Knowledge Gathering, Team Capabilities, and Project Performance in Challenging Work Environments

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KNOWLEDGE GATHERING, TEAM CAPABILITIES, AND PROJECT PERFORMANCE IN CHALLENGING WORK ENVIRONMENTS[•]

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ABSTRACT

Knowledge gathering can create problems as well as benefits for project teams in work environments characterized by overload, ambiguity, and politics. This paper proposes that the value of knowledge gathering in such environments is greater under conditions that enhance team processing, sensemaking, and buffering capabilities. The hypotheses were tested using independent quality ratings of 96 projects and survey data from 485 project team members collected during a multi-method field study. The findings reveal that three capability-enhancing conditions moderated the relationship between knowledge gathering and project quality: slack time, organizational experience, and decision-making autonomy. More knowledge gathering helped teams to perform more effectively under favorable conditions but hurt performance under conditions that limited their capabilities to utilize that knowledge successfully. Implications for theory and research on knowledge and learning in organizations, team effectiveness, and organizational design are discussed.

Keywords: knowledge management, project teams, capabilities, quality, work environment

Many project teams at the forefront of the knowledge economy are "open systems" that must continuously interact with their environments to obtain information, know-how, and feedback for their tasks (Ancona 1993, Cohen and Bailey 1997, Goodman and Wilson 1999). Knowledge-intensive organizations ranging from consulting firms to technology companies have invested substantial resources in "knowledge management" initiatives intended to facilitate these interactions, typically by installing information systems such as document databases or promoting forums that encourage interpersonal contact such as communities of practice (e.g., Brown and Duguid 2000; Davenport and Prusak 1998, Leonard 1998). Researchers as well as practitioners have observed, however, that more knowledge often fails to result in improved task outcomes in organizations (Pfeffer and Sutton 1999), and sometimes knowledge gathering even hurts project performance (Haas and Hansen 2005). This raises the question of how teams in knowledge-intensive work settings can derive greater benefits from knowledge gathered during their projects.

The expectation that knowledge gathering should be beneficial for project teams is consistent with strategic management theories that propose that knowledge resources provide a critical source of competitive advantage for firms (e.g., Grant 1996, Kogut and Zander 1992). Similarly, organizational learning theories argue that learning from others can enhance organizational performance (e.g., Levitt and March 1988, Huber 1991, Argote 1999). Applying these theories to work groups suggests that project teams in knowledge-intensive work settings should perform better if they engage in more external knowledge gathering, defined here as the active solicitation of task-related information, know-how, and feedback from experts and document sources external to the team, either within or beyond the organization (Ancona and Caldwell 1992, Hansen 1999, Cummings 2004, Majchrzak et al. 2004). Many knowledge-intensive work settings are characterized by overload, ambiguity, and politics, however, where project teams face a multitude of possible problems to address and solutions with which to address them, little way to know which problems and solutions to select, and multiple stakeholders with an interest in their selections (Alvesson 2004). The expectation that more knowledge gathering is better overlooks the resulting problems that project teams face in such settings.

In this paper, I develop a team capabilities view of the relationship between knowledge gathering and project performance in challenging work environments. The concept of team capabilities draws on the strategy literature on organizational capabilities, which calls attention to the capabilities that enable organizations to utilize knowledge effectively (e.g., Dosi et al. 2000, Grant 1996, Kogut and Zander 1992). Since "to be capable of something is to have a generally reliable capacity to bring that thing about as a result of intended action" (Dosi et al. 2000: 2), capabilities can readily be conceptualized at the team level as well as the organization level. The team capabilities view developed here proposes that project teams can benefit more from knowledge gathering in challenging work environments if they have greater processing, sensemaking, and buffering capabilities. These capabilities are important in any organizational context, but they are especially critical for addressing the problems of knowledge gathering created by overload, ambiguity, and politics. Arguing that processing, sensemaking, and buffering capabilities are greater in teams that have more slack time, work experience, and decision-making autonomy, I hypothesize that these three capability-enhancing conditions can moderate the relationship between knowledge gathering and project performance in challenging work environments.

The empirical context in which I test the hypotheses is an international development agency that exemplifies the ideal type of a challenging work environment since team members in this organization typically felt overloaded, both means and ends were highly ambiguous, and political agendas and interests abounded. As in many knowledge-intensive organizations (cf. Starbuck 1992), the most important performance outcome for these teams was the quality of the projects they delivered to clients, and the teams themselves were composed of highly qualified experts whose work consisted primarily of gathering information, know-how, and feedback through interpersonal exchanges or reading, analyzing and applying this knowledge, and delivering written and oral conclusions to their colleagues and clients.

KNOWLEDGE GATHERING AND PROJECT PERFORMANCE

Because knowledge gathering usually is regarded as desirable, much of the growing literature on knowledge in organizations focuses on the social structures and technological systems that enable

knowledge to be gathered more easily. Early organizational design research drew attention to arrangements that increase exchanges of information across internal boundaries, such as integrator roles and cross-functional taskforces (e.g., Lawrence and Lorsch 1967, Galbraith 1973). Subsequent studies of boundary spanning (e.g., Tushman 1977, Ancona and Caldwell 1992), communities of practice (e.g., Brown and Duguid 2000), and social networks (e.g., Hansen 1999, Reagans and McEvily 2003, Levin and Cross 2004, Uzzi and Lancaster 2004), further illuminate the types and patterns of interaction that facilitate knowledge gathering. These social perspectives are complemented by research on knowledge management technologies such as electronic database systems (e.g., Hansen and Haas 2001) and communication innovations from e-mail to teleconferencing (e.g., Sproull and Kiesler 1991), as well on research on the cognitive and motivational factors that facilitate learning such as the absorptive capacity of a firm (Cohen and Levinthal 1991) or the psychological safety of a work unit (Edmondson 1999). With the exception of some recent ethnographic studies (e.g., Carlile 2002, Bechky 2003, Patriotta 2003), however, studies of knowledge gathering generally overlook the distinctive problems faced by teams in environments characterized by overload, ambiguity, and politics. Yet even if teams manage to gather knowledge successfully, the benefits of gathering that knowledge may be limited by such problems, especially if the teams lack the capabilities to handle these problems effectively.

Knowledge Gathering in Challenging Work Environments

The characterization of a challenging work environment as overloaded, ambiguous, and politicized draws on the three dominant paradigms of the strategic decision-making literature, which emphasize bounded rationality, garbage can processes, and politics and power (Eisenhardt and Zbaracki 1992). While not confined exclusively to knowledge-intensive work settings, the characteristics of overload, ambiguity, and politics are important in such contexts because they can create problems that reduce the benefits of knowledge gathering if project teams lack sufficient processing, sensemaking, and buffering capabilities.

The issue of overload is salient in many knowledge-intensive work settings because the complex nature of the work typically generates a multitude of possible problems to address and solutions with

which to address them (cf. Huber and Daft 1991). In overloaded work environments, bounded rationality prevails: team members with limited time and attention aim to arrive at satisfactory solutions rather than ones that are clearly superior to all others on every dimension (March and Simon 1958). As information becomes increasingly abundant, the pressures toward satisficing behavior grow more acute because the processing demands required to identify the most relevant and useful information increase as the wealth of available information increases (Simon 1997). Having first devoted time and attention to locating and accessing appropriate experts and document sources from whom to seek and transfer knowledge (Hansen 1999, Reagans and McEvily 2003), team members must then devote more time and attention to sorting through all the information, know-how, and feedback obtained to select the content that is most useful for the project (Huber 1991). The more knowledge the team members gather, the more time and attention these processing requirements demand, and sub-optimal satisficing behaviors are likely to increase accordingly. The time and attention available to be allocated to other task-related activities is reduced too, further threatening team performance. For example, team members will have less time to invest in maintaining network ties that might be needed in the future (Hansen 2002), developing mutual understanding of their fellow team members' potential task contributions (Cramton 2001), or fine-tuning reports for their clients (Starbuck 1992). The processing requirements incurred as teams gather more knowledge thus can increase opportunity costs as well as satisficing behavior in overloaded environments.

The issue of ambiguity arises in knowledge-intensive work settings because projects in these environments typically are non-routine (Cohen and Bailey 1997), resulting in considerable uncertainty about which of the many possible solutions to a problem is best, or even which of the many problems to prioritize and address in a given project (Alvesson 2004). The rapid pace of change in many knowledge-intensive industries further exaggerates this ambiguity (Eisenhardt and Bourgeois 1988). Facing many interpretations of the information, know-how, and feedback they gather, team members must engage in a continuous process of sensemaking to construct meaning out of these inputs (Weick 2001). The sensemaking attempts of different team members often are inconsistent or conflicting; some may be

incomplete, and others inappropriate. The sensemaking demands facing the team increase, moreover, as the team members solicit and receive more knowledge from sources outside the team.

Beyond the problems created by overload and ambiguity, the issue of politics also arises when multiple stakeholders have an interest in the selection of problems to address and solutions with which to address them (cf. Cyert and March 1963). In knowledge-intensive work settings, there are often many competing views about what qualifies as useful knowledge and how that knowledge should be used (cf. Pettigrew 1973, Blackler 1995). While many of those who provide information, know-how, and feedback to a team do not attempt to influence the team unduly, others may promote their own agendas and interests through distortion or manipulation of the knowledge provided, or by demanding allegiance in return for their inputs (Pettigrew 1973, O'Reilly 1978, Feldman 1988). Teams that cannot buffer themselves against efforts to excessively influence their decisions can be derailed by these external agendas and interests. For example, team members who prioritize the interests of outsiders may resist compromises that could serve the project well, creating dysfunctional conflicts within the team (Jehn 1995). Alternatively, their colleagues may avoid challenging them directly, inhibiting reflective discussion and learning (Edmondson 2002). Some teams eventually may be coopted by powerful outsiders determined to advance their own interests (Selznick 1949). Managing political issues that arise during knowledge gathering also simply consumes valuable time and energy, leaving team members with less attention to allocate to other aspects of the task (Eisenhardt and Bourgeois 1988). The more knowledge teams gather in politicized work environments, the greater their vulnerability to such problems of excessive external influence.

Capability-Enhancing Team Conditions

While knowledge gathering can cause problems for teams that work in overloaded, ambiguous, and politicized environments, it also offers potentially valuable benefits. Conditions that enhance processing, sensemaking, and buffering capabilities can help teams to attain these benefits while avoiding or overcoming the problems of knowledge gathering. The hypotheses that follow focus on three such capability-enhancing conditions: slack time, work experience, and decision-making autonomy.

Slack Time. The concept of "slack" refers to a cushion of resources beyond those required for regular activities (Cyert and March 1962, Bourgeois 1981). Slack time, defined as the amount of time and attention the team members can potentially commit to the project beyond the minimum required, is a specific form of slack that can affect performance as well as satisfaction in organizations. For example, Perlow (1999) found that "time famine", a feeling of having too much to do and not enough time to do it, affected how software engineers used their time at work and reduced their productivity. Also, interventions that increase or decrease slack time can influence the performance of knowledge-intensive work. Even simple time management interventions in an experimental setting, for example, affected how well groups were able to integrate knowledge (Okhuysen and Eisenhardt 2002). For project teams, slack time increases processing capability because team members have more time and attention available to allocate to knowledge-related as well as other task activities. Sub-optimal satisficing behaviors and opportunity costs incurred as a result of knowledge processing demands will be reduced accordingly. In contrast, teams whose members have very little slack time face greater risks of problematic satisficing behaviors. For example, they may download large quantities of documents from a database without checking their quality, skim the papers on their desk superficially and miss important information as a result, or fail to solicit sufficiently diverse views by only consulting close colleagues who will return their phone calls promptly. The opportunity costs of knowledge processing also are greater when team members have less slack time, since the same level of processing cuts more deeply into the smaller total amount of time and attention available for the task. Furthermore, low levels of slack time can inhibit team sensemaking and buffering capabilities as well as processing capabilities, by limiting the time and attention available for interpreting knowledge and navigating the agendas and interests of knowledge providers successfully. Therefore:

Hypothesis 1 (H1): More knowledge gathering will be more positively associated with project performance when the team members have more slack time.

Work Experience. Prior experience creates absorptive capacity that facilitates the assimilation, interpretation, and application of new knowledge (Cohen and Levinthal 1990, Szulanski 1996). Prior experience also generates tacit knowledge that cannot be readily articulated but enhances a team member's ability to interpret external knowledge appropriately and apply it effectively (Von Hippel 1988). Furthermore, prior experience moves team members up their own learning curves, helping them to build on past successes and avoid past mistakes when interpreting and applying external knowledge rather than repeating those mistakes (Argote 1999). Teams whose members have more years of work experience thus have greater sensemaking capability. In particular, experience gained through years spent in the focal organization can be helpful for resolving ambiguities arising during knowledge gathering in ways that are not only technically optimal but also recognize the demands and limitations of the organization's systems, priorities, and stakeholders. Team members with longer organizational tenure can make better judgments about how to interpret and apply external knowledge, compared to team members who are relatively new to the organization, because they have a more firmly grounded understanding of what has or has not worked in this organization in the past and why. In addition to experience in the focal organization, experience gained through years spent working in other organizations can be helpful too, since any prior work experience may help team members to more effectively interpret and apply external knowledge. Work experience also may increase processing and buffering capabilities as well as sensemaking capabilities, if these years of experience make the team members more efficient at processing external knowledge or less likely to be swayed by the agendas and interests of knowledge providers. Therefore:

Hypothesis 2 (H2): More knowledge gathering will be more positively associated with project performance when the team members have more work experience in (a) the focal organization, and (b) other organizations.

Decision-Making Autonomy. The buffering capability of a team is greater if it has more autonomy, defined as the group's level of collective control over critical decisions about its objectives, resources, design, and processes, relative to others inside or outside the organization (Hackman 1987, Langfred 2000).[i] Autonomy enables team members to resist the agendas and interests of knowledge

providers whose influence might harm the project because the team can more actively rebuff influence attempts by refusing to give in to external demands when making critical task-related decisions. Outsiders also hesitate more before trying to influence the members of more autonomous teams because they realize that their attempts are less likely to succeed, or because they interpret greater autonomy as a signal that a team is more capable, making external interference in the name of improving project outcomes less justifiable (Langfred 2000). Autonomy also motivates team members to make decisions that are in the best interests of the project when these decisions conflict with the agendas and interests of external knowledge providers because greater decision-making autonomy aligns the team members' individual interests more closely with those of the project, by offering them a greater sense of control (Lawler 1992), the opportunity to contribute to a group that seems to be more highly regarded by others (Ashforth and Mael 1990) and the prospect of a successful project outcome that could help their careers (Langfred 2000). Finally, the buffering advantages of autonomy also can enhance the processing and sensemaking capabilities of project teams by freeing the team members to focus more energy on these activities. Therefore:

Hypothesis 3 (H3): More knowledge gathering will be more positively associated with project performance when the team has more decision-making autonomy.

METHODS

I tested the hypotheses in a multi-method field study conducted at a leading international development agency whose mission is to promote economic development and alleviate poverty around the world. The teams studied worked on financial assistance projects, which took the form of major development programs for client governments backed by multi-million dollar implementation loans, and technical assistance projects, which provided detailed analysis and advice for client governments on specific development issues. Typical examples included a slum upgrading project in Latin America, a social security reform project in Africa, and an infrastructure investment project in South-East Asia.

Research Setting

Prior to the quantitative phase of the study, I conducted 70 interviews with managers, staff, and team leaders and members at the organization's U.S. headquarters and at its country office in Moscow, and case studies of seven teams that involved observing meetings and reading project materials as well as interviewing past and present team members. I reviewed my notes to identify and code themes pertaining to knowledge gathering, the work environment, and the teams. These qualitative data indicated that the organization exhibited the typical characteristics of a project-driven knowledge-intensive work setting, and also that the environment was characterized by high levels of overload, ambiguity, and politics.

The organization staffed its interdisciplinary teams with experts who included economists, engineers, technical specialists, social scientists, and others with diverse functional backgrounds. Team leaders, who were hands-on members of the group rather than external managers, assembled their teams according to the needs of the project and the availability of experts with the skills to meet those needs. Teams included core members who were substantially involved in the project as well as more peripheral members who were sometimes external consultants. Team members worked with different teams on several projects simultaneously and rarely stayed together for more than one project.

Although the team members were highly regarded experts who often held postgraduate degrees, the complexity of the projects meant that they could not rely solely on what they already knew; instead, they had to supplement their expertise by gathering knowledge from sources outside the team. To facilitate this, the organization had undertaken an ambitious knowledge management strategy, investing in the development of intranet and internet sites for capturing, storing, and sharing knowledge about specialized topics and establishing communities of practice, helpdesks, expert directories, and discussion forums. These efforts had received public acclaim, including awards from independent business groups who placed the organization amongst the leading for-profit companies as one of the world's foremost innovators in knowledge management. However, the innovations did not always translate into improved performance for project teams. My qualitative research suggested that the reasons for this stemmed from the overloaded, ambiguous, and politicized nature of the work environment.

The problem of overload was captured in the common complaint succinctly voiced by one team member: “I just don’t have enough time to do everything I need to do”. This sense of overload limited the time and attention that team members felt able to allocate to taking advantage of the knowledge available to them. A central cause of the pervasive sense of overload was that the work itself was highly demanding because it involved so many complex and difficult issues and possible ways to address them. These demands were amplified because the team members worked on several projects simultaneously, creating a sense of over-commitment, conflicting demands, and continuous scrambling just to keep up. Many experienced employees also had left the organization due to recent downsizing, increasing the demands on those who remained. Finally, the team members complained about heavy administrative burdens, which they attributed in part to cost containment efforts that had resulted in cut-backs in support staff, and in part to the mounds of paperwork that were required to ensure compliance with policies that the organization had introduced in recent years to increase accountability to its stakeholders. As one team member sighed: “I call it bureaucracy overload – it’s a natural feature of such a huge bureaucracy.”

The problem of ambiguity in the organization arose from the complex nature of its mission. The best ways to structure national welfare systems, promote industrial growth, or prevent the spread of infectious diseases are issues that pose some of the greatest challenges for contemporary society. Consequently, the information, know-how, and feedback available to the project teams often were ambiguous and open to multiple interpretations. As one team member noted: “There are no right answers in this business.” For example, statistical data on wages or employment could be viewed in a positive or a negative light, reports commissioned from experts could suggest different messages to different readers, and advice from colleagues could be understood and applied in diverse ways. Functional expertise was not enough to ensure that external knowledge was interpreted and applied appropriately for a project, because the team members also had to take into account the organization’s specific goals, approach, technical requirements, and capacity limitations, as well as the history of past programs. Accordingly, they often looked to those with more extensive prior work experience for guidance.

The problems of overload and ambiguity were compounded by the politicized nature of knowledge in the international development domain. International development is an intensely controversial field where the best approaches are hotly debated, in part because so much ambiguity surrounds the question of appropriate solutions to such thorny problems, but also because actors in this field often have deeply held convictions about which approaches they consider superior, based on ideology, professional identity, or direct experience. Clashes among team members often echoed virulent debates in the organization and the wider international development community, focusing on such controversial issues as the appropriate balance between economic growth and environmental impact, or whether the organization was stretching its mission too far by addressing issues such as culture or corruption. These differences were played out primarily through competition over ideas, creating a context that encouraged influence attempts by knowledge providers.

Quantitative Data Collection

The initial phase of the field study indicated that this knowledge-intensive setting was a challenging work environment characterized by high overload, considerable ambiguity, and pervasive politics. To test the hypotheses concerning the relationship between knowledge gathering and project performance in such an environment, I collected performance data from the organization's quality monitoring unit and data for constructing independent and control variables from surveys and archives.

Dependent Variable

Project quality. This study benefited from an intensive effort to establish state-of-the-art measures of the quality of international development projects. Three years prior to this study, the organization had launched a top-level initiative to monitor project quality at the point of delivery to the client. A quality monitoring unit of 20 full-time staff drew an annual random sample of financial projects (stratified by region and division) and technical projects (stratified by cost) from all those completed in the past year, and assembled customized panels of experts to evaluate them. Each panel was composed of two or more respected experts who had no prior connections to the project. The expert panelists reviewed the project documents, interviewed the team leader, and evaluated the project on multiple quality

dimensions using more than 100 detailed questions developed through extensive consultation within the organization and with external stakeholders.[ii] Based on these questions, the panel assigned an overall rating of 3 (highly satisfactory) to projects that represented best practice, 2 (satisfactory) to projects that met all client needs without major deficiencies, or 1 (marginal/unsatisfactory) to projects with major deficiencies (project quality).[iii] The quality monitoring unit ensured that the evaluation results were robust across panels by providing a detailed standardized template for the evaluations and providing support and oversight throughout the review process. Tests of the evaluation methodology in the years prior to this study had shown that different panels were highly likely to rate the same project similarly.[iv]

Independent Variables

To collect data on explanatory variables that could be matched with the dependent variable generated by the project quality ratings, I developed a survey that was pre-tested in face-to-face interviews with five individuals and completed in part or full by more than 40 others before it was finalized. When a team was randomly selected for evaluation by the quality monitoring unit, I sent the survey to all the members of that team. The respondents were directed to focus on the project that was undergoing evaluation, as identified on the front page of the survey. The survey was sent to 1021 team members who had worked on 120 projects (60 financial teams and 60 technical teams). As levels of involvement in a project varied, I asked the team leaders to identify those who were core versus non-core members in their teams and sent surveys that identified their respondents accordingly. The qualifying standard for inclusion in the study was that teams had to return at least 50% of their core team members' surveys (Hackman 2002). Responses were received from 550 team members, giving an individual response rate of 54%, and 96 teams qualified for the study (50 financial and 46 technical teams), giving a team qualifying rate of 80%. Data from the 485 members of the 96 qualifying teams were used to construct the team-level measures below; both core and non-core member responses were used because the contributions and views of each were important to project quality (Hackman 2002).

Knowledge gathering. The survey asked about the team members' levels of knowledge gathering from sources outside the team, as follows: "During the course of the project, how much relevant

technical knowledge did you gather from (a) the country office? (b) the rest of the organization? (c) the client country? (d) the global community?", where technical knowledge was defined as "knowledge about the technical aspects of the work – the professional skills, competencies, and expertise relevant to the project." The team members were then asked the same set of four questions about *country* knowledge, which was defined as "knowledge about the local environment – the country-specific conditions relevant to the project", as before using five-point scales that ranged from 1 (very little knowledge) to 5 (a lot of knowledge). The four sources of external knowledge were identified as those that were most meaningful to team members at this organization during the preliminary qualitative research. Alternative ways of categorizing external knowledge sources such as communities of practice or document versus personal sources were much less commonly referenced in the interviews. The responses to all eight questions were averaged across all the members of each team to create an aggregate measure of the amount of external knowledge gathered with a Cronbach's alpha of 0.85 (knowledge gathering).

Slack time. The team members were asked two questions about their levels of slack time during the period of the project: "How much extra time outside your normal work week did you spend working during the course of this project (on the project or on other tasks)?", on a scale from 1 (fewer extra hours than usual) to 5 (more extra hours than usual), and "How overloaded did you feel that you were during the course of this project (due to the project or to other tasks)?", on a scale from 1 (not at all; the work pressure was reasonable) to 5 (excessively; the work pressure was much higher than usual). The answers were combined and reverse coded to generate an individual-level measure with a Cronbach's alpha of 0.82, which was then weighted by the proportion of their work time devoted to the project and averaged across the team members (slack time).[v]

Work experience. The team members were asked how many years they had been employed at the organization at the time the project began, and their answers were averaged within each team (organizational experience). They were also asked how many years they had been employed in development or other work altogether, and these answers were averaged within each team after subtracting the years at the organization (non-organizational experience).

Decision-making autonomy. The team members were asked to report on the extent of the team's influence over a list of 20 decisions generated through the field interviews. Following Hackman (1987), I identified five critical decisions in each of four categories: decisions about project objectives, resources, design and processes.[vi] The team members were asked: "How was influence over the decisions in your project distributed between the team itself (including the team leader) and others outside the team (including [organization] managers, the client country, and the development community)?" on a scale ranging from 1 (team had very little influence; others had almost all the influence) to 5 (team had almost all the influence; others had very little influence). The responses of the team members were averaged across each category to create four autonomy sub-constructs corresponding to influence over decisions related to objectives, resources, design, and processes (Cronbach's alphas of 0.84, 0.74, 0.73, and 0.81), and then across all 20 decisions to create an overall autonomy measure with a Cronbach's alpha of 0.90 (decision-making autonomy).

Control Variables

Previous research suggests that team size, task type, project cost and duration, prior team knowledge, and team interdependence and boundedness can influence team performance (Kozlowski and Bell 2004), and these factors also could be correlated with the independent variables of interest. Project records were used to determine the number of team members (team size), whether the project was a financial or technical task, coded 1 or 0 respectively, (project type), and its cost in dollars and duration in days, which were logged (project cost, project duration). The team members were asked to report on their own technical and country knowledge prior to the project using two five-point scales ranging from 1 "very little prior knowledge" to 5 "a lot of prior knowledge", and their responses were averaged within teams (team knowledge). Using items developed by Hackman (2002), interdependence was measured on a scale ranging from 1 "each member had his or her own individual job to do, there was no real need for coordination" to 5 "this team produced a real group product, that required a great deal of coordination" (team interdependence), and boundedness was measured on a scale ranging from 1 "it was not at all clear who was a member of this team" to 5 "team membership was clear" (team boundedness). The qualitative

field research also highlighted several additional factors that could matter for teams in this specific organization. To capture these, a binary variable was coded 1 if the project was situated in one particularly high-performing geographic region, or 0 otherwise (project region); another was coded 1 if the project was situated in one unusually poorly performing operational division, or 0 otherwise (project division); the number of days committed to the project per team member was calculated and converted to years (team member involvement); and teams based at the U.S. headquarters were coded 1 while those based in the client country were coded 0 (team location).

Preliminary Analyses

Preliminary analyses of the data established that averaging individual levels of knowledge gathering within teams did not disguise substantial differences in knowledge gathering by different team members, as the variation in the individual levels of knowledge gathering within teams was low (individual-level mean = 3.01, standard deviation = 0.78). Intra-class correlations (ICCs) for the three measures that were based on questions about the team as a whole were all significant, justifying the aggregation of the team members' individual responses to the group level (decision-making autonomy ICC1=0.05, $p<0.10$; team interdependence ICC1=0.19, $p<0.01$; team boundedness ICC1=0.07, $p<0.05$; Kenny and LaVoie 1985). Within-group agreement was also high for the autonomy measure and acceptable for the interdependence and boundedness measures (r_{wg}=0.85, r_{wg}=0.55, r_{wg} =0.56 respectively; James et al. 1984). Tests for response bias conducted at the group level (n=96) revealed no association between survey response rates and the variables in the study, with the exception of project division ($r=0.23$, $p<0.05$) and team location ($r=-0.29$, $p<0.01$). Teams with a higher percentage of survey responses thus were more likely to belong to the high-performing division and less likely to be based at headquarters. Comparing the 96 teams included in the study to the 24 teams excluded due to insufficient responses showed that qualifying teams worked on more costly and lengthier projects, but revealed no significant differences in the quality ratings or project type, region or division. Finally, tests for attribution bias conducted by comparing responses from 19 teams whose members all returned their surveys before their quality ratings were announced to those from 37 teams whose members all returned

their surveys after their ratings were announced revealed no differences on any of the variables vulnerable to attribution bias.

Statistical Approach

An ordinal logit model specification was used to test the hypotheses because the dependent variable was categorical, ordered, and had more than two possible outcomes (Long 1997). Under this specification, an underlying score is estimated as a linear function of the independent variables and a set of cut points. The probability of observing outcome *I* corresponds to the probability that the estimated linear function, plus random error, is within the range of the cut points estimated by the outcome:

$$\text{P(outcome}_j = i) = \text{P}\ (\kappa_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2j} + ... + \beta_k x_{kj} + u_j \leq \kappa_I)$$

where u_j is assumed to be logistically distributed. Using maximum likelihood, the coefficients β_1, β_2, …, β_k are estimated along with the cut points $\kappa_1, \kappa_2, ..., \kappa_{I-1}$, where *I* is the number of possible outcomes, κ_o is taken as $-\infty$, and κ_I is taken as $+\infty$.[vii]

RESULTS

--- Insert Table 2 and Table 3 about here ---

Descriptive statistics and correlations are reported in Table 2. Table 3 presents the results of the ordinal logit analyses. Model 1 in Table 3 shows that the main effect of external knowledge gathering is not significant. This finding is consistent with the initial observation that motivated this study – that the effects of knowledge gathering are not necessarily always positive. Model 1 also shows that there is a positive effect of team size on project quality, and this effect is significant across all the models, consistent with recent research on project teams in other knowledge-intensive work settings (e.g., Cummings 2004).[viii] For parsimony, the other control variables in the models are not reported in the table: they indicated a pattern of positive but usually non-significant effects for prior team knowledge, team member involvement, team interdependence, team boundedness, and project division, and a pattern of negative but usually non-significant effects for team location and project cost, duration, type, and region. The pattern of results reported below is substantively unchanged if more limited subsets of these control variables are

included, and also unchanged if additional control variables are included for the proportions of the survey respondents who were core team members, external consultants, or returned their surveys late.

The hypotheses concerning the moderating effects of slack time, work experience, and decision-making autonomy are tested in Models 2-10. Model 2 indicates a non-significant main effect of slack time, but the results for Hypothesis 1, shown in Model 3, reveal a marginally significant positive interaction between knowledge gathering and slack time. The predicted effect of knowledge gathering (KG) on the probability of receiving a quality rating of 3 at high versus low levels of slack time (ST) is calculated as follows, using the estimates from Model 3 and holding the other variables constant at their means:

$$P\{Rating=3\} = 1 - 1/(1 + \exp[(-0.04*KG + 0.03*ST + 0.44*KG*ST) - (0.78)])$$

The predicted effect on the probability of receiving a quality rating of 1 is calculated as follows:

$$P\{Rating=1\} = 1/(1 + \exp[(-0.04*KG + 0.03*ST + 0.44*KG*ST) - (-3.27)])$$

In Figure 1(a), these predicted probabilities are plotted by comparing teams with high levels of slack time (one standard deviation above the mean) and teams with low levels of slack time (one standard deviation below the mean), at levels of knowledge gathering ranging from low (two standard deviations below the mean) to high (two standard deviations above the mean). The plots show that a team whose members gathered high levels of knowledge had a substantially higher probability of achieving a highly satisfactory quality rating of 3 if the team members had high levels of slack time than if they had low levels of slack time, as well as a lower probability of achieving a marginal or unsatisfactory quality rating of 1. Put differently, these plots suggest that gathering more knowledge helped a team's chances of delivering a high quality project if the team members had high levels of slack time, but hurt those chances if the team members had low levels of slack time. These findings support Hypothesis 1.

----- Insert Figure 1 about here -----

To address Hypothesis 2, Models 4 and 5 examine the effects of having team members with more years of work experience inside the organization, while Models 6 and 7 examine the effects of having team members with more years of work experience in other organizations. Model 4 shows a marginally

significant positive main effect for organizational work experience, while Model 5 shows that organizational work experience positively and significantly moderates the relationship between knowledge gathering and project quality, as predicted in Hypothesis 2a. Plotting this result in Figure 1(b) illustrates that more knowledge gathering increased the chances of receiving a highly satisfactory project quality rating more if the team members had high levels of organizational experience than if they had low levels of organizational experience. The results for non-organizational work experience, however, are unexpected. While non-organizational work experience has no significant main effect in Model 6, Model 7 indicates that the association between knowledge gathering and project quality is negative for teams with more years of non-organizational work experience, rather than positive as predicted in Hypothesis 2b. To further explore this unexpected finding, non-organizational experience in development work and other work were examined separately in additional analyses. These models (not shown) revealed that the negative interaction effect for non-organizational experience was driven by the development work component, while the other work component was not significant. Additionally, although the interaction effect for the development work component was significantly negative for teams with levels of organizational experience below the median, it was significantly positive for teams with levels of organizational experience above the median. Teams that were low in organizational experience thus were hurt by having more non-organizational experience in development work, but teams that were high in organizational experience were helped by having more non-organizational experience in development work. Hence, the support for Hypothesis 2b is mixed.[ix]

The main effect of decision-making autonomy in Model 8 is not significant, but the results for Hypothesis 3, shown in Model 9, indicate that the interaction between decision-making autonomy and knowledge gathering is positive and significant. In additional models (not shown), the moderating effects of autonomy over objectives, resources, design, and processes were considered separately, and these interactions were all found to be positive and significant. The interaction plot in Figure 1(c) illustrates that gathering more knowledge was more likely to result in the delivery of a high quality project if the team had high overall autonomy than if it had low autonomy. Moreover, it seems that teams with low levels of

autonomy could actually reduce the quality of their projects by gathering more knowledge. Hypothesis 3 thus is supported.

Finally, Model 10 shows the full model in which the moderating effects of the slack time, work experience, and decision-making autonomy conditions are presented together. All the findings hold in this model, controlling for the effects of the other conditions as well as the team and project characteristics.

DISCUSSION

This study found that the benefits of knowledge gathering in challenging work environments depend on whether teams work under conditions that enhance or limit their capabilities to utilize this knowledge successfully. In a knowledge-intensive setting characterized by overload, ambiguity, and politics, project teams benefited more from external knowledge gathering if they had more slack time, organizational experience, and decision-making autonomy. Teams lacking these capability-enhancing conditions could actually harm their performance by gathering more knowledge. Unexpectedly, non-organizational experience in related work complemented organizational experience but caused problems for teams that lacked organizational experience, possibly because related experience in other organizations was less appropriate for the new organizational context than the team members realized.

Taken together, the findings of the study support the claim that conditions that enhance team processing, sensemaking, and buffering capabilities are important if knowledge gathering is to help rather than hurt performance. This insight highlights the need for scholars who study knowledge and learning in organizations as well as practitioners engaged in knowledge management to recognize that the value of knowledge gathering can be reduced by the situationally embedded, socially constructed, and highly contested nature of knowledge in many organizations (cf. Blackler 1995, Orlikowski 2002, Tyre and Von Hippel 1997), as well as by the more widely recognized difficulties of knowledge search and transfer. The capabilities required to benefit from knowledge gathering in challenging work environments thus render the potential value of knowledge gathering even harder to capture than is often assumed.

The concept of team capabilities serves to focus attention on the critical tasks involved in utilizing external knowledge and on the conditions that enable teams to carry out these tasks more successfully. A central advantage of conceptualizing capabilities at the team level of analysis is that team capabilities can be connected more closely to specific task demands than broader organizational capabilities. By emphasizing the daily work of the organization, the concept of team capabilities thus calls attention to the micro-structures that underpin broader strategic organizational capabilities (cf. Spender and Grant 1996). In addition to offering a micro-foundation for the organizational capabilities literature, a team-level conceptualization of capabilities also contributes to the work group literature, by offering insight into the conditions that enable teams to manage their interactions with their environments more effectively. Work group research that takes an external perspective on teams views interactions with the environment as essential for effective team functioning (Ancona 1993), but a team capabilities perspective recognizes that such interactions also create problems that teams must address successfully to perform well. In particular, knowledge gathering can be helpful, but it can also be harmful if teams lack processing, sensemaking, or buffering capabilities. Capability-enhancing conditions such as slack time, organizational experience, and decision-making autonomy allow teams to capture the benefits while reducing the downsides of their external interactions.

The findings of this study further suggest that while much recent research emphasizes the role of informal exchanges of knowledge, it is important to recognize that all such informal exchanges take place in the context of formal organizational structures that may constrain or enhance their effectiveness, and that these formal structures extend well beyond those usually associated with knowledge management. In particular, the conditions identified in this study each are shaped by dimensions of formal organizational design: levels of slack time are determined primarily by the bureaucratic structures of an organization, including the division of labor, spans of control, project assignment norms, and support staff ratios; levels of work experience in a team are shaped by the organization's career and recruiting systems, including choices about who is hired, how people are developed over time, and how projects are staffed; and levels of decision-making autonomy reflect the formal distribution of power inside the organization and between

the organization and its external stakeholders, as well as the informal weight assigned to formal attributes like job titles. Other aspects of formal structure not examined in this study may constrain or facilitate the effectiveness of informal knowledge exchanges too, such as the extent to which the organization rewards innovation or paces projects through high-pressure deadlines. Tracing variance in knowledge gathering outcomes to foundations in the formal structures of organizational design thus offers a rich perspective from which to approach questions about the effectiveness of knowledge exchanges in organizations.

A limitation of this research is the issue of generalizability from a single-organization study. The international development agency studied here provided an excellent setting in which to study the effects of knowledge gathering in an environment characterized by overload, ambiguity, and politics because this organization represents the ideal type of such a challenging work environment, but the research findings may not hold in all organizations. It seems reasonable to expect that overload, ambiguity, and politics are encountered in many other knowledge-intensive settings, however, given the nature of the work, and even in some organizations that are more labor-intensive or capital-intensive. To the extent that such characteristics prevail, the capability-enhancing conditions identified in this study are likely to be helpful for teams engaged in knowledge gathering.

Another limitation of the study is that the possible crossover effects of the three capability-enhancing conditions examined here cannot be empirically separated with the available data. For example, organizational experience may increase processing and buffering capabilities as well as sensemaking capabilities. Subsequent research could examine knowledge processing, sensemaking, and buffering activities directly, to isolate the effects of these different theoretical mechanisms. Future studies also might connect the problems of search and transfer to those of knowledge utilization by considering whether processing, sensemaking, and buffering needs are heightened or mitigated when knowledge is sought and transferred through different media, such as electronic databases or personal networks, or when the knowledge itself varies in complexity, novelty, or tacitness. Additionally, project teams often face challenges beyond those examined in this study, such the need to acquire and apply knowledge

across international boundaries, and these further challenges may require other capability-enhancing conditions (e.g., Haas 2006).

Finally, the practical implications of this study's findings should be interpreted with care. While greater slack time, more organizational work experience, and higher decision-making autonomy had positive moderating effects in this study, the findings should not be taken as suggesting an unmitigated endorsement of these conditions for all project teams. For example, the illustrative plots suggest that teams that gathered very little knowledge were more likely to deliver low quality projects if they had high autonomy than if they had low autonomy, probably because they were making important task-related decisions on the basis of insufficient external information. Slack time, work experience, and decision-making autonomy also may have negative implications in areas other than knowledge gathering, for the teams themselves or for organizations as a whole. At some point, for example, slack time becomes an inefficient use of valuable human resources, employees with more organizational work experience are more costly to retain, and autonomy creates risks of maverick decision-making.

In conclusion, this study suggests that project teams operating in overloaded, ambiguous, and politicized work environments face challenging issues when they obtain and use knowledge from sources outside the team. Paradoxically, knowledge gathering efforts that should help such teams to perform more effectively can hurt instead. Whether knowledge gathering ultimately is beneficial may depend less on the knowledge management architecture of the organization than on the capabilities of teams to use the knowledge available to them to improve their performance.

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Figure 1. Moderating Effects of Capability-Enhancing Conditions on the Relationship between Knowledge Gathering and Project Quality

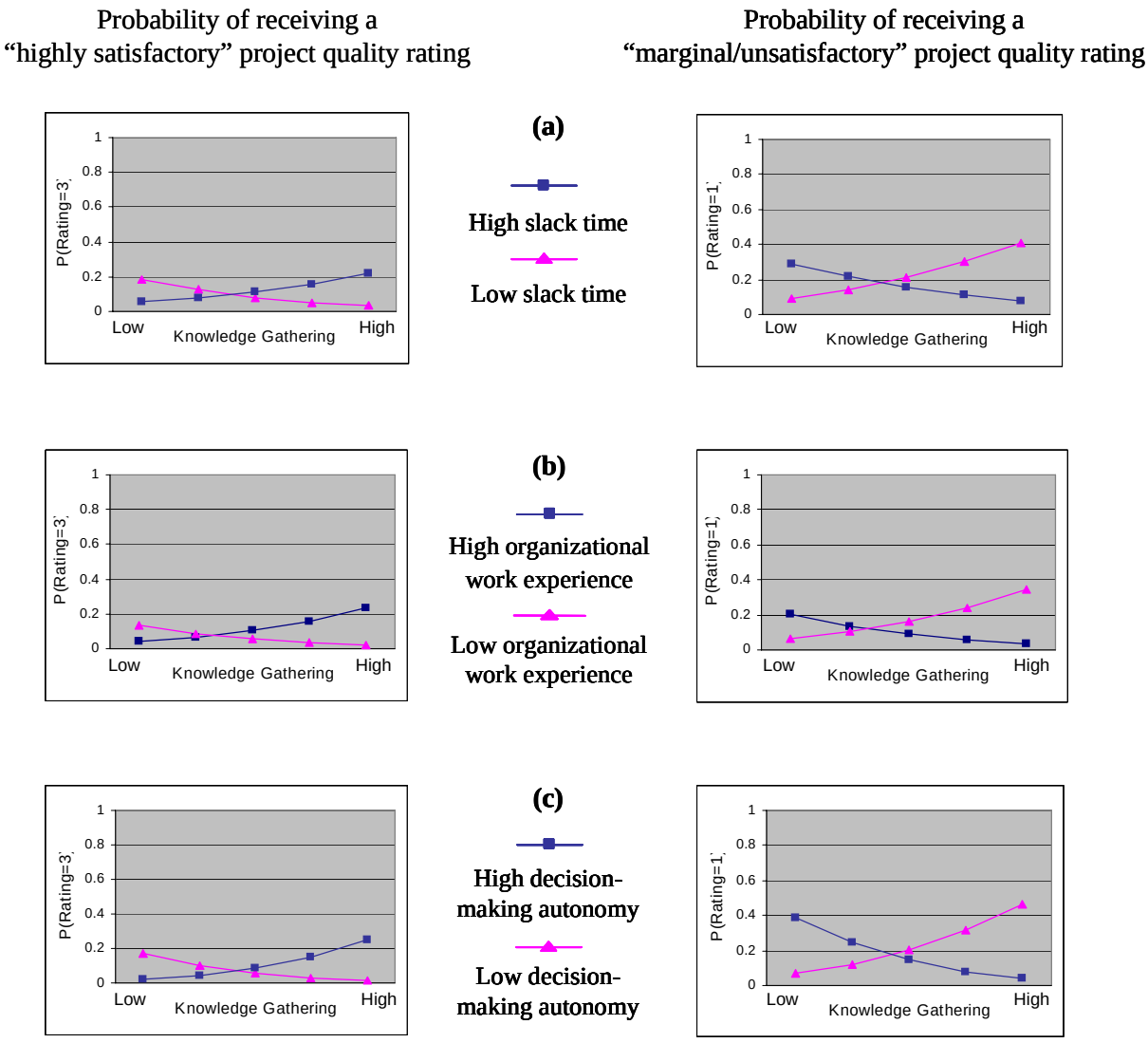

Table 1. Descriptive Statistics and Bivariate Correlations (n = 96)

Variable	Mean	S.D.	Min.	Max.	1	2	3	4	5	6
1. Project quality (dep. var)	2.02	0.54	1.00	3.00						
2. Team size	8.48	4.15	2.00	23.0	.14					
3. Team knowledge	3.62	0.54	2.00	4.60	.07	-.04				
4. Team member involvement	0.42	0.28	0.05	2.24	.09	.13	.03			
5. Team interdependence	3.48	0.67	1.33	5.00	.17	-.08	.03	.11		
6. Team boundedness	4.16	0.58	2.67	5.00	.07	-.33	.10	.10	.61	
7. Team location	0.80	0.40	0.00	1.00	-.03	.21	-.14	.09	.25	.08
8. Project cost	5.42	0.92	3.00	7.62	-.01	.45	.06	.32	-.08	-.18
9. Project duration	5.61	0.75	3.76	7.27	-.10	.00	.03	.22	-.08	-.10
10. Project type	0.52	0.50	0.00	1.00	.08	.28	-.09	.09	.30	.01
11. Project division	0.20	0.40	0.00	1.00	.13	-.14	.05	.16	.26	.15
12. Project region	0.21	0.41	0.00	1.00	-.07	.20	-.02	.32	-.06	-.04
13. Knowledge gathering	3.00	0.43	1.91	3.98	.10	.06	.19	.07	.22	.03
14. Slack time	3.95	0.64	1.19	4.87	-.07	-.03	-.09	-.34	-.06	-.24
15. Organizational experience	8.46	4.40	1.00	25.5	.09	-.13	.00	-.13	.00	-.15
16. Non-organizational experience	16.93	7.05	2.50	36.50	-.03	.20	.31	.11	.11	-.11
17. Decision-making autonomy	3.62	0.31	2.75	4.32	.15	.05	.11	.02	.15	.03

Variable	7	8	9	10	11	12	13	14	15	16
8. Project cost	.10									
9. Project duration	-.02	.21								
10. Project type	.31	.20	-.16							
11. Project division	.05	-.07	.17	.11						
12. Project region	.06	.16	.08	.03	.00					
13. Knowledge gathering	-.08	-.01	-.02	.00	.19	.18				
14. Slack time	-.09	-.19	.05	.25	.13	-.08	.15			
15. Organizational experience	.02	-.11	-.14	.12	-.12	-.02	-.02	.06		
16. Non-organizational experience	.13	.32	-.03	.35	.07	-.12	.05	.31	-.05	
17. Decision-making autonomy	-.04	.02	.03	.04	.17	-.05	.15	.14	.05	.14

Note: $r > 0.17$, $p < 0.10$; $r > 0.20$, $p < 0.05$; $r > 0.30$, $p < 0.01$

Table 2. Results of Ordinal Logit Analysis of Project Quality (n = 96)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Team size	0.15•	0.15•	0.16•	0.21••	0.21••	0.17•	0.19••	0.15•	0.18•	0.28•••
	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.07)	(0.08)	(0.07)	(0.07)	(0.09)
Knowledge gathering	0.01	0.04	-0.04	0.09	-0.01	0.07	-0.11	0.01	0.02	-0.31
	(0.26)	(0.26)	(0.27)	(0.26)	(0.26)	(0.27)	(0.28)	(0.26)	(0.26)	(0.31)
Slack time		-0.24	0.03							0.55
		(0.28)	(0.33)							(0.45)
Organizational experience				0.47†	0.34					0.43
				(0.26)	(0.27)					(0.34)
Non-organizational experience						-0.38	-0.51			-0.42
						(0.31)	(0.31)			(0.38)
Decision-making autonomy								0.23	0.20	0.19
								(0.24)	(0.24)	(0.29)
Knowledge gathering * Slack time			0.44†							0.98••
			(0.26)							(0.40)
Knowledge gathering * Organizational experience					0.49•					0.67•
					(0.23)					(0.34)
Knowledge gathering * Non-organizational experience							-0.60•			-0.87•
							(0.30)			(0.38)
Knowledge gathering * Decision-making autonomy									0.64•	0.78•
									(0.27)	(0.35)
Cut 1	-1.99	-2.49	-3.27	0.33	2.65	-0.16	0.96	-2.14	-1.02	-1.04
	(3.43)	(3.48)	(3.44)	(3.49)	(3.70)	(3.55)	(3.54)	(3.37)	(3.34)	(4.44)
Cut 2	1.94	1.47	0.78	4.61	7.13	4.03	5.34	1.83	3.16	4.24
	(3.42)	(3.46)	(3.41)	(3.53)	(3.82)	(3.57)	(3.60)	(3.36)	(3.38)	(4.23)
Degrees of freedom	12	13	14	13	14	13	14	13	14	20
Log likelihood	-70.50	-70.13	-68.66	-65.26	-62.73	-65.70	-63.56	-70.06	-67.20	-53.32
Log likelihood χ^2 ratio test	13.58••	14.32••	17.26••	24.06••	29.12••	23.18••	27.46••	14.46••	20.18••	47.94••
Pseudo R^2	0.08	0.08	0.10	0.12	0.16	0.11	0.14	0.09	0.12	0.28

Notes. †p < .10, •p < .05, ••p < .01. Standard errors are in parentheses below coefficients. The degrees of freedom reflect the non-significant control variables not reported here. The log likelihood ratio test is based on comparison to a model with cut points only, LL=-77.29. Independent variables were standardized before computing interactions.

[i] Such collective decision-making autonomy neither precludes nor necessarily implies individual autonomy within the team (Langfred 2000).

[ii] For financial projects, these dimensions included the quality of the project concept, technical, environmental, stakeholder, financial, institutional, and risk analyses, and readiness for implementation; for technical projects they included the strategic relevance and timeliness, internal quality, presentation, and likely impact of the project.

[iii] Of the 96 projects in the dataset, 16% received a rating of 3, 70% received a rating of 2, and 14% received a rating of 1. A continuous project quality rating constructed by summing each project's scores on its underlying quality dimensions correlated highly with this ordinal rating (r=0.86), and generated the same pattern of results.

[iv] The focus of these quality ratings on project outputs rather than eventual project impact made them appropriate for this study as such outputs were more closely related to team efforts. The quality monitoring unit had also established some preliminary evidence of a link to eventual impact, especially for projects rated marginal or unsatisfactory.

[v] Using an unweighted measure instead does not substantively change the results.

[vi] Decisions about project objectives concerned the initiation, overall priority, boundaries and scope, specific components, and level of innovation of the project. Decisions about project resources concerned budget size, additional funding, level of information and advice, team training or coaching, and team rewards or recognition. Decisions about project design concerned the duration of the project's phases, solicitation of feedback, quality standards, staffing requirements, and selection of team members. Decisions about project processes concerned setting up and managing missions, levels of interaction with clients and senior management, and handling conflict during the project.

[vii] Because calculation and interpretation of interaction effects in nonlinear regression models can be problematic (Ai and Norton 2003), I also generated the marginal effects for the interaction terms and ran the models using an ordinary least squares specification instead. These two alternative approaches both generated the same pattern of results.

[viii] There was no evidence for a curvilinear effect of team size.

[ix] The coefficients of variation in the organizational and non-organizational experience of each team's members were also interacted with the knowledge gathering measure, but neither interaction was significant.