Managing Innovation Development Across Borders in the Multinational Firm: The Role and Effectiveness of Coordinating Units

by

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Abstract

For multinational firms in many industries, cross-border innovation development – the process of combining capabilities from units in several countries to create new products, services or ways of doing business – is an increasingly important source of competitive advantage. However, in order to reap its benefits, the firms need to overcome significant organizational obstacles. One of them is the need to find an effective balance between local unit initiative and central intervention, between horizontal cooperation and vertical coordination.

The current study focuses on the role of central coordination units, like corporate, divisional and regional headquarters, in cross-border innovation development projects. It also examines conditions that influence how effectively the coordinating units support cooperation among local units in these projects.

The study combines interviews that provide information richness and a survey that allows large-sample testing of hypotheses. Based on exploratory case work in three countries and a review of the literatures, the research framework is developed and tested with a survey of large multinational firms in various industries. The quantitative analyses use data from 3 firms with 40 innovation development projects and 101 participating organizational units.

According to the results, the roles of central units depend mostly on their comparative unit-specific advantages vis-à-vis the local units, seen in terms of resources, inter-unit relations, cultural differences, uncertainty, and motivation. Their effectiveness is jointly determined by the size of their comparative advantages and various aspects of project coordination complexity. The findings support the notion of differentiated fit in multinational firms, and reveal current capability boundaries.

The study contributes to the international management literature a better understanding of cross-border innovation development. It complements previous, mostly case-based research with quantitative analysis. To the strategy and capability literatures, it adds insights about a dynamic capability that increasingly affects firm performance, and shows when central units can add value to the activities of local units. To the innovation management literature, it adds a contingency view of central support and an exploration of links between innovation development and subsequent innovation transfers. Practitioners may also find the implications for capability development, knowledge management and innovation project management useful.

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For multinational firms in many industries, cross-border innovation development – the process of combining capabilities from units in several countries to create new products, services or ways of doing business – is an increasingly important source of competitive advantage. On the one hand, this contribution to competitive advantage stems from the comparative benefits of cross-border development over local innovation development, the traditionally dominant innovation development process in these industries. For example, when a firm knows how to manage cross-border innovation development, it can assign its best globally available resources to an innovation opportunity wherever it arises. It can also more easily design the innovation for rapid firm-wide leverage; and it gains operational flexibility during the development process.

On the other hand, cross-border innovation development contributes to competitive advantage not just because of its benefits, but also because it is difficult to manage as an organizational process. It bridges diverse national business environments, involves communication across large geographic distances, faces language and cultural differences, and needs to cope with incompatible, locally adapted routines and technical systems. On top of all this, it is, like any other innovation process, full of uncertainty and risk. Therefore, cross-border innovation development often creates an attractive, yet formidable, organizational challenge to a multinational firm. But for the very reason that no firm can easily master the challenge and enhance its cross-border development capability, capability-building efforts can lead to fairly sustainable advantages.

This challenge is especially great for multinational firms in a period of transition towards higher decentralization of innovation activity. On the one hand, they are moving towards giving the dispersed, local units greater responsibility and initiative for entrepreneurial activities, and accordingly reducing the innovation roles of central coordinating units, such as corporate, divisional and regional headquarters. On the other hand, they still need to keep central units involved because the local units need time and effort to build the capability to collaborate autonomously with peer units elsewhere in the firm.

Previous research suggests that cross-border innovation development projects currently require not only a strong horizontal cooperation capability among local units, but also a carefully chosen distribution of activities and responsibility between local units and central coordinating units. Depending on the strength of the component of vertical cooperation when central units are involved, cross-border innovation development projects can fall anywhere between two extreme organizational alternatives: on the one end, a fully horizontal process among peer units which are not in a hierarchical reporting relationship, and, on the other end, a vertically dominated process in which one or more central coordinating units possess all responsibility and strong authority over the local units. The vertically moderated projects in between are characterized by a certain influence and involvement of central coordinating units, while some, if not most, responsibility and authority are distributed among peer units.

How, then, do multinational firms organize cross-border innovation development to meet its challenges? In particular, how do they try to achieve a balance between local unit initiative and central intervention, between horizontal cooperation and vertical coordination? This is the focus of the current study, which analyzes to what extent and how multinational firms distribute the

responsibility for cross-border innovation development projects between central coordinating units and local units. The study also examines the conditions that influence the effectiveness of a chosen organizational approach. Numerous previous studies have shown, for instance, that the involvement of central units has a positive effect on project performance. This study takes a closer look at the fit between the project role of central units and the needs of the local units to assess their effectiveness.

The study contributes to the international management literature a better understanding of cross-border innovation development. It complements previous, mostly case-based research with quantitative analysis. To the strategy and capability literatures, it adds insights about a dynamic capability that increasingly affects firm performance, and shows when central units can add value to the activities of local units. To the innovation management literature, it adds a contingency view of central support and an exploration of links between innovation development and subsequent innovation transfers. Practitioners may also find the implications for capability development, knowledge management and innovation project management useful.

The methodological approach is a combination of case studies that provide information richness and a survey that allows large-sample testing of hypotheses. Based on exploratory case studies in 3 countries and a review of the literatures, the research framework is developed and tested with survey data from 3 firms with 40 innovation development projects and 101 participating organizational units.

The thesis is structured as outlined in Figure 1. The first chapter introduces the management of cross-border innovation development projects as research topic. Chapter 2 positions the study within the associated literatures. After a discussion of the research methodology in Chapter 3, Chapter 4 presents the research framework as the outcome of the initial case studies. Chapters 5 through 8 are dedicated to the various survey analyses. The implications of the research are presented in Chapter 9. Chapter 10 concludes the dissertation with a summary of the findings.

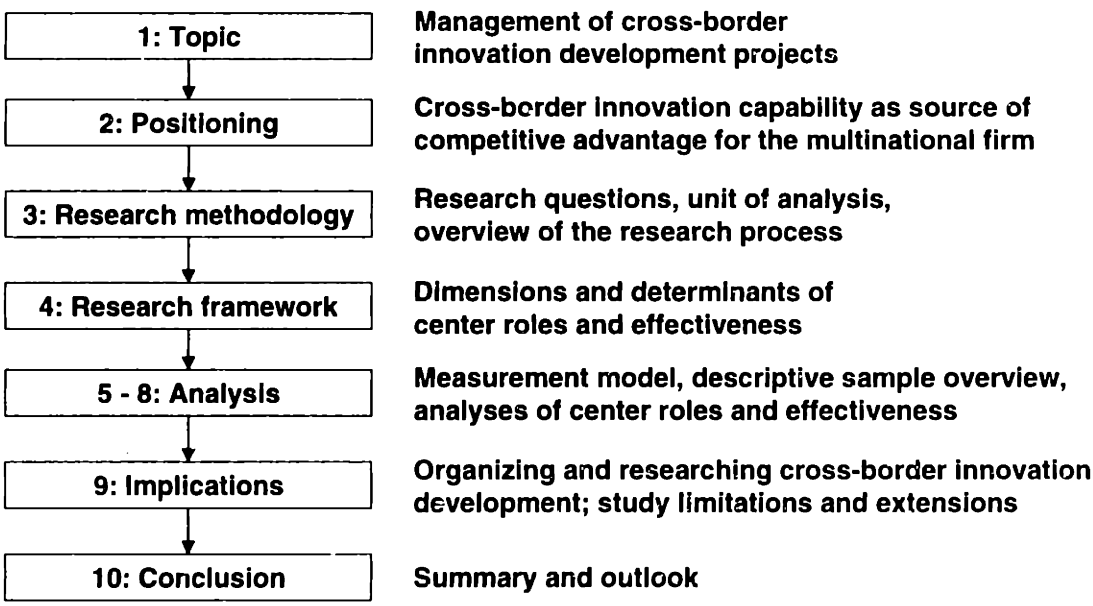

Figure 1: Structure of the thesis

1.1 Cross-border innovation development

The salient characteristic of cross-border innovation development in the multinational firm is dispersion. Dispersion takes four main forms: geographic dispersion of inputs into the development process, dispersion of favorable context conditions for development activities, dispersion of stimuli to develop innovations, and dispersion of opportunities to use the innovations (Bartlett 1986; Ghoshal 1986; Cheng and Bolon 1993; Granstrand, Håkanson et al. 1993; Brockhoff 1998).

Relevant inputs for innovation development, ranging from raw materials and process equipment to people with expert knowledge, products and services from co-specialized organizations, may be geographically dispersed for a variety of reasons. For example, certain inputs may be available in some places only or prohibitively expensive to transport. Process equipment may be too expensive to keep redundant in all locations. Useful organizational capabilities may have developed locally and not spread internationally (Kogut 1991; Szulanski 1995). And people with expert knowledge may be tied permanently to local settings that stimulate knowledge development.

Among the local conditions in the firm's environment that encourage dispersion of development activities, activities of local governments are particularly salient. They may establish favorable legislation and jurisdiction, insist on "local content" if the firm intends to serve the national market, or offer financial incentives for local activities. In addition, certain national business systems may have particularly attractive institutional and industry configurations (Porter 1990; Whitley 1992) of which the firm can take advantage during innovation development.

Dispersed lead users (Von Hippel 1986) and "hot spots" (Pouder and St. John 1996) create valuable external stimuli to develop innovations, often significantly before demand for the innovations arises more broadly across national markets. They tend to be more dispersed today than before because national markets have assimilated in terms of their level of sophistication. Assimilation of markets, the globalization of customer industries and narrowing time frames to capture value with innovations (Stalk and Hout 1990) also push firms to quickly search for and exploit internationally dispersed opportunities for innovation use. In consequence, firms introduce market innovations faster across national markets and organizational innovations more rapidly across their local organizational units.

If the dispersion of stimuli, inputs, favorable contexts and opportunities for innovation use does not allow the firm to co-locate the activities to develop an innovation, it needs to coordinate them across distance. The result is usually a cross-border innovation project. Such projects account for many widely acclaimed products and services. Consider, for instance, the development of the Nissan Primera, a car specifically intended for both international production and marketing.[1] As

[1] References to named firms in this document are taken from publicly available sources, unless explicitly stated otherwise. One cannot infer from a reference to a named firm that the firm was, or was not, one of the anonymous firms in this study.

described by Nonaka and Takeuchi (1995), Nissan had designated production sites in Japan and Great Britain, declared the goal to source 80 percent of components from Europe, and was planning to serve key markets in Europe as well as the US and Japan. Therefore, Nissan had to rely on international collaboration among units from the very start of the project, and for large parts of the value chain. Another example is ABB's platform for a distributed control system, which drew on capabilities from several countries in Europe and the US and was developed for global use (Ridderstråle 1996). Like the Primera project, it required massive international coordination and a sophisticated project management structure to be successful. An example from the computer industry is IBM's VSE software system, where a new release usually requires between 50 and 150 person years of work, in the past typically distributed among between four and eleven international locations (Gassmann 1997).

The international development processes to create these innovations share several characteristics. Most obviously, their goal is to develop an output that differs from what is currently available within the firm – be it a product, service, or way of doing business. Second, they unfold mainly within the firm's global network among a group of dedicated local project teams. Even if external parties are involved, the bulk of the activity remains within the boundaries of the firm. Third, the activities make units in different countries interdependent, in the sense that progress and outcome of the activities depend on decisions and actions taken in the various locations. The degree of interdependence can range from loose coordination, when units develop parts of the innovation pretty autonomously, to tight reciprocal interdependence that requires units to align decisions and activities frequently (Thompson 1967). Fourth, the interdependence is temporary and usually ends with the completion of development. Therefore, project management methods and organizational project approaches are required, as opposed to methods to handle routine, ongoing business.

Because a cross-border innovation development project needs intense coordination across borders and often encounters numerous other obstacles, several levels of managers are usually involved and assume complementary roles. Nissan's top management was critical to launching the project, pulling together the necessary resources, and specifying project goals before project mangers on lower levels took on the responsibility of day-to-day coordination among the organizational units. In ABB's project, top management representatives and business area managers continuously monitored progress, while the project remained highly decentralized throughout. IBM's VSE project seems to have been strongly dominated by lateral negotiations between the independent, participating profit centers, since higher managerial levels mostly acted as arbitrators of last resort.

Another important characteristic is the distribution of resources and capabilities among the participating units, which can be roughly distinguished as being either different and more complementary, or rather similar. For example, US-based market research for ABB's project complemented and supported much of the work performed in units outside the US. which possessed highly specialized technical capabilities. Conversely, Nissan's production sites in Japan and Great Britain brought similar knowledge of the required manufacturing technologies to the project. In case of such specialization, cross-border innovation development projects usually have a pronounced cross-functional flavor.

All these features above also characterize the cross-border innovation development projects that are the focus of this study. The study analyzes projects in which organizational units from different countries interdependently perform complementary or similar activities in order to

develop an innovation. The innovation represents a clear departure from the firms' existing portfolios of products, processes and ways of doing business. It is mostly developed within the firm, even though external parties can contribute to the project. Units on several organizational levels are involved in the project, and may take on different roles. The study thus excludes projects that do not yield an innovation, unfold within one country, only involve cooperation between one organizational unit and external organizations, do not involve organizational units on several levels of the firm's organizational structure, and activities which are managed as ongoing routine business and not as a clearly delineated project.

1.2 Challenges and promises of cross-border innovation development

A cross-border innovation development project faces many challenges. Some of them are innate to any kind of innovation development process (Van de Ven 1986), some are amplified in the multinational setting, and some are idiosyncratic to it (Westney 1990).

A main challenge in innovation development is to manage the gap between the existing and the new. By their very nature, innovations require change, a departure from the old. Therefore, innovation projects may encounter resistance from institutionalized patterns within the firm that usually preserve and reinforce themselves (Selznick 1957; DiMaggio and Powell 1983). To overcome it, the projects require legitimation from the firm's strategy (Burgelman 1983) and support from managers who promote and back them within the firm (Witte 1973; Hauschildt and Chakrabarti 1988).

Even when little change is needed, innovation development can compete with routine business for scarce resources, like funds or skilled employees. Such conflicts can occur within and across units. If unattended, they may undermine the quality of resources, coaching and other support the development teams receive from their units to support effective performance (Hackman 1990). Time pressure, a common condition for development projects, aggravates resource conflicts, since any delay is associated with high opportunity costs (Brockhoff, Picot et al. 1988; Eisenhardt and Tabrizi 1995) and may therefore require giving the project priority.

Additional difficulty arises from the uncertainty, lack of full awareness and understanding of the innovation opportunity that often surrounds cross-border innovation development projects. At the project launch, customer needs and preferences may be little understood, the specifications of the innovation may be yet unclear, and the detailed structure of the development process may not be worked out. Moreover, the projects may "fall into a vacuum where no shared understandings exist to make them meaningful" (Dougherty and Heller 1994:200). In the multinational setting in particular, it is often an open question to what extent an innovation has potential across countries, and if so, how the innovation needs to be adapted to each of them (cf. Doz, Bartlett et al. 1981). Thus, projects require careful management of attention (Van de Ven 1986; Ocasio 1996), mental models and emerging concepts (Nonaka and Takeuchi 1995), particularly at the outset.

Problems related to uncertainty tend to be particularly salient if the firm needs to develop an innovation internationally in an area in which it has traditionally developed innovations locally. This happens increasingly, since current competitive conditions push firms towards exploiting international innovation opportunities in parts of their value chains that they have so far not attended to, either because they have been mostly local before or not been the target of major innovation efforts. The reason is that recent developments, such as business process

reengineering, benchmarking, knowledge management and global enterprise resource planning systems, along with quickly falling computing and communications technology costs, have provided an enhanced technological and organizational basis for these innovations. With this basis, international innovations can, for example, now better streamline procurement as part of global supply chain management. Other functions, like finance, human resources or production, can benefit from innovations that introduce or improve world-wide technological platforms or organizational standards. And, of course, global customers often require firms to develop and introduce innovations globally as part of their global key account management. In brief, difficulties arise when firms have to manage cross-border innovation development in areas that they have not previously treated as innovation-oriented, and for which they consequently have little experience.

Cross-border innovation development also requires special attention to communication across geographic distance, since distance weakens the coordination power of many commonly used communication means (Allen 1977). Face-to-face communication in particular is comparatively difficult in an international project with widely dispersed participants. More generally, if distance implies less overlap in work hours, synchronous communication means only allow rather limited exchange of information. Thus, international projects need to rely more on asynchronous, less information-rich, means of communication, which in turn makes cooperation more prone to misunderstandings and conflicts.

Another major source of difficulty is rooted in the heterogeneity of environments to which the multinational firm as a whole is exposed. Those environments confront the firm with a variety of local business conditions, as well as a range of institutional and cultural forces (Rosenzweig and Singh 1991; Ghoshal and Westney 1993). For instance, the units face formal or informal pressure from powerful local actors, such as governments; pressure to imitate other local actors and institutions in response to uncertainty; normative pressure from professionalization and standardization; and, of course, incentives to adapt to local conventions and routines, so as to do business successfully.

Each of these forces pushes the local units towards local "isomorphism" (DiMaggio and Powell 1983; Westney 1993; Aoki 1994), and the firm's units accordingly adapt their structures, processes, cultures and cognition patterns (cf. Oliver 1991). Such assimilation of local patterns offers a variety of benefits, including start-up gains from using established cognitive and behavioral templates, higher efficiency of ongoing activities due to shared norms and standards with other actors, increased legitimacy, access to critical resources, and avoidance of negative sanctions (Tolbert 1985; Scott 1987).

By this process, however, external diversity translates into internal diversity and differentiates the firm's units from each other (Lawrence and Lorsch 1967). For instance, unit goals may target local business conditions and stakeholders, rather than the firm as a whole. Work processes and organizational routines may be adapted to the point that even the same task is managed and executed differently from country to country (Kogut 1991; Kedia, Keller et al. 1992; Beechler and Yang 1994). In addition, idividuals usually have not only different mother languages, but also institutionalized cognitive and behavioral patterns, norms and values that differ across countries (Hofstede 1980; Kostova and Cummings 1997).

Such differentiation is especially salient in cross-border innovation development, for it is an organizational process that requires much integration across units. Because the firm's local

environments are heterogeneous, integration problems are often considerable. Each of the ways in which units have adapted can cause cooperation difficulties and require organizational effort to overcome them. According to the literature on dispersed teams (e.g., O'Hara-Devereaux 1994) and the technology transfer literature (e.g., Teece 1977; Kogut and Zander 1992; Szulanski 1995; Kostova and Cummings 1997), those difficulties include diverging assessments of the desired innovation specifications, disputes over the best way to manage the project, and incompatibilities in key terminologies and standard organizational procedures.

Specialization within the firm has similar consequences, and has recently been encouraged by advances in communication technology and declines in transportation costs. It takes two forms: first, specialization of unit capabilities, and second, motivational specialization induced by narrowly targeted unit goals and incentives.

Capability specialization enables the units to better adapt to demands from their external environment, increase their "absorptive capacity" for local innovation opportunities and inputs (Cohen and Levinthal 1990), and build their capabilities quickly and purposefully within the firm. On the other hand, it reduces interdependence and cooperation with other units for routine business (Thompson 1967). This, in turn, limits opportunities for the units to develop the collaboration skills required in cross-border innovation development.

Motivational specialization promotes differentiation to the extent that unit goals and incentives do not overlap, since units will then pay attention to different aspects of their environments and likely choose different organizational means to achieve the goals. Less overlap increases the odds that units enter a cross-border innovation development with incompatible needs and goals, which then reveal themselves in conflicts and motivational cooperation difficulties (cf. Gassmann 1997:85). For instance, units may be held accountable for their own unit-level performance without consideration of, say, overall firm performance (e.g., by running them as cost or profit centers). Then, if the firm does not offer a corporate system to compensate units with scarce resources for support of other units, unit management may resist assigning local experts or special equipment capacity to projects that benefit mainly foreign units, unless the unit receives compensation.

Other motivational problems due to goal differentiation can arise if a project has the potential to change the internal distribution of power among the units, for instance by redefining workflows or altering dependencies (Hinings, Hickson et al. 1974; Pfeffer and Salancik 1978). Thus, if the internal power distribution could change because cooperation requires knowledge exchange among units, or the development of new skills in some units, the currently powerful units may try to shape the project so as to preserve their power. In turn, the less powerful units may attempt to influence it in order to gain power (cf. Ridderstråle 1996:307-8).

PROMISES OF CROSS-BORDER INNOVATION DEVELOPMENT

All these factors make cross-border innovation development projects a challenging organizational task. Nevertheless, multinational firms are increasingly enhancing their capabilities to perform it, for it promises several benefits. The first kind of benefit is flexibility regarding strategy as well as operations: The better the firm can develop innovations across borders, the more options it has in choosing and shifting the locations at which the contributing development activities are performed. This applies in the long run (strategically) and in the short run (for operations).

In the long run, the firm can better co-locate organizational units more closely with sources of capability enhancement (e.g., leading technology providers like universities, and qualified personnel) and innovation opportunities (e.g., lead customers). As mentioned before, it can thus seize favorable local conditions wherever they emerge, avoid unfavorable conditions elsewhere, interact closely with customers when developing an innovation, gain government support for work performed domestically, or avoid stringent legislation.

The short term benefit of location flexibility is the increase in operational flexibility during the development process. Having the opportunity to shift innovation tasks, mandates or resources in an international group of units generates valuable options to react to unforeseen events (cf. Kogut 1985; Malnight 1996). For example, the firm can shift activities quickly in response to fluctuations in factor prices and exchange rates (Lessard 1986; Lessard and Nohria 1990), or according to where development capacity is currently available.

A well-developed capability to develop innovations across borders also supports a higher degree of unit specialization, not just with regard to the business environment, but also within the firm. As to the business environment, locating units close to customers, inputs, opportunities for innovation use or in favorable contexts allows the units to adapt more to local conditions than if they had to interact with them from afar. As to internal organization, it facilitates the internal specialization of units vis-à-vis each other because the firm can involve a unit in innovation development regardless of its location. Therefore, the firm can make unit capabilities less redundant overall, exploit economies of scale, and offer more attractive working conditions for leading talent.

Cross-border innovation development offers other benefits as well. If the firm can connect a more diverse set of people from various countries in the development process, it can use their diversity to stimulate creativity, and thereby turn some of the challenges of cross-border innovation development into benefits. Some Japanese firms have tried to capitalize on diversity by internationalizing their product development activities. Their goal was to increase diversity among the participants and thus reduce the influence of strongly integrating, isomorphic mechanisms within the Japanese business environment (Sakakibara and Kosaka 1991). Obviously, they considered the benefits as higher than the associated difficulties.

Of course the firm also benefits from increased development performance. For one, it can draw on the best resources and capabilities it has internally available, regardless of their location. Besides, it can often hand development activities from location to location if development time is critical (cf. Eisenhardt and Tabrizi 1995). Thus, it is not uncommon in software development to have three or more teams work on the same project on different continents, each passing on its results to the next team at the end of its work day. In industries with highly similar business conditions across countries or important global customers, it can also roll out innovations quickly by involving local units early in the development process, and thus capture market share (cf. Håkanson and Zander 1988; Casson and Singh 1993; Papanastassiou and Pearce 1994). At the same time, the resulting high volume early on shifts learning effects forward in time and compresses the payback time for development expenses, both of which are especially valuable advantages under time-based competition (Stalk and Hout 1990).

1.3 Implications for the current study

Because of these challenges and benefits, multinational firms have strong incentives to manage cross-border innovation development effectively. Managerial responsibility for it lay traditionally at corporate headquarters and in organizational units with global responsibility in the firm's home market, which were also heavily involved in all associated projects. Now, however, firms shift responsibility and involvement away from such centrally positioned units towards local units in the various countries. In consequence, local units display more entrepreneurial initiative and collaborate more directly with foreign peer units than before (Birkinshaw 1995; Hansen 1996).

For several reasons, the shift usually happens only gradually and often partially. First, local units need time and practice to develop the required cooperation capability. Second, they do not have as much an overview of, and interest in, the overall corporate situation as central units unless the shift is supported by more profound organizational change. At the least, this change involves a supporting infrastructure, a culture that encourages initiative on lower levels, and adaptation of unit goals and incentives to a broader range of concern within the firm (cf. Ghoshal and Bartlett 1997). Third, because capabilities are costly to build and sometimes associated with economies of scale, keeping certain innovation-related activities in central units makes economic sense.

Determining how much, and in which regards, a multinational firm should delegate the cross-border innovation development task to local units is therefore a central organizational issue. The flip side of the question is of course which roles central units should assume, depending on the degree of decentralization. Less decentralization positions the firm's cross-border innovation development processes closer to the traditional hub-and-spoke model around central units, whereas more decentralization pushes them closer towards the "heterarchical" network of peer units that collaborate directly with each other (Hedlund 1986; Ghoshal and Bartlett 1990).

Current assessments of these factors in the academic and applied literatures are somewhat contradictory, because they have tended to focus on different capability components. If the cross-border innovation development capability, like other capabilities, consists of four components – physical systems, managerial systems, skills and knowledge, and values (Leonard-Barton 1995), then each of those can possibly be a roadblock to a more desirable distribution of activities within the firm.

Followers of a "rational system" view (Scott 1992) of the multinational firm, among them many information technology vendors and researchers, consider the systems component of the units' capabilities as primary obstacles. They therefore recommend that the firm improve its technical infrastructure and standardize operating procedures to improve communication across locations, facilitate global decision making, and support knowledge exchange among units. According to this view, capability enhancement via the systems component will yield the most benefits and enable local units to become more proactive.

In contrast, advocates of a "natural system" view are mostly concerned about peoples' skills, knowledge and values for cross-border innovation development. They stress that the emergent, incremental, and path-dependent development pattern of any organizational capability requires more organic, bottom-up solutions. It is critical in their opinion to carefully support emerging communities of practice, thereby preserving idiosyncrasies like shared cognitions, terminologies and practices. Since many important capability-enhancing initiatives start locally and rely on rich, shared and often implicit interaction context, top-down measures like the imposition of

global standards may turn out ineffective. Instead, the firm should enhance the "soft" factors that support cross-border innovation development, and develop specific skills and knowledge for international collaboration in the units. As (Ghoshal and Bartlett 1994:91) put it, "stretch, trust and support as the primary dimensions of organizational context ... influence the levels of individual initiative, mutual cooperation and collective learning within companies. Shaping the organizational context, we suggest, is the central task of general managers".

In sum, even though multinational firms have considerable interest in effective management of cross-border innovation development, and even though the topic has received quite some attention to date, existing recommendations are inconclusive.

To enhance the available knowledge of cross-border innovation development, the current study examines quantitatively how firms organize international development projects, and how effective their organizational choices are. Specifically, it focuses on two things: the distribution between central and local units of key activities to effectively integrate the local units' capabilities, and the conditions that make a chosen distribution more or less effective.

The results are intended to help practitioners better organize cross-border innovation development, in particular to prioritize activities to enhance their firm's capability. This includes a better understanding of ways for central units to add value to horizontal cooperation among local units. The contributions of the study to the fields of strategy and international management are discussed in the following chapter, which positions the study within the relevant literatures.

Chapter 2: Cross-border innovation development as source of competitive advantage for the multinational firm

This chapter positions the current study within the literatures by which it is informed, and to which it speaks. The first section focuses on the increasing importance that both the strategy and international management fields assign to organizational resources and capabilities as sources of a firm's competitive advantage. It also explains how cross-border innovation development is becoming a core capability of the multinational firm. The second part discusses organizational forms of cross-border innovation development and reviews the related literatures. The purpose is to show that multinational firms have to adapt cross-border innovation development to a complex set of contingencies. It then becomes clear why it is desirable to gain a better understanding of the role and effectiveness of central coordinating units in cross-border innovation development projects.

2.1 Cross-border innovation development as source of competitive advantage

Resources and capabilities: Determinants of firm performance

Explaining performance differences across firms has always been a central concern in the fields of strategy and international management (e.g., Rumelt, Schendel et al. 1990). Over time, both fields have researched explanatory factors on various levels of analysis and progressively shifted downwards the level on which they perceived the primary source of inter-firm differences to be located.

Early contributions in the two fields mainly addressed the industry as level of analysis. While the strategy literature focused on the (domestic) industry, the international management literature concentrated on the industry located in a particular country. According to then-prevalent models in both fields, performance was mostly determined by the firm's membership in a certain industry, and home country location, respectively. The strategy literature put forth structural, industry-specific explanations such as the number of firms, the concentration of power, and the barriers to entry (Bain 1956). International management pointed towards location advantages of various kinds that all firms in a given industry and country enjoyed, and that were difficult to replicate across national business systems.[2] These advantages were seen as causing international patterns of trade and firm specialization.

Analyses revealing heterogeneity of firm profitability within industries, which obviously could not be explained by industry membership, subsequently shifted the focus of strategy research from the whole industry to groups of firms within it (Caves and Porter 1977; Hatten and Schendel 1977; Rumelt, Schendel et al. 1991). The findings demonstrated that firms in an industry could cluster into strategic groups and jointly benefit from certain conditions that other

[2] This view remains prevalent in the literature on comparative business systems (e.g., Whitley 1992) and has been reaffirmed in recent contributions in international management. Porter (1990), for instance, maintains that the configuration of national business systems can largely explain differences in firm performance across countries. In a similar vein, Kogut (1991) sees country-specific technological and organizing principles as giving local firms persistent advantages over foreign firms.

firms could not imitate, substitute or invalidate. Those "mobility barriers" acted very much like the industry-level entry barriers identified earlier.

International management research supported the notion of within-industry heterogeneity at least implicitly. Specifically, Knickerbocker (1973) found that firms in oligopolistic industries tended to imitate each others' foreign direct investments in an effort "to checkmate the moves of rivals" (p. 2). Imitation appeared to be motivated by the threat of competitive advantage that firms with foreign direct investment would achieve over rivals without such investment. Thus, at any point in time an industry would divide into two groups, i.e., into firms with and firms without foreign investment. Foreign operations could consequently be considered as the "mobility barrier" that could only be overcome with time and effort.

As the resource-based view of the firm established itself within the strategy field (Teece 1982; Wernerfelt 1984), sources of competitive advantage were increasingly considered as firm-specific. The central tenet of the resource-based view was that firms were endowed with idiosyncratic bundles of resources, and that differences in those bundles accounted for heterogeneity in firm performance within an industry (Hansen and Wernerfelt 1989; Peteraf 1993; Rumelt 1991). Those resources were initially defined narrowly as "bundles of potential services", such as money and people (Penrose 1966; Andrews 1971). Procured on factor markets, they could be adapted to the firm and would therefore become more valuable to the firm than to competitors. The definition was subsequently broadened to include all other "stocks of factors that are owned or controlled by the firm" (Amit and Shoemaker 1993:35), or "(tangible and intangible) assets which are tied semipermanently to the firm" (Wernerfelt 1984:172). Many of these were not tradable on markets and could therefore contribute to even more sustainable, firm-specific sources of competitive advantage (Chi 1994).

Research on organizational capabilities and organizational learning has added considerable weight to firm-specific explanations of performance heterogeneity. Countering the prevailing view of the firm as organizational form of choice in case of market failure (cf. Dunning 1981; Williamson 1981; Caves 1982), this research explicitly depicts the firm as superior mechanism to create, internally disseminate and retain capabilities (Conner 1991; Kogut and Zander 1993; Conner and Prahalad 1996). Each capability constitutes a combination of task-related employee knowledge and skill, physical-technical systems, managerial systems, and values and norms (Leonard-Barton 1995:xi, 19, 45). It usually requires a whole bundle of heterogeneous resources,[3] and involves "complex patterns of coordination between people and between people and other resources" across organizational levels (Grant 1991:122).[4]

This systemic, complex and context-dependent nature makes a capability difficult to trade and imitate, and thus leads to persistent inter-firm differences. However, it also means that a capability takes time and effort to build. Its development is a process of "continuous improvement and enhancement that may span a decade or longer" in case of a core competence (Prahalad and Hamel 1990:85; cf. Nelson and Winter 1982). It involves a variety of activities over which each firm has a large degree of control, and which each may approach differently.

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[3] Hart (1995): "Capabilities result from bundles of resources being brought to bear on particular value-added tasks" (p. 988). Also cf. Lado, Boyd et al. (1992).

[4] Congruent with Collis (1994), Leonard-Barton (1995), Nonaka and Takeuchi (1995), Winter (1995), Teece, Pisano et al. (1997).

Those include systematic research and development, learning from customers (Von Hippel 1986) and external technology sources (Leonard-Barton 1995), alliance partners (Hamel 1991; Inkpen and Dinur 1996), organizational benchmarking and business process reengineering (Hammer and Champy 1993), systematic knowledge management (e.g., Davenport and Prusak 1998; O'Dell and Jackson Grayson 1998), and strategic intent (Hamel and Prahalad 1989).

Because firms have considerable difficulty imitating or trading capabilities, yet also much freedom as to how to develop them, their approaches and results can easily differ. Firms are therefore portfolios of idiosyncratic capabilities (cf. Conner 1991 for a review). In this sense, the resource based view, the capabilities literature and research on organizational learning offer firm-specific explanations of organizational heterogeneity and performance differences.

Quantitative research has supported this view substantially. Henderson and Cockburn (1994:77) conclude that "idiosyncratic firm effects account for a very substantial fraction of the variance in research productivity across the firms in our sample". Hansen and Wernerfelt (1989) provide evidence that organizational factors explain a very large fraction of the variance in firm profitability. Similarly, an even more explicit test across levels by McGahan and Porter (1997) reveals that 36 percent of aggregate variance in profitability can be attributed to firm-specific effects, about twice as much as to industry effects.

International management research has demonstrated the growing relevance of firm-specific factors more indirectly, namely, by showing that other sources of advantage had become less important. To paraphrase Dunning (1988), whose eclectic paradigm had very early already pointed out the competitive implications of firm-specific factors, the advantages from "location" shrank, while advantages from "ownership" grew. For instance, due to liberalization and deregulation, multinational firms could better establish operations in their competitors' markets and thus benefit from the same local advantages. In addition, subsidiaries that had operated locally before, but used to be fully dependent on innovations from the firm's home market, enhanced their local capabilities to the point that they could take better advantage of their local business environment and supply innovations to the rest of the firm (Granstrand, Håkanson et al. 1993; Birkinshaw 1996; Birkinshaw and Hood 1998). More generally, firms also became better at managing multi-point competition and undermine competitor advantages in key markets (Karnani and Wernerfelt 1985), which further eroded location benefits. Moreover, leading opportunities to acquire technology and develop innovations got more internationally dispersed. In some industries, dispersion increased mainly because rapidly developing markets closed gaps to established ones (Vernon 1979). In others, it was an indirect effect of deregulation and liberalization. In some industries, products also became more systemic and combined multiple technologies that were each most developed in a different country (cf. Kodama 1992).

To summarize this review, both strategy and international management research today view important sources of competitive advantage as specific to the firm and located within the firm's idiosyncratic portfolio of resources and capabilities. While industry, country and strategic group memberships by themselves may give a firm some base line advantage or disadvantage relative to other firms, they leave it ample opportunity to develop resources and capabilities within the respective boundary conditions, and thus to influence its competitive performance. This of course turns attention to internal organizational processes, and in particular the one that systematically enhances the firm's capabilities: innovation development.

Cross-border innovation development: An emerging core capability of the multinational firm

INNOVATION DEVELOPMENT AS IMPORTANT ORGANIZATIONAL CAPABILITY

How much competitive advantage a multinational firm's resources and capabilities create depends on their immediate value, scarcity, non-substitutability and non-imitability (cf. Barney 1991), as well the sustainability of these attributes over time. Current trends in many product markets and their technological as well as institutional environments suggest that the period over which multinational firms can sustain any given competitive advantage keeps shrinking (cf. Casson and Singh 1993; D'Aveni 1994). Modern information and communication technology not only allow organizational scope to increase more cheaply, but also cut down the time for diffusion of knowledge and reduce the time lags before products and services get imitated. And, as mentioned earlier, firms have lost due to liberalization and deregulation many previously stable location advantages that in turn led to superior capabilities, for firms can then better match the international reach of their rivals' organization.

Additional pressure on the windows of opportunity to exploit existing competitive advantage comes from time-based competition (Stalk and Hout 1990). Firms have learned to proactively exploit the latest capability enhancements in a shorter time frame, often to the point of purposefully cannibalizing existing revenue streams based on less advanced capabilities. For instance, they can do so by applying capabilities quickly across product lines, using increasingly shared product platforms (Nobeoka and Cusumano 1997), marketing channels for cross-sales, and mechanisms that migrate knowledge from high-end to mass market products (Kotha 1995). They can use them across product releases when introducing incrementally modified models in rapid sequence (Banbury and Mitchell 1995; Garud and Kumaraswamy 1995), or across locations, for instance, by standardizing products and services, reducing time lags in international rollouts, and enhancing the internal exchange of knowledge and best practices (Szulanski 1995; Kostova and Cummings 1997). Similarly, increasing use of external benchmarking reduces the time firms need to detect competitor innovations, and systematic management of externally available knowledge (Cohen and Levinthal 1990; Hamel 1991; Leonard-Barton 1995) ensures that they remain on equal grounds with their competitors in interactions with third parties.

When the value of existing capabilities erodes quickly, many firms focus on continuously enhancing their capabilities (cf. Collis 1994; Teece, Pisano et al. 1997). To do so, firms have developed a whole range of specific approaches. Those include "responsiveness to market trends, and short development cycles" (Amit and Shoemaker 1993:35; Eisenhardt and Tabrizi 1995); product design flexibility and rapid prototyping (Sanchez 1995; Sanchez and Mahoney 1997); a focus on lead users and suppliers (Clark, Chew et al. 1987; Clark and Fujimoto 1991) and positioning in technological "hot spots" (Pouder and St. John 1996); and, in general, a strong orientation towards learning from interdependent business arrangements (Inkpen and Crossan 1995).

Firms have also extended purposeful innovation activities into virtually all activities of their value chain. For instance, firms invest heavily in total quality management, management of intellectual capital and knowledge management (cf. Davenport and Prusak 1998; O'Dell and Jackson Grayson 1998). Corporate and business strategies now often include innovation-based goals, for instance, along the lines of the approach 3M pioneered with sales targets for innovative products, or development goals for the firm's intellectual capital (cf. Stewart 1997). In

consequence, firms now systematically exploit areas of activity that they previously did not recognize as relevant for innovation development. Innovation has effectively turned into a concern for all managerial levels and functions. As a result, the distinction between units specializing in innovation, and "executing" units, has begun to blur. There is a growing conviction that important innovations can arise in many, if not all, parts of the firm.

For the traditional R&D function, macro-level data demonstrates particularly clearly that multinational firms are increasingly emphasizing innovation (cf. Cheng and Bolon 1993; Dunning 1994; Duysters and Hagedoorn 1996 for related reviews). For example, US R&D expenditures increased over 60 percent in constant 1982 dollars from 1970 to 1987, the respective Japan expenditures 315 percent, and the amounts for Germany and France almost doubled (Dunning 1994).

The key conclusion is that, while firm-specific resources and capabilities in general have become more important sources of competitive advantage for a multinational firm, innovation-related resources and capabilities are now at the core of the firm's success. Not surprisingly, multinational firms therefore often race to exploit and improve these dynamic "meta"-capabilities (Collis 1994; Brown and Eisenhardt 1995; Teece, Pisano et al. 1997).

CROSS-BORDER INNOVATION DEVELOPMENT IN THE MULTINATIONAL FIRM

The traditional way for multinational firms to generate competitive advantage through innovative activity was to build their innovation capability in their home bases and develop innovations there. Compared to those efforts, international innovation development was secondary (Vernon 1966; Dunning 1981; cf. "center-for-global" innovations in Bartlett and Ghoshal 1989). In a complementary process, subsidiary units abroad would innovate independently within and for their local business environments only, i.e., generate "local-for-local" innovations (Bartlett and Ghoshal 1989). Characteristic for both processes is that the needs and conditions of a particular national business environment influence the development process most strongly, as opposed to giving it an explicitly international perspective.

In contrast, however, the most promising way recently for multinational firms to enhance their innovation capability has been to build and globally manage an international network of organizational units which can contribute to country-spanning innovation development processes. The various benefits of those processes have been discussed before (cf. p. 14). Relevant here is that multinational firms increasingly consider the marginal benefits from cross-border innovation development as larger than those from home-based or purely local innovation development.

Firms have reached such an international network for various reasons, and in a variety of ways (de Meyer and Mizushima 1989; Casson and Singh 1993; Birkinshaw 1995; Birkinshaw and Hood 1998). Those include, first, serious shortage in qualified personnel in their home countries, forcing the firms to hire talent abroad; second, changes in local business conditions that closed or even reversed the gap between their markets and the home market; third, an increasing need for global scale or scope that firms met by growth through acquisitions; fourth, the need to develop economies of scale that firms could best exploit with more modern technology in foreign units; and, fifth, internal capability development over time in foreign units, either in response to local market needs or in order to capture a larger share of the corporate resources allocated among subsidiaries.

The trend towards the international network is most visible in the research and development function, for which studies have demonstrated the growing importance of foreign R&D units within multinational firms (Kuemmerle 1996; Gassmann 1997). For instance, Zander (1998) found that foreign R&D labs of the Swedish multinational firms in his sample accounted for a growing share of filed patents. Dunning (1994), looking at the time frame from 1969 to 1986 and multiple countries, reported a growing fraction of US patents attributable to research outside the parent firm's home base. With an average of 10.6% for the latest period across all countries, it reached peak levels of 40% and more for the UK, Switzerland, Belgium, and the Netherlands. In Germany, foreign R&D expenditures grew to 17% of total R&D expenditures of German multinational firms in 1995 (Deutsche Bundesbank 1996), and in the US to more than 10% of US firms (National Science Board 1996). As to Japanese firms, almost half of all new R&D units established during the 1970s by the Japanese firms were located abroad, and 84% of all that were established during the 1980s, according to a recent survey (Pearce and Singh 1992; Papanastassiou and Pearce 1994). Continuing this trend, Japanese firms have roughly doubled the number of foreign R&D labs since 1990 (Kurokawa and Iwata 1997).

2.2 The organization of cross-border innovation development

Within the firm's international network, local units typically contribute to three types of cross-border innovation development projects. The types differ in the distribution of capabilities among the participating units, and the resulting requirements for international capability integration. For illustration, consider projects that require only one or two functions, and within each function two distinct functional capabilities. This could be a technical function with hardware and software engineering capabilities, and a marketing function with market research and customer service support capabilities. Assume further that these capabilities are distributed between only two organizational units. Figure 2 shows the relevant possible distributions and resulting project types, whereby T_1 and T_2 denote the technical, M_1 and M_2 the marketing capabilities.

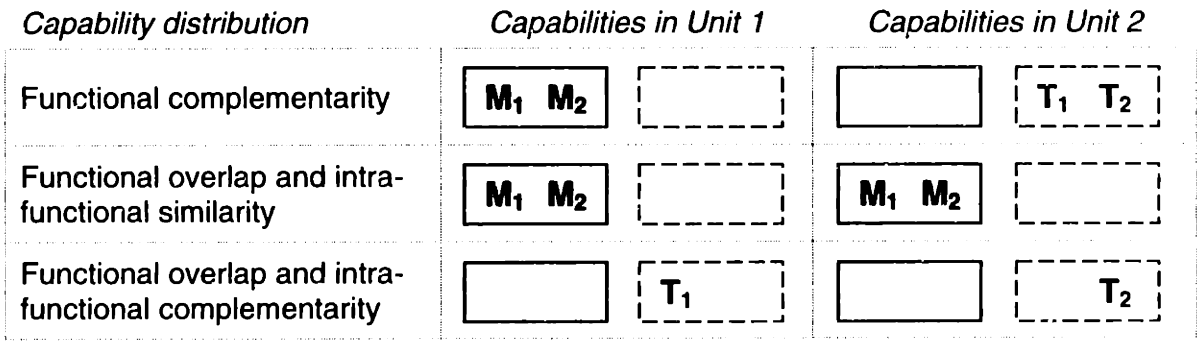

Figure 2: Typology of cross-border innovation development projects

The required capabilities can be distributed among the two units in three ways. In case of functional complementarity, each unit contributes capabilities from a different function. A typical example would be a marketing unit (unit 1) collaborating with an R&D lab in another country (unit 2) to develop an innovative product for a key local customer. The second project type refers to cases in which the units contribute similar capabilities from the same function. For

example, two marketing units from different countries may collaborate to develop a marketing-specific innovation, with the same marketing capabilities in each unit, only adapted to the respective local business conditions. Multinational firms also use such projects to compress development time (Eisenhardt and Tabrizi 1995) by rotating work in progress continuously among units that are several time zones apart. In projects of the third type, units contribute complementary capabilities that belong to the same function. This is a common situation when an innovation requires multiple technologies, and when each R&D unit specializes in one of them.

The above typology, and the organizational challenges discussed in the previous chapter, suggest that the organization of a cross-border innovation development project must take a whole range of factors into account: the kind and extent of capability differentiation among the units, their previous relations, the power distribution among them, cultural differences and geographic distance, to mention but a few. The central managerial question thus becomes which part of the firm can best organize and manage the project according to those factors, and should therefore receive authority and responsibility for it. Finding an effective compromise between central management and horizontal networking among the participating units, and understanding how this compromise depends on the particular contexts of the innovation efforts, turns into a core management problem (de Meyer and Mizushima 1989).

Several recent contributions demonstrate that units are often not optimally positioned to take full advantage of the firm's network, and that the involvement of central units can benefit the project. Hansen (1996), in one of the very few quantitative studies on cross-border innovation development so far, analyzes the effects of cooperation among units within the firm on the performance of development projects. Although he does not directly explore organizational process attributes, he can nevertheless show that characteristics of the project context and the project task – e.g., the managing unit's relations within the firm, and the degree of knowledge codification – affect how much and how easily a unit cooperates with others during innovation development. Interpreted differently, his findings indicate that units are not equally capable of collaborating internationally with other units when developing innovations. Consequently, there seems to be opportunity for support from central units. Such support, in order to be efficient and effective, needs to be adapted to the needs of the units and thus reflect a "differentiated fit" within the firm (Ghoshal and Nohria 1989; Nohria and Ghoshal 1994).

Support for this conclusion comes from Ridderstråle (1996), who demonstrates how the organizational context of a cross-border innovation development project shapes project structure. In the projects he studies, the context affects projects by limiting the range of available organizational coordination mechanisms and influencing the project via ongoing dependencies. He describes seven kinds of fits and misfits between project needs and aspects of project organization. One of those refers to the distribution of responsibility and involvement in key project activities within the firm, which, if mainly horizontal and without a "central" component, may cause projects to lack leadership and suffer from resistance from the organizational context. According to his analysis, cross-border innovation development projects face multiple contingencies (cf. Gresov 1989) and require a contingency approach to project organization with both a horizontal and vertical dimension. Key is to overcome the "administrative heritage" of the organizational context in which a project becomes embedded, for the established organizational patterns in the context may run counter to the organizational needs of the project.

Complementary insights about activity distribution between local and central units during the early stage of innovation development projects come from Birkinshaw (1995; 1997), who studies how subsidiaries launch international entrepreneurial initiatives. He finds characteristic activity distributions between subsidiary middle management, subsidiary top management and parent management, thus extending prior research on cross-level processes by Burgelman (1983; 1996) and Bower (1970). Here, too, involvement patterns vary, for example, by the intended scope of the initiative. Even though his process analysis ends at the point at which the initiative is either approved or rejected, and does not extend into the development process proper, one can infer that activities likely remain distributed across levels later on. Local as well as central units play influential roles in cross-border innovation development projects, and the distribution of involvement among them affects project organization and outcome.

In several other studies, a combination of vertical and horizontal cooepration within the firm turns out critical to cross-border innovation development. Nonaka and Takeuchi (1995:129) emphasize intense mutual information exchange between the project development team and higher management levels: "In the middle-up-down model, top management creates a vision or a dream, while middle management develops more concrete concepts that front-line employees can understand and implement." The main responsibility for the innovation development process rests with middle management, which not only manages the process, but also ensures that employees can be easily reassigned and draw readily on resources from all parts in the firm.

Gassmann's 1997 study of cross-border innovation development explicitly considers factors that determine to what extent project activities can be distributed across locations, or need to be co-located. His focus on the relation between project-specific conditions and project organization complements Ridderstråle's emphasis on the relation between project context and project organization. He finds that project-specific conditions lead to a choice of one of four organizational forms, which differ in their degree of central control and project involvement. The most decentralized form relies heavily on horizontal coordination among autonomous local teams. Only the budget decisions are made centrally. In contrast, the form with the most hierarchical structure involves a strong project steering committee with power over the line managers whose employees participate in the project.

His typology describes the link between project characteristics and the distribution of project responsibility and authority rather indirectly, since the former are seen as determining the extent to which project activities need to be co-located, which in turn affects the latter. Nevertheless, it puts Gassmann's study in line with the others discussed above: The distribution of responsibility and involvement, horizontally between local units on the one hand, and vertically between local units and central units, is important, and varies according to project needs.

Gassmann's typology is also quite consistent with typologies of project organization in the product development literature, such as the one by Wheelwright and Clark (1993:esp. 190-196). Their organizational options range from rather horizontal, "functional" and "lightweight" team structures to "heavyweight" and "autonomous" structures in which senior managers act as project managers. In the latter, senior managers may have "full control over the resources contributed by the different functional groups" (p. 196), override organizational procedures, create incentive and reward schemes, and assess performance of the participants from the local units. More generally speaking, the product development literature consistently points towards some form of activity distribution between central and local units. In comprehensive reviews of the literature, senior management support is commonly mentioned, typically in form of, but not limited to, project-

related leadership (cf. Johne and Snelson 1988; Montoya-Weiss and Calantone 1994; Brown and Eisenhardt 1995).

Further review of the related literatures reveals that, besides these contributions, the organization of cross-border innovation development has received comparatively little attention. The international management field has overall been most interested in innovation processes driven out of the firm's home base, rather than horizontal cooperation among subsidiaries (cf. Appendix A: Forms of innovation development in the multinational firm – an overview of existing models). Where it has addressed cross-border innovation development, it has done so mostly on more aggregate levels, such as the firm, industry or country level, often using political or economic rather than organizational theories. Therefore, the processes proper have rarely been looked at.

This is most noticeable in the literature on multinational R&D, the organizational function that participates in a large fraction of cross-border innovation development processes. It has contributed much knowledge about the intensity and determinants of foreign R&D on the macroeconomic, industry and firm levels (cf. Kuemmer'- 1996). Thus, much is known about the motives and means that lead to cross-border innovation development (cf. Granstrand, Håkanson et al. 1993 for a review). However, "very little has been done on the organizational and managerial aspects of multinational R&D", as recent reviews conclude (Cheng and Bolon 1993; see also Gassmann 1997:18). In contrast, the product development literature has addressed the organization of development projects in greater detail, yet has paid comparatively little attention to the idiosyncrasies of the international setting, and its implications for project organization.

To some extent, international cooperation within the multinational firm on the process level has been researched in the technology transfer literature. Yet, as Cusumano and Elenkow (1994:195) summarize in their review, the literature "usually does not elaborate on managerial issues or technical details or focus on internal organizational processes". Moreover, it addresses knowledge exchange for already developed innovations, rather than innovation development (cf. Teece 1977; Vernon 1979; Szulanski 1995; Kostova and Cummings 1997). Zander (1991:43-44) underscores both points by summarizing in his review that "the models of internationalization and international technology transfer stress that production moves out of the home country of an MNC with the aging of a technology ... it is common that internationalization (or the process of international technology transfer) is studied at the firm level".

In sum, existing studies have shed some light on cross-border innovation development projects, and several of them provide extremely rich, detailed accounts of them (cf. Nonaka and Takeuchi 1995; Ridderstråle 1996; Gassmann 1997). Most use a case-based methodology and thus are able to draw a comprehensive picture of the projects' starting conditions, activities and outcomes. Their two key findings with regard to this study can be summarized as follows. First, on project organization, they show that the organizational challenge of international development projects is rooted in a variety of project and context conditions, and typically requires adapted coordination mechanisms. The multinational setting adds complexity that manifests itself in various ways during the projects, and should not be neglected. They therefore recommend a flexible, contingency-oriented approach to cross-border innovation development.

The second central finding is that projects seem to require not only a strongly developed horizontal cooperation capability among local units, but also a carefully chosen distribution of activities and responsibility between local units and coordinating units more centrally located

within the firm's structure. Depending on the strength of this component of vertical cooperation, cross-border innovation development projects can fall anywhere between two extreme organizational alternatives: on the one end, a fully horizontal process among equal organizational peer units, not associated in a hierarchical reporting relationship, and, on the other end, a vertically dominated process in which one or more hierarchically superior units possess all responsibility and strong authority over the local units. The vertically moderated projects in between are characterized by a certain influence and involvement of those central units, while some, if not most, responsibility and authority are distributed among peer units.

With these findings, the studies create an opportunity to shed further light on cross-border innovation development in the multinational firm. In particular, because they predominantly use a case-study methodology, they call for follow-up quantitative research on the factors they have identified as influencing project organization.

Such quantitative research can make several contributions. First, it can demonstrate that these factors are relevant in a larger sample of projects, and thus indicate to what extent their findings are representative of the population of cross-border innovation development projects in multinational firms. Second, it provides a quantitative assessment of the relative importance of each factor. This gives practitioners clues as to how they should prioritize their efforts to make cross-border innovation development more effective, and thus enhance the competitive posture of their firms. At the same time, it signals to researchers which organizational theories appear most relevant for explaining an increasingly important phenomenon in the multinational firm, and opens avenues for more research. Third, quantitative research helps testing for different interrelations and patterns among aspects of cross-border innovation development projects than qualitative work alone can do. Promising areas include indirect and multidimensional effects. These, in brief, are also the contributions the current study intends to make.

2.3 Summary: The organization of cross-border innovation development and its contribution to competitive advantage

Several concurrent trends in the institutional, technical and business environments of multinational firms are turning organizational capabilities into more and more influential determinants of competitive performance. Among them, innovation capabilities are critical. Since the international dispersion of important resources, contexts, stimuli and opportunities for innovation development has increased, since technological and organizational tools to support cooperation across borders have improved, and since the net benefits from such cooperation have grown, the capability to integrate local capabilities in cross-border innovation development projects has become particularly relevant.

Yet, as promising as cross-border innovation development is, it is extremely difficult to manage. Cross-border innovation development projects face a variety of organizational challenges, including the idiosyncrasies of innovation development as a business process and the influences of the multinational setting. These confront multinational firms at a time of large-scale internal reorganization, which witnesses, among other things, a redistribution of authority and responsibility away from central coordinating units like headquarters to local operating units; the declining significance of traditional, formal coordination mechanisms; and the need for speed and flexibility that challenges existing organizational patterns.

Since the capabilities to meet those challenges are costly and time-consuming to develop, an organizational tension arises. On the one hand, it would be desirable to strongly decentralize innovation authority and responsibility to local units. On the other hand, the units' capabilities are often not yet well enough developed to do so fully. Thus, some form of joint involvement and shared responsibility is currently necessary. It combines horizontal cooperation among local units in the firm's international network as well as vertical coordination between local and central units. The key question is under which conditions to choose a certain mix between horizontal and vertical coordination.

Because the topic it is both promising and unexplored, the current study examines organizational aspects of cross-border innovation development projects. Specifically, it analyzes the degree of project decentralization, i.e., the vertical distribution of involvement between local and coordinating units, and how effectively coordinating units support local units. Its quantitative approach appears particularly useful in light of the prevailing case study approach, for it allows to evaluate the significance, relative importance and interrelatedness of determining factors in a large number of projects.

In sum, then, the topic of this study relates as follows to central concerns in the strategy and international management literatures (Figure 3): Decentralization and effectiveness of center involvement are two important aspects of cross-border innovation development, which is in turn part of the multinational firm's capability to develop and leverage innovations globally. This capability is becoming more important a determinant of competitive advantage.

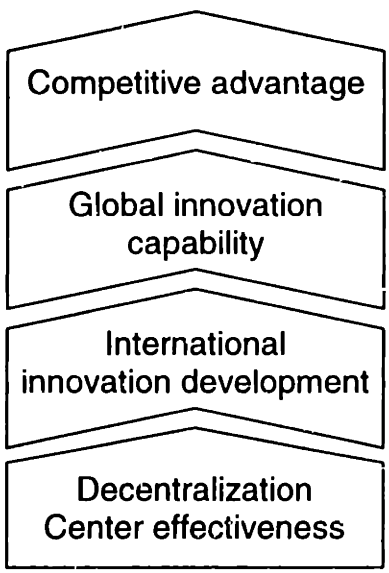

Figure 3: Study topic and central themes in related literatures

Chapter 3: Research methodology

This chapter presents an overview of the research methodology. It describes the research questions, the unit of analysis, gives an overview of the research framework, and outlines the research approach. The research approach was a combination of initial exploratory fieldwork to specify the framework precisely, and a large-sample survey to test the framework constructs and relationships. The research framework is more fully discussed as result of the fieldwork in the next chapter. Subsequent chapters are devoted to the framework test in the survey.

3.1 Research focus and unit of analysis

RESEARCH QUESTIONS AND INITIAL RESEARCH FRAMEWORK

As the discussion in the previous chapters has shown, a central managerial task in cross-border innovation development projects is to effectively integrate the resources and capabilities of the cooperating local units. Since the obstacles to effective integration vary across projects and units, an adapted organizational approach appears necessary. In particular, firms tend to adjust the extent to which they decentralize authority and responsibility for a project from specialized coordinating centers to local units.

To better understand the determining factors and outcomes of this adjustment process, the study seeks to develop answers to the following research questions:

1. Which factors impede or facilitate integration of local units' capabilities during cross-border innovation development projects?
2. How do central coordinating units adjust their involvement in cross-border innovation development projects in response to these factors?
3. How do these factors make the involvement of coordinating units more or less effective?

The research framework was to be developed inductively with a set of exploratory case studies. Accordingly, the initial framework contained four high-level categories that reflected the research questions. Two categories were used to classify emerging constructs as either specific to the project or specific to the local intra-organizational context in which the project is embedded. A third category for aspects of project organization would on the one hand contain aspects of project decentralization, so as to aid the operationalization for the survey, as well as other aspects of project organization that might need to be included as control variables for the analysis of project outcomes. Similarly, emerging aspects of center effectiveness and other measures of project performance would be attributed to the project outcome category.

As shown in Figure 4, the framework linked the four categories as follows: constructs describing project-specific conditions and the project context were seen as directly influencing both project organization and project outcomes. Project organization was furthermore a mediating process that could also affect project outcomes directly. With this structure, the framework was in line with organizational research on teams (e.g., Gladstein 1984; Gladstein Ancona and Caldwell 1992; Wageman 1995).

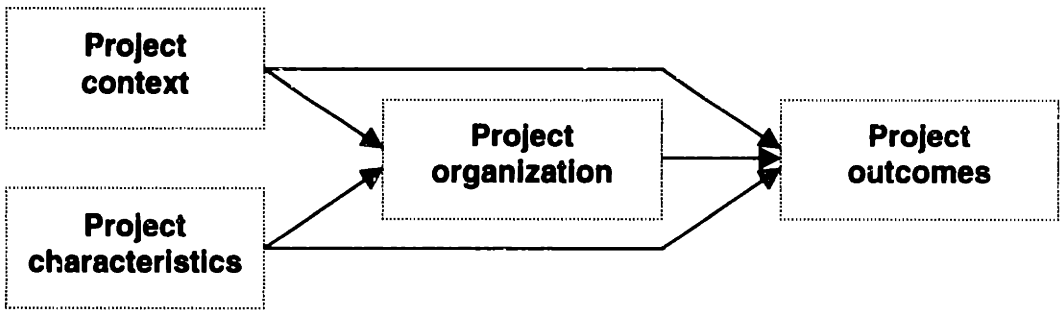

Figure 4: Initial research framework

RESEARCH FOCUS

The analysis focuses on the cross-border innovation development project, which is defined according to the following criteria (cf. Ridderstråle 1996; Gassmann 1997:42-44). First, its goal is to develop as an output an innovation that is new to the firm, and meets an external or internal need in a new way (cf. Kieser 1969; Witte 1973). Thus, it can be a new product, service, or way of doing business. Second, the main participants are several units of the same multinational firm from different countries, as opposed to external cooperation partners. Third, these units work internationally and interdependently on the project. Fourth, the project is temporary and thus not only possesses identifiable beginning and end points, but also uses project management methods, as opposed to management methods for ongoing, routine business.

Several factors make cross-border innovation development projects the preferred focus of analysis. As discussed before, they today contribute significantly to the competitive advantage of multinational firms, and are therefore an important organizational task for decision makers on multiple organizational levels. In particular, they highlight tensions and tradeoffs between differentiation and integration very clearly and strongly. Because the tensions and tradeoffs are so visible, and because they are strategically critical, cross-border innovation development projects require managers in coordinating units to make clear decisions as to whether and in what way to get involved, and managers in local units to decide whether and how to ask for central involvement. Thus, they offer the opportunity for multi-actor, cross-level research that reflects real-world complexity well and has been repeatedly called for (e.g., Doz and Prahalad 1991; Burgelman 1996). Because they are a fairly recent phenomenon and comparatively little researched, the topic of the study should be relevant for practitioners and researchers alike.

The project focus is also the most promising way to address the internal adaptation and "differentiated fit" of organizational processes that multinational firms have to achieve today (cf. Nohria and Ghoshal 1994). A study of cross-border innovation development on the firm level or above would certainly obscure the view by disregarding the within-firm variation that is to be expected, and that seems to pose the current managerial challenges.

Moreover, the development project as the focus of analysis puts the current study in line with previous studies of international knowledge development (e.g., Hansen 1996; Ridderstråle 1996; Gassmann 1997) and studies that focused on the transfer or diffusion of such knowledge, once developed (e.g., Teece 1977; Szulanski 1995; Kostova and Cummings 1997). With the same focus, thus study can complement the primarily case-based development research with a formalized, quantitative analysis of the effects that previous contributions have identified. With regard to the transfer literature, the study needs to use the project to demonstrate the link

between the organization and performance of innovation development on the one hand, and the performance of subsequent innovation transfers on the other hand.

A general methodological advantage of using international innovation projects is that their boundaries are well defined, compared to other international capability integration activities (e.g., informal, spontaneous cooperation, or ongoing cooperation). Furthermore, a small number of standard metrics are commonly used to measure their performance. In contrast, such standards do not yet exist for most other capability integration activities, as the debate in the fields of organizational learning, knowledge and intellectual capital management illustrate. Good boundaries and metrics thus enhance measurement precision and support the quantitative analysis. They also enable comparisons and contrasts across projects, and help in developing typologies.

UNIT AND LEVEL OF ANALYSIS

The study uses as unit and level of analysis the organizational unit which participates in the cross-border innovation development project. An organizational unit is seen as a collection of people which together fulfill a formally defined, permanent role within the firm. Organizational units typically involved in cross-border innovation development include R&D labs and marketing units. The term "local unit", as used here, denotes organizational units with no or only little formal responsibility for international coordination of activities in the topic area of the cross-border innovation development project. In contrast, the term "central unit" refers to units which hold much of this responsibility, as well as formal authority to influence other units in order to achieve the respective goals. Thus, central units are usually located above the local units in the firm's organizational hierarchy. Examples include regional and divisional headquarters, as well as corporate departments.

The organizational unit is the desired unit and level of analysis because most of the relevant variation in the constructs of the research framework is expected to be found on this level. Organizational units are the main actors in the development projects, but vary in their characteristics and in the idiosyncratic local contexts they are embedded in. For instance, they differ in their levels of local resources and autonomy. The same reasoning is reflected in recent typologies in the international management literature, which specifically address the unit level. Classification criteria there include local capability levels, firm-wide innovation contributions, top management effort, and local business conditions (Ghoshal and Nohria 1989; Gupta and Govindarajan 1991; Westney 1993; Birkinshaw 1995; Birkinshaw, Hood et al. 1998). Therefore, organizational units often enter cross-border innovation development projects with quite dissimilar starting conditions.

Conditions for cross-border innovation development that vary strongly across units have two methodological consequences. First, they indicate that the predictor variables are naturally located on the unit level, where the influential variation can be expected. Second, they suggest that the two dependent variables in this study – involvement of central units and their effectiveness in supporting lateral cooperation among local units – will also vary across units. Central units will adapt their involvement to the units in order to achieve the necessary "differentiated fit". Moreover, since the collaborating units are located in different countries and often have different functional specializations, they typically do not report to the same central units. Thus, one can expect central unit involvement and effectiveness to vary significantly within projects.

From a methodological perspective, it was also desirable to use the organizational unit as level of analysis because interview partners seemed more comfortable answering questions from the perspective of their unit rather than for the whole project. This suggested that high quality data on the unit level could be obtained. A further reason for using the organizational unit as unit of analysis was that follow-up research would build on this study's data set and require unit-level data.

Besides these advantages for the unit level, there did not seem to be any attractive, tested alternatives. Aggregation to the project level, for instance via cross-unit averages, was likely to conceal cross-unit variation. However, alternative ways to express cross-unit variation on the project level, such as heterogeneity measures, were not established in the literatures. Therefore, the unit level seemed to be the correct choice for this study.

3.2 Overview of the research process

The research process combined in-depth case studies with quantitative survey analysis, as summarized in Figure 5.

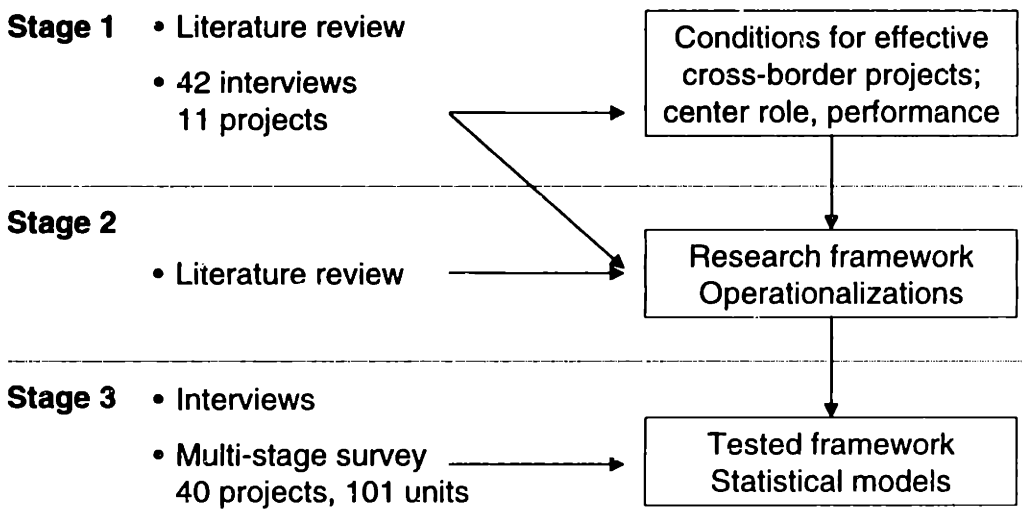

Figure 5: The research process

The first step in the research process was an extensive review of the literatures that seemed most relevant for international knowledge development in the multinational firm. Besides research on the resource and capability based views of the firm, and on the management of diversified and international firms, the organizational learning and innovation management literatures were screened for relevant contributions. This review and initial conceptual work formed the basis for interviews and case studies on eleven projects in two multinational firms. They led to a model of conditions for effective capability integration in cross-border innovation development projects.

A second round of literature reviews was then used to specify more precisely the research questions and the constructs for the quantitative analysis. This led to the final research framework, which will be described in the next chapter.

The large-sample survey as the last research stage included pilot interviews and a survey in three multinational firms, covering 40 projects and 101 participating units. It validated the framework and produced the detailed findings discussed in the respective chapters.

3.3 Structure of the analyses in subsequent chapters

The analyses in the following chapters are structured as follows. The next chapter presents the elements of the research framework, building on the results of the first research stage and the literature reviews. Chapter 5 discusses the operationalization of the research constructs, gives an overview of the sample, and assesses the performance of the measurement model. Chapter 6 tests the overall comprehensiveness and robustness of the research framework. Chapter 7 focuses on the extent to which firms rely on vertical coordination as part of their organizational approach to cross-border innovation development projects. Chapter 8 then examines how effectively firms use such vertical coordination, i.e., how well central units support the cooperation among local units during these projects. The final two chapters discuss the results, limitations and implications of the various analyses.

Chapter 4: Results of the case studies: Research framework to study decentralization and center effectiveness

4.1 Methodological approach

At the beginning of this study, little research on international cooperation among units of the multinational firm existed that related to innovation development and used the process level.[5] In particular, the combination of horizontal and vertical cooperation as critical element of decentralization had rarely been addressed. Thus, it was necessary to get a good understanding of cross-border innovation development projects, as seen by practitioners. Therefore, an initial case study approach seemed most appropriate to facilitate grounded theory building (Glaser and Strauss 1967). During this stage, the research therefore followed the standard methodology for case study research, as described in Yin (1989).

Secondly, inductive research seemed the most efficient way to develop enough breadth and depth of insight to prepare questionnaire development. it could capture much of the actual complexity of the research setting, which should serve to identify for follow-up research appropriate theoretical lenses and levels of analysis (Freeman 1978; Parkhe 1993). Because it did not restrict construct breadth upfront, emerging relevant constructs could be included later on to avoid omitted variable bias in the statistical analysis. On the other hand, the interviews would generate rich enough insight into construct sub-dimensions and their relative importance to facilitate the design of multi-item measurement scales.

Two diversified multinational firms with annual revenues in excess of $1 billion granted access for the case studies on condition of remaining anonymous. Alpha, headquartered in England, operates in several financial service businesses and has established a strong multinational presence in several business lines. Beta, with headquarters in Germany, has several manufacturing divisions operating globally and multiple service businesses serving European and increasingly non-European markets.[6] Due to their organizational structures, "centers" typically were corporate departments or departments at divisional headquarters.

As a first step, managers involved in strategy making and familiar with innovation activities in the units were asked to identify projects that came closest to meeting all of the following criteria:

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[5] As discussed before, Birkinshaw (1995), Szulanski (1995), and Hansen (1996) are the most noticeable exceptions. However, each study differs clearly from this one in its focus. Szulanski's analysis covers projects with lateral cooperation between a source and a recipient unit, excludes headquarters influence and addresses knowledge transfer, as opposed tc knowledge development. Birkinshaw's study is mostly qualitative, includes headquarters as actor, and covers the initiative process up to the point where the proposal to formally create a project is either rejected or approved in terms of "explicit or implicit endorsement ... by senior parent company management" (pp. 148 and 156). Hansen studies cooperation among units during innovation development projects, but does not explicitly distinguish between horizontal and vertical cooperation. In his analysis, cooperation is an unobserved mediating process between project conditions and project speed as outcome. Furthermore, he includes domestic as well as international cooperation.

[6] Due to confidentiality agreements, details about the sites cannot be provided.

- The project is innovative in the sense that it constitutes a clear departure from routine business and aims at creating value for the organization through novel task solutions (to ensure the existence of knowledge development, transfer or adaptation activities)
- Primary responsibility for the project is with a division, business unit or subsidiary (to ensure some degree of decentralization of capability integration activities)
- The project was launched less than three years ago, or is still actively pursued (to ensure data availability and comparability of external conditions)
- At least two people are or were working simultaneously on the project (to ensure significance of the project and increase likelihood of some center involvement)[7]
- The project outputs appear to have application potential for multiple units (to ensure cross-unit significance).

Maximum variation with regard to capability integration, decentralization and center effectiveness was then sought by selecting projects with varying intensities of horizontal cooperation among local units and vertical cooperation between local and center units. Table 1 on p. 36 describes the projects that were studied. All involved innovative solutions and were mainly performed by units. All were still in progress and were considered to have significant implications for the host unit as well as for other units, whether multiple units were currently cooperating or not. However, they were sufficiently heterogeneous along other dimensions, such as the nature of the opportunity to innovate, familiarity with the knowledge area and the process by which the project opportunity emerged, to expect variation in cooperation among units and center involvement.

DATA COLLECTION AND ANALYSIS

Data collection and analysis followed techniques for qualitative research as described in Miles and Huberman (1984), Strauss (1987), Eisenhardt (1989) and Yin (1989). Following early indications in both companies that more accurate and detailed information could be collected if interviews were not taped, notes were taken and edited as early as possible after the interviews. Field work began with unstructured interviews to identify key issues and events within the project, including the involvement of other units and headquarters. Overall, 42 interviews were held either with project team members, senior unit managers or center managers who were familiar with the projects.

All interview partners either received in advance written information about the purpose of the study, or, where not feasible, were given brief descriptions at the beginning of the interview. The interview partners were also assured that all information would be treated anonymously and confidentially. Interviews usually started with their involvement in the projects and the most important issues they saw in regard to the research topics. As the interviews progressed, more specific questions were asked.

During data collection, the interview data were triangulated in three ways to correct for potential respondent and systematic biases. First, for each central topic and project, multiple interview partners were sought who could provide information, which allowed cross-comparisons of responses. Second, archival data were requested and obtained, which provided additional details and reflected more directly earlier project stages than recollections of the interview partners. Third, research reports summarizing the interviews were written, based on the frameworks and

[7] Most of the projects had considerably larger project teams.

	Interview focus	Interviews*
Alpha	1. Customer data and information management initiative (at least 9 significant projects in 3 units)	16
	2. Cooperation between two retail units (multiple projects)	9
	3. Firm-wide cooperation regarding projects in one particular business (related projects in at least 3 units)	5
	4. New distribution channel project (involving multiple units)	2
	5. New business technology project (involving multiple units)	2
	6. Year 2000 project (involving multiple units)	1
	7. Knowledge management project (involving multiple units)	2
	Interviews covering corporate strategy, headquarters-unit relations, lateral cross-unit relations and innovation management at headquarters	11
	Total number of interviews:	*32*
Beta	1. Customer data and information management projects (3 projects in 2 units)	4
	2. Information technology projects (multiple projects, each typically involving 2 units)	2
	3. Financial services projects (multiple projects involving at least 2 units each)	3
	4. Real estate project (two units)	1
	Interviews covering corporate strategy, headquarters-unit relations, lateral cross-unit relations and innovation management at headquarters	5
	Total number of interviews:	*10*

*: Many interviews covered multiple topics or projects

Table 1: Interviews at Alpha and Beta

the interview guide. To detect and correct biases induced by the researcher, they were mailed to the interview partners along with requests to indicate where the descriptions were accurate and where corrections seemed necessary. All feedback was incorporated in the reports before further analyses were performed.

To capture emerging themes and issues related to the research phenomenon, the interview notes and research reports were content analyzed. Key statements from interview partners and the important features of each project regarding the research questions were compiled and synthesized. The emerging topics and categories then served as basis for more focused, semi-structured interviews towards the end of the stage.

At the end of the interview stage, it had become apparent how effective capability integration across units depended on a set of project and project context characteristics. Important insights regarding the interplay between local units and centers, the key activities for capability integration and the dimensions of center effectiveness had also been gained.

In stage 2 of the research process, the results were compared against themes, issues and predictions of a variety of organizational theories. This literature review connected observations to existing research and assessed the organizational theories in regard to their overall explanatory power for each project and across all projects in the sample. It also helped to sharpen the research questions and adapt the original framework to the findings of the first stage. Besides, it helped understand how best to focus on the key framework relationships, so as to make the framework a manageable basis for subsequent quantitative analysis. Of course, it was also a necessary preparatory step for developing sound conceptual definitions of the research

constructs, and for formulating specific research hypotheses with regard to decentralization and center effectiveness. Moreover, details of the methodological approach for the survey needed to be planned, building on methods used in related studies.

The tangible outputs of the research to this point were a specific research framework and a detailed research approach for stage 3, the large-sample survey. The remainder of this chapter discusses the components of the research framework.

4.2 Framework components (1): Decentralization and center effectiveness as endogenous variables

As mentioned before, the initial research framework contained four groups of project-related constructs: project context, starting conditions, project organization, and project outcomes. Its main relationships depicted project organization as depending both on project context and starting conditions, and project outcomes as a joint result of all three. This section discusses decentralization as aspect of project organization, and center effectiveness as an outcome dimension. Using findings from the literatures and the initial fieldwork, it presents and justifies relevant sub-dimensions that were subsequently used to operationalize the two constructs in the survey stage.

Project involvement to support capability integration

The fieldwork and the literature review revealed that six ways of involvement in a cross-border innovation development project allow an organizational unit to support capability integration across borders. For illustration, these ways of involvement can be roughly ordered according to their time orientation, as shown in Figure 6. Time orientation is seen as a combination of the extent to which they use future-related information as inputs, the extent to which their outputs directly influence future activities, and the associated time horizons for inputs and outputs. Thus, an activity is very future oriented if it uses mostly projections rather than historical data, attempts to shape future actions rather than explain past behavior, and does so for a long future period rather than the near future.

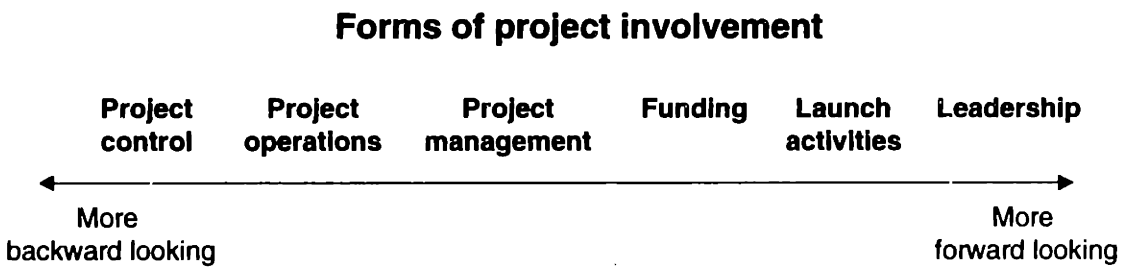

Figure 6: Project involvement to support capability integration, by time orientation

Key here is not so much the order of the activities as the fact that they are conceptually and empirically distinguishable from each other, typically occur at different times during the project, affect capability integration by various mechanisms, and can be performed by different people or units within the firm. Because of this, they offer possibly overlapping, but nevertheless separately manageable opportunities to achieve capability integration in a cross-border

innovation development project. In consequence, they also constitute alternative ways in which to distribute authority for and involvement in the project.

Leadership

Leadership in a cross-border innovation development project can fulfill several functions that support capability integration among units. The aspect of leadership most future oriented in regard to capability integration is its effect on employees before a project is formally set up. Leadership can make certain needs and challenges salient in the employees' minds. By outlining or highlighting them, they influence employees to enact their environments accordingly (Weick 1979) and help them focus their attention (Ocasio 1996). Employees can then attach solutions that lead to capability integration (Cohen, March et al. 1972). Thus, leadership activities set the stage for capability integration in an innovation development project even before it has begun.

In Alpha, one of the multinational firms, for instance, top management realized how important information management would become as a future core competency that the firm would have to develop. Therefore, it demanded from its units to develop a "world class information management" capability and "information management as core competence" (source: internal strategy document). This exposed the divisions to the topic and led some of their units to jointly develop frameworks and models.

A related function of leadership is to initially define and subsequently reinforce the purpose of a project by deriving its goals from, and linking them to, the project's organizational context. One such link is the role of the project within the strategy of the firm and the participating organizational units; another one is the role of the project in relation to other projects and ongoing routine business. Clarifying and communicating project goals and context links can give the project purpose and legitimacy within the firm. It motivates project participants throughout the project and reduces uncertainty about the project-related future, in particular at the start of the project. For instance, it helps managers in the participating units understand to what extent they should devote their attention and resources to the project, and how critical it will be to achieve the project goals. At the same time, leadership signals to non-participants how to assess the project and manage their interface with it. Specifically, it reveals information about the project's relative importance that provides an explicit basis for resolving conflicts between the project and the organizational context. Those may arise over scarce resources – e.g., people or equipment capacity - or the project goals, as in case of an innovation intended to reduce the labor intensity of a process.

The information management initiative described above was mostly characterized by the very opposite, namely, a lack of leadership that accompanied specific projects in the units. It appeared to the units as if only some corporate executives really bought into the initiative, while others dismissed it as little important. Overall, they left the desired content as well as the advantages of the initiative highly vague and intangible. The units were left to cope with a highly uncertain issue, due to their own limited knowledge and due to the missing, specific leadership from headquarters. Not surprisingly, efforts to collaborate across units faltered, and units mostly defined their information management activities according to their specific needs and available resources.

Besides developing a shared understanding of project purpose and position within the firm, leadership can influence other cognitions and behaviors that in turn support capability integration (cf. Schein 1985:224). It can shape the assumptions of project participants about the other

project participants and the collaboration process, which is particularly valuable if the participants do not know each other well at the project start, or have little collaboration experience in general (cf. Kerr and Jermier 1978). It has the potential to influence expectations and preferences, for instance as to how the participant's contributions to the project will be rewarded (cf. Fiske 1992). It can also help establish ground rules for collaboration, such as shared norms. In cross-border innovation development projects, those effects of leadership can be particularly relevant when the cultural and institutional backgrounds of participants differ quite strongly.

Additional opportunities for leadership to support capability integration in cross-border innovation development projects are extreme conflicts and other exceptional events (Bass 1985). Leadership can recreate the shared sense of purpose and commitment that participants would lose otherwise. For example, the field interviews covered a project in which participants refused to cooperate because it would have shifted the power distribution among them. After several failed attempts to resolve the dispute themselves, and at a point at which the feasibility of the project was in jeopardy, it escalated to senior management. Senior management then negotiated with the units a solution that maintained the power distribution and enabled them to develop the innovation. While doing so, it emphasized the importance of the project of the firm and thus tried to establish by leadership a shared sense of purpose and commitment among the units.

To summarize, leadership is an important activity to support capability integration, and may be performed more or less intensely by central coordinating units. Of course, how effective a certain amount of leadership actually is depends on the project characteristics, the characteristics of the project participants, the people exercising leadership, and the nature of the project context (cf. Vroom and Jago 1988, and Kerr and Jermier 1978, for discussions of situational theories of leadership). In particular, the leaders' basis of influence on the project participants can vary, and may range from expertise and formal authority within the firm to the quality of their relations to the project participants (French and Raven 1959).

Project launch activities

Project launch activities are important determinants of capability integration because they involve major project decisions. From the point at which an innovation development opportunity is recognized to the point of agreement on a full-fledged project proposal, the proponents define and refine the project idea, assess the international scope of the innovation opportunity, and identify possible cooperation partners (cf. Block and MacMillan 1993; Birkinshaw 1995).

While the proponents communicate and further develop the project idea, feedback from other parts of the firm may lead them to modify the project scope, its inputs or the planned outputs. For instance, the decision may be made to develop the innovation for more countries than initially intended, and may lead to cooperation among more local units. An international search for contributors helps identify available capabilities and integrate them into the development process (cf. Hansen 1996). Thus, as the project receives "definition" and "impetus" (Bower 1970; Burgelman 1983), it becomes structured, key tasks are distributed among the participants, and rules and norms begin to be established.

In case of Alpha's information management initiative, headquarters had left the project launch activities to the units. It neither specified tangible activities or outcomes, nor issued operational definitions, nor defined the roles of participating units across the firm. Its attempt to achieve cross-unit coordination by giving the seemingly most advanced unit a firm-wide mandate failed

because it did not outline the unit's role at the outset. Other units therefore constantly debated and challenged the unit's role. Internal memos complained about "unclear directives" and concluded that "the position is confused".

Conversely, senior management at Beta purposefully managed the project launch for a similar initiative. Contrary to senior management at Alpha, it chose a highly focused approach and defined the innovation opportunity very specifically. Moreover, it first identified three well-defined opportunities for cross-unit cooperation, then distributed responsibility among the units and initiated cooperation. Together with the units, it defined specific milestones with tangible results. While it delegated the initial cost-benefit analyses to the units, its staff performed the strategic analyses from a corporate and business perspective.

These alternative ways of handling the launch activities determined the need for, and the ways of, capability integration throughout the projects. At Alpha, units tried to integrate as little as possible and were little committed to cooperation, which led to unsatisfactory performance. At Beta, units cooperated closely from the start and needed less center involvement to manage capability integration later on. Thus, the projects demonstrated in almost opposite ways how influential project launch activities are for capability integration in cross-border innovation development projects.

Funding

Funding is not only one of the essential resources for effective task group performance (Hackman 1986; 1990). In cross-border innovation development, it is particular critical to capability integration, since the high costs of communication and travel make cooperation among dispersed units quite costly.

Besides this obvious benefit, the fieldwork suggested that funding could also facilitate capability integration in several other ways. For instance, one project required four units to consolidate their mutually incompatible, but functionally almost equivalent production systems into one global platform. The benefits of this platform were expected to arise in the long run and mainly on the corporate level, because it would allow production to be shifted more easily across plants on several continents. In contrast, the units had to incur significant short-term costs for the development and introduction of the platform. Therefore, central funding was necessary to motivate them to develop it together.

As in this example, central funding can compensate units for the cost of developing and introducing a globally standardized innovation. If the units' local needs differ, standardization may be costly to each of them individually, yet beneficial for the firm as a whole. In this case, central funding can give units an incentive to collaborate rather than independently develop local innovations.

Similarly, central funding supports capability integration if its benefits lie beyond the units' planning horizon. Central units that take a longer view can then compensate units in the short run and ensure that the long term benefits are realized. Excessively high project risks that neither unit alone can bear are another case in which central funding is critical. Finally, some projects may simply be too expensive even for joint financing by local units, and may require special central resources. For these reasons, most of the firms studied had a routine process to determine how much central funding cross-border innovation development projects would receive.

Management of ongoing project operations

Project management for the ongoing project after the launch can create virtually daily the conditions for effective collaboration among the units: it can establish clear and motivating task goals, design tasks according to their skills, motivate participants and provide feedback on results. Moreover, it can ensure that resources and coaching are available when needed, and manage the interface between the project and the organizational context (Ancona and Caldwell 1992). It may also have to keep promoting the project within the firm (cf. Witte 1973).

A particularly relevant opportunity for project management is the management of relations among the units. Strong relations give the units relative certainty about each others' motivation and behaviors, which in turn generates trust. They reduce agency and transaction cost problems, which arise due to unit specialization and opportunities for each unit to make autonomous, unobservable local decisions (Williamson 1981). Strong relations also provide the units with a social context in which to enforce behavioral controls. For example, units that do not cooperate satisfactorily can lose reputation or expect difficulties during future cooperation. For these reasons, units with strong relations may follow a different social exchange model than units with weak relations. This is often reflected in their willingness to incur greater net costs and forego compensation for their contributions for longer (Fiske 1992). Relational factors can therefore strongly influence capability integration across units, and project management has ample opportunity to influence them.

In the projects studied during the fieldwork, managers were able to vary to some extent the intensity and depth of relationship building between the collaborating units. For example, they could staff teams for subtasks either primarily with people from one unit or purposefully with people from several units. They could also allocate more or fewer funds for initial relationship building and for subsequent short-term travel to other local project teams. Some managers' emphasis on good personal relationships between participants in different locations also indirectly facilitated capability integration because the participants who had built good relations early on were more interested and proactive in sharing their knowledge later. And, acting as relation mediators, they lent credibility to unit actions and thus helped other units accept them while the direct relations between the units were still weak.

Project management has additional opportunities to influence capability integration. One is to counter moves by the units to change or maintain the power distribution among them. The power distribution at the beginning of a project is often unequal, for instance because some units control more valuable and scarce resources, can influence business processes, or can control uncertainty more than others (Hickson, Hinings et al. 1971; Hinings, Hickson et al. 1974; Salancik and Pfeffer 1974). At the same time, each unit possesses a unique position in the structural hole between its local environment and the rest of the firm (cf. Burt 1992; Westney 1993), a certain amount of local decision authority, and usually some unique capability to contribute to the cross-border innovation development project. Therefore, a unit may be tempted to use this, albeit temporary, power with regards to the project to change its overall power position in the firm.

In consequence, units may impede capability integration as they try to avoid loss of power, try to preserve their powerless status, or try to gain power (cf. Blau 1964; Pfeffer and Salancik 1978). Project management that addresses the underlying concerns can facilitate capability integration. For example, senior management at Beta had to do just this in a project that threatened to fail because units disagreed on who would own valuable customer data, and the revenues that could

be generated from cross-selling to each others' customers. In another case, the project was seen by the units as having long term implications for the allocation of corporate resources among them, and project management had to negotiate an agreement with the units that participation in the project would not affect their share of those resources adversely.

Further opportunities for project management exist in regard to uncertainty reduction. Because uncertainty requires much information processing (Galbraith 1977) and coordination by feedback (Thompson 1967), it places heavy demands on the communication links among units. Besides, it may increase the agency concerns discussed earlier. To support capability integration, project managers can manage uncertainty. For example, they can purposefully support the flow of information among people from different units if such information does not necessarily have to be exchanged.

Finally, project management can institutionalize norms and routines among project participants that support integration. In the projects studied, those included rules as to how conflicts between units were to be resolved. If units begin to take these norms and routines for granted, they can subsequently lead them to collaborate more effectively later during the project (cf. Jepperson 1991; Zucker 1991).

Project operations

Project operations are the activities during which capability integration takes place most intensely and on the most profound basis. Capability integration during innovation development critically involves the creation of shared knowledge among participants from different units. Therefore, as Nonaka and Takeuchi (1995:85) point out, "the sharing of tacit knowledge among multiple individuals with different backgrounds, perspectives, and motivations becomes the critical step for organizational knowledge creation to take place. The individuals' emotions, feelings, and mental models have to be shared to build mutual trust". This of course happens mostly in project operations.

It is also during project operations when many subtle particularities of the multinational setting that threaten to impede capability integration need to be addressed. These include cultural differences, differentiation due to heterogeneous local environments, and geographic distance (cf. Kiesler and Sproull 1991; O'Hara-Devereaux 1994).

As to differences in cultures and local organizational environments, when people from different units cooperate, they often have to question institutionalized cognitive patterns, norms and behaviors (Berger and Luckmann 1967; Hofstede 1980; Meyer, Boli et al. 1994). Their tacit knowledge and cultural elements that free people from conscious decision making within their usual contexts can suddenly turn into a legacy (Polanyi 1962). International cooperation forces people to surface many of these differences and find mutually acceptable compromises. People may even have to set aside complete established organizational routines and "thought worlds" (Dougherty 1992). For instance, in one project studied during the fieldwork, major parts of the units' project reporting systems turned out to be incompatible, so the units had to develop suitable reporting standards.

Geographic distance increases communication difficulties and therefore impedes capability integration. Since communication intensity declines with distance (Allen 1977), discussion of new ideas, concepts and thoughts as a critical step in shared knowledge development is less intense. Also, important knowledge, in particular if tacitly held initially, is often more difficult to

exchange via communication systems than face to face. Besides differences in time zones and high cost of communication, the fieldwork revealed as a related difficulty the inability to easily identify knowledge sources in other units and access them. Those knowledge sources could be people, documents or technical systems.

Involvement in project operations gives a unit some influence over the factors that affect capability integration on a day-to-day basis. For example, in Alpha's information management initiative discussed earlier, the central information technology unit attempted to facilitate mutual understanding among units by establishing a firm-wide glossary of key terminology. It also tried to develop some frameworks and process models that units could follow in their local activities. In another project, a corporate department found involvement in project operations to be the key to understanding the other units' cooperation difficulties, and addressing them effectively.

Project control

Project control has both a motivational and a feedback effect on capability integration (cf. Scott 1992:346-347). If the evaluation goals call for capability integration, control motivates units to contribute to the project, since they can expect their contributions to be recognized and rewarded. Control also signals to participating units that their performance will be assessed against those goals, which discourages shirking and loafing because units can expect lack of contributions to be detected (Milgrom and Roberts 1992). Moreover, if corporate management is involved in project control, and if the project is expected to mainly generate corporate-level benefits, participating units face pressure to look beyond their local interests and reconcile differences. Thus, even if control activities happen fairly late during the project, they can support capability integration from the outset. As one interview partner remarked, control by corporate management helped overcome serious obstacles in one project because the local project managers knew that their careers were at stake.

The feedback effect of project control is generally recognized as critical in theories of organizational learning (e.g., March and Olsen 1976). Causing the project participants to step back and assess past behaviors, the current situation and plans against initial expectations, it reveals unexpected successes as well as problems that have so far impeded capability integration. Repeated control, for instance after every project milestone, also allows participants to detect and tackle undesired recurring patterns early on. Creating such awareness of the larger picture focuses attention, helps overcome myopia (Levinthal and March 1993), facilitates reorientation towards prior goals and changing environments (Kiesler and Sproull 1982), and supports double-loop learning (Argyris and Schoen 1978). Going through the control process together also gives the project participants opportunity to align their project-related interpretations and is, in that regard, a process of collective sense-making which narrows perceptual differences (Weick 1979). If handled fairly, participants may also become more committed to the project, as procedural justice theory suggests (Thibaut and Walker 1975; Kim and Mauborgne 1993).

Decentralization in cross-border innovation development projects

To summarize the preceding section, a unit can influence capability integration in a cross-border innovation development project via its involvement in project leadership, launch activities, funding, management of ongoing project operations, project operations and control. Furthermore, how much each mechanism gets used may vary from project to project, and unit to unit.

As discussed earlier, central coordinating units have begun to reduce their involvement in favor of more responsibility for local units, and thus given way to more intense lateral cooperation. One can therefore speak of a trend towards decentralization of capability integration activities along vertical lines of authority. Decentralization refers to involvement levels of centers and local units in those activities relative to each other. As activities shift from centers to local units, decentralization increases. So, for instance, if local units perform most project operations and central units only few, one would consider project operations to be quite decentralized.

Decentralization expresses to what extent activities are performed away from centers in local units, i.e., are pushed hierarchically downwards. As used here, is a pure measure of vertical activity distribution, where the center is located higher up in the organizational structure than the local unit and has influence over the unit's cooperation activities with foreign peer units. It therefore differs from activity dispersion, which describes the distribution of activities among a group of units and contains both a vertical and a horizontal structural component (cf. de Meyer and Mizushima 1989; Cheng and Bolon 1993, for R&D in particular).[8] The horizontal component refers to the distribution of activities among peer units without reporting relations; the vertical component relates to the distribution of activities among units that stand in a reporting relationship.

The original intent at the beginning of the first research stage was to measure decentralization on the project level, across all participating units. It was based on the assumption that only one center would typically be involved in any one cross-border innovation development project, which would consequently make decentralization a project attribute. In other words, centers were expected to be corporate departments or corporate senior management teams. This assumption in turn was derived from the international management literature, which conceptualized international cooperation as mostly occurring between subsidiaries and headquarters, or among subsidiaries.

However, the fieldwork revealed quickly that this assumption was not valid for the research setting of this study. In most cases, the development projects were too small to cause any significant involvement of senior corporate management or corporate departments. In the survey sample, for instance, the average project size was less than 25 people. Similarly, unit sizes turned out to be far smaller than expected and on average did not exceed ten people in the sample.

These observations confirmed Birkinshaw's observation that the "sub-subsidiary unit of analysis" best reflected the reality of this kind of organizational process: "The reality in most MNCs today is that subsidiaries have a multitude of linkages with other corporate entities in the home country and worldwide (Ghoshal and Bartlett 1991), but academic research has – for the most part – continued to work on the basis of a single parent-subsidiary relationship." (Birkinshaw 1997:207-8). For instance, a research lab would ultimately report to a corporate technology group, whereas a marketing unit in the same country would report to a corporate marketing department, with a differently managed relationship.

Furthermore, because of the fairly small unit and project sizes, corporate entities did not tend to influence units and projects significantly. Instead, "centers" turned out to be units and teams on intermediate organizational levels, which would have some responsibility for international cooperation, and to which the units would report directly or indirectly. Those would usually be

[8] This is in line with the definition of "distributed innovation" (e.g., Nohria and Ghoshal 1991).

country management, regional management, or divisional management. In consequence, the assumption of one center per project had to be dropped. Instead, it was necessary to see each unit as related to its own center.

Because several centers were involved in projects, significant and organizationally relevant variation was found between unit-center relationships within projects. Since units participating in the same project tended to relate differently to their centers, it appeared unreasonable to conceptualize decentralization on the project level. If organizational structures and processes were strongly differentiated across units, and if decentralization depended on unit-level factors, then the vertical distribution of capability integration activities in cross-border innovation development projects could best be studied for the individual unit and its respective centers. Therefore, it was decided to operationalize decentralization for the dyadic unit-center relationship and not as a project average.

This way, the operationalization could also best reflect the firm's organizational tendency to achieve an internal "differentiated fit", that is, a match between each unit's characteristics on the one hand, and on the other hand the way it was managed by centers and interacted with the rest of the firm (Ronstadt 1977; Ghoshal and Nohria 1989; Pearce 1989). As far as the innovation projects were concerned, relevant unit characteristics appeared to be the unit's local capabilities and its relationships to other units, among other factors (cf. Ghoshal and Bartlett 1990; Gupta and Govindarajan 1991).

SUMMARY: DECENTRALIZATION IN CROSS-BORDER INNOVATION DEVELOPMENT PROJECTS

To summarize, fieldwork and literature review revealed that six kinds of involvement in cross-border innovation development projects most strongly influenced capability integration: leadership, project launch activities, funding, operations management, project operations and project control. Those activities varied in their time orientation and the point at which they were most commonly performed during the project.

Central coordinating units could be more or less involved in any of these activities, and appeared to adapt the nature and intensity of their involvement to characteristics of the unit and the project. Due to the organizational structure of the firms studied, units were typically connected to different centers, which often chose the kind and level of their involvement independently of each other. Therefore, decentralization was seen as a measure of the extent to which involvement in the six activities was left to a local unit, as opposed to a center higher up in the organization.

Center effectiveness

This section discusses the second focal aspect of cross-border innovation development projects in this study: the effectiveness of center involvement in those projects with regard to the integration of the local units' capabilities.

Innovation development studies have frequently included measures of project support from highly positioned teams or units. In one recent review on the product development literature, at least 16 out of the 47 studies covered contain some measure of "top management support, control or skill" (Montoya-Weiss and Calantone 1994). Another literature review concludes that enough studies have provided evidence to say that "senior management support is essential for fast and productive product development" (Brown and Eisenhardt 1995:371). This finding is fully in line with the summary assessment in an earlier review: "All recent major studies into product

innovation management have shown that a crucial factor in bringing a new product to the marketplace successfully is top management support" (Johne and Snelson 1988:124).

A closer look at the way the studies in these reviews and others have used the support construct leads to the following results and implications. First, the operationalization of "support" is critical. In particular, it needs to be distinguished from "involvement", since an understanding of "support" as "contribution to project performance" makes statements about a positive relationship between support and performance tautological. Second, when focusing on the involvement of top management as members of the highest managerial levels within the firm, it is easy to overlook the contributions that intermediate managerial levels can make. For instance, a regional manager who is not senior management of the firm is nevertheless "senior to the local units in the project". As mentioned before, this aspect is quite critical for projects that are managed or initiated on the sub-subsidiary level (cf. Birkinshaw 1995; 1997), and was corroborated in the fieldwork.

Third, studies considering top management involvement on the project level are primarily concerned with the relation between involvement and project performance: quantitative studies examine the directionality and strength of the effect, and qualitative studies explain the ways in which involvement affects the development process. However, a significant, positive performance effect for a complete sample does not imply the same effect for subsamples or individual projects: A certain kind and intensity of involvement may support some projects strongly, others only a little. Thus, to avoid an "ecological fallacy" (cf. Judd, Smith et al. 1991:405; Hofstede 1980:24), it seems necessary to test contingency models of the effectiveness of involvement, at the least to support normative conclusions.

In light of these findings, the current study set out with a contingency assumption to enhance the understanding of central support for development projects: That projects differ in their needs for support, and that different units participating in the same project may have different support needs. It is grounded in recent models of the multinational firm as differentiated networks, according to which firms adapt internal structures and processes to the characteristics of each unit and its context (Ghoshal and Nohria 1989; Doz and Prahalad 1991; Gupta and Govindarajan 1991).

Since the fieldwork supported the assumption, effectiveness was operationalized relative to the needs of a given unit and project in the survey. It put the operationalization in line with the general conceptual definition of effectiveness in organizational research as a measure of position relative to a standard, whereby the standard can either be absolute or relative (cf. Scott 1992:chapter 13). At the same time, it facilitated the analysis of the links between kind and intensity of involvement, nature of the unit and project, and effectiveness on a more detailed level than in previous studies. Furthermore, it helped identify conditions that influence effectiveness, because effectiveness could be used as a dependent variable in the quantitative analysis. In contrast, previous quantitative studies had to infer effectiveness from the relation between involvement and project performance, and could not identify such conditions.[9]

For the purpose of this study, effectiveness is conceptualized with regard to capability integration in cross-border innovation development projects. It is seen as the ability of a center to influence a

[9] Project performance data for follow-up research on the relation between involvement level, involvement effectiveness and project performance were collected as part of the survey.

local unit's cooperation with foreign units on a project such that it helps the unit achieve the project goals. Characteristics of the project and its context, which include certain unit characteristics, determine the unit's influence needs; how well the center meets these needs determines its effectiveness.

The fieldwork suggested considering four dimensions to assess center effectiveness comprehensively (Figure 7): the focus of center involvement, involvement timing, involvement intensity, and involvement coordination with the units. These dimensions are described in the remainder of the chapter.

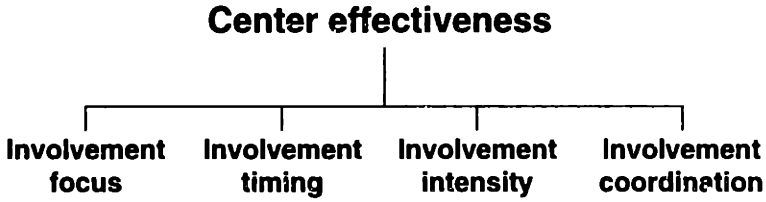

Figure 7: Center effectiveness with regard to capability integration among local units

Focus

"Focus" of involvement refers to the activities the center can perform to improve aspects of cooperation between the unit and foreign units. Those may include relationship building, conflict resolution and task assignment. A center's involvement focus is the more effective, the more closely the set of center activities matches the set of activities that the unit cannot, or does not, perform itself sufficiently well to achieve project goals, and the less the set contains activities for which the unit does not require center involvement. Put differently, the focus is ineffective when the center fails to perform activities that need support, or performs activities that do not need any.

For instance, in one project studied during the fieldwork, a unit with long-standing relations to the foreign units only needed very focused support with conflict resolution, so the center limited its role to the management of conflicts the units could not resolve by themselves. In another project, a unit had difficulty establishing appropriate working relationships with foreign units, yet its center, even though it had good relations to the unit and the foreign units, did not facilitate. Instead, it aimed at supporting cooperation by leadership at the start of the project and periodic progress reviews thereafter. Neither of those activities helped the unit build the relations it needed, and because cooperation suffered significantly in consequence, the unit did not consider the center's involvement as having effective focus.

Timing

Timing is the actual occurrence of center involvement relative to when the unit needs it. Effective timing means that the center supported cooperation neither too early nor too late, nor for too long or short a time. Put differently, timing effectiveness describes the quality of the match between the center's pattern of involvement over time, and the temporal pattern of the respective needs of the local unit.

Timing is an important effectiveness component for several reasons. First, many innovation development projects operate on tight schedules, and ineffective timing can cause delays. These

delays in turn can reduce the net benefits of the innovation dramatically (Eisenhardt 1989; Vesey 1991; Eisenhardt and Tabrizi 1995). For instance, they may allow competitors to complete their innovation development earlier than the own firm. Alternatively, competitors will not be punished for starting their development efforts later in order to incorporate the latest technological advantages or user trends (Wheelwright and Clark 1993:16; Stalk and Hout 1990:108). Delays in the introduction of internal, organizational innovations are also often associated with opportunity costs, e.g., lost cost reductions if the development of a global purchasing process is delayed.

Second, ineffective timing can allow development problems to become more costly to address, regardless of project delays. In the first project mentioned above, the center's influence had effective focus, since it helped resolve conflicts that impeded cooperation. However, it took the center time to realize that the unit was unable to solve the conflict on its own, and respond accordingly. Because of the long time lag between the onset of conflicts and the beginning of center influence, some conflicts had grown, and the units' positions had hardened, which made a compromise more difficult to achieve than if the center had been involved in the discussions early on. The project reflected what Wheelwright and Clark (1993:32) conclude about management influence on development projects in general: "managers often seek to respond to problems as their importance becomes apparent; at that point they are unavoidable."[10]

In Alpha's information management initiative, the timing of the center's involvement in project leadership was somewhat ineffective, too, but for a different reason. Certainly the center started to be involved at the right point, for it launched the initiative in the first place. However, it then withdrew leadership support too early, at a time when the units still required it in order to develop commitment to the project. This case illustrates that the start and ending of involvement are equally relevant components of timing effectiveness.

INTENSITY

Even with effective focus and timing, the center may fail to support cooperation best possibly if its involvement is lower or higher than the unit actually needs. Too little or too much involvement can both be associated with opportunity costs.

To take again an example from the fieldwork, in the global platform project described earlier the units did not have any subsidiary-level budgets for the development of the global platform. Consequently, the country-level controllers denied any associated expenses and forced the units to rely exclusively on the small project budget the corporate functions had set up. This budget was not large enough to cover expenses the units considered essential to effective cooperation, such as short-term trips to other units in order to familiarize their experts with the foreign units' local systems.

On the other hand, overly intense center involvement, e.g., strong centralization of operational decision making, can limit the units' ability to apply and enhance its capabilities. It can also inhibit the self-organization and creativity required to develop a successful innovation (Nonaka and Takeuchi 1995:75-76, 126, 157; Rubenstein, Chakrabarti et al. 1976). Furthermore, it may stifle the unit's motivation to launch innovative initiatives in the future. This was quite clearly

[10] See also their Exhibit 2-1, p. 33, which compares the timing of actual management influence with that of opportunities to influence project outcomes.

reflected in a comment by a manager at Alpha, who remarked that central involvement in the early launch activities of projects often seemed too high: "If they want to kill a project, they [a corporate department] just ask you to submit a complete business case for review."

Coordination of involvement

The focus dimension addresses the content, the timing dimension the start and end points, and the intensity aspect the amount of the center's involvement. Involvement coordination complements these dimensions as a procedural one. It refers to the way in which the center coordinates its own project involvement with that of the units.

Following procedural justice theory (going back to Thibaut and Walker 1975), the nature of the process by which the center gets involved in the project can on its own affect unit cooperation. As Kim and Mauborgne (1993) summarize, "people, be they executives, middle-level managers or lower-level employees, were consistently found to care a great deal about the justice of the procedures by which organizational decisions were reached ... procedural justice judgments have been shown to have positive and unambiguous effects on the higher-order attitudes of commitment, trust, and social harmony in organizational members subject to decision processes." (p. 240-1; citations omitted) The very same observations were made in the fieldwork.

Procedural justice in particular and process quality more generally can be particularly relevant in a project to which participants contribute diverse organizational contexts, cultural backgrounds and goals, and thus may have difficulty understanding each others' actions, as well as the intentions behind them. Participants may then use process quality as an indicator of content quality, here specifically the content quality of the center's involvement.

Consequently, the units consider as an important effectiveness aspect how well the center coordinates its involvement with them. The fieldwork suggests that this includes behaviors like adequate consultation of units before making important decisions, timely and comprehensive communication, flexibility when reacting to input from units, and expressed commitment to fairness when arbitrating conflicts.

Summary: Center effectiveness

This section has presented the dimensions of center effectiveness that emerged from the fieldwork. Regarding the integration of a local unit's capabilities with those of foreign units in a cross-border innovation development project, center effectiveness is viewed as the extent to which the center's project involvement supports cooperation between the local unit and the foreign units in ways that facilitate achieving the project goals.

Effectiveness thus defined has four dimensions. The effectiveness of involvement focus is the extent to which the center manages to perform the kinds of activities that facilitate cooperation, and refrains from getting involved in activities that impede it. Timing effectiveness describes the quality of the match between the center's pattern of involvement in these activities over time, and the temporal pattern of the respective needs of the unit. Intensity effectiveness expresses the quality of fit between the strength of involvement in the activities and the strength of involvement the unit needs. Finally, coordination effectiveness measures the quality of the way in which the center coordinates its project involvement with the units. Assessments along these dimensions are subjective and taken from the local unit's perspective.

4.3 Framework components (2): Determinants of decentralization and center effectiveness

This section discusses the determinants of decentralization and center effectiveness, i.e., the exogenous variables in the research framework. Factors affecting decentralization and center effectiveness can be attributed either to the organizational context of the project or the project characteristics (Figure 8).

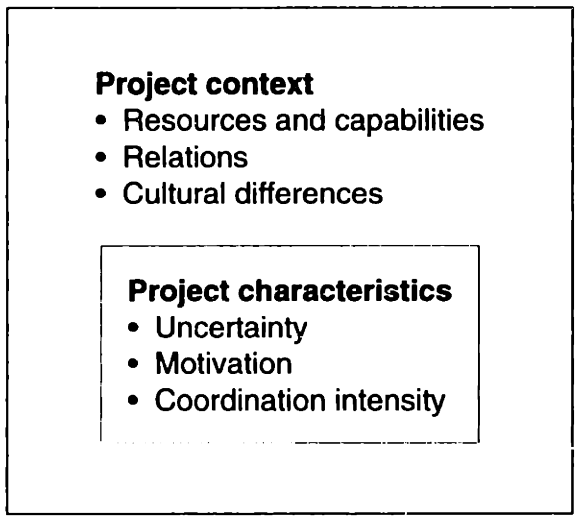

Figure 8: Determinants of decentralization and center effectiveness

Fieldwork and literature review identified the following relevant factors in the project's organizational context: the distribution of resources and capabilities within the firm, cultural differences among the cooperating units, and their relations to each other. Key factors specific to the project that emerged were: uncertainty associated with the project, the motivation of the various parts of the firm to participate, and the complexity of international coordination it required. These factors did not seem to impact decentralization and center effectiveness in the same way. Therefore, the purpose of this section is to introduce them, while later chapters will present the respective hypotheses.

Project context

RESOURCES AND CAPABILITIES

If an innovation is a combination of existing means to provide a solution to a perceived need (cf. Moore and Tushman 1982:132; Rickards 1985:10; Hauschildt and Chakrabarti 1988), then almost by definition an innovation development project requires multiple resources and capabilities as inputs. At the least, it combines the capability to use the "means" with the capability to understand the "need" and market the solution to those who have it. In functional terms, the former often takes the form of a technical capability, the latter of a marketing capability. Other capabilities and resources are of course regularly involved in innovation development, such as the capability to manage the innovation development process, and resources to fund it.

The very reason for cross-border innovation development projects is the fact that the required resources and capabilities are internationally distributed. By increasing the resource and

capability specialization of units, the multinational firm has better adapted to, and taken advantage of, local business environments. The immediate result is that units have been developing resources and capabilities which are valuable, scarce, difficult to substitute and imitate within the firm, and so have obtained internal comparative advantages (Barney 1991). The indirect result is a growing need to link them together in order to exploit these advantages globally (Doz and Prahalad 1991).

If the cross-border innovation development project is an organizational means to exploit the comparative advantages, and if those in turn depend on the internal distribution of resources and capabilities, then – assuming economic rationality – one should expect the involvement of organizational units to depend on the resources and capabilities they can contribute to the project (cf. Birkinshaw and Hood 1998). In the fieldwork, the distribution of funds for the project was the most obvious case in point. But units also searched for cooperation partners if they believed needed resources and capabilities were available elsewhere in the firm (cf. Hansen 1996). This behavior was particularly noticeable in one of Alpha's smaller foreign subsidiaries, whose CEO proudly opened the interview by presenting a list of contacts to foreign units and pointing out how his employees would use this list to get units in Alpha's other countries of operations involved in their projects.

For the same reason, the distribution of activities between a center and a local unit should depend on the benefits of each one's comparative advantage. Similarly, the effectiveness of the center's involvement will most likely depend on the underlying resources and capabilities the center can exploit. As the corporate strategy literature predicts, centers will probably not be effective unless they possess a "parenting advantage" over the local units (Goold, Campbell et al. 1994). Therefore, one can predict:

Proposition 1: The distribution of resources and capabilities in the firm systematically influences decentralization and center effectiveness in a cross-border innovation development project.

CULTURAL DIFFERENCES

Managing the tension between institutional pressures towards local assimilation of the firm's units and integration across borders is a central task in cross-border innovation development projects (cf. Westney 1993; 1996). When local institutional influences create incompatibilities among the participating units, they can easily cause cooperation difficulties that range from minor misunderstandings to serious conflicts.

Institutional influences that can affect cross-border cooperation in cross-border innovation development projects are rooted in several kinds of local institutional contexts (cf. Kostova and Cummings 1997). The culture of the country in which the unit operates influences the unit and its employees via regulatory, normative and cognitive standards (Scott 1992). Regulatory standards define appropriate actions as well as actor characteristics. Normative standards shape people's norms and values, principles considered important, and basic assumptions (Hofstede 1980). Cognitive standards affect how people perceive and interpret their environments, including other people's actions.

Besides the country-level cultural influences, idiosyncratic institutional elements on the organizational level often develop. These include organization-specific routines, norms and cognitions that members of the organizational unit use, but not necessarily share with other organizations in their country or with other parts of the firm (Kogut 1991). Finally,

specialization of and in organizational units brings with it a certain influence of cultural elements from the local professional environment. Therefore, every participating organizational unit exposes a cross-border innovation development project to a set of institutional influences from the individuals' cultural backgrounds, the local organizational or professional culture, and the local institutional environment.

Institutional influences can create various kinds of cooperation difficulty. For instance, they may cause units to have different preferences and goals regarding the output of the project, e.g., its functionality and appearance. This is a typical case in multi-national industries, whose national markets are comparatively dissimilar. Second, they may make units differ in the routines and standard procedures they use to perform certain activities. Third, they can lead across units to diverging preferences and goals for the process inputs, such as components or standards.

The global platform project from the fieldwork highlighted some of the difficulties arising from local institutional influences. Of the four cooperating units, three had previously developed systems in accordance with dominant manufacturing standards on their respective continents. Their systems had been certified as appropriate by local regulatory authorities. Mechanical and electrical engineers had been trained by local educational and professional institutions which had formed important work-related norms, values and thinking patterns. To develop, use and maintain the systems, each unit had created organizational routines that were closely adapted to the characteristics of the local system. Furthermore, local suppliers were co-specialized and had an interest in the preservation of the local systems. In sum, each unit had to cope with pervasive direct and indirect cultural influences during the project.

As the units tried to determine a joint approach to developing the platform by rating the performance of each local system along various categories, they also realized it was difficult to determine an overall weighting scheme that was equally justifiable across their local business contexts. This was an instance in which the functional equivalence of cultural elements added to coordination difficulty, for the units had no easy way to determine a "correct" approach, once they worked across the boundaries of their local institutional contexts.

The overall effect of cultural elements on cross-border innovation development projects can vary significantly. In the projects studied, the differences across units tended to vary across projects. Then, existing differences resulted in stronger or weaker incompatibilities. For instance, units were not able to change some cultural elements readily because they had become infused with value beyond their functional purpose (Selznick 1957), or because they had come to be taken as standards, sometimes even to the point that people were no longer aware of them (Schein 1985; Powell and DiMaggio 1991). In contrast, others were easily changeable once identified as a problem source. Moreover, the project characteristics also determined how important certain cultural differences were. Finally, not all units could equally well cope with differences and incompatibilities. Some units in particular were more experienced than others in cooperating across cultural borders, and thus knew better how to handle them.

The overall conclusion is that cultural differences tend to impact some cross-border innovation development projects more than others, and some units tend to have better skills at handling them than others. Coordinating centers in particular may have some comparative advantage over local units because managing these differences has been part of their formal responsibility for a long time. Their position in the firm's structure may also give them the formal authority required to resolve culture-induced conflicts among units. Furthermore, they can often best assess the

tradeoff between local adaptation and international standardization. For example, they may have relevant information from all units, and may pursue standardization benefits on the corporate that benefit the units only indirectly. These observations suggest the following proposition:

Proposition 2: Cultural differences across units in the firm systematically influence decentralization and center effectiveness in a cross-border innovation development project.

INTER-UNIT RELATIONS

It is a recurring theme in the literatures related to cross-border innovation development that relations among units prior to a project and their communication throughout the project are quite relevant for project performance. In the product development literature, Brown and Eisenhardt (1995) identify a whole stream of research explicitly concerned with communication. They and conclude that "internal communication improves development-team performance ... high internal communication increases the amount and variety of internal information flow and, so, improves development-process performance." (p. 358) Dougherty (1992) highlights how lack of unit relations prior to a project can cause departmental "thought worlds" to collide and reduce performance. Nonaka and Takeuchi (1995:81) see relations as an important means to build a shared basis of information that is essential to cooperative knowledge creation. And the international management literature broadly emphasizes the relevance of relationships for effective international cooperation within the firm. For example, Bartlett and Ghoshal (1989:182) recommend to "develop relationships that result in management flexibility and close interunit linkages".

Relations serve several purposes in cross-border innovation development projects. Most obviously, they are important means for transferring information as well as seeking and providing advice (e.g., Granovetter 1973; Galaskiewicz and Burt 1991). Thus, they can help units search for, and subsequently integrate, useful resources and capabilities from other units (Hansen 1996). At the same time, they provide a social context in which project-related interaction can be embedded. For one, they facilitate knowledge creation, since they create a stronger shared base of information, knowledge, behaviors and cognitions. Specifically, they offer project participants cognitive and behavioral guidelines for efficient interaction; a basis for trusting behavior due to mutual knowledge of each other; and opportunity for social behavioral control, since inappropriate behavior can be punished in the future (Sohn 1992). In consequence, relations alleviate agency concerns and reduce transaction costs related to project interdependencies.

Due to geographic distance, relationships between the units of a multinational firm are comparatively costly and difficult to build. There is little opportunity for serendipitous communication (cf. Allen 1977), and all other interaction requires purposeful planning and justification. Consequently, a unit at the start of a cross-border innovation development project often lacks relationships to other units with valuable resources and capabilities, and must then build them as needed for the project. This is particularly likely if the firm has traditionally pursued a multi-national corporate strategy that has left local units virtually independent of each other (cf. Bartlett and Ghoshal 1989). On the other hand, certain units with special roles, such as center of excellence status (Roth and Morrison 1992), may have a wide network of international relations.

Centers can assist units in building and managing relations because of their traditionally favorable function as hubs and intermediaries in the firm's internal communication processes (cf. Egelhoff 1988). Due to their responsibilities and the flow of information, they typically maintain more and stronger international relations than the local units. In addition, formal authority allows centers to help overcome difficulties as the units build relations.

Therefore, centers may have relationship advantages over units that they can exploit in the project, thus bridging structural holes between the units (Burt 1992; cf. Hansen 1996). For instance, a center studied in the fieldwork systematically assisted units in establishing relationships by hosting a series of meetings during which each unit presented its expertise in the project-related areas. The size of the center's relationship advantage obviously varies with the strength of the center relations, the strength of the units' relations, and the requirements of the project. For those reasons, it seems likely that:

Proposition 3: The strength of relations among units in the firm systematically influences decentralization and center effectiveness in a cross-border innovation development project.

Project characteristics

Uncertainty

The uncertainty concept has been used in multiple variations of the basic definition that it is lack of information about the composition or processes of a system (Schoonhoven 1981; Lippman and Rumelt 1982; Hambrick and Lei 1985; Milliken 1987; Boyd, Dess et al. 1993). This lack is usually seen as relative to the requirements of the task at hand (Galbraith 1973). Studies have typically incorporated uncertainty either explicitly as a concept or implicitly via classifications that reflect it. For instance, several authors have distinguished between incremental and radical innovations, the latter being associated with higher degrees of uncertainty.

In a cross-border innovation development project, uncertainty can characterize a variety of project aspects (cf. the review in Caeldries and Moenaert 1993:165-66). Input uncertainty refers to lack of information about the necessary participants, capabilities, materials and other inputs for the project. Process uncertainty is lack of information related to the organization, management and execution of the project. Output uncertainty means lack of information about the quality and usefulness of the process outputs, both usually related to unclear user needs and competitive dynamics.

Uncertainty requires a high amount of information-processing for decision making, and thus encourages the use of information-intense communication media, boundary spanning personnel, and systematic information collection (e.g., Tversky and Kahneman 1974; Tushman and Scalan 1981; Anderson 1983). As uncertainty increases, invariant, program-based structures become less useful than more loosely coupled, organic ones (Burns and Stalker 1961; Lawrence and Lorsch 1967; Van de Ven, Delbecq et al. 1976). Conversely, decreasing uncertainty makes it easier to rely on comparatively static, predefined structures and processes, such as coordination of activities by rules or schedules (Thompson 1967; Galbraith 1973).

This has several implications for cross-border innovation development projects. First, if the units' local organizational routines and the firm's international coordination routines are adapted to certain kinds and levels of uncertainty – the central tenet of the original formulation of contingency theory (Lawrence and Lorsch 1967), then it depends on the kinds and levels of

uncertainty of the project how well those routines work in the project. Since the requirements of innovation projects are often at odds with those of routine business (e.g., Dougherty and Heller 1994), one can expect those routines to work better for some projects than for others.

Second, uncertainty may affect the participating units unevenly and cause incompatibilities in the way each unit prefers to coordinate its activities with the other units. For example, if a research lab in one country cooperates with a marketing unit in another, the lab may perceive little technological uncertainty for the innovation, whereas the marketing unit may perceive rapidly changing customer needs and competitor moves. While the lab may press for detailed project scheduling to compress total development time, the marketing unit may prefer flexibility and successive planning as milestones are reached (cf. Eisenhardt and Tabrizi 1995). This may call for coordination support from centers in order to overcome the differences.

Third, uncertainty can create a mismatch between the distribution of power among the units for routine business and for the project. If the ability to cope with uncertainty is a source of structural power (Hickson, Hinings et al. 1971; Hinings, Hickson et al. 1974), and if project-related uncertainty puts other units in the best position to handle it than the units that handle uncertainty for routine business, units may be tempted to react to the mismatch. The implications on decentralization and center effectiveness have been discussed before.

Fourth, uncertainty can make it more difficult to assess each unit's contributions and performance, with two consequences. The units may have greater agency concerns because they cannot observe or verify the performance of the other units as easily; and they may be less willing to participate in the project if their goals and performance measures do not consider how much uncertainty they dealt with. Therefore, centers may need to respond and increase their level of involvement, for instance by supplying a larger portion of the required funds, taking on greater managerial responsibility, or exercising stronger project control.

Fifth, high uncertainty creates opportunities for center intervention which can change the units' perception of uncertainty and cooperation opportunities: if their perceptions are enactments of the environment (Weick 1979), then they are particularly likely to diverge from the actual situation under uncertainty (cf. Daft and Weick 1984; Dutton 1993). Consequently, centers may be motivated to exploit by information-processing and leadership the influence they can have on units under uncertainty. This is precisely what corporate management did in Beta's information management project when it confronted the units with the innovation opportunity and at the same time developed a detailed process model.

Yet, centers will themselves not be unaffected by uncertainty. Higher information-processing requirements also make it more difficult for them to determine the coordination needs of the units and the best ways of supporting them. Therefore, they may either have to increase their involvement, or risk by maintaining a lower level of involvement that they will be less effective than desired. Overall, then, it appears that project-related uncertainty increases the total complexity of the coordination task and stretches the available coordination capabilities of the units and the centers alike, even though possibly in different ways. Therefore:

Proposition 4: The amount of project uncertainty systematically influences decentralization and center effectiveness in a cross-border innovation development project.

MOTIVATION

Like other business processes, cross-border innovation development creates a motivation problem: "to ensure that the various individuals involved in these processes willingly do their parts in the whole undertaking, both reporting information accurately to allow the right plan to be devised and acting as they are supposed to act to carry out the plan." (Milgrom and Roberts 1992:126) This is most obviously difficult if some of the units are less committed to the success of the project than other units.

However, when all units are equally strongly committed, another source of difficulty tends to arise. Participating units often operate according to goals and incentives that do not take into account the goals and incentives of the other participants. If so, there is little default alignment of interests, since helping a foreign unit achieve its goals bears little effect on the achievement of one's own goals unless one gets appropriately compensated for it. Moreover, units that have strong interest in the project may also have strongly held preferences. If so, they may be quite inflexible regarding the project organization and outcomes. Consequently, unit alignment must be achieved by upfront negotiation of contribution and compensation levels, and subsequently their measurement and enforcement.

Uncertainty, unit specialization and geographic distance further add to the motivation problem, for they imply that units initially cannot take all contingencies and activities into account. Also, they are likely to possess private information about their local capabilities and external environments, which may causes well-known agency problems. Under these conditions, units must take the possibility of adverse selection and moral hazard seriously. If these issues are not addressed, units may end up underinvesting in specialized assets required for the innovation to avoid hold-up, or lowering project efficiency by attempting to renegotiate later on.

Projects which create benefits on the corporate level, but costs on the unit level, cause additional difficulty, since units need not only negotiate with each other, but also with corporate units for acceptable compensation. For instance, corporate benefits may occur within the corporate planning horizon, but beyond the horizon of the units; or they may relate to the firm's overall structure, from which units do not benefit directly, as in case of operational flexibility (Kogut 1985; Lessard 1986; Lessard and Nohria 1990) and multi-point competition (Karnani and Wernerfelt 1985). Similarly, the re-use of knowledge from other units (Hansen 1996) may be more efficient from a corporate perspective, but threaten to cut into local development budgets, employment and equipment capacity. For the same reasons, a source of knowledge may not be motivated to transfer its knowledge to other units (Szulanski 1995).

Weak relationships among units, the rule rather than the exception in many cases, tend to amplify motivational difficulties. As argued before, relations give units the opportunity to compensate other units for their contributions within a broader context, for instance, by recognition and status attribution. Without strong relations, units cannot use such incentives and must instead emphasize material compensation. Moreover, they cannot rely as much on shared expectations regarding the relationship in order to create implicit contracts, and have to enter explicit ones instead.

In sum, motivational factors appear to play a critical role in cross-border innovation development projects and influence the complexity of the motivation problem via the kind and level of motivation each unit brings to the project. One can expect center involvement and effectiveness to vary accordingly. Centers may have means to motivate units that units cannot offer to each

other – such as formal authority and control over critical resources – to induce unit commitment to the project. On the other hand, centers themselves may find it difficult to address certain motivational constellations, and may therefore not be equally effective in all cases. For those reasons, it is plausible to expect that:

Proposition 5: The distribution of project-related motivation in the firm systematically influences decentralization and center effectiveness in a cross-border innovation development project.

COORDINATION COMPLEXITY

Coordination complexity was the final project characteristic which the first two research stages consistently revealed as relevant for answers to the research questions. It refers to the amount of information exchange among units, and the speed and intensity of mutual adjustment of the units' activities due to their task interdependencies in the project. In the fieldwork, coordination complexity was determined only after tasks had been defined and distributed among units. Consequently, even though coordination complexity can plausibly seen as influencing decentralization levels, it was decided to focus on the *resulting* complexity of cooperation among local units *after* decentralization levels had been set. An additional benefit of this approach was that, by disregarding complexity considerations for the decentralization analysis, an endogeneity problem in the statistical analysis was avoided.[11]

The complexity of international coordination in a development project increases with the number of project tasks, the degree of their international dispersion, and the strength of required coordination within and across tasks.[12] Under high coordination complexity, the project creates high international information-processing requirements. Since those are difficult to manage and costly in an international setting, the complexity adds an organizational challenge to the project that is quite independent of the other factors considered so far. At the same time, however, complexity may amplify some of the cooperation difficulties discussed earlier. For instance, it can create more opportunities for cultural differences to create incompatibilities that need to be addressed.

High dispersion requires units to coordinate their activities with a large number of activities in foreign units, and possibly even with a large number of foreign units. In consequence, the units may have to manage a whole variety of dyadic international settings, each with its own idiosyncrasies. The resulting coordination difficulties can be amplified if joint decision making processes are not just dyadic, but need to simultaneously involve many units.

While leaving the coordination requirements per se unchanged, geographic distance contributes to coordination complexity insofar as it reduces the organizational degrees of freedom for the

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[11] The endogeneity problem would arise because the choice of a certain decentralization level in turn affects the amount of cooperation among local units. An alternative approach could be to define indicators of coordination complexity, such as project size and number of required functional capabilities, that are known and invariant from the very beginning of the project on. They could then be used to test complexity effects on decentralization. However, neither the literature review nor the interviews revealed a set of relevant, meaningful, and reasonably precise indicators beyond the other constructs already discussed (e.g., the distribution of resources and capabilities). Nevertheless, it was decided to test various decentralization models with variables that could function as indicators, such as project size and capability complementarity across units.

[12] A task is seen here as a coherent set of project-related activities intended to produce a specified outcome which can be assigned to a subset of project participants.

units to address them. It limits, first, the set of useful communication means among units, most obviously person-to-person communication (Allen 1977). Second, it adds scheduling constraints, at least for synchronous communication. For example, while two units in the same country may have nine overlapping work hours and can easily communicate during that time, two units on opposite points of the globe have no such overlap and explicitly need to schedule communication outside work hours.

A central factor which impacts coordination complexity is the extent of cross-functional cooperation across borders. Cross-functional international cooperation in an innovation development project may be necessary or purposefully created. It may be necessary when complementary or otherwise interdependent resources and capabilities are internationally distributed – for example, in a marketing unit in one country and a technology center in another. On the other hand, it may be voluntarily created in order to compress development time (Eisenhardt and Tabrizi 1995). For instance, cooperation between functions in the development process can avoid iterations of development steps by helping to detect problems early on.

Functions are known to develop specific thought worlds, terminologies and routines (Dougherty 1992; Dougherty and Heller 1994). While those are necessary to help them better manage specific environmental influences, they simultaneously reduce the cognitive and behavioral compatibility among the project participants. Thus, cross-functional cooperation increases the number of people involved in decision making and requires additional project activities, which creates obstacles to cooperation. "It rests on a foundation of tight linkages in time and in communication between individuals and groups working on closely related problems", which are organizationally difficult to create and manage (Wheelwright and Clark 1993:175; cf. Clark and Fujimoto 1991).

Considering the variety of its sources and implications, it is not surprising that coordination complexity poses significant organizational challenges to the development project. Where possible, it may therefore be best to co-locate activities and thus reduce the impact of the international setting (Gassmann 1997). At the same time, centers may find that complex coordination requirements may make it more difficult for them to be effective.

Proposition 6: The complexity of project-related coordination among local units systematically influences center effectiveness in a cross-border innovation development project.

4.4 Summary: Research framework

This chapter has presented the conceptual framework for the current study of capability integration in cross-border innovation development projects. It contains as endogenous variables *project decentralization*, defined as the distribution of involvement in key project activities between local units and coordinating centers, and the *effectiveness of center involvement* regarding cooperation among local units. These variables are seen as depending on the nature of the project context and certain project characteristics.

According to the fieldwork and the literature reviews, relevant aspects of the project context for these two variables are the distribution of resources and capabilities within the firm, the relations among units, and the cultural differences across them. Project-related uncertainty, motivation of the various parts of the firm, and required coordination complexity turned out to be influential project characteristics. This leads to the specification of the research framework for the statistical

analysis shown in Figure 9. Several control variables were added to the regression models and are discussed in the respective chapters.

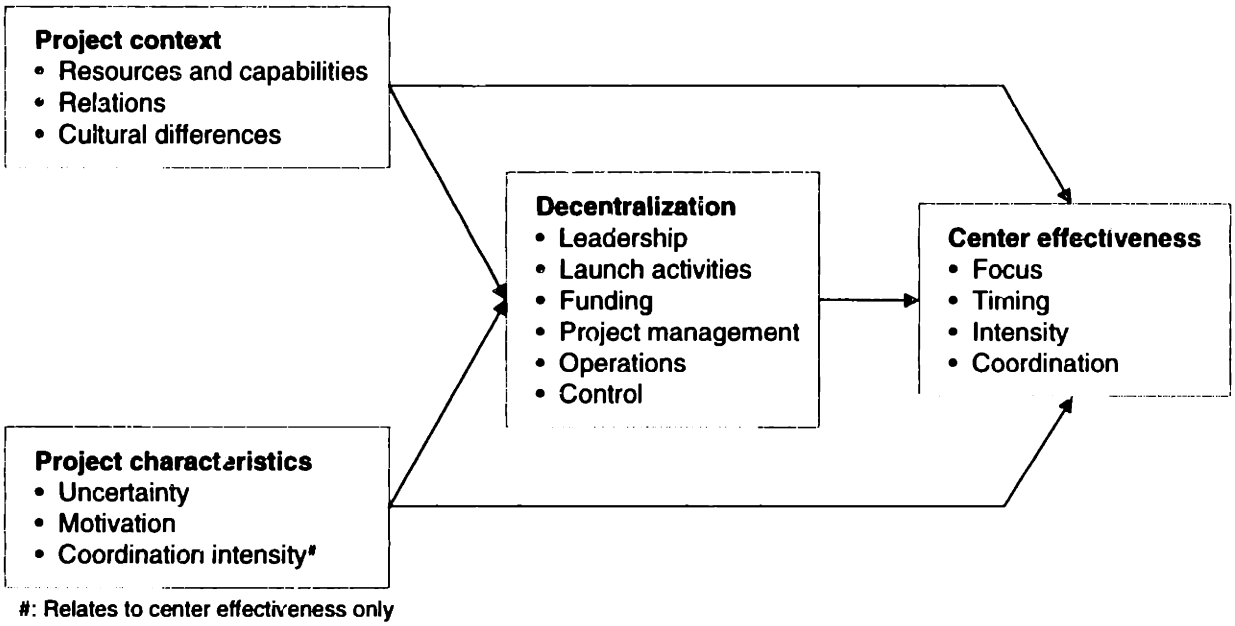

Figure 9: Research framework as result of the fieldwork

Building on the introduction of the determinants of decentralization and center effectiveness in this chapter, subsequent chapters will discuss specific hypotheses and analyze quantitatively the individual framework relations with multiple regressions. Canonical correlation analysis will be used to test the overall comprehensiveness of the framework, i.e., the total strength of relations between the variables describing project context and characteristics on the one hand, and the decentralization and effectiveness variables on the other hand. Separate multiple regression analyses will then reveal in greater detail how project context and characteristics relate to decentralization and effectiveness, respectively.

Chapter 5: Large-sample test of the research framework: Methodological approach and sample overview

This chapter discusses the methodological approach for the large-sample, statistical test of the framework. It first describes the research process and then presents the operationalization of the constructs in the research framework. The third section provides an overview of the sample, followed by a description and analysis of the measurement model.

5.1 Sample selection process

SELECTION OF FIRMS

Over the course of the study, cross-border innovation development kept receiving increasing coverage in the literatures, and many firms were stepping up their efforts to improve their global innovation management capability. In many cases, the study topic had also attracted their attention because of its significance for more broadly framed knowledge management initiatives. The study was thus to some extent targeting moving objects. Because of these dynamics, particular care was taken to ensure that participating firms considered the research as highly relevant and had sufficient exposure to cross-border innovation development.

Since there were no a priori criteria for firm selection, a list of conditions was compiled that were expected to require or motivate firms to rely on cross-border innovation development. Those included having a highly dispersed innovatory capacity (Dunning 1994), operating in an industry that had traditionally been multi-national, but had become more regionally or globally managed, and benefiting from rapid innovation development or international rollouts.

Next, a group of industries was selected that appeared to meet these criteria comparatively well. In each one, between 20 and 25 of the largest firms were contacted. The reason for focusing on the largest firms was that large multinational firms account for a disproportionally large share of cross-border innovation development (Pearce and Singh 1992; Casson and Singh 1993; Dunning 1994).

Assuming that firms interested in managing best practice transfer were disproportionally likely to also view cross-border innovation development as relevant, the American Productivity and Quality Center was approached. After careful review of the study purpose, it agreed to inform its members.

Additional contacts were established via the Industrial Liaison Program at MIT, which manages relationships to more than 140 large multinational firms; personal relations, articles in several publications, professional networks of mid-career managers at MIT, web sites dedicated to knowledge management, as well as handouts to attendees of MIT's 1999 Research Directors' Conference. Other firms were contacted because they had been mentioned in previous, related studies. Table 2 summarizes the contact methods and numbers.

As a result of this procedure, more than 40 firms expressed interest in the study. Follow-up conversations then helped determine whether it was reasonable for them to participate. This stage reduced to eleven the number of firms that committed to participating. Despite the initial commitments, however, several firms dropped out of the study even after pilot interviews had

been conducted or project lists compiled. All firms dropped out either because they had been taken over, had merged with another firm, or went through extensive reorganizations. In the end, four firms participated in the survey, and additional interviews and pilot tests were conducted in another five firms. Without the five losses, about 130 more projects could have been covered.

Contact method	Contacts
Direct mailing and phone follow-up	587
APQC mailing	270
MIT Industrial Liaison Program	40
MIT 1999 Research Directors' Conference	~200
Other, including Sloan Fellows 1999 mailing	>100

Table 2: Contact methods and numbers during sample selection

One of the four firms served as control setting, since it provided access to innovation development projects that involved multiple units within the same country, as opposed to international projects. Moreover, in all firms a second survey version was administered to members of centers who participated in the projects. This data were intended for triangulation of the data from local units and for additional analyses. All data from the control firm and all survey center data were excluded from the analyses in this study and are to be used in follow-up research. Therefore, the final sample in the survey stage for this study comprises three firms, 40 projects, and 101 units.

SELECTION OF PROJECTS AND QUESTIONNAIRE RECIPIENTS

Since each firm had to commit a substantial amount of management time for interviews and the survey, the firm had to appoint a high-ranked point of contact. The contacts needed to have good knowledge of the firm's international innovation projects and were asked to identify suitable projects and respondents. They received detailed guidelines and were asked to select projects according to the following criteria:

- The goal of the project was to develop an innovation. *Innovations* are new or significantly modified products and services, technical and organizational systems, as well as technical, administrative and operations processes. This includes non-standardized task solutions for which the project team has to develop a significant amount of task knowledge.
- The project team consisted of two or more full time members.
- The team members cooperated with people in foreign locations. *Cooperation* means: the use of resources (including funds, people, technical, market and customer knowledge, components, machines and other equipment, software, services), or divided functional or managerial responsibility during the project, or intangible forms of support (e.g., leadership support).
- The project could, but did not have to, involve units that have some formal responsibility for coordinating activities among a group of units (for instance, corporate or divisional headquarters).
- The project started in 1996 or later. The start of the project is the first date on which resources were formally committed to the project.

- The project was beyond the initiation stage, i. e., innovation development activities are in progress or completed.

The points of contact discussed their preliminary project lists with the researchers to ensure that the projects fit the criteria. This eliminated several projects in which only one local unit cooperated with its center. For each remaining project, the points of contact were asked to identify multiple local units per project, for the unit of analysis was the participation of a local unit in a project. For each unit, the contacts also identified a center unit that was considered to have the most influence on the local unit's involvement in the project. Local units and centers were defined as discussed earlier (cf. page 31). Questionnaire recipients in the local units were supposed to be knowledgeable about the project as a whole, but in particular about their unit's cooperation with foreign units and their center's involvement. In case of multiple respondents per unit, their responses would be averaged to get unit-level data.

5.2 Steps to maximize data quality

The study aimed for methodological triangulation (Jick 1979) to combine the advantages of rich information from in-depth interviews with the benefits of standardized survey data, while simultaneously reducing the idiosyncratic disadvantages of each data collection method. For the survey stage, several mechanisms were used to achieve high reliability and validity (Cook and Campbell 1979; Groves 1987).

Repeated instrument testing. Throughout the research process, cooperation with academics with expertise in the related fields of research and managers in the participating firms was sought to increase the validity of the research. The survey in particular was pre-tested and repeatedly refined over a period of several months. This ensured that recipients were likely to understand the questions as intended and could answer them easily.

Questionnaire customization. Questionnaire customization was an important means to get a high response rate and help the respondents interpret the survey questions correctly. Since the survey was administered in several firms, the questions used standard terminology in the main section, but defined those terms explicitly for each respondent, based on information from the points of contact. Thus, for instance, a questionnaire would provide for "foreign units" a generic definition and as potential cases a list of units outside the respondent unit's country that had also worked on the project. This customization should give respondents the impression that the survey was targeted as precisely as possible towards their project, help them go through the questionnaire more easily, and avoid data problems due to misinterpretations.

Multi-item scales. The questionnaire measured all framework constructs with several questions, with the goal to build multi-item scales that offered comparatively high validity and reliability of construct measurement. As Judd, Smith et al. (1991:163) point out, "the summation of many item responses into a single scale score allows the error components (some of which are positive, some negative) partially to be cancelled out, while preserving and strengthening the common core of the 'true' underlying attitude reflected in each item." Most of the questions were derived from findings of the fieldwork and the literature reviews. The pilot tests also revealed a few new construct aspects, and eliminated some that did not seem useful.

Standardized response scales. Because the questionnaire asked virtually identical questions about the respondent's unit, its center and foreign units, it was quite long. Moreover, it was

going to be administered in English to many non-native speakers of English. To avoid a low response rate, the question format had to make answering as easy as possible. Consequently, a symmetrical, five-point Likert scale format was used for most questions. The standardized agreement-disagreement answer options were: 1 - disagree strongly; 2 - disagree somewhat; 3 - neutral / no opinion; 4 - agree somewhat; 5 - agree strongly. Questions requiring an intensity scale had the same five-point format: 1 - not at all / very little; 2 - little; 3 - somewhat; 4 - much; 5 - very much.[13]

Elaborated survey administration procedure. Respondents were contacted by the respective point of contact before receiving the questionnaire, and if necessary up to two follow-up letters. They were assured of the confidentiality of their answers.

Reduction of context effects. To improve data quality, the survey also attempted to reduce so-called context effects, which occur if respondents use different frames of reference for their judgments. It is difficult to "understand the rating given to a single object without knowing something about the range of objects with which the judge is implicitly comparing it" (Judd, Smith et al. 1991:149). Therefore, the survey measured those ranges for several constructs. For instance, it included questions about the size and riskiness of the focal project *relative* to other projects in the respondent's unit, and the respondent's experience with international projects.

Addressing timing and censoring threats. Like all cross-sectional research on processes, this study also had to address potential effects of the timing of data collection (cf. Cook and Campbell 1979). Usually, timing concerns arise because the attributes of a process tend to change as it progresses, thus making data collected cross-sectionally at different points during the processes more difficult to compare and synthesize. Timing concerns of a different kind are warranted if the processes depend on external conditions at the time they unfold, if those conditions change over time, and if processes start at different points in time.

To address these timing concerns, firms were instructed to only select projects that had started in 1996 or later. This also limited respondent recollection problems. Moreover, the questionnaire anchored questions temporally wherever possible, i.e., asked about events or milestones that occurred at very similar points across projects. For most questions, it was either the start or the end of the project. The project start was defined as the first point in time at which resources - people or funds - were formally committed to the project; the end of the project was defined as the point at which project outputs were first put to routine use.[14] The remaining time-sensitive questions all focused on the time after the project had entered the "steady state" mode. Censoring

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[13] Pilot tests of a questionnaire version with a larger number of scales with more explicit scale anchors were conducted and suggested that the format reported here was most useful. Respondents found it difficult and time-consuming to switch from scale to scale and mis-scored items more frequently. Since the problem appeared worse for non-native speakers of English, using as few scales as possible was also a means to limit systematic measurement error.

[14] This formulation turned out to be most useful because some projects had been set up to develop a sequence of output versions. Discussions with the firms indicated that focal project conditions seem to change after the first version can be put to routine use. For instance, more user feedback becomes available, the level of outcome and process uncertainty is usually lower than during initial development, and the motivation of participants to work on a project is often different if the output already has proven benefits. Therefore, the point at which the first version of outputs was put to routine use was considered the end of the project for the purposes of this study.

threats appeared very small overall because the survey was administered after or close to project completion in the vast majority of cases.

Handling missing data. Since missing data is a typical problem in social survey research, various techniques have been developed to cope with it (cf. Little and Rubin 1986). This study used three techniques each to cope with missing values for individual construct indicators, as well as missing values for complete constructs. Thus, all statistical analyses could be tested with six different approaches to missing data. Details of these approaches are included in Appendix B: Procedures to handle missing questionnaire data.

5.3 Sample overview

This section provides a brief overview of the projects in the final sample, using descriptive statistics and correlation analysis. In particular, it discusses the structure and organization of the projects, as well as the organizational contexts in which they are embedded. This serves two purposes. First, it gives the reader a better understanding of the data underlying the analyses of project activities and outcomes in the following chapters. A broader, second purpose is to provide some simple, but informative data on cross-border innovation development projects in order to complement the mostly case-based, previous research on them.

RESPONDENTS

Table 3 lists the project affiliations of the respondents who returned questionnaires. Their average work experience with the firm was 10.5 years, with a standard deviation of 7.8 years. Most of them had previous experience with international projects in the firm. The sample average was 5.2 projects with a standard deviation of 8.4 projects.

Respondent's project affiliation	N	%
Project manager	25	24.8
Team leader	26	25.7
Team member	23	22.8
Supervising line manager	17	16.8
Other	9	8.9
Missing	1	1.0
Total	101	100

Table 3: Respondent's project affiliation

Units were located in a wide variety of countries. Table 4 lists the number of units by region.[15] Overall, the distribution reflects the geographic scope of the firms quite well, except for Japan, which is underrepresented. The Americas and Western Europe were about equally well represented, and somewhat more strongly than the Asia-Pacific region. Since this is also a pretty

[15] Due to confidentiality agreements, a breakdown by country is not possible.

accurate reflection of the geographic scope of the projects, the danger of cultural or location bias in the sample seems small.

Location of respondent's unit	N	%
Asia-Pacific	5	5.0
Central and South America	26	25.7
North America	27	26.7
Western Europe	43	42.6
Other	0	0.0
Total	101	100

Table 4: Geographic distribution of units in sample

UNIT AND PROJECT SIZES

Unit and project sizes were measured by headcount. Unit size was the number of people working in the unit at the start of the project. Internal and total project sizes were the number of people working on average on the project within the firm only, and within and outside the firm, respectively. Table 5 displays the size distributions. 70% of the projects have up to 25 people working on them internally, and about a quarter only up to ten. As mentioned before, these small sizes explain why the most influential center units for these projects are typically located on intermediate organizational levels.

As the identical categorical distributions suggest, internal and total project sizes differ only marginally. About half the projects are organized exclusively within the firm, and 86% of all projects involve four or fewer outsiders. A plausible explanation is that the firms try to shield those strategically sensitive projects and want to avoid information leakage via external business partners. Where external partners are involved, they are in quite a few cases customers.

Sizes	Unit		Project in firm		Project total	
	N	%	N	%	N	%
1 - 5	43	42.6	4	10.0	4	10.0
6 - 10	15	14.9	7	17.5	7	17.5
11 - 25	10	9.9	17	42.5	17	42.5
26 - 50	9	8.9	9	22.5	9	22.5
> 50	17	16.8	3	7.5	3	7.5
Missing	7	6.9	0	0.0	0	0.0
Total	101	100	40	100	40	100

Table 5: Unit and project sizes

It is remarkable that the organizational units in which the local project teams are embedded tend to be fairly small, in more than half the projects not exceeding 10 people. Given that the firms in

the sample are all large multinationals with many thousand employees, this fact also demonstrates that corporate units do in many instances not coordinate the activities of those units directly, but rather delegate the task to centers on intermediate levels. This provides support for the research approach taken here, namely, to have a coordinating center nominated for each unit.

Further correlation analysis reveals that projects in the sample tend to be large mostly because of large local teams, and to a lesser extent because they involve a large number of units. Consequently, large projects do not only require much integration activity across units, but also substantial coordination within units. Assuming that both kinds are important for project outcomes, it follows that the multinational firm needs to be able to integrate both across locations and within locations in order to make large projects successful. Project success therefore also depends substantially on the quality of local project management and team cooperation.

INNOVATION ROLES OF THE UNITS

Recent models of the multinational firm have emphasized the variety of innovation-related roles a unit can play within the firm (cf. Bartlett and Ghoshal 1989; Gupta and Govindarajan 1991). They define innovation roles along the dimensions of innovation supply and use, i.e., the frequencies with which the unit provides innovations to, or receives them from, other units. Those models also predict that the roles affect the way the unit is managed and organized.

The distribution of unit roles in the sample is displayed in Table 6, based on questions about the frequencies of within-firm innovation supply and use. Both are measured relative to other units in the peer group of the respondent's unit, as defined by the firm's organizational structure.

		Above-average reception frequency?					
Above-average supply frequency?	Scores	1	2	3	4	5	Total
	1: disagree strongly	6	2	0	0	0	8
	2: disagree somewhat	3	11	0	3	0	17
	3: neutral / nc opinion	1	3	22	3	0	29
	4: agree somewhat	1	13	12	9	1	36
	5: agree strongly	1	4	3	1	2	11
	Total	12	33	37	16	3	101

Table 6: Innovation roles of respondent units

According to the data, the units in the sample represent the whole role spectrum, from comparatively frequent to comparatively non-frequent suppliers and users. The correlation between the responses to the two questions is strongly positive and highly significant (.41, $p<.000$). The distributions seem marginally skewed towards slightly above-average innovation supplier units and slightly below-average innovation receivers, a perfectly acceptable and not surprising outcome of a sampling strategy that selected units participating in innovation development projects. Along both dimensions, they appear consistent with distributions to be expected in networks of peer units with dispersed innovative activity, as opposed to distributions in networks with most innovation activity in only one location (e.g., at headquarters). This

confirms the effectiveness of the sampling strategy, which aimed for firms in which internationally dispersed innovation activity is relevant.

ASSESSING THE REPRESENTATIVENESS OF THE SAMPLED PROJECTS

How representative and routine are the projects in the sample for the participating units, and therefore the observed patterns of decentralization and center effectiveness? Survey data on the nature of the respondent unit's project portfolio provide some indications. Respondents were asked to assess the size of their unit's project portfolio at the start of the focal project in terms of the number of other international projects and the number of other innovation development projects.[16] They also assessed the portfolio composition in regard to the heterogeneity of project sizes, outputs, and risk levels.[17] The three measures of portfolio heterogeneity correlate strongly and significantly with each other (correlations of between .36 and .45, all p<=.000). For illustration, they were merged into a summated heterogeneity scale, whose Cronbach's α value of .68 was adequate for the exploratory purpose.

According to the data in Table 7, respondents consider their unit's project portfolio as quite heterogeneous, and as many as 21% gave it the maximum heterogeneity ratings on all three dimensions. The portfolios range from those with a fairly low number of international projects to those with fairly high numbers, with a somewhat stronger representation of the latter.

	International orientation		Development orientation		Overall portfolio heterogeneity		
Score	N	%	N	%	Score	N	%
1	11	10.9	6	5.9	[3;5]	0	0.0
2	21	20.8	11	10.9	[6;8]	1	1.0
3	12	11.9	16	15.8	[9;11]	24	23.8
4	30	29.7	39	38.6	[12;14]	55	54.5
5	27	26.7	29	28.7	15	21	20.8
Total	101	100	101	100		101	100

Table 7: Composition and heterogeneity of the unit project portfolios
1: disagree strongly to 5: agree strongly (cf. Table 6)

As the second column suggests, units also tend to have quite a few development projects in their portfolios. More than 54% either agree or strongly agree to the statement that their unit "worked on many other innovation development projects" at the time the surveyed project started. Since the number of international projects correlates strongly positively with the number of innovation development projects (.62, p<=.000), one can infer that heavily innovating units are also quite involved in international projects. Thus, while most units in the sample need the capability to

[16] The survey questions were: "At the time of the project start, our unit ① worked on many other international projects; ② worked on many other innovation development projects."

[17] "At the time of the project start, the projects in our unit had ① quite diverse sizes; ② quite diverse outputs; ③ quite diverse levels of risk."

handle project heterogeneity, the heavily innovating ones simultaneously also require the capability to manage international cooperation during innovation development.

Given the heterogeneity of project portfolios, how representative is the project sample? Is there any significant selection bias regarding the projects' positions in the unit portfolios? In order to test this, respondents were asked to position the focal project within the project portfolio with respect to project risk, the required intensity of collaboration with foreign units, and the intensity of the center's involvement. Again, a total index of project position in the portfolio was constructed as a summated scale for illustrative purposes.

Table 8 displays information on the projects' portfolio positions. The sample projects are moderately above average in their risk levels, the intensities of international cooperation they require, and the amount of involvement from centers. Since the portfolios also contain purely local, domestic and non-development projects, above-average means were expected, if one assumes that the international scope and the development character create a certain amount of uncertainty and obviously international cooperation requirements.

Along all dimensions, the sample exhibits sufficiently large variation. Since the correlations across the dimensions are significant, but only moderately positive (between .22 and .26, $p<=.03$), large enough independent variation along each dimension seems ensured. The key conclusion is that the sample projects appear sufficiently varied to expect variation in the variables of interest, and well enough positioned within the portfolios to be representative of the other portfolio projects.

Project in portfolio	Relative project risk		Rel. intensity cooperation		Rel. intensity center involv.		Rel. position index		
Score	N	%	N	%	N	%	Score	N	%
1	3	3.0	10	9.9	15	14.9	[3;5]	0	0.0
2	16	15.8	10	9.9	13	12.9	[6;8]	1	1.0
3	19	18.9	22	21.8	26	25.7	[9;11]	24	23.8
4	31	30.7	31	30.7	19	18.8	[12;14]	55	54.5
5	29	28.7	28	27.7	24	23.8	15	21	20.8
Missing	3	3.0	0	0.0	4	4.0		0	0.0
Total	101	100	101	100	101	100		101	100

Table 8: Position of the sample projects in the units' portfolios
1: disagree strongly to 5: agree strongly (cf. Table 6)

SUMMARY: SAMPLE OVERVIEW

The main insights of the sample analysis with descriptive statistics can be summarized as follows: The distribution of respondents in the sample appears to represent well the geographic scope of the firms and the projects. The respondents' roles and locations are varied enough to avoid systematic respondent bias. The respondents' units are fairly small, typically up to 25 people, and fulfill a variety of innovation roles in their firms, both with regard to innovation supply and innovation reception in collaboration with other units. Overall, the sample

distributions of the roles look consistent with current models of distributed innovation in the multinational firm, as opposed to traditional models in which most innovations emerge at headquarters. This suggests that analyses based on the sample can inform those models.

The cross-border innovation development projects usually involve 25 people or less in total and only few outsiders. Within the units, the projects are part of project portfolios that are fairly heterogeneous in terms of size, outputs, and risk levels. A higher orientation in that portfolio towards innovation projects goes along with a higher orientation towards international projects. The sample projects seem to represent the whole spectrum of positions in the portfolios in terms of risk, intensity of international collaboration, and intensity of the coordinating center's involvement, which implies a low probability of systematic selection bias and good representativeness.

5.4 Measurement model: Description and analysis

This section presents the measurement model and analyzes it with regard to convergent and discriminant construct validity. Factor analysis is used to test the quality of the multi-item scales for the key constructs in the research framework.

The questionnaire was divided into four sections that corresponded to the categories of the research framework: project context, starting conditions, project organization, and project outcomes. Each section contained several subsections with questions on closely related constructs. Figure 10 summarizes the questionnaire structure.

Questionnaire structure

1. Project context
- Structure of the firm
- Information on respondent's unit
- Cultural differences
- Distribution of resources and capabilities
- Relations to other units and the center

2. Project characteristics
- Project nature and scope
- Project uncertainties and risks
- Incentives and motivation

3. Project activities
- Distribution of project tasks
- Cooperation with other units
- Center support of cooperation

4. Project outcomes
- Effectiveness of center involvement
- Project performance
- Transfer potential of project outcomes

Figure 10: Questionnaire structure

Operationalization of the research constructs

A primary concern for the study was to get valid and reliable measures for the constructs. Since scales are a proven way to achieve both high validity and reliability, the study used them where possible.

Dependent variables

Decentralization. Decentralization was operationalized as the difference between the respondent unit's levels of involvement in integration activities and the respective levels for the unit's center. Involvement was in turn measured by six items, one each for the activities that had been found to be important for capability integration during the project, as described before. Using the standard intensity scale, the survey contained three questions for each item, which measured the respective involvement levels of the respondent unit, the foreign units it cooperated with, and its center: "How much did your unit (the foreign units, the center)... ① supply funds for the project; ② provide project leadership; ③ manage the launch of the project (initial exploration and planning); ④ manage the project (e.g., plan, assign and coordinate activities); ⑤ perform non-managerial activities (e.g., research, marketing tasks); ⑥ control or review the progress of the project?" Respondents were instructed to estimate involvement levels if necessary.

Support effectiveness of the center. How effectively a center supported the respondent unit in its cooperation with foreign units was measured with four questions, related to the various components of effectiveness that had emerged. Respondents were asked to respond on the standard agreement-disagreement scale to the following statements referring to the point at which the project outputs became ready for routine use:[18] "① The center supported appropriate aspects of cooperation with foreign units. ② The center's support of cooperation was sufficient. ③ The center's support of cooperation was well timed. ④ The center's support of cooperation was well coordinated with the teams."

independent variables

Questions on all independent variables referred to the start of the project and used the standard agreement-disagreement scale.

Cultural differences. Respondents were asked about these cultural differences between project participants from their unit and those from foreign units and the center: "① Social norms (e.g., ways to handle conflicts, act in team meetings); ② values and principles they considered important (e.g., seeking consensus in a team); ③ likes and dislikes (e.g., how the project outputs should look or work); ④ languages and terminologies; ⑤ ways to make decisions; ⑥ ways to communicate with others; ⑦ standard routines and operating procedures for performing important tasks."

Cross-unit relations. A choice had to be made between measuring the respondent unit's dyadic relations to each of the foreign units it cooperated with, or taking an aggregate measure for all those units together. While dyadic measures would have offered greater precision and allowed further relation-oriented analyses, several factors suggested using aggregate data. First, the

[18] As explained before, the fieldwork indicated that this was the best common end point to ask about, since some projects continued beyond this point (e.g., to develop modified versions of the original outputs) and changed their character.

literatures and the fieldwork did not suggest that dyadic data were critical to explaining the phenomena of interest. To the contrary, it appeared in the fieldwork as if centers got involved more in reaction to a unit's overall relational position within the firm, rather than in response to particular dyadic relationships. As a practical concern, aggregate data helped keep the questionnaire length manageable and therefore better avoided nonresponse problems.

Another choice concerned the use of explicit scale anchors for communication frequency, one of the measures of relation strength. Even though frequency anchors are common in social network analysis, the difficulty here was that they were likely to be of little use in the regression analyses, because frequency was measured on the unit level and units could differ considerably in size. Therefore, scale anchors were not used, and respondents were purposefully left to interpret the scale themselves within their frames of reference.

The questionnaire measured several aspects of the respondent unit's relations within the firm, both to foreign units and the center. Relation strength as a very well-established construct in the social network literature bore little uncertainty about the quality of measurement and was measured with two statements: "① There was frequent communication; ② many people in the unit were involved in the communication."

Resources and capabilities. The levels of resources and capabilities in the respondent unit, foreign units and the center were all measured relative to the needs for the specific project, since relative levels were considered more relevant for the organization and outcome of a project than absolute levels: "① Sufficient funds for the project were available; ② sufficient people and equipment capacity were available; ③ sufficient knowledge to manage a project like this were available; ④ sufficient technological knowledge was available; ⑤ good relations to the users of the project outputs were available; ⑥ all functions needed for the project were available (e.g., marketing, research); ⑦ within the available functions, all capabilities needed for the project work were available (e.g., designing, testing, debugging)."

Motivation. Compared to other constructs, motivation levels were more likely to change over the course of the project and deemed particularly prone to recall bias for retrospective questions. Therefore, they were not measured directly, but rather indirectly via a range of factors that the literatures and the fieldwork suggested as causing, or inhibiting, motivation: "Team members from our unit / foreign units / the center were motivated to participate in the project because they ① thought the project goals were interesting; ② thought the project helped them achieve their work objectives; ③ thought the project helped them achieve their work objectives; ④ considered the project as important for their unit's business; ⑤ considered the project as important for other units' business; ⑥ wanted to use or improve existing capabilities; ⑦ saw that the other project participants had compatible goals."

Project uncertainties and risks. Measures for this construct were related to primary areas of uncertainty and risk identified in the contingency theory, innovation and project management literatures (Milliken 1987; cf. Caeldries and Moenaert 1993 for a review). Three adapted measures were added to specifically address uncertainty about cooperation with foreign units. Since several interview partners in the fieldwork could better describe the levels of knowledge they possessed in those areas than the respective lack of knowledge, the questions asked about the former. The answers were then reverse scored to get the uncertainty measure. Respondents were asked to rate their knowledge about the following project aspects at the project start: "① the project goals; ② the resources and capabilities the project needed; ③ how to organize the project

work effectively; ④ how the users would use the project outputs; ⑤ how to cooperate with foreign units on the project; ⑥ the costs and benefits of cooperation with foreign units; ⑦ how motivated foreign units were to cooperate."

Cross-functional cooperation. The questionnaire measured the extent of cross-functional cooperation with foreign units both directly and indirectly. As for unit relations, aggregate measurement was chosen. "① The capabilities in our unit and foreign units were quite similar; ② the capabilities in our unit and foreign units were quite complementary; ③ cooperation with people from foreign units was mostly cross-functional." The first two questions as indirect measures were based on the assumption that capabilities from foreign units in the same function would be rated as more similar than capabilities in other functions.

Cooperation intensity. Five questions measured the intensity of cooperation between the respondent unit and foreign units during the project. While three addressed communication directly, two focused on factors were indirectly related to cooperation intensity, namely, the interdependence of tasks and the predictability of communication content (Block and MacMillan 1993; Gassmann 1997): "① Team members from our unit often communicated face to face with people from foreign units; ② team members from our unit often communicated otherwise with people from foreign units (e.g., by email); ③ team members from our unit could predict about what to communicate with people from foreign units; ④ tem members from our unit and foreign units worked on closely related tasks; ⑤ compared to other projects, the project required pretty much cooperation with people from foreign units."

Control variables. Control variables for the statistical models were measured by single items. Relation conflict with the center and foreign units was measured with the statement: "The business goals caused conflicts (e.g., over resources)". Dependency of the respondent unit on foreign units was measured by: "Our unit depended on foreign units (e.g., for resources, decisions)", and the respective question regarding the center. For the size of the respondent unit, the number of people working in it at the start of the project was used. The largest number of time zones between the respondent unit and any of the foreign units served as an approximation of geographic distance. The maximum was used instead of an average because larger distances were expected to contribute disproportionally to cooperation difficulty. The quality of cooperation among team members within the respondent unit was measured by: "Team members from our unit cooperated well with each other."

Validity and reliability of the measurement model

The construct scales were developed via factor analysis, as opposed to simple summation. Factor analysis appeared preferable mainly because its assumption about the weight each scale component should receive in the construct score appeared more realistic. In contrast, it was not clear from the literature review that the assumption of equal component-to-construct relations would hold, which is key for summated rating scales.[19] Factor analysis also handled possible

[19] A summated rating scale simply sums the unweighted component values. It gives each component equal weight in the construct score because it assumes that each has the same relation to the underlying construct. In contrast, scale composition based on factor analysis takes a more general approach. It does not assume a priori that all components have the same relation to the construct and determines a specific weighting factor for each one. Therefore, it can better address cases in which components relate differently to the underlying construct, and in

measurement error for individual components better. For the purposes of this study, confirmatory factor analysis was the method of choice.

More observations were available for some scales than for others because the survey measured conceptually identical constructs for different parts of the firm, such as motivation levels of the respondent's unit, foreign units, and the unit's center. Therefore, the survey generated about twice or three times as many observations for certain constructs than for others. Since they were conceptually identical, the observations were stacked for the factor analysis, i.e., used jointly to compute the component loadings and construct scores. Stacking reduced measurement error for individual constructs and ensured that the weights for each scale component were the same across the conceptually identical constructs.

Factor analysis provided several diagnostics to assess scale reliabilities, including eigenvalues, uniqueness values, and component-factor correlations.[20] To facilitate comparisons with the reliability criteria for summated rating scales, Cronbach's α values and average component-to-component covariances were computed. The latter do not increase with the number of scale components, as Cronbach's α does.

Table 9 reports the results of the confirmatory factor analyses and the diagnostics for summation for all scales that enter the regressions of the study.

Scale	Scale items	Eigen-value	Avg. uniqueness	Avg. correl.: component to factor	Cronbach α	Avg. covar.: component to component
Cultural difference#	7	3.40	.51	.75	.87	.62
Relation strength#	2	.95	.53	.89	.75	.88
Resources#	7	2.53	.63	.67	.79	.40
Motivation#	6	2.82	.53	.75	.84	.48
Uncertainty	7	3.03	.44	.71	.84	.54
Cross-functl. cooperation	3	.49	.84	.67	.42	.28
Cooperation intensity	5	2.40	.51	.76	.82	.66
Project involvement#	6	3.63	.40	.80	.89	1.03
Support effectiveness	4	2.78	.23	.88	.91	.79

Table 9: Assessment of scale reliability
#: Analysis with stacked observations

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which the summated rating scale would most likely misrepresent the relationships. Obviously, a simple summated rating scale is a special instance of a scale constructed via factor analysis.

[20] These diagnostics were assessed as follows. The eigenvalues for the scales should exceed one (Kaiser 1960). The average uniqueness value is defined as the average fraction of component variation that the resulting factor – the actual operationalization of the unobserved construct – does not explain. It should not exceed .6. Furthermore, a high correlation between the component and the factor is desirable. Following standard practice, Cronbach's α values are considered sufficient if they exceed .7 (Nunnally 1978).

As the table indicates, the three-item scale intended to measure the cross-functional nature of cooperation between the respondent unit and foreign units does not meet the criteria for a reliable scale. Its eigenvalue is too low and the average uniqueness value too high, presumably to some extent because it is fairly short. Therefore, the questionnaire item measuring the actual cross-functional content of cooperation was retained as the one conceptually closest to the construct, since it measured an actual rather than a potential project activity and was intended to help predict the outcome of actual project activity.

With this modification, the measurement model performs well. All other scales besides cross-functional cooperation possess eigenvalues comfortably above the value of one, or only marginally below in case of relation strength. For relation strength, however, the eigenvalue is not as informative, given the expected high component correlation and the fact that the scale had only two components. Because of the latter, the scale is in fact a summated scale, and so Cronbach's α is most informative. The scale obviously performs well regarding α, as in regard to component-to-component covariation and component-to-factor correlation.

The levels of the component-to-factor correlations and their component-to-component covariances further support the notion of scale reliability in the measurement model. The uniqueness values are sufficiently low and exceed the critical threshold only marginally for the resources construct, which, on the other hand, has a high eigenvalue. The corresponding summated rating scales also exceed the critical threshold for Cronbach's α. Reliabilities are especially high for the dependent variables, project involvement and support effectiveness.

To test the unidimensionality of the scales, a set of confirmatory factor analyses was performed in which two factors instead of one were forced to be retained in order. The associated scree tests (Cattell 1966) indicate that the constructs also have the desired unidimensionality, since the eigenvalues drop steeply from the first to the second factor. Additional analysis of the correlations among the constructs indicates good discriminant validity. Thus, overall, the measurement model operationalizes the constructs with good convergent and discriminant validity.

The first step in the quantitative analysis was to assess the comprehensiveness of the research framework. It would indicate how relevant for decentralization and center effectiveness the project characteristics and context conditions were that the fieldwork had revealed. Specifically, the following research question was answered: If only the project characteristics and context conditions at the start of a cross-border innovation development project are known, how much of the variation in decentralization and center effectiveness can be jointly predicted? Accordingly, high predictability would mean that the research framework contains the major factors and relations which affect decentralization and center effectiveness.

From a practical perspective, the goal for this analysis is related. If much of the variation in certain organizational aspects and outcomes of a firm's projects is predictable with conditions known at the project start, then project management tools can be enhanced, or organizational processes adapted, so as to better address these conditions. For that purpose, it is helpful to know which of the conditions at the project start are particularly relevant, for improvement efforts can then be focused on them.

The above goals require a kind of analysis that examines the predictive power of each starting condition for all dependent variables combined. The method of choice is therefore canonical correlation analysis. Canonical correlation analysis allows to assess the multi-dimensional relevance of the conditions at the project start because it uses them as a set and estimates their relations to a second set, formed by the decentralization and effectiveness variables.

The analysis generates a series of linear combinations of the variables, one combination per set and step, which are most highly correlated to each other, subject to the constraint that each newly formed combination is uncorrelated with combinations from previous steps in both sets. These combinations are called canonical variates, the correlations between them canonical correlations. Due to their construction, all canonical variates together capture all correlation between the two sets of variables. Thus, the interpretation of the canonical variates and correlations, and of related statistics, will provide the desired information about the overall framework comprehensiveness and the most influential starting conditions.

6.1 The models for canonical correlation analysis

Several models were tested with canonical correlation analysis to compare the predictive power of the "core variables", i.e., project characteristics and context conditions at the project start, with the power of the firm dummies and the control variables for the multiple regression models in subsequent chapters. The control variables are defined and explained in connection with the respective model in those chapters.

The four models had the following structure: In all models, the "left set" of variables contained the two endogenous variables of the research framework, i.e., decentralization and center effectiveness. The right set in model 1 contained only the core variables. Model 2 added the firm dummies to examine the power of firm effects. For model 3, the core variables plus the control variables for subsequent regression models were used. Model 4 included core variables, firm dummies and control variables. Thus, the canonical analysis tested the following models:

Organization and outcomes (left set)	Conditions at project start (right set)
β_{i1}*Decentralization + β_{i2}*Effectiveness$_{Center}$	= $\Sigma\, b_{ij}$* x_{ij} i = 1..4, j's as in table below

and the following right sets:

j	Construct	Model 1	Model 2	Model 3	Model 4
1	Cultural_difference$_{Units}$	x	x	x	x
2	Relation_strength$_{Units}$	x	x	x	x
3	Resources$_{Center}$	x	x	x	x
4	Resources$_{Respondent_Unit}$	x	x	x	x
5	Resources$_{Foreign_units}$	x	x	x	x
6	Motivation$_{Center}$	x	x	x	x
7	Motivation$_{Respondent_Unit}$	x	x	x	x
8	Motivation$_{Foreign_Units}$	x	x	x	x
9	Uncertainty$_{Respondent_Unit}$	x	x	x	x
10	Conflict$_{Foreign_Units}$			x	x
11	Conflict$_{Center}$			x	x
12	Dependency$_{Foreign_Units}$			x	x
13	Dependency$_{Center}$			x	x
14	Size$_{Respondent_Unit}$			x	x
15	Distance			x	x
16-17	Firm dummies		x		x

6.2 Strength and significance of relations between canonical variates

As a first step, it is helpful to consider the strength and significance of correlations between the canonical variates in the left and right variable sets. The relevant data are given in Table 10, which contains the canonical correlations and their significance levels for each model. The significance levels were calculated in an iterative procedure as outlined in Stevens (1995:431) and Levine (1977:20). It begins with a test for the existence of a significant relation between the complete variate sets (reported in the rows labeled "Both pairs"). Then, the variate pair with the highest canonical correlation is excluded, and a significance test for the remaining variate pairs is performed (cf. row "1st pair removed"). Removal and testing are repeated until no more variates remain. Since the left variable sets only contained two variables, the procedure ends here after removing the first pair.

All variate pairs together create a highly significant overall relationship between the two variable sets in model 1, the core model. The explanatory power is high, given a total canonical correlation of .67. The square of this number indicates that 45% of variance in the left set of variates can be explained with the variates in the right set.[21] After removing the first variate pair,

[21] Note that this correlation is not equivalent to the correlation between the sets of *variables*, since the *variates* only extract part of the variance of the variables in each set.

the second pair is still able to explain about one quarter of the variance in the left variate set, and the relation remains highly significant at the .001 level.

Including firm dummies and/or control variables in the right set maintains the significance of the relationship between the two sets, and increases the explanatory power of the variate pairs in models 2 to 4. It is noticeable, however, that the core set of variables in model 1 already provides a very large fraction of the explanatory power in all extended models. For instance, model 3, which has the control variables added and is estimated on fewer observations, only has 4% more explanatory power.

Canonical correlations	N	R	R^2	df#	χ^2	p
Model 1: Both pairs	98	.67	.45	18	79.75	.000
1st pair removed	98	.49	.24	8	25.54	.001
Model 2: Both pairs	98	.72	.52	22	92.60	.000
1st pair removed	98	.50	.25	10	26.33	.003
Model 3: Both pairs	92	.70	.49	30	95.52	.000
1st pair removed	92	.62	.38	14	39.61	.000
Model 4: Both pairs	92	.79	.62	34	117.66	.000
1st pair removed	92	.62	.38	16	39.23	.001

Table 10: Strength and significance of canonical correlations
#: depends on the number of roots retained and variables in the sets, not on the number of observations

In sum, one can conclude that the research framework is quite comprehensive, for it captures strong relations between project characteristics and context conditions on the one hand, and decentralization and effectiveness on the other hand. Most of the overall relation between these variable sets can be attributed to the core framework variables. Firm dummies and control variables play a less influential role.

6.3 Relations between starting conditions, decentralization and center effectiveness

To find out which variables are most influential for the construct relations in the research framework, one needs to look at the relations between the variates and the variables in each set. That way, one can assess the overall relation strength between the variables in the two sets.

Table 11 describes the strength of the relationships between variables and variates within each set. The column "Left set variance" indicates what variance fraction of the variables in the left set the respective variate of the left set extracts. With two variates and two variables in the set, the left set variance extracted is always 100%. The column "Right set variance" contains the equivalent information for the right set. In model 1, the variates can extract 44% of the variance of the nine starting conditions. This suggests a sufficiently strong relationship between the variables and variates for the starting conditions. As the control variables and dummies are added in models 2 to 4, this fraction declines to 22%. Because these added variables are not as strongly related to the core from model 1 and cover range of diverse conditions, this decline is not

surprising. The key observation is that the variables of interest contribute strongly to the high observed canonical correlations, as desired for a robust framework.

Explanatory power of framework by variate	Left set variance	Left set redundancy	Right set variance	Right set redundancy
Model 1: 1st variate	62%	28%	19%	9%
2nd variate	38%	9%	25%	6%
All variates	100%	37%	44%	15%
Model 2: 1st variate	61%	32%	14%	7%
2nd variate	39%	10%	24%	6%
All variates	100%	42%	39%	14%
Model 3: 1st variate	61%	30%	11%	5%
2nd variate	39%	15%	14%	5%
All variates	100%	45%	25%	11%
Model 4: 1st variate	61%	38%	9%	6%
2nd variate	39%	15%	13%	5%
All variates	100%	53%	22%	11%

Table 11: Testing the explanatory power of the framework with redundancy analysis

To assess overall framework power, consider the redundancy values, which express the relation strength between the variables in the two sets. A redundancy value is the average of the R^2 values from regressing each variable in the second set on the variables in the first set. Accordingly, the "Left set redundancy" value for model 1 tells us that one can predict an average 37% of the variance in decentralization and center effectiveness with knowledge of only nine factors at the project start – relating to cultural differences, relations, motivation levels and uncertainty. [22] The average rises to 53% when controls and firm dummies are included. These numbers indicate strong overall predictive power of the conditions at the project start and show that the framework can be considered as comprehensive.

6.4 Sources of framework power

The variables that account for the strength of the framework relations can be identified by looking at the correlations between the variables and their variates. Table 12 shows that both

[22] A "Right set redundancy" value gives the equivalent average R^2 when decentralization and effectiveness variables are used to explain project starting conditions. This direction is less interesting for the study because of the underlying causalities. Apparently, the framework core is better suited for prediction than for retrospective analysis: the equivalent of the 37% predictive power for prediction is a meager 15% for retrospective analysis. This outcome is not surprising, since the right set contains a larger number of diverse constructs.

Note that redundancy values usually differ for the two directions.

decentralization and center effectiveness correlate strongly and significantly with the two left set variates. Thus, the observed high canonical correlations in the previous section point towards strong relations between the starting conditions and both endogenous variables, which is the desired outcome.

Correlations with variates, left variable set	Model 1		Model 2	
	Variate 1	Variate 2	Variate 1	Variate 2
Decentralization	-.87•	.50•	-.91•	.41•
Center effectiveness	.70•	.71•	.63•	.78•
	Model 3		Model 4	
	Variate 1	Variate 2	Variate 1	Variate 2
Decentralization	-.92•	.40•	-.91•	.40•
Center effectiveness	.61•	.79•	.61•	.79•

Table 12: Correlations between left set variables and their variates
•:p<.05

To understand which starting conditions account primarily for the predictive power of the framework, the relations between the starting condition variables and their variates are most relevant. They are displayed in Table 13 in form of variable-to-variate correlations for the right variable sets in the four models.[23]

For the purposes of assessing framework comprehensiveness, three observations are particularly important. First, all variables in the framework core correlate significantly with at least one variate. When control variables are included, the cultural differences variable turns marginally insignificant, but all other variables remain significantly correlated with at least one variate.

Secondly, the correlations are quite high overall. Therefore, one can conclude that the variates represent all variables well, as opposed to being determined by only a small subset. Consequently, the predictive power of the framework can be attributed to the whole set of variables. It does not seem to be the case that only a subset of the starting conditions accounts for the strength of relations in the research framework.

Third, the control variables tend to be less strongly correlated with the variates than the core variables. Moreover, half of them are not significantly related to either variate. This indicates that the set of core variables is the main source of relation strength in the framework, and that the influence of the control variables on the framework relationships is limited.

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[23] As in factor analysis, one can examine the relations in two ways: via the variable weights in the variate scores, which are the equivalent of factor loadings, or via correlations between the variables and the variates. The second way is used here because correlation between the variables in a set may lead to multicollinearity problems that can influence variable weights in the scores. According to Levine (1977:18) and Cooley and Lohnes (1971), who discuss this issue, the key point is that the variable weights in a variate score are not reliable indicators of the variables' representation in the variate if the variables are highly correlated. The reason is that one variable can suppress other correlated variables in the score. Put differently, even though all of the correlated variables can contribute equal information to building the score, the scoring algorithm may extract this information unequally from the variables and thus misrepresent their relation to the score. This problem does not appear with the correlations between variables and variates, because each variable is looked at independently.

Correlations with variates, right variable set	Model 1		Model 2	
	Variate 1	Variate 2	Variate 1	Variate 2
$Cultural\_difference_{Units}$	-.06	.24•	-.06	.23•
$Relation\_strength_{Units}$	-.12	.47•	-.14	.44•
$Resources_{Center}$	.68•	.54•	.59•	.62•
$Resources_{Respondent\_Unit}$	-.00	.77•	-.05	.75•
$Resources_{Foreign\_units}$	.21•	.49•	.17	.51•
$Motivation_{Center}$	.87•	.07	.81•	.19
$Motivation_{Respondent\_Unit}$	.22•	.57•	.16	.58•
$Motivation_{Foreign\_Units}$	.48•	.46•	.43•	.51•
$Uncertainty_{Respondent\_Unit}$	-.38•	-.57•	-.31•	-.61•
Firm dummies			.35•/.30•	.32•/-.35•
Correlations with variates, right variable set	Model 3		Model 4	
	Variate 1	Variate 2	Variate 1	Variate 2
$Cultural\_difference_{Units}$	-.06	.16	-.06	.16
$Relation\_strength_{Units}$	-.15	.37•	-.13	.37•
$Resources_{Center}$	.62•	.54•	.55•	.54•
$Resources_{Respondent\_Unit}$	-.08	.62•	-.06	.62•
$Resources_{Foreign\_units}$	.17	.43•	.16	.43•
$Motivation_{Center}$	.85•	.20	.77•	.20
$Motivation_{Respondent\_Unit}$	.16	.50•	.14	.50•
$Motivation_{Foreign\_Units}$	.45•	.45•	.41•	.45•
$Uncertainty_{Respondent\_Unit}$	-.33•	-.54•	-.29•	-.54•
$Conflict_{Foreign\_Units}$	.17	-.14	.15	-.14
$Conflict_{Center}$	.24•	-.27•	.22•	-.27•
$Dependency_{Foreign\_Units}$	.01	.06	.00	.06
$Dependency_{Center}$	-.08	-.20•	-.07	-.20•
$Size_{Respondent\_Unit}$	-.04	-.02	-.04	-.02
Distance	-.01	.37•	-.02	.37•
Firm dummies			.35•/.30•	.29•/-.27•

Table 13: Correlations between right set variables and their variates
•:p<.05

ASSESSMENT OF MODEL SPECIFICATION

The specification of the canonical models was examined with several tests. Since the analysis aimed at assessing the predictive power of starting conditions with regard to decentralization and effectiveness, the tests focused on fitted values of the canonical variates in the left sets, and the respective residuals.

All models pass the Cook-Weisberg tests of heteroscedasticity for all first and second variates in the left sets. Passing the tests suggests absence of heteroscedasticity in the residuals. Visual

diagnosis of the fitted-vs.-residual plots does not indicate any systematic patterns as signs of misspecification either. Furthermore, all models pass the Shapiro-Wilk tests for normality of residuals for the first and the second variates. In sum, the tests support the notion that the models were appropriately specified.

6.5 Summary of conclusions: Robustness of the research framework

The canonical correlation analysis in this chapter assessed the comprehensiveness and predictive power of the research framework. It demonstrated strong and highly significant relations between the framework parts, i.e., conditions at the start of a cross-border innovation development project on the one hand, and the decentralization and effectiveness variables on the other hand. With a substantial, significant canonical correlation of .67, the variates of the project characteristics and context conditions in the framework core – to which the hypotheses in subsequent chapters will relate – can predict about half the variation in the decentralization and effectiveness variates. Knowing the conditions in the framework core at the project start, one can predict on average 37% of variation in decentralization and center effectiveness at a highly significant level. Adding firm dummies and control variables allows explaining 53% on average. All but one variable in the core are significantly correlated to at least one variate even after firm dummies and control variables are added. According to several specification tests, the models seem correctly specified.

The main conclusions are therefore as follows: The focal framework variables contribute strongly to the framework relations. These relations are strong, highly significant, and based on a large set of focal variables. Control variables contribute less to those relations. In sum, the research framework that emerged from the fieldwork appears to be comprehensive and robust.

7.1 Introduction

The current section explores how firms vary the degree of vertical coordination of cross-border innovation development projects with project characteristics and context conditions. The main analysis tests the influences of project context and project characteristics on decentralization as aggregate involvement measure. Its hypotheses build directly on the findings of the fieldwork and the literature reviews presented earlier. Auxiliary analyses then focus on individual involvement aspects to discover deviations from the overall pattern. The models are complemented by a series of tests of alternative models to rule out plausible rival hypotheses. Figure 11 highlights the relevant parts of the research framework for this section.

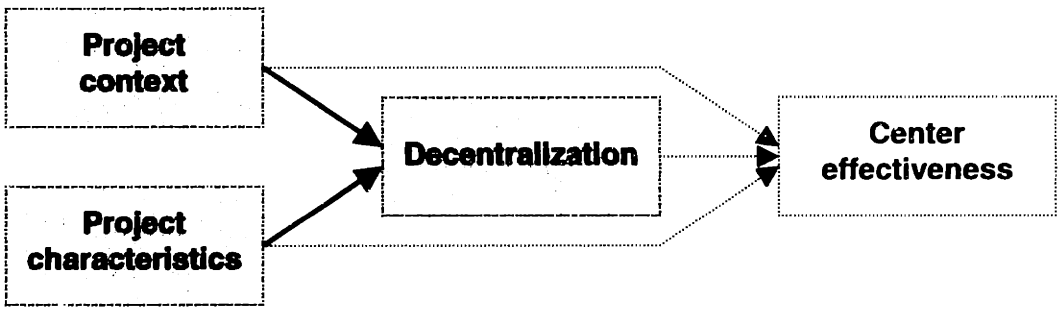

Figure 11: Focal framework constructs and relations in the decentralization analysis

7.2 Hypotheses for the decentralization model

This section presents the hypotheses to be tested. The predicted outcome is the decentralization of involvement in the six kinds of project activities that support capability integration, namely, leadership, funding, launch activities, management of ongoing operations, operations, and project control. Decentralization is operationalized as the difference in levels of involvement of the respondent unit and the center unit that can most strongly influence the unit's project work.

CULTURAL DIFFERENCES

The variety of institutional influences from the individuals' cultural backgrounds, their local organizational or professional cultures, and the local institutional environments often creates incompatibilities in a project that require effort to resolve. For instance, people from different units may have to clarify misunderstandings of each other. More seriously, they may need to solve conflicts on issues that can range from minor collaboration aspects to the core of the project, such as perceived user needs and innovation specifications. All else being equal, the fieldwork and the literatures suggest that higher cultural differences between cooperating units create higher risk of project conflict and inefficiency, due to extra efforts and transaction costs to overcome them.

At the same time, and again all other things being equal, higher cultural differences between local units put coordinating centers more into the position of mediator and conflict manager. By

the very nature of their task, coordinating centers routinely align activities across units and cultural contexts. Moreover, people in centers who will get involved in a project are often more senior than people in the local units who work on it. Due to their experience, they are more familiar with the units' cultures and possess better skills to handle cultural differences than people in the units. Thus, the experience with cross-border coordination and overcoming cultural differences likely gives centers a *capability* advantage over the units. The advantage can be expected to grow with the cultural differences between the units. Therefore, holding all other model parameters constant, higher cultural difference between the respondent unit and the collaborating foreign units should imply a higher capability advantage for its center and make its involvement more desirable.

Secondly, being higher up in the organization structure than the units, the center is the part of the firm to which a lateral conflict escalates if the units cannot resolve it themselves. In that sense, escalation is an organizational routine designed and developed to effectively overcome cultural differences between units. It allows and legitimizes the center to use formal authority in cases where other mechanisms fail. Consequently, the center can draw on a *positional* advantage, which grows with the cultural difference between the units if one assumes that conflict between them does so as well. Having high relative center involvement should therefore also be more beneficial when cultural differences are large than when they are small, regardless of the center's capability advantage.

Furthermore, strong cultural differences across units, in particular if they influence innovation specifications, may limit benefits from innovation standardization for the units. To avoid unnecessary differentiation costs, or cover standardization costs which none of the units is willing to bear, coordinating centers may have to become more involved in a project. Specifically, they may have to contribute extra resources or exercise strong project control to ensure adequate project outcomes.

In sum, a center's ability to support a local unit by coping with cultural differences, thereby drawing on scarce capabilities, positional power and additional resources, makes center involvement particularly valuable for cross-border innovation development projects whenever the differences between the local unit and the collaborating foreign units are large. Consequently, one should expect the following:

Hypothesis 1: The higher the cultural differences between the respondent unit and foreign units, the lower the degree of decentralization.

UNIT RELATIONSHIPS

Social relations between units can facilitate cooperation in multiple ways. For one, units that maintain strong social relations have good knowledge of each other and can therefore assess or even predict each other's motives and behaviors. This knowledge eliminates uncertainty about the cooperation partner and facilitates trusting behavior. Second, since social relations transcend the time scope of the project, they give a unit opportunities to punish or reward the others' behaviors, and therefore additional means of control and enforcement. Without them, a unit would need to rely on a more specific and explicit contract with the other units, which would increase transaction costs.

Strong relations also indicate mutual goal and behavior alignment among the units as a result of cooperation in the past. If units have had repeated choices as to whether to interact or not, the

fact that they did makes it more likely that their goals and behaviors are aligned, and that cooperation is perceived as mutually beneficial.

Regardless of whether such choices existed, strong social relations reflect many opportunities the units have had to develop and institutionalize routines to make their cooperation more effective. Those may include communication, project management and conflict routines and should prove advantageous even if the units' project goals conflict. Thus, units are likely to now possess the capabilities and resources to handle cooperation directly, without much center involvement.

When centers were heavily involved initially, repeated cooperation in the past gave units opportunities to acquire from centers the necessary capability, which in turn limits the centers' comparative advantage for the current project. Resource dependence theory (Pfeffer and Salancik 1978) would predict that units have an incentive to imitate center skills, for they can then justify taking more control of their environment.

From the unit perspective, these effects all directly reduce the need for centers to be involved in a project in order to manage relations among the units. From the centers' point of view, the repetition and routinization of cooperation that comes with strong social relations between units has similar effects. Routinized processes enable centers to exercise influence effectively with comparatively little involvement, for they can do so by program or schedule rather than mutual coordination (cf. Thompson 1967). On top of this, the learning process centers undergo with repeated involvement in unit interaction makes their involvement more efficient and effective. Moreover, centers have fewer "structural holes" (Burt 1992) in the information flows between units that they can exploit by mediating unit-to-unit communication. With strong lateral relations, units do not depend on the centers for critical project information any more, they can simply bypass them.

In sum, the basis on which centers can justify and add value by their involvement is considerably more narrow when units have strong lateral relations than when they are weak. One should therefore expect that, all else being equal:

Hypothesis 2: The stronger the relations between the respondent unit and foreign units, the higher the degree of decentralization.

DISTRIBUTION OF RESOURCES AND CAPABILITIES

Like any project, a successful international innovation project requires a variety of resources and capabilities. They range from financial funds, personnel and equipment capacities, project management knowledge, technological knowledge and knowledge of innovation users to dedicated organizational routines and administrative systems. The logic of the resource-based view, applied within the firm, suggests that their internal distribution should influence which parts of the firm contribute to the project, and thus also to what extent the project will be decentralized.

For most cross-border innovation development projects, the above resources and capabilities are obviously valuable, since the projects cannot be successfully completed without them. Secondly, they tend to be difficult to imitate and substitute, especially under time pressure within the project's window of opportunity, and when units are specialized. Third, if they are also scarce in one location, but available in another, they create for the other location the equivalent of a sustainable competitive advantage for the duration of the project (Barney 1991): that unit is in a

unique position to contribute them to the project. When each unit possesses complementary functional capabilities, the case may be quite obvious. But even if the units' capabilities are functionally substitutable, they are often geographically specialized and therefore scarce (cf. page 23).

The distribution of resources and capabilities with these qualities between the local unit and its center should therefore predict the relative levels of involvement. The less the respondent unit has resources and capabilities available when the center can contribute them, all else being equal, the more the center should get involved in the project, relative to the respondent unit. Conversely, the more resources and capabilities in the local unit relative to those at the center, the less center involvement is required. Thus, the available amount in the unit's center relative to the amount available in the local unit can predict decentralization:[24]

Hypothesis 3: The more resources and capabilities available at the respondent unit's center relative to the respondent unit, the lower the degree of decentralization.

MOTIVATION TO PARTICIPATE IN THE PROJECT

The degrees to which the respondent unit, the center, and foreign units are motivated to participate in the project can affect project decentralization in direct as well as indirect ways. First, motivation indicates how relevant the project is for the respective part of the firm. Being a future user of the innovation, or seeing it as an opportunity to achieve business goals, should motivate to participate in its development. Motivation theory thus suggests a straightforward direct effect: Motivation and involvement can be expected to go hand in hand. If a unit is also an innovation user, high motivation also signals to other parts of the firm that it is prudent to let the unit participate in order to avoid Not-Invented-Here effects (Katz and Allen 1982), e.g., save costly alterations and implementation problems after initial development.

Resource dependence and agency theory support this prediction, but for reasons less related to expected benefits. If high motivation indicates project relevance, then highly motivated parts of the firm will at the same time be very concerned about threats to achieving the best outcome. Therefore, they will try to be involved in the project not merely because of the net benefits, but also to control risks, such as agency problems during collaboration. High motivation can therefore not only result in willingness, but also in a claim of the respective part of the firm to be heavily involved.

From a center's position, agency considerations add a twist to that view. On the one hand, the center will adjust its involvement to the levels of motivation in the respondent unit and foreign units. However, it is also more responsible for, and concerned about, effective cooperation among the units than each unit. Consequently, a center is likely to remain more involved in the

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[24] It is important to note that each party's resource level has comparatively less predictive power if considered independently, instead of relative to each other. Consider a case in which both the respondent unit and its center have little of a needed resource, relative to what the project requires. Then, they will both contribute. If both have much of a needed resource, then, with the relative distribution and everything else unchanged, either one can contribute and use its resources as substitute for the others'. In consequence, since a statistical model holds everything else equal, the effect of the change in the resource levels on involvement relative to each other is undetermined. In contrast, by measuring levels relative to each other and relative to the project need, one can capture when one part of the firm possesses a comparative advantage over the other, and when there is little choice as to whether to use it – in other words, when the conditions for comparative advantage within the firm are met.

project if either only the respondent unit or only foreign units are motivated to participate, to avoid cooperation difficulties due to the less motivated party. Put differently, high motivation in both the respondent unit and foreign units allows a center to reduce its involvement even more because the units have a common interest in project success and should be more inclined to cooperate effectively. Of course the extra reduction may also be the effect of particularly strong claims by the units to handle the project themselves.

In sum, this reasoning suggests four motivation-oriented hypotheses, three about main motivational effects on decentralization plus the interaction effect discussed in the previous paragraph:

Hypothesis 4: The stronger the motivation of the respondent unit's center to participate in the project, the lower the degree of decentralization.

Hypothesis 5: The stronger the respondent unit's motivation to participate in the project, the higher the degree of decentralization.

Hypothesis 6: The stronger the motivation of foreign units to participate in the project, the higher the degree of decentralization.

Hypothesis 7: The stronger the motivation of the respondent unit as well as foreign units to participate in the project, the higher the degree of decentralization.

UNCERTAINTY

Uncertainty can relate to decentralization in several ways. For one, it creates a high risk of weak project performance or even failure. Therefore, the respondent unit may not want to bear that risk itself and seek higher center involvement than otherwise. One commonly observed example is the use of corporate funds instead of divisional or unit funds for high risk projects.

Secondly, under high uncertainty, centers may want to limit project risk and cooperation difficulties by strong involvement. For example, they can prevent conflict among the units when decisions need to be made under uncertainty. Their formal authority also allows them to maintain high project speed, for they can make decisions where units would need to engage in costly and time-consuming information-processing to justify a decision.

Third, high risk can indicate that the project falls outside the range of processes the firm's organizational routines are not designed to handle well. If so, the units will find their ability to cooperate directly more limited than otherwise. Similarly, the centers will not be able to maintain the desired level of influence with as little involvement as they could for a project to which the routines apply. Instead, they need to treat the project as an "exception" and be comparatively strongly involved.

Fourth, uncertainty may imply low expected net benefits of the project for the units. The units may perceive uncertain expected benefits as low compared to the known costs, or uncertain expected costs as high compared to the known benefits. Center involvement may then be necessary to motivate units to commit adequately to the project.

Finally, uncertainty gives a unit's center the opportunity to influence unit perceptions and behavior comparatively strongly. A center can therefore decide to get strongly involved in the project to exploit this opportunity, e.g., by providing project leadership. Therefore:

Hypothesis 8: The more project uncertainty in the respondent unit, the lower the degree of decentralization.

CONTROL VARIABLES

Several control variables were included in the model to ensure that the hypotheses could be tested correctly. Those variables had to meet two criteria: first, they needed to be based on a theoretically justified, underlying cause-effect relationship with decentralization as dependent variable. Second, they needed to have a theoretically justifiable non-zero correlation to at least one of the above independent variables, such that omitting them from the model could potentially bias regression parameters.

Firm effects

Since projects were sampled within firms, and since some of the relationships could potentially differ across firms, firm dummies were included to control for firm-level effects.

Resources and capabilities in foreign units

Resources and capabilities in foreign units could possibly shift the involvement of respondent units relative to their centers. For instance, one could posit that more resources and capabilities in foreign units would lead to greater project decentralization, for centers would now have less opportunity to add value to the project by their involvement. On the other hand, one could expect foreign units with more resources to be more involved in the project, which in turn could increase relative center involvement. For one, it would increase coordination requirements with the local unit, and centers might have to help taking care of them. Secondly, it could increase the risk that the interests of the respondent unit and its center would not be as well considered in the project, and higher center involvement could address this risk. Thus, while the overall effect of the level of resources and capabilities in foreign units on the distribution of involvement between the respondent unit and its center was difficult to assess in advance, there were plausible enough links to the other model variables to warrant inclusion as a control variable.

Dependency measures

Cross-border innovation development projects display quite complex patterns of unit power and dependence. Most obviously, the participating units may differ in the extent to which they depend on each other. Structural contingency theory has identified several internal sources of power that affects these dependencies (Hickson, Hinings et al. 1971; Hinings, Hickson et al. 1974): Some units' resources and capabilities are comparatively scarce, valuable and not easy to substitute and imitate (cf. Barney 1991). Some units are more centrally located in the firm's business processes or have particularly strong impact on them; and some are better able to reduce environmental or internal uncertainty than others (cf. Crozier 1964). External sources of unit power are a unit's relations to relevant actors in the firm's organizational field (cf. Scott 1992:292), or its contribution to providing external legitimacy.

While these conditions broadly determine a unit's power within the firm's structure, several other, more specific factors usually make the power structure in a particular development project even more complex. First, the development normally requires integration of valuable resources and capabilities from all participating units, regardless of which resources and capabilities are generally critical to the firm (cf. the typology of projects on page 23). Second, each unit is in a

unique position vis-à-vis its local environment and can exploit the lack of relations between the environment and the rest of the firm.

Third, an innovation development project can create contingencies for future distribution of critical resources, such as corporate investments and global responsibility for a certain line of business. If so, not only the current power distribution, but also possible future power constellations bear on the project. The project then provides an important opportunity for powerful as well as dependent units to influence the internal power distribution.

If a unit's power over another unit is the ability to control the things the other unit considers relevant (cf. Emerson 1962:32), then power gives units the option to use this control in order to reap greater benefits. Powerful units can try and use control over valuable resources and capabilities as project inputs, control over the development process, or over the desired outputs as means to extend their power. Conversely, dependent units can try to reduce their lack of power (Salancik and Pfeffer 1974; Pfeffer and Salancik 1978).

As most, if not all, units have some amount of power over each other in the project, and since many consider the project implications for the overall power distribution, the pattern of efforts can become quite complex. The efforts can focus on inputs that enhance unit power, such as locally manufactured components. They can aim at eroding the other unit's capability advantages, for instance by seeking as much knowledge transfer as possible during the project, or promoting local production instead of supply by other units. Or, they can relate to decisions that influence the unit's structural power, like the location decision for manufacturing the project outputs.

The implications of the internal power distribution for decentralization and center effectiveness are complex. On the one hand, the centers may themselves follow the typical patterns and attempt to stabilize their power over the units. This may imply being heavily involved in the project and allowing little decentralization. On the other hand, due to their responsibility and formal authority, they may be required to act as mediators of power-induced conflicts between units, and thereby maintain neutrality. For example, in Beta's information technology projects, corporate management had decisive influence on cooperation among the IT division and the other divisions by drafting a policy that allowed the latter to source IT from external vendors if desired.

To capture possible associated effects, two dependency measures were included in the model as control variables. They expressed the extent to which the respondent unit was dependent for routine business on the center and foreign units, respectively. These dependencies can reduce the respondent unit's project involvement relative to that of its center. Dependence on the center can imply that the center remains more involved than the factors entering the hypotheses would suggest otherwise. For instance, even if the unit possesses a resource and capability level that warrants high decentralization, the center might put the use of its resources and capabilities first. Or, the center might be tempted to maintain influence by mediating the unit's collaboration, despite the unit's adequate direct relations to foreign units.

If the respondent unit is dependent on foreign units for routine business, the foreign units can exercise their power to influence the project according to their needs. To prevent this, the center may increase its involvement in the project. In sum, all these cases suppress involvement of the respondent unit and would reveal themselves as artificially low decentralization, all else being equal.

Conflict measures

Conflict between the respondent unit and foreign units or the center can potentially alter the effects of the distribution of resources and capabilities, motivation, and dependencies. In case of no conflicts, one can expect involvement to mirror comparatively closely the relative levels of resources and capabilities, and strong project motivation should go along with stronger participation. Significant conflicts can change these relations. Even when other parts of the firm possess valuable resources or capabilities, or have an interest in the project, a unit may try and keep their involvement low, for fear it could lose influence over the project, or power within the firm.[25]

From the view of the respondent unit, conflicts would therefore have two effects. Conflicts with the center would lead to comparatively little decentralization, for the center would seek to exercise influence by higher involvement than otherwise indicated. Conflicts with foreign units would, for the same reason, lead to lower involvement of the respondent unit – all else being equal, including center involvement, this would appear as artificially high decentralization in the statistical analysis. Conversely, a center might increase its involvement to compensate for adverse effects of conflict between the respondent unit and its foreign collaboration partners.

Because of these effects, control variables for the respondent unit's amounts of conflict with the center and foreign units were included in the model.

Size of the respondent unit

The fieldwork suggested that participation in a cross-border innovation development project was particularly salient within a unit and in its interactions with its center if the unit was small. In contrast, it featured not very prominently in larger units, apparently due to lower overall significance within the unit's bundle of activities, and thus for the center. Therefore, a center might not only adapt its involvement in response to the unit's size, but might also exploit uncertainty and its relations to the unit differently if the unit was small.

Model summary

The hypotheses in this section lead to the model and expected coefficient signs shown below. The control variables are: firm dummies, resources and capabilities in foreign units, dependence of the respondent unit on foreign units for routine business, dependence of the respondent unit on the center for routine business, business conflict between the respondent unit and foreign units, business conflict between the respondent unit and its center, and size of respondent unit. To recall, decentralization scores were computed via confirmatory factor analysis, and as a weighted sum of the differences between the involvement levels of the respondent unit and its center in each of six key project activities that support capability integration: funding, leadership, involvement in the project launch, ongoing project management, project operations, and project control.

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[25] One manager described this as a recurring problem in cooperation between units in highly industrialized countries and units in emerging economies. The former had to cope with a high cost base, and the latter enjoyed clear cost advantages. To prevent future corporate investments being shifted away in the medium run, the former would avoid collaboration with the latter and so seek to avoid knowledge transfers during projects.

Dependent variable	Par.	Independent variable	Expected sign
Decentralization	$= b_0$		
	$+ b_1$ *	$Cultural\_difference_{Units}$	–
	$+ b_2$ *	$Relation\_strength_{Units}$	+
	$+ b_3$ *	$Resource\_spread_{Center}$	–
	$+ b_4$ *	$Motivation_{Center}$	–
	$+ b_5$ *	$Motivation_{Respondent\_Unit}$	+
	$+ b_6$ *	$Motivation_{Foreign\_Units}$	+
	$+ b_7$ *	$Motivation_{Respondent\_Unit*Foreign\_Units}$	+
	$+ b_8$ *	$Uncertainty_{Respondent\_Unit}$	–
	$+\Sigma b_i$*	$Control\_variable_i$	

7.3 Zero-order correlations

Table 14 reports the zero-order correlations between the independent variables, based on pairwise deletion. The shaded cells contain correlations with a significance level of .05 or higher.

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.14	.82															
2	.01	.74	-.05														
3	-.14	.81	.07	-.22													
4	-.17	.88	-.14	.20	-.00												
5	.03	.83	.04	.10	.42	.22											
6	.13	.91	.08	.12	-.05	.27	.32										
7	-.19	.96	-.03	.13	.14	.48	.47	.49									
8	.40	1.22	-.23	.03	.11	.07	.20	-.37	.03								
9	-.00	.92	.11	-.23	-.00	-.44	-.41	-.53	-.35	-.05							
10	-.05	3.26	.04	-.21	-.06	-.35	-.40	-.49	-.28	-.08	.93						
11	2.73	1.37	-.08	.10	.04	.21	.05	.08	.35	.10	-.09	-.05					
12	3.28	1.26	-.06	.05	-.04	-.07	.13	.04	.13	-.01	-.03	.02	.30				
13	2.86	1.28	.36	-.07	.05	-.24	-.01	-.03	-.07	-.07	.07	.09	.12	.22			
14	2.91	1.24	.27	.08	-.01	-.12	-.14	-.14	-.04	-.04	.15	.16	.02	.08	.56		
15	102	342	-.04	-.01	-.06	-.06	-.02	-.05	-.18	-.09	-.07	-.05	.03	.01	.03	.02	
16	.05	1.45	.10	.17	-.48	-.00	-.50	.02	-.17	.05	.07	.17	-.14	-.24	.04	.02	.02

1	$Cultural\_difference_{Units}$	9	$Uncertainty_{Respondent\_Unit}$
2	$Relation\_strength_{Units}$	10	$Uncertainty_{R\_U}$ * $Dependency_{Center}$
3	$Resource\_spread_{Center}$	11	$Dependency_{Foreign\_Units}$
4	$Resources_{Foreign\_units}$	12	$Dependency_{Center}$
5	$Motivation_{Center}$	13	$Conflict_{Foreign\_Units}$
6	$Motivation_{Respondent\_Unit}$	14	$Conflict_{Center}$
7	$Motivation_{Foreign\_Units}$	15	$Size_{Respondent\_Unit}$
8	$Motivation_{Respondent\_Unit*Foreign\_Units}$	16	Decentralization

Table 14: Zero-order correlations for the decentralization model (shading: p<=.05; pairwise deletion)

7.4 Results of the regression analysis

Since the observations were clustered within projects, the errors of observations from units participating in the same project were likely to be autocorrelated (Hanushek and Jackson 1977; Greene 1993). If not taken into account, autocorrelation would not affect the coefficient signs and values reported by an ordinary least squares procedure, but would lead to inefficient estimates and biased standard errors. Therefore, standard errors were corrected for autocorrelation across the observations for each project, which is implemented in STATA's regression procedure for survey data (StataCorp 1999).

Great care was taken to ensure that the model was correctly specified. Tests for omitted variables were conducted to see whether the model lacked important variables. Heteroscedasticity tests helped check for patterns in the variance of the residuals that were related to the independent variables. The normality of the distribution of the estimated residuals was tested. Visual diagnostics, including residual-vs-predictor plots and several other plot types to assess possible misspecification and outlier influence, were also employed.

The tests revealed one necessary modification to the model presented above. The original model's prediction of only a main effect of uncertainty when controlling for the respondent unit's dependence on its center seemed incomplete. The regression diagnostics indicated some heteroscedasticity for both the uncertainty variable and the control variable that could not be eliminated by transformation of either or both of the variables. Therefore, an interaction term for the variables was added to the main model and subsequent auxiliary models, namely, project uncertainty in the respondent unit times dependence of the respondent unit on its center. The correlations between the interaction term and the other independent variables are included in Table 14.

Before turning to the coefficient signs and sizes, it is instructive to consider the statistical power of the model. Table 15 displays the results of a hierarchical regression analysis for decentralization. The first row reports the results of regressing decentralization on the full model. In the second model ("core model"), firm dummies and control variables were taken out, leaving only those variables whose signs were hypothesized to be in a specific direction. This was to see approximately how much predictive power those variables contributed. The third model consisted of the core plus firm dummies, which were added back in to determine how much variance the control variables accounted for in the full model. The fourth model used the core plus the control variables to get a rough understanding of the strength of firm effects. Models five and six contained only firm dummies and firm dummies plus controls, respectively.

As the F values indicate, the full model and the partial models are all highly significant. According to the R^2 value, the full model can explain 69.9% of the observed variance in the dependent variable.[26] Together with the results from the omitted variable tests (discussed below), which do not indicate that relevant variables are excluded, this suggests that the model possesses fairly high explanatory power and is comprehensive. Compared to the total 69.9% of explained observed variance, the core set of variables alone can explain 46.7%. In other words, the explanatory power of the core variables represents about two thirds of the power of the full

[26] STATA's estimation procedure for survey data with correction for autocorrelation of standard errors does not compute adjusted R^2 values. The adjusted R^2 values reported in the table are taken from regressions without this error correction. This is possible because the correction does not change the R^2 value of the model.

model. Conversely, dummies and control variables can explain 30.7% of observed variance, which is somewhat less than half the power of the full model. Thus, it is fair to say that the variables in the research framework account for a large fraction of the full model's explanatory power. Furthermore, in the full model, the core variables on the one hand, and the control variables and the firm dummies on the other, seem to be explaining quite complementary parts of the observed variance.

Predictive power – hierarchical regression	R^2	R^2 adjusted	Model signific. (F)	N
Full model	.699	.631	.0000	93
Core only	.467	.413	.0000	99
Core + firm dummies	.541	.483	.0000	99
Core + controls	.636	.565	.0000	99
Firm dummies only	.202	.186	.0000	99
Firm dummies + controls	.307	.241	.0001	93

Table 15: Predictive power of statistical models for project decentralization

Turning to the details of the statistical analysis of the full model in Table 16, the following observations can be made. Hypothesis 1, predicting the effects of cultural differences on decentralization, is not supported. Contrary to the hypothesized direction, larger cultural differences between the respondent unit and foreign units at the start of the project tend to go along with higher project decentralization.

This result is puzzling and requires considering several other possible effects of cultural differences. First, assuming that cultural differences do not affect the amount of involvement of the respondent unit, and all else being equal, the result could imply that centers not only do not address higher differences by higher involvement; they even tend to be less involved than otherwise. One can then speculate that the resources and capabilities at the centers in the sample are little geared towards managing cultural differences. Alternatively, centers may be more reluctant to get involved with given levels of resources, capabilities and project interest, perhaps because of the very difficulties they expect.

A second possible explanation is that high cultural differences do not affect center involvement, but the involvement of the respondent unit. When facing cooperation with foreign units that are quite different culturally, the respondent unit might need higher involvement to address cooperation risks and difficulties. For instance, if an innovation requires standardization across locations, it may be best for the unit to reconcile differences directly rather than have a center impose a solution from above and meet resistance from the units.

A third explanation would be to consider the effect on decentralization as an outcome of a decentralized organizational structure that reproduces itself in the project as "administrative heritage" (cf. Bartlett and Ghoshal 1989; Ridderstråle 1996). High decentralization within the firm may not only allow large cultural differences among units to persist, but also impede higher center involvement in cross-border innovation development projects. Consider, for instance, the traditional *multi*-national organization, in which subsidiaries manage local activities quite

independently of each other. Regardless of the strength of their relation and the dependencies between them, the units may have little incentive and opportunity to assimilate culturally over time, and to learn to overcome associated conflicts. At the same time, the centers' opportunities for intervention and thus for building the capability to manage cultural differences may be limited. In consequence, this organizational context will carry over into the project organization when the units are required to cooperate on a project, in the sense that the respondent unit will be highly involved and its center relatively little. Put differently, an organizational context with these characteristics may not allow for higher centralization, even if possibly beneficial.

Decentralization	Coefficient	Actual sign	Expected sign
$Cultural\_difference_{Units}$	.39••	+	–
$Relation\_strength_{Units}$	.38••	+	+
$Resource\_spread_{Center}$	–.37•	-	–
$Motivation_{Center}$	–.80••	–	–
$Motivation_{Respondent\_Unit}$	.50••	+	+
$Motivation_{Foreign\_Units}$	–.05	0	+
$Motivation_{Respondent\_Unit*Foreign\_Units}$	.46••	+	+
$Uncertainty_{Respondent\_Unit}$	–.88•	–	–
$Uncertainty_{R\_U} * Dependency_{Center}$	.27••		
$Dependency_{Center}$	–.12	•:p<.05	
$Dependency_{Foreign\_Units}$	–.20••	••:p<.01	
$Conflict_{Center}$	–.26••		
$Conflict_{Foreign\_Units}$	.18•		
$Resources_{Foreign\_units}$	.02		
$Size_{Respondent\_Unit}$	.0005••		
Firm dummies	••		
R^2	.699		
R^2 adjusted	.631		
Model significance (F)	.0000		

Table 16: Regression results for the decentralization model

Hypothesis 2 receives strong support. Higher relation strength between the respondent unit and foreign units implies higher decentralization. If one interprets this mainly as indicator of the mediating role the center plays when unit relations are weak, then the underlying positional advantage in the firm's organizational structure shrinks as lateral unit relations grow. The finding is also consistent with the other parts of the hypothesis, namely, that stronger relations give the units better knowledge of each other and better opportunities to mutually control

behavior, both of which reduces the need for center involvement. It also supports the notion that cooperation may be more routinized when relations are strong, regardless of project risk, and that routinization enables higher decentralization as well as more efficient center involvement.

Hypothesis 3, based on reasoning that applies the logic of the resource based view within the firm, is also supported. The more the center has a resource and capability advantage over the respondent unit, the more it is involved relative to the unit, and vice versa. The standard error of the regression coefficient is slightly larger than expected, given that involvement based on the distribution of resources and capabilities could be considered the "base line" approach. It might be worth exploring whether a different operationalization of the advantage would lead to a more precise estimate. In any case, the effect is significant and in the expected direction under the current operationalization.

Hypotheses 4 and 5, concerning the motivation of the center and the respondent unit, respectively, are strongly supported: project interest translates into involvement. Since several organizational theories predict this outcome, it is difficult to attribute it to any one of them. Either a more motivated part of the firm is more willing to get involved because of the project benefits, and is allowed to by the other parts, or effectively claims higher involvement to avoid problems caused by the other part's lack of interest.

Suggestive evidence for this second view comes from the lack of support for a main effect of the foreign units' motivation on decentralization (Hypothesis 6), coupled with support for the interaction effect (Hypothesis 7). If higher motivation of foreign units by itself does not imply higher decentralization, but only in conjunction with higher motivation of the respondent unit, then a center can be seen as more reluctant to yield involvement if only some of the cooperating local units are motivated. Lack of joint motivation implies asymmetry in the cooperative setting – while one party has strong interest in a positive outcome, and is therefore quite committed to achieving the best outcome, the others are less so. Thus, the more committed party is more dependent on the less interested party's contribution and more exposed to agency problems than vice versa. The more both parties are motivated, the lower this asymmetry and its associated dangers.[27]

The effect of uncertainty on project decentralization is in the expected direction, since Hypothesis 8 receives support as well. Lower uncertainty implies higher decentralization, likely because the unit's routines and capabilities can handle the project well. In a routine situation, the unit does not desire or require much central involvement, since it can anticipate required actions and outcomes comparatively well. For the same reason, the center can reduce its involvement.

However, the picture appears more complex in regard to uncertainty than initially hypothesized. As explained before, the regression analysis suggested adding an interaction term to the original model to correct for heteroscedasticity associated with the uncertainty variable. Since the coefficient of this interaction between uncertainty and the respondent unit's dependence on the

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[27] It should be noted that the interpretation of the main effects of the motivation variables for the respondent unit and the foreign units is slightly different than that of the other variables, due to the inclusion of the interaction term: For those two variables, the regression coefficients indicate conditional effects on decentralization, namely, the effects when the respective other variable equals zero. Without interaction term, they would express relations across the whole range of observed values. See Jaccard, Turrisi et al. (1990) for a more detailed discussion and further references.

center turns out strongly significant, it adds an interesting twist to the picture. If the unit's dependence on the center for routine business is low, uncertainty is associated with a lower level of decentralization than in case of high dependence.

What explains the different organizational patterns? One explanation is to view influence that comes with a strong dependency relation for routine business as persistent enough to carry over into the project situation. Due to its structural power, a center can maintain influence over the unit and the project with less involvement than it would need in case of low dependence. This may in turn make the distribution of activities between the center and the respondent unit more adaptable to project needs in high-dependency situations than in low-dependency situations. However, since the model controlled for the amount of conflict between the center and the respondent unit, and since the main effect of the respondent unit's dependency on project decentralization is insignificant, any robust explanation along these lines has to be quite subtle.

A second possible explanation would be that organizational routines in a high-dependency context are adapted enough to permit decentralization. From an information-processing perspective, a center may be able to exchange all necessary information with the unit with little involvement. Conversely, it needs to be more heavily involved if the routines in a low-dependency context do not support the information flows that uncertainty necessitates.

A third explanation could be that the nature of decentralization differs between high-dependency and low-dependency contexts, and that the interaction effect reflects the differences across contexts. Since decentralization is operationalized with a six-item scale covering six key activities, it is possible that shifts in involvement in each of the activities differ between the contexts as uncertainty increases. On the other hand, the correlation between the items and the construct are quite strong and make this explanation appear improbable. Still, the current analysis cannot easily point towards any of the explanations as the most probable.

Turning to the results for the control variables in the model, one sees that, with one exception, the coefficient signs of the control variables are consistent with the reasons for including them in the model. That one exception is related to the amount of conflict between the respondent unit and foreign units. More conflict, it appears, is not associated with lower, but rather higher decentralization. While running counter to initial expectations, this result is consistent with the finding that higher cultural differences between units also come with higher decentralization. It suggests two possible explanations. If cultural differences cause conflicts during cooperation on the project, and if the control variable measures already manifest conflicts, then centers and/or units seem simply seem to react to latent as well as manifest conflicts in a similar way, regardless of the underlying cause. In particular, the centers may not be able or willing to increase their involvement in order to address these conflicts. Alternatively, one can question the ability of centers and units to compensate for the impact on the project of an organizational context that is characterized by conflict and cultural differences.

7.5 Analysis of the decentralization dimensions

Since the dependent variable, decentralization of project involvement, was a construct based on six measures of decentralization for different key project activities, separate analyses were performed for each activity to understand decentralization in greater detail. Six additional models were estimated in which the decentralization measure of the respective activity was the dependent variable. The results of these supplementary analyses are displayed in Table 17.

The top of the table contains item-to-factor correlations between the decentralization construct and the decentralization measures for each activity. Because management, leadership and control decentralization were most closely correlated with the construct, smaller deviations from the aggregate pattern were to be expected here. In contrast, decentralization of funding and involvement in project operations have lower item-to-factor correlations and should reveal larger deviations.

Decentralization by activity	Decentralization	Management	Leadership	Control	Launch mgt.	Funding	Operations
Item-to-factor correlations		.94	.91	.87	.86	.62	.59
$Cultural\_difference_{Units}$	+••	+	+•	+	+••	+•	+••
$Relation\_strength_{Units}$	+••	+••	+•	+••	+	+••	+•
$Resource\_spread_{Center}$	–•	–•	–•	–•	–	–•	–
$Motivation_{Center}$	–••	–••	–••	–••	–••	–••	–••
$Motivation_{Respondent\_Unit}$	+••	+•	+••	+••	+••	+	+•
$Motivation_{Foreign\_Units}$	–	+	–	+	–	–	–
$Motivation_{Respondent\_Unit*Foreign\_Units}$	+••	+••	+••	+••	+••	+••	+••
$Uncertainty_{Respondent\_Unit}$	–•	–	–•	–	–••	–•	–
$Uncertainty_{R\_U} * Dependency_{Center}$	+••	+•	+•	+	+••	+••	+•
$Dependency_{Center}$	–	–	–	–	–	–••	+
$Dependency_{Foreign\_Units}$	–••	–•	–••	–••	–	–	–
$Conflict_{Center}$	–••	–••	–•	–•	–	–	–•
$Conflict_{Foreign\_Units}$	+•	+	+	+••	+	+	+•
$Resources_{Foreign\_units}$	+	+	–	+	+	+	+••
$Size_{Respondent\_Unit}$	+••	+••	+••	+	+••	+	+
Firm dummies	••/••	•/••	•/••	••/••	••/••	••/	•/
R^2	.699	.579	.617	.630	.565	.581	.485
R^2 adjusted	.631	.484	.531	.546	.467	.486	.368
N	93	93	93	93	93	93	93

Table 17: Decentralization regressions by project activity
•:p<.05; ••:p<.01; shading: change from significant to not significant, or vice versa

As expected, the number of changes in significance levels, indicated by shaded boxes, increases as the correlation between the item and the construct drops (i.e., from left to right in the table). However, the impression of change as depicted in the table may appear stronger than it actually

is, since some of the coefficients reported as having turned insignificant actually remain significant below the .1 level.

Also noticeable are the drops in the percentages of explained variance when switching from construct to items as dependent variables. One can view this as a sign that the independent variables explain complete decentralization patterns better than any specific aspect of decentralization. At the same time, it raises the question whether the centers can use some of the activities as substitutes for each other, for this might cause inexplicable variation in the items while leaving the overall decentralization pattern intact.

Decentralization of project management

The key insight from the analysis of project management decentralization relates to the big puzzle from the previous analysis on the aggregated level: Why centers do not seem to address cultural differences and conflicts between the respondent unit and foreign units by centralizing project activities. The fact that the standard errors of the respective coefficients increase for both variables in this analysis suggests that some centers indeed do not do so, whereas others do. Put differently: decentralization "rigidity" in regard to cultural differences and conflicts seems lower for project management than for other components of the aggregate decentralization construct.

While this explains at least part of the puzzle, it raises a new question: How can the difference in organizational patterns be explained? With the current data, it seems difficult to produce an exhaustive explanation, since the difference persists even when decomposing the "resources and capabilities" construct into its components in the regression.

Decentralization of project leadership

The decentralization of project leadership follows the aggregate pattern very closely. As to conflict between the respondent unit and foreign units, the same reasoning as for project management seems to apply: centers vary in the extent to which they respond to conflicts among units with higher project leadership. If one considers leadership a better means to overcome conflicts than cultural differences, it makes sense that the variation in leadership decentralization is larger for conflicts than for cultural differences.

Decentralization of project control

The results for project control corroborate the additional insights from project management decentralization. In addition, they show that the size of the respondent unit and project uncertainty are less determining factors for decentralization of project control than for decentralization of other activities. Even for large units and for low uncertainty projects, centers have a tendency to keep control, decentralization in other project activities notwithstanding.

Decentralization of project launch management and project funding

The initial fieldwork had led to the finding that firms had institutionalized the launch activities for cross-border innovation development projects quite strongly, and likely more than for other key activities, such as the management of ongoing project operations. For example, it was often part of a routine launch procedure to compile a business case with financial projections and submit it for review. Centers therefore tended to be more routinely involved in the key decisions of this phase, like the specification of project goals, the choice of project participants within the

firm, and the means of project funding. In a similar way, funding decisions followed well-specified, less flexible guidelines than organizational decisions.

Since these routines made center involvement to some extent less sensitive to certain project and unit characteristics, it was expected that the model constructs describing those would predict the decentralization of launch management and funding less precisely than decentralization of other activities. According to the results of the analysis, this can be seen for the relation between units, lateral dependency, the conflict variables, and motivation of the respondent unit.

As to funding, it is noteworthy that the coefficient of the uncertainty construct was 50% higher than in the original model. This result is quite consistent with the fieldwork, which suggested that projects with high risks require higher amounts of central funding, but can nevertheless be managed and executed relatively independently by the units.

It should also be noted that the highly significant coefficient for unit dependence on the center is likely the result of the way the respondents interpreted the respective survey question, which asked explicitly about dependence in regard to key decisions and resources. Also, flexibility in the decentralization of funding seems to vary across the firms in the sample, since one of the firm dummies turns insignificant.

Decentralization of project operations

The decentralization of project operations tends to be influenced heavily and consistently by the amount of resources in foreign units – the associated coefficient grows to a multiple and turns highly significant in the disaggregated model. Higher resources in foreign units allow the centers to reduce their operational involvement relative to the respondent unit. This effect depicts operational resources and capabilities in the centers as much stronger substitutes for respective resources in foreign units than other kinds of resources and capabilities. Substitution seems to happen independent of the respondent unit's levels of uncertainty and dependency on foreign units.

At the same time, two more things happen: the coefficient of resource spread between respondent unit and center turns insignificant, but keeps about the same strength. Since the firm dummies lose precision, decentralization of operations appears most weakly associated with firm-specific characteristics, compared to other decentralization aspects.

7.6 Robustness tests

Assessment of model specification

An obvious threat to the validity of the above results and their interpretation is that the model was incorrectly specified. To assess the specification of the decentralization model, a variety of proven techniques were used.

Omitted variable tests. Two variants of the regression specification error test (RESET) were used to check for omitted variables (Kennedy 1998; StataCorp 1999).[28] Under the null hypothesis that

[28] The first adds the squares, cubes and fourth powers of the predicted values of the dependent variable as independent variables and tests whether their coefficients are zero. The second does the analogue for each independent variable.

no relevant variables are omitted from the original model, a significant result suggests omitted variable bias. For the above model, the test statistics were comfortably far from significance and thus did not indicate omitted variable bias.

Heteroscedasticity tests. A common indicator of model misspecification is heteroscedasticity, that is, systematic, unequal variance of the regression residuals in the sample. Heteroscedasticity was of particular concern here due to the structure of the data, as it might have indicated the need to consider project effects, or to estimate the parameters with a different estimation procedure. Therefore, the heteroscedasticity test developed by Cook and Weisberg was employed to test for systematic relations between residuals and each predictor variable, as well as between residuals and fitted values of the dependent variable. None of the tests suggested the presence of significant heteroscedasticity. The value for the motivational interaction term was lowest, which could indicate that a different functional form would slightly better capture the associated effects on decentralization. As a complement to the quantitative tests, residuals were plotted against the fitted values and the predictor variables, and visually inspected. Here, too, no signs of significant heteroscedasticity could be detected.

Specification test for the dependent variable. The so-called link test checks the specification of the regression model's dependent variable (StataCorp 1999). If the dependent variable is misspecified, certain additional independent variables will relate significantly to it with high probability in a modified model. Conversely, these variables should not be significant except for chance if the dependent variable is correctly specified. The basic idea of the link test is therefore to include the squares of the predicted values of the dependent variable as independent variable and test whether its regression coefficient is significant. For the above model, the test returned an insignificant coefficient, suggesting that the dependent variable was correctly specified.

Normality of the distribution of residuals. The normality of the distribution of regression residuals was tested with the Shapiro-Wilk test (StataCorp 1999). The significance level it returned did not allow rejection of the null hypothesis that the residuals were normally distributed, increasing confidence in the specification quality of the model.

Collinearity and discriminant analysis. Collinearity affects the interpretation of a model insofar as it can cause model parameters to be insignificant despite high overall explanatory power. For this model, the correlations among the variables in the model were far from levels at which collinearity may become a problem. To further check that the constructs were sufficiently distinct form each other, they were factor analyzed to test their discriminant validity. Highly overlapping concepts should load highly on a factor and exhibit low uniqueness values. The factor analysis did not reveal any noticeable or unusual associations between variables, supporting the conclusion that the model possesses good discriminant validity.

Estimation with alternative procedures to handle missing data. Six methods were used to addressed missing data on two levels: missing values for individual construct items, i.e., missing responses to individual survey questions, and missing values for complete constructs, i.e., scales based on several items. The procedures and the test results are described in detail in Appendix B: Procedures to handle missing questionnaire data. Overall, the regression results differ very little across the alternative methods. This is little surprising, given the high quality of the raw data in the returned questionnaires. One can conclude that the analysis is robust with respect to the procedure for handling missing data.

Fixed effects specification. To test whether the decentralization patterns within projects differed systematically from the patterns between projects, the decentralization model was also estimated with a random-effects model using generalized least squares. The comparison of the random-effects parameters with the parameters reported here reveals that the differences in the regression coefficients are less than 10% for all parameters, and in most cases less than 5%. The significance levels of $Dependency_{Foreign\_units}$ and $Conflict_{Center}$ both rise to .012, and unit size turns insignificant. For the other variables, the significance levels remain virtually unchanged. The Hausman specification test, which tests the null hypothesis that the coefficient differences are not systematic, returns a highly insignificant probability level of .72. These results strongly support the reported results and indicate that the model is robust with regard to the structure of the data and unobserved effects.

Ruling out alternative hypotheses

The validity and robustness of the conclusions has so far been tested on the methodological level by the tests of model specification, which have indicated that the model is appropriately specified. To do the same on a theoretical-conceptual level requires the development and test of rival hypotheses that have the potential to change or invalidate the conclusions.

Several variables representing conceptual relationships that were likely to influence the focal relationships in the model had been included as control variables from the outset. The rival hypotheses tested here by adding associated variables to the main model were seemingly less important or less justifiable. This section summarizes the findings in Table 18, while the detailed results are reported in Appendix C: Test of rival hypotheses for the decentralization and center effectiveness models.

Tested variable due to rival hypothesis	Summary of test outcome
Project size	Insignificant coefficient, R^2 up .0002
Cultural difference between respondent unit and center	Insignificant coefficient, R^2 up .004
Project routinization and experience	Insignificant coefficients, R^2 up <= .0012
Complementarity of resources and capabilities in foreign units to those in respondent unit	Insignificant coefficients, R^2 up <= .0065
Strength of relation between respondent unit and center	Insignificant coefficient, R^2 up .0005
Output type	Insignificant coefficients, R^2 up .0094
Functional unit specialization	Insignificant coefficients, R^2 up .027

Table 18: Tests of rival hypotheses for the decentralization model – summary results

According to the tests, none of the rival hypotheses has sufficient power to challenge the findings reported earlier. Adding each of the associated variables separately to the main model does not increase the model's explanatory power, and the regression coefficients for the variables turn out insignificant. Thus, it seems fair to say that the main model stands up against a series of plausible rival hypotheses.

7.7 Summary of conclusions: Decentralization in cross-border innovation development projects

To summarize, the model presented in this chapter can explain a large fraction of the observed variance in decentralization in cross-border innovation development projects. Firm effects seem to play a minor role and affect decentralization of managerial tasks more than of funding and operations. The model is robust in regard to autocorrelation by design of the regression procedure. With one interaction term added, the model passes a range of tests to detect common and important threats to validity, including omitted variables, heteroscedasticity, and functional misspecification. Furthermore, the findings are virtually identical across the six different procedures for handling missing data, as reported in the appendix to this chapter.

The majority of hypotheses are supported. Unit relations, the distribution of resources and uncertainty affect decentralization as expected. Decentralization varies according to the levels of interest in the respondent unit and its center. It is particularly strong when both the respondent unit and its foreign cooperation partners are motivated. Dependencies and conflicts do matter, but more so for certain decentralization aspects than for others. Surprisingly, large cultural differences and high levels of conflict between the respondent unit and foreign units are associated with high levels of decentralization.

The auxiliary analyses of decentralization by activity refine and clarify these results. In particular, they reveal that at least some centers seem to try and address cultural differences by centralization of management, leadership or project control. Higher uncertainty in the respondent unit tends to create particularly strong reliance on central funding. Moreover, the distribution of activities between centers and respondent units in regard to project launch and funding seems fairly routinized, and therefore appears less adaptive to the modeled conditions than the other project activities.

The findings of the model hold up against a series of plausible rival hypotheses. Neither does decentralization appear to be a function of project size, nor of cultural difference between the respondent unit and the center. Also, decentralization does not appear as the result of a unit's organizational routines for projects, which a respondent unit could have developed due to its overall project activity level.

As the model's explanatory power is mostly due to the key variables of interest, rather than the control variables or the firm dummies, one can conclude that the research framework gives a comprehensive view of the relation between the project contexts, the starting conditions, and decentralization patterns for the cross-border innovation development projects in the sample.

8.1 Introduction

This chapter analyzes the effectiveness of the support local units receive from coordinating centers for cooperation with foreign units in cross-border innovation development projects. Specifically, it addresses the following question: What conditions influence the effectiveness of the support a local unit receives from its center for collaboration with foreign units? The findings are intended to help understand when centers add value to the unit's own efforts, and in what regards their support capability is limited. Figure 12 shows on which constructs and relationships of the research framework the chapter focuses.

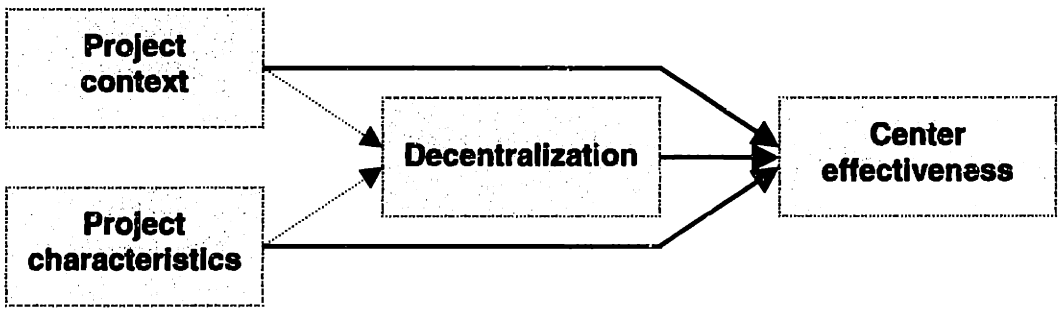

Figure 12: Focal framework constructs and relations in the effectiveness analysis

8.2 Hypotheses for the center effectiveness model

This section presents the hypotheses to predict the effectiveness of the center's support for the respondent unit during the project. According to the findings of the fieldwork, effectiveness was operationalized in terms of the quality of the focus, intensity, timing, and coordination of the center's involvement.

DECENTRALIZATION

There are several reasons to expect that higher decentralization leads to less effective center support. First, high decentralization means that the center contributes comparatively few resources and capabilities to the project, compared to the respondent unit. This in turn is likely to be the case when it has little or no resource or capability advantage over the unit. If so, it likely also cannot provide much support for the unit's cooperation activities that the unit cannot provide itself. The logic of the resource-based view of the firm therefore suggests that higher decentralization is associated with lower support effectiveness.

Second, high decentralization is a likely result if the center has comparatively little motivation to participate in the project. The center will therefore invest only few resources and little effort, regardless of the levels of resources and capabilities it has available. Consequently, high decentralization should be associated with low support effectiveness.

Independent of capabilities and motivation, and all else equal, low relative center involvement also means that the center's influence on the respondent unit for the project is low. As to

information processing, the center is less centrally positioned in the project's communication network and in consequence has little positional advantage to mediate the unit's communication flows. Being little involved also limits the quality of decision making at the center because it may not gain relevant information. For example, the center may not as easily understand the subtleties of a conflict between the units that arises from their cultural differences.

At the same time, low involvement restricts the legitimacy on which the center can base critical decisions and actions. The local unit may be concerned about the center's motivation and interest if the center is not much involved in the project, yet aims at exercising strong influence. Thus, transaction cost and agency considerations may affect its assessment of the center's effectiveness.

High decentralization can also be seen as a reflection of the local unit's strong project involvement. Viewed this way, it implies that the unit's cooperation situation and support needs are quite complex. Such complexity can make it difficult for the center to provide effective support. In particular, existing routines and capabilities may be of little use for handling the situation. Therefore:

Hypothesis 1: The lower the center's involvement relative to the respondent unit, the less effectively the center supports the unit's cooperation with foreign units.

Uncertainty

Uncertainty is expected to diminish the effectiveness of center support. For the project in general, it implies greater difficulty to plan and schedule ahead, and higher likelihood of unforeseeable changes to adjust to new information. For the units in particular, it causes difficulty in predicting the nature, timing, focus and intensity of cooperation with each other. Cooperation therefore happens under a certain time pressure, since lead times are small and coordination delays affect local activities immediately.

These conditions have various consequences for a center. The center can less readily determine from its own involvement how best to support the unit. The necessary information to be most supportive is less readily available, and the center's information processing requirements are particularly high. At the same time, the unit's demands on the center for support are higher because of the uncertainty, and its tolerance for deviation from the desired support lower.

Furthermore, and related to this point, the center runs a higher risk of not supporting the unit most effectively because the range of behaviors that are most effective is narrower. For instance, if uncertainty and coordination by feedback increase the time pressure under which the center needs to deliver its support, then any delay in providing such support will have a more adverse effect on project performance (e.g., in terms of completion speed and opportunity costs) than in a project where certainty creates "slack". In other words, center involvement is more likely to be suboptimal, and suboptimal involvement has higher associated costs. Therefore, one can expect support effectiveness to be negatively affected by uncertainty regardless of the level of center involvement.

Of course, uncertainty tends to also increase the probability of dissatisfactory project performance overall, e.g., spending beyond budget, slow project progress, or a mismatch between initial specifications and user needs at the time of project completion. Under high uncertainty, there may be a higher risk that the respondent unit attributes these outcomes to the center by considering its support as ineffective. In sum, one can therefore hypothesize:

Hypothesis 2: The more project uncertainty in the respondent unit, the less effectively the center supports the unit's cooperation with foreign units.

CULTURAL DIFFERENCES

It has been discussed before how differences in the institutional contexts of the local units can make cooperation more challenging for them to manage. The key implication with regard to center effectiveness is that it puts the centers in the role of mediator and conflict manager. As units tend to have less experience with cross-cultural collaboration than the centers, centers have a larger capability and authority advantage when the cultural differences are greater. For example, when neither of the units can claim its institutional elements to be preferable, deadlocks in lateral negotiations will often require center intervention. Therefore, the benefits of center intervention are likely to be higher when the cultural differences between the respondent unit and foreign units are greater, for any level of decentralization.

At the same time, centers may have a particularly strong interest in cross-border integration when cultural differences among units are large because of integration benefits on the corporate level. If so, centers can be expected to be highly motivated to provide effective support in those cases, whereas units themselves tend to have less motivation to address the cultural differences. Then, centers should appear as more effective supporters of cooperation than otherwise.

From the standpoint of statistical modeling, larger cultural differences can lead to higher center effectiveness because it is unlikely that the level of center involvement fully reflects their size, and because the involvement level, once determined, is not easy to increase. Since cultural elements are usually taken for granted and tacitly held (Jepperson 1991; Zucker 1991), they are a prime example of "pre-conscious processes and schema as they enter into routine, taken-for-granted behavior" (Powell and DiMaggio 1991:22) in cross-border innovation development projects. Because of their very nature, they will surface over time only, namely, when incompatibilities begin to impede collaboration. For that reason, some cultural incompatibilities and their effects on collaboration are not easy to fully anticipate at the start of a project, the point at which the project tasks are usually distributed between centers and local units.

In consequence, the chosen level of decentralization reflects an underestimation of cultural differences and creates particularly valuable opportunities for centers to support local units in case of high cultural differences, independent of the level of decentralization. Even if higher cultural differences are associated with higher relative levels of center involvement, and if higher relative center involvement makes center support more effective in general, the relation between cultural differences and center effectiveness will not be fully mediated by center involvement. Therefore, even though the effectiveness model controls for the decentralization level, one can expect to find a direct and positive effect of cultural differences on center effectiveness.

Hypothesis 3: The higher the cultural differences between the respondent unit and foreign units, the more effectively the center supports the unit's cooperation with foreign units.

UNIT RELATIONSHIPS

Strong relationships between the respondent unit and foreign units suggest that the center's task to support the unit is fairly easy. As discussed before, the units have had ample opportunity in the past to develop effective routines and capabilities for collaboration. Those can include ways to distribute activities among them, manage the project, exchange information, develop

knowledge together, and solve conflicts. Similarly, as a result of organizational adaptation, a center will have developed particularly effective ways to support collaboration of a unit with strong international relations. Moreover, the relationships provide a context in which to interpret, monitor and control the units' behaviors, which reduces the possibility of cooperation problems.

These conditions make it easier for a center to support the units effectively at any level of involvement. In addition, because of the strong context on which units can draw, center support is less critical, for failure to provide the best possible support will affect unit collaboration less adversely. Not only does a center have it easier to be effective, but also are the consequences of not being most effective less severe.

Regardless of the quality of existing routines, a center has incentives to support a unit which is centrally positioned in the project's collaboration network, since support creates disproportionally high benefits – e.g., supports communication and project performance comparatively much. These benefits are to some extent independent of the unit's overall level of project involvement. In addition, a centrally positioned unit is particularly important for internal communication flows and joint activities among units, and so possesses structural power within the project (Hickson, Hinings et al. 1971; Hinings, Hickson et al. 1974). Drawing on this power, it can demand effective project support from a center, even if the center is not motivated or particularly capable to support it more effectively than peripheral units. To summarize, motivation theory, the organizational learning literature, as well as power and structural contingency theories suggest the following:

Hypothesis 4: The stronger the relations between the respondent unit and foreign units, the more effectively the center supports the unit's cooperation with foreign units.

UNIT INVOLVEMENT

This section argues that a center has several reasons to support a unit more effectively when the unit is relatively much involved in the project, compared to foreign units. As was just mentioned, highly involved units can use their structural power to pressure centers for particularly effective support. Of course the center may also be particularly motivated to support units that are large project contributors, given the relatively high overall benefits a certain amount of support will create. Independent of this, high project involvement by itself makes the unit's project participation more salient and visible to the center. The center may therefore be better aware of cooperation needs and ways to support it.

In addition, high relative unit involvement can indicate that the unit possesses many valuable resources and capabilities for the project. Those are likely to be positively correlated with its skill level to cooperate effectively with foreign units, which facilitates the center's task to support the unit effectively. If such skills are the outcome of previous collaboration experience, then, in analogy to the argument for the previous hypothesis, the center may be able to rely more effectively on organizational routines to support large project players. These can either be routines to support whatever unit is a large player in any given project, or routines that have developed because a particular unit, being a large player in a current project, was a frequent large player in previous projects.

Conversely, a high involvement level of the respondent unit can imply a comparatively limited role of foreign units in the project. One can therefore expect the cooperation requirements to be less complex than in case of collaboration with large foreign project contributors, which in turn

facilitates the center's support activities. At the same time, the prominent role in the project gives the unit much immediate influence on its project relationships, so that it can better shape cooperation according to its needs. As a result, the unit needs to rely fairly little on the center for cooperation support, whose task to support the unit with a certain level of involvement becomes fairly easy.

Hypothesis 5: The higher the project involvement of the respondent unit relative to that of foreign units, the more effectively the center supports the unit's cooperation with foreign units.

UNIT MOTIVATION

Previous research has found a strong, but sometimes surprising, relationship between motivational factors and the performance of collaborative processes within the firm. For instance, when analyzing difficulties of best practice transfers from a source unit to a recipient unit, Szulanski (1995) discovered that motivation of the source unit does not have a consistently positive effect on process performance: "In particular, higher motivation of the source seems to increase the likelihood of cost overrun and, to some extent, of delays" (p. 82).

In several cases covered in the fieldwork for this study, the highly motivated units were particularly critical of performance and of the contributions of the other project participants. The interviews suggested that the high level of motivation tended to translate into ambitious and strongly held expectations about project organization and outcomes. As a result, the units got particularly frustrated with the compromises and adjustments that international collaboration required throughout the course of the project, which then led to the comparatively negative assessments. Moreover, because of their high motivation, they would attempt to resolve difficulties first laterally by themselves and only turn to their centers in case of deadlocks. The centers were thus primarily confronted with particularly difficult situations to solve, and more challenged in their capabilities. For these reasons, respondent units that were highly motivated were expected to be quite demanding of and less satisfied with support from their centers, all else being equal.

Demands on the center appear particularly strong if high motivation of the respondent unit goes along with low motivation in the foreign units it collaborates with. In this case, the respondent unit is likely to experience disappointments during collaboration not only because of its own, ambitious expectations, but also because the foreign units lack commitment and willingness to perform the tasks they have taken on. In particular, the foreign units have little interest in favorable project performance and are therefore less inclined to resolve any difficulties with the respondent unit. This creates a comparatively challenging intervention setting for the center. For example, the plain use of authority can easily backfire, since the foreign units control valuable resources for the project, while their stakes are low. Therefore, high motivation of the respondent unit along with low motivation of foreign units appears to make effective center support for the respondent unit extremely difficult to provide.

Due to the structure of the statistical model, one can hypothesize this relationship in yet another way. Since the model controls for the vertical and lateral distributions of project activities, the regression coefficient for relative unit motivation will indicate the change in center support effectiveness associated with a change in relative motivation *with all else equal.* In particular, it will represent an increase in the motivation of the respondent unit and/or a decrease in the motivation of foreign units without an associated change in the distribution of involvement.

If one assumes, as hypothesized before, that higher project motivation correlates positively with higher project involvement, the coefficient can be interpreted as indicating the consequences of a misfit between the distribution of motivation and involvement – specifically, if a highly motivated unit participates less than "adequate", or if little motivated foreign units participate more than adequate. A highly motivated unit can be tempted to respond to such a misfit with resentment and use of power during collaboration, besides general frustration that also targets the center's project involvement. More generally, the misfit can be indicative of ineffective project management. Here, too, the consequences should be particularly salient because unit motivation is expressed relative to the motivation of foreign units. Therefore, the ceteris paribus interpretation of the statistical model provides an additional explanation for the following hypothesis:

Hypothesis 6: The higher the motivation of the respondent unit relative to that of foreign units, the less effectively the center supports the unit's cooperation with foreign units.

COORDINATION INTENSITY

The following hypotheses all relate to various aspects of the intensity of coordination among the units. They are presented together in this section because interaction terms are to be included in the model.

Intensity of cross-border cooperation

Higher intensity of cooperation between the respondent unit and foreign units implies higher coordination effort and complexity. The units need to communicate more frequently with each other. They rely more on each others' decisions and activity results for their own project activities. At the same time, the interdependence between the units is stronger and most likely not pooled or sequential, as would be likely for low cooperation intensity. but rather reciprocal (Thompson 1967). Reciprocal interdependence between the units is comparatively difficult to manage by planning or scheduling. Instead, it requires much coordination by feedback and use of "information-rich" communication means, such as person-to-person interaction and videoconferencing rather than email or document exchange by mail.

Several reasons suggest that center support will be less effective when cooperation intensity is high. First, centers and units are known to have less experience with the complex and informal coordination mechanisms that high intensity requires, since multinational firms have traditionally relied on less complex and more formal mechanisms for coordination across borders (cf. Martinez and Jarillo 1989). Since, in consequence, the units and centers have had few opportunity to develop and institutionalize routines for high-intensity cooperation, it is likely that their capabilities can handle it less adequately than low-intensity cooperation. Suggestive evidence comes from Gassmann's cross-border innovation development study, in which firms considered cooperation across distance as a less desirable organizational solution than co-locating the teams from the units (Gassmann 1997).

Second, the strong information-processing requirements of high intensity cooperation imply that a center will have more difficulty to adequately understand the unit's support needs and respond effectively. Not only does the unit have to convey more information to the center, but also does the center have to invest more effort in processing information internally and communicating back to the unit.

Third, high-intensity cooperation limits the center's intervention options, since comparatively simple influence efforts such as decisions based on the center's formal authority are more likely to fail. The reason is that interdependence and coordination complexity give the units mutual power over each other, create more situations of information asymmetry and opportunities for hold-up, which units can use more readily to resist center interventions they perceive as inadequate. Thus, at any level of involvement, higher cooperation intensity appears to shift power to units and narrows the range of support interventions that turn out effective.

For a similar reason, relations between units of a given strength provide less useful a context in which high-intensity cooperation can be embedded. Units may find, for example, that they do not know or trust each other enough to enter a situation of high interdependence. In consequence, unit demands on the center to compensate for such lack of social context in which they can encourage and control behavior themselves are likely to be higher when cooperation intensity is high.

Because of the stronger interdependence among units, a unit is less able to contain uncertainty internally and buffer the other project participants from it (cf. Thompson 1967). Thus, uncertainty affects foreign units more strongly in situations of high cooperation intensity. This puts additional demands on the center to help address uncertainty and its effects on cooperation. In sum, even if centers possess certain capability advantages over the units in managing cross-border collaboration, one can expect high cooperation intensity to reduce the effectiveness of their involvement:

Hypothesis 7: The higher the intensity of project cooperation between the respondent unit and foreign units, the less effectively the center supports the unit's cooperation with foreign units

Cross-functional nature of cross-border cooperation

Functional specialization among the collaborating units can be seen as another source of coordination complexity and difficulty. Complexity increases because units share fewer of their local functional terminologies and routines with each other (Dougherty 1992). Therefore, they have to resolve comparatively many incompatibilities, establish more common standards and address more severe agency problems. Since functional specialization at the same time reduces the overlap of the units' needs and goals, units and centers have to tackle these issues in a less favorable context. With little natural activity and motivation alignment among the units, cross-functional cooperation therefore likely imposes higher demands on centers than cooperation within a function.

On the other hand, it can be argued that functional specialization within the project clarifies the interface between the cooperating units and simplifies the overall project structure. The less the units overlap in their capabilities, the more do the units' resources and capabilities constitute complements rather than substitutes. Consequently, the distribution of many functional, operational tasks becomes more obvious, which has been found to reduce the complexity of coordination (Gassmann 1997). Furthermore, the units are less well positioned to challenge each other's decisions based on their own expertise. At the same time, their capability complementarity makes them mutually dependent on each other in general and can increase their motivation to overcome difficulties. This should facilitate the center's task to provide effective cooperation support.

Moreover, the fieldwork suggests that specialization reduces fears of knowledge leakage to foreign units, especially when units have to collaborate on the project within a general climate of competition for corporate resources. Finally, unit contributions and lack thereof become better observable, which implies that units can be more easily rewarded for performance as well as held accountable for mistakes. Due to these effects, the resource dependence and transaction cost theories, as well as social exchange theory would suggest that functional unit specialization during collaboration can also reduce the complexity of the coordination task and therefore allow the centers to support units more effectively.

All in all, these reasons do not suggest a clear directionality for the relation between the extent of cross-functional project cooperation between the respondent unit and foreign units, and center effectiveness. Depending on which effects are stronger, the directionality could turn out either way in the statistical analysis. In consequence, two alternative hypotheses are specified, and the contribution of the analysis will lie in determining whether some effects are consistently stronger than others.

Hypothesis 8: The more cross-functional the content of project cooperation between the respondent unit and foreign units,
a) the less effectively the center supports the unit's cooperation with foreign units.
b) the more effectively the center supports the unit's cooperation with foreign units.

Interaction between cooperation intensity and cultural differences

So far, it has been hypothesized that higher cultural differences are associated with more effective center support, all other things being equal, and that higher cooperation intensity is associated with less effective center support, again all else equal. The reason to specify an interaction between these two effects is that cultural differences have more opportunity to manifest, and can cause more difficulty in overcoming them, if cooperation intensity is high. As argued before, under high cooperation intensity, the units can be expected to be particularly demanding of the centers, suboptimal center support will likely have more adverse impact on the project, and the units have more opportunity to resist undesirable center intervention. Consequently, the centers' comparative advantage over the units in managing cultural differences does not appear as beneficial under high cooperation intensity. Conversely, if cooperation intensity makes effective center support difficult, then adding additional complexity due to cultural differences to the support task will likely cause centers to support units less effectively with any given level of involvement. Therefore:

Hypothesis 9: The higher the intensity of project cooperation as well as the cultural differences between the respondent unit and foreign units, the less effectively the center supports the respondent unit's cooperation with foreign units.

Interaction between intensity and cross-functional nature of cooperation

A second interaction can be expected between the intensity and the cross-functional content of cooperation. Intensity by itself was seen as positively associated with coordination complexity. Similarly, cross-functional cooperation was considered as more complex than within-function cooperation, but for different reasons. Cross-functional cooperation under high intensity implies that the units have to deal with both sources of difficulty jointly. More incompatibilities and

differences between units can emerge and require resolution. On more occasions, each unit has to safeguard against agency problems. One can therefore reason that, when the two sources of complexity and difficulty impact a project at the same time, the unfavorable consequences for the centers amplify, and the centers will tend to provide less effective support. This overall effect would suggest a negative sign of the interaction term.

On the other hand, functional specialization may create a comparatively simple interface between the collaborating units which allows easy task assignment and control. It also reduces conflicts among units, for each unit has its domain of expertise that other units cannot challenge readily. High-intensity collaboration across functions may therefore be better defined and easier to manage than collaboration within functions. If so, units can draw better on their existing relations to coordinate their actions and face lower transaction cost problems. Moreover, if one sees unit specialization as a means to contain uncertainty internally, project-related uncertainty in one unit translates less readily into cooperation difficulties and uncertainty in foreign units. This suggests that, at a given level of cooperation intensity, highly cross-functional collaboration is easier to support effectively than collaboration within a function. Accordingly, the interaction term will have a positive sign. It is therefore recommendable to specify two alternate hypotheses:

Hypothesis 10: The higher the intensity as well as the cross-functional content of the respondent unit's project cooperation with foreign units,
a) the less effectively the center supports the unit's cooperation with foreign units.
b) the more effectively the center supports the unit's cooperation with foreign units.

CONTROL VARIABLES

The model included several control variables to ensure that these hypotheses could be tested correctly.

Unit dependency on foreign units

If a respondent unit is dependent on foreign units for routine business, the foreign units may have power to shape the project according to their interests. The respondent unit may therefore be particularly dissatisfied with the project and with its center's involvement. The center could possibly yield to the foreign units' power and bias its support towards their needs. Or, the center may face resistance from the foreign units in its attempts to support the unit, which may also render its involvement less effective. Thus, not controlling for the respondent unit's dependence on foreign units could bias the effects of relative project involvement or relative unit motivation, or of the model parameters for coordination intensity.

Conflict between respondent unit and center

Goal conflict between the respondent unit and the center can create agency concerns in the respondent unit with regard to the center. For instance, it could interpret the center's involvement as attempt to influence the project according to its own interests. The center may even be more involved than necessary to ensure its interests are taken into account. Furthermore, such goal conflict can bias the unit's perception of project uncertainty, which in turn can affect how the unit assesses center involvement.

Conflict between respondent unit and foreign units

A high level of conflict between the respondent unit and foreign units may cause the respondent unit to perceive foreign units as culturally more distant or as less motivated to cooperate. It may increase the unit's agency concerns or its perceived uncertainty, all factors that contribute to cooperation difficulty. On the one hand, the additional difficulty could reduce the center's support effectiveness. On the other hand, it could put the center in the position of conflict manager, which the units could perceive as a particularly supportive role.

Quality of cooperation within the respondent unit

If a unit does not organize and manage internal, local cooperation among its project team members effectively, it may attribute the problems to cooperation with foreign units or the center. For instance, it may claim that the foreign units lacked motivation, that coordination complexity was high, or that the center did not support cooperation effectively. At the same time, local cooperation problems can indeed affect cooperation with foreign units and the quality of center support, as when the unit fails to meet scheduled deadlines or exchange information as required.

Geographic distance

Geographic distance was controlled for because of two reasons. For one, it could systematically increase the unit's perception of project uncertainty and correlate negatively with the strength of relations to foreign units. In addition, it likely makes effective cooperation among units more difficult, at the least due to differences in time zones and higher costs of communication. As to the center, such difficulty could either reduce its effectiveness or give its additional opportunity to support cooperation, e.g., by facilitating communication among units.

Model summary

The hypotheses and control variables lead to the model of center effectiveness shown below. Effectiveness was operationalized as the weighted sum of the quality of center support regarding focus, intensity, timing, and coordination quality, as determined by confirmatory factor analysis. Relative involvement was operationalized as the level of involvement of the respondent unit, minus the level of involvement of foreign units, based on the same set of activities and weights as for the decentralization construct, and also with weights as determined by confirmatory factor analysis. Relative motivation was operationalized analogously as the difference between the levels of project-related motivation of the respondent unit and the foreign units.

The control variables are: dependence of the respondent unit on foreign units for routine business, business conflict between the respondent unit and foreign units, business conflict between the respondent unit and its center, quality of local cooperation in the respondent unit, and geographic distance between the respondent unit and foreign units.

Dependent variable	Par.	Independent variable	Expected sign
Center effectiveness	$= b_0$		
	$+ b_1 *$	$\text{Decentralization}_{\text{Respondent\_Unit}}$	–
	$+ b_2 *$	$\text{Uncertainty}_{\text{Respondent\_Unit}}$	–
	$+ b_3 *$	$\text{Cultural\_difference}_{\text{Units}}$	+
	$+ b_4 *$	$\text{Relation\_strength}_{\text{Units}}$	+
	$+ b_5 *$	$\text{Relative\_Involvement}_{\text{Units}}$	+
	$+ b_6 *$	$\text{Relative\_Motivation}_{\text{Units}}$	–
	$+ b_7 *$	$\text{Cooperation\_Intensity}_{\text{Units}}$	–
	$+ b_8 *$	$\text{Crossfunctl\_Cooperation}_{\text{Units}}$	+ / –
	$+ b_9 *$	CoopIntensity_CulturalDiff	–
	$+ b_{10} *$	CoopIntensity_Crossfunctl	+ / –
	$+\Sigma b_i *$	$\text{Control\_variable}_i$	

8.3 Zero-order correlations

Table 19 lists the zero-order correlations for the independent variables, computed with the pairwise deletion method. Correlations with a significance level of at least .05 are shaded.

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.05	1.45															
2	.00	.92	.07														
3	.14	.82	.10	.11													
4	.01	.74	.17	-.23	-.05												
5	.45	1.34	.52	-.14	.20	.02											
6	.32	.95	.19	-.16	.10	-.01	.52										
7	.00	.90	.09	-.39	.06	.36	-.06	-.13									
8	3.22	1.20	-.04	-.27	.07	.07	.12	-.05	.43								
9	.46	2.97	.09	-.38	.13	.30	.01	-.09	.92	.47							
10	.04	.69	.17	-.02	.35	.06	.24	-.14	.24	.30	.28						
11	2.73	1.37	-.14	-.09	-.08	.10	-.33	-.28	.20	.07	.13	.05					
12	2.86	1.28	.04	.07	.36	-.07	.15	.04	.03	.23	.00	.28	.12				
13	2.91	1.24	.02	.15	.27	.08	.00	-.09	.02	.09	.04	.21	.02	.56			
14	4.25	.75	.10	-.41	-.08	.23	.09	.06	.27	-.03	.28	.24	.24	-.15	-.25		
15	6.41	3.84	.12	.06	.09	-.08	-.04	.07	.07	.03	.06	.10	-.19	.08	.11	.02	
16	.00	.95	-.25	-.37	.05	.12	.04	-.11	.17	.21	.16	.11	-.05	.01	-.13	.27	.16

1	$\text{Decentralization}_{\text{Respondent\_Unit}}$	9	CoopIntensity_Crossfunctl
2	$\text{Uncertainty}_{\text{Respondent\_Unit}}$	10	CoopIntensity_CulturalDiff
3	$\text{Cultural\_difference}_{\text{Units}}$	11	$\text{Dependency}_{\text{Foreign\_Units}}$
4	$\text{Relation\_strength}_{\text{Units}}$	12	$\text{Conflict}_{\text{Foreign\_Units}}$
5	$\text{Relative\_Involvement}_{\text{Units}}$	13	$\text{Conflict}_{\text{Center}}$
6	$\text{Relative\_Motivation}_{\text{Units}}$	14	Local_Cooperation
7	$\text{Cooperation\_Intensity}_{\text{Units}}$	15	Distance
8	$\text{Crossfunctl\_Cooperation}_{\text{Units}}$	16	Center_Effectiveness

Table 19: Zero-order correlations for the effectiveness model (shading: p<=.05; pairwise deletion)

8.4 Results of the regression analysis

Table 20 displays the relevant information to assess the predictive power of the full model, the core model (i.e., the full model minus the control variables), and the model with control variables only.

Predictive power – hierarchical regression	R^2	R^2 adjusted	Model signific. (F)	N
Full model	.483	.385	.0000	95
Core only	.314	.232	.0000	95
Controls only	.121	.074	.0109	100

Table 20: Predictive power of statistical models for center effectiveness

All models are highly significant, and the full and core models have high predictive power. The variables related to the hypotheses account for about two thirds of the explanatory power of the full model, which is about equal to the equivalent number for the model in the previous chapter. Judging by the adjusted R^2 values, the control variables alone have about one fourth of the predictive power of the full model, which indicates that the core variables possess considerable explanatory power. Since no firm effects were hypothesized, a model with core variables plus firm dummies was not tested here. However, the section on rival hypotheses later in the chapter tests the full model plus firm dummies.

The details of the regression analysis are displayed in Table 21. Most coefficients turn out to be in the expected direction, even though several hypotheses do not receive support. The coefficients of the majority of control variables are insignificant.

Hypothesis 1 is strongly supported. The less the center is involved relative to the respondent unit, i.e., the higher the degree of decentralization, the less effectively it supports the unit's cooperation with foreign units. This result raises the question how much each of the reasons put forward to hypothesize the effect actually accounts for it. For example, does high decentralization reflect a lack of capability advantage at the center, lack of center interest in the project, lack of center power to influence cooperation, or lack of sufficient information to understand the unit's support needs and implement appropriate solutions?

Hypothesis 2 is supported as well. The coefficient is significant at the .01 level, which suggests that centers quite consistently have more difficulty supporting units effectively under high uncertainty. Most likely, the information-processing requirements to overcome uncertainty and higher pressure on the centers from the units jointly account for this outcome.

Hypothesis 3 receives support, but not as strongly. While cultural differences between the respondent unit and foreign units seem to give the center opportunities to provide more effective support with a given level of involvement, it appears as if some centers seem less able to seize them than others. The positive coefficient indicates that centers can add value to cooperation among local units by helping overcome cultural differences.

Hypothesis 4, about the strength of relations between the units, is not supported. Even though the coefficient sign is in the expected direction, relation strength does not seem to affect the center's support effectiveness directly. There are several possible explanations. First, it could

mean that centers are able to support units similarly well regardless of their relations. For example, the network of relations among cooperating units may be so prominent and influential a factor in cross-border innovation development projects that centers have already learned to address a range of constellations in an equally effective way.

Center effectiveness	Coefficient	Actual sign	Expected sign
$Decentralization_{Respondent\_Unit}$	−.27••	−	−
$Uncertainty_{Respondent\_Unit}$	−.27••	−	−
$Cultural\_difference_{Units}$	.24•	+	+
$Relation\_strength_{Units}$	.22	0	+
$Relative\_Involvement_{Units}$	.22•	+	+
$Relative\_Motivation_{Units}$	−.37••	−	−
$Cooperation\_Intensity_{Units}$	.41	0	−
$Crossfunctl\_Cooperation_{Units}$	.16•	+	+/−
CoopIntensity_CulturalDiff	−.26	0	−
CoopIntensity_Crossfunctl	−.14	0	+/−
$Dependency_{Foreign\_Units}$	−.13		
$Conflict_{Center}$	−.15		
$Conflict_{Foreign\_Units}$	.12		
Local_Cooperation	.36•		
Distance	.06••		
R^2	.483		
R^2 adjusted	.385		
Model significance (F)	.0000		

•:p<.05

••:p<.01

Table 21: Regression results for center effectiveness

Second, centers may differ strongly in their ability to respond to relation strength, but due to unrelated factors not captured in the model. This would imply the very opposite of the first explanation, namely, that relations tend to be little considered, and that the centers' ability to cope with them is a mere by-product of attention and effort focused on other factors. Third, and probably most likely, the result could merely indicate the absence of an additional direct effect of relation strength on effectiveness, once the indirect effects of relation strength via decentralization are taken into account. If, for example, weak relations of a unit cause high center involvement, as the previous analysis has shown, and if high center involvement implies high effectiveness according to the current analysis, then centers do consider relation strength, but in more indirect ways than hypothesized here. Such an explanation calls for a closer examination of direct and indirect effects by joint interpretation of all analyses so far, which is done later in the chapter.

According to the support for Hypothesis 5, centers seem to support comparatively effectively the units that are heavily involved relative to foreign units. Centers may be better able to perceive

support needs, may be more motivated to provide effective support, may be able to rely on better developed routines and capabilities for those units, may react to the respondent units' demands as large project players, or may simply face an easy constellation because the respondent units can shape cooperation due to their power within the projects.

Furthermore, the analysis confirms that high motivation of the respondent unit relative to foreign units relates negatively to support effectiveness (Hypothesis 6). The motivation gap may put the respondent unit and its center in a particularly difficult situation or may imply that the respondent unit is particularly demanding of the center. As discussed before, it can also indicate that center support is less effective when there is a misfit between the distribution of motivation for the project and the distribution of project involvement within the firm.

Hypothesis 7, specifying a main effect of cooperation intensity on support effectiveness, is not supported, for the coefficient is insignificant and has the opposite sign. Thus, an increase in cooperation intensity by itself does not diminish effectiveness. Either centers can handle higher intensity without effectiveness loss, or the effects of higher intensity are mediated by other variables, such as the level of center involvement. Similarly, higher cooperation intensity does not seem to make centers less effective in overcoming cultural differences between units, as the insignificant interaction term from Hypothesis 9 indicates. Even though it is not far from significance, the joint requirements of high-intensity interaction and high cultural differences do not seem to take an extra toll.

Of the two hypotheses specified in regard to cross-functional cooperation, Hypothesis 8b receives support. The more cross-functional the content of cooperation between the respondent unit and foreign units, the more does the respondent unit perceive center support as effective. This can be the result of the center's comparative advantage in overcoming functional specialization, or of a relative simplification of the coordination interface and task, which helps the center support the unit more effectively.

Interestingly, an increase in cooperation intensity with an unchanged intensity of cross-functional cooperation does not change center effectiveness significantly, according to the insignificant coefficient of the interaction term in hypotheses 10a and 10b. One can speculate that the complexity and requirements of cross-functional cooperation change little with varying intensity, or that the centers are able to handle any such change. Alternatively, there may be such strong variation in the centers' ability to handle them due to unrelated factors that no systematic relation emerges in the analysis.

This is in line with the insignificant interaction between cooperation intensity and cultural differences from Hypothesis 9. Higher cooperation intensity neither seems to make it significantly more difficult for centers to help units collaborate across cultural borders, nor to help them with functional ones. Yet, by themselves, cultural differences and functional boundaries appear as opportunities for centers to support units more effectively.

These findings can be further interpreted by looking at the effects of the independent variables on center effectiveness for each effectiveness aspect individually. Before doing so, however, a brief discussion of the robustness of the findings is warranted.

8.5 Analyses of the effectiveness dimensions

The relationships between the independent variables and the components of center effectiveness were examined in a series of auxiliary regressions. Table 22 contains the results for the four effectiveness dimensions: quality of the intensity by which the center supports the respondent unit's collaboration; quality of the way the center times its support; quality of the way in which the center coordinates its support; and quality of the focus of the center's support. The sequence in which these four dimensions are listed in the table corresponds to the decreasing order of correlations between the respective items and the aggregate construct.

Center effectiveness by aspect	Effectiveness	Intensity	Timing	Coordination	Focus
Item-to-factor correlations		.94	.92	.88	.76
$Decentralization_{Respondent\_Unit}$	−••	−••	−••	−••	−••
$Uncertainty_{Respondent\_Unit}$	−••	−•	−•	−••	−
$Cultural\_difference_{Units}$	+•	+	+•	+•	+
$Relation\_strength_{Units}$	+	+	+	+	+
$Relative\_Involvement_{Units}$	+•	+	+	+••	+••
$Relative\_Motivation_{Units}$	−••	−••	−	−•	−•
$Cooperation\_Intensity_{Units}$	+	+	+	+	+••
$Crossfunctl\_Cooperation_{Units}$	+•	+•	+•	+	+
CoopIntensity_CulturalDiff	−	−	−	−	−••
CoopIntensity_Crossfunctl	−	−	−•	−	−
$Dependency_{Foreign\_Units}$	−	−•	−	−	−
$Conflict_{Center}$	−	−•	−	−	−
$Conflict_{Foreign\_Units}$	+	+	+	+	+•
Local_Cooperation	+•	+•	+•	+	+•
Distance	+••	+••	+	+••	+•
R^2	.483	.448	.382	.474	.357
R^2 adjusted	.385	.343	.265	.374	.235
N	95	95	95	95	95

Table 22: Effectiveness regressions by effectiveness aspect
•:p<.05; ••:p<.01; shading: change from significant to not significant, or vice versa

Intensity of center support

In this model, cultural differences between the units and relative unit involvement do not have a significant effect on the quality of the intensity by which the center supports the respondent unit's cooperation. Several, not mutually exclusive explanations can explain this observation. First, all other things being equal, centers may simply be insensitive to these aspects, and therefore they fail to relate to the effectiveness of support intensity in a systematic way. Second, and again all else equal, centers may respond to them, but the appropriateness of the support intensity they choose may not depend on them. For example, centers may be able to choose as effective a support intensity when cultural differences and relative involvement, respectively, are low, as when they are high. Third, cultural differences and relative involvement may impact the effectiveness of support intensity only indirectly via other factors captured in the model, such as the decentralization level.

Centers are quite ineffective in their choice of support intensity in cases of high conflict with the respondent units. This may be due to the fact that centers, when supporting cooperation according to their interests, are more likely to conflict with the interests of the units than otherwise, which could explain why the respondent units rate their effectiveness as lower.

Moreover, units that are highly dependent on foreign units appear less satisfied with the intensity of center support than units that are less dependent. Regardless of their involvement level relative to foreign units, those units expect a level of involvement that centers do not provide. Judging by the findings of the fieldwork this most likely means they are getting too little rather than too much support.

Timing of center support

According to the lower percentages of explained variance, the constructs in the model are not as well suited to explain the effectiveness of the center's support timing, even though the percentages remain quite high in absolute terms. Timing effectiveness is little affected by the distributions of involvement and motivation among the units. This may point towards organizational routines according to which centers get involved at certain points for predefined durations, which one would expect to be somewhat insensitive to those parameters. For the same reason, timing effectiveness may not vary systematically with distance between the units.

Interestingly, however, timing suffers under high-intensity, cross-functional cooperation. This points towards cooperation difficulties that centers do not respond to appropriately. One can speculate that units perceive center involvement as too late under those circumstances.

Coordination of center support with units

Overall, the pattern regarding the coordination of center support with the units resembles that of the overall effectiveness construct quite closely. Coordination effectiveness does not seem systematically affected by the cross-functional nature of cooperation and the quality of local cooperation within teams. Compared to the base model for the effectiveness construct, how effectively the center coordinates its support with a unit depends on fewer factors, but more heavily on those, as the small difference in explained variance suggests. A comparison of coefficient sizes in the two models reveals that uncertainty and relative involvement affect the center's coordination effectiveness disproportionally strongly and consistently.

Focus of center support

The model for support focus, which has the lowest explanatory power, can still explain 74% of the variance the construct model can explain. Focus effectiveness appears quite unaffected by uncertainty and cultural differences. Thus, even when the respondent unit cooperates under high uncertainty or high cultural differences, centers do not seem to systematically lose focus. On the other hand, the relative involvement coefficient is more than 30 percent higher than in the base model, which suggests a tendency at centers to better perceive the support needs of big project players. According to the systematic relationship between the level of conflict among units and focus effectiveness, the centers appear particularly effective in choosing the appropriate activities to support units that are in conflict with each other.

Centers also seem to know particularly well what activities to focus on when cooperation intensity between the units is high, all else equal. In contrast, cooperation intensity does not affect any of the other effectiveness dimensions systematically. However, high cooperation intensity between culturally quite different units makes it more difficult for centers to focus on the right activities. At the same time, the degree of cross-functional cooperation affects focus effectiveness neither via the main effect or the interaction term. Therefore, one can infer that cooperation intensity, cultural differences and cross-functional cooperation create different needs for support focus, to some of which centers can respond more consistently than others.

8.6 Robustness tests

Assessment of model specification

The effectiveness model was subjected to the same battery of tests as the decentralization model in the previous chapter. To summarize in advance, the tests suggest that it was appropriately specified.

No signs of omitted variables were found in the two types of RESET tests, the one for the dependent variable and the one for the independent variables. The link test did not indicate misspecification of the dependent variable. The Shapiro-Wilk test indicated a slight divergence from a normal distribution for the regression residuals, but a close inspection of the residual-vs.-fitted value plot did not reveal any systematic patterns. Since there were no signs of collinearity problems among the variables in the discriminant analysis, the model appears to have good discriminant validity.

The Cook-Weisberg tests of heteroscedasticity for the independent variables and for the fitted values, as well as analysis of the residual-vs.-predictor and fitted-vs.-predictor plots led to the conclusion that heteroscedasticity was within the desired limits for all independent variables. The tests returned the lowest value for the cross-functional cooperation variable, and closer analysis indicates a marginally curvilinear relationship between that variable and center effectiveness. While not strong enough to warrant an extension of the analysis in this regard, it could indicate a tendency of centers to be slightly more effective in cases of either very little or very much cross-functional collaboration, as compared to intermediate cases. In sum, the tests support the notion that the model is correctly specified.

The robustness test for the missing data procedures indicates that the model is robust with respect to missing data. The results for most variables differ very little from method to method,

and the significant variables appear particularly stable. Cross-functional cooperation turns marginally insignificant when mean substitution is used, but maintains its direction and approximately its strength. The variables measuring cooperation intensity and conflict between the units change more with mean substitution, which seems partly due to their high standard errors. In total, however, the analysis seems robust with respect to the missing data procedures. Further details are reported in Appendix B: Procedures to handle missing questionnaire data.

Ruling out alternative hypotheses

As in the analysis of the previous chapter, the strategy to ensure model robustness was two-tiered. The seemingly most important and justifiable rival hypotheses were considered in the main model via the set of control variables. In contrast, seemingly less important or less justifiable rival hypotheses were subsequently tested in a series of auxiliary regressions. The results are briefly summarized in Table 23 and reported in detail in Appendix C: Test of rival hypotheses for the decentralization and center effectiveness models.

Tested variable due to rival hypothesis	Summary of test outcome
Firm effects	Insignificant coefficients, R^2 up .0034
Project size	Insignificant coefficient, R^2 up .0016
Cultural difference between respondent unit and center	Insignificant coefficient, R^2 unchanged
Strength of relation between respondent unit and center	Insignificant coefficient, R^2 up .017, relative involvement turns insignificant, interaction between intensity and cross-functional cooperation turns significant at .05 level
Center motivation	Insignificant coefficient, R^2 up .0065
Project routinization and experience	Cooperative innovation development: Coefficient significant and negative, R^2 up .016, other model parameters do not change significantly Unit breadth of project activity: Coefficient significant and negative, R^2 up .025, other model parameters do not change values significantly, interaction between intensity and cross-functional cooperation, and conflict among units turn significant
Output type	One dummy significant, R^2 up .052, cooperation intensity and conflict with center turn significant, local cooperation turns insignificant
Functional unit specialization	Insignificant coefficients, R^2 up .039

Table 23: Tests of rival hypotheses for the effectiveness model – summary results

Overall, the model is robust with regard to several plausible rival hypotheses. There do not seem to be any hidden influences from firm effects, project size, cultural differences between respondent unit and center, and center motivation. Including the strength of the relation between

respondent unit and center improves the model's predictive power, but does not threaten the conclusions because the coefficient is insignificant. Similarly, measures of project routinization and experience in the respondent unit enhance model power, but do not reveal any systematic bias in the original model. Neither does the distinction of innovation types or functional unit specializations via dummies in respectively enlarged models.

8.7 Direct and indirect effects between starting conditions, decentralization and effectiveness

Knowledge of direct and indirect relations between conditions at the project start, project organization and project outcomes has tremendous benefits. For practitioners, it is relevant because it allows units and centers to change how starting conditions affect outcomes by influencing the mediating activities and factors. In order to develop such an intervention capability, they need to learn what interventions are possible and how each affects the mediating activities and factors. For researchers, disentangling direct and indirect effects in organizational processes, specifically in groups, has been a long-standing concern (cf. Gladstein 1984; Gladstein Ancona and Caldwell 1992). To them, an analysis of the direct and indirect relations can reveal opportunities for further research.

Synthesizing some of the findings so far, the current section contributes some of this knowledge and builds a more dynamic picture of cross-border innovation development projects. It should be noted, however, that direct and indirect effects are preferably simultaneously estimated in a single structural equation model, which the size of the data set in this study did not permit. For that reason, the goal here is to merely point out to practitioners some avenues to consider when building their intervention capability, and to researchers some opportunities for future research, rather than derive conclusive results.

For the variables that entered the decentralization and effectiveness regressions, Table 24 reports in column 1 the directionality of direct effects on effectiveness, in column 2 those of the indirect effects via decentralization. The sign for the indirect effect was calculated by multiplying the variable's direct effect on decentralization, as estimated in the previous chapter and shown in column 3, by the negative direct effect of decentralization on support effectiveness (column 4). The table also lists the significance levels from the original analyses where available. To enable an analysis of indirect effects of motivational factors, the effect of relative unit motivation on decentralization was estimated in an adapted decentralization model using the relative motivation measure from the effectiveness model instead of the motivation constructs in the decentralization model, $\text{Motivation}_{\text{Respondent\_Unit}}$ and $\text{Motivation}_{\text{Foreign\_Units}}$. The reported coefficient is therefore merely an approximation.

Cultural differences

Cultural differences between the respondent unit and foreign units relate in two ways to the effectiveness of center support. First, they go along with lower center involvement in the project relative to the units, which in turn is associated with lower center effectiveness. Secondly, they directly make center support more effective, most likely because centers have capability and structural advantages over the units when addressing difficulties they create. Therefore, the overall indirect effect runs in the opposite direction of the direct effect and lowers center

effectiveness. While cultural differences seem to give centers opportunities to support units, the centers may not seize as many as possible because they are comparatively little involved.

An implication for centers would be to check whether and how to adjust the link between cultural differences and involvement. This may mean becoming more aware of cultural differences and the resulting support potential, or becoming better able to overcome organizational structures and routines that limit center involvement and perhaps even promote the persistence of cultural differences across units. Since the effects of cultural differences on the decentralization of management and control are not significant, changes might be most valuable for center support in form of leadership, involvement in launch management, funding and involvement in operations.

Direct and indirect effects on center effectiveness	Directionality of direct effect	Directionality of indirect effect^	**Effect *on* decentralization**	**Effect *of* decentralization**
$Cultural\_difference_{Units}$	$+^{\bullet}$	–	$+^{\bullet\bullet}$	$-^{\bullet\bullet}$
$Relation\_strength_{Units}$	+	–	$+^{\bullet\bullet}$	$-^{\bullet\bullet}$
$Relative\_Motivation_{Units}$	$-^{\bullet\bullet}$	–	$+^{\#}$	$-^{\bullet\bullet}$
$Uncertainty_{Respondent\_Unit}$	$-^{\bullet\bullet}$	+	$-^{\bullet}$	$-^{\bullet\bullet}$
$Conflict_{Foreign\_Units}$	+	–	$+^{\bullet}$	$-^{\bullet\bullet}$
$Dependency_{Foreign\_Units}$	–	+	$-^{\bullet\bullet}$	$-^{\bullet\bullet}$

Table 24: Direct and indirect effects of starting conditions on center effectiveness
$^{\bullet}$:p<.05; $^{\bullet\bullet}$:p<.01; ^: No significance levels for indirect effects available
#: Estimation in adapted decentralization model

Unit relations

Indirectly, the strength of relations between the respondent unit and foreign units impacts center effectiveness in the same way as cultural differences: centers reduce their involvement relative to units, which diminishes effectiveness. The effect is consistent for all involvement dimensions studied except for launch management. Since there is no significant direct effect, the overall effect is negative and primarily determined by decentralization. It raises the question how centers can add value for well-connected units, and how they can develop value-adding capabilities in the long run as lateral relations among local units become stronger.

Motivation

The respondent unit's motivation relative to foreign units does not appear to have a significant direct effect on decentralization in the adapted model. It is therefore realistic to assume no overall indirect effect on center effectiveness. High relative unit motivation thus reduces the center's support effectiveness independently of the center's involvement relative to the unit. The task for centers becomes to determine what exactly causes them greater difficulty in supporting

the highly motivated units, and whether to increase their involvement to better address the associated difficulties. An alternative could be to extend their influence on little motivated foreign units, either directly or via collaboration with those units' centers.

Uncertainty

Regardless of the decentralization level, uncertainty reduces center effectiveness. However, centers partly compensate for this effectiveness loss by becoming more involved. The indirect effect is therefore positive: uncertainty reduces decentralization, which increases center effectiveness. Here, too, centers are challenged to find out in what specific ways uncertainty reduces their effectiveness directly. Since higher uncertainty does not directly diminish the quality of the center's support focus, centers seem to remain able to determine in which activities they should get involved. At issue are more the intensity, timing and quality of coordination of their involvement. As to timing, the findings from the fieldwork suggest that centers at least sometimes do not recognize early enough difficulties due to uncertainty – e.g., because of uncertainty about innovation specifications – and intervene only after units have gone through periods of frustration or conflict.

Conflict

Conflict between the respondent unit and foreign units regarding routine business translates directly into more effective focus of center support. Even though there is no significant direct effect for the aggregate effectiveness construct, centers seem at least able to anticipate in which activities existing conflicts can carry over into a project. On the other hand, centers are not as much involved in case of higher conflict between units than otherwise, which indirectly reduces their effectiveness. Judging by the decentralization aspects to which conflict relates significantly, potential to increase effectiveness via higher involvement may lie primarily in the areas of project control and involvement in project operations, where such conflicts may be played out.

Dependency

Dependency of a unit on foreign units for routine business reduces the effectiveness of the center's involvement intensity directly. In light of the positive direct effect – higher dependency increases relative center involvement, which increases effectiveness, this is a surprising outcome. Possibly units expect centers to get more involved in launch management, funding or operations, the areas in which involvement is not significantly related to dependency. Alternatively, units may want centers to become even more involved in project management, leadership or control.

8.8 Summary of conclusions: Center effectiveness in cross-border innovation development projects

The goal of the analysis in this chapter was to explain under which conditions centers are more or less effective in the way they support collaboration among units in cross-border innovation development projects. Four aspects of support effectiveness were examined: to what extent the center focuses on the right kinds of activities, chooses the right timing and intensity for its support, and coordinates its involvement well with the units.

The model appears comprehensive and robust. It can explain about half of the observed variation in center effectiveness, of which the focal variables explain about two thirds. It is robust in regard to autocorrelation and heteroscedasticity, and passes all relevant tests for omitted

variables and functional misspecification. It also stands up against several plausible rival explanations.

Most of the hypotheses receive support, and the regression coefficients possess the expected signs. According to the confirmed direct effects in the model, several conditions generate settings in which effective center support seems difficult to provide. Among these are: high decentralization of activities, uncertainty, and little motivation in foreign units with simultaneously high motivation in the respondent unit. On the other hand, centers are comparatively effective when cultural differences or geographic distance between units are large, when they focus on units that are "big project players", and when they assist collaboration across functional borders. Good local cooperation among project team members in a unit also goes along with more effective center support.

Somewhat unexpectedly, neither the intensity of cooperation nor its interactions with cross-functional cooperation and cultural differences seem to impact the center's support effectiveness in any systematic way, even though there are some significant effects in the expected directions for individual effectiveness dimensions. The local unit's strength of relations to foreign collaboration partners does not have a significant impact either.

Additional tests reveal that project size, center motivation, the cultural difference between center and respondent unit, and functional unit specialization do not seem to play a significant role in explaining center effectiveness. Findings regarding the relation between the center and the unit, and regarding the effect of the unit's project activity level, are not fully conclusive. As to the latter, the most plausible explanation seems to be that it is comparatively difficult for centers to effectively support each project in units involved in comparatively many projects.

The auxiliary regressions for each of the effectiveness aspects complement the findings from the main model. The quality of the centers' focus varies comparatively little with uncertainty, cultural differences, and cross-functional cooperation. Involvement intensity tends to suffer for units that depend much on foreign units, or are in conflict with the center. The model explains the quality of timing and focus less comprehensively, which suggests that factors beyond its scope are particularly influential for those aspects. However, the tests for firm effects reveal that those factors do not seem to vary systematically across firms, but rather within firms across units or projects.

Another insight of the analyses by effectiveness aspect is that some conditions have quite broad and consistent, others only quite narrow implications for the various aspects of center effectiveness. As to the former, relative center involvement, uncertainty and distance affect effectiveness aspects quite consistently. In contrast, cultural difference primarily affects quality of timing and coordination; unit involvement relative to foreign units only relates significantly to coordination and focus effectiveness. Cooperation intensity, which does not have a significant relation to effectiveness overall, does affect the quality of support focus significantly. Equally specific are the effects of conflicts between the respondent unit and the center, or foreign units. The overall emerging picture is one of often very subtle requirements for the centers, and large associated challenges to be equally effective in all four regards.

The analyses also raise new questions and open research avenues. Most importantly, they show that one has to take a close look at the individual components of the centers' support capability in order to present conclusive interpretations of the results, sometimes closer than possible with the current data set. This is because the competing organizational theories used here offer

alternative, but not mutually contradictory explanations for several of the findings. The analyses are a valuable starting point for follow-up research because they indicate in which regards to examine the capability – for example, to probe whether the centers' lack of awareness of support opportunities limits their effectiveness under certain conditions, or whether the centers perceive those conditions, but lack appropriate solutions to address them. More research will thus help understand which theories can address the unresolved aspects best, and help practitioners better direct their efforts to improve critical organizational capabilities.

For at least two more reasons, the analyses call for additional, complementary research. First, by their very nature they cannot rule out either of two fundamentally different interpretations of insignificant regression coefficients. One is to view such insignificance as a sign that centers are equally effective across the whole ranges of the respective conditions, all else equal. Seen this way, their capability would be developed broadly enough to cover all cases within those ranges equally well, e.g., such that they can cope with bad relations among units as effectively as with good ones. The second posits the very opposite, namely, that the centers' capability is so little developed in regard to the conditions that their responses vary unsystematically and therefore fail to produce a significant pattern in the statistical analysis. Obviously, the interpretations have opposite implications: A recommendation to centers based on the first could be to no longer invest in capability enhancement along the respective dimensions, and focus on other areas with significant gaps. In contrast, based on the second view one could strongly recommend considering such investments if a better developed capability generates higher benefits.

Secondly, more research is warranted because the analyses have revealed direct and indirect effects between conditions at the project start, project organization and project outcomes. Even though the data set did not allow examining those effects as precisely as possible, the analysis indicated opportunities for centers to enhance their support capability by better attending to mediating activities and factors.

Chapter 9: Discussion and implications

This chapter discusses implications of the findings for the management of cross-border innovation development and associated research. Specifically, it offers a process framework of center involvement to better understand how the conditions that were found to influence center effectiveness come to bear on cognitions and behaviors of the project participants. It also connects the findings to the broader organizational context in which centers decide how to support and improve cross-border innovation development. Furthermore, it explores the link between innovation development and leverage, an increasingly relevant topic in both research and practice.

The final section of the chapter addresses the strengths and limitations of the study, and assesses its contributions to the related literatures. It describes how the study findings enhance the knowledge of cross-border innovation development as part of an organizational capability that has come to be a cornerstone of competitive advantage for many multinational firms. It concludes by outlining avenues for future research.

9.1 Enhancing center effectiveness

While the analysis in the previous chapters has identified several conditions that influence center effectiveness, it has only linked them to the outcome of the center's involvement, but not to the involvement process per se. This section therefore scrutinizes more carefully the sequence of activities a center passes through when providing support, in order to show where and how these conditions may affect the support process. Examples of how centers studied in the fieldwork adapted their support process to become more effective are also presented.

According to the interviews during the fieldwork, a center goes through three major steps as it supports a cross-border innovation development project. At the project start, project characteristics and project context give units the propensity to cooperate in a certain way with foreign units if there is no center intervention. At the same time, units have certain expectations regarding center involvement, which are based on current conditions as well as past experience.

The first step for a center is one of perception and assessment. It requires the center to perceive, understand and assess not only the default cooperation and the unit expectations, but also the involvement alternatives it has available. Those will obviously depend on its capabilities and the portfolio within which it operate. Building on this assessment, the next step is to develop an initial involvement plan, which typically happens at the beginning of the project. The plan defines the center's initial role in the project and relates directly to the project roles of the local units. It may be quite specific if circumstances permit, or just a general formulation of an intervention strategy, since several factors influence what degree of detail is feasible and desirable. For example, if the unit's support needs are within well-known territory, organizational routines may dominate in the design of the involvement plan. In the other extreme, the center may have to develop an intervention plan from scratch according to the perceived needs.

The third step is the implementation of the plan as the center assumes the predefined project role with associated responsibilities. Feedback from the implementation activities may lead to revisions of the initial plan.

Each step of the process, which is summarized in Figure 15, can impede center effectiveness. First, the center can fail to correctly and comprehensively assess the support needs or the possible support options. Such a "perception gap" reduces the center's probability of successfully designing an involvement plan that matches the units' support needs and its support capabilities. But even with correct perceptions of the situation, the center may have difficulty developing an involvement plan that supports unit cooperation effectively. For example, the center may not have enough resources to support a unit with the desired focus, timing, or intensity. Such "design gaps" can cause coordination problems, conflicts, wasted effort or substantial revisions later on when the center attempts to implement the plan.

Third, even a well-developed plan may be poorly executed and therefore fail to be effective. According to the fieldwork, centers sometimes lack persistence in establishing and maintaining their role. For example, a center in one project had developed and begun to implement a plausible leadership-plus-control role up to the point at which the project managers in the participating units had all accepted that leadership would lie with the center. At that point, however, the center became distracted by a major acquisition opportunity, lost focus of the project and left the units in a state of uncertainty that soon led to serious struggles over the leadership role among the project managers. As this example illustrates, a good initial involvement plan does not ensure the center against ineffectiveness due to an "implementation gap".

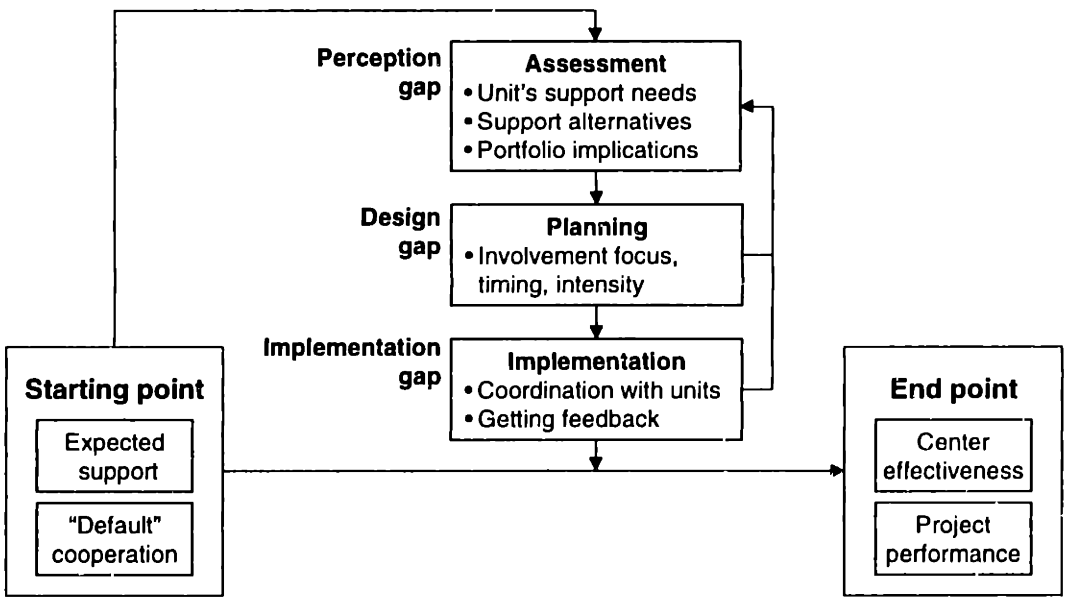

Figure 13: Locating sources of center ineffectiveness in the support process

The factors found to influence center effectiveness in the statistical analysis enter the support process in one or more of the steps and therefore contribute to the associated gaps. For example, as in the case of Alpha's information management initiative, uncertainty can create a perception gap because it makes assessment of support needs and opportunities difficult. Furthermore, support opportunities for highly intense cross-unit cooperation and for overcoming cultural differences are often not easy to evaluate. Little project involvement of the unit may also lead a center to pay too little attention to the project.

Conflicts and cultural differences may create lasting rigidities that do not permit designing and implementing desired forms of support. They may also bias centers to plan involvement that is not effective from a unit's point of view. On top, a highly motivated unit may impose strong demands on the center and reject certain forms of involvement. Uncertainty makes design and implementation gaps more likely, for plans developed according to correct assessments may become quickly outdated. Besides, a unit's internal cooperation problems and conflicts with the center may impede collaboration and can thus affect all process steps.

If managers explore when and how the conditions that impede center effectiveness enter the center support process, they can adapt the process accordingly. Th · interview partners during the fieldwork described specific examples of how center had done so in the past or were planning to do so in the near future.

Several centers that had repeatedly provided ineffective support due to a perception gap worked to improve their communication with units that participated in projects, in particular during early project stages. This included switching from less formal communication means to richer, face-to-face interaction. For instance, instead of reviewing the business cases only, people from one center would meet key people in person and attend initial planning meetings to improve their understanding of the situation.[29] At the same time, they would seek more feedback on their own interpretations. Measures like these helped the centers better understand the support needs, including subtle ones due to cultural differences. In turn, they reduced perceived uncertainty in the units about the project and the role the centers would assume. In one instance, the firm also purposefully promoted to a center a mid-level manager from a unit who was very familiar with cross-unit cooperation.

One center addressed recurring perception and design gaps by exploring indirect effects of its involvement that it had not paid attention to before. Traditionally, the center that responded to high project risk by covering the risk with corporate funding for units. It then recognized that it had indirectly encouraged units to overstate project risks initially, and given unit managers an incentive to make riskier project decisions once the center had covered the risk. Another center began to pay more attention to its resource constraints, which had several times led it to plan more intense project support than it could eventually deliver.

Of course more options to improve center effectiveness exist. The key issue for several center managers was not that they did not know how to close certain gaps, but rather to learn initially which gaps were actually critical, understand how project-related factors contributed to them, and what typical consequences for center effectiveness they had. As a diagnostic step, it may therefore be helpful to map center effectiveness by project activity along the four effectiveness dimensions. The mapping provides a basis for discussion and brainstorming about the causes of ineffectiveness in the center's support that can point towards specific gaps.

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[29] One project in the fieldwork had initially suffered from this problem. The unit's center was located at corporate headquarters and used to communicate primarily with subsidiary top management. However, the project was actually managed two levels below subsidiary top management. As long as the center relied primarily on its regular communication pattern, it received project information too late, and what the center communicated to the project manager via subsidiary management was in constant danger of being outdated.

9.2 Optimizing center effectiveness: Case-by-case vs. portfolio approaches

This study has assessed center effectiveness for each project and unit within a fairly narrow organizational context that is delineated by characteristics of the individual project and centered around the respondent unit. Such an approach helped generate insights into the micro-level conditions that influence center effectiveness, and therefore has undeniable merits.

However, centers often need to consider a whole portfolio of projects and/or units and therefore pay more attention to interrelations across units and across projects within each unit. Some centers studied during the fieldwork, for instance, managed a set of globally dispersed R&D labs, each with its own set of international collaboration projects. Others had to coordinate internationally the projects of several operating units in their country. Within such portfolios, centers decide how to participate in projects, and in particular how to plan the development of their capabilities. Often, they invest resources so as to maximize their overall effectiveness in the portfolio, rather than consider projects and units independently.

When center make critical decisions on the portfolio level, seeming center ineffectiveness for a certain project and unit may not indicate ineffectiveness in general. Instead, it can be the consequence of optimization of center involvement within a portfolio. At Alpha, several operating units in a comparatively small subsidiary did not get as much attention from divisional management and corporate departments as their counterparts in the larger subsidiaries because those centers had to focus their limited resources on the most promising support opportunities. Conversely, high effectiveness may not always imply that the centers possess particularly strong support capabilities, but can also result from a fairly small portfolio in which centers do not face major tradeoffs and can focus effectively on each project.[30] For example, top management in Alpha's small subsidiary was able to be comparatively strongly involved in unit projects because the subsidiary had fewer projects running at any time than the larger subsidiaries.

To connect the study results to those broader center contexts, it is worth discussing some general patterns that emerged during the interview stage, and during pilot interviews for the survey. Those patterns refer to the major contingencies centers face when attempting to support local units in cross-border innovation development, and the organizational responses they choose accordingly. Since those patterns were not the focus of the study, the following description is necessarily tentative and incomplete, but nevertheless useful.

The most fundamental pattern interview partners kept referring to is that of a rapidly changing business context in which multinational firms try to optimize under pressure their collaborative innovation development and support processes while tackling a variety of constraints. One such constraint is time, for the immediate needs of internal capability development tend to exceed what central and local units can realistically achieve in the short run. Alpha's information management initiative is a prime case, for the units were required by headquarters to rapidly develop a "world class information management" capability that would position "information management as core competence" and increase collaboration among them, even though the concept was completely new to them.[31]

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[30] Because the study cannot fully assess these aspects of the centers' decision making contexts, its results are clearly only part of a larger picture and are not intended to be normative.

[31] Quotes from an internal 1995 strategy document.

Resource limits also constrain optimization, since they force firms to prioritize and compromise, and thus do fewer or different things than otherwise. A third constraint is routinization of cognitive and behavioral patterns, for it limits awareness of current problems and available solutions. For example, part of the difficulty Alpha's top management had in uniting the units behind the information management initiative was the long history of unit autonomy for strategic initiative and innovation development. Due to such constraints, cross-border innovation development projects and center involvement may follow rationales that do not appear optimal to outsiders or within a long time frame. And when the constraints shift, the choices may change quickly and significantly.

Within these constraints, centers in the firms seemed to adjust their support strategies for collaborative innovation development among units according to two characteristics of the portfolios. The first characteristic was the *extent to which the support needs of the portfolio projects varied.* When the needs were highly heterogeneous, centers appeared to be choosing a different support strategy than when they were similar. Secondly, centers adapted their strategies to the *variability of the net support benefits* within the portfolio. With low variability, centers could achieve about the same amount of net benefits across the portfolio, no matter which project they focused on. In contrast, when variability was high, they could achieve comparatively large net benefits when focusing on certain projects, but only small ones otherwise.

Three dimensions characterized the support strategies of centers in the study (Figure 14). First, strategies differed in their *selectivity*, which describes how many of the projects that could benefit from a certain form of support actually receive it. For instance, one of the firms that participated in the survey had a corporate funding scheme under which projects from all divisions could apply for funds, but only those that met certain criteria would receive some. As in this case, a highly selective strategy therefore usually involved project prioritization.

Second, *specialization* indicated the extent to which a center addressed only certain support needs of the projects it focused on, to the neglect of other needs. For example, the highly specialized support strategy in the firm's funding scheme was to provide corporate funding and limit involvement of other kinds to infrequent progress reviews. Leadership, management and all other activities remained with the units. Third, strategies had a certain *support intensity*, that is, a typical strength of support a center provided for the kinds of support needs that the specialization covered. In the funding scheme, corporate contributions to total project costs were usually around 30%, and progress reviews were typically quarterly.

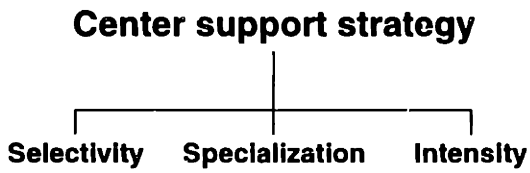

Figure 14: Dimensions of center support strategies

Figure 15 illustrates how the types of portfolios and the observed center support strategies seemed to relate. If support needs were homogeneous and the variability of support benefits low, centers could support comparatively many projects with fairly high intensity because they could focus their efforts on few kinds of support needs. The risk of suboptimal support across the whole portfolio appeared comparatively low. Thus, the center's support strategy was

characterized by low selectivity, low specialization, and high intensity. This strategy could best be observed in Alpha's small subsidiary. Since the key concern of project managers in the operating units was to establish initial contacts with experts in the other subsidiaries, management supported projects intensely by relationship building and initial communication facilitation. For that purpose, managers went as far as to establish dedicated budgets for organizing semi-annual visits of experts, their managers and spouses from the other subsidiaries.

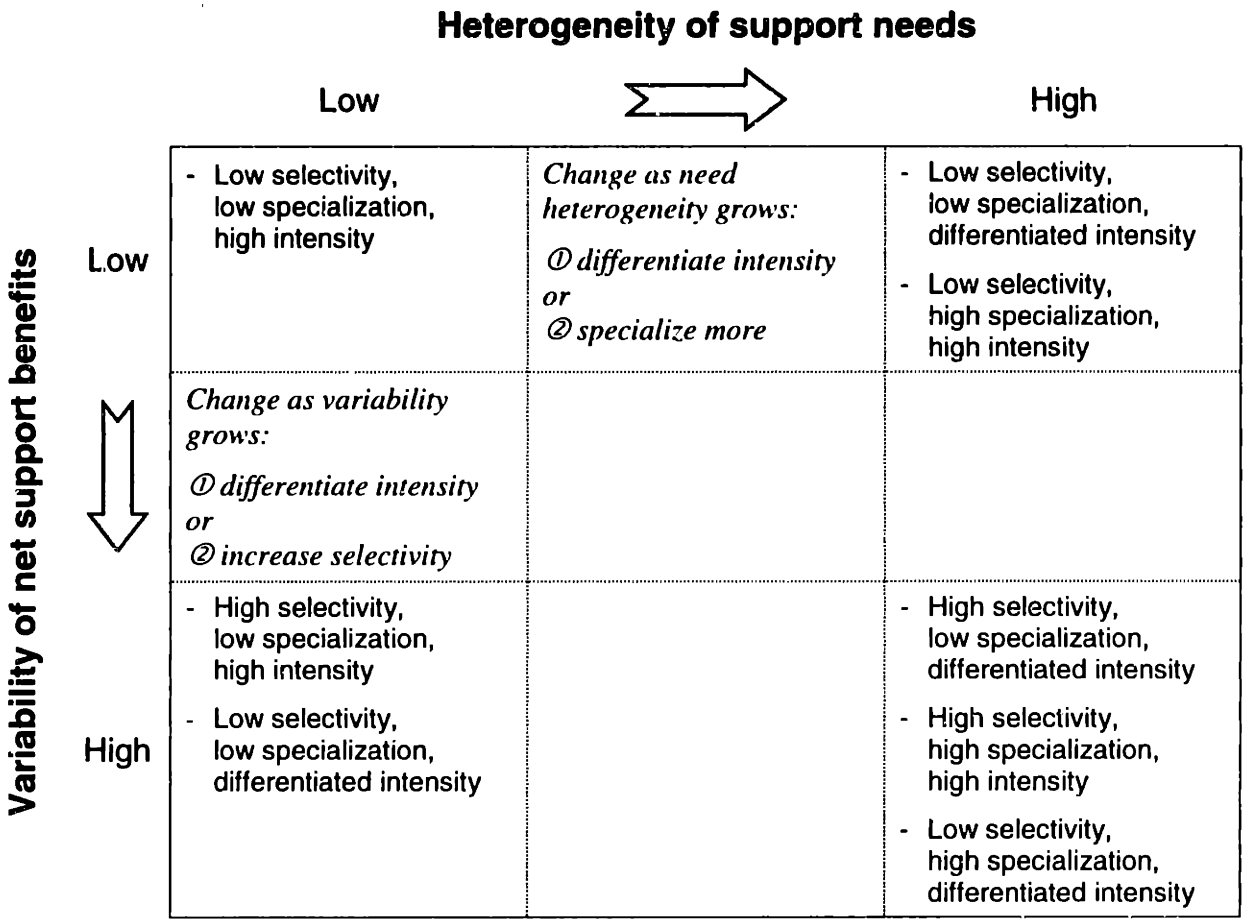

Figure 15: Support strategies for central units on the portfolio level

When the support needs were heterogeneous, centers could attempt to address the diverse needs and try to support as many projects as possible without specialization. Because they then had to invest much effort into nurturing a wide range of support means, and were consequently spread quite thinly, the intensity of support for some projects and needs was almost inevitably quite low, and caused differentiation in the intensity of support. For instance, interview partners at Alpha described headquarters managers as stretched so thinly that they had created a track record of seemingly picking up issues "at random" or "by accident" and "taking too little time to evaluate innovative ideas". Support for certain projects appeared to have a distinct "flavor of the month" character.[32]

[32] Quotes from managers at headquarters and in divisions.

An alternative strategy to address heterogeneous support needs was to combine high support intensity with low selectivity, but high specialization. Centers here effectively delegated substantial responsibility for effective cooperation to the units. One corporate manager in charge of firm-wide knowledge management in a conglomerate saw this as the only viable approach by which his department could support cooperation among divisions without imposing corporate designs that would not fit divisional interests well. Therefore, his support funds were dedicated to investments in a basic technological and administrative infrastructure on which all international projects could draw, such as the development of an internal yellow and blue pages system which units could access to identify potential collaboration partners firm-wide. Simultaneously, the units were encouraged to enhance their project management and operations capabilities for collaborative projects. Together with other means to facilitate communication among units, this strategy addressed a wide range of projects, was highly specialized, and provided strong support for relationship building.

A third, unobserved alternative, combining high selectivity with low specialization and high intensity, seemed unpopular because centers always needed a strong rationale for preferring certain projects over others if all had similar needs and net involvement benefits. Furthermore, centers sought to reap scale benefits, which the breadth of support means in this alternative would not easily generate. Therefore, it seemed difficult for centers to justify this approach internally. The main choice when support needs in the portfolio were heterogeneous therefore appeared to be between the intensity of support and specialization.

When support needs were homogenous, but the net support benefits varied considerably, centers had a different choice. On the one hand, they could be quite selective and focus on the high-potential projects only; alternatively, they could differentiate their support intensity across a large range of projects. For example, the corporate funding scheme described earlier allowed varying levels of center funding that ranged from 20% to 70% of total project budget in most cases. Support levels were determined according on the corporate, long-term benefits and the strategic options of accepted projects. Moreover, since early assessment and prioritization of the projects became important, centers scanned projects early.

For portfolios with highly heterogeneous support needs and highly variable support benefits, centers attempted to limit the overall complexity of the support optimization problem. As one basic approach, they could be highly selective and thus limit the number of supported projects. If they wanted to support the selected projects broadly, they would differentiate the support intensity across projects in order to not spread too thinly. Alternatively, if they decided to offer more specialized support, they could support all projects with equally high intensity.

The second basic approach was to be little selective and support many projects. To limit complexity, centers would then specialize and differentiate the intensity of support. This was the line along which the corporate knowledge management unit in the conglomerate planned to enhance its support for the divisions as it developed a better understanding of the variability of support benefits.

A center's strategy choices as it attempts to optimize its support across a portfolio can lead to certain inefficiencies on the project level. For instance, in a portfolio with heterogeneous support needs, project participants from local units may sometimes experience a specialized center as overly focused, or will note insufficient support intensity if the center is little specialized.

Similarly, a center that focuses on projects with the highest support benefits may be perceived by participants in other projects as too selective or too limited in its support intensity.

Managers could use the above framework and the conditions impeding center effectiveness that were identified in this study to assess whether typical forms of center ineffectiveness they encounter are caused by the center portfolio, and if so, to what extent. The assessment can be helpful to improve the match between portfolios, center strategies and project needs. In particular, it can identify areas in which centers can improve without compromising on the overall quality of their portfolio support strategy. It may also lead to a redefinition of portfolios or stronger support of capability development in local units to alleviate pressure on centers.

Because center "effectiveness" can have different meanings for decision makers on various organizational levels if their portfolios differ, a valuable extension of this study would be to explore the link between the individual project, or unit as project participant, and the portfolio. Better understanding how perceptions differ between units and centers, and how portfolio strategies lead to inefficiencies in specific cases would help devise solutions to reduce the tradeoffs. It would also explore quite uncharted territory in the associated literatures.

9.3 Managing connections between innovation development and leverage

What are the costs of ineffective management of cross-border innovation development? In the narrow sense, those are the various kinds of costs associated with poor performance of the development project. The most obvious are the actual development costs, which may exceed initial budgets or be higher than necessary due to inefficiencies. Others take the form of opportunity costs. Due to low speed of project completion, the firm may lose business and market share to competitors. Or, the innovation may end up having weaker performance characteristics, which can as well lead to lost business and other opportunity costs.

Seen in a broader context, it is also plausible that poor management of a cross-border innovation development project influences how the rest of the firm subsequently leverages the project outputs, specifically new knowledge and capabilities. For example, if the development process was ripe with conflicts, the participating units may have become defensive about their new knowledge and guard it more than otherwise. In such cases, poor development performance could cause hidden, indirect costs to the firm in form of barriers to rent appropriation (cf. Szulanski 1995:chapter 2) or impediments to future capability enhancement. As opposed to the narrowly defined development costs above, these costs would represent indirect leverage costs.

The central question then becomes whether firms need to make a tradeoff between development and leverage performance in cross-border innovation development. On the one hand, it is clear that emphasis on high development performance can lead to high leverage costs. For instance, the firm may decide to develop an innovation quickly and efficiently with regard to a certain lead market, only to discover later that costly and time-consuming changes are required before it can be introduced in less advanced markets. With more time or resources, a significant part of these costs might have been avoided.

On the other hand, high development performance can also create favorable conditions for subsequent leverage. For example, if two cooperating units agree to a documentation standard for exchange of knowledge and information, the same standard may facilitate subsequent knowledge transfers to other units. Similarly, if the two units are adequately rewarded for their

development contributions, they may not only be more motivated to contribute readily, but also less possessive of the new knowledge later on and support leverage more willingly. Of course, both positive and negative relations between development and leverage performance may exist. If so, the question is whether one directionality prevails, and what the overall pattern of relations looks like.

Descriptive data collected during this study sheds light on this pattern for the projects in the sample. While the questionnaire did not actually measure leverage costs or the cost of achieving a certain potential to leverage, it covered a variety of conditions known to affect knowledge leverage within the firm. Those conditions were primarily derived from Szulanski's 1995 study of internal best practice transfers.

Specifically, respondents rated the following conditions for knowledge leverage on a five-point disagree-agree scale: "① The project improved our ability to cooperate with people from foreign units; ② Team members know quite well how to show others the usefulness of the outputs; ③ The conditions and activities needed for effective use of the outputs are known; ④ The project generated good documentation (e.g., for outputs, lessons learned); ⑤ The outputs can be easily adapted to the needs of new users; ⑥ Team members know quite well how to motivate new users to use the outputs; ⑦ Team members know quite well how to teach new users to use the outputs; ⑧ Team members are motivated to transfer knowledge about the outputs to new users."[33]

Actual project cost, project speed and output quality were measured relative to initial expectations on a five-point scale from 1 – much higher than expected, to 5 – much lower than expected. For cost and speed, "much" was defined as a deviation of more than 20 percent. Cooperation quality among the units was measured with the following statement on the same disagree-agree scale as the transfer items: "Overall, we cooperated well with people from foreign units."[34]

The correlations between the project performance and leverage parameters are shown in Table 25. Items I through IV are the project performance measures, items 1 to 8 the above transfer potential measures. To facilitate interpretation, speed and output quality were reverse scored, such that higher values of items I to IV all express higher performance. Because of the small number of projects, a moderately strict significance level of .1 was chosen.

Looking at the performance dimensions only, one notices that all correlate positively. Project speed and cost improve and deteriorate together significantly, as do speed and output quality, and output and cooperation quality. In contrast, cost and the other performance dimensions appear more independent of each other, as do cooperation quality and project speed.

Project cost and almost all dimensions of leverage potential for the outputs turn out unrelated. The only exception is documentation quality, which increases as project speed increases. Thus, projects that achieve good cost performance relative to initial budget do not also achieve high

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[33] These items were included to form a "transfer potential" scale for follow-up research with the same data base. A summated rating scale with these items has a Cronbach's α of .86 with an average inter-item covariance of .45. Confirmatory factor analysis yields an eigenvector of 3.70 with an average uniqueness value of .53 and an average item-to-factor correlation of .72, which indicates good scale quality.

[34] It is necessary to keep in mind during the discussion that performance measurement relative to initial expectations has certain limitations. Conclusions are based on the premise that expectations were equally challenging for all projects in the sample.

overall transfer potential. However, they generate good documentation, which may facilitate leverage later on.

	Performance aspect	I	II	III	IV
I	Project cost				
II	Project speed*	.39			
III	Output quality*	.10	.38		
IV	Cooperation quality	.19	.23	.41	
1	Cooperation capability	.07	.27	.45	.73
2	Demonstrate usefulness	-.05	.15	.29	.49
3	Knowledge for output use	-.05	.02	.34	.42
4	Documentation quality	.28	.17	.19	.23
5	Output adaptability	-.07	.09	.48	.27
6	Ability to motivate users	-.08	-.03	.41	.54
7	Ability to teach users	-.03	.08	.21	.41
8	Motivation for transfers	.03	.18	.39	.57

*Table 25: Zero-order correlations among performance aspects, project level (shading: p<=.1; pairwise deletion (N<=40); *: reverse scoring)*

Project speed is almost consistently positively correlated with the dimensions of leverage potential, though most correlations are not significant. It seems as if projects with high speed relative to initial expectations have somewhat better transfer potential in most regards. In particular, they improve significantly the units' capability to cooperate with foreign units, which is useful for subsequent leverage.

Output and cooperation quality turn out to link knowledge development and leverage most strongly. Since they are significantly and strongly positively related to most leverage dimensions, projects with high output and cooperation quality have quite favorable starting conditions for leverage. Project outputs seem readily adaptable to the needs of new users, and units feel capable to demonstrate others their usefulness. The former points directly towards comparatively low costs of firm-wide innovation use, and the latter is known to be an important task when a unit tries to leverage the innovation or the underlying capabilities internally (cf. Birkinshaw 1995). Such a selling capability may encourage other units in the firm to use the innovation or associated capabilities. It may also help units to convince corporate management to allocate more resources for further capability enhancement to their units, rather than others.

IMPLICATIONS

What are the implications of this data? Overall, they lead to the conclusion that development and leverage performance are positively related. If a firm has difficulty managing cross-border innovation development projects successfully, it will likely have quite a bit of difficulty leveraging the innovation and underlying capabilities later on. Consequently, cross-border innovation development turns out to have double relevance as a business process in the multinational firm, and can make a double contribution to the firm's competitive advantage: first, with regard to development proper, insofar as it enables the firm to create potential to capture

value with innovations and new knowledge; second, with regard to leverage, for it supports the firm's efforts to capture rents from innovations and new knowledge across its scope of operations.

Making good decentralization and support decisions appears to contribute to competitive advantage in the same two ways. For the projects in the sample, the correlation between center effectiveness and a unit's cooperation quality is strongly positive (.29) and significant. Except for documentation quality, center effectiveness correlates strongly positively and significantly with all leverage conditions (correlations range from .21 to .40, all with $p<=.05$). On the project level, there is a weak tendency for higher center effectiveness to go along with higher project speed (correlation of .24, $p<=.14$), and a significant tendency to go with higher output quality (correlation of .31).

Accordingly, centers play a dual role in cross-border innovation development projects. Not only can they enhance project performance, but also do they help set the ground for innovation and capability leverage after the development project. The data thus lends support to findings from previous research and corroborates an important assumption of this study – that the distribution of activities between central coordinating units and local units, and the quality of center involvement, matter for cross-border innovation development projects.

While the above results are not fully conclusive, due to the underlying data, they nevertheless contain a clear message to practitioners. It is that the appropriate frame of reference for assessing decisions, actions and performance in cross-border innovation development projects must extend beyond the end of development activities. Decisions and actions taken during that time affect leverage processes later on and can influence their costs and benefits. Any assessment of decisions and actions that is limited to the development process will miss those implications and therefore lead to biases.

The bias can either be an overly optimistic assessment of an alternative because its future net costs are not taken into account, for instance, if it promises a reduction in innovation development costs but leads to an increase in adaptation costs for other users. Or, it can be conservative when future net benefits are not included in the picture, as in case of underinvestment in building shared procedures and standards during development that could beneficially be exploited in later transfers. Center involvement based on an assessment of the innovation's net benefits to the whole firm may be able to attenuate the bias. For instance, it can generate revised innovation specifications or additional funding that turns the innovation into a truly firm-wide one.

Practitioners can pursue at least two ways to better attend to the links between development and leverage. The first one is to incorporate leverage-related goals explicitly into the development process, e.g., via a balanced scorecard approach. Process performance measures can then reflect the potential for innovation and knowledge leverage. This approach does not necessarily integrate development and leverage goals, since the scorecard may list them without direct connection to each other and leave it up to the responsible managers to make tradeoffs. The second one, the real options approach, goes one step further. It attempts to derive a joint assessment of the development and the leverage stages, and thereby integrates the respective goals. Both, however, have a similar effect, for they extend the view of the participants in the development project beyond the end of initial innovation development.

9.4 Studying decentralization and center effectiveness as aspects of cross-border innovation development

The current study has focused on decentralization and center effectiveness as key elements of the cross-border innovation development process in multinational firms. It has provided a framework whose constructs and relationships, derived from various organizational theories, possess high conceptual validity and predictive power. Overall, the hypothesized relationships have received good support, and reasonable alternative explanations have been presented for unexpected results. Thus, future research can either adopt parts of the study's measurement model, or extend it by drawing more heavily on associated concepts in the organizational theories, for instance to rule out competing explanations for the unexpected results.

One desirable extension would be to complement subjective, retrospective questionnaire data in the measurement model with other kinds of quantitative data, possibly collected in the field as the development projects unfold.[35] This would reduce recall problems and could shift the burden of dealing with a multinational research setting to researchers, away from project participants who may have had some difficulties with a questionnaire that was not formulated in their mother language (even though there was little indication of it, given the quality of the data in the returned questionnaires). It would also help to validate the measurement model with a different kind of data.

At the same time, such data would provide richer insights into project dynamics. Like much process research that captures the essence of organizational processes in a few aggregate constructs (cf. Van de Ven and Polley 1992), the current study has neglected those dynamics, even though project conditions obviously change over time (cf. Ridderstråle 1996). Most interestingly, a longitudinal approach could help disentangle the mutual effects that center involvement and cooperation among units may have on each other over time. Assessing those effects is in fact one of the goals for follow-up research based on the study. The longitudinal data would also put the researcher in the position to refute concerns about effect causality commonly encountered in cross-sectional research. While the study used temporal anchors and customized questionnaire instructions to minimize potential causality problems, actual longitudinal data would be preferable.

The study also simplified process dynamics in another regard. Facing a tradeoff between data specificity and questionnaire complexity, it used aggregate data for the set of foreign units with whom the respondent's unit cooperated during the project. Such aggregation hides variation in the nature and quality of collaboration between the focal unit and each of the foreign units. If this variation is significant and consequential, then another meaningful extension of the study would be to use dyadic data.

Moreover, due to the focus of the study, the research framework did not control for cooperation among the various centers involved in a project. If an elegant way can be developed to model horizontal cooperation on the levels of local units as well as centers, and in addition the vertical cooperation between local units and centers, then it would be a very desirable extension of the framework to include cooperation among centers.

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[35] E.g., content analysis of records collected via communications software, such as email communication among participating units. Cf. Yates, Orlikowski et al. (1999).

The overall research approach was complex and demanding, for the researcher as well as the points of contact in the participating firms. In retrospect, it appears warranted, given its contribution to the quality of data in a complex research setting with a multi-actor, multi-level research framework. Specifically, the initial exploratory interviews and case studies provided rich insights into the phenomenon and allowed links to several organizational theories to emerge. They also helped to develop a research framework that seemed relevant to both research and practice. In the later stage, feedback during the pilot tests and customization of the questionnaires avoided pitfalls in the data analysis.

On the other hand, the research approach inevitably slowed down the overall pace of progress. Partly due to the difficulties of getting firms to participate in a study that addresses their very sources of competitive advantage, partly due to the dynamism of a field that causes high turnover, frequent internal restructuring and enormous M&A activity, this study had to cope with a fairly high attrition rate in the sample. Those conditions also made it impossible to not let the participating firms self-select the projects to be studied, which of course raises questions about the generalizability of findings to a broader population. The research approach addressed them by using selection guidelines and including specific measures of the representativeness of the sample projects. Nevertheless, it would be helpful to validate the findings in a larger, different sample. Follow-up research could do so by using a larger sample of firms, a larger sample of projects within each firm, or both.

Such a larger sample would also contribute to a more specific analysis of direct and indirect effects in the framework. Due to the sample size, this study did not use simultaneous equation models to test them in a statistically robust way, and therefore provided a more exploratory analysis. As this analysis and previous research on collaborative processes in different settings suggest, indirect effects are both important and interesting. Therefore, they deserve closer attention in subsequent research. One goal would be to better explain how cultural differences, relations among units, uncertainty, conflicts and the distribution of motivation and power among the units indirectly influence the outcomes of development projects via mediating processes, such as chosen decentralization levels.

The analysis of the individual components of the decentralization and effectiveness constructs revealed interesting and sometimes surprising variation in their relations to the independent variables – variation that requires more and different data than available in order to be explained conclusively. The results therefore provide a good starting point for further investigation into multidimensional organizational patterns associated with cross-border innovation development. For example, cluster analysis could help better understand which forms of project involvement firms decentralize simultaneously, and discriminant analysis could show under which conditions they choose a particular decentralization pattern. Research on the effectiveness components could generate analogous results and shed more light on critical tradeoffs in the projects.

As discussed in the previous section, such tradeoffs are likely to be relevant if structures, processes and outcomes can be optimized on various levels. For example, this study has chosen to define center effectiveness on a fairly detailed level to fill a knowledge gap in the associated literatures and help practitioners better understand the "micro-mechanisms" of what influences project organization and center effectiveness. It has been pointed out that studying effectiveness in a portfolio of projects or units would generate valuable complementary insights. An extension of the framework in this regard would likely strengthen its explanatory power.

Along the same lines, it would be helpful to consider as performance measures a broader portfolio of the goals centers and development projects have to meet, which usually include goals for project cost, speed, and output quality. Because center effectiveness as defined in this study addresses only one of the many performance aspects of cross-border innovation development, more analysis of the other effectiveness dimensions is clearly desirable. For that very reason, this study also does not intend to draw normative conclusions and considers the findings as part of a larger, complex picture that can only be appropriately described after further research. Specifically, additional research could use a more encompassing view of performance to better analyze the tradeoffs within a goal portfolio. Among other things, this would open up opportunities to develop contingency models in which centers and local units act differently, depending on the constellations of constraints and demands they face.

Going one step further, the set of performance measures could be extended to include not only goals for the development process proper, but also for subsequent leverage of the innovation and associated new capabilities. As shown in the previous section, development and leverage are linked at least insofar as the former influences the starting conditions for the latter. Consequently, organization and performance of development and leverage most likely cannot be treated as independently as the neat separation of the development and transfer literatures currently suggests. While this study has taken a tiny first step towards a more integrated view of capability development which takes various kinds of costs and benefits on a portfolio level into account, ample opportunity remains to explore the development-leverage relations further, and in particular provide practitioners with models that help optimize process organization in a more holistic context.

More research could also test the applicability of the study framework in other organizational settings. For instance, multinational firms develop quite a few innovations internationally not via collaboration among local units, but via collaboration with customers or suppliers. It seems possible to adapt central framework concepts -- such as dependence and cultural differences – so that the framework can also be tested for inter-organizational, cross-border innovation development. It can also be adapted to innovation development between units located in the same country, whether those are part of the same firm or not.

9.5 Cross-border innovation development as capability that contributes to competitive advantage

Cross-border innovation development is one of several innovation development processes that multinational firms use to exploit and enhance their local capabilities globally. As the discussion in chapter 2 has shown, firms now rely on it quite often and consider it as increasingly important, compared to alternative innovation processes. Therefore, the study adds to the international management literature some knowledge on how multinational firms organize an important innovation process. It complements previous, mostly case-based studies by its quantitative orientation and the in-depth analysis of particular organizational aspects and outcomes, namely, decentralization and effectiveness. Going beyond the level of detail of previous studies, it considers various aspects of involvement and effectiveness independently. In consequence, it can analyze more specifically how multinational firms adjust process organization to the project setting, and how their organizational choices affect aspects of process effectiveness.

With its attempt to describe the interaction between horizontal and vertical coordination processes on the project level, the study enters fairly unexplored territory. While previous quantitative research has usually either neglected or simply controlled for vertical coordination (e.g., the extent of top management support in product development, cf. Eisenhardt and Tabrizi 1995), this study depicts it as variable response to characteristics of the project and the context in which it is embedded. Doing so, it shows how cross-border innovation development involves complex coordination among multiple actors on multiple levels, a generally neglected topic in organizational research.

With both horizontal and vertical coordination covered, the study can also speak to the recently proposed organizational models of the multinational firm. It shows that, at least for the time being, coordinating centers keep playing an important role for a critical organizational capability, even though multinational firms overall may now display more noticeably than ever the features of horizontal networks, heterarchies or transnational organizations (Hedlund 1986; Bartlett and Ghoshal 1989). The results suggest this role is today more subtle and less encompassing than it most likely was earlier, in that local units often take on substantial amounts of responsibility and initiative. Nevertheless it exists and needs to be played effectively, at least until local units become fully able to initiate and manage cooperation by themselves. With these findings the study supports the concept of "differentiated fit", i.e., confirms that firms try to adapt structures and processes to the situational needs of each unit. On the other hand, it shows that the extent of "fit" varies, because firms fail to achieve equally good adaptation across the whole range of settings.

The results support a central theme of the corporate strategy literature, namely, that central units need a comparative advantage vis-à-vis local units in order to add value to dispersed processes (cf. Goold, Campbell et al. 1994). Without such advantage, central units are likely to destroy value if involved in the processes, and are better advised to delegate as much as possible. This study takes the notion of comparative advantage to the process level by proposing at least six different dimensions along which centers can adjust their involvement somewhat independently from each other, according to whether they can add value: leadership, launch support, management, funding, control, and operations. Analyzing how much centers facilitated cooperation among local units, it focused on one critical area in cross-border innovation development in which centers can add value.

This view of internal comparative advantage and its use not only extends a corporate strategy approach to a specific business process. Moreover, it shows how the logic of the resource-based view of the firm (cf. Barney 1991; Peteraf 1993) applies meaningfully within the firm if one considers each unit as an actor with resources and capabilities that compete against those of other actors for being used. Such a picture of resources and capabilities in the multinational firm stands in marked contrast to much of the organizational learning literature, which has either tended to view firms as unitary actors when going beyond the group level (cf. review in Miner and Mezias 1996), or explicitly emphasized the collaborative advantages of firms relative to markets when it comes to creating and combining knowledge (e.g., Conner and Prahalad 1996). The study adds a word of caution by pointing out that motivational factors, conflicts and dependencies between the various parts of the firm may affect the firm's position relative to markets. Because capabilities are not uniformly distributed within the firm and therefore not equally available throughout, it recommends paying more attention to organizational learning processes that involve multiple, distributed units and groups. The multinational firm is a particularly suitable

setting for research along these lines because some barriers to organizational learning are extremely salient.

The study has also attempted to strengthen the connection in research between two different, yet in practice related processes underlying competitive advantage. If cross-border innovation development is a process that combines joint knowledge creation and leverage of local knowledge, then effective management of the creation-leverage links should contribute to competitive advantage. The study has looked at two such links: first, the leverage of existing, local knowledge within the development project during cooperation of local units; secondly, and more exploratively, the connection between the newly created knowledge and its potential for subsequent leverage. With these links it has tried to connect previous innovation development studies (e.g., Hansen 1996; Ridderstråle 1996; Gassmann 1997) more strongly with those on international innovation transfer (e.g., Zander 1991; Kogut and Zander 1992; Szulanski 1995; Zander and Kogut 1995; Kostova and Cummings 1997). Though not conclusive, the results suggest that the most accurate development performance measures for large, complex firms may be those that also consider the implications of the development process for subsequent leverage opportunities.

9.6 Summary: Implications for research and practice

Underlying any effort to improve cross-border innovation development is a certain definition of process effectiveness. The discussion pointed out that practitioners can define effectiveness either for each project and unit independently, or take a portfolio view that incorporates more interrelations among projects and units. Portfolios can be classified by the heterogeneity of support needs and the variability of net support benefits. The resulting portfolio types have associated support strategies that vary in their selectivity, specialization and intensity.

Because different parts of the firm can favor different support strategies, conflicts may result if the associated perceptions and behaviors diverge, even though each part acts rationally from its position. Therefore, a center's seeming ineffectiveness in a certain instance can actually be the visible sign of tradeoffs in a portfolio-oriented support strategy that necessitates compromises and occasional suboptimal support.

Influenced by the chosen support strategy, centers can effectively support cooperation among local units in cross-border innovation development projects if they avoid four kinds of gaps: a perception gap from limited understanding at the center of support needs and available involvement options; a design gap if an involvement plan for the center that does not add value; an implementation gap from inappropriate execution of the involvement plan; and, finally, a coordination gap that represents inadequate communication about the center's involvement with the local units.

When developing a support strategy and addressing support gaps, practitioners should keep in mind that the development process sets the stage for subsequent leverage of the innovation and associated capabilities. Well-managed development appears to facilitate future leverage, and difficulties during development tend to translate into leverage difficulties. Therefore, the appropriate framework to assess consequential decisions and actions, including in particular the involvement of centers during development, encompasses not just the development project, but the development project plus potential subsequent leverage opportunities. Without such a broad framework, decisions may be biased and cause direct or indirect costs for which some parts of

the firm will have to pay. With it, the firm can gain operational flexibility to shift the use of resources across time and locations. Ways to institutionalize a broad framework include a balanced scorecard and a real options approach.

Chapter 10: Summary and conclusion

The starting point for the current study was the observation that innovation development across borders has become more important for multinational firms in many industries, due largely to increasing dispersion of innovation stimuli, favorable business environments for innovation development, necessary inputs, and opportunities for innovation use. While cross-border innovation development offers a variety of competitive benefits, it at the same time poses considerable organizational challenges.

This study focused on a central issue in the organization of multinational firms, as it applies to cross-border innovation development: the need to find an effective balance between horizontal cooperation among local units and vertical coordination involving central units, such as corporate, divisional and regional headquarters. Based on more than 40 interviews and a sample of 40 projects with 101 responding units in a total of 11 multinational firms, it sought to determine which conditions affect this balance in cross-border development projects, and which conditions influence how effectively central units participate in them. Put differently, the goal was to understand the role of central units, and identify the boundaries of their support capabilities.

Broadly speaking, the results corroborate the notions of "differentiated fit" and "parenting advantage" that have recently been established in the international management and corporate strategy literatures. Firms do choose coordination mechanisms, and accordingly the role of central units, in response to characteristics of the projects and the participating units. In brief, the more the central units can draw on unit-specific advantages vis-à-vis the local units, the more they get involved. Thus, if local units lack strong lateral relations, centers may act as relation brokers, facilitators and controllers; if they have valuable resources and capabilities that the units do not possess, they will act as input providers and process managers; if they have strong interest in the project, or can address lack of motivation in the local units, they will get involved. Furthermore, they handle project risk, both related to uncertain conditions outside the firm and collaboration within.

In choosing center roles, firms seem to have a "blind spot", however: they neither use centers to address cultural differences nor conflicts among the units by higher involvement. This may be either because centers lack the respective mediating capability, or because differences and conflicts are correlates of a highly decentralized organizational context that centers and units cannot overcome in the projects. If cultural differences and conflicts actually impede project performance, this blind spot suggests a current capability limit and opportunities for future capability enhancement.

As to the effectiveness of center roles, the picture is not quite as easy to describe. While firms seem to follow a straightforward logic when determining the roles of centers and local units – whoever appears to have an advantage, contributes –, the actual outcomes diverge somewhat from this pattern. First, centers apparently are not as effective in supporting local units when they play only small roles. Second, even though centers may be better able than local units to manage project risk, they are nevertheless affected by it. Third, they have difficulty supporting local units that are "small" project players compared to the foreign units they cooperate with. Similarly, they cannot cope as easily with the demands of highly motivated local units when foreign local units

are little motivated. In sum, these results also point towards current limits in the cross-border development capability of the firms, and associated avenues for improvement.

On the other hand, centers appear quite able to handle varying degrees of coordination complexity among the local units. They also turn out to address cultural differences among the units and support cross-functional collaboration. Geographic distance among the units gives them another kind of opportunity to add value. The overall picture is thus one of multinational firms choosing center roles according to a fairly intuitive logic of center-specific advantages, but achieving desired results only according to a much more subtle and complex logic which puts those advantages in relation to the complexity of the project situation.

In the firms studied, when project organization or center support turns out less effective than desired, the cause can normally be found in one or more of three main steps in the center intervention process. As a first step, centers need to understand the units' situations and support needs, and to recognize ways to support them. Secondly, they have to develop an involvement plan that matches support needs and the means of involvement available to them. Then, of course, they have to overcome obstacles during the implementation of the plan. Seen this way, ineffectiveness can be the result of inaccurate perception, planning, or execution for the respective project and unit.

Stepping back from the individual project and looking at the bigger organizational context in which it is embedded, one locates another potential source of center ineffectiveness. If a center is responsible for a whole portfolio of units or projects, it may attempt to optimize its involvement across the portfolio, rather than for each project or unit individually. In that case, ineffective support for a particular project and unit may well be the outcome of a center support strategy whose selectivity, specialization or intensity are desirable and feasible for the portfolio in total, but not fully effective in certain instances.

This point highlights the organizational challenge multinational firms currently face: On the one hand, to define a "differentiated fit" that adapts the organization of important processes to situational circumstances; on the other hand, to operate within the constraints of limited resources, time required for capability development, and established behavioral or cognitive patterns. As to the roles of centers in cross-border innovation development, this almost inevitably involves tradeoffs.

Despite such compromises, however, and even though multinational firms are moving towards greater decentralization overall, the study finds that centers maintain an important function in cross-border innovation development, at least for the time being. Compared to traditional modes of organizing, those roles may be more narrow and subtle than before. Nevertheless, firms currently still seem to justify them by an organizational logic based on fairly well observable kinds of unit-specific advantages, related to internal distributions of resources, motivation, as well as cultural differences and uncertainty. However, given the observed variations in effectiveness, one must ask whether those advantages are the best available decision criteria, and whether they are best possibly combined in the firms' decision processes. Looking into the future, the question also arises whether it will be more desirable to preserve certain center advantages (and possibly promote highly specialized center roles), or better to further erode center advantages indirectly by strengthening the position of local units.

In this regard, the results of this study appear quite useful for practitioners. Practitioners receive with the research framework, which is empirically tested and validated, an additional tool to

think about cross-border innovation development projects. The patterns uncovered in the study hopefully stimulate their thinking about organizational variations. And the observed capability boundaries point towards avenues for improvement, or at least an assessment of associated costs and benefits. In brief, practitioners can use the study results in both organizational diagnosis and organizational improvement efforts.

Given the questions the study has raised and left unanswered, researchers can use the study as a basis for follow-up projects. A logical next step would be for them to try and replicate the findings in a larger-sample study. At the same time, they could attempt to identify variations across industries, firms, unit or innovation types that the study could not, or did not, detect. Furthermore, the details of the three-stage process by which firms assess the support needs of local units, plan center involvement and then implement it, remain to be examined. There is also ample room for the multi-level, multi-actor research that strategy process researchers have repeatedly called for, whether it focuses primarily on cross-level issues such as the connection between portfolio optimization and individual projects, or on dynamics between actors in centers and local units. Finally, the link between development performance on the one hand and subsequent innovation transfer and use within the firm on the other can be explored in much greater depth.

Even without these extensions, the study contributes to the international management literature a better understanding of cross-border innovation development as an organizational process that increasingly contributes to firm performance in many industries. In particular, it complements previous, mostly case-based research on the topic with quantitative, large-sample findings. Within the strategy literature it addresses the fundamental question of the role of central units, and how they can add value to local activities. The identified capability boundaries seem of particular interest to the capability and organizational learning literatures. Moreover, the connection between center involvement and performance is quite relevant for innovation management research.

Positioned as it is at the intersection of those fields of research, the study does of course not claim to provide conclusive answers for either. However, if it has managed to inform and stimulate thinking in several of them with regard to a shared, important research phenomenon, and consequently perhaps even strengthened some links among them, it has achieved a major goal.

Appendix A: Forms of innovation development in the multinational firm – an overview of existing models

Various models of innovation development in the multinational firm have been developed in international management research. They can be distinguished by the strength of international aspects in their process and outcome orientations.

International process orientation refers to the importance a model ascribes to two things: first, the international distribution of knowledge development activities addressing the same kind of innovation opportunity, and second, the international coordination of these activities. In this it roughly reflects two critical components of a firm's international strategy (Porter 1987:67): "The first is what I term the *configuration* of a firm's activities worldwide, or where in the world each activity in the value chain is performed, including in how many places. The second dimension is what I term *coordination*, which refers to how like activities performed in different countries are coordinated with each other."

Combining the two components of process orientation yields three fundamental cases: low international distribution of knowledge development with obviously low international coordination, high international distribution of activities that remain largely uncoordinated, and highly distributed activities that are at the same time highly coordinated. Cross-border innovation development processes, as defined earlier, fall into the third category.

The international outcome orientation relates to the characteristic international distribution of newly developed knowledge among units as a result of the knowledge development process. These outcomes refer directly to the criterion for the classification of cross-border innovation development process presented earlier (cf. p. 23). The models describe three main kinds of outcomes. Some development processes lead units to develop complementary knowledge for different parts of a business process, as, for example, when one unit specializes in research and development, and another in marketing. Other processes generate substitutable knowledge for the same activity in a business process, e.g., for the same manufacturing process in plants in various countries. Again others create complementary knowledge for the same business process activity, as in case of two research labs that specialize in complementary technologies.

Key for the classification is the main focus of the model, and it is therefore quite possible that a model also addresses other types of processes and outcomes, yet with less emphasis, or implicitly. For instance, it can be argued that Vernon's product cycle model (Vernon 1966) not only describes innovation development in the multinational firm's home country with complementary marketing and sales specialization in units serving foreign markets, but also indirectly the development of substitutable marketing and sales knowledge across all units that serve foreign markets. However, since the latter is not the primary focus of the model, given its emphasis of the relation between the home market and foreign markets, it is not considered relevant for the classification here.

Based on their international process and outcome orientations, Figure 16 classifies key contributions in the international management literature that address knowledge development in the multinational firm. Meant to be illustrative rather than exhaustive, it shows that the field has begun with and then gradually shifted away from processes with low international dispersion and

coordination of development activities. Currently, processes ranking high along both dimensions receive the most attention.

Process International aspects of knowledge development process		**Outcome** International distribution of knowledge		
Activity dispersion[A]	Coordination complexity[B]	Complementary knowledge for different activities in a business process	Substitutable knowledge for same activity in a business process	Complementary knowledge for same activity in a business process
Low	Low	• Product cycle (early stage)[3] • Locally-leveraged innovation process[1,6,12] • Centralized-hub / ethnocentric MNC[2,4,5,7,8]	• Product cycle (late stage)[3] • Polycentric MNC[5,7] • Country-by-country expansion strategy[4, 11] • Locally-leveraged innovation process[1,6,10,12] • International technology transfer literature	
High	Low		• Local-for-local innovation process[1] • Multi-domestic / federation MNC[4,5,7,8] • Heterarchy[4, 12] • Global scanner[6]	
Cross-border innovation development		• Transnational / geo-centric MNC[1,4,5,7] • Heterarchy[4] • Globally-linked innovation process[1,10]		• Globally-linked innovation process[1,10] • Literature on R&D internationalization[9]
High	High			

1	Bartlett and Ghoshal 1989	7	Bartlett 1986
2	Porter 1990	8	Porter 1987
3	Vernon 1966	9	Westney 1990; 1993
4	Hedlund 1986	10	Nonaka and Takeuchi 1995
5	Perlmutter 1969	11	Johanson and Vahlne 1977
6	Vernon 1979	12	Birkinshaw 1995

Figure 16: Major models of knowledge development in the multinational firm (Adapted from Gast and Lessard 1997)
A: International dispersion of initial innovation development activities with related foci
B: Complexity of coordination among units during initial innovation development

LOW INTERNATIONAL DISPERSION AND COORDINATION OF KNOWLEDGE DEVELOPMENT

Models in this category describe innovation development as multinational firms predominantly organized it several decades ago, and continue to organize it in early stages of their international

expansion. More recent models also contain development processes in this category that are considered one of several processes the multinational firm uses in parallel.

For the most part, the models relate closely to the product cycle model by Vernon (1966). It depicts firms as developing innovations primarily in their home bases and then exploiting them internationally, often with considerable time lag and as demand in less advanced market emerges. With all relevant research and development activities in the home country, the subsidiaries develop complementary marketing, sales and after-sales knowledge for the innovations they receive. Thus, this stage of the model describes a situation of complementary knowledge for different activities of a business process in which development activities are comparatively little internationally dispersed and coordinated. It also characterizes quite well similar knowledge development models proposed by other researchers. Those include the centralized hub model (Bartlett 1986), the "global" firm (Porter 1987; Bartlett and Ghoshal 1989) and ethnocentric models of the multinational firm (Perlmutter 1969; Hedlund 1986). Strong similarities also exist with the model of firms that are seen as mainly exploiting the "diamond of national advantage" in their home markets (Porter 1990).

Vernon's product cycle model describes in a later stage how foreign subsidiaries expand their range of capabilities to the point at which they learn to manufacture the products locally, and thus use knowledge that substitutes for same-activity knowledge in the home country. This allows them to serve other markets, including the firm's home market. The reversal of product flows is based on product standardization and cost advantages of foreign countries as primary drivers of foreign knowledge development. Yet, even though the location of knowledge development shifts across countries in a series of characteristic stages, the overall initial knowledge development activities in the firm at any time are little internationally dispersed. Firms keep developing innovations in their home markets, but use international knowledge transfers intensely.

The same pattern is associated with the "international" model of organizing the multinational firm (Bartlett and Ghoshal 1989), according to which firms may choose to keep core competencies centralized while decentralizing less central ones. It also characterizes firms pursuing an incremental international expansion strategy (Johanson and Vahlne 1977) or "selective tapping" (Sölvell and Zander 1995). Related models can be found in the international technology transfer literature.

In a subsequent modification of the product cycle model (Vernon 1979), only two types of firms maintain this approach. The first type benefits from scale economies and can produce globally standardized products without paying too much attention to individual markets. "Accordingly, they can be expected to maintain the central core of their innovational activities close to headquarters, where complex face-to-face consultation among key personnel will be possible; in this respect such firms are likely to perform consistently with the product cycle pattern." (p. 262) Firms of the second kind offer their subsidiaries the opportunity to locally produce innovations developed in the home market. Key is that they give the management of each subsidiary the opportunity to decide whether or not to adopt an innovation, without embedding their decisions in a global strategic context. For both types, the bulk of development activity remains in one country, even though selected, routine development activities may be relocated abroad.

HIGH INTERNATIONAL DISPERSION, LOW COORDINATION OF KNOWLEDGE DEVELOPMENT

The pattern of internationally dispersed, yet little coordinated knowledge development activities is typical for firms pursuing a multi-national, "decentralized federation", or "polycentric" strategy that treats local markets as quite independent of each other (Perlmutter 1969; Bartlett 1986; Hedlund 1986; Porter 1987; Bartlett and Ghoshal 1989). In those firms, units develop their capabilities locally according to local needs, even if similar capabilities and innovations already exist elsewhere in the firm. The firms' potential to leverage their international scope of operations is accordingly limited. Typically, many relevant innovations do not get used internationally after they have been developed locally.

Several related models that describe highly dispersed, yet little coordinated development processes emphasize the firms' effort to exploit new knowledge globally upon completion of development. For example, Vernon's 1979 modified product cycle model includes one kind of multinational firm in which knowledge development is internationally dispersed, yet little internationally coordinated. Firms of this kind possess what he calls a "global scanning" capability. They can detect and exploit innovation opportunities in any market they serve, and, "once the innovation was developed, the global scanner would be in a position to serve any market in which it was aware that demand existed; and would be in a position to detect and serve new demands in other markets as they subsequently arose." (p. 261) Since this model's emphasis remains on local innovation development coupled with global exploitation thereafter, it views international knowledge development as highly dispersed, but little coordinated.

This knowledge development pattern corresponds with the "locally leveraged" process model (Bartlett and Ghoshal 1989:116), in which the firm "capitalizes on the resources and entrepreneurship of individual national subsidiaries but leverages them to create innovations for exploitation on a worldwide basis." Birkinshaw (1995) describes a related type of process in which subsidiaries attempt to exploit firm-wide their independently, locally developed capabilities. Here, too, innovation activity is highly internationally dispersed, but international coordination primarily sets in after the initial development activities are completed. There is little emphasis on cooperation with other units during development, and much on the global use of innovations. This of course is the central concern of the international technology transfer literature (cf. Cusumano and Elenkow 1994 and Zander 1991 for reviews).

HIGH INTERNATIONAL DISPERSION, HIGH COORDINATION OF KNOWLEDGE DEVELOPMENT

Knowledge development processes that are both highly dispersed and coordinated, and to which the cross-border innovation development processes in this study count, have received much attention recently.[36] They are based on the notion that multinational firms are "actively seeking advantages originating in the global spread of the firm", since "the foundations of competitive advantage no longer reside in any one country, but in many." (Hedlund 1986:20, 21) Accordingly, subsidiary managers increasingly take on firm-wide responsibility and initiative to exploit innovation opportunities (Roth and Morrison 1992). They thereby benefit from a heterarchical organizational context in which they can obtain and relinquish control as necessary,

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[36] The distinction between knowledge and innovation development processes is that the former do not necessarily create innovations. For example, consider global communities of practice within a firm (cf. Brown and Duguid 1991). Dispersed community members create much shared knowledge in closely coordinated ways, but new pieces of knowledge thus created often do not constitute innovations for the firm.

draw on locally available information about the whole firm, and form lateral relations with peer units as needed (Hedlund 1986).

Bartlett and Ghoshal (1989:116) share essentials of this view in the "globally linked" process they outline. It "links the resources and capabilities of diverse worldwide units in the company, at both headquarters and subsidiary level, to create and implement innovations on a joint basis. In this process, each unit contributes its unique resources to develop a corporatewide response to a worldwide opportunity." Because of its relevance for competitive success, it is a cornerstone of the transnational model of the multinational firm they propose. The model of global knowledge development proposed by Nonaka and Takeuchi (1995:chapter 7) shares these features. They can also be found in Westney (1990; 1993), who presents a detailed analysis of how the units in a firm's global R&D network cope simultaneously with local and corporate pressures that arise from dispersed, intensely coordinated activities.

The main text in Chapter 2 further discusses contributions that fall into the third category.

Appendix B: Procedures to handle missing questionnaire data

B.1 Description of the procedures

Since missing data is a typical problem in social survey research, various techniques have been developed to cope with it (Little and Rubin 1986). Given the data structure of this study, two related missing data problems could be expected. Respondents who would not answer some of the questions that jointly formed a scale would create missing observations for individual scale items (i.e., missing indicator values). Respondents who would not answer any question of a scale or might not answer a stand-alone question would create missing construct values, since none of the techniques to deal with missing indicator values could be used.

The study employed several procedures for handling each case. Using several procedures, rather than only one, appeared the best way to make the most use of the available data and at the same time test how sensitive the results were to the missing data procedures. Accordingly, identical analyses were performed for each procedure and their results compared. These results were reported in the respective chapters.

HANDLING MISSING INDICATOR VALUES

If some, but not all indicator values of a construct are missing for an observation, a commonly used approach is to substitute for the missing value the mean value of the indicator in the whole data set. Such indicator mean imputation is easy, but often causes stronger biases than available alternative. Nevertheless, it was included because it had been used so often before.

Other procedures take the information from the observation's other indicators to compute a scale score and thus a construct value. Considering more information from the data set, this approach is usually preferable to casewise deletion and mean imputation, especially since the overlapping relations of the indicators to the underlying construct provide a strong theoretical justification. It also tends to lead to conservative, rather than inflated, regression estimates (StataCorp 1999), and typically has a lower risk of causing sample selection bias than casewise deletion. Two variants of such regression imputation were implemented to handle missing indicator values: indicator imputation and score imputation. Both are based on available other indicator values for the respective observation.

Indicator imputation requires three steps. First, for each observation and indicator with a missing value, all other scale indicators whose values are also missing for the respective observation are dropped from the whole data set. Second, the values of the focal indicator are regressed on the set of other indicators for all complete cases in the data set to get regression coefficients. Then, the value for the focal observation indicator is set to be the value that can be predicted with the regression coefficients and the observation's available indicator values.

Score imputation with indicator values, the third method used, proceeds in a similar way, but applies after scale scores are calculated. First, factor loadings and scale scores are computed for the complete cases in the data set. Second, the indicators whose values are missing for the respective observation are dropped from the data set. Then, the scale scores of the complete cases are regressed on the set of remaining indicators to get regression coefficients. Finally, the

scale score for the incomplete observation is set to be the score that can be predicted with the regression coefficients and the observation's available indicator values.

HANDLING MISSING CONSTRUCT VALUES

Missing construct values are more serious than missing indicator values, at least insofar as no values for any of the scale items are available to predict the observation's construct value. Commonly used approaches rely on information from the whole data set and exploit the correlations among the predictor constructs.

The study used two approaches to handle missing construct values: Mean imputation, which imputes the mean value of the construct in the data set, and regression imputation, which estimates the missing construct values. Mean imputation was included because the theoretical rationale for regression imputation was weaker than for the case of missing indicator values, given that non-zero correlations among constructs were observed, but not necessarily justifiable a priori, unlike for indicators in the same scale.

Value imputation using available other construct values proceeds in analogy to the regression imputation for missing indicator values. For constructs that are to be independent variables in the analysis, the construct values of the complete cases are regressed on the values of the other predictor constructs for which the observation has values (cf. Little 1992). Then, the estimate of the construct value is imputed. For obvious reasons, values for dependent variables should not be imputed.

In combination, these routines on the item and construct levels lead to the six alternative ways to handle missing data shown in Table 26. Since alternative one is considered to most accurately reflect the actual data structure, it was used to generate the results reported in earlier chapters.

1	Construct item: Construct:	Imputation with available other construct items. Imputation with available other constructs.
2	Construct item: Construct:	No imputation. Construct score imputation with available items. Imputation with available other constructs.
3	Construct item: Construct:	Mean imputation. Imputation with available other constructs.
4	Construct item: Construct:	Imputation with available other construct items. Mean imputation.
5	Construct item: Construct:	No imputation. Construct score imputation with available items. Mean imputation.
6	Construct item: Construct:	Mean imputation. Mean imputation.

Table 26: Alternative ways to handle missing data for the regression models

B.2 Robustness test of results for the decentralization model

This section reports the regression results for the decentralization model, using the six alternative procedures to handle missing individual construct items and missing values for complete constructs. Column 1 in Table 27 contains the results reported earlier, columns 2 to 6 the alternative results.

Overall, the regression results differ very little across the methods, which is little surprising in light of the high quality of the raw data in the returned questionnaires. One can conclude that the analysis is robust with respect to the procedures for handling missing data.

Decentralization	1	2	3	4	5	6
$Cultural\_difference_{Units}$	.39••	.39••	.39••	.39••	.39••	.39••
$Relation\_strength_{Units}$	.38••	.38••	.40••	.41••	.40••	.40••
$Resource\_spread_{Center}$	−.37•	−.36•	−.32•	−.32•	−.32•	−.32•
$Motivation_{Center}$	−.80••	−.81••	−.86••	−.82••	−.83••	−.86••
$Motivation_{Respondent\_Unit}$	.50••	.50••	.52••	.53••	.52••	.52••
$Motivation_{Foreign\_Units}$	−.05	−.05	−.03	−.06	−.06	−.03
$Motivation_{Respondent\_Unit*Foreign\_Units}$	.46••	.47••	.47••	.48••	.49••	.47••
$Uncertainty_{Respondent\_Unit}$	−.88•	−.87•	−.94•	−.90•	−.90•	−.94•
$Uncertainty_{R\_U} * Dependency_{Center}$	.27••	.27••	.28••	.28••	.27••	.28••
$Dependency_{Center}$	−.12	−.11	−.11	−.11	−.10	−.11
$Dependency_{Foreign\_Units}$	−.20••	−.20••	−.24••	−.23••	−.22••	−.24••
$Conflict_{Center}$	−.26••	−.26••	−.28••	−.27••	−.27••	−.28••
$Conflict_{Foreign\_Units}$	.18•	.18•	.20•	.19•	.19•	.20•
$Resources_{Foreign\_units}$	.02	.02	.01	.03	.01	.01
$Size_{Respondent\_Unit}$	.0005••	.0005••	.0006••	.0006••	.0006••	.0006••
Firm dummies	••	••	••	••	••	••
N	93	93	94	93	93	94
R^2	.699	.701	.707	.710	.711	.707
Model significance (F)	.0000	.0000	.0000	.0000	.0000	.0000

Table 27: Decentralization model with alternative missing data procedures
•:p<.05; ••:p<.01

B.3 Robustness test of results for the effectiveness model

This section reports the regression results for the effectiveness model, using the alternative procedures to handle missing data.

Overall, the results for most variables differ very little from method to method, as Table 28 shows. The significant variables appear particularly stable across all procedures. Cross-functional cooperation turns marginally insignificant when mean substitution is used, but maintains its direction and approximately its strength. The variables measuring cooperation intensity and conflict between the units change more with mean substitution, which seems partly due to their high standard errors. It can also indicate that the respective observations with missing data differ in those two variables from the sample means. In total, however, the analysis seems robust with respect to the missing data procedures. This can again be attributed to the data quality in the returned questionnaires.

Center effectiveness	1	2	3	4	5	6
$Decentralization_{Respondent\_Unit}$	−.27••	−.28••	−.26••	−.27••	−.28••	−.26••
$Uncertainty_{Respondent\_Unit}$	−.27••	−.27••	−.25••	−.27••	−.27••	−.25••
$Cultural\_difference_{Units}$	.24•	.24•	.22	.24•	.24•	.22
$Relation\_strength_{Units}$	.22	.22	.20	.22	.22	.20
$Relative\_Involvement_{Units}$	.22•	.22•	.22•	.22•	.22•	.22•
$Relative\_Motivation_{Units}$	−.37••	−.37•	−.36•	−.37•	−.37•	−.36•
$Cooperation\_Intensity_{Units}$	.41	.42	.20	.38	.39	.20
$Crossfunctl\_Cooperation_{Units}$	.16•	.16•	.13	.16•	.16•	.13
CoopIntensity_CulturalDiff	−.26	−.26	−.22	−.25	−.25	−.22
CoopIntensity_Crossfunctl	−.14	−.14	−.08	−.13	−.13	−.08
$Dependency_{Foreign\_Units}$	−.13	−.13	−.14	−.13	−.13	−.14
$Conflict_{Center}$	−.15	−.16	−.11	−.13	−.14	−.11
$Conflict_{Foreign\_Units}$	.12	.12	.07	.10	.10	.07
Local_Cooperation	.36•	.36•	.35•	.37••	.37••	.35•
Distance	.06••	.06••	.06••	.06••	.06••	.06••
N	95	95	101	95	95	101
R^2	.483	.482	.431	.478	.477	.431
Model significance (F)	.0000	.0000	.0000	.0000	.0000	.0000

Table 28: Effectiveness model with alternative missing data procedures
•:p<.05; ••:p<.01

Appendix C: Test of rival hypotheses for the decentralization and center effectiveness models

This appendix describes the results of the tests of rival hypotheses that could potentially bias the results of the decentralization and effectiveness models. Rival hypotheses are seen as expressing theoretically justifiable relationships between an explanatory variable and the respective dependent variable that can cause bias in the model if omitted in the statistical analysis. This does not include relationships that merely enhance the explanatory power of the model.

C.1 Test of rival hypotheses for the decentralization model

"Project size affects decentralization and starting conditions, such as perceived uncertainty." The degree of project decentralization may be lower for larger projects, because large projects are more critical to the firm as a whole, and thus to centers. At the same time, larger projects may be more uncertain than small ones, and may increase the value of resources and capabilities in foreign units. Consequently, a measure of total project size within the firm, expressed in terms of the average number of people working on the project throughout the firm, was added to the main model. Its regression coefficient turned out to be small, the t statistic highly insignificant (.821), and the increase in explanatory power marginal, with an R^2 increase of .0002. Thus, project size does not seem to hold up as a rival explanation of decentralization.

"The centers do not address cultural differences between the respondent unit and foreign units because they themselves are culturally distant from the respondent unit." This is less a rival hypothesis than a possible way to explain the fact that decentralization does increase with cultural distance between units. If cultural distance between units correlates with high cultural distance between units and their centers, then centers would not have as much of an advantage to handle cultural differences among units as one might suspect. Indeed, cultural distance between the respondent unit and its center, measured on the same scale as cultural distance to foreign units, was positively and significantly correlated with cultural distance to foreign units (.43, $p<.001$). Thus, every unit increase in lateral cultural distance implies a half-unit increase in vertical distance. While this still leaves centers closer to foreign units than the respondent units themselves, it can nevertheless attenuate their ability to mediate effectively.[37]

When adding the measure of cultural distance between the respondent unit and its center to the model, the explanatory power of the model rises by .004 percentage points. The coefficient is positive and non-significant ($p<.213$). Due to the correlation with cultural distance between the units, the coefficient of that variable diminishes moderately, but remains significant at the .023 level. All other parameters remain virtually unchanged. Thus, it does not appear as if cultural difference between units and their centers can explain why centers do not react to cultural difference between units by higher centralization. It leaves the hypothesis intact that centers are either ill-equipped to address them, or cannot override institutionalized organizational patterns for routine business.

[37] Assuming the same correlation for the cultural distance between the center and foreign units; this data was not available.

"Project uncertainty and relation strength are in fact proxies for the unit's project routinization. More direct measures of project routinization can not only explain decentralization, but will also weaken the observed effects for the two constructs." This statement claims that the respondent unit's uncertainty and strength of relations to foreign units actually express the extent to which it has routinized project activity in general, and that this routinization has a decentralization effect which is independent of who the collaboration partners are for the current project.

Project routinization can be understood as resulting from experience either specifically with collaborative innovation development and transfer within the firm, or more generally with a broad range of projects. Therefore, two additional three-item constructs from the survey were tested. The first construct measured experience in innovation-related cooperation with other units. It was expected to correlate positively with routinization since it measured how often the unit participated in innovation transfers to and from other parts of the firm, relative to the average of other units, as well as the absolute level of experience with innovation transfers to other units. Its Eigenvalue of 1.30 and an α of .71 made it sufficiently reliable for this test. When added to the main model, it increased the R^2 by .0012 and yielded a positive, but insignificant coefficient ($p<.58$).

The second construct captured the breadth of the unit's project portfolio, based on three heterogeneity measures for the portfolio of projects in the unit: size heterogeneity, output heterogeneity, and risk heterogeneity. It possessed an Eigenvalue of 1.07 and an α of .68. Portfolio breadth could either be negatively related to routinization if differences across projects impeded standardization in the past, or positively related, since higher breadth could imply a higher likelihood that the current project falls within the range of projects for which routines developed over time. It was therefore a good construct to test for routinization effects in either direction.

However, adding portfolio breadth to the main model did not change the R^2 and yielded only an insignificant positive coefficient ($p<.95$). As with the first construct, neither of the parameters of the main model changed noticeably. Thus, decentralization seems to be little determined by factors related to the unit's overall project and collaboration activity, and thus little by project routinization within the unit.

"Not the amount of resources in foreign units affects decentralization, but their nature." It is of course possible that decentralization depends less on the amount of resources and capabilities in foreign units than on the degree to which they are complementary or similar to those in the respondent unit. One can hypothesize that cooperation between units with complementary resources is more difficult than between units with similar resources, and therefore requires more central support. Thus, there may be a main effect of complementarity on decentralization, and an interaction effect with the amount variable.

To test this possibility, two additional models were estimated. The first contained a single-item measure of the complementarity of capabilities between the respondent unit and foreign units. The second contained this measure plus an interaction term with the amount of resources in foreign units. The first model did not change any of the parameters in the core model noticeably, added only .0018 in explained variance and yielded a positive, insignificant coefficient ($p<.50$). The second model diverged slightly more, but still very little overall. Adding .0065 in R^2, it produced an insignificant coefficient for complementarity ($p<.59$) and a negative, insignificant coefficient for the interaction ($p<.12$). At the same time, the coefficient for the amount of

foreign resources became larger and lost 75% of its standard error, down to .22. These results fully support the original specification.

"Some effects of the variables in the main model may be influenced by the strength of the relation between the respondent unit and the center." Decentralization and some independent variables could be influenced by the strength of the relation between the respondent unit and its center. A model including the analogue of the measure of relation strength between the respondent unit and foreign units was therefore tested. The R^2 increase of .0005 was negligible and the regression coefficient insignificant ($p<.71$), with all other parameters virtually unchanged. In other words, relation strength between the unit and the center did not seem to affect decentralization decisions for the sample.

"The observed patterns depend on the nature of the innovation." This hypothesis was tested with two models. The first model included dummy variables for innovation type, classified by the respondents as either new product, service, organizational process/organizational system, technical process/system, or other. This model yielded insignificant coefficients for the dummy variables and a marginal increase in R^2 of .0094. The second model included dummies for the functional specialization of the respondent's unit, measured by nine categories in the survey. Adding the dummies revealed insignificant coefficients and a small increase in explanatory power of .027. Thus, the observed pattern appears to be independent of output type and functional unit specialization.

In sum, it seems fair to say that the model stands up against a series of plausible rival hypotheses. Neither of the alternative models tested possesses a significant relationship between the added variable and decentralization, increases the explanatory power noticeably, and significantly changes the parameters of the original model.

C.2 Test of rival hypotheses for the center effectiveness model

"Unobserved firm characteristics systematically affect some of the independent variables as well as center effectiveness." For example, firm-specific project management systems designed to facilitate cooperation among units could not only reduce the respondent units' perceived project uncertainty, but also allow centers to better support them. It was therefore advisable to check for firm effects with a model including firm dummies. In this model, all firm dummies turn out insignificant and only lead to a marginal increase in explained variance of .0034, while not changing the other parameters noticeably. To see whether firm effects might relate only to particular aspects of center effectiveness, analyses were also run for each of the aspects, with similar outcomes. Only in the regression for coordination is one firm dummy marginally significant. In sum, these results lead to two conclusions: Unobserved firm effects do not seem to bias the regression coefficients in the main model, and center effectiveness appears to depend mostly on conditions that vary within the firms.

"Centers can support large projects more effectively than small projects." As for the analysis of decentralization, the argument can be made here that project size does matter. For instance, if a large project is more salient and important within the firm, or if the firm's routines are geared towards large projects, one could expect centers to support units working on large projects better. If project size is also considered to be correlated with at least one of the independent variables – e.g., one could claim that respondent units perceive large projects as particularly uncertain, it becomes necessary to control for project size. This was done with a model containing project

size as an additional variable. Returning an insignificant coefficient for project size, it leaves the coefficients of the original model virtually unchanged and increases the R^2 only by.0016. Apparently, project size does not seem to bias the estimates in the main model and cannot explain much variation in center effectiveness.

"Whether a center is more or less effective depends on the cultural difference between the respondent unit and the center." This statement was also examined in the tests of the decentralization model to understand the role of centers with regard to cultural differences between units. Here, it points towards the possibility that the center's capability to mediate such differences in support of the respondent unit depends on its cultural proximity to the unit, which in turn may be correlated with the cultural difference between units. It asks whether it is in fact the cultural distance between the respondent unit and the center, rather than the cultural distance between units, that affects how well a center can support the unit. As the analysis indicates, this does not seem to be the case. The coefficient for the cultural distance measure between respondent unit and center turns out insignificant and does not increase the explanatory power of the model. At the same time, the coefficient for cultural distance between units changes only marginally. Thus, centers do seem to be able to support local units regardless of their own cultural distance to them.

"To explain center effectiveness correctly, one has to consider the center's relation to the respondent unit." It is reasonable to hypothesize that centers will be the more effective, the better they know the units whom they support, and that such knowledge also allows them to get comparatively little involved in the projects. Adding a variable for relation strength between center and respondent unit to the model increases the explanatory power by 1.66 percentage points, but yields an insignificant coefficient. The result indicates that relation strength does not directly impact support effectiveness, and this may have for several possible reasons. With a given relative level of involvement, centers may be able to provide support of a certain quality regardless of their relations to the respondent units – i.e., because they are able to effectively overcome obstacles like lack of detailed unit knowledge. Alternatively, centers may fail to systematically exploit the potential these relations offer, for instance, because they lack the capability to do so, or because established organizational routines do not allow them to behave as flexibly as the situations might warrant.

Two more changes are noteworthy: the coefficient for relative involvement of the respondent unit, previously significant at the .05 level, turns insignificant, and the interaction term between cooperation intensity and cross-functional cooperation becomes borderline significant at the .05 level. The latter change may point towards a systematic relation to effectiveness, as hypothesized, which the main model did not pick up. Given an insignificant direct effect of relation strength between respondent unit and center on effectiveness, those changes do not threaten the validity of the model in the sample, but if a significant direct effect can be thoroughly justified for the population, it would be advisable to add the center relationship variable to the model.

"The motivation level of the center does not only affect its level of involvement, but also the quality of support it provides." A model with center motivation as additional construct tested this possibility. It increased the fraction of explained variance only marginally by .0065, yielded an insignificant coefficient for center motivation, and did not change any other coefficient significantly. This suggests center motivation directly affects only a center's involvement level, but not its effectiveness.

"The center's effectiveness varies with the degree to which the unit has routinized project activities." Routinization of project activities in the respondent unit may reduce its perceived uncertainty for the current project and at the same time make center support more effective. To test this possibility, two more models were analyzed, each with one of the two indicators of project routinization and activity level already used for tests of rival hypotheses in the decentralization model (cf. p. 155).

The model with a measure of the unit's activity in innovation-related cooperation with other units does not cause relevant changes in the parameters of the main model, but increases the R^2 by 1.59 percentage points and returns a significant negative coefficient. Thus, it does not threaten, but rather enhances the model by adding a separate dimension. In the second model, the measure of the unit's breadth of project activity increases the R^2 by 2.54 percentage points. Its coefficient turns out significant at the .02 level and possesses a negative sign. The coefficients of the interaction term between cooperation intensity and cross-functional cooperation, and of the conflict level among the units, become marginally significant. Since they maintain their signs and strengths and thereby do not indicate any model bias, this added variable does not pose a validity threat to the original model either; like the activity variable, it merely enhances its explanatory power.

The negative coefficient signs of the two variables contradict the rival hypothesis that higher activity leads to routinization and therefore higher effectiveness. An alternative explanation may be that comparatively active units have become less satisfied with center involvement, for instance, because centers have less opportunity to complement the units and have not adapted their involvement accordingly. More intriguingly, the coefficient sign of the heterogeneity variable can indicate limits to capabilities and capability building. If units with a more heterogeneous project portfolio receive less effective support, it may be because it is more difficult to build routines and capabilities that support a project in a more heterogeneous portfolio as effectively as in a more homogeneous one. One can imagine, for instance, that the effectiveness of the center's support declines as the difference in support requirements between a project and the most frequent, or most important, project type in the unit's portfolio grows. Since projects in a comparatively heterogeneous portfolio have larger average differences, average center effectiveness would be lower.

"The observed patterns depend on the nature of the innovation." As in the decentralization analysis, two additional models with dummies for innovation type and functional unit specialization, respectively, were tested. As to innovation type, all dummies but one are insignificant, but increase the explanatory power of the model by .052. Furthermore, while the sizes of the coefficients in the main model remain largely unchanged, adding the dummies turns cooperation intensity as model core variable significant. As to the control variables, conflict with center turns significant as well, whereas local cooperation turns insignificant. In sum, considering output type appears to enhance the main model somewhat, but not doing so does not seem to bias it noticeably. Similarly, when dummies for functional unit specialization are added to the main model, its explanatory power rises by .039, but the dummy coefficients are insignificant. Here, too, there seems to be no threat of model bias.

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