

CENTERS OF EXCELLENCE IN MULTINATIONAL CORPORATIONS

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This paper seeks to understand the conditions under which ‘centers of excellence’ emerge in foreign subsidiaries of multinational firms. We define a center of excellence as an organizational unit that embodies a set of capabilities that has been explicitly recognized by the firm as an important source of value creation, with the intention that these capabilities be leveraged by and/or disseminated to other parts of the firm. Drawing on overlapping research in international business and strategic management, we argue that the formation of centers of excellence is shaped by conditions in the subsidiary’s local environment as well as by various aspects of the subsidiary’s relationship with other parts of the multinational firm. Based on a survey of 99 foreign units in Canada, our results highlight the fundamental role played by parent firm investment as well as the role of internal and external organizations in the development of subsidiary capabilities. Performance implications of the center of excellence phenomenon are also explored. Copyright © 2002 John Wiley & Sons, Ltd.

A fundamental challenge for large multinational firms is how to identify and leverage capabilities that develop within their global network of subsidiaries and affiliate companies. Regardless of whether the MNE is conceptualized as a set of internalized cross-border transactions (Buckley and Casson, 1976), a ‘differentiated network’ of affiliated companies (Ghoshal and Nohria, 1989; Nohria and Ghoshal, 1997), or a social community that crosses national boundaries (Kogut and Zander, 1992, 1993), the ability to manage dispersed capabilities effectively is seen by most scholars as a key source of competitive advantage for multinational firms.

In this paper we focus on the concept of a ‘center of excellence’ as one mechanism that MNEs are

increasingly using as a means of identifying and leveraging pockets of expertise found within their corporate networks. We define center of excellence as *an organizational unit that embodies a set of capabilities that has been explicitly recognized by the firm as an important source of value creation, with the intention that these capabilities be leveraged by and/or disseminated to other parts of the firm*. While the term could apply to any organizational subunit within the firm, in this paper we focus on centers of excellence within foreign subsidiaries. Many, indeed most, headquarters units within multinational firms are a key source of the kinds of advanced capabilities that are the bedrock of our definition of a center of excellence, and there exists a well-developed literature on the strategic and organizational challenges associated with managing these capabilities abroad. In contrast, the existence of centers of excellence in foreign subsidiaries appears to be both a rarer and more recent phenomenon, notwithstanding the few

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well-known examples that have been frequently cited in the literature.¹ As we will discuss shortly, the managerial challenges associated with developing, identifying, and leveraging centers of excellence in foreign subsidiaries are many and varied. These challenges—and the evident difficulty that many companies have in coping with them—are the underlying motivation for this paper.

The paper has three main goals: first, to review the existing literature on the term 'center of excellence' and to explain how our definition remedies the major shortcomings in current usage; second, to advance a conceptual model and specific set of hypotheses regarding the factors contributing to the emergence of centers of excellence in foreign subsidiaries; and third, to test the explanatory power of our model and hypotheses using recently collected survey data on 99 foreign-owned subsidiary companies in Canada.

The remainder of the paper is structured as follows. We begin by discussing the center of excellence concept and providing examples of its usage in practice. This section concludes with our formal definition. We then develop our main theoretical argument, drawing on overlapping research in international business and strategic management. In this section we formulate a set of hypotheses about the factors that are likely to give rise to centers of excellence in multinational firms. The next section discusses research methods, including our data collection strategy and variable operationalizations. We then present the results of our hypothesis tests and, in a more exploratory vein, investigate the performance consequences of the center of excellence phenomenon. Finally, the paper concludes with a discussion of the contribution and limitations of the study and suggests several avenues for future research.

CENTERS OF EXCELLENCE IN MULTINATIONAL FIRMS

To ground our discussion and subsequent definition of the center of excellence concept, we begin by offering the following case examples culled from

¹ Well-known examples include Fuji Xerox, Nestlé's headquarters for its confectionery business in England, GE's power systems business in Canada, and Volvo's manufacturing operation in Belgium. Often such centers of excellence have arisen through acquisitions of foreign firms rather than through active cultivation by the parent firm.

an extensive search of the practitioner literature as well as our own case research:

- Merck Frosst Canada, the Canadian subsidiary of Merck & Co., is a center of excellence for drug discovery in the area of leukotrienes. Although the subsidiary also has a broad set of responsibilities in terms of manufacturing, sales and distribution, it has gained primary responsibility within the company for leukotriene research, and has developed several major products that are now sold by Merck & Co. worldwide. Interestingly, the subsidiary's most recently developed product in its area of specialization is not manufactured in Canada, but rather at the company's Irish subsidiary, itself a center of excellence for the manufacture of ethical pharmaceuticals.
- Philips established a Center of Competence in Le Mans for its communications terminals business. This center became the business headquarters for cordless phones, smart cards, paging and fax terminals. It drew on its own specialized expertise in communication terminology and also the expertise of the rest of the Philips group worldwide (Bright, 1996).
- Hewlett Packard has a 'center of manufacturing expertise' in Singapore that is responsible for managing the migration of lower value-added activities out of Singapore into low-cost regions in China and South East Asia. At the same time, the Singapore subsidiary has been granted the worldwide mandate to develop, produce, and market all of HP's handheld information products, including mobile printers, calculators, and palmtop organizers (Leonard-Barton, 1995).
- ITT Fluid Technology Corp. created several centers of excellence in the Information Technology area. Technical staff remained in their local offices performing functions such as LAN administration, but in addition several became company-wide experts in specific technologies. Staff anywhere can now call on these experts for assistance in their specific areas of expertise. This arrangement, according to the CIO, 'is the ideal balance between the efficiency of centralized resources and the high-touch relationships that are only possible when technical staffers stay in business units' (Liebmann, 1996).
- IBM has established a number of centers of excellence in key technology areas. For example, the newly created Intelligent Agent center

of excellence has a mandate to develop and market intelligent agent-based applications for use on the Internet. The center brings together the key individuals throughout IBM with expertise in this area to ensure rapid development in this fast-moving area (Cooney, 1997).

In terms of existing academic usage of the term, at least two distinct strands of thought can be identified in the literature. The first approach is rooted in studies of subsidiary evolution and subsidiary-headquarters coordination and control (e.g., Bartlett and Ghoshal, 1986; Jarillo and Martinez, 1990). This approach, also adopted by Fratochii and Holm (1998), Surlemont (1998), and Holm and Pedersen (2000), views centers of excellence as a form of high value-added subsidiary—one that has a strategic role in the corporation. Typically, these centers are responsible for certain product areas or lines of business within the corporation as a whole, and, as such, they have a geographic scope that transcends the local market. This approach has much in common with the earlier concept of ‘product mandates’ used to describe subsidiaries that had earned the responsibility for manufacturing a particular product or product line for regional or even global markets (Rugman, 1983; Science Council of Canada, 1980; Crookell, 1986; Birkinshaw, 1995).

The main shortcoming of this conceptualization is its adoption of the subsidiary *as a whole* as the main unit of analysis. Two problems stand out. First, as the ITT example above illustrates, multiple centers of excellence may coexist within a particular subsidiary, meaning that a subsidiary may not be synonymous with a particular center of excellence. And second, a center of excellence may be only one aspect of the overall capability profile and mandate of a particular subsidiary, as suggested by the Merck Frosst example. Especially in an era where multinationals are moving to ever more complex and sophisticated value chain configurations, the subsidiary level is simply too aggregate a unit of analysis to be the basis for a valid definition of the term. For example, it is clear that many firms are creating centers of excellence based around particular functional specializations within subsidiaries, such as Merck Frosst’s specialization in leukotriene research or the same company’s center of excellence for drug manufacturing in Ireland.

A second approach is to see the center of excellence as a form of *best practice* that is then disseminated throughout the firm. Moore and Birkinshaw (1998: 1), for example, see centers of excellence as ‘the focal points for knowledge development and dissemination’ in service multinationals. And Lyle and Zawacki (1997: 26) define them as ‘horizontal units based on related skills or disciplines’ that are used to ‘foster competitive competencies.’ Viewed in this way, centers of excellence do not require a fixed physical location. Rather, they represent the shared capabilities of a fairly small group of people. For example, Accenture (formerly Andersen Consulting) has ‘competence groups,’ which are small groups of 20–30 people with expertise in an emerging practice area. A competence group may span more than one office and may be drawn upon to solve problems, provide advice, etc. in any part of the firm’s multinational network.

This conceptualization of the center of excellence concept remedies the subsidiary-level focus of the earlier view, but at the same time suffers from problems of precision and generalizability. For example, it is unclear whether, in this view, a center can be defined as a single individual whose expertise is valued by the firm or, the other extreme, as a ‘virtual’ center, consisting of a group of individuals based in multiple locations within the firm. In theory, a definition of the term could be broad enough to cover both of these cases. In practice, however, it appears that most firms do not equate centers to individuals for the obvious reason that the center would cease to exist if the key individual left the firm. Similarly, the notion of ‘virtual centers’ seems, in our view, to outstrip current practice by a considerable amount, although we acknowledge that this approach may be gaining some currency among firms, at least as an idea. Finally, the conceptualization of the term found in Moore and Birkinshaw (1998) seems to us to focus too narrowly on the dissemination of knowledge as the primary way that centers of excellence can contribute to the overall firm.

The above examples and discussion of current academic usage of the center of excellence concept suggests several dimensions that appear particularly salient. We focus on four.

First, centers of excellence tend to have a physical presence, i.e., they are typically based in a particular organizational subunit. However, as

discussed above, it is a mistake to equate centers of excellence with subsidiaries on a one-for-one basis, especially given the advanced global configurations adopted by many of today's leading MNEs. Second, centers of excellence represent a focus for a superior set of capabilities within the firm, including tangible resources such as equipment, licenses, and patents, and intangible resources such as knowledge and experience.² As such, a center of excellence is probably best defined in terms of its basis for creating value rather than in terms of a specific product or line of business, especially given that many centers of excellence possess fungible capabilities, i.e., capabilities that are able to create value for more than one line of business (e.g., ITT's information technology centers). Third, a center of excellence is explicitly recognized or declared as such by the corporation. This is important if the term is to mean something other than a particular unit is 'excellent' at a particular activity or practice. And finally, the pronouncement that a particular unit is a center of excellence in a particular activity or domain implies the intention to derive value from that unit's capabilities for the broader organization, through, for example, the development of products and technologies that can be sold throughout the firm's global sales network, or through the diffusion of intangible assets (knowledge, learning) to other organizational units. These dimensions suggest the following definition:

A center of excellence is an organizational unit that embodies a set of capabilities that has been explicitly recognized by the firm as an important source of value creation, with the intention that

these capabilities be leveraged by and/or disseminated to other parts of the firm.

DETERMINANTS OF CENTERS OF EXCELLENCE FORMATION

Having advanced our definition of the term center of excellence, we are now in a position to explore the conditions under which they are likely to be created in multinational firms. This issue is concerned fundamentally with the development and recognition of advanced capabilities that provide a source of value beyond the boundaries of the originating unit, i.e., within the multinational's global network of activities. Thus the research question we are concerned with is the following: Under what conditions do foreign subsidiaries develop a set of advanced capabilities that are recognized by the parent as an important source of value creation for the firm?

Our overarching argument is that the formation of centers of excellence is influenced by conditions in the subsidiary's local environment as well as by various aspects of the subsidiary's relationship with other parts of the multinational firm. Figure 1 provides an overview of our conceptual model. External factors concern the extent to which the subsidiary is embedded in a dynamic market and institutional context and is connected to key sources of competence within that context. Internal factors include, most fundamentally, capability-building investments made by the parent firm, as well as organizational conditions such as the autonomy of the subsidiary and its connectivity to important sources of competence within the firm. Performance in our model is endogenous: the superior capabilities and the greater-than-unit locus of exploitation for these capabilities drive positive performance on several possible dimensions, including profitability, competitiveness, innovation, and learning. But performance, in turn, influences the center of excellence formation process, most fundamentally by inducing greater levels of parent firm investment in the unit. In the remainder of this section we flesh out this framework by drawing on overlapping literature in international business and strategic management. We also generate a set of hypotheses that are subsequently tested in the empirical portion of the paper.

² The above discussion raises the question as to whether a particular organizational subunit needs to have *unique* capabilities in order for it to qualify as a center of excellence. In our opinion, uniqueness is not a requirement. Our fieldwork clearly indicated that there were many examples of companies that had established several centers of excellence within the company that were very similar in terms of capabilities and mandate, in some cases identical. Intel, for example, has several leading-edge fabrication plants around the world at which the latest microprocessors are being built. These are clearly centers of excellence by our definition, but they also have to have the same key capabilities because of Intel's 'copy exactly' manufacturing model. Merck is another example of a company that has several manufacturing centers of excellence spread throughout the world with very similar capabilities. For many companies, this apparent redundancy is purposive and strategic, as it allows the company to shift production in response to need and opportunity (e.g., e-rate fluctuations), and it engenders both learning and competition within the network.

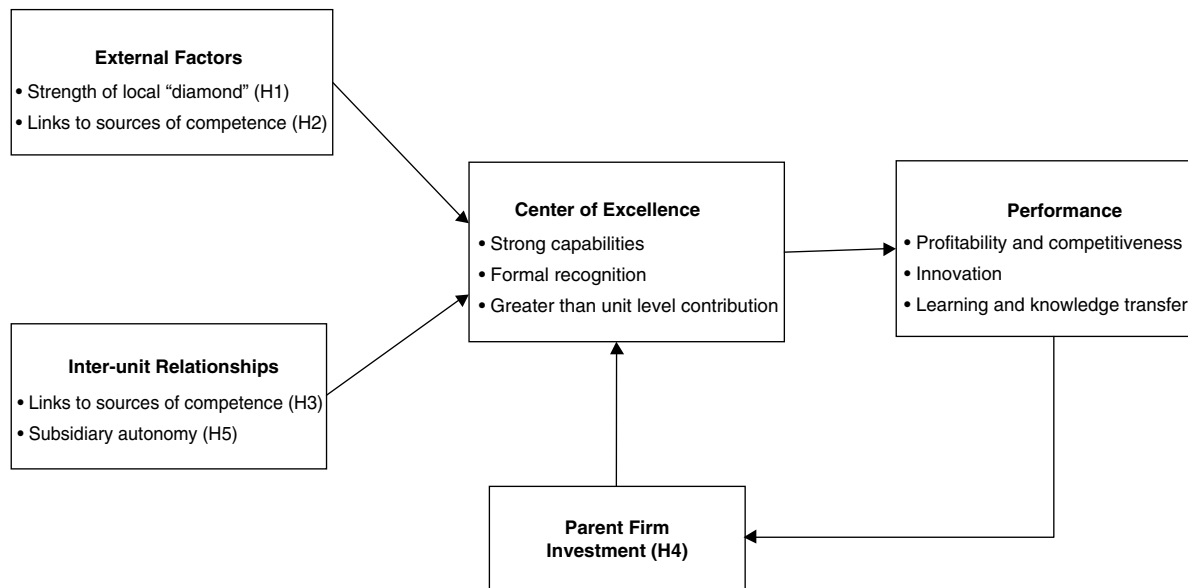


Figure 1. Conceptual model of center of excellence formation in multinational firms

External factors

Scholars have long recognized that location (and all that term implies) is important to the development of firm-level capabilities and competitive advantage (Marshall, 1920; Kogut, 1991; Porter, 1990). At a macro level, differences across countries in terms of endowments and institutional conditions play out in enduring patterns of international trade. At more micro levels, the dominance of particular firms—and clusters of firms—in certain industries can be attributed, in part, to the institutional conditions in which these firms are born and evolve. Porter's (1990) diamond model is perhaps the most complete articulation of this perspective to date and has led to a renaissance of interest in the relationship between geography and firm-level competitive advantage.

Applied to a global strategy context, the most basic insight of this work is that the multinational enterprise is a firm-level manifestation of home country competitive advantage. In essence, this is the classical view of the multinational firm: the headquarters organization, responding to local stimuli (e.g., customers, competitors, suppliers) generates innovations, including organizational capabilities, that then find application and success in international markets. A more recent stream of research has extended this perspective to

include the possibility that the institutional diversity that is inherent in the border-crossing process of global strategy may actually provide opportunities to *create* new sources of competitive advantage. As Frost (2001: 101) notes:

a potentially important source of competitive advantage for multinational firms is the capacity of their foreign subsidiaries to generate innovations based on stimuli and resources resident in the heterogeneous host country environments in which they operate.

Although empirical work in this emerging research stream has been slow to develop due primarily to data limitations, a recent wave of research has highlighted the importance of the host country to the subsidiary development process. For example, Kogut and Chang (1991) and Anand and Kogut (1997) provide evidence at an industry level that foreign investment may be motivated, in part, by the 'pull' of skills and capabilities resident in the host country. Case study research bears this argument out as well, especially in studies that have focused on the motivation for and role of foreign R&D in multinational firms. Florida and Kenney (1994), Kim (1997), Kummerle (1996), and Westney (1992) all provide examples that subsidiaries assimilate knowledge from their local environment. Frost's (2001) larger sample work drawing on patent citation analysis finds that

areas of technological specialization in foreign subsidiaries are underpinned by ideas that originate in the subsidiary's immediate geographic locale.

A closer look at this line of inquiry reveals two distinct, albeit related arguments. The first, typically cast at the country or regional level, looks at the strength and dynamism of a particular location as providing a 'latent' opportunity for multinational firms to derive a learning benefit from that location. Fundamentally, this is an argument about locational advantage—the strength of the industry 'diamond' in a particular location, to use Porter's (1990) terminology.

The second argument is a subsidiary-level argument and points to the connectivity of the unit to key actors and resources in the host country. In this view, competence development is facilitated by active participation of the subsidiary in the 'community of practice' that structures activity and relationships in a particular area (Powell, Koput and Smith-Doerr, 1996). Local customers may influence the path of subsidiary capability development through a stringent set of needs, as was the case with the Canadian subsidiary of Britain's ICI, which became a center of excellence for explosives due, in part, to the demanding usage requirements of the Canadian mining industry. Researchers have noted a similar role for suppliers, especially in facilitating the adoption of innovations by downstream organizations (Dosi, 1988). Competitors, too, may stimulate the process of competence development through direct (e.g., alliances) or indirect (e.g., mimicry) means, as noted frequently by Porter (1990). From these arguments, we derive our first two hypotheses:

Hypothesis 1: The greater the strength and dynamism of the local industry 'diamond,' the more likely is the subsidiary to contain a center of excellence.

Hypothesis 2: The greater the impact of external organizations on the development of a subsidiary's competence, the more likely it is to contain a center of excellence.

It is important to recognize that the above arguments are not in any sense deterministic. That is, we are not saying that a strong industry diamond in the host country guarantees the formation of a center of excellence in a subsidiary based

there. Rather, our point is that, all else equal, a strong industry diamond increases the likelihood that a subsidiary based there will form a center of excellence. These factors, then, need to be seen as contributory, as empirical evidence suggests they may not be necessary or sufficient. For example, many multinationals have 'scanning units' (Vernon, 1979) in dynamic environments whose role is to pick up and transfer knowledge back to corporate headquarters, rather than develop strong capabilities themselves. Equally, there are some cases of centers of excellence emerging in locations that are not particularly dynamic and where external linkages are weak, such as Monsanto's manufacturing center in Morden, Manitoba (Birkinshaw, 1995). As in most of the issues studied by strategy researchers, outcomes are subject to many and varied forces, as is suggested in our model, which we believe is the most parsimonious way of explaining what is in practice a very complex phenomenon.

Internal factors

In addition to the external factors discussed above, our model also highlights the importance of factors within the boundaries of the multinational firm that play an important role in the formation of centers of excellence. Consider first the relationship of the foreign subsidiary to the parent firm. Nohria and Ghoshal (1997) suggest that the multinational enterprise can be modeled as a 'differentiated network,' in which the foreign subsidiary is connected not only to the headquarters of the parent firm but also to other subsidiary units around the world. These network linkages make it easier for foreign subsidiary units to coordinate their activities on a worldwide basis, but they also represent an important source of intangible knowledge flows. If, for example, the subsidiary is selling to another business unit within the multinational network, the relationship with that customer can be an important source of ideas about how to improve its product offering. Equally, in working with an R&D unit in another country, that relationship can also be the seeds of a new product that results in the development of the foreign subsidiary. The argument, in other words, is that internal network linkages can work in a very similar way to relationships in the local market, i.e., by stimulating the emergence of new ideas and

fostering the emergence of advanced capabilities in the subsidiary.³

Hypothesis 3: The greater the impact of other units within the multinational network on the development of a subsidiary's competence, the more likely it is to contain a center of excellence.

The preceding discussion highlighted the role of the parent firm as a provider of important intangible assets (skills, knowledge, expertise) that a subsidiary can draw upon to develop its own capability base. But a more fundamental role of the parent firm is typically as a provider of tangible resources, especially investment capital, needed by the subsidiary to develop the kind of advanced capabilities that may give rise to its eventual recognition as a center of excellence. Indeed, Birkinshaw and Hood (1998) identify parent-driven investment (PDI) as one of the classic processes through which subsidiaries develop capabilities that subsequently form the basis for an expanded role within the company. This claim is also supported by the more mainstream literature in strategic management on the process of capability development and strategic decision making. Dierickx and Cool (1989) and Barney (1991), for example, note the importance of sustained investment over time to the development of capabilities and positions that are likely to lead to competitive advantage. Similarly, Burgelman (1996) and others (e.g., Galunic and Eisenhardt, 1996; Noda and Bower, 1996) argue that strategic decision making, especially concerning the capabilities needed to enter new businesses, can be understood as 'as an iterated process of resource allocation' (Noda and Bower, 1996: 159). In this spirit we propose:

Hypothesis 4: The greater the investment made by the parent firm in the subsidiary, the more likely it is to contain a center of excellence.

Although investment may be a precondition for the development of advanced capabilities as suggested

by our fourth hypothesis, it is also clear that the decision by the parent firm to invest in a particular subsidiary's development is endogenous—i.e., it is at least partly determined by preexisting capabilities of the subsidiary, by preexisting commitments by the parent to the subsidiary's position as a center of excellence within the firm (in the form of past investments and explicit recognition, perhaps), and by outcomes. Subsidiaries that perform well in their role as a center of excellence can expect to be rewarded by the parent firm in the form of additional investment and, perhaps, an expansion of their charter. The HP Singapore case noted earlier is a classic example of the positive feedback loops running from parent investment to capability development to subsidiary performance to charter extension to more parent investment (Leonard-Barton, 1995). In this sense the formation of centers of excellence in multinational firms can be understood as a cumulative, evolutionary process. We return to this point later in the discussion.

The other classic subsidiary development process identified by Birkinshaw and Hood (1998), which they term subsidiary-driven charter extension (SDE), also involves the parent firm. However, in this case, the role of the parent is more of a sanctioning body, granting a subsidiary with a preexisting set of advanced capabilities the right to pursue a new or extended charter. In this sense, the SDE process actually requires the foreign subsidiary to have considerable autonomy in terms of the ability to identify and pursue interesting market opportunities without explicit permission from the parent company. The link between autonomy and the development of centers of excellence is supported by early work in the Canadian context by Crookell (1986) as well as by more recent research by Birkinshaw (1997). Hence our final hypothesis:

Hypothesis 5: The greater the autonomy of the subsidiary, the more likely it is to contain a center of excellence.

METHOD

Data collection

This paper is part of a larger project on centers of excellence in multinational firms conducted by a team of researchers in eight countries, all of whom used a similar survey instrument. In the course of

³ Note that this is in some ways a mirror-image of the process by which the center of excellence leverages its capabilities throughout the multinational corporation. However, the two processes are distinct, because in the first the center of excellence is the receiver of knowledge and in the second it is the sender (Szulanski, 1996). Also, one will often see the center of excellence develop its expertise through one set of relationships (e.g., a sister plant or HQ) and then apply that expertise in other relationships.

developing the instrument, the research team met on four occasions. The first meeting defined the objective of the questionnaire. Subsequent meetings were used to more carefully define the core constructs and then the wording of specific items. We also made use of existing scales from previous studies. Finally, after the second iteration of the survey instrument we pilot tested it using a number of executives from one multinational company. The net result was a carefully crafted instrument that had been subjected to three rounds of revision, pilot testing, and the opinions of eight researchers working in the field.

This study focuses on Canada, which is in many ways an ideal context in which to explore the center of excellence concept. First, the Canadian economy is characterized by a high level of foreign ownership of industry, a feature that has long distinguished it from other advanced industrial nations. In addition to obvious advantages in terms of convenience, this feature of the Canadian economy makes it likely that the center of excellence phenomenon is more evolved in Canada than in many other countries. Findings from the Canadian experience are thus likely to presage experience in other countries where FDI has more recently become a major part of the institutional landscape. Second, the 1989 Free Trade Agreement between Canada and the United States resulted in a considerable amount of restructuring of foreign-owned activities in Canada, with some being terminated or transferred to other locations and others receiving greater investment. We believe that this restructuring process has led many foreign firms operating in Canada to articulate explicitly their goals and rationale for developing (or not developing) centers of excellence within their Canadian subsidiaries. Again, this suggests that the Canadian experience is likely to be on the leading edge of developments elsewhere. And finally, because Canada is a developed country with many advanced factors of production, it provides a good location for exploring the linkage between the characteristics of the host country and the development by foreign subsidiaries of the kind of value-creating capabilities that are central to our understanding of the center of excellence phenomenon.

We developed a list of 780 foreign-owned (greater than 50% of equity) companies in Canada with annual sales of greater than \$25 million. The mailing list was developed using well-established sources such as the *Financial Post*

1000, *The Globe and Mail* 500, and various online directories. Although some companies deliberately exclude themselves from such listings, our research suggests that this mailing list includes more than 90 percent of the population.

To give the study additional focus, the 780 foreign-owned companies were drawn from Canada's manufacturing sector. Service sector firms were thus excluded from the sampling frame. This choice was driven by both practical and methodological considerations. On the practical side, the focus on manufacturing firms reduced considerably the cost of administering the survey. Two methodological considerations influenced our decision to focus on the manufacturing sector. First, because the center of excellence 'phenomenon' is still not well understood, we believed that it was important to pay primary attention to matters of internal validity rather than external validity. Many researchers have noted important differences between manufacturing and service sector multinationals—differences that we believe are likely to impact the processes by which centers of excellence emerge and are subsequently leveraged by the firm. Combining both sectors in the same study risked a marginal gain in generalizability for a potential serious cost in terms of internal validity. Second, because our definition of a center of excellence is cast at the subunit level (i.e., at the level of a function or activity), we believed it would be wise to focus initial research attention on two primary activities—R&D and manufacturing—where centers of excellence appear particularly likely to emerge. For service sector firms, it is much less clear (in terms of activities) where centers of excellence are likely to develop.

The questionnaire was mailed to the CEOs of the 780 foreign-owned firms in late 1997. In deciding upon the CEO as our target respondent, we faced both theoretical and practical issues. On the one hand, our conceptualization of a center of excellence pushed us to consider respondents at lower levels in the subsidiary, ideally more than one per organization. We ruled out this approach primarily for practical reasons relating to the difficulty of obtaining the necessary contact information, and cost. Instead, we chose a single respondent—the CEO—but structured our instrument such that key questions were very explicitly focused around functional areas, i.e., below

the overall organizational level. As discussed earlier, this functional level focus is consistent with our conceptual approach and with our observations from the field about where and how centers of excellence develop. The specific choice of the CEO as our target respondent follows traditional practice and was intended to ensure that the respondent had a sufficient breadth of knowledge about all of the major facets of the organization, its activities, and environment.

Following the recommendations on survey protocol contained in Dillman (1978), we followed up on our first mailing with a reminder letter. After this follow-up, a total of 99 questionnaires were returned in usable form, giving us a response rate of 13 percent. This is not as high a response rate as we would have liked, but it is well within the normal range for surveys of multinational subsidiaries (Harzing, 1997).

Data and measures

The data used in this study came primarily from the questionnaire.⁴ Most items were measured using 1–7 Likert-type scales. Some, such as the number of employees and the percentage of foreign sales, were measured using actual values. In addition, we conducted field interviews in five subsidiary companies. The data collected during these interviews were used to formulate the theoretical framework and, subsequently, to help make sense of the results when they did not always correspond to our predictions.

Centers of excellence

Recall that our definition of the term is composed of three main elements: strong capabilities, formal recognition, and greater-than-unit level contribution. Our survey contained questions designed to operationalize all three elements. First, we asked respondents to indicate their organization's competence level in (1) research, (2) development, and (3) manufacturing using a 7-point scale, where 1 was defined as 'weak competence' and 7 was defined as 'very strong competence.'⁵ We chose a

score of 4 as our cut-off point for defining strong competence. This seemed to us a reasonable level as a first approximation, and the distribution of responses bore this out. However, as discussed below, we experimented with alternative cut-points as a way of assessing the robustness of our results. Second, for each activity we asked respondents to indicate whether 'Our competence is formally recognized by the headquarters' (1 = yes, 0 = no). Finally, we asked the respondents to provide an indication of the extent to which their capabilities impact other units. Our fieldwork suggested that the impact on other units can take many potential forms, and that there is not a uniform hierarchy of importance. Thus we chose to frame our question on impact in purposively broad terms. For each of the three functional activities, we asked: 'To what extent are the subsidiary's distinctive competences in [Research, Development, Manufacturing] of use for other units in the Corporation?' As above, we used a 7-point scale, where 1 indicated 'No use for other units at all' and 7 indicated 'Very useful for other units'.

In summary, we operationalized a center of excellence as a dichotomous variable based on respondents' answers to all three of the questions noted above. Only those units that met all three criteria were classified as centers of excellence for the purposes of our subsequent analysis. The dichotomous nature of our variable seems to us to capture the essence of the center of excellence construct as used in practice, although we recognize that it may also be valid to conceptualize them in terms of degree, i.e., as a continuous variable. With this in mind we explored several alternative operationalization strategies as a way of checking the robustness of our initial findings. We discuss these and other interventions in a separate section following the main presentation of results.

qualitative work, which suggested that managers think *simultaneously* about their unit's capabilities in relative (to other units within the firm and other firms) and absolute terms. Especially in manufacturing activities, it is apparent that many managers would characterize their capabilities as being very strong in absolute terms, but essentially on a par with local competitors and many other units within the firm. Merck's Canadian subsidiary has world-class capabilities in the manufacture of ethical pharmaceuticals—but similar to several other units within Merck and, indeed, similar to the operations of many of the world's leading pharmaceutical firms. Our concern was that if we focused the question around *comparative* or relative ability, we would miss many centers of excellence that have this kind of profile, i.e., multiple centers with similar capabilities worldwide.

⁴ The complete questionnaire can be downloaded in PDF format from the lead author's home page: http://live1.ivey.uwo.ca/faculty/Tony_Frost.html.

⁵ Note that we chose to use an absolute scale, not a relative scale, in operationalizing strong capabilities. This was driven by our

Table 1. Centers of excellence: activities, competence, recognition and use to others

Activity	A Undertakes Activity	B Strong Competence	C Formal Recognition	D A + B + C	E D + Use to Others
Research	45.3	35.8	20.0	18.9	17.9
Development	68.4	63.2	33.7	33.7	26.3
Manufacturing	93.7	91.6	70.5	70.5	51.6
Any of the above	100.0%	92.6%	74.7%	74.7%	58.9%

Because the center of excellence phenomenon is not yet well understood, it is worthwhile providing some sense of the distribution of responses to these questions—and thus the distribution of centers of excellence among Canadian subsidiaries in each of the three functional areas. Table 1 provides an overview. Column A begins by showing the distribution of research, development, and manufacturing activities across respondent units. Column A was derived from our questionnaire, which asked respondents to indicate which value-adding activities their unit engaged in. Whereas nearly all units reported undertaking some manufacturing activity, less than half reported undertaking research activities. Using a cut-off point of 4 out of 7 to define ‘strong competence,’ Column B shows that the distribution of such capabilities across functional activities is even more skewed toward manufacturing. Fully 91.6 percent of all respondents rated themselves 4 or higher in terms of manufacturing capabilities, whereas only 35.8 percent of respondents rated their research capabilities at that level. Development was in the middle, at 63.2 percent.

Column C shows the distribution of formal recognition of the unit’s competence by headquarters across the three functional activities. Formal recognition turns out to be even rarer than strong competence, as evidenced by the consistently lower numbers in Column C than in Column B. Somewhat surprisingly, three-quarters of all of the units surveyed indicated that they had at least one functional area where their competence was formally recognized by headquarters. However, in Column E, this number drops considerably once we add the last criterion from our definition, namely that to be considered a center of excellence a unit’s capabilities must create value beyond its own boundaries, i.e., in the broader corporation. Thus, only 18.9 percent of respondents indicated that their unit (1) possessed

strong capabilities in research, (2) had those capabilities formally recognized by headquarters, and (3) considered their capabilities to be of significant use to other units in the corporation.⁶ These units are centers of excellence (in research), according to our definition. The corresponding numbers for development and manufacturing were 26.3 percent and 51.6 percent respectively. Although the manufacturing percentage seems quite high, we believe that this number is reasonable based on our understanding of the Canadian context and the major role played by foreign companies in that country. Especially in the post-NAFTA context, many multinationals have looked to their Canadian subsidiaries as platforms for regional production strategies—and have made correspondingly significant investments in manufacturing capabilities and capacity. We suspect that these numbers would be lower in most other contexts, although we defer this and other questions of generalizability to future research.

External environment

Building on the main elements of Porter’s (1990) diamond model, and the scale developed by Birkinshaw *et al.* (1998), respondents were asked to assess the business environment in which they compete along four dimensions: availability of supply material; quality of suppliers; demanding customers; level of competition (1 = very low, 7 = very high). Ideally, we would have been able to use individual measures in our models. However, the high intercorrelation between many of the items motivated us to construct a composite index. *Diamond Strength* is calculated as the sum of the scores across these four items.

⁶ We adopted a cut-off point of 4 out of 7 for establishing that a particular unit contributed to the broader organization.

External sources of competence

This construct was measured by asking respondents to assess the impact of various organizations outside the boundaries of the firm on the development of the subsidiary's competencies, where 1 = no impact at all, 7 = very decisive impact. We chose to focus the questions specifically around the issue of competence development rather than a more general 'strength of ties' conceptualization in order to avoid ambiguity in the interpretation of the results. Our fieldwork suggested that many subsidiaries would characterize themselves as having strong ties (depth and breadth) to, say, a particular customer or supplier—without those ties necessarily impacting the development of the subsidiary's capabilities. In other words, many—probably most—interorganizational relationships appear to be geared toward the exploitation of existing capabilities rather than the development of new ones. We identified four external organizations that the existing literature and our own fieldwork suggest were potentially important sources of competence development in foreign subsidiaries: customers, suppliers, competitors, and external research institutions. In the models used to test our hypotheses we use a composite measure, *External Influence*, based on the sum of the responses across the four actors.

Internal sources of competence

The measurement of this construct mirrored the one above. Four specific organizations were identified (foreign corporate headquarters, specific internal corporate customer, specific internal corporate supplier, specific corporate R&D unit) and respondents assessed their impact on the development of the subsidiary's competence, where 1 = no impact at all, 7 = very decisive impact. Our measure, *Internal Influence*, is the sum of the individual scores.

Parent firm investment

For each of research, development, and manufacturing, respondents were asked to 'describe the level of investment in the Canadian Subsidiary for the past 3 years' (1 = very limited, 7 = very large). We chose a 3-year time frame to eliminate single-year fluctuations and anomalies. Unfortunately, many surveys were returned with missing

values on this question, potentially undermining its use in our statistical analysis. However, subsequent analysis of the data indicated that the cause of the missing values was the absence of a zero anchor, i.e., a 'no investment' category. This was confirmed by cross-tabulations, which revealed that surveys with missing values for the level of investment question were overwhelmingly those in which the respondent also checked 'NA' for any activity in that area. Hence, we interpreted a missing value as indicating little or no investment in that activity and recoded these values as 1. Our resulting measure, *Investment Level*, is therefore an activity-specific measure of parent firm investment in the subunit, ranging from 1 to 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 = subsidiary level, 2 = subcorporate, 3 = foreign corporate HQ). Decisions were as follows: hiring top subsidiary management; entering new markets within the country; entering foreign markets; changes to subsidiary organization; introduction of new products/services; approval of quarterly plans/schedules. Our measure, *Decision Making Autonomy*, is based on the average of these six items ($\alpha = 0.63$).

Controls

The multinational literature suggests several factors that might be correlated with the formation of centers of excellence, but which are not causally related to or even essential to the subsidiary development process. In particular, we expect that larger and more established (i.e., older) subsidiaries will be more likely to contain centers of excellence. Both variables find some evidence in the previous empirical research on the evolution of foreign subsidiaries in multinational firms (e.g., Birkinshaw, 1997; Frost, 2001; Ronstadt, 1977). To control for size, we used the unit's sales revenue in 1997, which was one of the items on our questionnaire. The age of the unit was similarly obtained from the questionnaire.

A final factor that we considered important to control for was the entry mode of the foreign unit. For example, research by Eun, Kolodny, and Scheraga (1996), Harris and Ravenscraft (1991),

and Capron, Dussauge, and Mitchell (1998) has highlighted the role of technological assets of acquiring and target firms. Acquisitions may be particularly favored when the capabilities of the target firm would be difficult to develop internally (for example, where intangibles are key) and when the acquiring firm has few technological capabilities of their own (Granstrand and Sjölander, 1990). Based on field interviews and our general knowledge of the Canadian context, we do not have a strong prediction about the role of entry mode in the development of centers of excellence. We have seen centers of excellence in units established through greenfield investment and acquisition. However, to ensure that entry mode is not driving our results, we controlled for it by creating a dummy variable that takes on the value of 1 if the unit was established through greenfield investment, and 0 otherwise.

RESULTS

We begin by presenting descriptive statistics on centers of excellence in each of the three functional areas. These are presented in Table 2. In addition, we provide a set of comparison points with those units that do not meet our three element definition of a center ('non-centers' in Table 2). These statistics reveal interesting differences across the three types of centers of excellence as well as substantial differences between centers (of any kind) and non-centers. In terms of size, manufacturing centers are the largest, with average sales in 1997 of over C \$300 million compared to less than C \$100 million for both research and development centers. Non-centers are in the middle at

C \$179.2 million. A similar pattern is reflected in the number of employees, with manufacturing centers averaging 774 employees compared to 436 and 404 for research and development centers, respectively. Non-centers were again in the middle at 558 employees, on average. Research and development centers are also younger (19 years and 27 years old, on average, respectively) and more likely to be formed within an acquired subsidiary than a greenfield subsidiary. This finding accords with recent work in strategic management on international acquisitions that has highlighted the importance of technology-seeking motivations for cross-border M&A (Capron *et al.*, 1998; Inkpen, Sundaram and Rockwood, 2000; Teece, 1992). Manufacturing centers average about 35 years old, the same as non-centers, with a closer split between greenfield and acquisition (55% acquisition).

Centers of excellence in all three areas are more export oriented than non-centers. This is not surprising in light of our earlier discussion on the evolution of multinational firms from multidomestic-type strategies and structures to more global and transnational-type structures (Bartlett and Ghoshal, 1989). As noted earlier, centers of excellence are seen by many scholars as an important manifestation of the transition to more globally rationalized structures for innovation, production, and distribution. Further evidence of this trend comes from the statistics on internal sales and purchases. Development and manufacturing centers sell significantly more of their output internally (i.e., to other units of the multinational firm) than do non-centers: 19 percent of total sales for manufacturing centers (14% for development centers) vs. an average

Table 2. Descriptive statistics: centers of excellence vs. non-centers*

Activity	Research Center	Development Center	Manufacturing Center	All Non-Centers
Sales revenue (\$C million)	78.6	85.5	300.8	179.2
Employees (#)	436	404	774	558
Age (years)	19	27	34	35
Acquisition (%)	65	64	55	56
Exports (%)	34.8	36.7	38.6	25.4
Internal purchases (%)	9	15	26	30
Internal sales (%)	10	14	19	7
Autonomy [†]	1.87	2.00	2.01	2.02

* All statistics shown are means, except where noted.

[†] Average response to five questions (lower numbers indicate more autonomy).

for non-centers of only 7 percent. Interestingly, however, non-centers have the highest average level of internal purchases, averaging 30 percent of total purchases. The asymmetry between internal sales and purchases for non-centers is suggestive of a dependent relationship between headquarters and subsidiary, consistent with the classical view of the multinational firm as a mechanism for exploiting headquarters-created advantages in foreign markets. However, manufacturing centers appear to be especially well integrated into the global operations of the parent firm, as evidenced by the combination of high exports and high levels of both internal sales and purchases. Overall, there do not appear to be major differences in the autonomy levels experienced by any of the different types of unit: only research centers appear to have a slightly higher level of autonomy (reflected in the lower average autonomy score).

Table 3 contains the correlation matrix. For all three centers, there is a moderately high correlation with external sources of competence development; the correlations with internal influences are more modest, although still significant, with the exception of manufacturing centers where internal influences appear especially important ($r = 0.296$, $p < 0.01$). Investment by the parent firm stands out for its high correlation with all three types of centers, but particularly research and development centers. Finally, the strength of the local business environment (*Diamond Strength*) and the autonomy of the unit are not significantly correlated with any of the centers. *Autonomy*, in particular, appears to bear little relationship to center of excellence formation in our data. Further investigation revealed that none of the individual items used in our composite measure of autonomy was significantly correlated with any of the dependent variables. Given our modest sample size, we therefore chose to drop *Autonomy* from our regression models to preserve degrees of freedom. We pick up the issue of unit autonomy again later in the paper.

Hypothesis tests

We turn now to the multivariate tests of our hypotheses. Because our dependent variables are dichotomous (center/not center), we used logistic regression techniques. Results are reported in Table 4. The table is divided into three sections by functional area in order to explore differences in the factors contributing to the development of

centers of excellence in research, development, and manufacturing activities. Numbers in parentheses represent standard errors. Interpretation of the logistic regression coefficients follows the normal pattern: positive, significant values indicate that an increase in that variable (or a movement from 0 to 1 for indicator variables) increases the odds that a particular unit will meet our definition of a center of excellence, *ceteris paribus*. Negative values indicate the reverse. For each activity, we begin with a baseline model including just our control variables. Comparisons in the model fit between this baseline model and the fully specified model provides an indication of the overall explanatory power of our hypotheses. In addition to these two models, we also present models in which *External Influence* is included but *Internal Influence* is not, and vice versa. This decision was motivated by the correlation matrix (which shows that the two variables are correlated more highly with each other than with the dependent variables) and by the results we obtained in our fully specified models (Models 2, 6 and 10). Our intervention follows a classic approach for dealing with problems of multicollinearity (Kennedy, 1998).

Overall, the models shown in Table 4 work well, although, interestingly, the baseline models (Models 1, 5, and 9) do not. For research and development centers, the baseline models (Models 1 and 5) barely reach significance; in Model 9, the baseline model for manufacturing centers, it does not. This is in contrast to the fully specified models (2, 6 and 10), which in all cases are significant at a minimum of $p < 0.05$. This result suggests that structural characteristics alone (size, age, entry mode) do not provide a solid basis on which to understand and predict patterns of center of excellence formation.

Hypothesis 1 posited a relationship between conditions in the local business environment and the development of centers of excellence in foreign subsidiaries. This hypothesis is not supported. In all cases the coefficient on *Diamond Strength* is not significantly different from zero. Subsequent investigation revealed that this result does not indicate that respondents perceive the local business environment to be weak. Rather the reason for the lack of significance of this variable is that virtually all of the respondents rated the four attributes of the local context that compose our measure quite highly. As such, perceptions of the strength of the local industry diamond do not distinguish centers

Table 3. Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12
1. COE (Research)	0.656***											
2. COE (Development)	0.287***	0.292***										
3. COE (Manufacturing)	-0.074	-0.086	-0.049									
4. Greenfield	-0.161	-0.156	0.062	-0.107								
5. Log (Sales)	-0.235**	-0.291***	-0.038	0.436***	0.126							
6. Log (Age)	0.147	0.095	0.124	-0.102	0.064	-0.082						
7. Diamond Strength	0.393***	0.306***	0.330***	-0.280**	0.148	0.078	0.148					
8. External Influence	0.213*	0.244**	0.296***	-0.000	0.017	-0.014	0.073	0.464***				
9. Internal Influence	0.606***	0.451***	0.210**	-0.163	0.037	-0.096	0.062	0.458***	0.206*			
10. Investment Level (Research)	0.359***	0.445***	0.104	-0.174	0.033	-0.128	0.157	0.394***	0.180	0.619***		
11. Investment Level (Dev.)	0.052	0.013	0.230**	-0.186	0.214**	-0.041	0.244**	0.297***	0.078	0.166	0.409***	
12. Investment Level (Manuf.)	-0.126	0.007	0.027	0.124	0.020	-0.014	0.090	-0.152	0.129	-0.189*	-0.227**	-0.197*
13. Autonomy												

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

Table 4. Factors affecting the likelihood of center of excellence formation

	Research Centers				Development Centers				Manufacturing Centers			
	1	2	3	4	5	6	7	8	9	10	11	12
Greenfield	-0.214 (0.688)	-2.258 (1.671)	-0.894 (1.175)	-2.088 (1.573)	-0.314 (0.595)	-0.818 (0.888)	-0.060 (0.756)	-0.901 (0.895)	0.188 (0.478)	0.072 (0.626)	0.308 (0.571)	-0.155 (0.604)
Log (Sales)	-0.289 (0.190)	-0.974** (0.496)	-0.769** (0.374)	-0.923** (0.453)	-0.236 (0.168)	-0.464* (0.244)	-0.382** (0.222)	-0.454* (0.247)	0.081 (0.139)	0.032 (0.164)	-0.017 (0.160)	0.035 (0.158)
Log (Age)	-0.476* (0.246)	-1.044* (0.532)	-0.537 (0.386)	-0.988* (0.507)	-0.559** (0.231)	-0.748** (0.321)	-0.466** (0.277)	-0.754** (0.317)	-0.042 (0.193)	0.056 (0.233)	0.054 (0.215)	-0.034 (0.227)
Diamond Strength		0.260 (0.234)	0.256 (0.195)	0.240 (0.229)		-0.055 (0.107)	-0.025 (0.092)	-0.049 (0.110)		0.044 (0.082)	0.016 (0.076)	0.030 (0.081)
External Influence		0.358** (0.170)		0.331** (0.160)		0.218** (0.104)		0.242** (0.100)		0.070 (0.067)		0.127** (0.061)
Internal Influence		-0.046 (0.096)	0.057 (0.095)			0.058 (0.069)	0.116* (0.064)			0.099* (0.056)	0.151** (0.046)	
Investment Level		1.166*** (0.403)	1.277*** (0.347)	1.117*** (0.370)		0.638*** (0.216)	0.663*** (0.199)	0.609*** (0.209)		0.328* (0.181)	0.366** (0.178)	0.320* (0.179)
Constant	1.155 (1.195)	-7.684 (5.806)	-6.967 (5.035)	-7.769 (5.852)	1.782 (1.093)	-1.738 (2.865)	-1.783 (2.514)	-1.230 (2.873)	-0.290 (0.889)	-5.183* (2.283)	-3.982** (2.027)	-3.868* (2.134)
Model Chi-Square	7.251*	46.87***	43.25***	46.65***	9.92*	31.59***	28.67***	30.86***	0.716	14.96**	13.08**	11.68*
% Correctly Predicted	81.5	89.5	90.0	89.5	76.1	78.9	77.5	80.3	57.6	63.2	67.5	64.5
N	92	76	80	76	92	76	80	76	92	76	80	76

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

from non-centers: lack of variation, not low ratings, drove this result.

Hypothesis 2 was concerned with the role of external actors in the capability development process, which is at the root of our conceptualization of centers of excellence. We posited a positive relationship between external actor influence and center of excellence formation. This hypothesis is generally supported in our models. The strongest results are obtained in the research and development models, where *External Influence* is positive and significant in all cases at $p < 0.05$. In the manufacturing centers models, *External Influence* does not reach significance in the fully specified model (Model 10). However, when the effects of multicollinearity are treated by dropping *Internal Influence* from the model (Model 12), *External Influence* is positive and significant as hypothesized.

Turning to Hypothesis 3, we argued that other parts of the multinational firm (headquarters, as well as internal suppliers, customers, and research units) were likely to play an important role in the formation of centers of excellence, especially in terms of the capability development process. This hypothesis receives modest support across the three groups of models, although support is quite strong in the manufacturing center models. *Internal Influence* is positive and significant in all three manufacturing models (Models 10, 11, and 12). In the development center models (Models 6 and 7), it is only significant when *External Influence* is dropped. In the research center models (Models 2 and 3), *Internal Influence* does not reach significance at any point.

It is worthwhile elaborating on the results of the tests on Hypotheses 2 and 3, since an interesting pattern is revealed. For manufacturing centers, internal actors—i.e., other parts of the multinational firm—appear to play a more important role in the development of strong capabilities than do actors outside the boundaries of the firm. The pattern is reversed for research and development centers, where external customers, suppliers, and competitors are given more credit as important sources of competence development. This pattern seems to us to be quite consistent with the general thrust of much of the literature on innovation and capability development, which tends to view manufacturing competence as developing through incremental improvements and the internal transfer of superior practices. Research and development,

on the other hand, are generally thought to involve a greater amount of boundary spanning activity and participation in the technological community that exists in the ‘interstices between firms, universities, research laboratories, suppliers, and customers’ (Powell *et al.*, 1996: 118).

Hypothesis 4 posited a positive relationship between parent firm investment and the formation of centers of excellence. This hypothesis is supported for all three types of centers. The impact of parent firm investment appears to be especially important for research and development centers, as indicated by the size of the coefficients on *Investment Level* in Models 2–4 and 6–8. In all cases, this variable is significant at $p < 0.01$. For the manufacturing models, *Investment Level* is also positive and significant as hypothesized, but there is a notable reduction in the effect size and significance level of this variable compared to the research and development models. One explanation for this result is that research and development tend to be very high fixed-cost activities, often involving large investments in specialized equipment, personnel, and other resources. As such, we would expect parent firm investment to be a more important driver of center of excellence formation in these activities than in manufacturing, though manufacturing can also involve very high fixed costs.

Perhaps a more persuasive argument comes from an understanding of the context for this study, namely Canada in the post-free trade era.⁷ After the passage of the 1989 Free Trade Agreement, many foreign multinationals operating in Canada took the opportunity to reevaluate their North American operations with an eye to building more efficient regional innovation and production platforms. At that time, many firms discovered that their Canadian manufacturing operations were actually quite competitive as a result of the historical accumulation of capabilities as well as a favorable macroeconomic context. These units often became centers of excellence within the company with only a modest amount of additional investment, typically in capacity to enable the unit to scale up to regionally

⁷ Recall that Canada was a signatory to two major trade agreements in the last decade, the 1989 Canada–United States free trade agreement and NAFTA. Both agreements had a significant impact on the structure of foreign investment (and disinvestment) in Canada, especially the 1989 bilateral agreement with the United States.

efficient levels. In R&D, on the other hand, Canadian operations had by and large remained small and underdeveloped—a subject of much public debate in Canada (Rugman, 1983). Many of those operations were, in fact, closed down in the post-1989 restructuring. This shows up in the data in the much smaller number of research and development centers compared to manufacturing centers. Those R&D operations that were maintained often required substantial investment in equipment and personnel, a fact that seems a likely explanation for the result with respect to *Investment Level* in Table 4.

As noted earlier, we dropped *Autonomy* from the models based on the absence of a relationship between it and any of the dependent variables, as revealed in the descriptive statistics. Hence Hypothesis 5 is not supported. One way to reconcile this result with prior research (e.g., Birkinshaw, 1997; Crookell, 1986) is through a dynamic argument. It may indeed be the case, as suggested by this earlier body of work, that high levels of autonomy are associated with the accumulation of subsidiary capabilities through the process of ‘subsidiary-driven charter extension’ described by Birkinshaw and Hood (1998). However, it also seems likely that, once formally recognized as a center of value creation for the corporation as a whole, the subsidiary may be forced to give up some of its autonomy as the firm seeks to integrate the unit into its global network of innovation, production, and distribution. In Bartlett and Ghoshal’s (1989) terms, this may describe the rationalization process associated with moving away from ‘multidomestic’ configurations characterized by substantial independence at the unit level to ‘transnational’ configurations characterized by substantial *interdependence*. In short, achieving recognition as a center of excellence may involve a kind of Faustian bargain for the subsidiary: more investment, more responsibility, but less autonomy to act independently in key decision areas.

Robustness checks and extensions

We assessed the robustness of our findings in several ways, most importantly by exploring whether and how alternative operationalizations of the dependent variable might impact the results obtained. These results are contained in Table 5. First, we experimented with the cut-points we

adopted in defining ‘strong capabilities’ as part of our definition of a center of excellence. Whereas our original models used 4 out of 7 as the minimum threshold for defining strong capabilities, in subsequent analyses we tried more stringent cut-points: 5 out of 7, and 6 out of 7. The 5-point cut-off had no bearing on the results. A 6-point cut-off had only minor impact, as can be seen in Models 12, 15, and 18 in Table 5. None of the earlier results was contradicted and, indeed, some of the results were strengthened.

Second, we experimented with alternatives to our stipulation that centers must receive formal recognition of their distinctive competence by headquarters. Drawing on another item from our survey, we first considered whether shifting the recognition requirement to *either* formal or informal recognition would impact our results. This intervention had little impact on the research and development center models, but it caused a general attenuation in the significance of the individual coefficients in the manufacturing models. This can be seen in Models 13, 16, and 19 in Table 5. This result appears to be caused by the greater inclusiveness of the modified dependent variable: adopting the criterion that the capabilities could be formally or informally recognized boosted the number of units falling into our definition of a manufacturing center to 60 percent, thus reducing the amount of variation in the dependent variable. Finally, we tried dropping the recognition requirement altogether, in effect creating a continuous variable as our center of excellence measure: strength of capabilities multiplied by use to others. Models 14, 17 and 19 represent OLS regression results on this measure. Although these models proved more sensitive to the problems of multicollinearity discussed above, when we entered *Internal Influence* and *External Influence* separately into the models, the results obtained were very similar to those obtained in Table 4.

Finally, we turn to the question of performance. Although the central focus of this paper is on the emergence of centers of excellence as an important phenomenon to be understood, ultimately strategy scholars and managers are interested in whether new organizational strategies and structures contribute to the performance of the enterprise. But performance is also of particular interest in this paper because of its dual role in our conceptual model: as outcome of the center of excellence process and as driver of subsequent investment by the

Table 5. Robustness checks

	Research Centers			Development Centers			Manufacturing Centers		
	12 ^a	13 ^b	14 ^c	15 ^a	16 ^b	17 ^c	18 ^a	19 ^b	20 ^c
Greenfield	-0.441 (1.679)	-1.683 (1.174)	1.395 (2.555)	0.380 (1.144)	-1.977 (0.881)	0.003 (0.920)	0.072 (0.626)	-0.553 (0.659)	2.060 (3.063)
Log (Sales)	-1.781 [*] (0.946)	0.042 (0.252)	0.525 (0.758)	-0.992 ^{***} (0.398)	-0.109 (0.194)	-0.266 (0.239)	0.032 (0.164)	-0.003 (0.175)	0.455 (0.916)
Log (Age)	0.120 (0.771)	-0.933 ^{**} (0.382)	-0.684 ^{**} (0.295)	-0.068 (0.426)	-0.897 ^{**} (0.350)	-0.672 [*] (0.358)	0.056 (0.233)	-0.284 (0.264)	-0.297 ^{**} (0.350)
Diamond Strength	1.069 [*] (0.608)	-0.009 (0.127)	-0.031 (0.093)	-0.011 (0.168)	0.020 (0.107)	-0.264 ^{**} (0.113)	0.044 (0.082)	0.140 (0.086)	0.008 (0.119)
External Influence	0.505 [*] (0.305)	0.203 (0.119)	0.009 (0.089)	0.361 ^{***} (0.144)	0.390 ^{***} (0.124)	0.491 ^{***} (0.105)	0.070 (0.067)	0.051 (0.070)	0.137 (0.098)
Internal Influence	-0.037 (0.152)	-0.012 (0.085)	-0.002 (0.065)	-0.093 (0.087)	-0.089 (0.069)	-0.157 [*] (0.078)	0.099 [*] (0.056)	0.086 (0.057)	0.007 (0.078)
Investment Level	2.306 ^{**} (0.927)	1.087 ^{***} (0.302)	2.346 ^{***} (0.203)	0.955 ^{***} (0.341)	0.511 ^{***} (0.182)	1.423 ^{***} (0.211)	0.328 [*] (0.181)	0.281 (0.183)	1.125 ^{***} (0.258)
Constant	-36.287 [*] (18.912)	-1.392 (3.394)	1.395 (2.555)	-5.976 (4.890)	-2.288 (2.841)	6.475 ^{***} (3.089)	-5.183 ^{**} (2.283)	-4.576 [*] (2.337)	2.060 (3.063)
Model significance	***	***	***	***	***	***	**	**	***
N	76	76	75	76	76	75	76	76	75

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ ^a Dependent variable operationalized as: minimum 6 out of 7 for level of competence; formal recognition; minimum 4/7 for use to others.^b Dependent variable operationalized as: minimum 4 out of 7 for level of competence; formal recognition or informal recognition; minimum 4/7 for use to others.^c Dependent variable operationalized as: level of competence \times use to others.

Table 6. The performance impact of centers of excellence

Individual Item ^a	Research Centers		Development Centers		Manufacturing Centers	
	COE	Not COE	COE	Not COE	COE	Not COE
Corporate Business Volume	4.18***	2.96	3.42	3.10	3.77***	2.55
Corporate Profitability	5.18***	3.82	4.68**	3.84	4.42**	3.64
Corporate New Product Introduction	4.53***	2.76	4.04***	2.74	3.50**	2.64
Corporate Competitiveness	4.82***	3.15	3.92*	3.29	3.94***	2.90
Other Units' Competence Development: Research	3.94***	1.81	2.96**	1.95	2.62**	1.89
Other Units' Competence Development: Development	4.06***	2.33	3.44**	2.35	3.16***	2.18
Other Units' Competence Development: Manufacturing	3.94**	3.01	3.76*	2.97	4.04***	2.31

Numbers represent means on a 7-point scale. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

^a For each performance outcome item (top half of table), respondents were asked: 'To what extent has the subsidiary influenced the foreign corporation when it concerns _____. For each competence development item (bottom half of table), respondents were asked: 'What impact has the subsidiary had on the development of competence of other units within the foreign corporation in the following activities?'

parent firm. In the spirit of exploratory research, we briefly consider both issues.

To assess performance, we asked several questions on our survey that were designed to illuminate the various mechanisms through which centers of excellence might conceivably impact the firm. These are listed in Table 6, the top half of which is concerned with traditional 'outcome' variables pertaining to performance: business volume, profitability, new product introduction, and overall competitiveness of the firm. For each of these variables, we asked respondents to assess the influence of their unit on the company on a 1–7 scale. Figures are mean response scores. The bottom half of Table 6 is concerned with the subsidiary's role in the development of competence in other units, i.e., a learning and knowledge transfer outcome.

The results are striking. Compared to non-centers, centers in all three functional areas appear to contribute at a much higher level in most areas. For research and manufacturing centers, respondent ratings indicate superior performance (compared to non-centers) on all of the outcome variables in the top half of Table 6. For development centers, the unit's impact on profitability and new product introductions was rated at a significantly higher level than non-centers. Similarly, in terms of competence development, centers of excellence were consistently rated more highly than non-centers. These results were further corroborated in subsequent regression analysis (not shown),

in which these measures of performance were regressed on a center of excellence dummy variable along with a set of controls. Finally, although it is impossible to untangle cause and effect given our cross-sectional data, some sense of the relationship between performance and parent firm investment (as indicated in our conceptual model) can be obtained by examining the correlation between the two. Using a composite measure of performance, the correlation between performance and parent firm investment in (a) research was 0.399 ($p < 0.001$); (b) development was 0.252 ($p < 0.05$); and (c) manufacturing was 0.321 ($p < 0.01$). Although purposively exploratory, these findings serve to at least suggest the plausibility of these paths in our conceptual model and, more importantly, to motivate the importance of the center of excellence phenomenon as an issue worthy of future research.

CONCLUSION

A central question in current debates about the nature and evolution of the multinational firm concerns the ability of multinationals to identify, develop, and leverage capabilities within their dispersed network of foreign subsidiaries. This paper has sought to provide some initial insight into one such mechanism that multinationals have turned

to in dealing with this issue, namely the creation of 'centers of excellence' within foreign subsidiaries. A growing body of mostly anecdotal evidence suggests that the center of excellence phenomenon is increasing among the world's major multinationals, at the same time that this evidence also suggests that many firms are struggling with the managerial issues involved. As such, we believe there is significant value in studying this phenomenon, both for academics and managers.

Perhaps the most basic contribution of this paper is to advance a formal definition of the term 'center of excellence' that we believe is both robust enough to capture the diversity of its usage in practice and precise enough to guide subsequent academic research.

A second contribution of the paper is the development and testing of a basic conceptual framework for understanding the development of centers of excellence in multinational firms.

We argued that centers of excellence can be viewed as the outcome of a combination of external and internal factors, the most important of which (based on our results) appear to be parent firm investment and linkages to sources of competence both within and outside the boundaries of the firm. Our results also showed that the relative importance of these factors varies across different types of centers (e.g., manufacturing vs. research and development).

At a higher level of abstraction, we believe our results are consistent with a view of capability development that is inherently evolutionary in nature. That is, the development and recognition of subsidiary capabilities can be understood as a cumulative, path-dependent process that is shaped by both external and internal factors. This view has deep roots in strategic management, of course, but is also widely shared among international business scholars as a way of understanding the role of foreign subsidiaries within the broader multinational network (Birkinshaw, 1997; Frost, 2001; Kogut, 1983). Our fieldwork also bears this out. We identified a number of examples of subsidiaries that had incrementally increased their competence over an extended period of time, underpinned by multiple 'tranches' of parent firm investment. These observations are consistent with an overarching evolutionary process that is captured in the double-headed arrows

in our model: investment to capabilities to performance to investment.⁸

This paper contributes to the ongoing dialogue in strategic management on the organizational determinants of competitive advantage. Our exploratory investigation of the relationship between centers of excellence and corporate performance showed that, along several standard measures of performance, centers of excellence scored significantly higher than non-centers. The results held across all three types of centers, although the data also suggested that different kinds of centers have different kinds of impact.

Finally, it is worth noting several limitations of our study as well as avenues for future research. In addition to the obvious limits on generalizability inherent in a study set in a single country and time period, our results must be considered preliminary due to the combination of small sample size and inherently complex phenomena. Anecdotal evidence concerning centers of excellence in multinational firms abounds. Arguably what the literature needs at this point is more detailed qualitative work (through, for example, longitudinal and/or comparative case studies of particular subsidiaries) as well as large sample research, perhaps using surveys or even patent data as a way of adding rigor to the analysis of both the antecedents and consequences of the phenomenon.

Observations from the field tell us that the incidence of multinationals adopting center of excellence structures is very likely to increase, both in breadth and scope going forward. More broadly, it is our belief that the twin motors of globalization and technological change will push a growing number of multinational firms to adopt ever more complex global configurations and ever more finely grained divisions of competence and authority. The creation of centers of excellence appears to be one important manifestation of, and response to, this trend. Clearly more work needs to be done

⁸ The evolutionary logic that we are advancing here probably applies most closely to the process experienced by greenfield subsidiaries. It is interesting to note, though, that a large number of the centers of excellence in our sample—over half of the research and development centers—were acquired. Although the capabilities of the acquired organization probably also developed along the evolutionary lines we are referring to, from the perspective of the acquiring multinational this is much less an incremental, cumulative process than it is a direct and purposive move that in some sense bypasses the need to engage in this kind of protracted internal upgrading of capabilities.

in this area to understand both the nature and scope of the contribution made by various kinds of centers, as well as the specific organizational mechanisms through which companies have been able to 'extract' corporate-wide value from such distributed capabilities. Given the still limited understanding of the phenomenon by researchers and the apparent ascendance of the concept in the practice of multinational management, it is clear that further research on centers of excellence is warranted.

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