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# The MNC as a Knowledge Structure: the Roles of Knowledge Sources and Organizational Instruments for Knowledge Creation and Transfer


## Abstract

Most recent research on the differentiated MNC has been taken up with knowledge flows between MNC units. In contrast, we develop a view of the MNC as a knowledge structure where knowledge elements in MNCs are seen as being structured along a number of dimensions (e.g., complementarity, dispersal, sources of knowledge) that help determining the costs and benefits of knowledge transfer. Based on this conceptualization, we argue that MNC management through choices regarding organizational control, motivation and context can influence the development, characteristics and transfer of knowledge. This further extends existing literature. For example, in most of the literature, the characteristics of knowledge are seen as exogenous rather than endogenous variables. However, to the extent that management chooses a specific way of sourcing knowledge, it also implicitly chooses the characteristics of the sourced knowledge and the ease with which it can be transferred inside the MNC. This is because knowledge from different knowledge sources have different characteristics and are thus transferred at different cost. The six hypotheses that we draw from the main argument are tested against a unique and very rich dataset on subsidiary knowledge development (including information on the organizational setting, sources of subsidiary knowledge and the extent of knowledge transfer to other MNC-units) that has been constructed in connection with a cross-national project Centres of Excellence. The dataset covers more than 2.000 subsidiaries located in seven different European countries.

# I. Introduction

Within the last fifteen years, the role of knowledge and learning in gaining and sustaining competitive advantage has become a central area of research in a number of different fields, such as innovation studies, strategic management and international business.[1] Yet, in spite of the present popularity of such "knowledge-based" explanations it is fair to say that we are still some way from a satisfactory understanding of a number of the central aspects, mechanisms and contextual factors in the causal links between knowledge, learning, and competitive advantage. We see two main, and closely related, problems. First, rather little analytical effort has been devoted to understanding the ways in which knowledge is stratified, distributed, overlapping, complementary, etc. — in other words, *structured* — inside firms, and how this may influence competitive advantage. Second, there is a relative neglect of how organizational arrangements (e.g., the allocation of authority and decision rights inside firms) interact with the creation and use of knowledge, and how this may influence competitive advantage. We see these two problems as closely related, because the structuring of knowledge inside firms is closely related to issues of organizational structure. Both problems arguably stem from a fundamental conceptual problem: Existing conceptualizations of a knowledge-based view of firms move on an extremely high level of abstraction, in which the finer details of organizational structure and structuring of knowledge inside firms are left out of the picture.

The literature that is perhaps least vulnerable to these critiques is recent work on the differentiated multinational corporation (MNC) (e.g., Hedlund 1986**;** Bartlett and Ghoshal 1986; Gupta and Govindarajan 1991, 1995, 2000). A number of contributions to this literature have indeed examined organizational aspects of the development, characteristics and transfer of knowledge.[2] Among other results, this has led to a renewed conceptualization, understanding and appreciation of subsidiaries which are now seen as potential sources of MNC-wide strengths (Bartlett and Ghoshal 1986, 1989; Birkinshaw 1996; Forsgren, Pedersen and Foss 1999; Moore and Birkinshaw 1998; Holm and Pedersen 2000a). However, in spite of some attention being devoted to the organizational dimensions of knowledge creation and transfer of knowledge, as well as an implicit recognition that knowledge is indeed structured inside firms, the literature is still only at a beginning with respect to understanding the central aspects, mechanisms, and contextual factors of the process

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[1] Much of this work has taken place in the context of resource-based (Wernerfelt 1984; Barney 1991), knowledge-based (Grant 1996), and evolutionary theories of the firm (Nelson and Winter 1982; Foss, Knudsen and Montgomery 1995).

[2] On the very abstract level, an influential argument is it that the differentiated MNC is *more* favorably positioned than the non-differentiated MNC or the purely domestic firm with respect to mobilizing knowledge in the development and renewal of competitive advantage because of its access to more (and more differentiated) knowledge sources (Hedlund 1986**;** Bartlett and Ghoshal 1989).

of managing knowledge in MNCs, that is, creating and transferring knowledge, as well as the characteristics of knowledge. Progress on these matters seems handicapped, we shall argue, by the absence of a well developed conceptualization of the MNC as a knowledge-based entity. The present paper represents an attempt to contribute to remedying some of these weaknesses.

In accordance with what we see as the root problem, we begin by offering a conceptual development of the notion of the MNC as a knowledge-based entity. We argue that the MNC knowledge structure may be understood in terms of such dimensions as the distinction between core and more peripheral systems of knowledge and beliefs, complementarities between knowledge elements, dispersal of knowledge, complexity of knowledge and tacit and explicit elements. The MNC knowledge structure forms the backdrop to processes of creating, transferring and utilizing knowledge within the overall MNC network, co-determining their costs and the benefits. These processes are influenced by management decisions relating to organizational design (e.g., the relations between subsidiaries, or between subsidiaries and the center) and to the sources of knowledge that subsidiaries tap into (Foss and Pedersen 2002). Underlying our reasoning is an overall conceptualization of the MNC organizational design problem as an dynamic optimization problem in which MNC management organizational instruments (i.e., the control variables) in such a way that 1) knowledge is optimally developed, 2) knowledge is optimally transferred, and 3) the optimal MNC-wide mix between tacit and explicit knowledge components is achieved (i.e., the state variables), all given the pre-existing MNC knowledge structure.

In our development of hypothesis from this overall conceptualization, we distinguish between knowledge sourced from the internal development of knowledge in the subsidiary and the MNC network, and knowledge sourced externally from network relations and from local clusters. We argue that the subsidiary choice of such knowledge sources can be influenced by MNC management. Specifically, we argue that the success of developing knowledge from such sources is influenced by the degree of autonomy that is granted to the subsidiary, as well as the extent to which interdependence with other MNC units is promoted. Finally, we argue that the extent to which knowledge can be transferred within the MNC network reflects prior managerial choices with respect to the choice of source of knowledge and the way in which subsidiaries are organized. This is because the choice of knowledge sources influences the characteristics of knowledge (e.g., tacit vs explicit, perceived complementarities). This is one way in which a knowledge structure view of the MNC serves to make the costs and benefits of knowledge transfer clearer.

In sum, our contribution in this paper are, on the overall level, to put forward a conceptualization of the MNC as a knowledge-based entity, focusing on the MNC knowledge structure, as well as to explicitly argue that the development, characteristics, sources, and transfer of knowledge may be influenced through

choices regarding organizational control, motivation and context. The empirical setting of this paper is the MNC as seen from the perspective of the subsidiary. The hypotheses that we draw from the main argument are tested on the basis of a unique and very rich dataset on subsidiary knowledge development (including information on the organizational setting, sources of subsidiary knowledge and the extent of knowledge transfer to other MNC-units) that has been constructed in connection with a cross-national project Centres of Excellence (Holm and Pedersen 2000a). The dataset covers more than 2.000 subsidiaries located in seven different European countries.

# II. Theoretical Model and Hypotheses

In this section, we begin by arguing that there is a need for a knowledge structure approach to firms, including MNCs, and outline the rudiments of such an approach. On this basis, we then develop the theoretical arguments that intra-MNC knowledge creation and transfer are influenced by managerial choices relating to 1) the sources of knowledge, 2) organizational instruments and 3) the mix of tacit and explicit components in the overall MNC knowledge structure. These determinants are placed in the context of a view of the MNC as a knowledge structure. We begin by briefly explaining this conceptualization and then discuss the determinants *seriatim*.

**The Need for a Knowledge Structure Approach to the Multinational Firm**

It has now become almost axiomatic that knowledge and learning are at the root of understanding how competitive advantage is gained and sustained, an approach that is usually, implicitly or explicitly, founded on a "knowledge-based" conceptualization of the firm (as in Kogut and Zander 1992; Grant 1996). However, these conceptualizations usually move on a very high level of abstraction or aggregation that usually rule out a concern with the finer details of organizational structure and structuring of knowledge inside firms.[3] For example, reference is sometimes made to organization-level "higher-order organizing principles" that exist for the purpose of easing organizational learning or "combinative capabilities" that create new applications of existing knowledge (e.g., Kogut and Zander 1993). However, these notions are neither carefully defined and elaborated, nor are they linked to organizational arrangements, notably, issues of internal organization (Nickerson and Zenger 2001). Because these conceptualizations are so highly abstract, conceptualizations of what are essentially *derived* phenomena must also be correspondingly abstract.

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[3] As an example, Casson and Wadeson (1999) argue that in most of the literature on knowledge transfer, it is *assumed* that whereas knowledge is extremely costly to transfer across markets, it is transferable at close to zero cost inside firms. Nickerson and Zenger (2001) argue that the knowledge-based literature is fundamentally confused on the rationale of firms: In some parts of the literature, firms exist to conserve on the costs of transferring knowledge (e.g., Conner and Prahalad 1996), while in other parts (e.g., Kogut and Zander 1992), firms exist to exploit the low costs of transferring knowledge inside a hierarchy.

Consider the example of organizational learning. As Kogut and Zander (1992) rightly argue, in principle any theory of (organizational) learning requires an underlying theory of (organizational) knowledge. If this theory of organizational knowledge is highly abstract, or crude, this must also be the case for a derived theory of organizational learning. Thus, if the underlying theory of organizational knowledge abstracts from the structuring of knowledge inside firms, the derived theory of organizational learning cannot as a simple logical matter be cast in terms of changes in this structure. In fact, we argue that it is hard to understand the nature and costs and benefits of organizational learning — of which knowledge transfer is an example — in the absence of an underlying theory of the organizational knowledge structure. The clearer that underlying theory is, the better the understanding of the nature, costs and benefits of organizational learning will be.

With respect to the *nature* of organizational learning, it seems hard to meaningfully conceptualize the phenomenon *in lieu* of some prior notion of knowledge in firms being structured. Apart from the theoretically possible, but extreme and unrealistic, case where organizational learning takes the form of an equal increase in everybody's knowledge stocks, organizational learning always involves some change in the way in which knowledge inside a firm is dispersed, or combinable, or overlapping, etc., in other words, changes in the ways in which knowledge is structured. Trivially, this is also the case of knowledge transfer. Understanding of the *costs* and *benefits* of knowledge transfer will be strengthened by paying more attention to how knowledge is structured across a firm, because the motive for knowledge transfer usually is the wish to somehow combine knowledge elements that have hitherto existed separately and the difficulties of knowledge transfer are at least partly related to the specific characteristics of the knowledge being held at the sending as well as the receiving organizational units.

Nevertheless, most work on knowledge-based theory of the firm tends to neglect the structuring of knowledge elements across the firm, although there are exceptions (such as Henderson and Cockburn 1994). This is also the case for the recent literature on the differentiated MNC which attempts to concentrate almost entirely on knowledge *flows*, abstracting from the composition of knowledge elements across the MNC network (i.e., the MNC knowledge structure) (e.g., Gupta and Govindarajan 1991, 1995, 2000).[4] While this may be adequate for some purposes, more attention to the structuring of knowledge across the MNC network will lead to an improved understanding of the net benefits of knowledge transfer. In turn, this means that the implications for competitive advantage of knowledge flows will become clearer. These implications have not been clearly spelled in the differentiated

[4] A partial exception is a recent cottage industry which is taken up with understanding subsidiaries as potential sources of MNC-wide strengths (Bartlett and Ghoshal 1986, 1989; Birkinshaw 1996; Forsgren, Pedersen and Foss 1999), and perhaps even as "centers of excellence" (Moore and Birkinshaw 1998; Holm and Pedersen 2000a). Even in this literature, however, the main analytical emphasis is on knowledge flows, and there is no underlying coherent notion of the MNC as a knowledge structure.

MNC literature. This is because this literature takes the knowledge flow as the relevant unit of analysis, whereas what matters for competitive advantage is the deployment of knowledge knowledge stocks.

Moreover, in spite of its concern with knowledge flows, the differentiated MNC literature has not made much out of flows from the external environment to the subsidiaries, which is a manifestation of a broader neglect of the *sources* of subsidiary knowledge stocks (e.g., local networks, local universities, local markets, internal R&D, etc.). These sources come more clearly into focus in a conceptualization of the MNC as a knowledge structure. Furthermore, as we demonstrate later, an improved understanding of the costs and benefits of intra-MNC knowledge transfer also follows, because the choice of sources of knowledge conditions these costs and benefits.

Finally, although the differentiated MNC literature has not neglected *organizational arrangements* (e.g., Ghoshal, Korine and Szulanski 1994), concern with these issues has — in keeping with the overall thrust of this literature — almost exclusively concerned the organization of intra-MNC knowledge flows (e.g., Gupta and Govindarajan 1995). Two comments are pertinent here. First, in the literature, organizational arrangements are seen to reflect the characteristics of transferred knowledge (i.e., there is an underlying efficient alignment hypothesis). It is not that organizational arrangements are chosen to influence the characteristics of knowledge (Gupta and Govindarajan 1995). Second, there are much wider implications of organizational arrangements for the understanding of the creation, use and transfer of knowledge within MNCs — implications that, however, only become visible if more attention is devoted to how knowledge is structured across the MNC network. In particular, we argue that MNC by means of organizational instruments can indirectly influence the characteristics of knowledge, for example, the proportion between tacit and explicit knowledge in their knowledge structures. They can do so by influencing the subsidiary choice of knowledge sources, because these sources are associated with different mixes of tacit and explicit elements. A greater concern with how knowledge elements are structured across the MNC will bring the role of organizational arrangements as instruments to "work on" the MNC knowledge structure, that is, influencing the creation, utilization and transfer of knowledge, more clearly into the picture than has hitherto been the case.

**The MNC as a Knowledge Structure: Some Building Blocks**

So far, we have made two fundamental and broad arguments. First, we have argued that most existing literature on the relations between knowledge, learning, and competitive advantage is founded on a, at best, highly abstract view of firm knowledge, and that this unnecessarily constrains the domain of application of this literature. Second, we have suggested that a view of firm knowledge should be one that builds on a conception of firm knowledge being structured. Both arguments apply to knowledge-based view of the firm in general, and therefore also to the recent differentiated MNC literature. The purpose of the present section is to add

content to the notion of knowledge structure by providing some building blocks for such a view.

The notion that firms may be understood in terms of knowledge *structures* (and not just knowledge *assets*) was probably first explicitly put forward by Lyles and Schwenk (1992). They introduce the notion of an "organizational knowledge structure" to refer to shared beliefs at the organizational level about "… goals, cause-and-effect beliefs, and other *cognitive* elements." However, firms are characterized by a differentiated consensus in these beliefs, so that in the firm's "core" the degree of consensus is high, while in the "periphery" it is low. According to Lyles and Schwenk, it is mainly in the periphery that new perspectives are developed — an idea that relates to the recent discovery in the MNC-literature of the role of subsidiaries as sources of new ideas, perspectives, etc. (e.g., Moore and Birkinshaw 1998; Holm and Pedersen 2000a).[5] They further argue that the organizational knowledge structure is characterized by *complexity* which (somewhat unclearly) refers to "… the amount of information … within a knowledge structure" (p.163) and "… the degree to which cognitive units are interrelated" (p. 164), as well as by *relatedness* which refers to the degree of coupling (tight vs. loose) between elements in the core and periphery of knowledge structures. Thus, Lyles and Schwenk think of organizational knowledge structures, first, entirely in cognitivist terms, and, second, as referring to mainly shared beliefs at the organizational level. However, this view seems unnecessarily constraining, since, first, it seems to rule out tacit knowledge (which is hard to represent as an explicit belief about goals, cause-and-effect relations, etc.), and, second, excludes those elements from the organizational knowledge structure that are not shared at the organizational level.

We adopt a broader and essentially simple conceptualization of the firm — including the MNC — knowledge structure. To get an idea of this, think of the overall MNC knowledge structure as a set of nodes and their connections, as in the toy example in Figure 1.

XXXXXXXX *Insert Figure 1 here* XXXXXXXX

The individual nodes refer to *knowledge elements*, for example, a marketing capability in a subsidiary in a certain country. The individual nodes are the elemental building blocks of our view of firm knowledge structures. Nodes may be identical as when two subsidiaries exploit the same patent. Lyles and Schwenk's notion of organizational knowledge structures can be represented as the set of identical nodes over subsidiaries and MNC headquarters (i.e., the small dark circles). Nodes may represent tacit (e.g., the colourless circles) or explicit knowledge, or, knowledge with or without public good character.

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[5] On the other hand, knowledge that is built in the context of the core is less costly to transfer to other parts of the MNC network than knowledge that arises in the periphery because it can rely on greater bandwidth communication channels (Heimann and Nickerson 2002). Thus, there is a possible tradeoff between the novelty of ideas and the costs of communication.

Nodes may also be *connected* (and they may not, e.g., the knowledge sets controlled by subsidiary x and y in Figure 1), for example, in terms of lateral or bilateral dependencies. It is such perceived dependencies that underlie intra-MNC knowledge transfers. More refined conceptualizations, representations and taxonomies of interdependencies can be easily developed (e.g., Thompson 1967: 15-18; Buckley and Carter 1999). The notion of complementarity (Milgrom and Roberts 1990) is particularly helpful for conceptualizing interdependencies. Loosely, knowledge elements are complementary when there are gains from combining them (the degree of complementarity being measured by the size of the gain). For example, knowledge elements pertaining to marketing controlled by one subsidiary (or MNC headquarters) may be a useful addition to existing marketing knowledge in another subsidiary, so that the relevant knowledge elements are *additive* (Buckley and Carter 1999). Or, subsidiary knowledge may be an input prior to the building of knowledge in another part of the MNC, as when knowledge of local tastes are transferred to centralized R&D functions, so that the relation of complementarity is *sequential* (ibid.). Finally, dependencies may go both ways. For example, knowledge gained from combined marketing knowledge in a number of subsidiaries may be transferred back to these as best practice knowledge. Or, strategies and actions based on knowledge elements in different MNC units may be interdependent, thus requiring coordination (what Buckley and Carter 1999 call "*complex complementarity*").

The perceived net benefits of combining complementary knowledge elements depend on three elements. First, net benefits depend on the characteristics of the relevant knowledge elements, that is, *how* complementary they are, what *kind of* complementarity is involved, overlap, tacitness, etc. Second, they depend on the governance costs implied by these characteristics, in terms of costs of motivation and coordination (Buckley and Carter 1999). Third, net benefits depend on the costs of transfer (personal or codified communication, embodied transfer). For example, transferring highly tacit knowledge elements under conditions of complex complementarity is likely to be very taxing for the organization in terms of governance and transfer costs. The presence of strongly overlapping knowledge elements (i.e., the shared beliefs of Lyles and Schwenk 1992) may, of course, reduce such costs.

In sum, we see firm (MNC) knowledge structures as being composed of knowledge elements, which may be characterized in a number of dimensions, such as their sources, and connections between these, which may be conceptualized in terms of complementarities. Net benefits depend on the costs of governing and transferring knowledge in order to realize complementarities.

This is a fundamentally simple framework; however, it is descriptively richer than most other discussions. It is also quite flexible; for example, it covers both the transfer of existing knowledge and the creation of new knowledge, since both may be analyzed as complementarities (i.e., as additive/sequential and complex complementarities, respectively). It is entirely consistent with, but adds to, the basic perspective in recent work on the differentiated MNC — namely that MNC units

control heterogeneous stocks of knowledge, and that the MNC may obtain competitive advantages from orchestrating knowledge flows between units in such a way that knowledge is transferred to where it will increase value-added. However, we explicitly identify those dimensions along which the MNC knowledge structures may be classified. This allows us to add insight into the nature of the decision problem faced by MNC management.

Under norms of rationality, MNC management wishes to maximize net benefits. Looking only at knowledge transfer, this translates into maximizing the difference between the expected (gross) benefits from transferring knowledge, as determined by complementarity, and the expected costs of such transfer, as determined by the governance and transfer costs, which in turn is influenced by knowledge characteristics such as tacitness, overlap, public good properties, etc. As we argued, this is usually cast in terms of choosing those organizational arrangements — that is, governance and transfer mechanisms — that minimize the relevant costs of undertaking transactions (i.e., transfer) involving knowledge with *given* characteristics (e.g. Kogut and Zander 1993). The possibility of a reverse causality, in which organizational arrangements are chosen so that they influence the relevant characteristics, is not inquired into. This is because most of the emphasis in the literature is placed on flows of knowledge with given characteristics between MNC units, and little analytical attention is devoted to analyzing the knowledge elements in terms of their characteristics and interdependencies. Therefore, the possibility that the costs and benefits of MNC knowledge management may be managed by influencing the characteristics and composition of knowledge elements in MNC units — that is, changing the MNC knowledge structure — is neglected (see Forsgren, Petersen and Foss 1999; Foss and Pedersen 2002 for exceptions). However, this is exactly the possibility that we shall investigate in the following as the key illustration of the added insights of adopting a knowledge structure approach to the MNC.

**Developing and Transferring Knowledge as Key Managerial Decision Problems**

Although it is very often argued in the literature that the MNC owes its existence to its superior ability (relative to markets) to transfer knowledge and that this superior ability may at the same time be a source of competitive advantage (relative to purely domestic firms), it is also widely recognized that the resource costs of developing and transferring knowledge may often be substantial. With respect to the transfer of knowledge, Teece (1981) estimated that transfer costs for the intra-MNC technology transfer cases he examined ranged from 2, 24 percent to 59 percent with a mean of 19,16 percent. In the view of Kogut and Zander (1993: 630) "… these costs are derived from the efforts to codify and teaching complex knowledge to recipient."[6] On the other hand, the benefits from transferring knowledge are often

[6] Similarly, Szulanski (1996) showed that his findings imply that the barriers to knowledge transfer were only to a very small extent motivational (at least in the sense of, for example, agency theory). Rather, the barriers to knowledge transfer had to do with causal ambiguity, the receiver's absorptive capacity and the general atmosphere in the relation between sender and receiver. However, his findings did not relate to the context of cross-border knowledge transfer.

very substantial, as indicated by, for example, Subramaniam and Venkatraman's (2001) finding that transnational product development capability is highly dependent upon the transfer of knowledge in MNCs.

Thus, the costs and benefits of developing, transferring, codifying, teaching, etc. knowledge are quite substantial. This suggests that it may be rational for MNC management to do more than maximize net benefits from exploiting complementarities between existing MNC knowledge elements and choosing those organizational arrangements that minimize the costs of transfer and governance associated with those given knowledge elements. MNC management will also seek to control the *determinants* of those benefits and costs. It will try to influence the characteristics of the knowledge elements, such as the sources of subsidiary knowledge. As stated earlier we assume that management will choose organizational instruments, influencing knowledge sources, so as to maximize the net benefits of knowledge transfer. This main argument is summarized in figure 2:

XXXXXXXX *Insert Figure 2 Here* XXXXXXXX

However, in spite of their obvious theoretical importance, rather little is known empirically about the determinants of intra-MNC knowledge flows[7] in spite of some attention to knowledge characteristics (e.g., Hamel 1991; Kogut and Zander 1993; Simonin 1999), organizational controls, and motivational factors (Gupta and Govindarajan 1991, 1995). The next sections consider the knowledge sources of MNC subsidiaries and organizational instruments in some detail and discuss their implications for the transfer of knowledge in MNCs.

**Sources, Characteristics and Transfer of Knowledge**

As a general matter, impediments to knowledge transfer may be classified as either motivational or cognitive barriers (Cohen and Levinthal 1990; Zander and Kogut 1995; Gupta and Govindarajan 2000). In this section, we are primarily taken up with cognitive barriers to transfer, reserving motivational factors for later treatment. Cognitive barriers to transfer are usually conceptualized in terms of such constructs as causal ambiguity, complexity, tacitness, absorptive capacity, and the like. Although they make perfect theoretical sense, these variables may be hard to operationalize and measure.[8] A more operational approach is to start directly from the *sources* of subsidiary knowledge and argue that these sources result in knowledge with different characteristics. Given this, sources of knowledge may be treated as

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[7] Thus, Crossan and Inkpen (1994: 271) point out that "… while much of the MNC research has dealt with static theories of the firm and investigations of structural questions, very little research has delved into the process of knowledge transfer and the barriers to successful intraorganizational learning." And as late as in 2000, Gupta and Govindarajan (2000: 474) observed that with some notable exceptions (e.g., Zander and Kogut 1995), "… very little systematic empirical investigation in the determinants of intra-MNC knowledge transfers has so far been attempted." See also Buckley and Carter (1999: 81) for similar observations.

[8] Although successful attempts do exist, for example,. Cohen and Levinthal 1990; Kogut and Zander 1993; Simonin 1999; Gupta and Govindarajan 2000.

choice variables, so that under norms of managerial rationality, the MNC wide development and transfer of knowledge is optimized through the choice of knowledge sources (and organizational controls and motivation).

Although an internal element necessarily enters into the production of all subsidiary knowledge, it makes sense to distinguish between the following types of knowledge, derived from different knowledge sources:

1) ***Internal knowledge*** — that is, knowledge that is produced mainly through investing in the internal production of knowledge (e.g., much R&D).

2) ***External knowledge*** — that is, knowledge that is to a large extent created on the basis of knowledge inputs from relations to external partners (customers, suppliers, etc.) or on the basis of knowledge inputs from a local cluster (e.g., a well educated work force, high quality research institutions, etc.).

The first category of knowledge is the kind of internal knowledge that has been highlighted in resource- and knowledge-based theories of the firm (Foss 1997). In this literature, the focus has been on production and organization knowledge that is embodied in bundles of routines of a highly tacit and social nature. Teams of individuals operate it for some strategic purpose. Because of its characteristics, such knowledge is strongly intertwined with the organization itself and is therefore hard (very costly) to trade in the market. It may, however, be transferable at much lower cost inside the MNC network than across markets, particularly to the extent that internal knowledge is developed within the core of the MNC knowledge structure and is developed explicitly as a complement to other knowledge elements in the MNC network. This leads us directly to the conventional argument for the existence of the MNC, which asserts that MNCs exist because of their comparative advantages (*vis-a-vis* markets) of transferring knowledge. Though arguably correct, that argument fails, however, to distinguish between the transfer of knowledge that differs in terms of sources.[9] In contrast, we argue that the ease of transfer of knowledge is likely to be influenced by the sources of the knowledge.

Of course, no knowledge is entirely internally accumulated (Nohria and Eccles 1992; Foss and Eriksen 1995; Kogut 2000); in fact, as we later elaborate, there may be significant relations of complementarity between internal and external knowledge sources. Nevertheless, it makes conceptual and empirical sense to say that some knowledge is largely internally produced, while some other knowledge is strongly based on external knowledge inputs. Conceptually, one may distinguish between two external sources of knowledge that may be available to subsidiary firms. The first category may be called "network-based knowledge." We here have in mind the gaining of knowledge from long-lasting interaction with specific external parties, notably customers or suppliers, and the use of that knowledge in the firm's activities

[9] Of course, the literature has introduced distinctions between, for example, R&D capabilities and marketing capabilities. However, this doesn't go to the heart of the matter of the sources of knowledge.

(Ford 1990).[10] The second category may be called "cluster-based knowledge." This kind of external knowledge is not to the same extent the result of long-lasting interaction with specific parties. Rather, it is based upon knowledge inputs from, for example, an well-educated work force or local knowledge institutions, such as technical universities, etc. (Porter 1990; Porter and Sölvell 1999). Here, we treat both categories as one, namely as "external knowledge."

Our distinction between internal and external sources of knowledge in the subsidiary knowledge base is different from the conventional distinction between, for example, production, marketing or R&D knowledge; the latter types of knowledge may all in principle have both internal and external components, to varying degrees. The advantage of our distinction is that it may be *more* plausibly discussed in terms of general characteristics of knowledge than the activity-based definitions of knowledge. For example, it is hard to argue on *apriori* grounds that, for example, production knowledge is inherently more complex, ambiguous or tacit, and therefore harder to transfer, than marketing knowledge. In contrast, we consider it more justified to make this kind of arguments with respect to our distinction, although with considerable cautiousness.

Sidestepping motivational issues, the success of knowledge transfer is primarily a matter of cognitive matters, such as the existence and richness of transmission channels (Bartlett and Ghoshal 1989; Ghoshal, Korine and Szulanski 1994), the characteristics of the transferred knowledge in terms of such dimensions as tacitness, ambiguity, etc. (Zander and Kogut 1995; Szulanski 1996), and the absorptive capacity of the target unit(s) (Gupta and Govindarajan 2000). We submit that these cognitive dimensions are systematically related to knowledge sources. Therefore, knowledge transfer depends on knowledge sources (i.e., an important aspect of knowledge structure), which — we have argued — may be influenced by MNC management by organizational means.

With respect to *how* knowledge transfer is dependent upon knowledge sources, we argue that internal knowledge is likely to be more easily transferable than external knowledge, fundamentally because it is more likely to have many overlapping elements with other parts of the MNC knowledge structure and is more likely to be at least partly developed through interaction with other MNC units. Internally accumulated knowledge may be relatively easily transmitted through existing transmission channels, and although it may contain, for example, tacit elements, the absorptive capacity of target units is likely to be relatively high. Therefore, we propose the following hypothesis:

> ***Hypothesis 1:*** *Internal subsidiary knowledge will be positively correlated with knowledge transfer from subsidiaries to other MNC units.*

[10] For example, Dyer and Nobeoka (2000) examine Toyota's production network, and argue that Toyota's ability to create, manage and take advantage of network-based knowledge flows is a strong explanation for the many productivity advantages enjoyed by Toyota (as well as its suppliers).

In contrast, external knowledge which tends to be of a more peripheral character in the MNC knowledge structure, is likely to be less easily transferable than internal knowledge. This is because this type of knowledge is to a large extent derived from specific, perhaps very specific, problems and needs of the external parties with which the subsidiary interacts, and/or it consists of knowledge of local skill levels, tastes, regulatory authorities, etc., much of which may be hard to transfer or of no or little use for other MNC units. External knowledge thus largely lies outside of the core of the MNC knowledge structure. Therefore, it contains many elements that makes it hard to transfer to other MNC units.[11] In fact, we argue that the more a subsidiary is prone to accumulate external knowledge, the less knowledge will it transfer to other MNC units. Given the above discussion, we can put forward the following hypothesis:

> ***Hypothesis 2:*** *External subsidiary knowledge will be negatively correlated with intra-MNC knowledge transfer, because external knowledge is not (or only weakly) complementary to knowledge in other MNC units.*

However, a key point of the literature on the differentiated MNC is that important knowledge may develop in what we call the periphery of the MNC knowledge structure - knowledge that when transferred and combined with complementary knowledge in other MNC units will yield a high value-added. However, in order for such knowledge to be transferable and combinable with complementary knowledge in other MNC units, it has to be interpreted and formulated in such a way that it will be accessible to other units. In terms of the distinction between external and internal knowledge, this may be accomplished by bringing external knowledge in more direct contact with internal knowledge. Remember that we have defined internal knowledge to also include knowledge developed in the interaction between MNC units, that is, as also including the "codes" (Arrow 1974) through which communication may take place, and to include more core knowledge than peripheral knowledge. Thus, we are not denying a key point of the literature on the differentiated MNC, but rather refining it. Given this, we can put forward our third hypothesis:

> ***Hypothesis 3:*** *When brought in contact with internal knowledge, external knowledge is highly correlated with knowledge transfer from subsidiaries to other MNC units. In more formal terms, the interaction effect between internal and external knowledge is positively correlated with knowledge transfer from subsidiaries to other MNC units.*

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[11] This is admittedly somewhat counter-intuitive, since it may be argued that some kinds of external knowledge may be less characterized by tacit elements than internal knowledge. For example, knowledge inputs from local universities may have a high explicit knowledge content. However, knowledge inputs from local universities may constitute a rather small part of cluster knowledge, given that the tendency in most MNCs is to source this kind of inputs in centrally placed R&D departments and not in local subsidiaries (Gassman and von Zedtwidtz 1999). Moreover, the emphasis is not so much on tacit knowledge as a barrier of transfer as on whether the relevant knowledge lies within the core of the MNC knowledge structure. Tacit knowledge may lie within this core.

Because internal and external knowledge are associated with different costs of transfer (different degrees of complexities and different tacit knowledge content) and with different complementarities, MNC management will influence the sources of knowledge that subsidiaries tap into in such a way that net benefits are maximized. However, influencing these sources through, for example, locational decisions, is not the only means of optimizing the accumulation and transfers of knowledge that is available to MNC management. It can also make use of mechanisms of organizational control and motivation.

A basic organizational problem is to motivate the subsidiary to actually transfer knowledge that may be useful to other subsidiaries. One problem concerns who should bear the resource costs of transferring knowledge, and how the party who "gives up" knowledge is to be compensated. We shall abstract from this problem, and assume that the subsidiaries and the headquarters through structuring compensation in the right way can handle it. A rather different motivational problem is that to the extent that a subsidiary possesses a knowledge monopoly it controls a lever of bargaining power in the MNC, since it controls a crucial complementary asset (Hart 1995). Transferring knowledge is tantamount to giving up this power (Forsgren, Pedersen and Foss 1999; Holm and Pedersen 2000b). Gupta and Govindarajan (2000) briefly point to such a problem. Foss and Pedersen (2001) argue that repeated know how exchange may act as a mechanism that keeps this bargaining problem at bay. In this paper, as in Foss and Pedersen (2001), we deal with subsidiaries that are involved in lengthy relations with headquarters and other subsidiaries and, hence, engage in repeated interaction with these. Thus, we believe it is justified to assume that in fact subsidiaries will be motivated to transfer knowledge. However, one point that has not been dealt with concerns the organizational mechanisms of control and motivation that may be applied, not just to the transfer of knowledge, but also to the *development* of knowledge.

**Organizational Instruments and the Development of Knowledge in Subsidiaries**

Many contributions to the MNC literature recognize that the process of knowledge transfer is likely to be supported by different organizational means of control and motivation (e.g., Bartlett and Ghoshal 1989; Gupta and Govindarajan 1991, 1995; Buckley and Carter 1999). Indeed, a key theme in many recent contributions is that interdependencies (complementarities) between knowledge flows strongly condition the choice of types of management systems and processes for managing subsidiary relations (e.g., Gupta and Govindarajan 1995).

We agree with the basic thrust of this literature. However, we add two points. First, the choice of organizational mechanisms of control and motivation also influence the accumulation of knowledge in the sense that the application of different mechanisms lead to different kinds of knowledge being accumulated. Second, causality may go in the reverse direction in the sense that the choice of organizational mechanisms of control and motivation also influence the transferability of knowledge. Consider these points in turn.

The knowledge structure of the MNC contains shared elements as well as local elements (in the sense of Hayek 1945), for example, knowledge about local tastes, technologies, regulators, suppliers, etc. In order to efficiently utilize the local elements of the knowledge, it will often be necessary to delegate rights to make decisions that involve such local knowledge to those decision-makers that best know how to turn the relevant knowledge to productive uses. Along such lines, it may be argued that granting more decision rights to a MNC subsidiary — giving it more autonomy — improves the incentives of the subsidiary to engage in the accumulation of local knowledge (cf. Aghion and Tirole 1997). Local knowledge is more likely to be of the external kind than of the internal. If subsidiary knowledge is mainly based on external knowledge, it is hard for MNC headquarters and top-management to direct the subsidiary's acquisition of such knowledge because of the knowledge asymmetry (Jensen and Meckling 1992) and because the subsidiary is distant from the core in the knowledge structure. Thus, stimulating the development of external knowledge in a subsidiary — for example, in the hope of increasing local marketing and product development — may involve granting a high degree of autonomy to the subsidiary. This leads to our fourth hypothesis:

> ***Hypothesis 4***: *The development of external knowledge in MNC subsidiaries is positively influenced by the degree of autonomy granted to the subsidiary.*

In contrast to external knowledge, internal knowledge is produced mainly through investing in the internal production of knowledge (e.g., much R&D) or from learning by doing, using, etc. in the subsidiary itself, or developed through interaction with other units in the MNC network. The emphasis is on developing knowledge that is at least potentially transferable. Such knowledge will typically lie within the core of the MNC knowledge structure. Also, the accumulation of internal knowledge in a subsidiary will strongly reflect perceived complementarities with knowledge elements in other parts of the MNC; more precisely, developing such knowledge takes place with an eye to these potential benefits. Thus, we put forward the following hypothesis:

> ***Hypothesis 5***: *Developing internal knowledge in MNC subsidiaries are positively influenced by the perceived interdependencies (complementarities) between the focal subsidiary and other MNC units.*

Further, the development of internal knowledge is likely to be stimulated by the transfer of goods and/or services between MNC units. This is because the transfer of goods and/or services, that is, intra-MNC trade, is in itself a force pulling in the direction of a widening of the bandwidth of communication channels. This prompts the discovery of new opportunities for realizing complementarities between knowledge components (Kirzner 1973). Thus:

> ***Hypothesis 6***: *Developing internal knowledge in MNC subsidiaries is positively influenced by the amount of trade between the focal subsidiary and other MNC units.*

The hypotheses are summarized in the following model.

*XXXXXX Insert Figure 2 here XXXXXX*

# III. Data and Method

**Data Collection**

The data for this paper were collected as part of the Centres of Excellence-project that engaged researchers in the Nordic countries, the United Kingdom, Germany, Austria, Italy, Portugal and Canada. The CoE-project was launched in May 1996 with the purpose of investigating headquarter-subsidiary relationships and the internal flow of knowledge in MNCs. In order to collect comparable quantitative data on acquisition of subsidiary knowledge, it was decided to construct a questionnaire that could be applied in all the involved countries. After several project meetings and extensive reliability tests of the questionnaire on both academics and business managers, this was accomplished.[12]

For practical reasons, it was decided that each project member should be responsible for gathering data on foreign-owned subsidiaries within their own country. Thus, all subsidiaries in the database belong to MNCs. In the data gathering, subsidiary managers, rather than headquarters, have been respondents. One advantage of choosing subsidiary respondents is that they are directly engaged in the market and therefore are more acquainted with its characteristics. Although we can expect that the subsidiary have a reliable awareness of its own competencies, it would be an advantage to gather information on intra-MNC knowledge flows from other corporate units as well. However, it would be an unmanageable task first to identify the subsidiaries in each country and then to identify the relevant management units in the foreign MNCs.

The paper is based on empirical data from seven countries: Austria, Denmark, Finland, Germany, Norway, Sweden and the UK. All countries are located in the northern part of Europe, and the four Nordic countries are considered to be relatively small, while Germany and the UK are among the largest in Europe. Approximately 80 per cent of the questionnaires were answered by subsidiary executive officers, while financial managers, marketing managers or controllers in the subsidiary answered the remaining 20 per cent. The response rate varies between 20 (UK) and 55 per cent (Sweden), depending on the country of investigation. The quality of the data is quite high with a general level of missing values of not more than 5 per cent.

XXXXXXXX *Insert Table 1 Here* XXXXXXXX

As shown in table 2, the total sample covers information on 2.107 subsidiaries. It comprises all kinds of subsidiaries in all fields of business. Between countries, the

[12] For more information on the CoE-project, see Holm and Pedersen (2000a).

sample ranges from 202 (UK) to 530 (Sweden). With the exception of Sweden, the size of the sample is rather similar in the other six countries. The average number of employees in the subsidiaries is 742 and the median is 102. Within the five smaller countries, the average size of the subsidiaries are very similar, while Germany and UK — due to their larger market sizes — comprise substantially larger subsidiaries. As we expect larger subsidiaries to comprise more knowledge and therefore more potential for knowledge transfer we need to control for this bias in the data material when conducting our tests of the hypotheses.

For all these subsidiaries are covered information on the level of subsidiary competencies, the sources of this competence, organizational context variables, and to what extent the knowledge has been transferred to other MNC-units. The subsidiaries were asked to indicate the level of competence for six different activities performed by the subsidiary on a seven-point Likert scale, from 1=very weak competence to 7=very strong competence. The six activities are research (basic and applied), development (of products and processes), production (of goods and services), marketing and sales, logistics and distribution and purchasing. The average score on the seven-point scale of the level of competence is shown in table 3.

XXXXXXXX *Insert Table 2 Here*XXXXXXXX

In general, the subsidiaries are indicating that they comprises a relatively high level of competence for all activities with average values ranging from 4 to 6 in the upper level of the seven-point scale. The pattern is very similar for all the six countries with the highest competence levels for production and marketing/sales and somewhat lower levels for the four other activities. As expected, the larger German and UK subsidiaries have higher competence levels than the other subsidiaries in the sample. They have slightly higher values than the total sample for all six activities.

**Measures**

All data were collected through the questionnaire and most variables are multi-item measures that were measured using seven-point Likert scales. However, items such as the number of employees were measured using actual values. The following sections provide the exact wording used for questionnaire items.

**Knowledge transfer.** Following, Foss and Pedersen (2002) our definition of knowledge transfer captures the application rather than the transfer *per se* of the subsidiary knowledge in other MNC units. Accordingly, in the questionnaire the subsidiaries have been asked to what extent the subsidiary knowledge has been of use to other MNC units. Respondents have indicated this on a seven-point Likert scale, where 1 was defined as "to no use at all for other units" and 7 was defined as "very useful for other units" for all the six above-mentioned activities. *Knowledge transfer* is a multi-item construct calculated as the average score reported by respondents across these six items (Alpha=0.74).

**Internal knowledge**. The construct of internal knowledge is capturing both the subsidiaries own effort of knowledge production and the knowledge developed

through interaction with other MNC units. The subsidiaries own knowledge production was measured by asking respondents to assess the level of investments in the subsidiary in the past three years, where 1=very limited, 7=substantial. The level of investments was assessed for all the six above-mentioned activities. In order to measure the knowledge developed through interaction with other MNC units the respondents was asked to assess the impact of various internal organizations on the development of the subsidiary's competencies, where 1=no impact at all, 7=very decisive impact. Three organizations were identified: internal MNC customers, internal MNC suppliers, and internal MNC R&D units. In the models used to test our hypotheses we use a composite measure, *Internal knowledge*, based on the average across all nine items (Alpha=0.73).

**External knowledge**. The variable of external knowledge is capturing both the importance of external counterparts (like customers and suppliers) and the local cluster as sources of knowledge development in the subsidiary. The inputs from external partners was measured by asking respondents to assess the impact of various external organizations on the development of the subsidiary's competencies, where 1=no impact at all, 7=very decisive impact. Four organizations were identified: external market customers, external market suppliers, specific distributor and specific external R&D unit. Building on the elements of Porter's (1990) diamond model, respondents were asked to assess the business environment in which they compete along the following dimensions: Availability of business professionals; availability of supply material; quality of suppliers; level of competition; government support; favorable legal environment; and existence of research institutions (1=very low, 7=very high). In the diamond model, the items are presented as different dimensions, however, Porter's (1990) own emphasis on the holistic nature of the model and the high inter-correlation between many of the items motivated us to construct a composite index. *External knowledge* is calculated as the average score reported by respondents across these eleven items (Alpha=0.68).

**Interdependence (Complementarity)**. This variable measures the extent to which the MNC units are dependent on the subsidiaries and *vice versa*. The MNC dependence on the subsidiary knowledge were assessed by asking the respondents the following question: "What would be the consequences for other units in the Foreign Company if they no longer had access to the competencies of the subsidiary?" (1=no consequences, 7=very significant consequences). In a similar vein, the subsidiary dependence on knowledge from other MNC units was captured by the following question: "What would be the consequences for the subsidiary if it no longer had access to the competencies of other MNC units?" (1=no consequences, 7=very significant consequences). Taken together these two items reflects the interdependence between the focal subsidiary and other MNC units.

**Intra-MNC trade**. The level of intra-MNC trade is an indicator of the breadth of the internal trade links. It is measured as a single item, as the share of subsidiary sale going to other MNC units in 1996. The subsidiary sale to other MNC units includes both semi-products and final goods and services.

**Autonomy.** Based on the scale developed by Roth and Morrison (1992), respondents were asked to identify the level at which certain decisions were made, where 1=foreign corporate (HQ), 2=sub-corporate (e.g. division), 3=subsidiary level. Decisions were as follows: Hiring top subsidiary management; entering new markets within the country; entering foreign markets; changes to subsidiary organization; introduction of new products/services; approval of quarterly plan/schedules. Our measure, *Autonomy*, is based on the average of these six items (Alpha=0.61).

**Controls**. To control for structural characteristics of the subsidiary that might also influence the extent of knowledge transfer, we controlled for the following factors: Number of subsidiary employees in 1996 (a proxy for size), its mode of formation (a dummy: greenfield or acquisition), and the host country of the subsidiary (six dummies: using UK as a base case). We expect that larger subsidiaries will be more likely to transfer knowledge to other MNC units, consistent with our theoretical arguments of a cumulative process of knowledge development in foreign subsidiaries. We have no predictions on the role of entry mode and the country dummies for the extent of knowledge transfer.

# IV. Results

## Tests of Hypotheses

The six hypotheses may be summarized in three basic models as follows.

1) Internal knowledge = Interdependencies + Intra-MNC trade + Error

2) External knowledge = Autonomy + Error

3) Transfer of knowledge = Internal knowledge + External knowledge + Internal knowledge*External knowledge + Controls + Error

Hypotheses 1-3 are reflected in model 3, while hypothesis 4 is expressed in model 2, and, finally, hypotheses 5-6 are expressed in model 1. However, since the above models represent decisions that are interdependent (they have to be considered jointly), the use of single equation models may yield biased results and obscure interesting theoretical possibilities. Since the above models are interdependent, then it is possible that the joint optimization of all involved decisions may lead to suboptimization of one or more individual decisions. Statistically the interdependence might be reflected in that error terms of the three models are somehow correlated. Hence the correct model to estimate these decisions is a simultaneous equation model as three-stage least square, that circumvent the problem of interdependence by using instrument variables (often the exogenous variables) to obtain predicted values of the endogenous variables (in our case: knowledge transfer, internal knowledge, and external knowledge).

We have applied the three-stage least square regression techniques (3SLS) with instrument variables to test all six hypotheses simultaneously. All the exogenous variables (interdependencies, intra-MNC trade, autonomy, subsidiary employees, mode of formation, and country dummies) are used as instrument variables in the estimation of the model. The result of the total model is reported in Table 4. Numbers in parentheses represent standard errors.

XXXXXXXX *Insert Table 1 Here* XXXXXXXX

Overall, the system of the three equations (models) works well with a system weighted R-square of 0.44. This indicates that almost half of the observed variation in the extent of knowledge transfer is explained by the variables in the model. We turn now to the tests of our explanatory hypotheses.

Starting backwards with hypotheses 5 and 6, recall that they posited a relationship between the interdependence and intra-MNC trade and internal knowledge development. These hypotheses are tested in the first equation and they are strongly supported. Both organizational decision variables have a significantly positive relationship with the development of internal knowledge (both at 1 per cent level). Hypothesis 4, on autonomy determining the development of external knowledge is also supported with a significant positive relationship, although only at 5 per cent level.

Hypotheses 1-3 proposing that the development of internal and external subsidiary knowledge is facilitating the level of knowledge transfer are tested in the third equation. All three hypotheses are supported, indicating that development of internal knowledge has a positive effect (at the 1 per cent level), while the development of external knowledge has a direct negative impact (5 per cent level) on the transfer of knowledge to other MNC units. However, the interaction effect of internal knowledge and external knowledge has a strong positive (1 per cent level) relationship with the level of knowledge transfer. These results point to the conclusion that while internal knowledge have a direct and positive effect on knowledge transfer, the effect external knowledge is more indirect going through the interaction with internal knowledge, which might prove that external knowledge must be transformed from periphery to core knowledge before the knowledge transfer takes place.

The number of subsidiary employees turn out to be insignificant, while acquisitions do transfer more knowledge than green-fields to other MNC units (formation is significant). Recall that UK was used as a base case for the six country dummies, therefore the country dummies shows that subsidiaries from Denmark, Norway and Sweden are transferring significantly less knowledge to other MNC units than do the foreign owned subsidiaries hosted in UK (and Finland, Germany, and Austria). This might be explained by the small size of the Scandinavian markets and the location in the periphery of Europe.

# V. Concluding Comments

The present paper is essentially a contribution to the recent differentiated MNC literature on intra-MNC knowledge transfer. However, it goes beyond this literature in a number of ways. First, we have the methodological and theoretical arguments that the understanding of knowledge transfer between MNC units will be furthered by taking an explicit starting point in a conceptualization of the MNC as a knowledge structure. We argued that such a conceptualization was at best implicitly present in existing literature. Therefore, there is no explicit, coherent view of what it means to say that the MNC is a knowledge-based entity. This means that the extent tow which MNC management can "work on" the MNC knowledge structure may be under-appreciated in the literature. As an illustration, the development, characteristics and transfer of knowledge are seldom consistently taken to be endogenous to organizational processes and arrangements. In the literature, it is rather the other way around. Organizational arrangements are seen as rational responses to the requirements implied by different characteristics of knowledge.

In contrast, we submitted that it is useful to conceptualize the decision problem of MNC management as a dynamic optimization problem in which it choose control variables (here, organizational instruments) to influence certain state variables (here, the creation and transfer of knowledge), the existing MNC knowledge structure forming the starting point for such an exercise. In our operationalization of this overall, and far-reaching approach, we concentrated on how MNC management may influence the key characteristic of the MNC knowledge structure of the sources of subsidiary knowledge by means of organizational instruments. We largely found support for the main argument of the paper that MNC management through choices regarding organizational control, motivation and context can influence the development, characteristics and transfer of knowledge. It was shown that organizational choice variables as the level of subsidiary autonomy (own decision-making), level of intra-MNC-trade, and interdependence among the subsidiary and other MNC units all have a bearing on the development of different sources of subsidiary knowledge.

Furthermore, internally sourced knowledge has a direct positive effect, while externally sourced knowledge has a direct negative effect on subsidiary knowledge transfer. However, the indirect effect of externally sourced knowledge going through the interaction (and transformation) with internally sourced knowledge also has a positive effect on subsidiary knowledge transfer. This indicate that the extent that management chooses a specific way of sourcing knowledge, it also implicitly chooses the characteristics of the sourced knowledge and the ease with which it can be transferred inside the MNC. This is because knowledge from different knowledge sources has different characteristics and is thus transferred at different cost.

However, there are various problems with our approach that need to be briefly commented upon. First of all, the measures that proxy organizational means and context (Interdependence, Intra-MNC Trade, Autonomy) admittedly do so only rather imperfectly, and we would have preferred to have much more direct

measures. For example, it is somewhat unclear what kind of organizational means or context the measure, Intra-MNC Trade exactly represents. However, these are unavoidable limitations of the dataset.

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**Table 1** *Sample size and subsidiary employees in the different countries*

| COUNTRY | SAMPLE SIZE | SUBSIDIARY EMPLOYEES (mean) |
|---|---|---|
| Austria | 313 | 318 |
| Denmark | 308 | 284 |
| Finland | 238 | 200 |
| Germany | 254 | 1.574 |
| Norway | 262 | 130 |
| Sweden | 530 | 244 |
| UK | 202 | 3.787 |
| **Total** | **2.107** | **742** |

**Table** 2 *The average score on a seven-point scale of the level of competence.*

| COUNTRY | Research | Development | Production | Marketing /sales | Logistics/ distribution | Purchasing |
|---|---|---|---|---|---|---|
| Austria | 3.1 | 4.4 | 5.8 | 6.1 | 5.7 | 5.2 |
| Denmark | 4.8 | 5.2 | 6.0 | 5.9 | 5.7 | 5.3 |
| Finland | 4.3 | 4.9 | 5.9 | 5.9 | 5.5 | 5.3 |
| Germany | 4.6 | 5.3 | 6.3 | 6.2 | 5.9 | 5.7 |
| Norway | 4.2 | 4.9 | 5.6 | 5.7 | 5.3 | 5.2 |
| Sweden | 4.7 | 5.3 | 5.9 | 5.9 | 5.5 | 5.2 |
| UK | 4.9 | 5.3 | 6.1 | 6.1 | 5.9 | 5.5 |
| **Total** | **4.4** | **5.1** | **6.0** | **6.0** | **5.6** | **5.3** |

**Table 3:** *The three-stage least squares estimation of a simultaneous equation model.*

| | Equations | | |
|---|---|---|---|
| | INTERNAL KNOWLEDGE | EXTERNAL KNOWLEDGE | TRANSFER OF KNOWLEDGE |
| Intercept | 2.38 (0.06)*** | 3.71 (0.08)*** | 1.29 (1.43) |
| Interdependence | 0.10 (0.02)*** | | |
| Intra-MNC trade | 0.08 (0.01)*** | | |
| Autonomy | | 0.09 (0.04)** | |
| Internal knowledge | | | 0.99 (0.24)*** |
| External knowledge | | | -1.33 (0.56)** |
| Internal knowledge* External knowledge | | | 0.28 (0.01)*** |
| Employees | | | 0.00002 (0.00002) |
| Formation | | | 0.26 (0.06)*** |
| Country dummies: | | | |
| - Austria | | | 0.32 (0.24) |
| - Denmark | | | -0.39 (0.13)*** |
| - Finland | | | 0.10 (0.18) |
| - Germany | | | 0.20 (0.26) |
| - Norway | | | -0.50 (0.11)*** |
| - Sweden | | | -0.49 (0.11)*** |
| F-value | 90.61*** | 2.30** | 73.40*** |
| R-square | | | 0.44 |
| N | 2056 | 2056 | 2056 |

***, ** and * = significant at 1, 5 and 10 per cent, respectively.

**Figure 1**

***Simple representation of MNC as a knowledge structure***

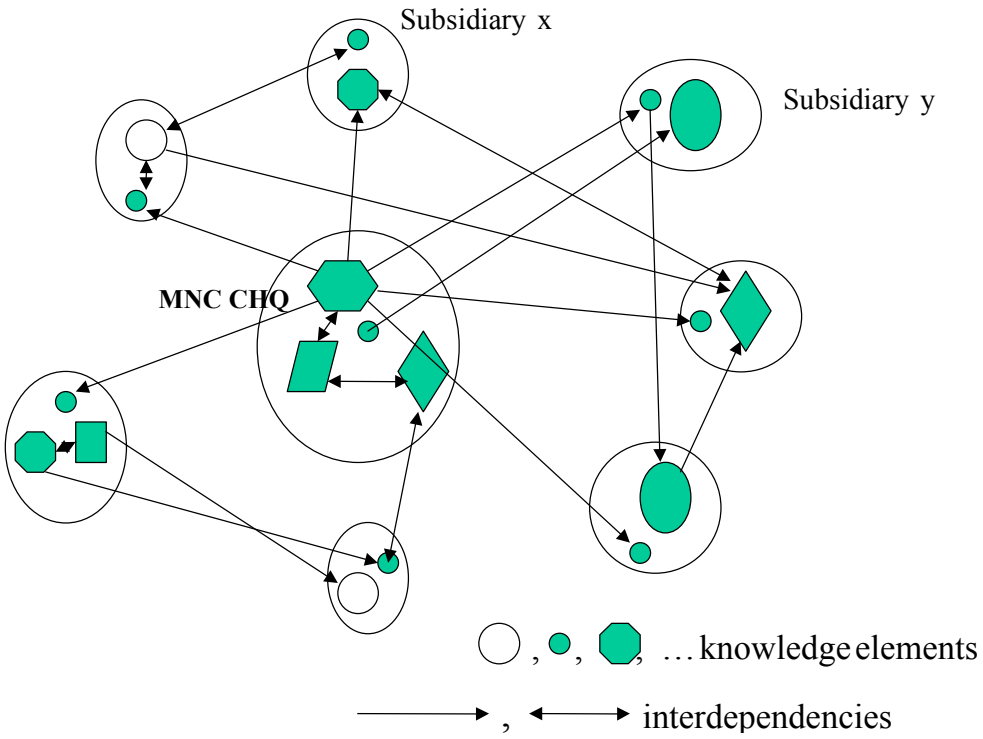
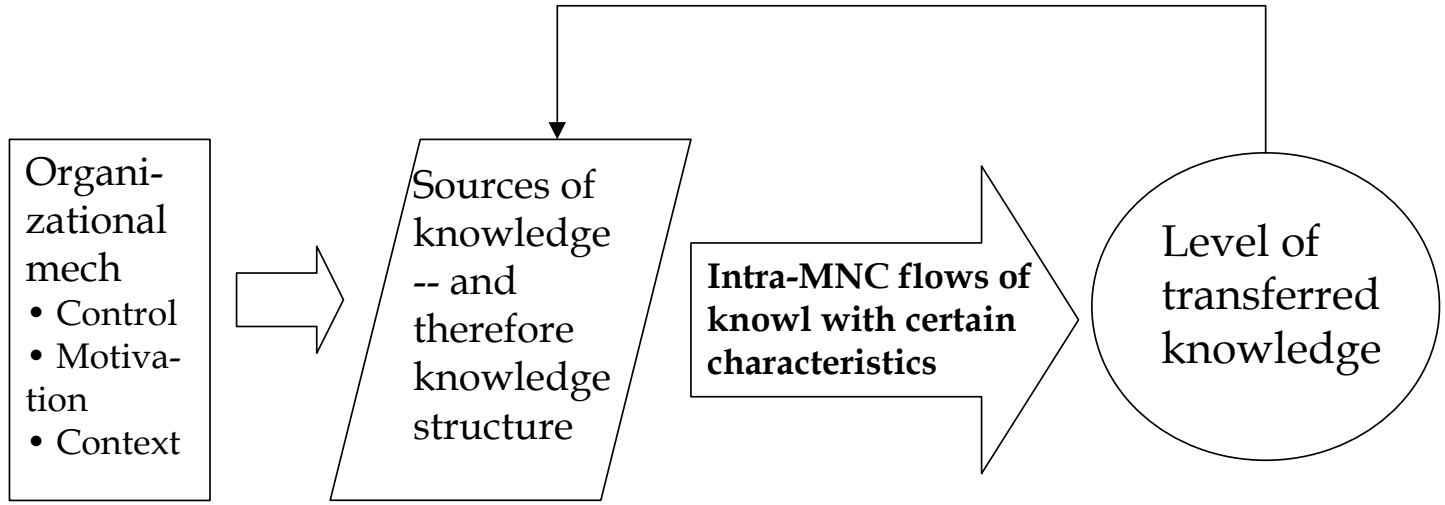


*Figure 2: Variables and Mechanisms*




***(Managerial discretion)*** ***(Knowledge stocks)*** ***(Knowledge flows)***

**Figure 3**: *The hypothesized model*