (2-tailed)	.097	.000	.227	.002	.002	.295	.000	.124	.879	.881	.001	.001
POverall	Pearson Correlation	.022	.170*	.046	.257**	.309**	.055	.282**	.121	.038	.004	.270**	.268**
	Sig. (2-tailed)	.784	.032	.565	.001	.000	.493	.000	.127	.636	.962	.001	.001

Table 8b. Correlations between metrics of project success and metrics of boundary spanning quality and complexity. Projects that adopted Web 2.0 tools (N=160).

5 CONCLUSION

Our findings show that the use of variety of communication tools does not improve a project's outcomes. However, organizations where many different tools are used are more likely to try Web 2.0 tools. We further observe that projects using Web 2.0 tools do not exhibit significantly higher boundary spanning quality or more conscious approach to boundary complexity (except for REF1, "reflection on the tools in use"). However, for the users of Web 2.0 tools, boundary spanning activities are strongly associated with the project's success, which is not the case for projects where Web 2.0 tools have never been tried. Web 2.0 tools, therefore, which are able to support the most complex level of boundary complexity – the pragmatic level - facilitate boundary spanning and leverage information novelty negotiation toward project success.

We also identified those aspects of boundary spanning that are deemed to be more important for adoption of Web 2.0 tools and project success. Client organizations who adopted Web 2.0 tools are characterized by higher level of reflection on the tools they use, and also by involvement of management who encourages project related communication. Appointing leaders who are capable of becoming boundary spanners in practice and the freedom to select and abandon communication tools improve all metrics of project success for Web 2.0 adopters. Reflection on communication tools and wisely selected boundary objects also can improve both process-based and product-based success

metrics. Approaching the client-vendor boundary at the pragmatic complexity level is important for negotiation of information novelty and therefore is associated with better quality and functionality of the final product, but not with meeting budget and schedule restrictions.

Our findings provide additional empirical support to boundary spanning conceptual approach to communication and to Carlile's model of boundary complexity. The boundary spanning approach is specifically tailored for knowledge intensive and innovative environments where communication involves negotiation of interests and creation of new knowledge rather than just information exchange. Existing boundary spanning research is predominantly qualitative. Our positivist quantitative study makes a valuable contribution to this body of research by operationalizing some of the boundary spanning concepts and using statistical methods to identify tendencies across multiple IT projects.

Our findings are also of immediate value for practitioners. They illustrate the importance of reflection on communication practices, the key role of boundary spanners and the circumstances that make Web 2.0 tools contribute to the project's success.

5.1 Limitations

The study is subject to some inherent limitations related to the survey design, measures and sampling methods. Data collection method is prone to social desirability bias. Each project in the data set is represented by a single informant, which may lead to self-reporting bias. Further, we cannot adequately assess the participation rate since the survey was offered to PMI members by email sent directly by the association. The resulting sample may be affected by the self-selection of the respondents to participate in the study. Finally, we studied only outsourcing arrangements for IT projects, and the generalizability of the findings for projects performed in-house or for other types of outsourcing arrangements may be limited.

5.2 Directions for future research

Web-based communications tools are constantly evolving and used in new and novel for communicating ideas and knowledge in complex projects. In this study we compared projects where Web 2.0 tools are not adopted with those where these tools are successfully used. We offered our respondents three types of Web 2.0 tools: shared documents; Wikis, blogs and forums; and virtual social networks. A more focused insight into the use of specific tools and comparison among them will improve our understanding of the ability of these and other tools to support Carlile's pragmatic level of boundary complexity and of the relationship between the use of Web 2.0 tools and project success.

Different projects may introduce different levels of novelty, and, consequently, benefit more or less from the use of tools. Future research might explore the role of project complexity and other demographic characteristics such as the client organization's industry or prior relationships (trust) among the partners. Another suggestion for future research is moving beyond outsourcing to other interorganizational relationships, such as supply chains.

References

Ancona, D. G. and Caldwell, D. F. (1992). Bridging the Boundary: External Activity and Performance in Organizational Teams. *Administrative Science Quarterly, 37*(4), 634–65.

Bosch-Rekveldt, M., Jongkind, Y., Mooi, H., Bakker, H., and Verbraeck, A. (2011). Grasping project complexity in large engineering projects. *International Journal of Project Management, 29* (6)

Carlile, P. R. (2002). A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development. *Organization Science, 13*(4), 442–455.

Carlile, P. R. (2004). Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge Across Boundaries. *Organization Science*, *15*(5), 555–568.

Cram, A. (2009). Success Factors for Information Systems Outsourcing: A Meta-Analysis. In *Proceedings of the 15th Americas Conference on Information Systems* (p. 554). San Francisco, CA.

Gal, U., Lyytinen, K., and Yoo, Y. (2008). The dynamics of IT boundary objects, information infrastructures, and organizational identities. *European Journal of Information Systems*, *17*(3), 290–304.

Gopal, A. and Gosain, S. (2009). The role of organizational controls and boundary spanning in software development outsourcing. *Information Systems Research*, *20*(8), 1–23.

Grant, R. M. (1996). Toward a Knowledge-Based Theory of the Firm. *Strategic Management Journal*, *17*, 109–122.

Grover, V., Cheon, M., and Teng, J. (1996). The effect of service quality and partnership on the outsourcing of information systems functions. *Journal of Management Information Systems*, *12*(4), 89–116.

Hätönen, J. and Eriksson, T. (2009). 30+ years of research and practice of outsourcing–Exploring the past and anticipating the future. *Journal of International Management*, *15*(2), 142–155.

Lacity, M. C., Khan, S. A., and Willcocks, L. P. (2009). A review of the IT outsourcing literature: Insights for practice. *Journal of Strategic Information Systems*, *18*(3), 130–146.

Lanubile, F., Ebert, C., Prikladnicki, R., and Vizcaíno, A. (2010). Collaboration tools for global software engineering. *Software, IEEE*, *27*(2), 52–55.

Lee, J.-N. (2001). The impact of knowledge sharing, organizational capability and partnership quality on IS outsourcing success. *Information & Management*, *38*(5), 323–335.

Levina, N. (2005). Collaborating on Multiparty Information Systems Development Projects: a Collective Reflection-in-Action View. *Information Systems Research*, *16*(2), 109–130.

Levina, N., and Vaast, E. (2005). The Emergence of Boundary Spanning Competence in Practice: Implications for Implementation and Use of Information Systems. *MIS Quarterly*, *29*(2), 335–363.

Orlikowski, W. J. (2002). Knowing in Practice: Enacting a Collective Capability in Distributed Organizing. *Organization Science*, *13*(3), 249–273.

Pan, S. L., Newell, S., Huang, J., and Galliers, R. D. (2007). Overcoming knowledge management challenges during ERP implementation: the need to integrate and share different types of knowledge. *Journal of the American Society for Information Science and Technology*, *58*(3), 404.

Pavlou, P. A. and El Sawy, O. A. (2006). From IT leveraging competence to competitive advantage in turbulent environments: the case of new product development. *Information Systems Research*, *17*(3), 198.

Pawlowski, S. D. and Robey, D. (2004). Bridging User Organizations: Knowledge Brokering and the Work of Information Technology Professionals. *MIS Quarterly*, *28*(4), 645–672.

Schwab, R. C., Ungson, G. R., and Brown, W. B. (1985). Redefining the boundary spanning-environment relationship. *Journal of Management*, *11*(1), 75–86.

Star, S. L. (1989). The structure of ill-structured solutions: boundary objects and heterogeneous distributed problem solving. In M. Huhn & L. Gasser (Eds.), *Readings in distributed artificial intelligence* (pp. 37–54). Menlo Park, CA: Morgan Kaufmann.

Storey, M.-A., Treude, C., van Deursen, A., and Cheng, L.-T. (2010). The impact of social media on software engineering practices and tools. In *Proceedings of the FSE/SDP workshop on Future of software engineering research* (pp. 359–364)

Tiwana, A. (2004). Beyond the black box: knowledge overlaps in software outsourcing. *Software, IEEE*, *21*(5), 51–58.

VitoDiBari.com. The Ten Characteristics of Web 2.0: The internet has changed, have you? http://www.vitodibari.com/en/ten-characteristics-web-20-internet-changed.html, retrieved Mar 13, 2014

Volkoff, O., Strong, D., and Elmes, M. (2002). Between a rock and a hard place: Boundary spanners in an ERP implementation. *AMCIS 2002 Proceedings*, 135.

Wenger, E. (1998). Communities of practice: Learning as a social system. *Systems thinker*, *9*(5), 1–5.

Willis, G. (2005). *Cognitive interviewing: a tool for improving questionnaire design*. Sage Publications