

COMPLEMENTS OR SUBSTITUTES?:
ORGANIZATION AND PROJECT TEAM STRATEGIES FOR DEVELOPING THE
CAPABILITY TO MOBILIZE AND CREATE NEW KNOWLEDGE *

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We identify and test two strategies used in developing the capability to mobilize and create knowledge for innovation. The organization strategy requires investment in organization-level management practices to facilitate the capability, independent of when individuals are organized for creating knowledge. The project team strategy requires investments in project team-level management practices to facilitate the capability once individuals are placed in teams to create knowledge. The results of the empirical test show that they are substitutes rather than complements for developing the capability across several of its outcomes. The study extends the knowledge-based view and integrates previous literature on innovation.

[99 words]

Key words: Knowledge mobilization and creation, Innovation, Knowledge-based view

Knowledge is the basis for the competitive advantage of the firm, but the different strategies for developing it are still not well understood. In the knowledge-based view of the firm (Grant, 1996; Kogut and Zander, 1992; Spender, 1996; Tsoukas, 1996), an organization's ability to mobilize knowledge that is embodied in individuals and to create new knowledge, that is, product innovation that meets the demands of the external markets, is a source of competitive advantage. However, despite the importance of knowledge and the wealth of studies on the effects of resources such as knowledge on competition, it is still not well understood how they are generated in firms (Foss, Knudsen, and Montgomery, 1995). Part of the reason for this is that studies of knowledge tend to be theoretical (Grant, 1996; Helfat and Raubitschek, 2000; Kogut and Zander, 1992; Nahapiet and Ghoshal, 1998; Spender, 1996; Tsoukas, 1996; Winter, 2000), while empirical work tends to focus on knowledge mobilization rather than creation (Hansen, 1999; Szulanski, 1996; Tsai, 2000; Tsai and Ghoshal, 1998; Zander and Kogut, 1995). Although there are a few empirical studies that focus on knowledge creation rather than mobilization, providing rich descriptions of the new knowledge creation process (Leonard-Barton, 1995; Nonaka and Takeuchi, 1995), the identification and testing of management strategies that facilitate this process are still limited.

In this paper we analyze management strategies that facilitate the development of the capability to mobilize and create knowledge. Specifically, we focus on product innovation as an outcome of knowledge mobilization and creation (Eisenhardt and Martin, 2000; Helfat and Raubitschek, 2000; Leonard-Barton, 1995; Nonaka and Takeuchi, 1995; Prahalad and Hamel, 1990).

In approaching this issue we identify two alternative strategies for developing the capability to mobilize and create new knowledge for innovation, integrating them under an

internally coherent framework drawn from the knowledge-based view (Grant, 1996; Kogut and Zander, 1992; Spender, 1996). On the one hand, what we call the organization-level innovation strategy suggests investment in organization-level management practices that facilitate the development of the capability to create knowledge independent of when individuals from different functions are organized specifically for creating knowledge. This strategy is grounded in the literature that suggests that organization-level interactions among individuals in different parts of the organization facilitate innovation (Lawrence and Lorsch, 1967; Galbraith, 1977; Nohria and Ghoshal, 1997; Tsai, 2000; Tsai and Ghoshal, 1998). On the other hand, what we refer to as the project team-level innovation strategy argues for investments in project team management practices that facilitate the knowledge mobilization and creation process once individuals are placed in teams to create knowledge. This strategy is based on the literature that suggests that interactions among team members are important in generating knowledge mobilization and creation for innovation (Ancona and Caldwell, 1992; Clark and Wheelwright, 1992; Griffin and Hauser, 1992; Keller, 2001; Subramaniam and Venkatraman, 2001).

After identifying the two strategies and what they entail in terms of specific management practices, we test whether these strategies are complements or substitutes for developing the capability to mobilize and create knowledge for product innovation. The answer to this question could have a deep impact on both past and future research. If the strategies are substitutes, the organization-level and project team-level research streams on innovation can continue working in parallel without needing to interact. The results of both lines of research provide valid suggestions for managers. However, if the strategies are complementary, previous single level studies on innovation need to be revisited to acknowledge the influence that different levels of

analysis have on one another. The results of these single-level analyses would suffer as a result of confounding influences at the levels of analysis that have not been included.

The results of the empirical analysis indicate that the organization and project team strategies are substitutes for each other for several outcomes of the capability to mobilize and create knowledge for innovation: product innovation, speed-to-market, customer satisfaction, and efficiency. Hence, managers can use either the organization or project team strategy to achieve the same desired outcome, while researchers can continue to operate in parallel. We provide an explanation for the reason that these strategies have the same outcome; the explanation integrates and extends the literatures on innovation within the knowledge-based view.

The rest of the paper is organized as follows. In section 2 the capability to mobilize and create knowledge for innovation is reviewed and two alternative strategies for developing this capability are identified: the organization strategy and the project team strategy. In section 3 their substitutability or complementarity in developing the capability is discussed, generating the formal hypotheses. In section 4 the research design for the test is presented. In section 5 the results of the empirical analysis are presented and their implications are discussed. Finally, in section 6 conclusions are presented.

STRATEGIES FOR DEVELOPING THE CAPABILITY TO MOBILIZE AND CREATE KNOWLEDGE FOR INNOVATION

The Capability to Mobilize and Create Knowledge for Innovation

The capability to mobilize and create knowledge and its benefit for sustaining the firm's competitive advantage has been studied previously in the resource-based view and innovation literature, under different names. It has been called the "combinative capability" (Kogut and Zander, 1992), that is, the firm's ability to combine different types of individual knowledge from

different functions for product innovation. It has also been related to “core competence” (Prahalad and Hamel, 1990), or the firm’s ability to coordinate and integrate production skills and streams of technologies. Moreover, it has been associated with “dynamic capability” (Teece et al., 1997), or the subset of competence/capabilities that allows the firm to create new products and processes and respond to changing market circumstances. All these concepts have in common the ability of a firm to continuously mobilize knowledge from the external environment and combine it with internal knowledge embodied in its personnel in order to create new knowledge and generate innovations that meet the demands of external markets. Thus, the basis for this capability is the interactions among employees in different parts of the firm, such as design and production engineering, sales and marketing, and customer services, who have different knowledge sets that need to be integrated to create something new.

We analyze one particular type of capability, the capability to mobilize and create knowledge for product innovation. Since the literature on knowledge discusses innovation as a critical outcome of the knowledge creation process, and the capability to mobilize and create knowledge itself cannot be measured directly (Godfrey and Hill, 1995), we analyze innovation as one outcome of this capability. By innovation we mean improvement made to existing products of the firm (Van de Ven, 1986) in response to external market demands (Eisenhardt and Martin, 2000; Helfat and Raubitschek, 2000; Teece et al., 1997).

The development of the capability to mobilize and create knowledge for innovation can ultimately be traced back to the management of individuals in firms. Knowledge resides in the individuals that are part of the organization (Grant, 1996; Hansen, 1999; Tsoukas, 1996), but it is more than the sum of individuals’ knowledge. There is an organization knowledge that arises from the interactions among individuals and that cannot be traced back to any particular

individual. Thus, the firm's knowledge at any given point in time will be the knowledge possessed by the individuals in it and the knowledge created by their interactions.

The creation of knowledge in the firm requires the promotion of interactions among individuals, particularly those with different knowledge sets, through the use of teams. First, the interaction and sharing of knowledge among individuals facilitates new knowledge creation because it enables the exchange and transformation of the individuals' existing knowledge. Although a single individual can develop new knowledge, the scale of the task requires, in many cases, the use of multiple individuals to achieve a degree of economies of scale in knowledge. Their interaction facilitates the creation of knowledge in two ways: by creating new knowledge that is the result of the combination of the knowledge of the individuals involved in the process, and by expanding the knowledge set of each individual through interaction with others with different knowledge sets.

Second, the creation of new knowledge for innovation is better facilitated by the interaction among individuals with different knowledge sets than by the interaction among individuals with similar knowledge sets. The complexity of the environment and task, that is, product innovation that meets the demands of the external markets, requires diverse knowledge sets. The possibility of exchanging knowledge and recombining existing knowledge in order to create new knowledge is greater when the people involved have diverse knowledge sets; in this way a degree of economies of scope in knowledge is achieved.

Third, the interaction among individuals for knowledge creation requires the use of teams rather than the organization as a whole. In contrast to pure knowledge mobilization or transfer (Szulanski, 1996; Tsai, 2001; Tsai and Ghoshal, 1998; Zander and Kogut, 1995), which can be performed unidirectionally from source to recipient, such as when diffusing practices across the

firm, knowledge creation requires multidirectional interaction among people with diverse knowledge sets. That the interaction be multidirectional is especially important, as it is not only the transfer of explicit knowledge that is involved, but also that of tacit knowledge, which can only be acquired through personal interaction (Nonaka, 1994; Nonaka and Takeuchi, 1995). This multidirectional interaction is facilitated by the use of teams with a limited number of people; this enables members to become both sources and recipients of knowledge.

The interaction among individuals in teams with different sets of knowledge that are exchanged and transformed to create new knowledge has two prerequisites: the willingness of these individuals to exchange knowledge in order to create new knowledge and the understanding among individuals who exchange knowledge. First, individuals need to be willing to establish interactions and share their knowledge sets to create new knowledge; that is, they need to be provided with incentives to generate the desired behavior (Milgrom and Roberts, 1992). Second, the interaction and exchange of knowledge among individuals with different knowledge sets requires an understanding among them that enables their interaction; that is, they need a common code (Arrow, 1974), absorptive capacity (Cohen and Levinthal, 1990), or common knowledge (Grant, 1996). These two factors are necessary but insufficient on their own. Without willingness on the part of the individuals to interact, there is little exchange of knowledge among them. Without understanding among individuals knowledge cannot be exchanged in a meaningful manner. Only when the two coexist are mobilization and subsequent knowledge creation possible.

Two Strategies for Developing the Capability to Mobilize and Create Knowledge for Innovation

We propose two alternative strategies that managers can use to invest in facilitating the interactions among diverse individuals in order to develop the capability to mobilize and create knowledge for innovation: the organization strategy and the project team strategy.

The organization strategy requires an investment to be made at the level of the organization or independently of when individuals are organized into cross-functional project teams to work on tasks that require knowledge mobilization and creation. In the organization strategy, the firm uses organization-level management practices promoting the individuals' willingness and their ability to understand other individuals with diverse knowledge sets, that is, coming from different functions to interact with others independent of when they are placed together to create knowledge.

The project team strategy requires the investment to be made at the project team level, that is, after organizing individuals into project teams where they will interact in performing the task that requires knowledge mobilization and creation across functions. In the project team strategy, the firm uses project team-level management practices that promote their willingness to share knowledge once the task for creating knowledge has been established and that facilitate the development of the ability to understand people with different knowledge sets.

These two strategies, the organization strategy and the project team strategy, facilitate the development of the capability to mobilize and create knowledge as they influence the two requirements of this capability. Figure 1 illustrates the relationships among the various constructs discussed. Now each strategy is analyzed in more detail, reviewing what they entail in terms of practices and how they affect the capability to mobilize and create knowledge for innovation.

Insert Figure 1 about here

The Organization Strategy for Developing the Capability to Mobilize and Create Knowledge for Innovation

The organization strategy is characterized by the management of individuals at the organization level, independent of the definition of the task that requires knowledge mobilization and creation across functions, that is, regardless of when they are placed in a team where they have to exchange knowledge in order to create new knowledge. This strategy comprises three practices: organization-level control of individuals' rewards (Galbraith, 1977; Katz and Allen, 1985; Lawrence and Lorsch, 1967), organization-level development (Nohria and Ghoshal, 1997; Nonaka and Takeuchi, 1995), and organization-level cross-functional routine communication (Lawrence and Lorsch, 1967).

Organization-level reward, specifically the assignment of responsibility for determining individuals' rewards, promotes knowledge creation by influencing the willingness of individuals to interact and create knowledge. When the control of individuals' rewards is shared between functional managers and managers outside the functional areas, individuals are encouraged to interact with others outside their disciplines to share knowledge, as they are controlled and rewarded by people in different functions (Katz and Allen, 1985; Milgrom and Roberts, 1992; Morrill, 1995).

Organization-level development of employees facilitates the development of the capability to mobilize and create knowledge by promoting understanding among individuals with different knowledge sets. It does so by integrating different functions in the firm. The integrative mechanisms range from establishing gatekeepers between functions and compensating them for

these roles (Lawrence and Lorsch, 1967), to developing or socializing employees initially (Nohria and Ghoshal, 1997; Newport, 1969; Weiner, 1970) so that they build social ties which encourage interaction (Hansen, 1999; Tsai, 2000; Tsai and Ghoshal, 1998), or establishing a team-based work pattern rather than defining tasks and responsibilities on an individual basis (Ghoshal, Korine, and Szulanski, 1994). However, of these practices, cross-functional development of new employees is viewed as the most promising, since it promotes the building of social ties, which encourages understanding among employees based in different disciplines.

Organization-level cross-functional routine communication, which we define as the formal and informal communication patterns that occur on a regular basis among organizational members belonging to different functions, facilitates knowledge creation. We depart from previous organization-level innovation literature in that rather than arguing for cross-functional communication that occurs formally among employees in the management ranks (Lawrence and Lorsch, 1967; Nohria and Ghoshal, 1997), we argue for the more comprehensive concept of organization-level routine communication among individuals. This is composed of institutionalized communication patterns (Morrill, 1995) or routines (Nelson and Winter, 1982) that include both formal and informal communication between individuals at all levels of the organization. These patterns may be vertical, that is, between superior and subordinates within the same function, or lateral, that is, between employees in similar ranks in different functions (Galbraith, 1977; Morrill, 1995). Organization-level cross-functional routine communication improves understanding amongst individuals as they become accustomed to interacting with people from different functions, thus inducing them to develop the necessary common code for understanding people with different knowledge sets. The establishment of routines leads to automatic behaviors, which require less subsequent effort (Nelson and Winter, 1982).

Furthermore, organization-level routine communication increases the willingness of individuals to exchange knowledge as they form social bonds and a sense of belonging and interdependence among people that promotes mutual cooperation and exchange of knowledge.

The Project Team Strategy for Developing the Capability to Mobilize and Create Knowledge for Innovation

The project team strategy entails the development of interactions among individuals once the challenge that requires the mobilization and creation of knowledge for innovation has been identified. In this case, the strategy requires the promotion of understanding among individuals and their willingness to exchange knowledge to create new knowledge when they are placed together in a team to solve the task, that is, to develop new products. The strategy requires the use of project team management practices that facilitate the understanding and willingness of individuals to interact in order to create new knowledge: project team reward (Ancona and Caldwell, 1999; Wageman, 1995; Wageman and Baker, 1997), project team development (Roth and Kleiner, 1996; Thamhain and Wilemon, 1997), and project team routine communication (Keller, 2001; Subramaniam and Venkatraman, 2001).

Project team reward for team performance impacts knowledge creation as it provides individuals with an incentive to interact and exchange knowledge. Research on teams in laboratory settings and single-function teams suggests that team reward impacts team cooperation and interaction (Ichinowski, Shaw, and Prensushi, 1997; Wageman and Baker, 1997). Research reported in the control literature suggests that rewards based on team outcomes, such as product innovation, place the emphasis on a common goal and nurture cooperation (Pinto, Pinto, and Prescott, 1993) and the associated interaction. Similarly, cooperation is developed by providing a common goal and informing people that their role is to exchange

knowledge, rewarding them to the extent that the group successfully accomplishes its goal (Tjosvold, 1986).

Project team development facilitates knowledge creation by promoting understanding among individuals. Project team development is a process by which interactions among team members are facilitated, so that the organization of work processes such as setting the agenda for meetings, or task allocation and suggestions about the resources needed and where they may be acquired, runs more smoothly; thus it influences understanding and therefore facilitates accomplishment of the project. Teams that have a clear objective and a schedule for meetings to work on the project meet more frequently than those that do not have these measures in place at the beginning of the project (Roth and Kleiner, 1996; Thamhain and Wilemon, 1997). Moreover, when part of the agenda requires team members to search for resources outside the team, this practice also influences the interaction between team members and their external relations.

Finally, project team routine communication influences knowledge creation by affecting understanding among team members and their willingness to share knowledge. It promotes willingness by creating social interactions and a sense of interdependence among team members as they communicate with each other. At the same time it increases the understanding among individuals as individuals reveal parts of their knowledge sets to others in their routine communication.

**ORGANIZATION AND PROJECT TEAM STRATEGIES AS COMPLEMENTS OR
SUBSTITUTES FOR DEVELOPING THE CAPABILITY TO MOBILIZE AND
CREATE KNOWLEDGE FOR INNOVATION**

Having specified the two alternative strategies, organization and project team, for knowledge mobilization and creation for innovation, the question that arises is whether these two

strategies are complementary or can act as substitutes for each other. The strategies are substitutes if they are able to influence the prerequisites of the interaction among individuals for knowledge mobilization and creation –willingness and understanding– separately, thus achieving the capability to mobilize and create knowledge independent of each other. The strategies are complements if they each influence a different prerequisite of the interaction among individuals for knowledge mobilization and creation; in this case the presence of both strategies would be required to achieve the capability. These alternatives are discussed in more detail below and the formal hypotheses tested in this paper are generated.

Organization and Project Team Strategies as Substitutes

Organization and project team strategies can substitute for each other in the development of the capability to mobilize and create knowledge for innovation if they exert similar influences on the knowledge creation prerequisites, understanding and willingness. If this is the case, managers can either choose to pursue the organization strategy, developing personnel before they are required to create knowledge, or the project team strategy, developing human resources once the task of creating knowledge is defined.

Organization strategy facilitates the understanding among individuals and the willingness that are necessary for knowledge creation. Organization-level reward and organization-level routine communication promote willingness to interact and create knowledge by providing individuals with the incentives, monetary in the case of reward and social in the case of routine communication, that induce the exchange of knowledge. Moreover, organization-level development and routine communication generate understanding among individuals. Since individuals communicate and share information for reasons other than knowledge creation for innovation, when they are placed together purposefully to share knowledge in order to create new

knowledge they have already a degree of absorptive capacity or common code embedded in them that facilitates knowledge creation.

On the other hand, the project team strategy can also facilitate understanding and willingness to exchange knowledge in order to create new knowledge. Project team reward can positively influence the motivation of people to interact in order to exchange knowledge and create knowledge, providing incentives that are directly tied to the process of knowledge mobilization and creation in the team. Moreover, project team development can promote the necessary understanding of each other's knowledge set by providing individuals with a sense of the knowledge sets of others and some common language that facilitates interactions. Finally, project team-level cross-functional routine communication promotes the development of willingness and understanding by providing social ties and relationships between individuals on the team.

Hence, the two strategies are substitutes and can be used independently to achieve the mobilization and creation of knowledge for innovation. Each strategy influences the two requirements of knowledge creation, willingness and understanding. Hence, we hypothesize that:

Hypothesis 1. The organization and project team strategies are substitutes in the achievement of outcomes of the capability to mobilize and create knowledge for innovation.

Organization and Project Team Strategies as Complements

Alternatively, it could be the case that organization and project team strategies for knowledge creation for innovation are complements, stressing different requirements of knowledge creation, and need to be used together to develop the capability to mobilize and create knowledge. That is, whereas organization strategy primarily facilitates understanding among individuals before they join the team to create new knowledge, project team strategy particularly

promotes the willingness of the individuals to perform a particular task once they join the team. Hence, managers need to develop their personnel using both strategies to fully achieve the capability to mobilize and create knowledge for innovation. Each of the strategies would be insufficient to achieve the capability on its own.

On the one hand, organization strategy enables the development of the required understanding of other individuals' knowledge set for knowledge creation, but has limitations in terms of the development of individuals' willingness to exchange knowledge. Organization-level development promotes understanding by providing a common code, while organization-level cross-functional routine communication enables individuals to create different interfaces, allowing them to understand others. However, although the organization-level reward and organization-level cross-functional routine communication provide incentives to support each other as social interactions are developed, these incentives are not strong enough to motivate people to exchange knowledge to create new knowledge, especially when they have competing demands on their time, as the incentives are not directly linked to the task at hand.

On the other hand, the project team strategy encourages willingness to exchange knowledge in order to create new knowledge, but faces limitations in the generation of understanding among individuals. Project team reward and routine communication provide individuals with incentives that are directly related to the behavior desired, the interaction to mobilize and create new knowledge. These practices increase the willingness to interact by providing explicit incentives, both monetary and non-monetary, for the task at hand among people who might not have known each other previously, and may have competing demands for their effort. However, the project team strategy is unable to generate the necessary understanding among people to facilitate the knowledge creation process. Although project team development

might enable some understanding among individuals, the development of the interfaces that individuals require in order to understand each other takes a long time. Individuals need to master different interfaces for diverse knowledge sets, but these cannot be compressed into a short period of time through project team development; that is, the development of understanding suffers from time compression diseconomies (Dierickx and Cool, 1989).

Hence, the strategies complement each other. The use of each strategy independently will not achieve the desired objective of developing the capability, since they stress different requirements of the knowledge mobilization and creation process, requirements that are necessary but not sufficient. However, when the strategies are used together, they complement each other, since they influence the two requirements of the interaction among individuals necessary for knowledge mobilization and creation. Therefore, we hypothesize that:

Hypothesis 2. Organization and project team strategies are complements in the achievement of outcomes of the capability to mobilize and create knowledge for innovation.

RESEARCH DESIGN

The empirical test reported in this article was performed on data from a survey of 182 cross-functional project teams of 38 large household-named US and Japanese multinational firms in the computer, photo imaging, and automobile industries with operations in the United States. The analysis of firms in different industries facilitates the generalization of results across industries (Chandler, 1990).

Selection Criteria

We selected firms in three industries that have different innovation cycles –short in the computer industry, medium-sized in the photo imaging industry, and long in the automobile industry– that affect the time pressure on gathering and processing different types of knowledge

for innovation (Lawrence and Lorsch, 1967). This enables the generalization of results across industries with different demands for knowledge creation.

We chose firms that met two criteria. First, they were the largest in their respective industries based on revenue as reported in the Hoover's Handbook of World Business (1999). Second, they had customer service centers in the USA and Japan dealing with similar products within the same division. This requirement was necessary because this study is part of a larger one that compares sources of knowledge creation for innovation of US and Japanese multinationals in both the USA and Japan, and how they mobilize knowledge across operations located in different national contexts to generate product innovation. Bearing in mind these requirements, we drew our sample from a population of 43 firms. 38 of these companies agreed to participate, representing a response rate of 88.4%.

For each company, we selected the largest customer service center in terms of employees located in the United States. We identified these centers using the Directory of Corporate Affiliations (1998). We chose the customer service organization because it is the gatekeeper linking a firm's external markets and its internal knowledge and activities. These large customer service centers had at least three functions represented: sales/marketing, customer service, and engineering, which is linked to the R&D and manufacturing organizations. Unlike previous studies which go directly to product development teams as their empirical settings, results from our field studies indicated that most of the product innovation projects were stimulated by below-expected sales performance or the need to keep ahead of competition based on marketing research, which is also housed in the main customer service center of each firm. Thus, we selected the customer service center as the research setting because it is an ideal site for studying the knowledge creation process.

In each customer service center, we randomly selected a set of cross-functional project teams. These teams had to meet two criteria. First, at least three functions must be represented: customer service, engineering (R&D or manufacturing), sales/marketing, or manufacturing. Second, the project team's main objective must be to transform specific external customer feedback obtained from the firm's worldwide operations about their products into an innovation. For example, one project team in a photo imaging firm worked on developing a new camera, as the previous model had been losing \$8m per year for the last 8 years. Another team in an automobile company redesigned alternators to work in extreme heat conditions, as the alternators designed in Detroit under performed in the Saudi Arabian and South East Asian markets, while another team in a computer company dealt with developing a new model of personal computers because of the underperformance of a previous model in the academic market.

Although the type of firms selected is appropriate for this study, the generalizeability of the results of the analysis is subject to limitations. First, the firms selected are large manufacturing companies. Therefore, we cannot be certain that the results are fully applicable to small companies or firms in service industries. Second, data are cross-sectional and represent only a snapshot of organizational life, which limits the establishment of causality. However, the case studies analyzed previously enabled us to view the organization over time and observe and understand how firms use different strategies in developing the same capability, increasing our confidence in the results of the empirical test reported in this paper.

Data Sources

Three steps were followed in collecting data. In the first step, in-depth comparative case studies were conducted through field interviews, observations, and phone interviews, in order to understand the capability to mobilize and create knowledge. Different outcomes of the capability

were identified; not only product innovation, but also customer satisfaction with the innovation, speed-to-market of that innovation, and efficiency in resources used. In the second step, the questionnaire was developed and a pilot study was conducted in order to test the variables, measures and survey instruments. Finally, the surveys were conducted.

Companies were approached through the vice-presidents of customer services and/or sales/marketing, who identified and introduced us to the project and personnel managers. For each company the project manager was then asked to provide a list of names of projects and the team leaders supervising them. Based on this list, five projects were randomly selected to complete the survey. Each survey was labeled with the name of the project so that the respondents knew which project was being evaluated. Out of 190 projects sampled, 182 valid questionnaires were received, representing a response rate of 95.8%.

Since cross-level analysis was utilized, data were collected from four different sources using four separate surveys (Klein et al., 1999; Rousseau, 1985), in order to avoid single respondent bias and separate out levels of analysis. Data on the organization-level cross-functional routine communication were collected from four randomly selected employees based in R&D, sales/marketing, customer services, and manufacturing engineering respectively. Data on the organization-level reward and organization-level development were obtained from the personnel manager of each firm. Data for the team-level management practices were collected from the project team leaders. Data on the outcomes of the projects were collected from project managers in order to minimize team member response bias (Ancona and Caldwell, 1992; Keller, 2001; Subramaniam and Venkatraman, 2001).

Variables and Measures

The capability to mobilize and create knowledge. This capability is represented by its outcomes, since capability is intangible and is not measurable directly but only through its effects (Godfrey and Hill, 1995). Four outcomes of this capability were studied: product innovation, speed-to-market, customer satisfaction, and efficiency, using Likert-type scales. Product innovation is measured by the extent to which projects using customer feedback led to new product development and/or modification ($\alpha = 0.87$). Speed-to-market is measured by the extent to which the innovation was delivered quickly according to schedule. Customer satisfaction is measured by the extent to which the innovation met customer expectation. Efficiency was measured by the expectations that management had about the level of staff hours and financial resources used (excluding staff hours) at the beginning of the project in completing the project ($\alpha = 0.81$). The specific questions used in our surveys are found in Appendix 1.

Organization strategy. Organization strategy was measured by organization-level reward, organization-level development, and organization-level cross-functional routine communication. Organization-level reward was measured by the extent to which managers other than functional managers have influence over individuals' rewards in terms of promotion opportunities, salary increase, bonus payment, and job assignment (Katz and Allen, 1985; Lawrence and Lorsch, 1967; Milgrom and Roberts, 1992; Morrill, 1995). Organization-level development was measured by the extent to which new professional employees are provided with cross-functional orientation (Nohria and Ghoshal, 1997). Finally, organization-level cross-functional routine communication was measured using three factors ($\alpha = 0.85$): (1) meetings between management and non-management employees from different functions to discuss work-related issues; (2) meetings between non-management personnel from different functions during personal time to

discuss work-related issues; and (3) meetings between non-management personnel from different functions during personal time to discuss non work-related issues.

Project team strategy. Project team strategy was measured by project team reward, project team development, and project team routine communication. Project team reward was measured by evaluating the extent to which project team outcome affected team members' salary increases, bonus payments, promotions, and job assignment ($\alpha = 0.78$). A value of 1 was given for each of these components affected. Project team development was measured using a Likert scale to evaluate the extent to which the team agreed that they received training specifically for working on the project as an initial step in their teamwork. Project team routine communication was measured using four items to assess communication among team members ($\alpha = 0.83$): (1) face-to-face meetings, (2) face-to-face meetings informally with only certain team members, (3) phone conversations, and (4) electronic mail. Measures were based on previous team-innovation studies (Griffin and Hauser, 1992; Subramaniam and Venkatraman, 2001). The specific questions used to measure the variables are found in Appendix 2.

Control variables. We controlled for industry and country of origin of the firm using dummy variables. Additionally, at the project team-level, we controlled for tenure diversity and functional diversity. Previous studies have shown that these demographic variables have an influence on team processes and outcomes (Ancona and Caldwell, 1992; Keller, 2001; Smith et al., 1994). Consistent with this research, we measured tenure diversity using the team members' tenure standard deviation divided by its mean. The same procedure was followed to measure functional diversity.

Method of Analysis

In order to answer the question of whether organization and project team strategies are substitutes (Hypothesis 1) or complements (Hypothesis 2) for developing the capability to mobilize knowledge and create knowledge for innovation, we ran regression models for the organization strategy (Model A), project team strategy (Model B), and both strategies (Model C).

The specific models are the following:

Model A. *Outcomes of the capability to mobilize and create knowledge for innovation* = $\alpha + \beta_1$ *Organization-level reward* + β_2 *Organization-level development* + β_3 *Organization-level routine communication* + β_7 *Industry₁ control* + β_8 *Industry₂ control* + β_9 *Country of origin control* + ε

Model B. *Outcomes of the capability to mobilize and create knowledge for innovation* = $\alpha + \beta_4$ *Project team reward* + β_5 *Project team development* + β_6 *Project team routine communication* + β_7 *Project team tenure diversity control* + β_8 *Project team functional diversity control* + β_9 *Industry₁ control* + β_{10} *Industry₂ control* + β_{11} *Country of origin control* + ε

Model C. *Outcomes of the capability to mobilize and create knowledge for innovation* = $\alpha + \beta_1$ *Organization-level reward* + β_2 *Organization-level development* + β_3 *Organization-level routine communication* + β_4 *Project team reward* + β_5 *Project team development* + β_6 *Project team routine communication* + β_7 *Project team tenure diversity control* + β_8 *Project team functional diversity control* + β_9 *Industry₁ control* + β_{10} *Industry₂ control* + β_{11} *Country of origin control* + ε

Our decision rules regarding whether these two strategies are complements or substitutes are as follows: (1) The strategies identified have no impact on the capability to create and

mobilize knowledge for innovation if model A, B, and C are not statistically significant, or the coefficients of the strategies are not statistically significant. In this case, although the strategies are theoretically sound, they are not empirically supported. (2) The two strategies are pure substitutes for each other if models A and B are statistically significant and the coefficients of the strategies are statistically significant, while model C is not statistically significant or the coefficients of the strategies are not statistically significant. (3) The organization and project team strategies are pure complements if models A and B are not statistically significant or the coefficients of the strategies are not statistically significant, while model C is statistically significant and the coefficients of the strategies are statistically significant. (4) The strategies are substitutes and partial complements if models A and B are statistically significant and the coefficients of the strategies are statistically significant, while model C is also statistically significant and the coefficients of the strategies are statistically significant.

In the fourth case, a rule is needed to determine whether it would be recommended for managers to use both strategies when they can obtain the desired results, the outcomes of the capability to mobilize and create knowledge, with each strategy independently. As a rule of thumb, at least an additional 50% increase in explanatory power is expected when the firm undertakes two strategies rather than just one. We chose the cut-off point for recommending the strategy as a 50% increase in explanatory power to compensate management for the effort of undertaking both strategies instead of just one. If the firm invests in both strategies, we expect to see a higher return on this investment than when only one of the strategies is used.

RESULTS OF THE EMPIRICAL ANALYSIS

Table 1 presents the descriptive statistics and correlation matrix. Before testing the relationships among constructs, we analyzed the relationships among variables within constructs.

The correlation coefficients between dependent measures are relatively low, with the highest being only $r = 0.36$. Therefore, we do not expect any major biases in project managers' ratings of the projects. We also observe a relatively low correlation between organization-level management practices and between project team management practices. Therefore, we can treat these practices as separate variables.

Insert Table 1 about here

The results of the empirical analysis (Table 2) support the idea that the organization strategy and project team strategy for knowledge mobilization and creation for innovation are substitutes (Hypothesis 1) and provide weak support to the hypothesis that they are complements (Hypothesis 2).

Insert Table 2 about here

The two strategies can be used as substitutes. Organization strategy has statistically significant models and has positive and statistically significant coefficients in all the outcomes of knowledge creation for innovation (Models A.1, A.2, A.3, and A.4). Project team strategy also yields statistically significant models and positive and statistically significant coefficients for the same outcomes of knowledge creation for innovation (Models B.1, B.2, B.3, and B.4). Both strategies have similar explanatory power. Hence, the strategies can be used interchangeably to achieve the capability to mobilize and create knowledge for innovation.

The two strategies are weakly partial complements. Although the combination of both strategies generates statistically significant models and positive and statistically significant results for all the outcomes (Models C.1, C.2, C.3, and C.4), all full models provide only

marginal additional explanatory power over the models with the independent strategies (Models A.1, A.2, A.3, A.4, B.1, B.2, B.3, and B.4). For product innovation as an outcome of the capability to mobilize and create knowledge, the organization strategy explains 37% of the variance while the project team strategy explains 35% of the variance, and both strategies together explain only 38%, which represents an increase in explanatory power of 2% over the organization strategy and of 8% over the project team strategy. For speed-to-market of the innovation, the organization strategy explains 32% while the project team strategy explains 28%. Together, the two strategies explain 34% of the variance, which is an increase in explanatory power of 6% over the organization strategy and an increase of 21% over the project team strategy. For customer satisfaction with the innovation as an outcome of this capability, the organization strategy explains 29% of the variance, and the project team strategy explains 26%. Both strategies together explain 31% of the variance. Again, the increase in explanatory power over the organization strategy is only 6%, and the increase in explanatory power over the project team strategy is 19%. Finally, for efficiency in terms of resources used in achieving the product innovation, the organization strategy explains more of the variance than project team strategy, 33% versus 31%. However, the two strategies together yield an explanatory power of 36%, which represents an increase of around 9% over the organization strategy and of 16% over the project team strategy. Hence, we conclude that the strategies are only weakly complementary.

We also analyzed the effects of the control variables alone on the outcomes of the capability in order to check the robustness of the previous results. The outcomes of these analyses, not presented here, yielded statistically significant models with an explanatory power of under 10%. Therefore, we still conclude that the organization and the project team strategies are substitutes for developing the capability to mobilize and create knowledge for innovation.

CONCLUSIONS

The study suggests that there are two potential investment strategies for developing the capability to mobilize knowledge and create new knowledge for product innovation. On the one hand, we propose the *organization* strategy, where the investment in developing the understanding and willingness of individuals to interact is made independently of when the workforce is organized into project teams for product innovation. On the other hand, we discuss the *project team* strategy, where the investment in developing the understanding and willingness of individuals is made at the project team-level, or after the definition of a task that requires knowledge mobilization and creation across functions.

The study shows that these two strategies are substitutes for each other. The strategies independently lead to the development of the capability to mobilize and create knowledge for innovation. Although these capability development strategies are substitutes, they are not perfect substitutes for each other. There are differences in their explanatory power that allow them to be ranked. On some occasions one strategy explains the outcomes of the knowledge mobilization and creation capability better than the other. Specifically, while for product innovation and efficiency the two strategies appear to be almost perfect substitutes, organization strategy seems to be better for speed-to-market and customer satisfaction than project team strategy. However, these are only preliminary conclusions. More detailed studies are needed to be able to rank the strategies.

This study contributes to theory in several ways. First, it extends the knowledge-based view (Grant, 1996; Kogut and Zander, 1992; Spender, 1996; Tsoukas, 1996) by identifying and analyzing strategies for knowledge creation and not only mobilization. It tests empirically how organizations might invest in developing the capability to mobilize and create knowledge for

innovation, which is considered a major source of competitive advantage. Specifically, it shows that this capability can be developed either through the organization strategy by developing the understanding and willingness among individuals at the organization level independently of when they are needed for innovation, or through the project team strategy by developing them at the project team level as needed when organizing for innovation.

Second, it extends each of the streams of literature in which the strategies are grounded. This study extends the organization-level innovation literature (Lawrence and Lorsch, 1967; Nohria and Ghoshal, 1997; Tsai, 2001) by showing that instead of integrating different functions to generate cross-functional interactions independent of when they are needed for innovation, interactions across these functions can also be created as needed when organized for innovation by using project team management practices. This study expands the project team-level innovation literature (Keller, 2001; Subramaniam and Venkatraman, 2001) by indicating that project teams are embedded in organizations and therefore subject to the routine interactions of their contexts. Thus, firms that already have the cross-functional routine interaction fused in their context do not always require team management practices to generate interactions when they are organized into project teams for innovation.

Third, the study integrates these two streams of literature on innovation within an internally coherent framework based on the extension of the knowledge-based view. It presents a framework of the knowledge creation process that integrates the viewpoints of the two streams of literature on innovation by showing how the processes and management practices that affect innovation influence the two requirements of knowledge creation.

This study suggests several directions for future research. First, we can examine whether these two strategies are complements or substitutes for other outcomes of the knowledge creation

besides for product innovation and other outcomes associated with it. We could analyze the application of the strategies in alternative knowledge creation processes, such as new organizational, marketing or financial practices. We could also examine the use of the strategies not only for knowledge creation, but also for knowledge mobilization, such as in the transfer of practices from subsidiaries to headquarters and vice versa, or among partners in an alliance.

Second, now that we have identified that these two strategies are substitutes, we need to analyze which strategy is more effective in the different outcomes of the knowledge creation process. From the analysis we conducted, it appears that the strategies are relatively equal in terms of the achievement of the outcomes of the capability to mobilize and create knowledge for innovation, with some slight advantage of the organization strategy over the project team strategy for some outcomes. However, a more detailed analysis is needed to be able to conclude that one strategy is superior to the other.

Third, it would be interesting to study the applicability of the strategies to other types of companies to increase the generalization of the results. Small firms might be a good research setting as they are traditionally viewed as more agile in the innovation process. Another interesting setting would be the use of the strategies in companies in other countries besides the United States.

Although the study is primarily academic in nature, it can serve to generate recommendations for managerial practice. This study suggested that managers have the choice of two alternative strategies for developing the capability to mobilize and create knowledge for innovation, and the specific practices that each strategy entails. These strategies are substitutes and enable the firm to achieve the outcomes of the capability independently. Hence, managers have alternative options for benefiting from the knowledge creation process.

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FIGURE 1

Theoretical framework for the development of the capability to mobilize and create knowledge for innovation

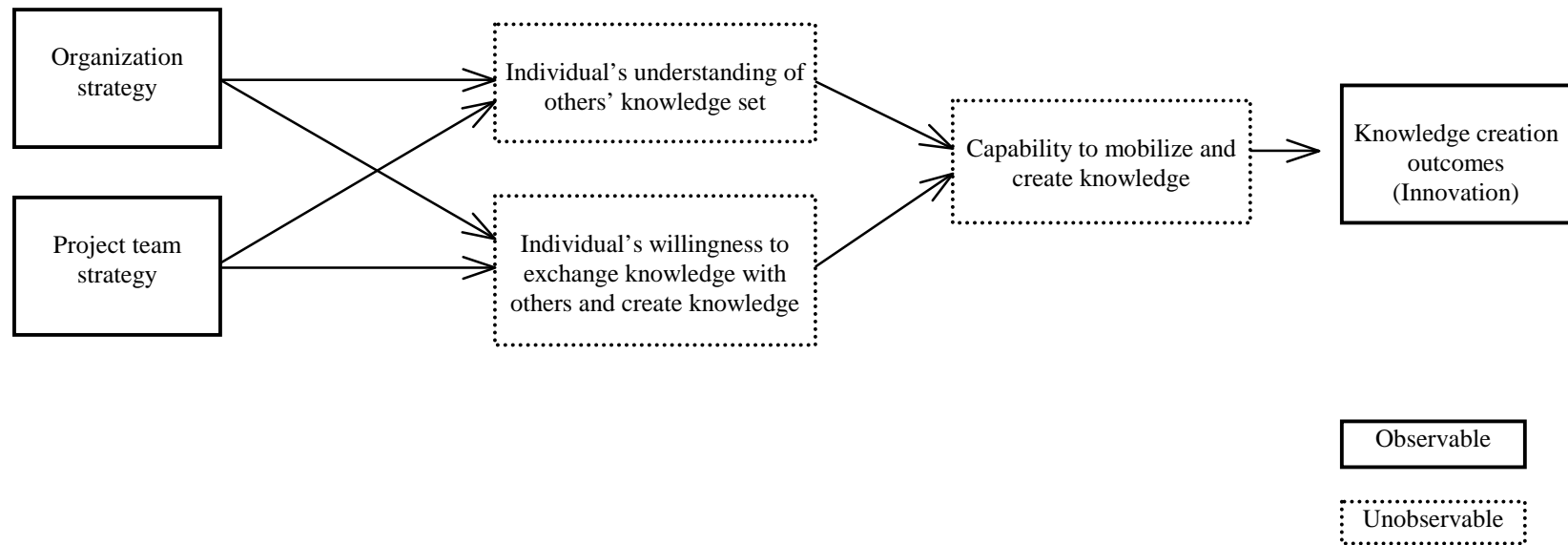


TABLE 1

Descriptive statistics and correlation matrix

		Mean	Standard Deviation	1	2	3	4	5	6	7	8	9	10	11
Outcomes of the capability to mobilize and create knowledge for innovation	1. Product innovation	3.72	3.05	1										
	2. Speed-to-market	3.24	2.90	0.22	1									
	3. Customer satisfaction	4.05	2.85	0.28	0.36 *	1								
	4. Efficiency	1.79	1.85	0.17	0.04	0.18	1							
Organization strategy	5. Org.-level reward	1.12	3.69	0.42 **	0.36 **	0.31 *	0.34 *	1						
	6. Org.-level development	1.37	3.02	0.51 ***	0.48 ***	0.39**	0.43 **	0.22	1					
	7. Org.-level routine communication	2.63	2.65	0.49 ***	0.39 **	0.42**	0.44 ***	0.38 **	0.48 ***	1				
Project team strategy	8. Team-level reward	2.12	1.56	0.34 *	0.37 **	0.38 **	0.39 **	-0.06	-0.26	0.33*	1			
	9. Team-level development	2.91	3.70	0.32 *	0.46 ***	0.41 **	-0.23	-0.19	0.17	0.46***	0.12	1		
	10. Team-level routine communication	2.78	2.10	0.58 ***	0.48 ***	0.47***	0.35 *	0.21	0.36 **	0.53***	0.27	0.38*	1	
Controls for project team strategy	11. Team-level tenure diversity	3.40	1.26	0.22	-0.17	-0.19	-0.13	-0.23	-0.22	-0.56***	-0.21	0.02	-0.47**	1
	12. Team-level functional diversity	3.63	1.55	0.27	0.01	-0.05	0.50***	-0.25	-0.18	-0.19	-0.28	0.07	-0.19	0.11

* p < 0.05

** p < 0.01

*** p < 0.001

TABLE 2

Results of the regression analysis for testing whether the organization and project team strategies are complements or substitutes

		Outcomes of the capability to mobilize and create knowledge for innovation											
		1. Product Innovation			2. Speed-to-market			3. Customer satisfaction			4. Efficiency		
		Model A.1	Model B.1	Model C.1	Model A.2	Model B.2	Model C.2	Model A.3	Model B.3	Model C.3	Model A.4	Model B.4	Model C.4
		Organizat.	Team	Both	Organizat.	Team	Both	Organizat.	Team	Both	Organizat.	Team	Both
Organization strategy	Organization-level reward	0.47 ** (0.11)	-	0.63 *** (0.11)	0.55 *** (0.17)	-	0.68 *** (0.14)	0.61 ** (0.21)	-	0.74 *** (0.26)	0.39 ** (0.11)	-	0.88 *** (0.24)
	Organization-level development	0.92 *** (0.23)	-	0.82 ** (0.21)	0.88 *** (0.30)	-	0.73 *** (0.29)	0.93 *** (0.21)	-	0.87 *** (0.26)	0.66 ** (0.25)	-	0.73 *** (0.16)
	Organization-level routine communication	0.85 *** (0.16)	-	0.94 *** (0.21)	0.83 *** (0.32)	-	0.52 *** (0.09)	0.77 *** (0.26)	-	0.68 ** (0.21)	0.59 ** (0.22)	-	0.81 *** (0.33)
Project team strategy	Team-level reward	-	0.39 ** (0.13)	0.45 * (0.13)	-	0.38 *** (0.09)	0.47 ** (0.21)	-	0.39 *** (0.10)	0.69 *** (0.13)	-	0.53 *** (0.21)	0.71 *** (0.24)
	Team-level development	-	0.83 *** (0.21)	0.52 *** (0.13)	-	0.63 *** (0.14)	0.55 *** (0.19)	-	0.48 ** (0.14)	0.92 *** (0.33)	-	0.47 * (0.21)	0.65 *** (0.27)
	Team-level routine communication	-	0.72 ** (0.29)	0.81 *** (0.26)	-	0.49 ** (0.15)	0.72 ** (0.34)	-	0.90 *** (0.26)	0.85 *** (0.19)	-	0.49 ** (0.21)	0.66 ** (0.26)
Controls	Team-level tenure diversity	-	0.29 ** (0.09)	0.32 * (0.11)	-	0.52 ** (0.19)	0.17 (0.21)	-	0.58 *** (0.14)	0.26 * (0.11)	-	0.71 *** (0.32)	0.62 (0.51)
	Team-level functional diversity	-	-0.23 (0.19)	0.39 (0.23)	-	0.27 (0.14)	0.39 (0.20)	-	0.44 * (0.17)	0.32 (0.19)	-	0.42 (0.73)	0.33 (0.27)
	Industry ₁	-0.18 (0.18)	0.12 (0.42)	0.11 (0.14)	0.41 (0.61)	0.17 (0.31)	0.29 (0.44)	0.38 ** (0.11)	0.36 (0.17)	0.39 * (0.15)	0.68 ** (0.19)	0.46 (0.42)	0.19 (0.13)
	Industry ₂	0.21 (0.14)	0.25 (0.19)	0.19 (0.12)	0.63 ** (0.16)	0.53 ** (0.22)	0.74 (0.52)	0.75 ** (0.27)	0.81 * (0.37)	0.14 (0.07)	0.61 ** (0.22)	0.22 (0.17)	0.16 (0.14)
	Country of origin	0.18 (0.23)	0.41 (0.35)	0.19 (0.42)	0.22 (0.18)	0.19 (0.18)	0.38 (0.27)	0.28 (0.31)	0.52 (0.81)	0.78 ** (0.22)	0.43 (0.26)	0.69 (0.34)	0.34 (0.39)
	Intercept	4.97 *** (0.63)	2.17 ** (0.89)	3.78 *** (0.91)	3.24 *** (0.53)	4.67 *** (0.99)	4.39 *** (0.87)	2.55 *** (0.16)	2.77 *** (0.32)	3.64 *** (0.29)	3.76 *** (0.59)	4.11 *** (0.63)	2.99 *** (0.17)
F	4.99 ***	4.32 ***	4.99 ***	4.77 ***	3.63 **	4.10 **	4.82 ***	3.89 **	4.29 ***	3.89 ***	4.52 **	5.22 ***	
R ²	0.42	0.36	0.46	0.46	0.37	0.49	0.43	0.32	0.46	0.39	0.38	0.42	
Adjusted R ²	0.37	0.35	0.38	0.32	0.28	0.34	0.29	0.26	0.31	0.33	0.31	0.36	

White's heteroskedastic-consistent standard errors in parentheses.

* p < 0.05

** p < 0.01

*** p < 0.001

APPENDIX 1

Dependent variables and measures

Product innovation, customer satisfaction, and speed-to-market

◆ Please use the following scale to rate the performance of the following teams working on the projects listed below.

(5) Strongly Agree (4) Moderately Agree (3) Slightly Agree (2) Slightly Disagree (1) Strongly Disagree

The projects:	Project #1	Project #2	Project #3	Project #4	Project #5
1. The project led to new product development	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. The project led to product modification	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. The team delivered the product to the customers according to schedule	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. The outcome of the project (innovation) met customers' expectation	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Efficiency

◆ Please rate the performance of the following teams working on the projects listed below. Please indicate the level of resources used in completing these projects as compared to what was expected by management at the beginning.

The projects:	Project #1	Project #2	Project #3	Project #4	Project #5
1a. In terms of <u>man hours</u> used, it was _____	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected
1b. In terms of financial resources used (excluding man hours), it was _____	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected	¹ <input type="checkbox"/> More than expected ² <input type="checkbox"/> Same as expected ³ <input type="checkbox"/> Less than expected

APPENDIX 2

Independent variables and measures

Organization-level reward

(5) Strongly Agree (4) Moderately Agree (3) Slightly Agree (2) Slightly Disagree (1) Strongly Disagree

◆ *Managers outside the functional areas have an impact on employees' rewards (e.g., promotion, salary increase, bonus payment, and favorable job assignment).*

Organization-level development

(5) Strongly Agree (4) Moderately Agree (3) Slightly Agree (2) Slightly Disagree (1) Strongly Disagree

◆ *The company provides cross-functional training to all new professional employees (e.g., engineers, sales/marketing, and customer services).*

Organization-level routine communication

◆ *For this section, please answer the following questions about the communication pattern between the sales/marketing, customer service and engineering functions (e.g. R&D and manufacturing) in their daily work. Please place a (✓) in the relevant boxes.*

	(5)	(4)	(3)	(2)	(1)
Frequency/types of communication	Once/1-2 weeks	Once/2-3 weeks	Once/3-4 weeks	Once/1-2 months	Once/2-3 months
1. Non-management employees from <u>different</u> functions meet with peers to discuss work-related issues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Employees from <u>different</u> functions spend their personal time with each other (e.g. coffee breaks, lunch, after work) involving work-related issues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Employees from <u>different</u> functions spend their personal time (e.g. coffee breaks, lunch, after work) NOT involving work-related issues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Project team reward

◆ *The performance of the team impacted your (more than 1 answer possible):* Salary increase Bonus payment Promotion Job assignment none of these

Project team development

(5) Strongly Agree (4) Moderately Agree (3) Slightly Agree (2) Slightly Disagree (1) Strongly Disagree

◆ *You received some training at the beginning of the project specifically for working on this project.*

Project team routine communication

Please indicate how frequently you communicated with other team members and how by placing a (✓) in the relevant boxes.

	(5)	(4)	(3)	(2)	(1)
Frequency/Type of communication	Daily	More than once / week	Once / 1-2 weeks	Once / 2-3 weeks	Once / 3-4 Weeks
1. Meeting: How frequently did you <u>formally</u> meet as a team?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Phone: How frequently did you communicate with other team members via the phone?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. How frequently did you meet <u>informally</u> with some of the team members?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. E-mail: How frequently did you communicate with other team members via e-mail?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>