Multi-point knowledge development processes in the multinational firm

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Structure of the paper

Abstract

Multi-point knowledge development processes in the multinational firm

The nature of multi-point knowledge development

Idiosyncrasies of multi-point knowledge development

Dispersion of managerial activities

Contextual diversity and geographic distance

Coordination complexity

Simultaneity of activities

Variations of multi-point processes

Variations in the coordination of key management activities

Variations in the functional relation between the knowledge each unit develops

Links between research on knowledge development in international management and organization theory

Models of knowledge development in the multinational firm

Models of knowledge development in international management and organization theory: Emerging connections

Conditions supporting the use of multi-point knowledge development

Factor conditions

Related and supporting industries

Demand conditions

Industry structure and rivalry

Governmental influence

Issues in the management of multi-point processes

Building the organizational capability to manage multi-point processes

Criteria for the design of multi-point processes

Local adaptation vs. cross-unit coordination of knowledge development

Knowledge variety vs. knowledge redundancy

The speed of international knowledge exploitation

Conclusion

Acknowledgments

References
Abstract

This paper focuses on an increasingly important form of distributed knowledge development in the multinational firm: the multi-point process, a set of related knowledge development activities which are internationally dispersed among multiple units, coordinated, and performed at least partially simultaneously.

We draw on the organizational literature on knowledge development to identify the challenges associated with multi-point processes. We then present environmental conditions under which multinational firms can be expected to use them, compare several variants of multi-point processes, and explore criteria guiding managers in central process design activities. We conclude with a discussion of how the extreme case presented by multi-point processes in the multinational firm informs our general understanding of the management of knowledge development processes in organizations.
Multi-point knowledge development processes in the multinational firm

Knowledge has always played a central role in the theory of the multinational firm. In the early literature, knowledge was considered an asset that gave the multinational firm monopolistic and efficiency advantages vis-à-vis local firms (Caves 1971; Hymer 1960; Kindleberger 1969; Magee 1979; Teece 1977). It was treated as a static resource of domestic origin which the multinational firm subsequently exploited internationally (Buckley and Casson 1976; Vernon 1966). More recently, knowledge has been viewed as a dynamic asset that is developed at least in part as a result of the firm’s multinational reach (e.g., Bartlett and Ghoshal 1990; Kogut and Zander 1993), and the emphasis is now shifting towards knowledge development as a continuous and geographically dispersed process. In Dunning’s terms, the treatment of knowledge is becoming less an ownership than a location plus internalization phenomenon.

This paper focuses on an increasingly important form of knowledge development across borders in the multinational firm: the multi-point process, a set of related knowledge development activities which are internationally dispersed among multiple units, coordinated, and performed at least partially simultaneously. It explains the factors which often make managing multi-point processes unusually challenging and presents environmental conditions under which multinational firms can be expected to use them. It also compares several variants of multi-point processes and explores criteria guiding managers in central process design activities. The purpose of this analysis is to offer frameworks and propositions for researching the multi-point process as organizational phenomenon, and to show how it complements other models of knowledge development in the multinational firm.

A second, major goal of this paper is to demonstrate how a salient phenomenon in an applied field can inform research in an underlying discipline. Knowledge development has become more prominent in organization theory and strategy, to the point that it is virtually a fad. Organizational learning concepts, the capabilities approach and the resource-based view have shifted the level of analysis further inside the firm and more towards dynamic phenomena (Levitt and March 1988; Conner and Prahalad 1996; Montgomery 1995; Teece et al. 1992). However, there has been little cross-fertilization between these streams of research and research on knowledge development in multinational firms. On the one hand, the organization theory approaches tend to focus on knowledge development at the individual or group level, giving little attention to the institutional and cultural contexts in which knowledge develops (cf. Boyacigiller and Adler 1991) or to the issues of knowledge development that bridges units. On the other hand, the international management literature remains in large part anecdotal, with its own definitions and categories, and therefore has had little impact on the emerging general paradigms of knowledge development. This paper builds in particular on the agenda of cross-fertilization between the organization theory and international management fields set forth by Ghoshal and Westney (1993). It demonstrates that multi-point processes raise important organizational issues, caused in particular by the effects of geographic distance and the embeddedness of organizational units in heterogeneous local environments (Rosenzweig and Singh 1991; Westney 1993), which arise in less pronounced form in other organizations as well.

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1 An early mention of the role of a firm’s multinationality in its development of knowledge is Kogut (1985).
2 The exception is Ghoshal and Westney (1993), whose explicit goal is to foster such cross-fertilization.
After characterizing multi-point processes, we briefly analyze how knowledge-oriented approaches in organization theory speak to knowledge development under conditions of multiple embeddedness and distance. Then, we link multi-point processes to other models of knowledge development in the international management literature within a simple framework. The framework illustrates how multi-point knowledge development complements these models, but differs regarding the influences of contextual diversity and distance. Using this framework, we consider conditions under which firms should be expected to engage in multi-point knowledge development and examine the central tradeoffs involved in designing multi-point processes. Though by no means comprehensively, we also explore contingencies for organizational knowledge and capability development processes which are currently virtually absent in the organizational learning, resource and capability literatures. We conclude with a synthesis of the findings and a sketch of avenues for further research.

The nature of multi-point knowledge development

Multi-point knowledge development processes consist of geographically dispersed knowledge development activities which, first, are performed in several countries by subsidiaries or at headquarters, second, unfold at least partially simultaneously, and, third, are coordinated among the participating units. Fourth, the knowledge thus created in each organizational unit is either functionally complementary or functionally similar to that in others. For instance, specialized subsidiaries may complement each other technologically in an international product development process with knowledge from their technological domains. In other cases, knowledge substitutability is exploited by identifying best practice across units through internal benchmarking and then transferring the underlying knowledge from lead units to others.

Whether and how multinational firms use multi-point processes depends on a whole array of external and internal driving forces. While some multi-point knowledge development may result from ongoing cross-unit interactions, or may be made obvious because of the clear complementarity of different units, in general we expect that it requires deliberate choice. It therefore seems appropriate to analyze the use of multi-point processes both from an environmental determinism and a strategic choice perspective.

If information technology continues to make it dramatically easier and more cost-efficient to coordinate activities across units, multi-point knowledge development processes can be expected to become more feasible technically and economically in a larger range of areas. In terms of decision making in these areas, technological progress may then cause predictable shifts, from an

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3 We define knowledge development as a process during which a well-defined set of people become able to react systematically to a task-demand in a novel way by acquiring or creating, then retaining and consistently applying a set of interdependent bits of information. The structural scope of the set of people (i.e., the individual, dyad, group, unit, organization, network level) determines the structural level to which the process can be attributed. Primary knowledge development activities generate the knowledge for initial solutions to a task. The subsequent refinement of this knowledge as well as knowledge development activities in recipient units during knowledge transfers are both secondary knowledge development activities.

4 ABB used this approach in power transformers during the early years after the merger, as it sought to capitalize on differences in functionally similar processes that had evolved in Asea and Brown Boveri.
initial stage of environmental determinism in which multi-point processes are prohibitively expensive to realize, to an intermediate stage of strategic choice in which they are feasible, but not required, to yet another stage of environmental determinism in which they need to be used to maintain competitive parity. Of course, this scenario rests on the assumption that multi-point processes possess certain benefits over other forms of international knowledge development. We therefore have to understand their distinguishing characteristics, the environmental conditions which do or do not favor their use, and the criteria managers will base their decisions on in situations of strategic choice.

**Idiosyncrasies of multi-point knowledge development**

Like other internal business processes, multi-point processes are embedded in the corporate and local organizational contexts, which are to a large extent created before initial knowledge development projects are launched. Activities in this pre-launch stage condition the firm for a multi-point process in a cognitive and behavioral way. Not only do they create dominant mental mind-sets and cognitive patterns (Weick 1979; Daft and Weick 1984; Dougherty 1992; Ocasio 1997), but also do they account for the organizational routines and technical systems upon which units and headquarters rely during the process (Nelson and Winter 1982). Consequently, they have considerable influence on the areas in which opportunities for knowledge development are pursued, as well as on the way managers and employees interpret, assess and respond to specific opportunities within these areas. This, in turn, means that the managerial issues encountered during a multi-point process partially result from the way in which the firm was conditioned to react to the underlying knowledge development opportunity.

A multi-point process begins to unfold when several units start developing knowledge to exploit the same opportunity and thereby coordinate their activities, for instance, by using several linked unit initiatives (Birkinshaw 1997). From the initial launching activities onwards, multi-point processes differ from other international knowledge development processes not so much regarding the nature of managerial activities they require, extensively described in well-known models of innovative processes in complex firms (e.g., Bower 1970; Burgelman 1983, 1996; Noda and Bower 1996). What makes multi-point processes special are the conditions under which some or all of these activities have to be performed, and, consequently, the ways in which this happens. Those of particular interest for multi-point knowledge development in this regard are activities related to process design, resource management, and operations management.

Process design activities specify the desired outputs on the highest level and thus link the knowledge development activities to the goals and strategies of the unit and the firm. They also decompose tasks into less complex subtasks, specifies the desired intermediate outputs and the links between them, and sets deadlines for the completion of the subtasks. Resource management activities allocate human, technical and financial resources to the subtasks. These include general management know-how and specific functional skills, whether available internally or procured

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5 It may be difficult to determine ex ante how these activities influence a specific multi-point process, since managers will likely target them towards what may be called an "opportunity space" - a number of domains in which they expect important opportunities to arise in the future. An ex post analysis may more easily reveal activities which turned out to be particularly important for a specific opportunity and process.
from other organizations. Finally, operations management activities encompass all managerial activities necessary to accomplish subtasks according to plan with the allocated resources.

These activities are usually performed in sequence, such that initial process design activities precede resource management activities, which in turn are followed by operations management activities. However, deviations are possible, for instance, in reaction to unforeseen difficulties or changes in the organizational or external context of the activity. Therefore, the classification should be considered less a stage model than a functional model of key managerial activities in multi-point processes.

Managers in charge of these activities confront a combination of conditions quite typical for multi-point processes, but quite unusual for all other processes (Figure 1). These are a high degree of dispersion of managerial activities among organizational units and headquarters; the fact that the units often operate at large geographic distance from each other; that they are embedded in different local contexts; furthermore, the need for highly complex coordination of activities across units, and the simultaneity of activities in different locations, which, for instance, makes it often necessary to transfer knowledge to other units only shortly after it has been developed initially.

![Figure 1: Sources of managerial difficulty in multi-point processes](image)

**Dispersion of managerial activities**

In multi-point processes, several organizational units contribute jointly to the process outcome, yet perform many activities locally. For many of these activities, managers need intimate knowledge of local conditions. Since the process therefore cannot be managed from one central location, managerial activities typically remain quite dispersed across units, compared to other knowledge development processes.

Typically, the actual distribution of managerial responsibility is not purely derived from the task at hand, but also reflects the internal distribution of management capability. This capability can
be more concentrated at headquarters in some firms and more distributed among unit managers in others. The overall dispersion of managerial activities is therefore often the joint result of vertical dispersion, a function of the fraction of activities performed at headquarters, and horizontal dispersion, depending on the number of units involved in the key managerial activities and the concentration of activities among them.

**Contextual diversity and geographic distance**

Two other features of multi-point settings distinguish the multi-point process from those contained within only one country: the participating units are embedded in different local environments and have to overcome geographic distances between them. As Table 1 illustrates, contextual diversity affects a process on all levels, ranging from heterogeneity of norms, values and skills of individuals involved (Adler 1991) to locally adapted routines and technologies to solve process subtasks (Kogut 1991) up to unit goals and strategies, whose orientation towards local business and institutional demands (Porter 1990) affects how its employees act as process participants.

Geographic distance amplifies such influence from contextual diversity by limiting interaction among units and thus attenuating internal isomorphic pressures that would otherwise help to assimilate units on these levels. It is not only responsible for the gradual development of heterogeneity in the first place, but also for difficulties in overcoming it during the multi-point process.

<table>
<thead>
<tr>
<th>Internal influence factor for knowledge development</th>
<th>Related aspects of external context diversity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit goals and strategies (Unit level)</strong></td>
<td>› Industry structure</td>
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<td></td>
<td>› Competitor characteristics</td>
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<td></td>
<td>› Terms of competition</td>
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<td>› Demand and factor conditions</td>
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<td>› Legal and regulatory frameworks</td>
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<tr>
<td></td>
<td>› Influences from professional associations</td>
</tr>
<tr>
<td></td>
<td>› Indirect influences from other levels, e.g., top management team members and strategy formulation process</td>
</tr>
<tr>
<td><strong>Process goals, routines and technologies (Process level)</strong></td>
<td>› Local availability of technology</td>
</tr>
<tr>
<td></td>
<td>› Institutionalization of local processes, e.g., for interorganizational cooperation and internal organization</td>
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<tr>
<td></td>
<td>› Path-dependent local development of routines and technologies</td>
</tr>
<tr>
<td></td>
<td>› Indirect influences from other levels, e.g., process managers and unit goals</td>
</tr>
<tr>
<td><strong>Personal values, norms and skills (Individual level)</strong></td>
<td>› Societal influence on peoples’ values and norms</td>
</tr>
<tr>
<td></td>
<td>› National educational systems</td>
</tr>
<tr>
<td></td>
<td>› Indirect influences from other levels, e.g., unit culture and unit routines</td>
</tr>
</tbody>
</table>

*Table 1: The impact of external context diversity on a knowledge development process*

**Coordination complexity**

All coordination activities among units required to perform a multi-point process form a process-specific interface. This interface can be characterized by its scope - the number of activities or
outcomes to be managed interdependently - and the complexity for each of these links. Link complexity can in turn be decomposed into three indicators: The directionality of dependence between units, which can be either unilateral or bilateral (Thompson 1967); the degree of unit dependence on the link, defined as the amount of resources the unit would have to invest to compensate for the failure of the other unit to deliver according to specification; and the number of locally performed activities influenced by the link.\(^6\)

Multi-point knowledge development processes typically require more complex coordination among units than other kinds of processes. Most fundamentally, the tasks generating multi-point processes are often more complex than those for other knowledge development processes. Combined with internationally dispersed managerial and operational activities, this creates almost inevitably a large interface scope. Coordination is further made complicated by the need to overcome incompatibilities between activity inputs, sub-activities or outcomes as a consequence of diverse contextual influences.\(^7\)

Furthermore, coordination requirements tend to be higher for bilateral than for unilateral dependence and rise with the degree of unit dependence and the influentiality of each link. Multi-point processes score high in all three regards. Many of the locally managed activities are performed simultaneously, making the timing of coordination with other units regarding activity inputs, schedules and outputs more critical than, for instance, for sequentially performed knowledge development activities. In contingency terminology, other kinds of knowledge development processes often allow for cross-unit coordination by plan where multi-point processes demand intense coordination by feedback and mutual adjustment (Galbraith 1973; Van de Ven et al. 1976).

**Simultaneity of activities**

The final distinguishing characteristic of multi-point processes is the comparatively large temporal overlap of activities, which has operational and managerial consequences. For one, it forces units to transfer with little delay to other units a large percentage of the knowledge and outputs they develop, compressing buffer times and the time for refinements or modifications of outputs before their use abroad. Units thus have fewer opportunities to cope locally with the difficulties associated with knowledge development, including risk of failure or disturbance,
uncertainty about the speed of progress, adjustments to plans, and errors made when using new knowledge. Due to the links to ongoing activities in other units, any problems encountered locally cannot be contained as easily as in case of coordination with time lags.

Since a large fraction of activities are performed interdependently and thus need ongoing coordination, units have to begin coordinating them comparatively early and manage reciprocal dependence on each other. As early coordination goes along with high influentiality, units can rely less on locally adapted organizational routines (Kogut 1991) to proceed with what may be called a closed systems logic, i.e., by buffering local activities from the firm's internal environment and the dissimilarity of other units' local environments (Scott 1992). They need to adopt more of an open systems approach throughout under conditions of greater communication difficulty, delay and cost, which geographic distance imposes.

In sum, multi-point processes exhibit an unusually challenging combination of organizational characteristics. First, they tend to have highly dispersed managerial activity among units and headquarters. Second, the coordination requirements across units are complex, involving many links across units with bi-directional dependence, a high average degree of unit dependence per link, and high influentiality of coordination on locally performed activities. Contextual diversity and geographic distance as third and fourth factors amplify these sources of managerial difficulty, as does the high overlap of activities as fifth typical condition.

**Variations of multi-point processes**

**Variations in the coordination of key management activities**

Adapted to the nature of the underlying business opportunity and the available managerial capability, multi-point processes differ from each other in the extent to which units coordinate process design, resource allocation and operations management with each other. Using the functional model introduced above, we distinguish between directed, co-managed, facilitated and emergent processes, for each of which units coordinate different sets of activities strongly (Table 2).

In a directed process, such as the development of the Nissan Primera reported by Nonaka and Takeuchi (1995), process design activities are coordinated early and explicitly. This in turn typically leads to strong coordination of resource allocation and operations management activities, and of course to output sharing. Such strong coordination of all activities is often required if activities in the process conditioning stage did not create a process context in which units would perform these activities more independently, yet still in a compatible or coordinated way. For that reason, headquarters is often heavily involved in managing directed processes.

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8 This section draws heavily on our ongoing empirical work, early results of which are reported in Gast (1997).
In co-managed processes, process design activities involve less coordination effort among units, since one unit, most often headquarters or a unit with a world mandate, takes the lead. While other units get involved for well-defined subtasks, such involvement is based on the basic activity and output specifications by the lead unit. Nevertheless, central resource allocation and operations management activities are closely coordinated, even though normally to a lesser overall extent than in directed processes, since initial resource allocation decisions made simultaneously or shortly after designing the process are often also made by the lead unit. In practice, co-managed processes tend to rely on strong process conditioning activities, which prepare units for cooperation without joint formulation of process goals and structure. An example for a co-managed process is the development of the Pampers-Uni diaper for middle-income countries by P&G (Lessard and Amsden 1998).

What primarily distinguishes co-managed from facilitated processes is that units closely coordinate operations management activities in the former, but perform them quite independently in the latter. Typically, units support each other by exchanging resources and outputs according to specification. Independence in operations management activities thus creates a more narrow process interface at which coordination mostly revolves around the management of resources and outputs.

Emergent processes are those in which none of the management activities are strongly coordinated. Typical emergent processes are created by internal benchmarking systems for a set of units performing functionally similar business processes in different local environments. Here, each unit manages its local activities independently, yet learns about the most successful variants from other units. Such low-intensity coordination is often a first step towards more intense coordination of activities. The term "emergent" refers to the discretion units retain as to which

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9 There is a certain similarity between this typology and the distinction Hackman (1986) makes between self-governing, self-designing, self-managing and manager-led units. He defines a performing unit as "the people who have been assigned responsibility for accomplishing some specified task or set of tasks", typically "several individuals working interdependently on a common task", but sometimes also just individuals or larger sets of people (p. 91). However, our typology does not relate to the distribution of decision making authority for the units in general, but rather to the degree to which decisions for a single process are coordinated across units, i.e., take the situation of multiple units jointly into account.
knowledge to exchange and request, and to the fact that much knowledge emerges at the interface only with considerable delay after having been developed locally.

**Variations in the functional relation between the knowledge each unit develops**

Multi-point processes further vary regarding the relation between the knowledge each unit develops. Three dominant patterns can be distinguished. First, participating units can generate complementary knowledge for different kinds of activities in a business process. Often, for instance, one unit specializes in product design and another in production, both being located in different countries to access local design know-how in one and benefit from cheap factor costs in the other.

Second, the units can develop substitutable knowledge for a particular activity in a business process. Consider the case of a multi-domestic industry in which several units of a multinational firm produce the same products with similar organizational routines. Using a multi-point process can help the units to share knowledge development efforts or solutions for selected activities.

Third, units can create complementary knowledge for the same activity in a business process. This happens, for instance, whenever R&D units in different countries cooperate in the development of a product. Therefore, there is nothing such as "the" multi-point process; multi-point processes vary in the kind of activities coordinated among participating units, the intensity of coordination, and the relation of locally generated knowledge.

**Links between research on knowledge development in international management and organization theory**

**Models of knowledge development in the multinational firm**

The evolution of models of knowledge development in the multinational firm over the last three decades, which are classified in Table 3, shows clearly that the issues associated with multi-point processes - contextual diversity and distance, distributed authority, immediate international application of new knowledge, and coordination complexity - have become significantly more important.\(^\text{10}\) All of these were little relevant at a time when firms were mostly driven by their home markets and tended to view international business primarily as an opportunity to procure tradable factor inputs or exploit already existing assets in other geographic markets, or as means to keep domestic competition balanced. When performing the most innovative activities at headquarters in and for the home market, neither the diversity of foreign business and institutional systems, nor geographic distance or internationally distributed authority had to be explicitly managed.

This orientation had several effects. First, it kept international coordination needs low, and secondly caused long time lags between domestic use of innovations and their transfer to foreign

\(^{10}\) This is consistent with the major findings of a meta-analysis of research on coordination mechanisms in multinational firms (Martínez and Jarillo 1989).
markets. Third, it created two typical international distributions of knowledge development activities related to the same process.

In the first one, headquarters would perform upstream activities like R&D and production, while subsidiaries would specialize in downstream activities such as logistics, marketing and after-sales service. Due to the time lag, however, the knowledge these activities created would not feed back into the primary knowledge development activities at headquarters. This situation is captured in early stages of Vernon's product life cycle (Vernon 1966), the "oligopolistic reaction" (Knickerbocker 1973), and in models of multinational firms depicted as ethnocentric (Perlmutter 1969) or centralized hubs (Bartlett 1986). The more recent model of locally-leveraged innovation (Bartlett and Ghoshal 1990) describes processes with essentially the same characteristics, though it is not restricted to primary knowledge development at headquarters. In brief, this pattern can be characterized as co-specialization across units of knowledge development activities for different parts of a business process (column 1, row 1 in Table 3).

In the second pattern, units would not co-specialize, but generate functionally equivalent knowledge for the same part of a business process. This case would typically occur after an international technology transfer, when both the unit originally developing the knowledge and the receiving units keep modifying and enhancing it. It is also common in knowledge areas for which local performance of innovative activities is considered essential, such as marketing to end consumers.

Variants of this case can be found in later stages of the product life cycle, Perlmutter's polycentric firm, firms competing in multi-domestic industries (Porter 1987), in descriptions of local-for-local innovations (Bartlett and Ghoshal 1990), and even in a heterarchy (Hedlund 1986), where much knowledge is stored holographically in several units. These models differ in the time lags between internationally dispersed, initial knowledge development activities, which can range anywhere from substantial and low, but all view these activities as usually not being coordinated (column 2, rows 1 and 2 in Table 3).

In contrast, models of multi-point knowledge development combine small time lags and high coordination intensity of primary knowledge development activities in multiple units. One class of models takes a corporate perspective and depicts headquarters as orchestrator of these activities in a primarily lateral network with distributed decision making responsibility, as described in the transnational MNC (Bartlett and Ghoshal 1989) and the heterarchy (Hedlund 1986). However, it is important to see that much of the simultaneity and complexity of corporate knowledge management activities in these models is the joint result of a firm's degree of diversification and the simultaneity and complexity of activities within each line of business, due to the corporate level of analysis. For instance, a multinational firm may have R&D labs in different countries, but each of them for a separate business area. Thus, what appears as multi-point process at corporate headquarters may be seen as a set of simultaneous, but unrelated activities in the units. What is still lacking in these models is a description of the interactions between different kinds of knowledge development processes, and in particular of the simultaneous management of multiple process types.\(^{11}\)

\(^{11}\) This aspect appears important because some studies suggest that managerial competence for one type of process can lead to rigidities or relative incompetence for other types of processes (cf. Dougherty 1992; Leonard-Barton 1992; Henderson and Clark 1990).
### Characteristics of knowledge development

<table>
<thead>
<tr>
<th>Cross-country time lags</th>
<th>Cross-country coordination complexity</th>
<th>Complementary knowledge for different activities in a business process</th>
<th>Substitutable knowledge for same activity in a business process</th>
<th>Complementary knowledge for same activity in a business process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>Low</td>
<td>➤ Product life cycle (early stage)³</td>
<td>➤ Product life cycle (late stage)³</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>➤ Locally-leveraged innovation process¹,¹⁰</td>
<td>➤ Polycentric MNC⁵</td>
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<tr>
<td></td>
<td></td>
<td>➤ Centralized-hub / ethnocentric MNC⁴,⁵,⁷,⁸</td>
<td>➤ Country-by-country expansion strategy⁴,¹¹</td>
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<td></td>
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<td>➤ Locally-leveraged innovation process¹</td>
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<td></td>
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<td>➤ International technology transfer literature</td>
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<tr>
<td>Small</td>
<td>Low</td>
<td>➤ Local-for-local innovation process¹</td>
<td>➤ Polycentric MNC with multi-country expansion strategy⁴,⁵</td>
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<td></td>
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<td>➤ Multi-domestic / federation MNC⁷,⁸</td>
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<td>➤ Heterarchy⁴</td>
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<tr>
<td>Small</td>
<td>High</td>
<td>➤ Multi-point</td>
<td>➤ Multi-point</td>
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<td></td>
<td></td>
<td>➤ Transnational / geocentric MNC¹,⁴,⁵,⁶,⁷,⁸</td>
<td></td>
<td>➤ Literature on R&amp;D internationalization⁹</td>
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<td></td>
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<td>➤ Heterarchy⁴</td>
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<tr>
<td></td>
<td></td>
<td>➤ Globally-linked innovation process¹,²,¹⁰</td>
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</tbody>
</table>

Table 3: Major models of knowledge development in the multinational firm (references in footnote)¹²

A: Duration between completion of initial, local innovation development and international knowledge transfers
B: Complexity of coordination among units during initial innovation development

Taking just one innovative process as unit of analysis, the second class of multi-point models highlights more of the managerial issues associated with multi-point knowledge development within a single business area. As the models of globally-linked innovation (Bartlett and Ghoshal 1990) and global knowledge creation (Nonaka and Takeuchi 1995) indicate, knowledge development activities are both unfolding in parallel and coordinated across units, suggesting high degrees of managerial complexity on the process level.

The models also suggest that multi-point processes creating substitutable knowledge across units can raise different corporate managerial issues than those generating complementary knowledge. In the former case, the same capabilities develop within several units, which each unit can apply and improve independently. Therefore, the units may compete on the corporate level for opportunities to do so, e.g., when it comes to assigning global mandates (Birkinshaw 1996; Roth

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¹² 1: Bartlett and Ghoshal (1990)  
2: Porter (1990)  
3: Vernon (1966)  
4: Hedlund (1986)  
5: Perlmutter (1969)  
6: Vernon (1979)  
7: Bartlett (1986)  
8: Porter (1987)  
9: Westney (1990)  
11: Johanson and Vahlne (1977)  
12: Bartlett and Ghoshal (1990)  
4: Hedlund (1986)  
7: Bartlett (1986)  
11: Johanson and Vahlne (1977)
and Morrison 1992), making corporate investment decisions, or redistributing the markets served among units. In contrast, the latter case creates a corporate capability grounded in interdependence of units during knowledge development and use. Here, the units have to cooperate, and managerial skill to coordinate the simultaneous use of unit capabilities must be developed.

**Models of knowledge development in international management and organization theory: Emerging connections**

How do models of multi-point knowledge development in international management and knowledge-oriented approaches in organization theory inform each other? It seems fair to say that studies of knowledge development in the international management literature and in organization theory currently do not inform each other well, and even less so for multi-point processes as a young and still emerging managerial phenomenon. However, we see great need and opportunity for stronger cross-fertilization of the fields, in particular for multi-point processes, given the present state of knowledge in the resource-based view, the organizational capabilities approach and the organizational learning literature, i.e., the streams of research in organization theory most closely oriented towards knowledge development.

The resource-based view focuses on firm heterogeneity within an industry, essentially skipping phenomena of internal organization and links a firm's possession of knowledge with certain attributes directly to competitive outcomes (Amit and Shoemaker 1993; Barney 1991; Peteraf 1993). A firm may have to procure knowledge on strategic factor markets (Barney 1986), which may be internationally dispersed. However, organizational problems associated with small lags between the development of knowledge and its international transfer, with coordination complexity, or with multiple embeddedness and distance of organizational units, the two idiosyncrasies of the multinational firm, are currently not considered.

First steps towards better understanding of the problems associated with geographically distributed, internal resource development have been made if one considers the barriers to resource imitation by competitors (Barney 1991; Lippman and Rumelt 1982; Reed and DeFilippi 1990) simultaneously as barriers to internal resource deployment. However, to what extent and by which means firms can lower such barriers internally, yet maintain them vis-à-vis competitors, is still unexplained. Multi-point processes with their geographically dispersed set of activities, the outcomes of which may jointly be considered a resource, point towards another avenue for future research: to focus attention on the internal structure of resources and examine how such structures develop and change over time.

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13 Prior corporate decisions to increase the firm's overall operational flexibility (Kogut 1985), acquisitions or growth through international replication of domestic activities (Brooke and Remmers 1970) may create such competitive bidding situations.

Note that each unit has internalized the knowledge and does not just have access to it. Internalization means independence in knowledge management activities, whereas merely having access to knowledge available in other organizational units creates unilateral dependence.

14 In the original formulation of the resource-based view, Penrose (1966) explained how managers had to adapt resources procured on markets to firm idiosyncrasies; subsequent research has expressed little interest in internal processes and instead explored cross-sectional firm differences in resource endowments within industries.
The organizational capabilities approach takes a somewhat broader approach in two regards. First, it does not as much emphasize competitive outcomes, but rather the firm's ability to perform tasks, regardless of their strategic importance or their quality relative to competitors. Covering a broader range of organizational tasks, it is more oriented towards the internal organization of the firm. Second, while the resource-based view treats resources essentially as monolithic, the organizational capability approach emphasizes interrelations and complementarities among capability components, such as individual knowledge, physical and managerial systems, and organizational values (Grant 1996; Leonard-Barton 1995). The dynamic capabilities view in particular (Collis 1994; Teece et al. 1992) expresses clearly that developing each of these components and the system of relations among them requires cumulative and path-dependent processes. Consequently, there is an implicit acknowledgment that a large variety of knowledge development processes unfold simultaneously within a firm, that they may be internally distributed, require coordination, and constrain managerial choice in terms of process design and resource deployment. As of yet, the specifics of the relations among knowledge development activities which characterize multi-point processes remain largely unaddressed.

According to the organizational capabilities view, task knowledge within organizational units is often embedded in knowledge structures that span units, in the same way "component competence" is associated with "architectural competence" (Henderson and Clark 1990) and "combinative capabilities" (Kogut and Zander 1992). This hierarchical view of knowledge directs attention towards interrelations between task knowledge internalized in different organizational units (Henderson 1995), and towards local idiosyncrasies in these units which may make their exploitation more difficult than in a single-country setting. What this view of knowledge does not address is when and why an organizational capability is desirable to link knowledge across units if such knowledge is not complementary, but substitutable.

Within the organizational learning literature, models of "organizational" knowledge development are built upon the concepts of internal knowledge retention on the one hand, and on internal diffusion as secondary activity involving local knowledge creation on the other. Retention-based models consider knowledge as organizational as soon as it becomes insensitive to personnel turnover (Carley 1992; Cohen 1994; Hedberg 1981; Walsh and Ungson 1991). Therefore, an essential part of every organizational learning processes are activities which create such insensitivity, like knowledge sharing with other team members (Nonaka 1994), the institutionalization of organizational routines (Cohen 1994; Nelson and Winter 1982) and the codification of knowledge in manuals.

Making knowledge insensitive to turnover is often a required step before increasing the scope of knowledge availability within the firm, but hardly sufficient to consider it "organizational" in terms of accessibility. In the multinational firm in particular, task knowledge is typically available only in the units performing the task and diffuses to others only slowly, and involuntarily only much less frequently than in other firms, due to low interaction intensity and often high dissimilarity among units. Therefore, internal power struggles over accessing and using local knowledge, incentive and reward problems when providing locally kept knowledge to other units, and

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15 The nature of individual knowledge has been a point of controversy for a long time. We define as individual knowledge related to a task a set of complementary, coordinated bits of information a person can use in a repeatable way with the intention to solve the task and fulfill performance expectations.
and internal searches for knowledge across units are not unusual (Hansen 1995). In brief, even though knowledge may be widely diffused and retained within a subsidiary, it may still be virtually inaccessible for people in the rest of the firm. Consequently, resources, capabilities or knowledge should be labeled "organizational", in the sense of "pertaining to the whole organization", only if knowledge is retained in all units confronting a certain task such that each unit can use it independently from others. This is the case, for instance, when each of several subsidiaries possesses the knowledge to produce locally a certain product or service. In all other instances, knowledge is not as widely distributed within the firm as the term "organizational" suggests, and might more appropriately be attributed to lower structural levels (e.g., the unit).1

Knowledge diffusion processes in models of organizational learning seem to be reflected most strongly in models of sequential knowledge development in the international management literature (cf. Table 3), since both assume that knowledge is initially developed by teams consisting of co-located, heavily interacting members, and often primarily for local purposes. Only after these initial activities are completed does the knowledge get transferred to remote organizational units.

Regarding the speed and direction of internal knowledge diffusion, the three approaches in organization theory have identified several impeding factors, such as causal ambiguity based on tacitness, complexity and specificity (Reed and DeFilippi 1990). In the multinational setting, at least two others are influential: the degree of similarity or compatibility of the contexts in which task knowledge is used, and the physical or virtual distance between organizational units. Geographic distance imposes limits on communication intensity among units, and contextual variety creates difficulties when decoupling knowledge from one local context and applying it in a different one (Westney 1993). Admittedly, these factors have always played an important role in internationally coordinated knowledge development processes. Yet, they seem to be most critical in multi-point processes, not only because embeddedness and distance effects manifest themselves more intensely when moving from knowledge development within a unit to knowledge development coordinated across units, but also because more activities have to be coordinated with smaller time lags under conditions of higher authority dispersion.

The case of the multinational firm illustrates that some types of processes generating organizational knowledge do not rely on knowledge diffusion at all. For one, similar, yet uncoordinated local knowledge development activities (cf. Table 3, row 2, column 2) can also create organizational knowledge, for instance when several units independently perform highly similar tasks in different environments at the same time. This is particularly likely in multinational firms when they grow internationally through acquisitions, set up subsidiaries as replicas of domestic structures and processes (Brooke and Remmers 1970), or compete in multidomestic industries. Such knowledge can take all of the forms the organizational learning literature emphasizes, including cognitions and organizational routines.

A second type of knowledge development process which may not involve much knowledge diffusion relates to tasks requiring coordinated use of complementary knowledge across units. Multi-point processes are a prime case in point. Here, the organizational knowledge developed is

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16 Similarly, it may be helpful to distinguish between organizational and lower-level knowledge development processes. Organizational knowledge development processes require coordination of activities across units, unit processes only coordination of activities within them, and so forth.
a knowledge structure linking together complementary bits of knowledge for subtasks performed by different organizational parts or individuals within them, which these can and need to use \textit{interdependently}.\footnote{In the analogous way, we define knowledge for intermediate organizational structures between the group and the whole organization, such as the organizational subunit and unit. This makes the two definitions interdependent and regressive. They are interdependent because organizational knowledge in the first sense often consists of unit or subunit knowledge in the second sense, and regressive because knowledge in the second case can decompose into multiple knowledge structures when descending several structural levels, but at most until the individual level is reached.} For example, the use of R&D knowledge in one subsidiary and the production knowledge in another has to be coordinated in many global product development processes. While the knowledge not needed for coordination of activities across units does not have to be diffused at all, the knowledge to coordinate activities develops instantaneously at the interface between units and need not be diffused thereafter.

In sum, there is still ample room for greater cross-fertilization of knowledge-oriented streams of research in organization theory and research on knowledge development in the multinational firm. At present, the resource-based view and the capabilities view address internal organizational issues associated with knowledge development processes in general and multi-point ones in particular only rudimentarily. If the former were to address issues of multi-point processes more explicitly, one promising path could be to use insights from inter-firm cooperation and competition to explain situations during multi-point processes when cooperation among units is desired. For instance, resource trading between firms (Chi 1994) may have organizationally equivalent problems and solutions inside the firm.

The organizational learning literature currently speaks best to knowledge development in the multinational firm. Yet, it still offers plenty of opportunities to incorporate geographic distance and institutional variety in its models, and to explore similar influences specific to a region or organizational unit on organizational knowledge development within the same country.

\section*{Conditions supporting the use of multi-point knowledge development}

While extant models of knowledge development in the multinational firm offer rich insights into innovative processes and outcomes, they rarely make explicit the conditions under which firms favor the respective mode of knowledge development. In this section, we describe factors supporting the use of multi-point processes, which are either located in the units' local environments, associated with the firm's internal organization, or related to technologies used.

Since multi-point processes can be organized in different ways, as will be discussed later, neither pure environmental determinism nor strict managerial choice (Astley and Van de Ven 1983; Hrebiniak and Joyce 1985) will suffice to explain their use. Instead, there seem to be situations in which environmental pressures leave managers little choice as to whether and how to use multi-point processes, and others in which they have high degrees of freedom. If this is correct, then the use of multi-point processes essentially depends on two factors: the sophistication of the organizational capability to manage them, which will be more influential in, or even create, situations of high managerial choice, and the potential benefits of using them, which may not only
severely constrain decision options, but also stimulate managers to use multi-point processes even if the organizational capability is not well developed yet.

The nature and size of the potential for using multi-point processes becomes clear when going back to the evolution of models of knowledge development in the international management literature. Vernon (1966) presented with the product life cycle an early model of knowledge development based on conditions in the firm's environment. He argued that firms located in relatively advanced markets would develop products to meet domestic customer needs and then profitably exploit the fact that other markets lagged behind in their developments. This suggests that the configuration of markets in which a firm competes influences the choice of knowledge development mode. If the markets are large enough, move on the same developmental trajectory and follow one clear lead market with considerable lags, then a firm can profitably concentrate knowledge development efforts in the lead market and subsequently transfer the knowledge to the less advanced markets.

Vernon's revision of his original life cycle hypothesis adds an important qualification: If the lags between markets following the same trajectory shrink, the incentives for knowledge development processes of this kind vanish (Vernon 1979). On the one hand, competitors in the markets catching up can increasingly export to the more advanced markets. On the other hand, the business opportunities emerging in each market at the same point in time assimilate. Firms with the capability to transfer knowledge, products and services quickly across borders, independent of their home base, can therefore capture more of the business opportunities than firms which do so slowly. Firms are thus forced to stronger coordinate upstream and downstream activities across markets, to compress knowledge development time and facilitate quick international knowledge exploitation (Porter 1987; Eisenhardt and Tabrizi 1995; Kessler and Chakrabarti 1996).

If the markets keep converging, overlap of conditions in these markets will grow and the remaining heterogeneity shrink. This creates an intermediate stage of moderate overlap and heterogeneity in which the disadvantages of completely centralizing activities in one location outweigh its benefits. For instance, variety in national consumer demands may still be large enough to warrant local adaptation of products, even though product platforms are internationally standardized. In such a set of moderately heterogeneous local environments, firms can use multi-point knowledge development across parts of the value chain, thus coordinating centralized, standardized innovative activities with locally adapted ones.

At the same time, there is high potential for multi-point processes linking similar, locally adapted activities across countries, for instance, because the emerging business opportunities these local activities can handle independent of the centralized activities create potential for diversification or incremental product innovation in multiple markets. As the markets become more and more heterogeneous, the benefits of centralization rise further, while the need for local adaptation declines. Therefore, multi-point knowledge development observed in a set of highly homogeneous markets may be more an artifact of a firm's history than the most efficient solution designed from scratch. This can be summarized as follows:
Proposition 1: A multinational firm is most likely to use multi-point knowledge development in business areas in which the important business units operate in moderately heterogeneous local business and institutional environments.\textsuperscript{18}

The notion of heterogeneity can and should be further specified. Following Porter (1990), national business environments can be assessed in terms of local factor conditions, demand conditions, the characteristics of related and supporting industries, the nature of industry structure and rivalry, as well as the role of government. For each of these conditions, more specific propositions can be formulated, even though equilibrium statements are difficult to make. Not only are multi-point processes a fairly young phenomenon compared to the time it takes to build the respective managerial capability, but also do some of the environmental conditions change quickly. Therefore, both the size of benefits and the relative quality of a firm's organizational capability can shift significantly over time, changing the decision making context for managers.\textsuperscript{19}

Factor conditions

It is becoming increasingly common to locate R&D facilities in multiple national business environments to tap into locally available technological knowledge which cannot be procured on international markets (Kuemmerle 1996). If a firm's products or services require joint use of multiple technologies, each most developed in a different local environment and thus best mastered by a different organizational unit, multi-point processes are likely to be chosen. Whenever such "hot spots" for different technologies are internationally dispersed, multi-point knowledge development allows a firm to take advantage of the spots' favorable conditions (Pouder and St. John 1996), yet prevents it from getting caught in the local dynamics ultimately leading to the decline of the hot spot. A multi-point process in this case either involves several units contributing complementary knowledge in the same functional area, such as product R&D, or units contribute to different parts of the value chain, as when one unit specializes in product technologies, the other in production technologies. In both cases, local business environments are heterogeneous in terms of their technological sophistication, but overlap insofar as the technologies are complementary. This implies that multi-point processes are more likely to be used for complex products with technologically diverse components, compared to simple products or products with narrow technological bases.

Proposition 2: A multinational firm is the more likely to use multi-point knowledge development processes, the more its products require complementary technologies.

Proposition 3: A multinational firm is the more likely to use multi-point knowledge development processes, the more geographically dispersed the most sophisticated environments for the complementary technologies its products require.

\textsuperscript{18} Note that for non-diversified and diversified multinational firms alike, heterogeneity is measured across business units \textit{within} a business area, not \textit{across} areas.

\textsuperscript{19} For that reason, the propositions are formulated in terms of likelihoods.
Related and supporting industries

Multinational firms may also rely on several related or supporting industries, each of which most developed in a different country. If they have co-located units to interact with local firms in these countries, multi-point processes can be the knowledge development mode of choice. As with complementary technologies, they are the more likely to be used the less easily the firms can develop or transfer knowledge across distance and organizational borders. Then, the multinational firm benefits from dispersed, co-located knowledge development activities, as opposed to geographically centralized ones.

Proposition 4: A multinational firm is the more likely to use multi-point knowledge development processes in a specific business area, the more geographically dispersed the important business partners for this business area in related and supporting industries.20

Demand conditions

Local customers create incentives for multi-point learning when their demands are heterogeneous enough to not allow for complete centralization of international operations, but homogeneous enough to enable adaptation of locally developed solutions for other markets. Under these circumstances, the subsidiaries of multinational firms tend to react to new business opportunities in their respective market by locally targeted knowledge development activities. A multi-point process can then capture these local solutions and facilitate knowledge transfers across borders, thus allowing the subsidiaries to support each other in functionally equivalent activities (cf. column 2 in Table 3). Another favorable condition for multi-point knowledge development exists when a market consists of several segments, each of which is particularly developed or demanding in a different country. Then, subsidiaries can learn from each other on a segment-by-segment basis.

Key to the use of multi-point processes is the awareness within the multinational firm that business opportunities emerging in either of the markets served are likely to exist in other markets as well, and that complete re-development of knowledge by other subsidiaries is unnecessary. Furthermore, multi-point processes seem to be particularly encouraged whenever the markets served are about equal in size, since a dominant market can lead firms to concentrate innovative efforts on it and neglect other markets.

Proposition 5: A multinational firm is likely to use multi-point knowledge development processes when the needs of local customers are heterogeneous enough to require local development of products and services, but homogeneous enough to allow sharing important elements of locally developed innovations across markets.

A firm's multinational customers can stimulate multi-point processes as well, in particular through isomorphic processes (Westney 1990). If the customers use multi-point processes and want the firm to supply inputs for them, then the firm may have to develop a requisite capability (Von Hippel 1988).

Proposition 6: A multinational firm is the more likely to use multi-point knowledge development processes, the more important multinational customers use them.

20 This proposition applies to a single business area only, regardless of the degree of firm diversification.
Industry structure and rivalry

The strategic motive to maintain competitive parity, which earlier drove foreign direct investment in the "oligopolistic reaction" (Knickerbocker 1973), easily applies to multi-point knowledge development as well. If a firm's competitors use certain multi-point processes, then it may be beneficial to replicate how competitors coordinate knowledge development activities across borders, in particular, when the firms compete in multiple markets. Isomorphic pressures within an industry can thus push firms towards multi-point knowledge development (Ghoshal and Bartlett 1990; Westney 1993).

**Proposition 7:** A multinational firm is the more likely to use multi-point knowledge development processes, the more its competitors use them.

Irrespective of the degree of market heterogeneity faced, a multinational firm can still benefit sufficiently from other international knowledge development processes if its knowledge cannot be imitated readily. The resulting time lag until competitors catch up may be large enough to not threaten much of the international business potential even if the firm uses it internationally only with considerable delay. However, if the knowledge is readily imitable and transferable, the firm has only a short period of knowledge-based competitive advantage in each market and can capture more of the associated market value if it exploits the knowledge quickly internationally. The more competition demands rapid international knowledge exploitation, the more overlapping will knowledge development activities in multiple units of the multinational firm become. For instance, international transfers of knowledge may begin even before the knowledge development activities in the lead unit are completed.

**Proposition 8:** A multinational firm is the more likely to use multi-point knowledge development processes, the more easily imitable and internationally transferable newly generated knowledge is by competitors.

Multi-point processes can also help multinational firms to cope with strategic uncertainty (Dixit and Pindyck 1994; Milliken 1987). Strategic uncertainty is high in early stages of an industry's life cycle, for instance, when several competing technologies emerge in different national environments (Abernathy and Utterback 1976), or when it is yet unclear which markets will emerge as leaders. Multinational firms can hedge against this uncertainty by establishing presence in the countries in question and coordinating knowledge development across them, at least to the extent that they become able to shift resources quickly to the most attractive environment when it becomes visible. Contrary to the case of geographically dispersed hot spots for complementary technologies discussed earlier, several units here develop functionally substitutable knowledge. As soon as a clear lead environment or technology develops, the options value of simultaneous knowledge development in multiple environments declines, and maintaining the multi-point process may become unnecessary.

**Proposition 9:** A multinational firm is the more likely to use multi-point knowledge development processes, the higher the uncertainty about future lead environments for its technologies and markets.

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21 See Boeker et al. (1997) for the analog for diversified firms.
Governmental influence

A multinational firm may also be forced by host country governments to perform part of its knowledge development activities in their countries, and thus end up having to manage multi-point processes. Requirements of this kind are not uncommon, especially when multinational firms from highly developed countries establish facilities in less developed countries to benefit from favorable local factor conditions. Similarly, if international trade of knowledge of a certain kind is prohibited, the firm may have no choice other than using multi-point knowledge development to transfer knowledge internally across borders.

Proposition 10: A multinational firm is the more likely to use multi-point knowledge development processes, the more regulatory constraints impede the co-location of knowledge development activities.

Issues in the management of multi-point processes

Multi-point processes should not be expected to emerge as soon as the environmental conditions outlined above turn favorable. Firms have to develop the organizational capability to manage them before they can exploit whatever business potential their environment provides. Consequently, whenever the environment creates a situation in which multi-point processes are desirable, only firms with a sufficiently strong capability will be able to implement them. This raises two questions. First, how can a firm build such a capability, given that it has certain experience with other kinds of internationally distributed knowledge development processes? Second, which decision making criteria will managers likely use in multi-point choice situations to determine the most appropriate process variant?

Building the organizational capability to manage multi-point processes

As described earlier, multi-point processes differ from other kinds of international knowledge development processes in the systemic combination of activity dispersion, effects of contextual diversity and geographic distance, complex coordination among units, and activity simultaneity. Managers and employees can cope with these aspects the more easily, the more familiar they are with them, which in turn depends on the kinds of processes managed before. Therefore, multi-point choice situations can create tensions between the first best process design and the available organizational capability. This capability can be limited in several ways.

Regarding the dispersion of managerial activity, the firm apparently needs a process by which headquarters or unit managers determine how to allocate managerial authority and how to handle conflicts. Problems may arise, for instance, when the multi-point choice situation suggests a distribution of authority running counter to the distribution for routine business. Due to the high interdependence of activities and decisions across units, motivational mechanisms have to be either in place or applied to ensure that participating units follow decisions made elsewhere.

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22 Two primary goals are to facilitate the local creation of highly skilled jobs and to generate local knowledge spillovers.
The firm will also benefit from skills in minimizing the effects of contextual diversity and geographic distance on the process. As to the former, a modular process design which gives participating units high local autonomy for the design and management of subtasks despite a pre-specified interface can reduce influence of local idiosyncrasies and increase total process flexibility (Sanchez and Mahoney 1997; Doz et al. 1997). Barriers to knowledge exchange and activity coordination can be further reduced by standardizing activities and systems across units, or by making them flexible to adapt to local idiosyncrasies of other units (Solvell and Zander 1995: 29, 35).23

The planning system used for the process must be flexible enough to incorporate unexpected events and delays (Hedlund 1993). Besides, it should be capable of handling the large number of coordination links among units, and be compatible with project planning systems the units use internally for locally performed activities. Moreover, the resource allocation, incentive and reward systems need to acknowledge a unit's contributions to activities other units, especially when they are made at the expense of own performance (Westney 1996).

To overcome geographic distance effects and minimize delays between the local generation of knowledge and its international transfer, the communication systems should support information-rich, immediate and flexible electronic interaction between many process participants (Egelhoff 1993; Gupta et al. 1994; Van de Ven et al. 1976). In addition, the information systems have to generate comprehensive, articulated and current information to support the coordination of complex reciprocal interdependence. Again, compatibility across units is an important issue.

As far as individuals are concerned, it helps to have available highly flexible, error tolerant, trusting managers and experts with a good understanding of cooperating units (Nonaka and Takeuchi 1995; Tushman and Katz 1980; Tushman and Scalan 1981; Nohria and Ghoshal 1994). In this regard, long and short term support from human resource management is helpful, as in form of international career planning systems and provisions for short-term personnel exchange.

It should become clear from this brief characterization of the organizational capability to manage multi-point processes that the firm may have to upgrade some or all of the capability components to meet the needs of a certain process variant. The more similar the requirements of the desired process in a multi-point choice situation are to those of processes managed before, the less adaptation will be necessary.24 Since the organizational capability to manage multi-point processes is already sufficiently elaborate to deal with the higher demands of the more complex variants of multi-point processes, the need for leapfrogging, as previous research suggests (Collis 1994; Leonard-Barton 1992; Teece and Pisano 1994). Ample evidence in the field of international management demonstrates that most firms focused on sequential knowledge development long before multi-point processes became an issue (Bartlett and Ghoshal 1989; Vernon 1979; Vernon 1966). Moreover, enhancing capabilities is costly. From an efficiency point of view, it is thus unlikely that firms have in the past extended their organizational capabilities much beyond what they needed, with the rare exception of firms with clear, long term strategic visions (Prahalad and Hamel 1990). Firms should first develop the capability to manage sequential processes on their development paths, and only with additional effort the one to manage multi-point processes.

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23 In Gast and Lessard (1996), we distinguish between access barriers in the source unit, communication barriers between source and recipient units, comprehension barriers in the recipient units, and motivational barriers. Cf. Szulanski (1995) for a discussion of knowledge transfer problems.

24 It appears unlikely that a firm's organizational capability for other knowledge development processes is already sufficient to meet the higher demands of the more complex variants of multi-point processes. Process management capabilities result from path-dependent learning, which takes considerable time and does not allow for leapfrogging, as previous research suggests (Collis 1994; Leonard-Barton 1992; Teece and Pisano 1994). Ample evidence in the field of international management demonstrates that most firms focused on sequential knowledge development long before multi-point processes became an issue (Bartlett and Ghoshal 1989; Vernon 1979; Vernon 1966). Moreover, enhancing capabilities is costly. From an efficiency point of view, it is thus unlikely that firms have in the past extended their organizational capabilities much beyond what they needed, with the rare exception of firms with clear, long term strategic visions (Prahalad and Hamel 1990). Firms should first develop the capability to manage sequential processes on their development paths, and only with additional effort the one to manage multi-point processes.
processes develops gradually and cumulatively, a firm's past is therefore a good predictor of future process design choices. Not being able to shed its "administrative heritage", the firm is likely to build in the near future on its administrative heritage (Bartlett and Ghoshal 1989) or will change marginally at best. Over a series of multi-point processes, the firm's capability should gradually evolve towards managing the more complex processes variants.

When strengthening the organizational capability to manage multi-point processes, co-managed and facilitated processes will often be more difficult to manage than directed and emergent ones. In directed processes, headquarters can maintain high control over local activities, even at the cost of stifling local initiative. Emergent processes with only little coordination easily preserve local initiative, but underexploit coordination benefits. Conversely, co-managed and facilitated processes often require a delicate balance between coordination and distributed initiative and are then comparatively difficult to manage.

**Proposition 11:** Firms with limited experience with multi-point knowledge development will more likely employ directed or emergent processes than co-managed or facilitated ones.

**Criteria for the design of multi-point processes**

Assuming that the organizational capability is sufficiently well developed to allow managers to choose which variant of multi-point process to implement, they will assess the design options in terms of certain criteria. Among others, their choice will depend on the desired compromises regarding several tradeoffs associated with multi-point processes. Two of them go back to the fundamental organizational problems of differentiation and integration (Lawrence and Lorsch 1967) and responsiveness vs. integration (Prahalad and Doz 1987). Like in ongoing business processes, managers have to find a balance in knowledge development between finely adapted responses to local conditions and coordination across units to exploit economies of scale and scope. Second, they need to determine to what extent knowledge variety or redundancy across units is desirable. Finally, they have to consider tradeoffs regarding the speed at which locally developed knowledge gets exploited internationally. Each process variant strikes different compromises along these dimensions, and neither appears most favorable for all multi-point choice situations.

**LOCAL ADAPTATION VS. CROSS-UNIT COORDINATION OF KNOWLEDGE DEVELOPMENT**

If units manage their knowledge development activities independently, they can adapt them very flexibly to the opportunities in their local environments, in particular regarding goals and plans. Such local responsiveness may allow them to create and capture business beyond what is possible with products, services and processes developed jointly with other units, since these typically reflect compromises to overcome the diversity of local environments.

However, autonomy and responsiveness come at a cost, some of which is visible from the perspective of local units, some that can only be seen at the level of the entire firm. From a local standpoint, autonomy may be perceived as cutting the unit off from complementary resources possessed elsewhere in the firm and therefore result in redundancy as well as a failure to respond in an integrative fashion to the variety of stimuli present in various locations. Further, autonomy may disconnect the unit from stimuli present in other locations, especially when they are viewed as "hot spots" (Pouder and St. John 1996) in terms of technology or customer demands.
In some cases, however, coordination of knowledge development across units in a multi-point process has advantages. It can eliminate redundant and inefficient knowledge development efforts. Moreover, it can increase the specialization of knowledge development activities within units and thus generate scale economies, or can stimulate investment in knowledge development whenever required resource commitments are prohibitive for a single unit. For a unit, the primary downside of intense coordination are the additional administrative and production costs incurred, and the fact that it may have to bear costs for benefits realized in other units, which raises the well-known motivational and compensation issues.

Proposition 12: The higher the benefits of integrating knowledge development activities relative to those of local responsiveness, the more likely a directed or co-managed process will be used rather than a facilitated or emergent one.

Proposition 13: The higher the benefits of unit specialization relative to those of local knowledge breadth, the more likely a directed or co-managed process will be used rather than a facilitated or emergent one.

Proposition 14: The greater the scale of investments in knowledge development relative to the resources of individual units, the more likely a directed or co-managed process will be used rather than a facilitated or emergent one.

Knowledge Variety vs. Knowledge Redundancy

A second tradeoff in the coordination of knowledge development activities exists between the benefits of international knowledge variety and the benefits of knowledge redundancy. Variety may be especially desirable in highly dynamic environments, for it makes the firm as a whole less vulnerable to future external shifts. Variety tends to increase the less knowledge development activities are coordinated across units, for the units can then adapt most strongly to the needs and circumstances of their local environments. The potential for innovative variety thus generated increases operational flexibility of the units, since each unit can respond independently to local innovation opportunities without having to mobilize resources in other units.

Furthermore, variety may improve the firm's chances of developing particularly useful knowledge in at least one location, which it can then exploit internationally. As March (1991: 84) concludes from a computer simulation of knowledge development in an organization: "[M]ultiple, independent projects may have an advantage over a single, coordinated effort. The average result from independent projects is likely to be lower than that realized from a coordinated one, but their right-hand side variability [regarding a performance distribution function] can compensate for the reduced mean in a competition for [the best solution among firms]." This becomes particularly

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25 These advantages are not specific to multi-point knowledge development if the variety can be reproduced by operations in only one location. Often, however, the required degree of diversity of environmental stimuli causing such variety cannot be generated in one location.

26 March elaborates further: "The argument can be extended more generally to the effects of close collaboration or cooperative information exchange. Organizations that develop effective instruments of coordination and communication probably can be expected to do better (on average) than those that are more loosely coupled, and they also probably can be expected to become more reliable, less likely to deviate significantly from the mean of their performance distributions. The price of reliability, however, is a smaller chance of primacy among competitors." (p.
important for winner-take-all markets (Frank and Cook 1992), in which marginal competitive advantages have large payoffs.

However, knowledge variety may decrease overall corporate operational flexibility (Kogut 1985). For instance, it makes it more difficult to redistribute tasks across borders in response to exchange rate movements (Lessard 1986; Lessard and Lightstone 1986). Finally, it increases the risk of knowledge loss, e.g., when the specialists of a unit quit. Therefore, managers may have to compromise regarding the degree of knowledge variety and redundancy across units when they design a multi-point process. They face the well-known tension between integration and responsiveness (Doz et al. 1981; Prahalad and Doz 1987), but here more specifically for innovative activities rather than for routine business.27

Proposition 15: The larger the benefits of knowledge variety, the more likely a facilitated or emergent process will be used.

THE SPEED OF INTERNATIONAL KNOWLEDGE EXPLOITATION

One of the sources of managerial difficulty in multi-point processes is the temporal overlap of activities performed in different units. Managing overlapping activities is more complex than managing sequential activities, as the operations management literature clearly demonstrates. All other things being equal, a multinational firm attempting to maximize benefits in a multi-point choice situation should therefore set activity overlap to the point at which the marginal benefits of faster international use of locally generated outputs equal the associated marginal costs. For instance, multi-point choice situations in which knowledge is easily imitable and internationally transferable (cf. Proposition 8) should lead to processes with comparatively intense coordination. To ensure that the firm exploits the benefits of activity overlap, higher overlap can be expected to go along with closer coordination of knowledge development goals and essential process features.

Proposition 16: The larger the benefits of rapid international knowledge exploitation in a multi-point choice situation, the more a directed or co-managed process will be preferred over a facilitated or emergent one.

To summarize, situations in which managers can choose among several process variants do not seem to lend themselves to simple decision making rules. The benefits of local responsiveness relative to those of cross-unit coordination, the advantages of knowledge variety or redundancy among units, and the benefits of various speeds at which local knowledge gets used by other units are all factors to be considered, and likely to vary from setting to setting. Managers will likely try to optimize across these dimensions, keeping in mind the limitations to process complexity the

84) In other words, if the variability of competitor performance is high, it can be advantageous to increase solution variety.

27 It should be noted that intermediate solutions between integration and responsiveness exist. For instance, one solution is to make the activities and outcomes in each unit compatible, but not redundant, so as to benefit from partial redundancy while preserving some variety. These compromises have not always been acknowledged in the international management literature. For instance, a currently popular model of the successful multinational firm claims that shared values, which can be considered a particular kind of knowledge applied when solving tasks, are essential to facilitating cooperation among units (Nohria and Ghoshal 1994; Nohria and Ghoshal 1997). However, such an extreme degree of redundancy may not be required - often, value compatibility or other forms of social control ensuring behavioral compatibility will suffice (Westney, personal communication; cf. Sohn 1992).
current organizational capability imposes. The better this optimization process and the better the capability, the more sophisticated compromises the implemented multi-point process will make (Figure 2).

![Diagram](image)

**Figure 2: Managing tradeoffs in the design of a multi-point process**

### Conclusion

Since the competitive, institutional and technological conditions favoring multi-point knowledge development are becoming more and more relevant across industries, we expect that multinational firms will increasingly use multi-point processes. This paper has taken initial steps to define and characterize them as organizational phenomenon, and to address associated managerial issues caused by heterogeneous local environments, geographic distance, the dispersion of managerial activity, the temporal overlap of activities and the complexity of coordination across units. It has compared and contrasted several variants of multi-point processes, differing not only in terms of the kinds of activities linked across units and thus in the timing, intensity and focus of activity coordination, but also in terms of the functional relation between the knowledge each unit develops.

Though not extensively elaborated upon in this paper, this differentiation is important for four reasons. First, it illustrates that multi-point processes are more frequent and relevant a phenomenon than is commonly assumed. Second, it highlights the choices managers have in the design of multi-point processes whenever environmental and organizational conditions make multi-point the preferred or an optional knowledge development method. The propositions put forth can serve as starting points for both, research with an environmental determinism or
managerial choice emphasis. Third, it allows to specify decision making criteria managers are likely to rely on when designing multi-point processes. Some of these relate directly to fundamental issues in corporate strategy, such as the global allocation of resources and the definition of international market scopes for the firm’s products. Finally, it opens up an avenue for evolutionary research on the development over time of the organizational capability to manage internationally dispersed knowledge development processes (cf. Nelson and Winter 1982; Nelson 1994).

Within the international management literature, this paper is a call not only for more research on international knowledge development, as opposed to knowledge exploitation, but also for a broader approach to the subject, going beyond studies of internationally dispersed R&D facilities. Many situations in which multi-point processes can be implemented are found outside R&D and raise different organizational problems, two of which are the management of knowledge development processes in units not specialized in the creation of knowledge, and the management of interactions between knowledge development and routine processes in such units. These issues are particularly relevant in industries without dedicated R&D units, like service industries.

Complementing and further differentiating models of knowledge development, the paper also stresses the importance of multi-level, multi-location phenomena vis-à-vis the two currently dominant views of center-periphery and lateral-network processes in research on the multinational firm. Though it neither presents a thorough analysis of the role of corporate headquarters nor of possible role differentiation among units, it makes clear that multi-point processes typically possess a vertical and a horizontal organizational dimension, and that further research along these lines is warranted.

The paper also raises questions about current changes in the nature of the multinational firm. Is multi-point knowledge development a transient stage on the road to even different forms of international knowledge management, or should it be viewed as an endpoint of a developmental trajectory, much like the transnational model of the multinational firm (Bartlett and Ghoshal 1989) is currently interpreted? Present conditions in many industries encourage multinational firms to gradually build an organizational capability to manage multi-point processes, thereby shifting repeatedly and gradually towards higher coordination complexity. However, since local environments should be moderately heterogeneous to favor multi-point processes, their continued convergence or renewed divergence can make these processes less relevant in the future. At issue is therefore not so much the organizational specialization on a particular international knowledge development mode, but rather the simultaneous management of a process portfolio with different modes whose composition keeps changing.

With multi-point processes, the multinational firm offers an organizational phenomenon with great potential for cross-fertilization of international management as applied field and organization theory as underlying discipline. Specifically the knowledge-oriented approaches in organization theory - organizational learning, the resource-based view, and the organizational capabilities approach - can benefit from studying the setting that makes a phenomenon most salient. Multi-point processes strongly reflect the influence of local contexts and contextual variety, which are only beginning to be introduced in models of knowledge development in

28 These aspects will be addressed in a forthcoming companion paper and are subject of our ongoing empirical work.
organization theory. Since such influence manifests itself most visibly in coordination across units, the multinational firm suggests considering the organizational unit as a very promising, yet currently underexploited, unit and level of analysis for such research. Doing so would not only strengthen the impact of knowledge-oriented approaches in organization theory on international management research in this area, but also inform related research in organization theory and strategy on diversified firms and multi-regional firms operating in a single country.

One major purpose of the paper is to outline broadly the nature, antecedents and implications of multi-point knowledge development. It therefore only touches upon numerous issues associated with multi-point processes, leaving many opportunities for future research. In addition to those already mentioned, it would be worth exploring interactions between the conditions favoring or impeding the use of multi-point processes; the organizational routines for identifying and assessing situations in which they are feasible; the differences between multi-point as corporate and as divisional phenomenon; and avenues for applying other organizational theories, such as institutional, agency and power theories.

Conceptually, there is great need for more specific constructs to characterize multi-point processes and the organizational capability to manage them. If multi-point processes are but one way of simultaneously creating and exploiting knowledge across borders, then future models of knowledge development in the multinational firm need a unit of analysis below the firm level to explain such variety in detail. The knowledge development process may turn out to be a suitably positioned mid-range concept between the more narrowly defined product development process in innovation management and the all-encompassing transaction in transaction cost theory.

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