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MANAGING EXPERTISE IN A DISTRIBUTED ENVIRONMENT

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Abstract

Expertise is the primary resource and product of professional service and technical firms. These firms often organize around project teams that advise and work under contract for clients. A key problem for management is to deploy expertise in project teams so as to meet the expertise requirements of projects and clients. Because expertise may be geographically distributed across multiple sites, many of these firms create virtual or distributed teams. Doing so gives these firms access to a larger pool of knowledge resources than would be available at one site and helps leverage expertise across the organization. However, geographically distributed collaboration in teams incurs coordination and other costs that local work does not. Is a distributed team worth these costs? We studied a professional service firm with distributed and collocated project teams. In this firm, domain expertise tended to be concentrated within geographic sites, whereas methodological expertise was distributed across the firm. We examined whether a better match of domain and methodological expertise to the needs of projects resulted in more profitable projects, and whether distributed teams matched these two types of expertise to the requirements of projects as well as or better than did collocated teams. We found that most projects were collocated, with members drawn from one site who had domain expertise that matched project requirements as well as when members were drawn from other sites. The profits of projects were unrelated to the match of domain expertise with project requirements. However, project profits were significantly and positively related to a match of methodological expertise with project requirements. Furthermore, distributed projects showed a stronger match of methodological expertise with project requirements than did collocated projects, and predicted disproportionately more profits. We conclude that an appropriate utilization of organizationally distributed expertise has a positive impact on project performance.

1 INTRODUCTION

With the transformation of the industrial organization into an information-based organization (Drucker 1988), firms are increasingly viewing knowledge as an important resource (Kogut and Zander 1992). Proponents of the resource-based theory of the firm (Barney 1991) have argued that knowledge is a primary source of competitive advantage for firms (Amit and Schoemaker 1993; Galunic and Rodan 1998; Wernerfelt 1984), especially for those firms whose critical resource and primary source of value is knowledge (Grant 1996b). For professional service and technical organizations, whose business is the selling of expertise, the

management of expertise plays a key role in their performance (Empson 2001). The main assets of these firms are their intellectual property and the knowledge and skills of their employees. Many professional service and technical organizations grow through acquisitions of people or firms that offer expertise in new areas or deeper expertise (Robinson 1999). Acquisitions offer unique business opportunities, not only to serve local customers better but also to pursue new clients (Maister 1993; Venkatraman and Henderson 1998). Many professional service and technical organizations evolve into multisite firms through acquisitions, each site with differing areas of specialization.

In this study, we examined the utilization of expertise in the distributed organizational environment of a multisite professional service firm. We focused on the deployment of expertise within and across sites for project work. We defined better utilization of expertise to be a closer match of employees' expertise with project requirements. We also examined how effective utilization of knowledge affected performance of projects.

1.1 Project Organization of Distributed Collaborations

To draw on and sell expertise, professional service and technical organizations often organize around project teams. Projects have specific expertise requirements to meet the goals of the project and the needs of clients. For example, one project may require statisticians; another project may need survey researchers. In the project environment, appropriate expertise utilization means that the members of projects have expertise that is matched to project requirements. However, utilizing expertise in project teams may be difficult in a multisite organization because employees are geographically dispersed in different sites with different specializations (Becker 2001). These firms can address this problem by creating so-called virtual teams whose members are located at different sites (Brockhoff 1998; Carmel 1999; Herbsleb et al. 2000). Computer and telecommunications technology make these arrangements possible. Organizational priorities and a competitive business environment make these arrangements desirable. For example, when a professional service firm acquires another, it might be infeasible to bring all employees to a single site. Instead, to better utilize the expertise available, the company may create some cross-site project teams to leverage expertise from the different sites. These distributed collaborations may be able to bring in new business or better match projects' requirements.

1.2 Challenges of Distributed Collaboration

If professional service and technical organizations depend on expertise that is distributed unevenly across multiple sites, then utilizing expertise where it is needed may present serious challenges (Brown and Duguid 1998; Grant 1996b). Many researchers argue that utilization of knowledge, rather than the knowledge itself, forms the basis of a firm's competitive advantage (De Boer and Volberda 1999; Galunic and Rodan 1998; Grant 1996a 1996b; Teece 1998; Tsoukas 1996). Utilizing expertise in a distributed environment, however, depends on whether people know about the expertise of others (as they do in small groups; Liang et al. 1995), whether they are motivated to work with others across the organization (Drucker 1988), and whether management is able to organize and coordinate teams in which experts are well matched to the needs of the work (see also Ancona and Caldwell 1992; Faraj and Sproull 2000).

Geographically-distributed work has always presented problems in the conduct of work. Research from over 30 years ago to the present suggests that physically proximate work has powerful and positive effects (Kiesler and Cummings 2002; Olson et al. 2002). Moreover, proximity has proven to be hard to simulate through modern technologies such as video conferencing (Kraut et al. 2002). Organizations face some major hurdles when work is distributed rather than collocated. Distance can make it difficult for team members to establish mutual regard and common ground, increasing the likelihood that communication will be misunderstood (Cramton 2001) and information will be distributed unevenly (see Herbsleb et al. 2000; Olson and Olson 2000). Organizational relationships and procedures also often encourage a focus on local sites and discourage collaboration across sites (e.g., Armstrong and Cole 2002).

Because of their exaggerated coordination and other costs, distributed collaborations, on average, are unlikely to be as efficient as collocated collaborations. However, if different sites have different strengths, with people who have different expertise specializations, restricting expertise resources for projects to a single site limits the range of expertise resources available to a project team. Distributed collaborations represent an attempt to go beyond local resources and to draw on distinctive or unique expertise from other sites.

2 HYPOTHESES

Considering the difficulties and costs of distributed collaboration, we expect most project teams will be collocated and will tend to draw on local expertise resources where the projects are headquartered. We argue that doing so will limit the project's expertise match with project requirements. For example, the project might require statisticians, but an expert statistician would not be available locally and would not be deployed to the project. We also argue that the minority of project teams that deploy members from other sites will have performed a more selective and deliberate search than would be the case in collocated projects. We thus expect distributed teams to have a superior match of expertise with project requirements. Thus, in the example above, the project that needs statisticians is more likely to appoint an expert statistician to the project if the project is a distributed collaboration. We hypothesize:

H1: Distributed projects will match project members' expertise with project requirements better than will collocated projects.

The literature suggests that better knowledge utilization should improve firm performance (Becker 2001; Grant 1996b; Tsoukas 1996). From this literature, we argue that a good match of project member expertise with project requirements represents effective knowledge utilization and should improve performance. The group work literature has also shown group composition to be a key factor affecting group performances (Ancona and Caldwell 1992; Cohen and Bailey 1997). We hypothesize:

H2: Projects with a better match of project members' expertise with project requirements will have better project performance.

If distributed projects are created to leverage distributed expertise resources of the organization, then these projects are likely to be especially effective. In these cases, the selection of experts for the project team will be deliberate and careful. Instead of simply taking what is available locally, management looks for specialists who will differentiate the company from its competition, accomplish the project work in a superior manner, and help win the contract for the project team. Furthermore, a distributed project with its superior experts may help management negotiate a more favorable contract or larger project than would be possible otherwise. The wider availability of resources and the potential to pull together a unique combination of expertise and knowledge to meet client requirements can thus give the firm a competitive edge against the collocated projects. We hypothesize that:

H3: The positive association between a match of members' expertise with project requirements and project performance will be stronger in distributed projects than in collocated projects.

3 METHOD

We studied distributed and collocated projects of a medium-size professional service organization over a five-year period. We examined financial and personnel data including attributes of projects (e.g., size, type), profitability of projects, participation of project team members from different locations, the expertise of project members, and the expertise required by projects.

3.1 Organizational Context

Research Inc. (a pseudonym) is a multisite firm that does applied research, consulting, and technical work for other organizations. Its customers include government agencies such as the Department of Education and the Census Bureau and private and public companies. Peer organizations in the industry include RAND, Educational Testing Service, SAS, Inc., and Westat. As of 2000, Research Inc. had offices in seven sites located in the District of Columbia, Virginia, Maryland, Massachusetts, and California. The organization creates project teams to bid competitively for work in domains such as elementary education, child health, and Internet-based information services. Top management and a project manager select team members for projects.

Research Inc. is an appropriate setting to study our research problem. As a professional and technical service firm, its key resource is the expertise of employees. Over 80 percent of the staff are professionals, and over half of these employees have doctoral degrees. The organization has formed distributed project teams for some of its projects. The organization has invested in network technology to support this distributed work. The organization also has a highly competitive business environment. In spite of its top standing in the industry, the firm wins only about 40 percent of its project bids. Hence the organization must ensure the appropriate deployment of resources on project bids and project work. Figure 1 shows the growth of the organization and the extent of distributed collaboration during the period of 1996–2000.

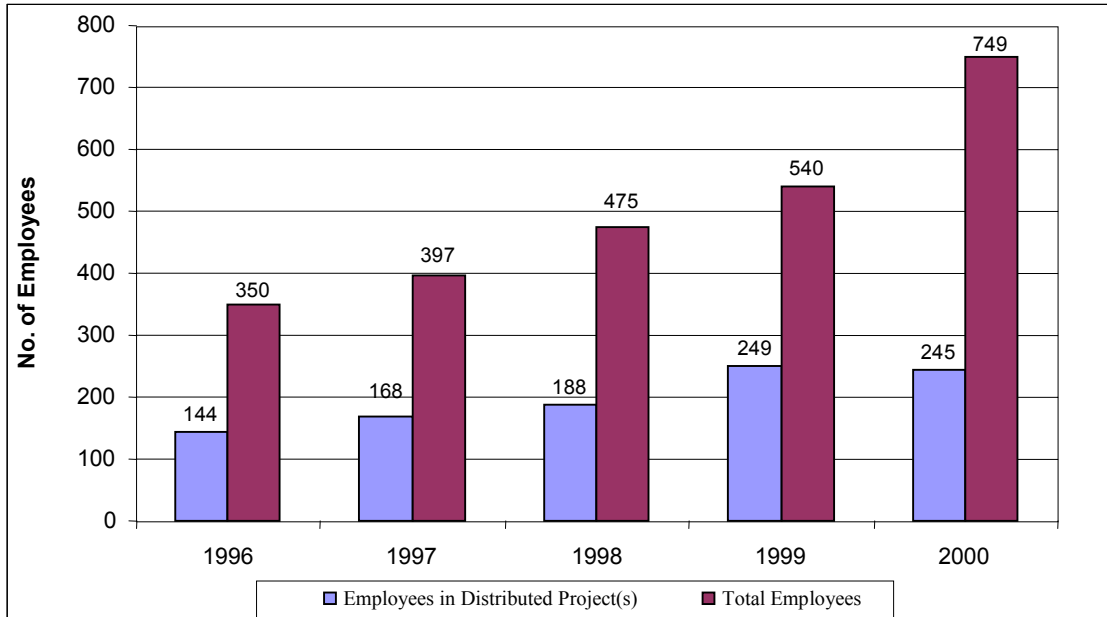


Figure 1. Employees Engaged in at Least One Distributed Project

3.2 Sources of Data

To test our hypotheses about the match of project members’ expertise to project requirements, we collected information about the types of expertise that employees possessed, and the expertise the projects required. We differentiated between two types of expertise: methodology and domain expertise. Domain expertise involves knowledge of a topic area, such as education, children’s mental health, or organizational performance. Methodology, on the other hand, refers to the research techniques used in each project, or specific services provided to the client, such as statistics, database construction, or surveys and measurement.

We obtained detailed archival data covering a 5-year period (1996–2000) from the organization, including project abstracts, revenues and costs, and employee participation on projects, their locations at the various sites, and their positions. We distributed a survey to site directors to obtain their perceptions of employees’ expertise and also obtained information from the company Web site, reports, and newsletters. To collect contextual information about the company, we conducted hour-long interviews with directors of four sites, two vice president-level employees, and four groups of senior researchers.

3.3 Measures

Individual expertise. For one of the sites, two directors were surveyed on the expertise of research staff, and their judgments agreed on 73.33 percent of the individuals they rated. Based on this result, one director at each of the other sites completed an expertise form for that site’s researchers. We also collected domain expertise information from the company Web site. The directors’ ratings were combined with the information from the Web site; an individual was coded as an expert in a particular domain if he or she was rated as such an expert by a director, or if he or she was listed as such on the Web site.

Project requirements. From the project database, we obtained one-page project abstracts for 499 projects. To determine the expertise requirements for each project, we coded the domain and methodology expertise required for each project based on the abstracts. Two coders coded a random sample of 200 abstracts independently. Inter-rater reliability for the second set of 100 abstracts had a kappa statistic of 79.97 percent. The rest of the abstracts were then coded by one of the two coders.

Match of project member expertise with project requirements. The match of project members’ expertise with project requirements for each project was operationalized as the number of individuals on the project whose expertise matched the coded project requirements. We created a variable (methodology match), the match of project members’ methodological expertise with project methodological requirements, and a variable (domain match), the match of project members’ domain expertise with project domain requirements.

Distributed projects. A project was defined as distributed if it involved some project members whose home sites were different from the project's owning site.

Project performance. We operationalized project performance as the profit earned by the project, that is, the excess of revenue over expenses. Project profits play an important role in the firm and are a primary measure of firm performance. Project profits in the firm are used to invest in new business (e.g., acquire new people or firms), and were therefore important in growing the firm. The expertise of project members can influence project profits in several ways. When experts are deployed, management is better able to compete for more profitable, more interesting, or bigger projects, or to negotiate superior technological and other resources applied to a project. Having a better match of expertise also enables the project team to be more productive and efficient.

Control variables. In the analyses, to differentiate between mere project size and the match of expertise on the project, we controlled for the total number of researchers on each project. We also included a dummy variable for each site.¹ Because types of contracts can affect project composition decisions and profits, we included dummy variables representing fixed price, cost plus fixed fee, cost reimbursable, time and materials contracts, and grants. We also included dummy variables for each of the coded methodologies to control for the possible impact of a particular methodology on the match of project members' expertise on profits. Controls for domains were not included, as they were highly correlated with the sites.

4 RESULTS

Preliminary observations revealed that, at Research Inc., employees with domain expertise were concentrated within sites. These employees tended to develop relationships with clients in their own domains and to compete for work within the same domains. Once the work was won, they would work on these projects. In that respect, domain expertise was localized. By contrast, the methodological expertise used in projects such as statistics, survey design, and training was distributed across sites and was more fungible (applicable to different topics and domains). Hence we expected that distributed collaborations would be more likely targeted at matching employees' methodological expertise with projects than employee domain expertise.

Regression analyses were conducted at the project level of analysis, and the data for projects were pooled across 5 years.² The results of our analyses are summarized in Figure 2. Projects that were distributed did not show a better match of employee domain

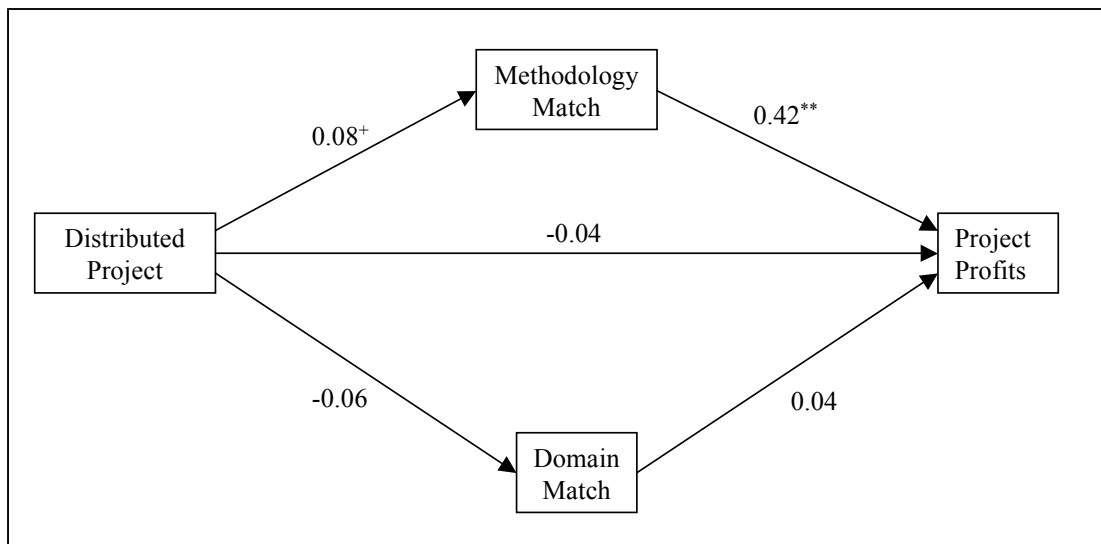


Figure 2. Summary of Results for Main Effects (Without Interactions)

¹We omitted the seventh site because it was acquired in 2000, and the data on this site were sparse.

²An outlier analysis indicates that there were two outliers in the data set. The analysis was thus conducted without the outliers. Multicollinearity and heteroskedasticity has been checked and corrected for in all of the analyses.

expertise to project requirements than did collocated projects. However, in accord with hypothesis 1, projects that were distributed showed a marginally better match of the project members’ methodological expertise with project requirements than did collocated projects ($p < 0.10$).

To analyze the impact of a match of employee expertise with project requirements on project profits, as proposed in hypotheses 2 and 3, we conducted hierarchical regression analyses of the impact of domain match and impact of methodology match on profits. We first estimated a model of project profits with the main effects domain match, methodology match, and distributed project (the results of the main effects are illustrated in Figure 2), then we added the variables defining the interaction terms (domain match * distributed project) and (methodology match * distributed project). The graphs in Figures 3 and 4 show how the impact of methodology match and domain match on project profits differ for distributed and collocated projects respectively. Overall, the results show that a match in methodological expertise had a positive and significant impact on project profits (hypothesis 2), and the impact was greater for distributed projects than for collocated projects (hypothesis 3). A better match of domain expertise had a positive, but insignificant, impact on project profits, and the impact did not differ significantly for distributed and collocated projects.

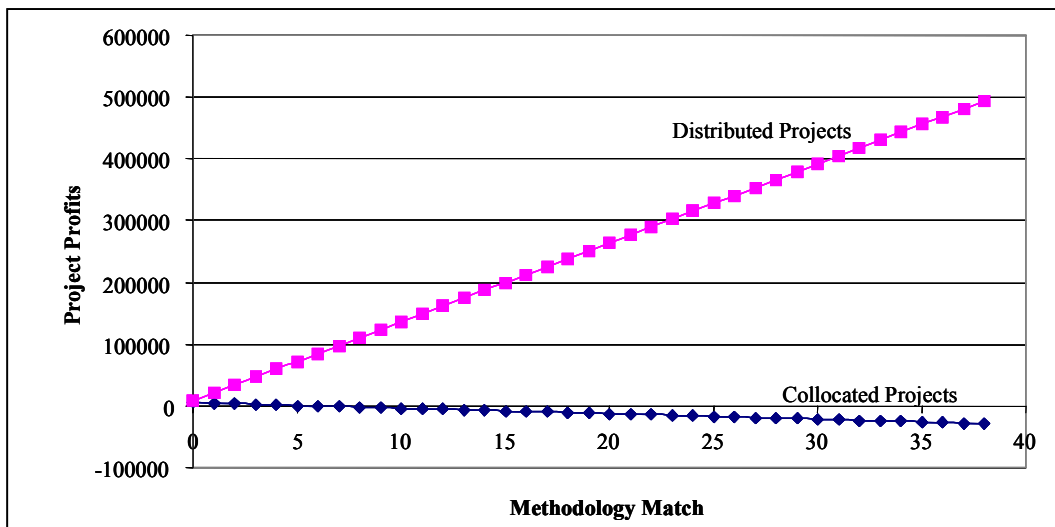


Figure 3. Graph Showing How Distributed Projects Affect the Association Between Project Profits and Methodology Match

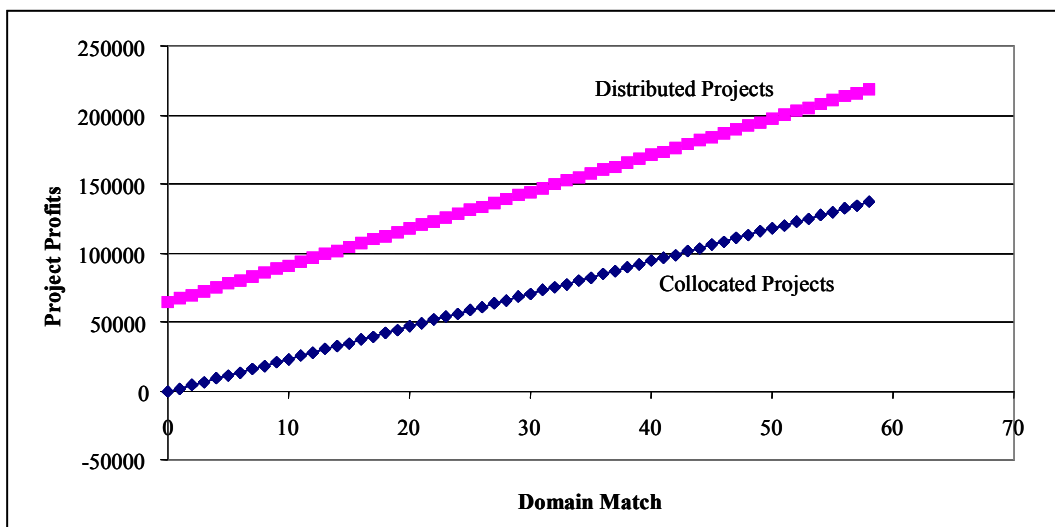


Figure 4. Graph Showing How Distributed Projects Affect the Association Between Project Profits and Domain Match

5 DISCUSSION

We argued that, due to the costs of distributing work geographically, distributed projects would not be created lightly. In the firm we studied, only 13 percent of projects over a 5-year term were distributed. We argued that distributed projects would have the purpose, in many cases, of applying needed expertise not available locally. Accordingly, distributed projects would show a better match of individuals' expertise with project requirements than would collocated projects (H1). We found that distributed collaborations were positively associated with a greater number of people on the project whose methodological expertise matched project methodological requirements. However, distributed collaborations were not associated with more people on the project whose domain expertise was matched with project domain requirements. We think this pattern occurred because the company's sites were organized around domains such as education, information technology, and so forth. Clients and projects in these domains tended to be clustered around these domain-specialized sites. Management did not have a high incentive to seek domain experts outside the site where the project (and often the client) was headquartered because they already had sufficient expertise available locally.

Our results suggest that methodological skill at this firm was considered more fungible than domain knowledge, and more applicable to distributed work. However, we believe the latter conclusion might be specific to this company, in which geographic sites were mapped onto domain expertise. One can imagine a scenario in which a firm's geographic distribution is mapped onto its methodological expertise (e.g., designers and design projects in New York; actors and film projects in Los Angeles). Similarly, a manufacturing firm may be organized by functions, or by products. Organizing by functions would result in functional expertise being collocated whereas product expertise would be distributed across the organization.

The inference we draw from our results is that organizations are likely to create distributed collaborations to fill in gaps or to supplement local expertise. Because a distributed collaboration is likely to entail costs, the search for outside expertise would likely focus on experts who are especially well suited for the work and who can help increase the profitability of the work. This interpretation would account for our finding that methodological expertise was mapped to distributed collaborations somewhat better than to collocated collaborations.

Our most interesting finding, perhaps, is the positive impact of expertise match on profit that was stronger for distributed teams than for collocated teams (H3). One can see in Figure 2 that distributed projects did not lead to higher profits per se, when controlling for other factors and for expertise match. However, controlling for the main effect of distributed work, a better match of individual methodological expertise with project requirements predicted higher profits for distributed than for collocated collaborations. In fact, a better methodological match of expertise seems to have influenced profits almost entirely in the distributed projects. The results suggest that distributed collaborations pulled in highly relevant methodological experts who could add to the project's viability.

We obtained further insights from the 10 semi-structured interviews we carried out with site directors and project managers. Interviewees answered questions about staffing distributed teams, and procedures and consequences of distributed collaboration. Interviewees discussed multiple costs and barriers that commonly arose in the process of distributed collaboration. These included conflicting priorities or availability of staff, time zone differences impeding communication, differences across sites in culture and management style, lack of ongoing interaction, and lack of awareness, all consistent with problems identified in previous studies (Cramton 2001; Weisband 2002).

In the interviews, managers spoke of their preference to keep work within the site due to both convenience and management considerations. The company's financial system credited site directors according to the work performed by their own employees, even when these people worked on projects managed and located at other sites. Hence, site directors should not have opposed sending their people out to other projects. On the other hand, each site had fixed costs of operation (overhead costs) that had to be allocated over all billable hours of their staff. To cover all the overhead costs and ensure that all employees in the site were assigned to work that was billable to clients, sites did have an incentive to keep their own employees working on their own projects. This incentive added to the cost of distributed collaboration. We list here some interesting quotes from the interviewees:

I don't know if I should mention this as a reason not to [involve people from other sites], but...the way the offices that are set up, certain amount of overhead goes to different offices based on people charging hours in those offices and so that...there may be kind of some underlying desire to try to keep it in [your own site]... keep the overhead within your office....Our first priority is to cover our own staff.

Additionally, there were issues surrounding communications across sites:

if there's a skill set that I need, I'm probably still more likely to try to fill it within this site, especially if someone's available...and I'd like to make sure that they're covered. ...The real question becomes how much of a better-fit does someone have to be in another site to make up for the inconvenience of not being right here.

how much incremental expertise are you getting to make it worthwhile to do it 'cause under any circumstances it's always gonna be less convenient to have to, you know, walk 10 minutes down the street or wait till 11:00 to make a phone call versus if I know that all I got to do is walk around the corner and there's the person, and so you do it [distributed collaboration] because of some benefit that can be had in terms of making your project better.

Despite these sentiments, managers discussed benefits of being able to draw expertise from other parts of the organization. Searching outside of the host site allowed managers to draw from a larger pool of expertise and to find expertise that better met the needs of customers. They also mentioned other advantages such as the use of distant people who were close to clients or populations to be investigated.

I think the most useful thing [of distributed collaboration] is the availability of expertise that you don't necessarily have in our office.

None of the people we interviewed reported an effect of distributed collaboration on project profits. We would have expected them to mention this if they sought outside experts to enhance revenues. Hence it seems that, at least for public discourse, distributed collaborations were created almost always to fill in or enhance gaps in expertise for the project.

6 CONCLUSION

From this study, we learned that distributed projects are not, of themselves, superior. However, those projects that matched methodological expertise from across the organization with project requirements showed better outcomes. Our findings suggest that, to the extent that a superior match of intellectual resources and project needs is obtained through distributed collaboration, it can be well worth its costs. Many practices, such as rotation of staff and *social filters* (databases for storing information about organizational expertise), have been advocated to encourage distributed collaboration. Our results suggest that these practices may lower barriers to distributed collaboration, but the point is not to encourage just any distributed work. To the extent that practices encourage applying expertise from the organization where it is particularly useful to the work, outcomes should be improved.

7 ACKNOWLEDGEMENTS

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