MULTINATIONAL ENTERPRISES AND COMPETENCE-CREATING KNOWLEDGE FLOWS:
A THEORETICAL ANALYSIS


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Abstract
In recent years, considerable evidence has been gathered, pointing to knowledge creation by MNE subsidiaries through tapping into local centers of leading technologies. This process has implications for the MNE’s network, for its overall performance, as well as for the host location of the subsidiary. In the paper we attempt to characterize the strategic behavior of the MNE in managing knowledge flows (both inflows and outflows) to maximize value creation. The critical element of the analysis is to focus on the MNE’s ability to leverage its internal network of subsidiaries in order to integrate knowledge bases that are geographically dispersed. We characterize competence-creation at the home site as well as at subsidiary sites. We also examine the implications for the locations where the MNE operates.

KEYWORDS: Knowledge management, multinationals, networks

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1. Introduction

Historically, multinational enterprises (MNEs) located R&D in their subsidiaries abroad mainly for the purposes of the adaptation of products developed in their home countries to local tastes or customer needs, and the adaptation of processes to local resource availabilities and production conditions. In this situation subsidiaries were dependent on the competence of their parent companies, and so their role was essentially just competence exploiting, or in the terminology of Kuemmerle (1999) their local R&D was 'home-base exploiting'. In recent years instead, linked to the closer integration of subsidiaries into international networks within the MNE, some subsidiary R&D has gained a more creative role, to generate new technology in accordance with the comparative advantage in innovation of the country in which the subsidiary is located (Cantwell 1995, Papanastassiou and Pearce 1997, Cantwell and Janne 1999, Pearce 1999, Zander 1999). This transformation has led to a quantitative increase in the level of R&D undertaken in at least those subsidiaries that have acquired this kind of competence-creating mandate, and in these subsidiaries there has been a qualitative upgrading in the types of research project away from the purely applied towards the more fundamental; although the research undertaken is generally of an (increasingly) specialized kind, to take advantage of the particular capability of local personnel and the other local institutions with which the subsidiary is connected.

The shift towards internationally integrated strategies within MNEs is partly grounded on a 'life cycle' effect within what have become mature MNEs, which have now created a sufficient international spread in their operations that they have the facility to establish an internal network of specialized subsidiaries, which each evolve a specific
regional or global contribution to the MNE beyond the concerns of their own most immediate market (Cantwell and Piscitello 1999, 2000). Thus, subsidiaries that began as local market-oriented (import-substituting) units are gradually transformed into more export-oriented and internationally integrated operations. While some of the subsidiaries within such a network may have essentially just a competence-exploiting or an 'assembly' role, others take on a more technologically creative function and the level and complexity of their R&D rises accordingly (Cantwell 1987).

In the paper we attempt to characterize the knowledge flows associated with MNE operations and to analyze the firm’s strategic behavior in managing such flows (both intra-firm and inter-firm flows) to maximize value creation. This characterization develops work in international business (Gupta and Govindarajan, 1991, 2000) by integrating perspectives from strategic management (e.g., the knowledge-based view of the firm - Grant, 1996) and economics (e.g., private good and public good aspects of knowledge). The critical element of the analysis is to focus on the MNE’s ability to leverage its internal network of subsidiaries in order to integrate knowledge bases that are geographically dispersed. We characterize competence-creation at the home site as well as at subsidiary sites (see Figure 1). We also examine the implications for the locations where the MNE operates.

The paper is organized as follows. In Section 2 we trace the history of knowledge processes within MNEs and provide a brief survey of the current literature on geographically dispersed knowledge management. In Section 3 we describe and analyze a model of knowledge flows related to MNE operations. We offers discuss some implications and offer some concluding remarks in Section 4.
2. Background

Much of the early literature on knowledge management in the MNE during the post-1945 period viewed it through the lens of the Vernon (1966) product cycle model. Vernon argued that having established a new product or a new production process in the home market, MNEs would subsequently export and/or locate production facilities in foreign locations. This process would inevitably involve some foreign knowledge creation, mainly concerned with adapting the products and the production processes to suit local market conditions. According to this view, MNEs’ knowledge management consisted of primary knowledge creation in their home markets and then, as secondary activity, adaptation for use in foreign markets.

A complementary theory is the stage theory of MNE evolution (Johanson and Vahlne, 1977). This has become the textbook view of the MNE and is that of a mature divisionalized company that often grows large in its domestic markets before turning multinational through a sequence of steps beginning with exports. On the basis of this theory, it has been argued that even secondary adaptive knowledge creation in foreign markets occurs at a later stage of foreign operations (Ronstadt, 1977).

Beginning with the late 1970s, even Vernon (1979) observed a changed pattern of MNE knowledge management. Particularly in high technology industries, he suggested that the product cycle had by that time become highly compressed so that many MNEs were engaged in programs of almost simultaneous knowledge creation in many major markets. This finding has been supported and amplified by a number of other studies, including Cantwell (1995), Dunning (1992) and Howells (1990), though some conflicting evidence has also been presented (Patel and Pavitt, 1991).
In the decades following 1945, home country strengths were exploited in foreign markets so that knowledge activities in these markets were largely driven by local demand. Even prior to 1980, this demand-led view of foreign knowledge management was argued by some to be one-sided and potentially misleading (Mowery and Rosenberg, 1979). More recently, a number of studies point to MNEs adopting a much more sophisticated approach to knowledge management. Considerable evidence has been gathered indicating that the hierarchical model of knowledge management, where strategic decisions were taken at the home country headquarters and suitable implementation decisions were taken in the host country subsidiary, has become encompassed within a more general model.

Forces underlying subsidiary evolution: This change in MNE knowledge management practices has not come about spontaneously, but is the product of powerful external forces. On the demand side, increasing wealth, even in many emerging markets has led to a growth in the demand for more customized products. This has led to MNEs striving for ‘mass customization’ (Kotha, 1995), where the firm continues to exploit its home country expertise of exploiting economies of scale and scope, while at the same time incorporating the scope for considerable country-specific differentiation. Customization inevitably involves a large service component that is most effectively delivered at the local or subsidiary level (Pine et al, 1993). This has led to major changes in the role of subsidiaries in the knowledge management process. It has created a need for strategic decision making at the subsidiary level\(^1\) as subsidiaries are involved more deeply and at a

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\(^1\) Customization is understood to include a substantial pre-manufacture design function whereas adaptation is understood to involve post-manufacture activity such as retrofit.
much earlier stage in the MNE’s innovation process. In turn, this requires and has led to increased cooperation between headquarters and subsidiaries (Hitt et al, 1998).

On the supply side, many of the information and communication (ICT) technologies have greatly reduced the advantages of mere size. Knowledge, including market knowledge is increasingly becoming the key source of competitive advantage (Bettis and Hitt, 1995). This has required MNEs to lean ever more heavily on their subsidiary network to continually maintain their knowledge advantage. It has been said that ‘in an increasingly networked world economy, it is not the big that will beat the small, but the fast that will beat the slow’ (Chambers, 1998).

Finally, the institutions of the world economy are inexorably moving toward increasing the level of competition (Hitt et al, 1998). As trade barriers are rolled back, MNEs find that their former ‘profit sanctuaries’ are no longer secure and many of their cross-subsidization based advantages have been dissipated. Increased competition and falling rates of return on their traditional activities have forced MNEs to ratchet up their offerings. Thus, forces of demand, supply and institutional change have all pushed MNEs towards becoming more decentralized knowledge management systems.

**Intra-MNE knowledge flows:** How have these worked in practice? A number of studies have attempted to shed light on this question. Gupta and Govindarajan (2000) report that knowledge flows into and out of subsidiaries depend crucially on the motivation of the subsidiary to acquire knowledge and to share it. This places a great deal of emphasis on firm organization, where the incentive structure of unit managers needs to be carefully designed.
The nature of the knowledge itself has a bearing on how it is managed (Cantwell and Santangelo, 1999). Thus, the norm is for codified knowledge that is relatively easy to transmit to be geographically dispersed, while highly tacit knowledge tends to remain localized. However, in some cases highly tacit knowledge is sourced from foreign subsidiaries and this tends to be driven either by particularly strong and unique local competencies or by particularly strong company-specific networking capabilities. This finding complements and qualifies earlier findings reported by Jaffe et al (1993) that knowledge creation tends to be highly localized.

Further, the position of the MNE in knowledge hierarchy is also likely to have a bearing on its knowledge management practices. Cantwell and Janne (1999) report that MNEs emanating from the leading technological centers in their industries are likely to disperse their knowledge creating activities, while those from weaker centers of the same industries tend to replicate their technologies in new locations. The subsidiary’s location also matters, since the more munificent the location, the greater the potential knowledge creation (Cantwell and Iammarino, 1998).

Cantwell and Piscitello (1999) report that by the 1980s MNEs had begun to utilize their international networks to access locationally specialized branches of innovation across national boundaries. However, they find a trade-off between geographical and sectoral dispersion of knowledge creating activities. Thus, MNEs whose knowledge development spans a wide spread of technological activities tend to have knowledge networks that are less geographically dispersed and conversely. This points to the highly complex nature of knowledge management processes.
**Intra-MNE politics:** It is important to bear in mind that MNEs are not mechanistically driven towards value maximization. Indeed, the loosening of the traditional hierarchical structure and increased subsidiary role has made them more like political coalitions and less like military formations (Holm and Pedersen, 2000). This implies that a subsidiary’s competence development also creates tensions. Indeed such development may not always strengthen the subsidiary’s position within the MNE and could actually hinder it. Forsgren and Pedersen (2000) report that greater subsidiary competence only strengthens its role within the MNE to the extent that other units are able to assimilate and use it. Further, greater effort spent in developing its own competencies (at the expense of engagement in the transfer and use of this competency in other units) actually has a negative effect on the subsidiary’s position within the MNE (Forsgren *et al*, 2000).

Zander (1999) finds that the structure of knowledge networks differs significantly across industries and also amongst firms, concluding that there does not appear to be a single approach to knowledge management. Industry and firm specific factors appear to have a significant role in influencing the strategies that are implemented. Further, he also casts doubt on a systematic link between the geographical dispersion of knowledge capabilities and firm performance. He is therefore doubtful whether a strategy of tapping into local competencies is a sure route to developing competitive advantage.

However, a joint reading of Zander (1999) and Forsgren and Pedersen (2000) suggests that it may be the implementation and not the strategy that is the problem. In other words, subsidiaries embedded in leading technological centers of competence (Cantwell and Janne, 1999) may be sources of potential competitive advantage that remains unrealized due to the internal political structure of the MNE. Indeed this is very likely to
be the case. In large panel of US firms, Rajan et al (2000) show that when intra-firm diversity becomes high enough, inter-divisional rivalries lead to enormous value destruction through resource transfers from stronger to weaker units. MNEs with geographically dispersed competencies fit the Rajan et al (2000) definition of high diversity firms extremely well. This lends force to the conclusion of Forsgren and Pedersen (2000) that actually realizing the benefits of the MNE’s geographically dispersed knowledge network is a daunting task.

3. Characterizing Knowledge Flows Related to MNE Operations

Our objective is to set up a model to characterize the knowledge flows created within and contiguous to the operations of a modern MNE. As we have seen in the preceding section, two sets of inter-related forces have led to a fundamental change in the nature MNE operations. Induced by external drivers and taking advantage of their structure in the face of a changing external environment, MNEs have generally adopted a decentralized approach to their knowledge management processes. Knowledge flows themselves are underpinned by the knowledge creation process and the location of centers of competence within the MNE (see Table 1).

We analyze five inter-related aspects of knowledge flows. These are (a) the source–target nature of the flow; (b) the size of the flows relative to a common numeraire; (c) the market structure within which the flows occur; (d) the role of the knowledge in the firm’s business process and (e) the applicability of the knowledge.\(^2\) We proceed to discuss each one of these dimensions in detail. We then attempt an integrative

\(^2\) The nature of the knowledge itself – codified vs. tacit – is also an important consideration that will run through the analysis.
analysis of all dimensions. We use this analysis to draw out implications for MNE knowledge strategies, as well as for public policy toward subsidiaries.

The source-target dimension: This dimension is concerned with the nodal and dyadic aspects of knowledge transfer. Thus, each knowledge flow occurs between a source and target along a channel (Gupta and Govindarajan, 2000). We will principally be concerned with three knowledge flows (see Figure 1):

Flow 1 – Flows from subsidiary to parent. These flows may be called knowledge transfer, and form the basis of the MNE’s network leverage. High levels of these flows enable MNE headquarters to exploit local competencies and act as a knowledge intermediary or knowledge integrator (or as a facilitator of such activities).

Flow 2 – Flows from location to subsidiary. These flows consist of the subsidiary’s learning, local competence exploitation and local resource utilization. This is the pod or ‘listening post’ role of the subsidiary where the receiver competence (assessing, filtering and choosing information) and absorptive capacity (adapting inflows to fit firm-specific requirements) become crucial.

Flow 3 – Flows from subsidiary to location. These flows are part of what have been termed spillovers. In the literature, spillovers have often been used to refer to flows both into and out of the firm. However, since our analysis is firm-centric rather than location-centric, we define spillovers to include only outflows from the subsidiary. Further, we recognize that spillovers include both intended and unintended elements. Thus, flows to local partners, customers and suppliers may be largely planned. However, flows that occur through employee mobility, local imitation and reverse engineering by competitors may be largely unintentional. The combination of these flows are the focus of most
public policy measures, like those implemented in the context of national systems of innovation (NSIs). For example, Franssmann (1997) analyzes the factors underlying the success of such policies adopted by MITI in Japan and Mudambi (1998) suggests that the absence of some of these factors may explain the relatively poor results of such policies in Europe.

The fourth knowledge flow from the parent to the subsidiary is the traditional flow where the subsidiary exploits a home-base knowledge advantage. We do not mean to minimize the importance of this flow, but rather will normalize all flows relative to this flow, i.e., this traditional flow is our numeraire. Thus, any of the three flows above will be described as high or low relative to the knowledge flow from parent to subsidiary. Thus, in the terminology of Gupta and Govindarajan (1991), if flow 1 is high, then the subsidiary is a net provider of knowledge, whereas if flow 1 is low then it is a net user of knowledge.

Knowledge flows, whether intentional and unintentional, flow through channels and the nature of these channels affects the quality and quantity of knowledge received by the target. For most channels, knowledge flows are subject to transmission losses in sense of Shannon and Weaver (1998). This equally true whether the flows are within the MNE or are across firm boundaries. This means that in general the flow of knowledge received by the target will be smaller than the flow transmitted by the source. A number of factors influence the level of transmission losses. For example, transmission losses are greater for tacit knowledge than for codified knowledge (Roberts, 2000).

However, as discussed by Nonaka and Takeuchi (1995), the problem of transmission losses can be solved using rich communication media. These media
comprise face-to-face communication, informal interaction and team-based mechanisms (Daft and Lengel, 1986). Using rich communication media can reverse transmission losses, so that the communication process itself results in an enrichment of the original knowledge flow. Thus, the target receives a larger knowledge flow than the originating flow from the source. However, rich communication media are typically high cost media, so that the firm faces an optimization problem in its choice of knowledge channel, i.e., is the high cost justified by the improved knowledge transfer?

The knowledge channel choice is also influenced by the nature of the knowledge that is being transferred. Szulanski (1996) points out that tacit, context-specific and ambiguous knowledge is likely to the most difficult to transfer within the firm. This implies that in conventional mechanistic channels, codified knowledge is likely to be subject to low transmission losses in whereas tacit knowledge is likely to be subject to high transmission losses. Thus, rich communication media are likely to be used in transferring such knowledge.

However, when knowledge flows through nodes, in addition to pure transmission issues, motivational considerations (both strategic and environmental) become relevant (Szulanski, 1996). Thus, flow 1 from the subsidiary to its parent will in general be different from flow 2 from the location to the subsidiary. This point will be amplified below.

**The size of knowledge flows:** In the context of knowledge flows, the problem of measurement is acute. How do we measure knowledge? This is particularly problematic when the knowledge itself is composed of both codified and tacit components. Previous studies (e.g., Jaffe *et al* 1993, Cantwell and Piscitello 1999, 2000) have used quantitative
patent data to measure codified knowledge flows. Tacit knowledge flows have generally been inferred from questionnaire data (e.g., Hakanson and Nobel 1993). Neither of these measurement methods relates the size of knowledge flows to value creation potential. In an interesting study, Hakanson and Nobel find that the size of knowledge flows from subsidiary to parent (flow 1) are strongly related to their potential for creating value, i.e., size and value creation are positively correlated. We may conjecture that this positive correlation is likely to hold for most intra-firm flows within the MNE, moderated by some political considerations noted above in Section 2.³

For a given source-target pair, the size of knowledge flows will be strongly influenced by the pre-existing knowledge stock at the two ends of the channel. These two stocks determine the ‘absorptive capacity’ of the target, i.e., the quantity of knowledge that the target can internalize and the speed at which it can do so (Cohen and Levinthal, 1990). The greater the knowledge stock disadvantage of the target as compared to the source, the lower its absorptive capacity. For example, if the source is much more advanced in its level of technology, most of the knowledge that it can transmit may be beyond the understanding of the target, restricting the size of the possible knowledge flow. Thus, the target’s absorptive capacity places an upper bound on the maximal size of the knowledge flow.

All other factors being equal, it is still more difficult to transfer highly tacit knowledge as compared to codified knowledge. Thus, codified knowledge can be

³ According to both the resource-based and the knowledge/competence-based views of the firm, value creation potential comes from the rareness of the resource or competence. In this context we can distinguish between ‘defensive’ knowledge flows meant to match the industry standard (and ensure survival) and ‘offensive’ knowledge flows meant to create competitive advantage. Only the latter flows lead to measurable value creation, providing a second moderating influence on the positive correlation between knowledge flows and value creation.
transferred in large volumes at relatively low cost. However, large volumes of highly tacit knowledge are difficult to transfer and are only possible at relatively high cost.

The size of knowledge flow is also contingent on the motivation of agents within nodes, i.e., within the subsidiary and within the headquarters of the MNE. Even very favorable knowledge creation, knowledge absorption conditions and knowledge characteristics will not lead to large knowledge flows if the agents managing the process are not motivated to ensure that they happen. This motivation is generally a matter of incentive design dictated by the nature of the principal-agent game being played between the MNE headquarters, its subsidiaries and its external knowledge network (Mudambi, 1999). Incorporation of each agent’s objectives will generally result in an optimal set of incentives. However, much of the earlier literature has ignored the importance of intrinsic motivation (Frey, 1997) and this can be particularly important in the context of the highly skilled agents involved in knowledge transfer (Osterloh and Frey, 2000).

A closely related point in considering the configuration of knowledge flows is the issue of reciprocity. A large Flow 2 into the subsidiary from the location is often contingent on a large Flow 3 out of the subsidiary into the location. There is considerable evidence both in case study research as well as in more formal game theoretic models that symmetric knowledge flows based on reciprocity are more stable than asymmetric flows.

Given the three knowledge flows under consideration, there are eight possible size configurations. We begin by specifying the configurations and then proceed to analyze each case (see Table 2).
HHH – Case A: This is the virtuous case with high knowledge transfer, high subsidiary learning and high local spillovers. The subsidiary is likely to enjoy positive interactions with both its parent and with local authorities.

HHL – Case B: This is similar to A, but with limited spillovers. This is likely to be the case where the subsidiary as has much to learn but little to contribute. Co-location of a weaker firm into a leading technological center would fall into this category.

LHH – Case C: This case is also similar to A, where the subsidiary is very integrated into the location, but where it finds it difficult to transfer the knowledge it has gained to its parent. The nature of the knowledge (e.g., high levels of tacitness) or the nature of the organization of the firm (e.g., subsidiaries prone to high levels of internecine rivalry as in the analysis of Rajan et al (2000)) can lead to this configuration. The nature of the subsidiary can also be a factor. Too high a level of local integration (Forsgren et al, 2000) where the subsidiary becomes isomorphic to the location (Ghoshal and Westney, 1993) or ‘embedded’ in it (Andersson and Forsgren, 2000) can increase the distance and reduce trust in the relationship with headquarters, reducing knowledge flow. Obviously any combination of these factors can have the same effect.

LHL – Case D: This case is a combination of B and C. Like B, in this case the subsidiary has little to contribute and much to learn. As in B, this is likely to be weaker firm co-locating into a center of excellence. However, like in C, the knowledge transfer from subsidiary to parent is poor, as discussed above.

LLH – Case E: In this case, the subsidiary generates large spillovers, but there is little learning and knowledge transfer to the parent. This case is not the primary focus of this paper, since it is likely to represent market-seeking FDI, where the MNE’s knowledge
spillover in the location is compensated by a flow of profit. Adverse selection operates here, since if there are no compensating profits, there is no reason for the firm to place its knowledge-intensive activities in this location.

LLL – Case F: This is the opposite of A, where there are virtually no knowledge flows of any kind. This situation is likely to be representative of many firms, although companies may have differentiated knowledge even if they are not at the leading edge of knowledge creation. An example might be a highly replicative industry, (like franchise operations) where the knowledge flow consists mostly of a closed business system. Like E, this is likely to be market-seeking FDI.

HLH – Case G: This is the opposite of D. The subsidiary generates large spillovers, but it has little to learn from the location. It is nonetheless able to generate large knowledge transfers to its parent. This may be the case of the subsidiary as a flagship firm with substantial strategic independence (Rugman and D’Cruz, 1997). Thus, it is able to synthesize a great deal of knowledge using relatively little local inflows, while at the same time generating large spillovers to its associated peripheral firms. It is simultaneously able to provide substantial knowledge transfers to its parent that can be used to create value elsewhere in the multinational network.

HLL – Case I: This case is similar to G, with the difference being that relatively low spillovers occur. This would be the case if the peripheral firms in the area were competitive rather than collaborative and if the firm itself were oligopolistic, so that it would view outflows to competitors negatively and strive to prevent them.

Market structure and knowledge flows: We may safely assume that all firms regard knowledge inflows (like Flow 2) positively. However, perceptions of knowledge
outflows (like Flow 3) may differ, depending on market structure. Knowledge spillovers have both positive and negative effects on the firm. The private effect on the owner firm is a leakage of its valuable intellectual capital, which would be viewed negatively (Grindley and Teece, 1997). The positive effect is the public good aspect of knowledge (d’Aspremont et al, 1998), where outflows contribute to a virtuous cycle by strengthening the knowledge base of the location and making it more attractive to other knowledge-bearing firms. This, in turn, makes for larger knowledge inflows in the future. The firm’s view of spillovers (Flow 3) will depend on its assessment of these two effects.

A competitive market structure is characterized by a large number of firms, each with a relatively small market share and profits. Thus, such firms have less to lose from knowledge outflows and more to gain from inflows stemming from a strong location, so that the public good aspect of knowledge may predominate and Flow 3 is viewed as an overall positive. On the other hand, an oligopolistic market structure is characterized by a few large firms, each with a large market share and considerable strategic interdependence. Thus, oligopolistic firms realize that knowledge spillovers to industry rivals can be extremely costly in terms of lost competitive advantage, so that the private good aspect of knowledge is the dominant consideration. Consequently, such firms may view Flow 3 as an overall negative.

This analysis implies that market structure should have a strong effect. When the overall effect of knowledge spillovers (Flow 3) is perceived to be negative, leading firms should not locate in clusters\(^4\). This is because their outflows are very valuable to their

\(\text{\footnotesize {\textsuperscript{4}\ We distinguish between clusters and networks as related to the two aspects of spillover knowledge flows. Clusters consist of co-located firms without any planned knowledge sharing so that spillover knowledge flows amongst them are largely unintended. However, networks consist of firms with planned knowledge sharing so that spillover knowledge flows amongst them are intentional.}}\)
competitors, but the inflows from these competitors are less valuable. In this case, adverse selection ensures that clusters of competing firms, become concentrations of mediocrity. Then, in the spirit of Akerlof’s (1970) lemons model, clusters including large oligopolistic competitors should fail to form.

Conversely, in relatively competitive market structures, the positive effects of knowledge spillovers may be considered to outweigh the negative effects, so that co-location of leading firms becomes likely. This analysis would explain the empirical finding that largest firms do not co-locate their knowledge creation activities with those of their competitive rivals (e.g., Cantwell and Santangelo, 1999). It would also explain the co-location of knowledge creation activities in high-quality clusters in competitive industries (Jaffe et al, 1993; Saxenian, 1994).

The above argument is based on the perspective of the incoming MNE. However, an analysis of the perspective of the region is equally important. When the inter-firm dispersion of the innovative activity is high, the regional innovation system is characterized by considerable interaction amongst multiple poles of innovation excellence. This is common in many regions of the UK and Italy. In this case, a local presence is attractive for the MNE as there are plentiful opportunities for the sourcing of local technology. However, when the regional system of innovation is dominated by a single firm (as in many regions of Germany), inter-firm links are largely of the dependent kind, with firms in the local cluster hierarchically linked to the local giant. In this case, technology opportunities for incoming MNEs become more limited.

**Knowledge flows and the firm’s business process:** Thus far we have assumed that all knowledge flows are homogeneous. This is obviously not the case and we must
characterize knowledge flows relative to the MNE’s business model. In this context we distinguish between core and complementary knowledge flows. Core knowledge relates to the firm’s main business and is the basis for its value creation. Complementary knowledge, on the other hand, relates to secondary processes that support the firm’s main business. For example, chemical technology represents core knowledge for a chemical firm, while information technology (IT) may relate to its secondary processes. Obviously there is a continuous spectrum between core and complementary knowledge so that knowledge can be said to more or less ‘core’.

We can link our analysis of market structure to the nature of the knowledge flow in order to draw out implications for the location of subsidiary knowledge creation activities. Thus, our analysis of market structure implies that in oligopolistic industries co-location of core knowledge creation activities is unlikely, since outflows to competitors are deemed too costly. However, complementary knowledge creation activities are likely to be co-located with leading firms in these activities since this relationship is likely to be collaborative, i.e., a firm in industry A would co-locate a knowledge-creating subsidiary with a leading firm in industry B, where B’s technology is complementary to A. Thus, clusters of oligopolistic firms would be characterized by complementary knowledge flows, while clusters of competitive firms would be characterized by core knowledge flows.

Knowledge flows and knowledge applicability: Another perspective from which knowledge is the objective distinction with regard to its applicability. Some technologies have wider applicability than others. In this context, we can distinguish between specialized technologies and general-purpose (GP) technologies. Specialized
technologies have limited applicability (and value) outside of the firm’s specific industry. However, GP technologies have a much wider applicability (Eliasson, 1997; Helpman, 1998). Thus many of the technologies in the chemical and pharmaceutical industries are likely to be highly specialized, whereas many technologies in the IT and machine tool industries are likely to be GP technologies. Most specialized technologies are likely to form core knowledge, since they have limited applicability outside of their ‘home’ industry. Most GP technologies are likely to function as complementary knowledge in a wide range of industries. Following our analysis, industries whose core knowledge is operationalized in the form of GP technologies are most likely to be characterized by clusters and consequently, larger knowledge flows.

4. Implications and Concluding Remarks

In this paper we model the knowledge flows created by the activities of an MNE. We have attempted to provide a more complete picture of the process underlying such knowledge flows by integrating three perspectives – that of the MNE parent, that of the subsidiary and that of the subsidiary’s host site. Early work in international business generally adopted the perspective of the MNE parent, while work in international management tended to adopt the perspective of the subsidiary. Beginning with the pioneering work of Gupta and Govindarajan (1991), attempts have been made to integrate these two perspectives and study knowledge flows within the MNE as flows within a network of nodes. In the regional science literature in-depth studies of spillover flows into the host location were undertaken, but these typically treated the MNE as a single decision-making unit. (Young, Hood and Peters, 1994).
While our model underlines the contributions of earlier literature along each of the three perspectives, it suggests that an integrated view of all three perspectives yields some new insights. First, consider the strategy of leveraging an MNE’s internal international network by accessing knowledge in the leading technology centers through its subsidiaries there. Earlier literature has suggested numerous issues concerning the development of the subsidiary’s absorptive capacity, following the analysis of Cohen and Levinthal (1990). However, while problems in the subsidiary-parent knowledge transmission process have been pointed out (e.g., Forsgren et al., 2000), optimal incentive design to solve this principal-agent game has not been addressed. A joint consideration of the incentives of subsidiary and parent under different organizational designs would go a long way toward addressing this problem. Essentially this requires considering ways of rendering Cases C and D in Table 2 behaviorally sub-optimal.

Second, consider the perspective of the host location. Typically a government or quasi-government agency articulates this perspective (e.g., Mudambi, 1999). Previous literature has suggested choice rules for developing the local economic base (Young, Hood and Wilson, 1994). However, an appreciation for the internal dynamics of the MNE would greatly increased the effectiveness of such agencies. This includes both the pre-investment location phase as well as post-investment knowledge management phase. Examples of these considerations include higher knowledge spillovers and MNE knowledge-intensive investment attraction. Thus, higher local spillovers through local integration may be a short-term benefit if they come at the expense of the subsidiary’s engagement with the rest of its intra-firm network. Attempts at attracting fresh MNE investment by leveraging of existing stocks of knowledge-intensive investment in the
quest for critical mass must take account of the nature of the industry structure. Attempting to attract competitors from an oligopolistic industry may be ill advised.

Finally, how should the MNE view spillovers? We have suggested that market structure and firm organization both have a bearing on whether the proprietary or public good aspects of knowledge will gain ascendancy within the firm. Thus, when the proprietary aspect predominates, it is likely that adverse selection will ensure that clusters of like firms will fail to form. This explains the finding that in oligopolistic industries co-location of knowledge-creating activities with competing firms rarely occurs. Further, that clusters with such firms consist of the co-location of firms generating complementary knowledge. Conversely, in competitive industries, the public good aspect of knowledge is likely to predominate, leading to the formation of homogeneous clusters that generate knowledge synergies.

References


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<th>LEVEL OF KNOWLEDGE FLOW</th>
<th>COMMENTS</th>
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<tr>
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</tr>
</tbody>
</table>

Figure 1

Home

Knowledge transfer

Host

Spillovers

1

2

3

Numeraire knowledge flow (from parent to subsidiary)