



Transferring knowledge in MNCs: The role of sources of subsidiary knowledge and organizational context

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Abstract

We link up with the recent literature on the differentiated MNC and in particular with its stress on intra-MNC knowledge flows. However, rather than focusing on the characteristics of knowledge as determinants of knowledge transfer within MNCs, we focus instead on levels of knowledge in subsidiaries, the sources of transferable subsidiary knowledge and on the organizational means and conditions that realize knowledge transfer as the relevant determinants. We find largely positive support for the relevant hypotheses. These are tested on a unique dataset on knowledge development in subsidiary firms [the Centre of Excellence (CoE) project]. © 2002 Elsevier Science Inc. All rights reserved.

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1. Introduction

It is generally accepted that knowledge ranks first in the hierarchy of strategically relevant resources (e.g., Grant, 1996). More precisely, the issue of the degree to which valuable knowledge can be imitated by rival firms is seen as crucial to the understanding of competitive advantage and its sustainability (Lippman and Rumelt, 1982; Simonin, 1999). Accordingly, a

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cottage industry has emerged on the various characteristics of knowledge that may hinder the imitability of rent-yielding knowledge assets, such as causal ambiguity (Lippman and Rumelt, 1982), complexity and tacitness (Barney, 1991). Much of this has taken place in the context of work on the resource-based (Wernerfelt, 1984; Barney, 1991), knowledge-based (Grant, 1996) and evolutionary theories of the firm (Nelson and Winter, 1982).

However, the issues of the knowledge-based determinants of competitive advantage and the creation and renewal of knowledge have not yet been satisfactorily integrated in the above literatures. Moreover, the literatures on the connection between knowledge and competitive advantage have paid rather little attention to the organizational aspects of the connection. For example, little attention has been paid to which organizational mechanisms may decrease “internal stickiness” (Szulanski, 1996) and help diffusing valuable knowledge inside the firms while still keeping knowledge hard to imitate to would-be imitating rivals.

A parallel interest in knowledge as a strategic resource has characterized much research in international business, perhaps particularly during the last decade and a half (Bartlett and Ghoshal, 1986; Gupta and Govindarajan, 1991; Kogut and Zander, 1993).¹ Some of this research has drawn upon the above type of research into those dimensions of knowledge assets that hinder imitability (e.g., Kogut and Zander, 1993; Simonin, 1999).² A concern with knowledge as a source of competitive advantage and on the renewal of competitive advantage through building new knowledge has also characterized the literature on the differentiated multinational corporation (Bartlett and Ghoshal, 1986, 1989; Birkinshaw, 1996). A well-known argument posits that the differentiated MNC is in fact more favorably positioned than the nondifferentiated MNC or the purely domestic firm with respect to mobilizing knowledge in the creation and renewal of competitive advantage, *ceteris paribus*, simply because of its access to more knowledge networks, internal as well as external (Hedlund, 1986; Bartlett and Ghoshal, 1989). In different terms, the differentiated MNC can strike an exploitation/exploration tradeoff (March, 1991) that may not be available to, for example, purely domestic firms.

In such a perspective, the organizational design problem is to choose organizational instruments of control, motivation and context in such a way that (1) subsidiaries actually access and produce knowledge, for example, through tapping into local knowledge bases, (2) communication is established between those who need and those who possess knowledge and (3) the relevant subsidiary knowledge is actually made available to those MNC units that need it.

¹ One may rightly point out that knowledge has been central in the theory of the MNC since Hymer’s (1960/1976) early work. However, the focus on knowledge has traditionally been a (static) matter of explaining the existence of the MNC by focusing on failures in markets for knowledge rather than on (dynamically) stressing the MNCs distinct capabilities of realizing competitive advantages through managing knowledge flows.

² However, even as late as 1994, Crossan and Inkpen (1994, p. 271) could 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.”

Among other things, 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 et al., 1999) and perhaps even as “centres of excellence (CoE)” (Moore and Birkinshaw, 1998; Holm and Pedersen, 2000a). In fact, recent research has emphasized the need for direct *lateral* mechanisms between individual subsidiaries (Moore and Birkinshaw, 1998).

However, much of the empirical (if perhaps not the theoretical) research on the differentiated MNC still tends to focus on characteristics of knowledge and characteristics of senders and receivers rather than on organizational means of transferring knowledge. Moreover, much of this literature is silent on the sources of transferable subsidiary knowledge (but see Porter and Sölvell, 1999; Forsgren et al., 1999), for example, whether transferable subsidiary knowledge is largely internally produced or acquired through interacting with firms in networks or acquired through interaction with local knowledge institutions, etc. However, not only may the sources of subsidiary knowledge strongly condition the characteristics of knowledge but it may also be of more direct managerial relevance. Thus, while it may not be directly helpful for a manager to be told that competitive advantage is best sustained if the rent-yielding knowledge asset conforms to certain criteria (like tacitness, ambiguity, etc.), it may be quite helpful to be told that certain sources of knowledge are more likely to be associated with these criteria than other sources. This is because it may be difficult to change the characteristics of knowledge by managerial action, but managerial action may change the mode of knowledge acquisition.

In the present paper, we link up with the recent literature on the differentiated MNC. However, rather than focusing on the characteristics of knowledge that hinder or stimulate knowledge transfer within the MNC, we focus instead on the sources of potentially transferable subsidiary knowledge. We distinguish between knowledge sourced from internal development of knowledge in the subsidiary, knowledge sourced from network relations and knowledge sourced from local clusters. We argue that these sources condition the characteristics of knowledge in specific ways. Therefore, they require different organizational means and conditions of transfer. For example, the extent of interdependence among the MNC units, the amount of intra-MNC trade and the autonomy of the subsidiary are all conditions that we argue influence in different ways the expected success of transferring knowledge from different sources.

In sum, our contributions in this paper are (1) to examine how well knowledge acquired by subsidiaries and stemming from diverse sources is transferred within an MNC and (2) to examine the organizational means and conditions specific to individual MNCs that condition the success of transferring knowledge, arguing in effect that knowledge stemming from different sources requires different organizational means and conditions for successful transfer. Both of these two contributions are, to our knowledge, novel to the literature. Moreover, the hypotheses related to how the sources of knowledge and organizational context influence knowledge transfer are tested on the basis of a unique and dataset on subsidiary knowledge development that has been constructed in connection with the cross-national research project “Centres of Excellence” (Holm and Pedersen, 2000a). The dataset covers more than 2000 subsidiaries located in seven different European countries.

2. Theoretical model (Fig. 1)

Although it is widely accepted 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 knowledge transfer are likely to be substantial. Thus, Teece (1981) estimated that transfer costs for the intra-MNC technology transfer cases he examined ranged from 2.24% to 59% with a mean of 19.16%. In the view of Kogut and Zander (1993, p. 630) “. . .these costs are derived from the efforts to codify and teaching complex knowledge to recipient.”

Along similar lines, 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. In fact, rather little is known about the determinants of intra-MNC knowledge flows in spite of their obvious importance to theoretical arguments about the MNC. Thus, Gupta and Govindarajan (2000, p. 474) observe 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.”

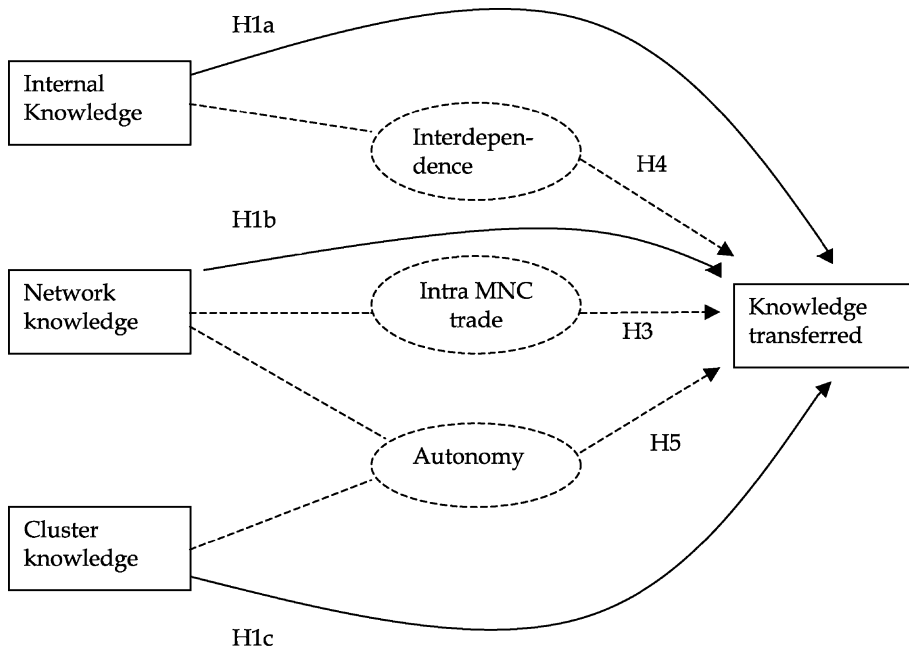


Fig. 1. The hypothesized model.

In this section, we develop the theoretical arguments that intra-MNC knowledge transfer is influenced by the intensity of knowledge production and knowledge absorption of subsidiaries, the sources of knowledge and the organizational instruments and conditions that surround the transfer of knowledge within an MNC. These determinants are discussed seriatim in the following.

2.1. Intensity of subsidiary knowledge production and absorption

As a trivial matter, for knowledge transfers from a subsidiary to the MNC headquarters or to other subsidiaries to take place, transferable knowledge has to exist. As we later discuss, we focus on three main sources of such transferable knowledge, namely internal development, networks and local clusters. Less trivially, a basic organizational problem is to motivate the subsidiary to actually transfer knowledge that may be useful to other subsidiaries. One set of problems is who should bear the resource costs of transferring knowledge and how the parties to the knowledge exchange are to be compensated. We shall abstract from this problem and assume that it can be handled by the subsidiaries and the headquarters through structuring compensations in the right way (O'Donnell, 2000). 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 (Holm and Pedersen, 2000b), which may be quite unattractive. Gupta and Govindarajan (2000, p. 475) briefly point to such a problem.

However, whether this is a serious problem depends not only on whether MNC headquarters can somehow force or motivate subsidiaries to transfer knowledge to other subsidiaries or to headquarters but also depends on the time frame. Thus, the knowledge monopoly problem is likely to be much more serious in a static context than in a dynamic one. In a dynamic setting, generalized knowledge exchange may catch on in a network of subsidiaries, so that subsidiaries are motivated to transfer knowledge to each other through the discipline of repeated dealings (Klein and Leffler, 1981). In fact, in a dynamic context, one may *gain* power by transferring knowledge. This is because influence is likely to flow to a subsidiary that is able to continuously transfer knowledge to other subsidiaries.³ In contrast, the argument that knowledge transfer diminishes power implicitly assumes that once knowledge is transferred, the subsidiary is on par with everybody else in the MNC in terms of knowledge held and therefore cannot exercise any power based on the control of knowledge assets.

Here, 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. The ability of headquarters to influence the transfer of knowledge through control and incentive

³ Thus, the power-wielding asset is the dynamic capability to produce and transfer new knowledge. For further discussion, see, for example, Forsgren et al. (1999, p. 184).

mechanisms only reinforces this. In other words, to the extent that subsidiaries control knowledge that may be useful to other units in the MNC, they will in fact make an attempt to transfer this knowledge. Therefore, we state the following set of hypotheses:

Hypothesis 1: The more knowledge that the subsidiary creates and absorbs, the more knowledge will be transferred to other units in the MNC. (a) The more knowledge that the subsidiary creates through investing in internal production of knowledge, the more knowledge will be transferred to other units in the MNC. (b) The more knowledge that the subsidiary creates and absorbs through network relations to external partners (customers, suppliers, etc.), the more knowledge will be transferred to other units in the MNC. (c) The more knowledge that the subsidiary creates and absorbs by tapping into the knowledge base of a local cluster (e.g., a well-educated workforce, high-quality research institutions, etc.), the more knowledge will be transferred to other units in the MNC.

Two things should be noted in connection with these hypotheses. First, transfer of knowledge does not imply a “full” replication of knowledge in a new location. Indeed, transfer of knowledge is often associated with modification of the existing knowledge to the specific context. Therefore, what is transferred is not the underlying knowledge but rather applications of this knowledge in the form of solutions to specific problems. Second, note that the hypotheses are cautiously stated so that a qualitative change leads to another sign-preserving qualitative change. This is because of the many nonmotivational barriers to the process of transferring knowledge. We treat this next.

2.2. Sources of subsidiary knowledge and barriers to knowledge transfer

The basic premise for work on the differentiated MNC is that subsidiaries control heterogeneous stocks of knowledge and that competitive advantages can be achieved from orchestrating knowledge flows between MNC units in such a way that knowledge is transferred to those MNC units where it will increase value-added. In this connection, much has been made out of the directionality of knowledge flows (e.g., Gupta and Govindarajan, 1991), the centrality of certain subsidiaries (Birkinshaw, 1996) and patterns of corporate control (Egelhoff, 1988). Arguably, less attention has been devoted to the determinants of intra-MNC knowledge transfer, although work has been done on motivational and cognitive barriers to knowledge transfer (Zander and Kogut, 1995; Gupta and Govindarajan, 2000). In Section 2.1, we briefly discussed motivational barriers to transfer. Nonmotivational barriers to transfer are usually conceptualized in terms of such factors as causal ambiguity, complexity, tacitness, absorptive capacity and the like. Although they make perfect theoretical sense, these variables are hard to operationalize.⁴ A more operational approach may be to examine how the *sources* of subsidiary knowledge influence intra-MNC knowledge transfer.

⁴ However, a few successful attempts do exist (Kogut and Zander, 1993; Simonin, 1999; Gupta and Govindarajan, 2000).

Although an internal element necessarily enters into the production of all subsidiary knowledge, it makes sense to distinguish between

1. knowledge that is produced mainly through investing in the internal production of knowledge (e.g., much R&D) or from learning by doing, using, etc.,
2. knowledge that is to a large extent created on the basis of knowledge inputs from network relations to external partners (customers, suppliers, etc.) and
3. knowledge that is to a large extent created 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. 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. Because of their characteristics, such knowledge is strongly intertwined with the organization itself and are therefore hard (very costly) to trade in the market. This leads us directly to the conventional argument for the existence of the MNC, which asserts that MNCs exist because of their comparative advantages of transferring knowledge. However, that argument fails to distinguish between the transfer of knowledge that differs in terms of its sources. We argue that the ease of transfer of knowledge will be influenced by the sources of the knowledge.

Of course, no knowledge is entirely internally accumulated (Nohria and Eccles, 1992). For example, parts of the knowledge base of a subsidiary firm are likely to be the result of previous knowledge transfer from other MNC units.⁵ Nevertheless, it makes sense to say that some knowledge is largely internally produced, while some other knowledge is strongly based on external knowledge inputs. We distinguish among 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 (Ford, 1990). In contrast, “cluster-based knowledge” is not to the same extent the result of long-lasting interaction with specific parties. Rather, it refers to knowledge controlled by the subsidiary that to a substantial extent is based upon knowledge inputs from, for example, a well-educated work force or local knowledge institutions, such as technical universities, etc. (Porter, 1990).

Our distinction between three types of sources of knowledge that enter into 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 internal, network and cluster components. The advantage of our distinction

⁵ We shall, however, treat such knowledge inputs as internal (to the MNC network) in nature.

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 a priori 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.

Cautiousness is necessary because the three sources of knowledge might be highly correlated and intertwined in a way, so it is rather the combination of the different types of knowledge than each of the knowledge sources that matters. However, as we have no a priori expectations on how the knowledge sources should interact, we will leave it as an empirical problem to what extent the knowledge sources are, in fact, correlated.

Sidestepping motivational issues (which have been dealt with earlier), the success of knowledge transfer is primarily a matter of the existence and richness of transmission channels (Bartlett and Ghoshal, 1989; Ghoshal et al., 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).

Thus, of the three knowledge sources that enter into the subsidiary knowledge base, we submit that internally accumulated knowledge is likely to be the type of knowledge that is most easily transferable and of which most will be transferred. This is because such knowledge to a large extent is based on knowledge that has already been transferred to the subsidiary from other MNC units. Moreover, one reason why some subsidiaries control a knowledge base that is characterized by many internally accumulated elements may have to do with a strategic decision at the MNC level concerning the localization of processes of knowledge creation. Thus, there is likely to be considerable understanding of the knowledge developed internally in the subsidiary at least at a headquarters level. In sum, 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.

Network-based knowledge is likely to be less easily transferable than internally accumulated knowledge. This is because it is largely derived from the specific problems and needs of external local counterparts. It is therefore likely to contain many tacit elements. Still, because network-based knowledge relates to the subsidiary's products or processes, much of it will still be transferable, at least to those other MNC units that have similar products or processes. Finally, cluster-based knowledge will be the kind of knowledge that will be least transferred. This seems counterintuitive: Arguably, some cluster-based knowledge, for example, knowledge inputs from local universities, may be less characterized by tacit elements than, say, internally accumulated knowledge. 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 Zedtwitz, 1999). Therefore, much of the content of cluster-based knowledge is likely consist 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. Thus, to sum up, we put forward the following hypothesis:

Hypothesis 2: More internally accumulated knowledge will be transferred from subsidiaries to other MNC units than network-based knowledge, which in turn will be more transferred than cluster-based knowledge.

2.3. Organizational means and conditions of knowledge transfer

Because knowledge built from different sources (internal, cluster and network) is associated with different degrees of ease of transfer, the process of knowledge transfer is likely to be supported by different organizational means and conditions. By “organizational means and conditions,” we refer to such issues as the degree and type of interdependence between MNC units and the management of that interdependence through formal systems and informal processes (Bartlett and Ghoshal, 1989; Gupta and Govindarajan, 1991, 1995; Buckley and Carter, 1999; O’Donnell, 2000). A key theme in many recent contributions to the theory of the MNC is that—under norms of administrative rationality—the degree and type of interdependence strongly condition the choice of types of management systems and processes for managing subsidiary relations (*ibid.*).

We agree with the basic thrust of this literature. However, the type and degree of interdependence is not the only determinant of the choice of administrative and managerial systems and processes. We argue that the concern with this link be supplemented with attention to how the sources of subsidiary knowledge conditions the choice of such systems and processes. For example, subsidiary knowledge with a large component of network-based knowledge may require different administrative mechanism for its successful transfer than subsidiary knowledge with a large component of internally accumulated knowledge. Transfer of network-based knowledge may require nonroutine communication, such as the temporary transfer of people from the transferring to the receiving MNC unit (e.g., cross-unit teams and job rotation), for its successful transfer.

In general, network-based subsidiary knowledge is likely to require close and rich communication between the transferring and the receiving MNC unit/subsidiary. Further, such communication is likely to be stimulated by the transfer of goods and/or services between MNC units. First, 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. Second, network-based knowledge is per definition derived from needs and problems of counterparts. To the extent that such knowledge is embodied in products and services, which are then transferred to other MNC units, it is likely to give rise to communication about possible modifications in goods and/or services, so that these may better be adapted to the needs of the receiving MNC unit. We may therefore put forward the following hypothesis:

Hypothesis 3: Network-based knowledge will be more successfully transferred to other MNC units if there is substantial transfer of goods and/or services between the transferring and the receiving units.

We argued earlier that when the knowledge bases of some subsidiaries show a high proportion of knowledge that is mainly accumulated internally, this may reflect MNC level strategic choices, in the sense that headquarters establish a pattern of specialization in the accumulation in certain types of knowledge within the MNC. Such MNC-wide specialization evidently implies a high degree of interdependence. Thus, we hypothesize that

Hypothesis 4: Knowledge that is mainly accumulated internally will be more successfully transferred to other MNC units if there is a high degree of interdependence between the transferring unit and the receiving units.

Finally, we argue that a very important aspect of the management of subsidiaries in the MNC network is the autonomy granted to the subsidiary. If subsidiary knowledge is mainly based on external knowledge (i.e., network and cluster-based), it is hard for MNC headquarters and top management to direct the subsidiary's acquisition of such knowledge in any detailed manner because of the knowledge asymmetry (Jensen and Meckling, 1992). In that case, it may be better to delegate decision rights to the subsidiary (Aghion and Tirole, 1997), that is, increase its autonomy. We have earlier argued that to the extent that a subsidiary is engaged in knowledge trading with other subsidiaries, this counteracts the control loss that accompanies giving a subsidiary increased autonomy. Thus, giving a subsidiary more autonomy allows it to better tap into networks and local clusters and also means that more knowledge will be more successfully transferred to other MNC units. Hence, we have the following hypothesis:

Hypothesis 5: Knowledge that is strongly based on participation in networks and local clusters will be more successfully transferred to other MNC units if the transferring unit has been given a high degree of autonomy.

The hypotheses are summarized in the following model.

3. Data and method

3.1. Data collection

The data that we use here have been collected as part of the CoE project that engaged researchers in the Nordic countries, the UK, 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 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, the construction of such a questionnaire was accomplished.⁶

⁶ For more information on the CoE project, see Holm and Pedersen (2000a).

For practical reasons, it was decided that each project member would be responsible for gathering data on foreign-owned subsidiaries within their own country. Thus, all subsidiaries in the database belong to MNCs. In the process of data gathering, subsidiary managers, rather than headquarters, were 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 has a reliable awareness of its own competencies, it would clearly 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% of the questionnaires were answered by subsidiary executive officers, while financial managers, marketing managers or controllers in the subsidiary answered the remaining 20%. The response rate varies between 20% (UK) and 55% (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%.

As shown in Table 1, the total sample covers information on 2107 subsidiaries. It comprises all kinds of subsidiaries in all fields of business. Between countries, the 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 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),

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

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 2.

In general, the subsidiaries are indicating that they comprise 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.

3.2. Measures

All data were collected through the questionnaire and most items 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.

3.2.1. Knowledge transfer

Recall that our definition of knowledge transfer was capturing the application rather than the physical transfer 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 abovementioned activities. *Knowledge transfer* is a multi-item construct calculated as the average score reported by respondents across these six items ($\alpha=.69$).

3.2.2. Internal knowledge

The construct of internal knowledge captures the subsidiaries’ own effort of knowledge production. This construct was measured by asking respondents to assess the level of

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

investments in the subsidiary in the past 3 years, where 1 = very limited, 7 = substantial. The level of investments was assessed for all the six abovementioned activities. In the models used to test our hypotheses, we use a composite measure, *Internal knowledge*, based on the average across all six items ($\alpha = .70$).

3.2.3. *Network knowledge*

The variable of network knowledge captures the importance of external counterparts like customers and suppliers as sources of knowledge creation in the subsidiary. It 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. Our measure, *Network knowledge*, is the average of the individual scores ($\alpha = .62$).

3.2.4. *Cluster knowledge*

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 intercorrelation between many of the items motivated us to construct a composite index. *Cluster knowledge* is calculated as the average score reported by respondents across these seven items ($\alpha = .66$).

3.2.5. *Interdependence*

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.

3.2.6. *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 semiproducts and final goods and services.

3.2.7. *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 = subcorporate (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 and approval of quarterly plan/schedules. Our measure, *Autonomy*, is based on the average of these six items ($\alpha = .61$).

3.2.8. *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), the age of the subsidiary (a proxy for accumulated experience) and its mode of formation (greenfield or acquisition). We expect that larger, more established (i.e., older) 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 with respect to the role of entry mode for the extent of knowledge transfer.

4. Results

4.1. *Tests of hypotheses*

A correlation matrix of all the independent variables in the model is presented in Appendix A. As can be seen, no more than 21 out of 36 pairwise correlations are highly significant (1% level). However, this is hardly surprising given the large number of observations (2,107). The highest correlation coefficient is between age and formation with the value of .37, which is well below the usual threshold of .5 (Hair et al., 1995). However, in order to detect potential multicollinearity problems, we have included the tolerance values where the tolerance is the amount of variability of the selected independent variable not explained by the other independent variables. The tolerance value for each variable is shown in Table 3. The lowest values are for the two control variables, mode of formation (.78) and age of subsidiary (.81). However, both are well above the usually applied thresholds (Hair et al., 1995). Therefore, we do not expect any multicollinearity problems.

The correlation matrix suggests that there is a high correlation among the three sources of subsidiary knowledge with all three pairwise correlations being significant at 1% level. This indicates that there might be leeway for exploring complementarities among the knowledge sources in future research. However, as already mentioned, the high correlations do not create a multicollinearity problem since the tolerance values of internal knowledge (.83), network knowledge (.87) and cluster knowledge (.90) are far above the threshold (Hair et al., 1995). The tolerance values indicate that only 10–17% of the variation in each of the knowledge source variables are explained by other independent variables included in the model.

Table 3
Factors affecting the extent of knowledge transfer to other MNC units

	Parameter estimates	Tolerance
Constant	0.039** (0.020)	
Internal knowledge	0.375*** (0.021)	0.83
Network knowledge	0.178*** (0.020)	0.87
Cluster knowledge	0.083*** (0.020)	0.90
Interdependence	0.166*** (0.021)	0.80
Intra-MNC trade	0.146*** (0.020)	0.87
Autonomy	0.056*** (0.020)	0.92
Internal knowledge × Interdependence	0.065*** (0.019)	0.96
Network knowledge × Intra-MNC trade	0.029 (0.019)	0.97
Network knowledge × Autonomy	−0.014 (0.019)	0.97
Cluster knowledge × Autonomy	0.044** (0.020)	0.95
Number of employees	0.795*** (0.159)	0.92
Age of the subsidiary	0.039* (0.021)	0.81
Formation (1 = Greenfield, 2 = Acquisition)	0.086*** (0.022)	0.78
<i>F</i> -value	89.76***	
<i>R</i> ²	41.9	
<i>N</i>	1.629	

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Since all variables in the model are measured as continuous variables or dummies (as in the case of mode of formation), we can apply standard regression techniques. However, since Hypothesis 2 is about the relative strengths of the three different sources of subsidiary knowledge and the variables is not measured on the same scale, we have standardized all variables in the model with mean = 0 and standard deviation = 1. This makes it possible to use the parameters in the model to compare the relative strengths of the variables.

It is straightforward to test Hypothesis 1a–c, while 3–5 are tested by including the interaction term between the knowledge source and the organizational mechanism. The result of the total model is reported in Table 3. Numbers in parentheses represent standard errors.

Overall, the model works very well with a highly significant *F*-value of 89.8 and an *R*² of 41.9. 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.

Hypothesis 1a–c posited a relationship between sources of subsidiary knowledge and the transfer of that knowledge to other MNC units. These hypotheses are strongly supported. All three knowledge sources (internal, network and cluster knowledge) have a significantly positive relationship with the extent of knowledge transfer (all at the 1% level). However, the parameter for internal knowledge (.375) is substantially higher than for the two external knowledge sources (.178 and .083), indicating that internal knowledge is transferred to a much larger extent transfer than network and cluster knowledge. The parameter for net-

work knowledge is somewhat higher than for cluster knowledge. All in all, Hypothesis 2 is supported which points to the conclusion that not all knowledge is transferred to the same extent, and the sources of knowledge seems to be a good indicator for the extent to which knowledge is actually transferred. We argue that this is because the sources of knowledge are determining the characteristics of knowledge, and in this case of internal MNC knowledge transfer, the context specificity of the knowledge turn out to be of major importance.

Hypotheses 3–5 were concerned with the organizational mechanism as facilitators of the knowledge transfer for the different sources of knowledge. In Hypothesis 3, we posited that intra-MNC trade would interact positively with network knowledge in the process of knowledge transfer. However, the interaction term between network knowledge and intra-MNC trade does not meet the requirements for significance, although with a value of .12, it is close to reaching the acceptable level. Therefore, Hypothesis 3 is not supported.

In the same vein, we posited that interdependence would interact positively with internal knowledge (Hypothesis 4). This hypothesis is strongly supported by the highly significant (at 1% level) and positive interaction term. Hypothesis 5 on the positive interaction between cluster and network knowledge, respectively, and autonomy is supported with regard to cluster knowledge (at 5% level), but not for network knowledge.

The three organizational mechanisms—interdependence, intra-MNC trade and autonomy—are also significantly and positively affecting the knowledge transfer in itself.

Moreover, all three control variables—the size, age and the formation of the subsidiary—turn out to be highly significant, indicating that larger experienced subsidiaries and acquisitions rather than greenfields do transfer more knowledge to other MNC units.

5. Concluding comments

In this paper, we have addressed the issue of intra-MNC knowledge transfer in a novel way. Whereas most of the literature has focused directly on either the characteristics of knowledge in terms of causal ambiguity, tacitness, etc., or the links between interdependencies and administrative systems and processes, we have taken a perhaps more direct approach and focused on the levels of subsidiary knowledge, the sources of this knowledge and organizational means and conditions as important determinants of knowledge transfer.

We found support for the main argument of the paper that the sources of knowledge are determinative of the characteristics of knowledge-to-be-transferred and that knowledge with different characteristics needs different organizational mechanism to facilitate the transfer of that knowledge. The source of knowledge—whether internal, network or cluster-based—has a profound impact on the characteristics of knowledge. In turn, this affects the extent of knowledge transfer. In particular, the context specificity of the knowledge has an effect on the extent of knowledge transfer, both because the more context specific the knowledge is, the smaller the absorptive capacity of the received and the less it can be used in other MNC units.

Moreover, given the different characteristics of the knowledge, it cannot be transferred in the same way. Thus, even in the case of MNCs, internal knowledge transfer is not an easy task. MNCs need to apply different organizational mechanisms in order to facilitate knowledge transfer and depending on the specific characteristics of the knowledge. For a differentiated MNC engaged in global knowledge sourcing, a main organizational task is to develop a large spectrum of different organizational mechanism. In some instances, as with subsidiaries tapping into local cluster knowledge, the autonomy of the subsidiary seems to be important for the knowledge transfer, while interdependence between the subsidiary and the other MNC units are very important for the knowledge transfer in the case of internal production of subsidiary knowledge.

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 and 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. Another limitation that is also dictated by the nature of dataset concerns the role of motivation factors. However, we may invoke the Szulanski (1996) findings that motivational factors were of relatively minor importance for understanding the efficiency of knowledge transfer as a partial justification for neglecting motivational issues.

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Appendix A. Correlation matrix of the independent variables

	1	2	3	4	5	6	7	8
(1) Internal knowledge	1.00							
(2) Network knowledge	.31***	1.00						
(3) Cluster knowledge	.19***	.21***	1.00					
(4) Interdependence	.12***	.20***	.13***	1.00				
(5) Intra-MNC trade	.18***	.09***	.14***	.30***	1.00			

(6) Autonomy	.12***	.01	– .03	– .20***	– .06 **	1.00		
(7) Employees	.03	.001	.003	.02	.08***	– .02	1.00	
(8) Age	.003	.01	.07***	.14***	.05 **	– .06 **	.001	1.00
(9) Formation	.17***	.08***	.03	– .15***	.08***	.11***	.03	– .37***

All the variables have mean = 0 and standard deviation = 1.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

References

- Aghion, P., Tirole, J., 1997. Formal and real authority in organizations. *J. Polit. Econ.* 105, 1–29.
- Barney, J.B., 1991. Firm resources and sustained competitive advantage. *J. Manage.* 17, 99–120.
- Bartlett, C.A., Ghoshal, S., 1986. Tap your subsidiaries for global reach. *Harv. Bus. Rev.* 64 (4), 87–94.
- Bartlett, C.A., Ghoshal, S., 1989. *Managing Across Borders: The Transnational Solution*. Harvard Business School Press, Boston.
- Birkinshaw, J., 1996. How multinational subsidiary mandates are gained and lost. *J. Int. Bus. Stud.* 27, 467–495.
- Buckley, P.J., Carter, M., 1999. Managing cross-border complementary knowledge. *Int. Stud. Manage. Organ.* 29, 80–104.
- Crossan, M.M., Inkpen, A.C., 1994. Promise and reality of learning through alliances. *International Executive* 36, 263–273.
- Egelhoff, W.G., 1988. *Organizing the Multinational Enterprise: An Information Processing View*. Ballinger, Cambridge, MA.
- Ford, D., 1990. *Understanding Business Markets: Interaction, Relationships, Networks*. Academic Press, London.
- Forsgren, M., Pedersen, T., Foss, N.J., 1999. Accounting for the strengths of MNC subsidiaries: the case of foreign-owned firms in Denmark. *Int. Bus. Rev.* 8, 181–196.
- Gassman, O., von Zedtwitz, M., 1999. New concepts and trends in international R&D organization. *Res. Policy* 28, 231–250.
- Ghoshal, S., Korine, H., Szulanski, G., 1994. Interunit communication in multinational corporations. *Manage. Sci.* 40 (1), 96–110.
- Grant, R.M., 1996. Toward a knowledge-based theory of the firm. *Strategic Manage. J.* 17, 109–122.
- Gupta, A.K., Govindarajan, V., 1991. Knowledge flows and the structure of control within multinational corporations. *Acad. Manage. Rev.* 16, 768–792.
- Gupta, A.K., Govindarajan, V., 1995. Organizing for knowledge flows within MNCs. *Int. Bus. Rev.* 3, 443–457.
- Gupta, A.K., Govindarajan, V., 2000. Knowledge flows within multinational corporations. *Strategic Manage. J.* 21, 473–496.
- Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C., 1995. *Multivariate data analysis*, fourth ed. Prentice-Hall, Englewood Cliffs, NJ.
- Hart, O., 1995. *Firms, Contracts, and Financial Structure*. Oxford Univ. Press, Oxford.
- Hedlund, G., 1986. The hypermodern MNC — a heterarchy? *Hum. Resour. Manage.* 21 (1), 9–35.
- Holm, U., Pedersen, T., 2000a. *The Emergence and Impact of MNC Centres of Excellence*. Macmillan, Basingstoke.
- Holm, U., Pedersen, T., 2000. *The Dilemma of Centres of Excellence: Contextual Creation of Knowledge versus Global Transfer of Knowledge*, LINK Working Paper no 8.
- Hymer, S.H., 1960. *The International Operations of National Firms: A Study of Direct Foreign Investment*. MIT Press, Cambridge, MA.
- Jensen, M.C., Meckling, W.H., 1992. Specific and general knowledge and organizational structure. In: Werin, L., Wijkander, H. (Eds.), *Contract Economics*. Blackwell, Oxford.

- Klein, B., Leffler, K., 1981. The role of market forces in assuring contractual performance. *J. Polit. Econ.* 89, 615–641.
- Kogut, B., Zander, U., 1993. Knowledge of the firm and the evolutionary theory of the multinational corporation. *J. Int. Bus. Stud.* 24, 625–646.
- Lippman, S., Rumelt, R.P., 1982. Uncertain imitability: an analysis of interfirm differences in efficiency under competition. *Bell J. Econ.* 13, 418–438.
- March, J.G., 1991. Exploration and exploitation in organizational learning. In: Cohen, M.D., Sproull L. (Eds.), 1996. *Organizational Learning*. Sage, London.
- Moore, K., Birkinshaw, J., 1998. Managing knowledge in global service firms: centers of excellence. *Acad. Manage. Exec.* 12, 81–92.
- Nelson, R.R., Winter, S.G., 1982. *An Evolutionary Theory of Economic Change*. The Belknap Press, Cambridge, MA.
- Nohria, N., Eccles, R.G., 1992. *Networks and Organizations: Structure, Form and Action*. Harvard Business School Press, Boston.
- O'Donnell, S.W., 2000. Managing foreign subsidiaries: agents of headquarters, or an independent network? *Strategic Manage. J.* 21, 525–548.
- Porter, M.E., 1990. *The Competitive Advantage of Nations*. Free Press, New York.
- Porter, M.E., Sölvell, Ö., 1999. The role of geography in the process of innovation and the sustainable competitive advantage of firms. In: Chandler, A.D., Hagström, P., Sölvell, Ö. (Eds.), *The Dynamic Firm—The Role of Technology, Strategy Organization, and Regions*. Oxford University Press, Oxford.
- Roth, K., Morrison, A.J., 1992. Implementing global strategy: characteristics of global subsidiary mandates. *J. Int. Bus. Stud.* 23, 715–736.
- Simonin, B., 1999. Ambiguity and the process of knowledge transfer in strategic alliances. *Strategic Manage. J.* 20, 595–623.
- Szulanski, G., 1996, Winter. Exploring internal stickiness: impediments to the transfer of best practice within the firm. *Strategic Manage. J.* 17, 27–43 (Special Issue).
- Teece, D.J., 1981. The market for know-how and the efficient international transfer of technology. *Ann., AAPSS* 458, 81–96.
- Wernerfelt, B., 1984. A resource based view of the firm. *Strategic Manage. J.* 9, 443–454.
- Zander, U., Kogut, B., 1995. Knowledge and the speed of the transfer and imitation of organizational capabilities. *Organ. Sci.* 6, 76–92.