Competence-Creating Overlaps and Subsidiary Technological Evolution in the Multinational Corporation

ABSTRACT

This paper explores overlapping competence-creating activities within the boundaries of the multinational corporation (MNC) by exploring how foreign greenfield subsidiaries' technological evolution is affected by the addition of an acquired unit in the same location. Drawing upon the complete U.S. patenting activity by subsidiaries of 21 Swedish multinationals over the 1893-1990 period, we use repeated event history analysis to test a set of hypotheses concerned with the effect of this competence-creating overlap. Findings include an initial retrogressive effect on greenfield subsidiaries' technological evolution as a result of competence-creating overlaps, which, over time diminishes, to become positive after more than a decade of overlap exposure. Thus, we add to the theory of subsidiary evolution by expanding the view of the archetypal subsidiary that has so far been constrained to evolve without operational overlaps. Managerial implications are discussed.

INTRODUCTION

This paper explores overlapping competence-creating activities within the boundaries of the multinational corporation (MNC). Suppose that the MNC acquires a competence-creating subsidiary in any given foreign location that already hosts a competence-creating greenfield subsidiary. In such a scenario, how will it affect the ongoing technological evolution of the first-comer subsidiary? In other words, in what way will a competence-creating overlap impact its future potential for strategic renewal by entering into technologies that represent new additions to the entire multinational group?

Extant work on the internationalization of technological capabilities in the MNC has already confirmed an overall increase in foreign competence-creating activities, and foreign subsidiaries which have acquired these skills have become common in the large and well-established MNC (Cantwell, 1989; Dunning, 1994; Reger, 2002; Cantwell & Mudambi, 2005). The general explanation for the internationalization of technological capabilities is the MNC’s initial need to adapt products to local market needs, which over time transforms into more sophisticated technological roles and responsibilities among foreign subsidiaries (Håkanson & Nobel, 1993; Miller, 1994; Papanastassiou, 1999; Patel & Pavitt, 1998; Cantwell & Piscitello, 2000). This advancement has generated mature MNCs with such an international dispersion of technological activities that it allows them to maintain an internal network of highly specialized subsidiaries (Cantwell & Mudambi, 2005). Certain subsidiaries have been able to venture beyond the general role of the international technological activities by obtaining competence-creating mandates, exploring agendas for regional or even global contribution to the MNC’s technological portfolio.

In the past decades, foreign acquisitions have become a major contributor to the expansion of technological capabilities outside the MNC’s country of origin (Zander, 1999). In fact, a host of studies have explored the choice between greenfield and acquisition modes of entering and developing operations in foreign markets (e.g. Caves & Mehra, 1986; Kogut & Singh, 1988; Hennart & Park, 1993; Cho & Padmanabhan, 1995; Andersen, 1997; Harzing, 2002; Larimo, 2003), and there is a fair amount of agreement on which factors influence market entry choice. However, the entry mode option has almost exclusively been treated as a choice of several definite entry strategies, producing a lack of investigations addressing the dynamics when similar types of subsidiaries are set up to share the same turf. The archetypal subsidiary depicted in the literature on subsidiary evolution has been constrained to evolve without internal role overlaps in the local market. As a result, important dynamics in the evolution of subsidiaries in general and technology in particular have remained largely unexplored, both from a theoretical and empirical perspective. This paper addresses this gap by empirically testing for the effects of competence-creating overlaps on the evolution of technological capabilities at the level of greenfield subsidiaries. Thus, we contribute to the literature on subsidiary evolution by expanding the field of analysis to incorporating role overlaps in the same local market. We believe that this may be a critical next step for the literature on subsidiary evolution, and by going beyond the foreign market entry decision, we will be allowed to empirically explore patterns affecting subsequent subsidiary evolution. Moreover, we contribute to management practice by re-affirming and extending Nadler and Tushman's (1999) assertion that corporate headquarters should have a key role in managing simultaneous cooperation and competition within the MNC. Also, our which is new to the field, repeated events analysis, will provide a brief user guideline for scholars interested in analyzing the occurrence of an event that may take place multiple times during the window of observation.

The paper is divided into five main sections. The first section starts off by reviewing prior research on the internationalization of technological capabilities in the MNC, making a distinction between greenfield and acquired subsidiaries respectively. Then follow a conceptualization of competence-creating overlaps within the MNC and the formulation of a set of hypotheses on how these overlaps can impact subsidiary evolution. The third section describes the sample, data and data collection, variables, and statistical method. The fourth section presents the results, and investigates the results in a number of robustness checks. The fifth and final section provides a discussion of the observed consequences of competence-creating overlaps and their implications for the strategies and management of the MNC.

SUBSIDIARY EVOLUTION AND COMPETENCE-CREATING OVERLAPS

The emergence of competence-creating roles among foreign subsidiaries of the MNC is essentially driven by two different types of organizational units and processes - (1) the establishment and evolution of greenfield subsidiaries, and (2) the establishment and development of subsidiaries through foreign acquisitions, which have been shown to progress through dissimilar development paths (Bertrand & Zuniga, 2006; Hitt, Hoskisson, Ireland & Harrison, 1991; Hitt, Hoskisson, Johnson & Moesel, 1996).

This paper focuses on the evolutionary processes associated with subsidiaries that were originally established as foreign greenfield subsidiaries, and treating foreign acquired subsidiaries as a specific dynamic element which may affect the ongoing and long-term operations of the former. Below, we will refer to these two types as simply greenfield and acquired subsidiaries, keeping in mind that the subsidiaries which we are interested in are all foreign subsidiaries. We admit that greenfield theorizing can be fruitfully enhanced by incorporating the MNC's acquisition strategies. Our point of departure is the moment greenfield subsidiaries achieve a competence-creating role in the MNC, and the expectation that they will continue to contribute to corporate-wide strategic renewal. Greenfield subsidiaries provide sound testing conditions due to their comparatively long history in the MNC, which has also resulted in their becoming the standard type of unit for the theories of subsidiary evolution. This has been noted by Frost, Birkinshaw and Ensign (2002), who assert that the evolutionary logic appears to apply predominantly to greenfield subsidiaries. Also, examinations of competence-creating overlaps will show that greenfield subsidiaries most often come first in the sequence.

The greenfield subsidiary

When greenfield subsidiaries are established, the MNC starts *de novo* activities in a foreign market, frequently on the basis of initially limited but subsequently expanding resources. Once a subsidiary has developed some type of rudimentary technological capabilities, it is often assumed that this process will continue and result in units with increasingly sophisticated technological capabilities. While it is true that a certain number of subsidiaries will reach a stage where they are capable of making substantial contributions to the technological and strategic development of the entire corporation, it is important to note that many subsidiaries do not develop any technological capabilities at all, or they may maintain only basic levels of technological support for extended periods of time.

The evolution toward more advanced technological capabilities and the likelihood to contribute significantly to the strategic renewal of the MNC among greenfield subsidiaries have been explained by a set of interrelated drivers or mechanisms (Pearce & Singh, 1992; Pearce, 1994; Taggart, 1996; Birkinshaw & Hood, 1998; Frost, 2001; Cantwell & Mudambi, 2005). The major drivers and mechanisms put forth in the literature are usually, but not necessarily, limited to (1) enhanced degrees of local market embeddedness, (2) opportunities to re-combine existing knowledge within the MNC, (3) subsidiary entrepreneurship, and (4) overarching resource allocation and coordination by corporate headquarters.

First, enhanced degrees of local embeddedness are expected to occur as greenfield subsidiaries evolve over time concurrently with their immediate local market. At the location level, the greenfield subsidiary will have opportunities for deliberate exploration of locally developed knowledge but it will also be in a position to take advantage of spillovers (Taggart, 1996; Mudambi, 1998; Feldman, 2000). This is based on the notion that each local environment offers a unique set of technological and business opportunities which especially competence-creating subsidiaries can assimilate and exploit, and suggests that competence-creating subsidiaries will continue to develop technologies that will make new additions to the MNC portfolio. Obviously, greenfield subsidiaries which have enjoyed long tenures as advanced units in given environments, should stand a better chance of leveraging the local market to their advantage, and thus bring about more strategic renewal than greenfield subsidiaries which have yet to gain such experience.

Second, Almeida (1996) and Cantwell & Mudambi (2000) suggest the existence of a virtuous cycle, in which technology diffuses to local firms, whose innovative efforts then have corporate-wide spillover benefits and cause the local subsidiary to further increase its own research efforts. This effect is proposed to be the most accentuated where the corporate headquarters invests in high value-added activities of research-intensive kind in the host country. In this process, the technological capabilities once transferred from the parent organization play an important role as stepping-stones into new technological fields. In general terms, technological capabilities transferred from home-country units represent resources that may be re-combined with internal and external resources in response to what can be tapped from the local environment. Such enhanced integration of the subsidiary within the MNC extends the opportunities to re-combine different ideas and resources into new products and services to the international level (Johanson & Vahlne, 2003).

Third, local embeddedness and the ability to respond to local business opportunities can trigger creative activities of what has been referred to as subsidiary entrepreneurship (Birkinshaw, 1999). Birkinshaw proposes a connection between distinctive capabilities and broadly defined subsidiary initiatives. Generally speaking, subsidiary initiatives are found to be promoted by a high level of distinctive subsidiary capabilities, but it also appears that initiatives, however created, have a positive impact on the formation of distinctive capabilities. It is also indicated that initiative-driving factors such as parent-subsidiary communications, credibility, and openness to initiatives all gradually increased over a ten-year period (Birkinshaw, 1999).

Finally, as an entity that can either facilitate or hamper subsidiary evolution, the corporate headquarters has the opportunity to run an internal capital market which supposedly will put resources to use in those units where it finds the best strategic use for them (Shin & Schultz 1996; Lamont 1997; Stein 1997; Mudambi 1999; Khanna & Tice 2001). The reason for headquarters to engage in the utilization of the internal capital market is the possibility to create additional value protected from the external markets and the ability for headquarters to choose the most promising subsidiaries to support and thus further increase profits in the MNC (Stein 1997), and at the same time upgrade the technological capabilities of the favored subsidiary. It has been suggested that headquarters through the implementation of suitable strategies and differentiated control mechanisms can enhance the MNC's capabilities to innovate and transfer technology (Nohria & Ghoshal, 1997).

The acquired subsidiary

Although the emergence and development of competence-creating acquired subsidiaries can be expected to somewhat coincide with the processes of greenfield subsidiaries, there are certain elements worth taking notice of, especially since acquired subsidiaries are the creation of a change in corporate strategy that has become much more prominent in modern MNC history. The increasing importance of acquisitions as a means of establishing operations in foreign markets has been documented in a number of publications (Hood & Young, 1979; UNCTAD, 2000; World Bank, 2001). There appear to be two main reasons for their growing popularity: (1) Rapid access to foreign markets and strengthened competitive advantage through enhanced economies of scale or diversification of international operations (e.g. Zander & Sölvell, 2002; Bergek & Berggren, 2004), and (2) access to new technology and future growth potential (Doz & Prahalad, 1991; Hitt *et al.*, 1996; Dunning, 2000). In many cases, whether intended or unintended, foreign acquisitions have had a considerable effect on the overall share of foreign research and development in the MNC (Håkanson & Nobel, 1993; Serapio & Dalton, 1999), and, in addition, on the direction of development of the MNC's overall technology portfolio (Zander, 1999).

Two prominent differences in the evolutionary patterns of greenfield and acquired subsidiaries are the immediate local market embeddedness provided to the acquiring corporation subsequent to an acquisition, and the possibilities of re-combinations of the subsidiary's old – and new technologies. What may be termed instant embeddedness (Forsgren, 1989; Andersson, Johanson & Vahlne, 1997) can allow the acquiring MNC to tap into operations that are already firmly embedded in the local context, which suggests that the levels of innovativeness and responsiveness to local business opportunities are likely to be higher than among greenfield establishments, at least in the initial stages. This would imply that acquired subsidiaries at any given point in time have a higher probability of introducing technologies that are new to the corporate groups than greenfield units. However, there may also be an acquisition-specific process at work, which involves a reduction of entrepreneurial effort to develop new products and technologies in the immediate post-acquisition period (Hitt *et al.*, 1991). Possibly, the acquired unit may then again increase its innovative efforts (Håkanson & Nobel, 1993), although observed patterns are sensitive to a small number of observations. In sum, acquired subsidiaries are likely to give the acquiring MNC immediate access to new technological capabilities, some of which are the result of the acquired unit's long-term involvement in the local business environment.

The dynamics of competence-creating overlaps

Thus far, we have reviewed the literature and presented likely evolutionary patterns for greenfield and acquired subsidiaries, albeit separately. The explicit focus of this paper is on how the greenfield subsidiary is affected by the addition of an acquired subsidiary in the same location. This kind of role overlap and overlaps in general between units within the boundaries of the MNC has yet to receive more attention in the literature. Recent exceptions include conceptual (Birkinshaw & Lingblad, 2005), case-based (Galunic & Eisenhardt, 1996) and quantitative (Kalnins, 2004) studies largely exploring under which conditions overlaps are likely to be observable, but they offer less insights into how they actually impact the corporation in general and technological evolution in particular necessitating for the inclusion of several strands of theorizing in the current paper.

Birkinshaw & Lingblad (2005) identify three dimensions regarding overlaps; (1) product market, (2) capability, and (3) intended charter, and following them we have extracted one for closer scrutiny. Here, we are especially interested in the capability dimension which applies to corporations' ability to deploy resources to achieve a desired end (Amit & Schoemaker, 1993; Eisenhardt & Martin, 2000). In the present paper, this is tantamount to the ongoing technological evolution at subsidiary level. Similar to Birkinshaw and Lingblad's (2005) conceptualization of overlaps, we acknowledge that there may be varying degrees of role overlap, but argue that the physical presence of the focal subsidiaries is of great consequence. That is, we argue that operating with overlaps within the MNC will have a particular effect if it takes place in some form of physical proximity (for example in the same country, region, business area). A stylized model of the role overlaps considered in this paper is presented in Figure 1, showing a competence-creating greenfield subsidiary being overlapped by two competence-creating acquired subsidiaries.

INSERT FIGURE 1 ABOUT HERE

Intra-firm overlaps, competence-creating ones included, have been associated to corporate internal competition (Birkinshaw & Lingblad, 2005). It is acknowledged that corporations includes elements of simultaneous cooperation and competition, because subsidiaries are expected to collaborate but at the same time also compete for limited headquarters resources, attention, and network positions. For competence-creating units, sharing technological knowledge becomes important in enhancing each other's competitive advantage, and is encouraged by corporate headquarters in the belief that it will promote efficiency. Corporate headquarters may actively reallocate resources facilitating the sharing of technological knowledge, which can take the form of technology transfer, resource reallocation, research syndication, expatriate rotation (Ghoshal & Nohria, 1989; Wolf & Egelhoff, 2002). These actions can also come about voluntarily and be completely external to the corporate headquarters' regular control scheme, when there are rationales for increased technological linkage between units.

In the internal competition for attaining and sustaining a competence-creating role within the MNC, competition in overlapped markets can also be an act of strategizing by the individual subsidiary seeking foreign market expansion. This sort of internationalization of the second degree (Forsgren, Holm & Johanson, 1992) is most likely to occur in initially neighboring markets, depending on factors such as psychic distance. Subsidiaries operating in the same country or region frequently compete for growth opportunities in overlapping business segments. This is most likely when experiencing fast growing bull-markets and corporate headquarters comes under pressure to explore those markets in order to secure future promising cash-flows.

Competence-creating overlaps: the effect on greenfield subsidiaries

Predictions regarding greenfield subsidiaries' entry into new technologies rest on assumptions about the existence of several interrelated processes: (1) enhanced degrees of local market embeddedness, (2) opportunities to re-combine existing knowledge within the MNC, (3) subsidiary entrepreneurship, and (4) overarching resource allocation and coordination by corporate headquarters. These processes can also be affected by the dynamics of overlapping activities of other subsidiaries in their physical presence. In fact, it is expected that an acquisition generating a competence-creating overlap will trigger several consecutive events that are likely to affect the technological evolution of the greenfield subsidiary. Mainly, these events pertain to the activation of the subsidiary-headquarters relationship and subsidiary-subsidiary interaction and rests on the assumption that the rationale for the acquisition goes beyond merely market-seeking motives to incorporate some degree of technology seeking.

When the MNC acquires a technologically advanced subsidiary which already hosts its own research capabilities, and then allows for a continuation of technological activities, some of these acquired subsidiaries will not only share the same mandate for corporate-wide technological and strategic renewal, but they will also directly duplicate what is already done in the MNC. If not remedied in the post-acquisition phase, and if subsidiaries are in the same geographical location, sharing the same immediate market may cause a crowding out effect, and the element of competition potentially may gain the upper hand in the overlap. This mirrors the often negative development which the MNC faces in the post-acquisition phase, with implementation problems and general unsatisfactory deal performance (Haspeslagh & Jemison, 1991). A reason for this is the problems that are associated with the integration of acquisitions (Porrini, 2004). It is during the integration stage that the inflow of technology, practices and routines from an acquisition occur (Barkema & Vermeulen, 2001). Therefore, acquisitions may broaden a firm's technological base, which can enhance the viability of its later undertakings and its ability to subsequently transfer technology.

Due to their ability to provide the MNC with instant embeddedness in the acquired subsidiary's market (Forsgren, 1989; Andersson, Johanson & Vahlne, 1997), these investments represent a means to obtain full-fledged operations and technologies that can be expected to differ from existing ones. Generally, this suggests that acquired units at any given point in time have a higher probability of introducing technologies that are new to the entire multinational groups than greenfield units. However, Hitt, Hoskisson, Ireland and Harrison (1991) found that acquisitions were, generally, followed by a corporate-wide reduction in research intensity, thus potentially lowering the likelihood for future entries into new technologies by both types of units.

Competence-creating mandates are not easy to come by in the MNC (Cantwell & Mudambi, 2005), and the logic of headquarters' resource allocation tells us that duplicative functions are not preferred in the MNC (Gaynor, 1989; Williamson, 1991; Stein, 1997). In the competence-creating overlap scenario, corporate headquarters could increase investment in an established subsidiary instead of allocating the resources to a completely new and acquired subsidiary. If the duplicative functions were to occur within the same location or region, the two competence-creating subsidiaries would draw upon identical local environments and be able to tap into similar knowledge-bases for prospecting re-combinations of knowledge. From an optimal resource allocation perspective, it makes little sense for the MNC to have two or more subsidiaries with such unique competencies tapping into the same market for local knowledge. Once this has been recognized, the level of competition between the units will increase at the expense of collaboration, and the objective will be to become the favored competence-creating subsidiary in the local market. This notion is in line with the argument proposed by Burt (1987) that structurally equivalent entities are substitutable and tend to be more competitive in nature.

In a similar vein, recognizing that all the subsidiaries of the MNC are interdependent and subject to the headquarters' limited resource allocation, control rights indicate that a competence-creating subsidiary will not only be evaluated on their own absolute merits, but also on the relative merits of other competence-creating subsidiaries. For similar units operating in the same location, headquarters may be reluctant to support all units in the overlap forcing them to compete for additional support or even survival. This behavior, rent-seeking, relates to influence activities as studied by Meyer, Milgrom, and Roberts (1992) where headquarters has the control rights to reallocate resources among subsidiaries, and the only distortions to making this efficient is time and the effort by subsidiary managers to bargain for the size of their subsidiaries. As a corollary, this has the potential to reduce productive behavior at subsidiary level when more time is diverted into unproductive rent-seeking, ultimately slowing down the technological evolution of the subsidiaries in the overlap.

Hypothesis 1: A competence-creating overlap will have a negative impact on the greenfield subsidiary's hazard of entering into a new technology.

Following the same underlying logic that suggests an initial retrogressive effect on the units in the overlap, these effects may not be proportional over time. The disequilibrium caused by the sudden role overlap, initially propelling the units into a negative trend, is likely to become even greater with time due to increased competitive behavior. Previous studies have found that acquired subsidiaries show a relatively larger technological output than similar greenfield ones (Mudambi & Navarra, 2004), which places them in a better position to be allowed by corporate headquarters to upgrade and develop their technological capabilities. In fact, Scharfstein and Stein (2000) argue that the effects of increased competition are more likely to be a problem among weak subsidiaries because of the opportunity cost of diverting from productive behavior is lower. Following this reasoning, greenfield subsidiaries will have incentives to use their bargaining power in an increasingly inefficient manner, as they will have continually less to lose due to their capability retrogression. This suggests that, over time, greenfield subsidiaries' technological capabilities will be depleted at an accelerating pace.

Hypothesis 2: Over time, a competence-creating overlap will increase its negative impact on the greenfield subsidiary's hazard of entering into a new technology.

METHOD

Sample

The empirical analysis is based on the complete U.S. patenting activity by foreign locations represented by 21 Swedish multinationals over the 1893-1990 period. Out of these subsidiaries, 108 were located in Europe (most importantly, Germany, 15, Switzerland, 14, United Kingdom, 12, Denmark, 11, and Finland, 10), 18 in the United States, and 31 in other countries (most importantly, Canada, 9, Australia, 5, Japan, 3, and Mexico, 3). The sample firms represent a relatively broad spectrum of industries, including pulp and paper, motor vehicles, pharmaceuticals, and telecommunications equipment and were chosen because of their significance by the number of inventions and research and development expenditure in the Swedish industry in the time period (see Wallmark & McQueen, 1986; Håkanson & Nobel, 1993).

We gathered detailed information about the sample MNCs and their foreign subsidiaries through the official publications “Svenska Aktiebolag – Handbok för Affärsvärlden”, “Koncernregistret – KCR”, and “Who Owns Whom – Continental Europe” and supplemented with annual reports whenever needed. This made it possible to define potential subsidiary name changes and systematically follow the corporations’ patenting by first-order, majority owned subsidiaries for the periods during which they belonged to the parent companies. Ending the observation window in 1990 alleviated potential parent-subsidiary identification issues. In fact, at that point in time, none of the sample firms had become involved in major international mergers (with the exception of ASEA, which merged with Brown Boveri to become ABB, and for which observations were truncated in 1988), but, after the mid 1990s, several of the sample firms became involved in more complex ownership structures as a result of mergers and acquisitions.

According to Fisher and Behrman (1979), there are four basic ways in which a firm can establish advanced R&D activities in a foreign market: (1) Allow technical service to manufacturing and marketing activities to evolve into continuous and more sophisticated R&D activities, (2) acquire a foreign firm possessing R&D resources, (3) directly establish an R&D group abroad, and (4) enter collaborative joint ventures involving R&D. In the current sample, the majority of foreign units fall into the first two categories. Among major Swedish multinationals, many of which are represented in the current sample, less than 10 percent of all foreign R&D units have historically been long-range, basic research units (Håkanson & Nobel, 1993; Ronstadt, 1978, presents similar figures for large, mature U.S. MNCs). Some of the patents picked up by the data may be the result of collaborative work in partially owned units, but in the present sample joint ventures involving R&D represent a small minority of the observations.

To define a sample with exclusively competence-creating units we extracted those with a proven capacity to contribute significantly to the technological and strategic development of the multinational group. Proof of this capability is that the units have been awarded at least one U.S. patent, which by definition requires that inventions be novel, non-obvious, and constitute useful additions to the existing stock of knowledge. Therefore, the insights from the current paper will be limited to the MNC’s technological evolution in terms of relatively significant new additions to the technology portfolio, and the paper does not account for the potentially wide range of minor technological advancements and improvements that may have taken place in parallel in the multinational network.

The explicit focus on greenfield subsidiaries' technological evolution is in part based on methodological considerations, particularly the identification and measurement of entry into new technologies by means of patenting records as applied in this paper. Whereas the registration of entry into new technologies on the basis of patenting is straightforward in the case of greenfield subsidiaries, it becomes potentially complicated in the case of acquisitions. Specifically, when the MNC acquires an ongoing operation, it acquires a stock of existing technologies and their related patents (which suggests a sometimes very high number of added new technologies in the year of acquisition), but some of the stock of existing technologies may go undetected because they may not have received any patent(s) in the year of acquisition. This results in particular patterns in the timing of entry into new technologies (the expectation would be a relatively high number of new entries in the year of acquisition), but also uncertainty as to whether registered entries into "new" technologies in the years following the acquisition indeed represent new additions. A reliable comparative assessment of the evolution of greenfield and acquired units would require data on the full history of all acquired units, and these data were not available in the present study.

As an indication of the relative importance of greenfield and acquired units in the patenting and technological activates in the current sample of firms, the total number of patents associated with greenfield units was 79 percent compared to 21 percent for acquired units. Acquired units have account for an increasing share of all patents across the sample firms, but greenfield units nevertheless continue to play an important role in the generation of new technology in the overall multinational group. Taken together, the outcomes of competence-creating overlaps are likely be more thoroughly understood by extracting greenfield subsidiaries and their technological evolution for close scrutiny.

Finally, it is notable that in some of the locations foreign units of the MNC may have been awarded one or several U.S. patents, but never accomplished entry into a technology that was new to the entire multinational group. Other locations are associated with single or multiple entries, but testing for patterns in the entry into new technologies requires the inclusion of both types in the empirical investigations. A stylized representation of the different types of greenfield subsidiaries, also illustrating the different time periods between entries into new technologies that are central to the empirical investigation, is provided in Figure 2.

INSERT FIGURE 2 ABOUT HERE

Data

We use patents as an indicator of technological evolution and greenfield subsidiaries' entry into new technologies. Patents have the advantage of being a source of consistent and comparable information over long periods of time, and are frequently used as indicators of technological activity of different sorts (e.g. Jaffe, 1986; Archibugi & Pianta, 1992; Almeida & Phene, 2004; Feinberg & Gupta, 2004). Another advantage of using patents are their high correlations with other types of alternative measures of technological activity. In fact, Hagedoorn & Cloodt (2003: 1375, 1365) found "no major systematic disparity amongst R&D inputs, patent counts, patent citations and new product announcements", concluding that "future research might also consider using any of these indicators to measure the innovative performance of companies in high-tech industries".

As mentioned, we rely on the complete sample corporations' U.S. patenting activity. This allows us to assume that the patents are regarded to be of relatively high quality and of commercial value as a result of the potential attractiveness of the large U.S. market, reducing the risk of capturing an excess number of minor inventions biasing the data set. While it has not been possible to estimate the relative proportions of these units in the current sample, only a small number of the identified units were responsible for only one patent over the entire period. It has been found that Swedish corporations' patenting behavior does not differ significantly from patenting behavior in other large markets, such as Germany or France (Archibugi & Pianta, 1992). As with all advantages, the usual drawbacks apply to this study. For instance, the empirical analysis is based on the assumption that, over time, the sample firms maintain one greenfield unit per country (an assumption supported by the historical accounts and information on the international operations of the sample firms in annual reports), although in some cases individual greenfield investments may have included several legally separate entities. This is not the case with acquired subsidiaries, where we have succeeded in singling out the specific units. The data also supports the notion that unlike greenfield subsidiaries, acquired subsidiaries may sometimes be found in multiples in any given location, and that they seem more prone to be divested. For many of the observations, it is known that the parent firm was awarded a U.S. patent having its origin in a foreign country (assumedly because of corporate patenting policies), but the patenting records do not with certainty reveal the organizational identity of the unit performing the actual research. In the analyses, it is assumed that the research underlying a patent with for example U.K. inventors was carried out at the local U.K. subsidiary.

Although information from patents must be treated with some caution (Schmookler, 1950; Pavitt, 1988), no substantial biases are anticipated in the present study. Most of the sample firms are active in medium to high tech industries, where patenting is considered an important competitive device. While patenting propensity varies across the sample firms, causing variation in the number of patents associated with each firm, this does not in itself affect patterns in the timing of entry into new technologies in foreign locations.

Measurements

Dependent variable. The dependent variable of interest is technological evolution. It was measured as the event when, and if, a greenfield subsidiary in a specific foreign location generates entry into a technology that is new to the MNC. Entry occurs when the unit is awarded a patent in a patent class in which the multinational group has not been previously active. It is an event that for some subsidiaries not takes place at all, only once, or occurs successively. Time to entry is measured as the number of years between either the first recorded patenting in a location and its first recorded entry into a technology that is new to the MNC, or the number of years between any two following entries.

Entry into new technologies is measured at the level of approximately 400 classes of technology as defined by the U.S. Patent Office. At this level of aggregation, it is possible to distinguish between relatively narrowly defined technologies, such as resistors and electrical connectors. Other examples include paper making and fiber preparation, chemistry carbon compounds, liquid purification and separation processes, and pulse or digital communications. For the purposes of this paper, the classification should strike a good balance between more aggregate groups (the use of which would result in fewer identified entries into new technologies) and finer levels of disaggregation.

Main covariate. The main covariate, *competence-creating overlap*, takes the value 1 for every annual observation that one or more acquired competence-creating subsidiaries operated in the same country as a competence-creating greenfield subsidiary, and 0 otherwise. The competence-creating acquired subsidiaries were identified in much the same way as the competence-creating greenfield subsidiaries and were tracked once they had been awarded patent(s) in the U.S. As most of the measures in our paper, this covariate is time-varying, allowing for independent fluctuations. As an example of how the measure can shift, one of the sample MNCs, ASEA's U.S. greenfield subsidiary had been generating competence-creating outputs since 1942, but it was not until 1969 that an operational overlap occurred as corporate headquarters acquired a competence-creating subsidiary. Twelve years later, in 1981, a second acquired competence-creating subsidiary was introduced to the U.S. market, making the total number of advanced subsidiaries in the local market three. Another six years passed and ASEA decided to divest itself of both its competence-creating acquired subsidiaries, leaving the original greenfield investment as the only advanced subsidiary in the local market.

Control variables. While limited by the observation window of almost a century and the fact that many of the drivers behind technological evolution at subsidiary level are expected to evolve with each entry into a new technology, we nevertheless introduced several control variables to reduce unobserved heterogeneity. *Size of the local market* was included as a proxy for the munificence of the local technological and business environments. The variable is measured annually in the total GDP expressed in the logarithm of millions of USD (constant 1990 terms) and was collected through the GGDC total economy database (2006). We expect that large markets will generally offer broader technological and business opportunities than small markets, increasing the number of opportunities to identify and recombine diverse ideas and resources within the local context.

In order to account for the potential effects of national culture on technological developments among foreign subsidiaries, we included a *cultural distance* measure using Kogut and Singh's (1988) index and the scores of Hofstede's (2001) cultural dimensions, with the exception of the Confucian dynamism dimension. The measure captures cultural dissimilarities between the foreign country and the MNC home country, which may influence both the ability and desirability to control the technological activities of foreign subsidiaries.

The age as a competence-creating unit, measuring the time elapsed from the unit's first awarded patent to any identified entries into new technologies, continuing each year the unit is at risk of experiencing an event was included and labeled *subsidiary experience*. The tenure as a competence-creating subsidiary should provide insights into the level of embeddedness in the local environment and an individual subsidiary's ability to draw upon and recombine the technological capabilities of other units in the multinational network. We expect that higher levels of local embeddedness will correlate positively with a subsidiary's ability to sense and exploit new business and technological opportunities, and by extension also make it possible for a subsidiary to become engaged in the recombination of existing technologies into novel inventions.

Technological diversity was conceptualized as the extent to which individual subsidiaries could draw upon other sister subsidiaries in developing new technologies, outside of the sometimes occurring competence-creating overlap. The variable was divided into two to acknowledge greenfield and acquired subsidiaries' different evolutionary patterns and to create more fine-grained measurements. For each annual observation the variables measure the number of other greenfield (acquired) subsidiaries in the MNC that have produced entry into technologies that are new to the multinational group. These two control variables do not capture or measure actual effects from interaction between units, but merely reflects the subsidiary's potential for becoming engaged in inter-subsidiary collaborative (or competitive) efforts.

Four *industry dummies* were introduced to control for industry-dependent effects. The dummy variables are expected to reflect different propensities to centralize R&D activities (Papanastassiou & Pearce, 1998) and exchange knowledge across individual subsidiaries of the multinational network (Randoy & Li, 1998). The first dummy variable captures MNCs in the automotive industry, the second MNCs in processing industries such as pulp and paper, and steel, the third firms involved in pharmaceuticals and chemicals, and the forth a broad spectrum of mechanical engineering MNCs. This left a mixed group of sample firms, often with highly diversified product portfolios.

To reflect the changing business environments throughout the entire observation period, we introduced ten year interval *time period dummies*, using 1980-1990 as the baseline of more "modern" times in the development of the MNC. Among the myriad of changes, notable drivers are the liberalization of financial markets, privatization of state-owned utilities, the integration and growth of regional trade blocks, the intensification of international competition, and new technological breakthroughs in information technology (UNCTAD 1993; Bartlett and Ghoshal 1998).

Statistical method

Since our longitudinal data calls for methods which can handle time-varying explanatory variables, censoring and repeated events, we use event history analysis as the statistical method.

While many are familiar with the popular Cox partial likelihood estimator for single events, few know that the techniques pertaining to event history analysis have seen vast progressions in the last decade. This is particularly true for repeated events analysis, which now offers several models to chose between (e.g. Therneau & Hamilton, 1997; Kelly & Lim, 2000; Box-Steffensmeier & Zorn, 2002; Ezell, Land & Cohen, 2003; Jiang, Landers & Rhoads, 2006). In this paper we use the most common and easily applied Andersen-Gill (AG) model (Andersen & Gill, 1982), and we subsequently check the estimations made against the more conservative Prentice-Williams-Peterson (PWP) model (Prentice, Williams & Peterson, 1981).

The AG and PWP models have some similarities and differences worth noticing. First, the risk interval determines when the greenfield subsidiary is at risk of having an entry into a technology new to the MNC along a given time scale. We chose to apply the gap-time specification to both models as to make them as comparable as possible. This means that the measured time restarts after each event. For example, if a greenfield subsidiary enters the risk set in 1950 and then experiences one event in 1955 and another in 1970, the model counter will define it as being at risk for 5 [0, 5] years for the first event and 15 [0, 15] for the second event. Other approaches include fitting the models with a total time specification, making all greenfield subsidiaries at risk from the observation start date (1893). Since the data set experiences late entrants, this specification was deemed unfeasible and thus ignored.

Second, a major disparity between the AG and the PWP models is how they treat the baseline hazard function. The AG model has the same underlying baseline hazard for all events, implying that all events are assumed to be independent. The PWP model, on the other hand, allows for stratification on event number and consequently for different baseline hazards at each event, thus relaxing the independence assumption.

Third, the specification of when the greenfield subsidiaries are at risk after entering the risk set also separates the models. The AG model uses an unrestricted risk set, and thus all observations' risk intervals contribute to the risk set for any event, irrespective of the number of events that any particular observation has experienced. The restricted risk set of the PWP model allows only those which have experienced the k^{th} event to contribute to the k^{th} risk set. That is, only greenfield subsidiaries who have experienced a first entry will be considered to impact the risk set for the second entry. Table 1 summarizes these and other properties.

INSERT TABLE 1 ABOUT HERE

For both model specifications, each spell between entries into new technologies represents a distinct observation (the 1st, 2nd,…, kth entry into a technology that is new to the multinational group by a greenfield subsidiary). We measure the first spell as the time between the first recorded patenting in a specific location and the first entry into a new technology. In some cases there is no entry at all over the observed time period (resulting in a right censored observation) and in yet other cases the first recorded patenting coincides with the entry into a new technology. The subsequent spells are between successive entries into new technologies. Since all observations end in 1990, the last spell of any sequence of entries into new technologies is typically right censored.

One limitation of repeated events approaches is that they do not account for or correct for unobserved heterogeneity. To a certain extent, the homogeneity of the sample firms in terms of geographical origin and organizational traits should have contributed to creating similar conditions across firms and individual subsidiaries. Also, a number of controls that account for possible industry and regional dependent effects on the timing of entry into new technologies are introduced. Finally, all subsidiaries in the sample have reached at least a stage with documented capability to contribute significantly to the technological and strategic developments of the multinational group (through inventions awarded patents, judged sufficiently important to be applied for in the United States). This will exclude a number of subsidiaries from the analysis, for example those representing only sales subsidiaries or those involved in minor modifications and adaptations of products and services to local market needs.

RESULTS

Data adjustments

Before initiating estimations, some data issues had to be confronted. First, we found 5 cases where the last recorded patent in a particular technology had occurred more than 25 years before the unit registered a patent in the associated technological class, suggesting that a competence-creating mandate may have been lost and re-gained during the window of observation. To be on the cautious side, we excluded all such cases.

Continuing our conservative approach, we excluded 6 cases where we could not match patent and subsidiary. In these cases, entries into new technologies were initiated by foreign units, but in each of these cases the location was different from that of the home location of the unit (for example, a German unit enters a new technology, but the nationality of the inventor(s) behind the patent suggests that the underlying research was carried out in the U.S.). These may be instances where a large and mature foreign unit carried out some research-related activities in foreign countries, but they could also be instances where internationally connected or mobile researchers have developed patents in units located outside their permanent country of residence.

After these adjustments, and by using a one-observation per year approach as to allow for time-varying covariates and thus a greater degree of dynamics in the models, the final data set consists of 3,804 annual observations with 169 events.

Estimation outcomes

Preliminary analyses included the calculation of descriptive statistics. Descriptives of the sampled MNCs' number of competence-creating greenfield subsidiaries, their median age as well as their number of entries into new technologies are reported in Table 2. Competence-creating overlaps occurred in approximately 8 per cent of the complete annual observations in the data set. In absolute terms, the maximum number of competence-creating subsidiaries in the sample MNCs were found to be four (Sandvik) under the window of observation whereas, in relative terms, one MNC (SCA) had overlaps in 50 percent of its foreign competence-creating activities. Also notable are two MNCs (Alfa Laval and SKF) with a much higher propensity among its subsidiaries to add new technologies to the corporate portfolio.

INSERT TABLE 2 ABOUT HERE

Regarding the individual variables, basic statistics are reported in Table 3 and confirm the small number of locations experiencing a competence-creating overlap. Data on the competence-creating covariate reveals that the 295 annual observations with such overlaps amounted to almost 60 percent of the total population of the competence-creating acquired subsidiaries (495 annual observations).

INSERT TABLE 3 ABOUT HERE

Correlation statistics are shown in Table 4 and reveals only some modest correlations among the covariates. Thus, in order to check for possible multicollinearity issues, the variance inflation factor was calculated. The calculated variance inflation factor scores (min=1.179, max=2.751, mean=1.934) indicate that the predictor variables do not interfere with each other, and will hence not cause a problem when interpreting results from the estimations, since the highest value was below 3 (Studenmund, 1992).

INSERT TABLE 4 ABOUT HERE

The results of the AG (Models 1a and 1b) and PWP (Models 2a and 2b) models are presented in Table 5. Models 1a and 2a test the hypothesis that a competence-creating overlap will have a negative impact on the greenfield subsidiary's hazard of entering a new technology. Both model specifications accept Hypothesis 1 at the 0.1 percent level for the AG model and at the 1 percent level for the PWP model. The likelihood ratio tests of model fit are acceptable and significant at the 0.1 percent level. Notable is that the AG model enjoys a much higher likelihood ratio statistic than the PWP model. This is not uncommon when comparing the AG to the PWP model, and occurs because of the risk set differences of the two models. Recall that the PWP model consists of strata for each event, and in our data very few observations are associated with later events making the power of the model relatively weaker than that of the AG approach, for which the observations are independent.

In Models 1b and 2b we tested the hypothesis that, over time, a competence-creating overlap will have an increasingly negative impact on the greenfield subsidiary's hazard of entering a new technology. To test this hypothesis, we multiplied the competence-creating covariate with the function of time to create an interaction effect that may vary over time. This then becomes a variable that not only can change independently over time but also test for proportionality of the covariate. That is, it becomes possible to test if the effect of a competence-creating overlap on a greenfield subsidiary is weaker or stronger at the beginning of the state than it is at a later point. We predicted that the effect would be initially negative and become even more negative with time. Interestingly, the results imply that while initially negative, the effect becomes less pronounced with time as shown by the positive estimate of the interaction covariate. The original term, as well as the interaction term, is significant in both the AG and the PWP specifications at the 5 percent level at the lowest, and thus reject Hypothesis 2. In fact, the AG (PWP) model suggests that after some 17 (13) years, the negative effect reverses to become positive [$0 = -1.926 + (0.115)t$, (for the AG model)]. Again, the AG and the PWP models show acceptable goodness of fit statistics as indicated by their likelihood ratio test scores, which are both significant at the 0.1 per cent level. Both Model 1b and 2b were preferred over the simpler Model 1a and 2a as assessed by likelihood ratio chi-square tests at the 0.1 percent level.

INSERT TABLE 5 ABOUT HERE

Robustness checks

This section presents some basic robustness tests of the results in Table 5. First, we checked to see if the results are driven by singular MNCs. They are not. We re-tested the models excluding the MNCs one at a time, and found results robust. Next, we checked to see if the two high performers in terms of number of events influenced the findings. To do that we estimated the models event by event and, in addition, full models restricted to three events. The results remain qualitatively the same.

With regards to our main covariate, overlap was measured at the country level. As an extension to the one-country approach, the covariate was re-specified to include all adjacent units (that is, units in neighboring countries). The results remain very similar although generally somewhat weaker. Interestingly, when increasing the aggregation of the covariate to its ultimate limits, that is, including all competence-creating units for each MNC in the overlap, it still produced negative estimates but results are not consistently significant throughout the models. This suggests that the closer the units are when operating similar functions, the worse the greenfield subsidiary's technological performance is initially. We also re-ran the estimations using time-lags up to three years after the occurrence of the overlap covariate without it having any effect on significance levels. On another note, as data only allowed us to track the acquired subsidiaries once they provided some competence-creating output, it is likely that they had had such status prior to the inclusion, and therefore a time lag effect might already have been captured endogenously.

A test that we were unable to investigate satisfactorily was overlaps where the focal subsidiaries shared the identical technological base. That is, subsidiaries that at some point in time had performed research in identical patent classes. As our dependent variable was set to capture a rare evolutionary event, for competence-creating subsidiaries in the MNC (which are limited in number), to have an identical technological background would potentially be too infrequent to fit a quantitative analysis, and consequently, not explored in the current paper.

The strictest way of defining overlaps is the degree to which the focal units have the same competence-creating roles (Felsenthal, 1980; Lerner, 1987). In the original models, we defined the competence-creating overlap as a dichotomous outcome of either overlap or not. In doing so, we ran the risk of ignoring information about the size of the overlap. To this risk, we re-ran all of the estimations, and changed the main covariate to include the scope of the overlap. It was found that among the relatively few total competence-creating greenfield subsidiaries in the sample MNCs, some of the overlaps included several acquired subsidiaries over the window of observation (mean competence-creating overlap covariate score 0.097 as opposed to 0.075 in the original approach, and the maximum number of acquired subsidiaries to share turf with a greenfield subsidiary was three).

These results have some particularly interesting features that will increase our understanding of operational overlaps and are thus reported in complete form (see Table 6). As with the original specification, the models are significant at the 0.1 percent level, the control variables remain the same and the main covariates and their interaction terms are significant. However, the magnitude of the main covariates tells us that when taking into account the scope of the overlap, we find that the time it takes for the initial negative effect to diminish and turn positive is longer. In the PWP model, it takes almost three more years longer to occur [$0 = -1.561 + (0.098)t$] and in the AG model the time almost doubles. Crude as they are, these results indicate that it is not only the existence of an overlap that matters, but the number of local subsidiaries involved in the overlap; the higher the number of local subsidiaries, the worse the initial performance of the greenfield subsidiaries and the longer times until the effect reverses.

INSERT TABLE 6 ABOUT HERE

DISCUSSION

The aim of this paper was to explore overlapping competence-creating activities within the boundaries of the MNC by exploring how greenfield subsidiaries' technological evolution is affected by role overlaps in their local markets. The results indicate a process where the addition of an acquired subsidiary initially shocks the greenfield subsidiary, forcing it to decrease the pace at which it enters into new technologies, to diminish over time and ultimately turn positive after some years. Further analyses uncovered another interesting dynamic, that the effect is not only present when overlap occurs, but is actually augmented when incorporating the scope of overlaps in the market. We find that the initial shock and the recovery time increase with the number of acquired subsidiaries sharing the same turf. While historical in its perspective, the paper shows that by restricting subsidiary evolution to only the archetypal subsidiary, the greenfield subsidiary, important dynamics are neglected. The results suggest that processes that involve multiple local units are evolutionary and process-like, and take place over a large number of years.

Apart from the observed effect of competence-creating overlaps, several of the control variables showed results that are generally in line with expectations. It appears that large and munificent markets offer favorable conditions for subsidiaries to develop new innovative technologies, presumably since they offer extensive opportunities to identify and re-combine knowledge and resources. Cultural distance, as measured by the Kogut and Singh (1988) index, showed negative hazard rations on the likelihood of entering into new technologies. Although not significant, this satisfies the notion that far away cultures not only are associated with a lower likelihood of entering that market, but also represent more cautious approaches and thus less sophisticated competence-creating roles sanctioned by corporate headquarters.

On a more unexpected note, subsidiary experience was found to slightly slow down subsidiary technological evolution. That is, younger competence-creating subsidiaries are associated with a relatively faster development pattern than the equivalent older ones, possibly suggesting diminishing returns from experience. The results for the two technological diversity measures are also worth some attention. Here, we wanted to capture greenfield subsidiaries' possibilities to link up and recombine existing knowledge with sister subsidiaries which have previously contributed to strategic renewal. In other words, MNCs that are generally benign toward unique technological initiatives in foreign subsidiaries will see a range of subsidiaries entering their own specialized technologies. We found that greenfield subsidiaries tended to be positively influenced by having a larger group of competence-creating greenfield subsidiaries in the MNC, but there was no similar effect among the acquired subsidiaries. This could be explained by network differences among subsidiaries, in that acquired subsidiaries have not had the time to accumulate closer contacts within the corporation. Another reason could be that acquired subsidiaries are perhaps more isolated as a consequence of corporate headquarters' wish to retain key personnel and human capital (Puranam, Sigh & Zollo, 2006).

Limitations

The present paper is but a first step to empirically explore the effects of competence-creating overlaps within the boundaries of the MNC, and it has certain limitations. First, the sample is restricted to a limited non-random sample, and while the MNCs represent a large and representative proportion of Swedish MNCs, they are not necessarily representative of MNCs of other national origin. On the balancing side, the sample includes corporations with long and extensive exposure to international markets and international business. In combination with the historically large degrees of operational freedom granted to subsidiaries of Swedish MNCs (Hedlund & Åman, 1984), they ought to offer a useful testing ground for identifying basic tendencies in subsidiary technological evolution.

Second, by solely using patent data we had to treat the competence-creating roles in a rather abstract and static way, and abstract and static they are not, obviously (Birkinshaw & Hood, 1998). We attempted to remedy this inconvenience by altering the final data set by excluding subsidiaries which had no reported technological activity for considerable periods of time. Divestments were also accounted for by using time-varying covariates. However, as the data revealed relatively few locations with subsidiaries with competence-creating roles, it may be a fair assumption that those with recognized competencies had had them for prolonged periods of time.

Third, while we have discussed competence-creating overlaps in terms of capabilities among subsidiaries in the MNC, we know very little about the degree of overlap. We assume that there is always overlap to some extent in subsidiaries with similar roles, although they may have different responsibilities. We expect and have argued that it is this similarity in roles, competence-creating, that is crucial for potential competition to occur, and we would not expect, for instance, additions to the same location of an assembly subsidiary to interfere with the technological evolution of a competence-creating greenfield subsidiary.

Finally, the observation window ends in 1990. However, using almost a hundred years of data should allow for essential tendencies to be detected, and we argue that it is unlikely that the fundamental logic of role overlaps and its effect on subsidiary evolution should have changed dramatically in more recent times. One benefit of ending observations in 1990 is that, at the time, none of the sample firms had become involved in major international mergers (with the exception of ASEA, which merged with Brown Boveri to become ABB, and for which observations were truncated in 1988). The potentially broad organizational effects of these mergers, including the potential reorganization of international research and development activities, do not interfere with the current data and analyses.

Implications

At a theoretical level, our findings add to the theorizing on subsidiary evolution by expanding the field of analysis to incorporate operational overlaps. They also lend support for the notion that corporate headquarters should have a say in what Nadler and Tushman (1999) refer to as the management of “intra-enterprise cannibalism”. That is, it seems that when competence-creating roles change, the greenfield subsidiaries tend to dwindle for a number of years until they finally resurface and again speed up the pace of technological renewal. If duplication of activities is sought after, these gaps must be limited and the time span from a negative to a positive interaction must be shortened. However, it is important to note that the configuration of competencies and capabilities inside the MNC cannot be fully controlled by hierarchical decisions dictated by corporate headquarters (Rugman & Verbeke, 2001), because subsidiaries may have their own motives and interests. This is not to say that subsidiaries necessarily have contradictory or even conflicting goals compared to the corporate agenda, only that goals may not be identical. For example, it has been shown that subsidiaries may actively search and vie for competence-creating roles, whether referred to as mandates (Roth & Morrison, 1992) or charters (Galunic & Eisenhardt, 1996), with the objective of taking on a larger and more productive role for the corporation as a whole.

We have argued that the archetypal subsidiary depicted in the literature on subsidiary evolution has been assumed to evolve without role overlaps. As suggested by the data and the results, this is not always the case, and, in fact, almost three out of five competence-creating acquired subsidiaries were evolving alongside a competence-creating greenfield subsidiary.

This indicates that further theorizing on subsidiary evolution should not neglect the phenomenon and dynamics of operational overlaps. In the light of the generally limited additions to the strategic portfolio as measured by the entry into new technologies by competence-creating greenfield subsidiaries in the sample MNCs, it does seem to be a slow process. Yet, there is significant variation in terms of the number of entries across individual subsidiaries, which may suggest that the strategic effect on the multinational group should not be discussed in general terms, but rather in the context of a select number of advanced subsidiaries.

As opposed to previous theorizing which has made great effort to explain the phenomena of simultaneous cooperation and competition between different levels of the firm's hierarchy (e.g. Ouchi, 1979), this paper argues that these conflicts also arise at subsidiary level even though the subsidiaries could be considered equal in terms of their position in the MNC's organizational chart. As noted, subsidiaries may have self-interest not necessarily in congruence with the rest of the MNC (Coff, 1999, Scharfstein & Stein, 2000). While this paper only constitutes a first attempt to address the, both theoretically and empirically, largely unexplored effects of potential intra-MNC cooperation and competition, there are a number of theoretical arguments that could enrich the analysis. For instance, it is not unlikely to assume that the effect on technological evolution may be influenced by the age of the subsidiaries in the overlap. Previous literature has shown that the ability to explore new technology depends on past experience from similar activities (e.g. Nelson & Winter, 1982; Cohen & Levinthal, 1990). On another note, subsidiaries may learn to play the political game better the longer they remain within the MNC, which could be connected to the "experience curve" that Huber (1991) associates with general learning. As regards autonomy, it has previously been suggested that older subsidiaries may have obtained a more independent intra-MNC role (Forsgren, 1990, Foss & Pedersen, 2002). It has also been argued that financially stronger subsidiaries may be associated with a weak bargaining power position since they may attract more attention and interventions from headquarters because of their greater economic worth and higher visibility, which in turn translates into potentially lower autonomy. Whether this also implies fewer possibilities to explore new technologies should largely be industry and firm-specific. This paper opens up several theoretical questions that need attention in this respect.

Regarding the practical significance of the findings, the tendencies revealed by the empirical investigation may serve as a starting point for reflecting upon and designing desired policies for the technological and strategic renewal of the MNC. Nonetheless, exactly what these policies should involve remains somewhat MNC dependent, and further work will be needed to identify the most significant drivers behind the observed processes. While faster and more broad-based entry into new technologies among subsidiaries would, in many cases, yield strategic benefits (Hamel & Prahalad, 1994; Dougherty & Hardy, 1996), for some MNCs, controlled and cautious approaches to technological renewal in the multinational network may prove more desirable. What is clear, however, is the need for top managers to balance simultaneous cooperation and competition whenever role overlaps occur in order to limit the initial retrogressive capability effects on first-comer subsidiaries by late-comer ones. Closing the gap until the observed effect reverses could, except for progressing subsidiary evolution, also reduce potential rent-seeking behavior if the subsidiaries do not suffer in the overlap.

The paper also introduces statistical analytical tools that are novel to the field of management studies in general, tools that are of interest for the study of the timing of the occurrence of events which may take place at more than one occasion. The methods presented have slightly different underlying assumptions and researchers should choose method mainly on theoretical grounds. The two models here are merely a selection of the number of repeated events applications becoming available in recent years. While a deeper review of the statistical work is beyond the scope of this paper, the short presentation of similarities and differences of the applied models provide references that will guide interested research.

The overall conclusion, which holds throughout a number of different specifications and robustness tests, is that competence-creating overlaps do influence the first-comer greenfield subsidiaries significantly, resulting in an initial capability retrogression which diminishes over time, ultimately to become positive after more than a decade after the occurrence of the overlap. The findings need to be confirmed by studies that include a broader sample of MNCs of different national origin, but the baseline assumption would be that the dynamics created by competence-creating overlaps is worth some serious consideration. Other possible venues for future research would be testing the logic of why corporate headquarters seem reluctant to further invest in competence-creating first-comer subsidiaries but occasionally opt for allowing another subsidiary in the same location gaining matching competencies. A deeper understanding of headquarters' role in subsidiary evolution could add to our understanding of subsidiary evolution in general and competence-creating overlaps in particular.

REFERENCES

Almeida, P. 1996. Knowledge sourcing by foreign multinationals: Patent citation analysis in the U.S. semiconductor industry. *Strategic Management Journal*, 17: 155-165.

Almeida, P. & Phene, A. 2004. Subsidiaries and knowledge creation: the influence of the MNC and host country on innovation. *Strategic Management Journal*, 25: 847-864.

Andersen, O. 1997. Internationalization and market entry mode: a review of theories and conceptual frameworks. *Management International Review*, Special Issue (2): 27-42.

Andersen, P. & Gill, R. 1982. Cox's regression model for counting processes: a large sample study. *Annals of Statistics*, 10 (4): 1100-1120.

Andersson, U., Johanson, J. & Vahlne J-E. 1997. Organic acquisitions in the internationalization process of the business firm. *Management International Review*, 37 (2): 67 – 84.

Archibugi, D. & Pianta, M. 1992. Specialization and size of technological activities in industrial countries: The analysis of patenting data. *Research Policy*, 21 (1): 79-93.

Bartlett, C. & Ghoshal, S. 1998. Beyond strategic planning to organization learning: lifeblood of the individualized corporation. *Strategy & Leadership*, 26 (1): 34-39.

Bergek, A. & Berggren, C. 2004. Technological internationalisation in the electro-technical industry: a cross-company comparison of patenting patterns 1986-2000. *Research Policy*, 33: 1285-1306.

Bertrand, O. & Zuniga, P. 2006. R&D and M&A: are cross-border M&A different? An investigation on OECD countries. *International Journal of Industrial Organization*, 24 (2): 401-423.

Birkinshaw, J. 1999. The determinants and consequences of subsidiary initiative in multinational corporations. *Entrepreneurship Theory and Practice*, 24 (1): 9-36.

Birkinshaw, J. & Hood, N. 1998. Multinational subsidiary evolution: capability and charter change in foreign-owned subsidiary companies. *Academy of Management Review*, 23 (4): 773-795.

Birkinshaw, J. & Lingblad, M. 2005. Intrafirm competition and charter evolution in the multibusiness firm. *Organization Science*, 16 (6): 674-686.

Box-Steffensmeier, J. & Zorn, C. 2002. Duration models for repeated events. *The Journal of Politics*, 64 (4): 1069-1094.

Burt, R.S. 1987. Social contagion and innovation: cohesion versus structural equivalence. *American Journal of Sociology*, 92: 1287-1335.

Cantwell, J. 1989. *Technological innovation and multinational corporations*. Oxford: Basil Blackwell.

Cantwell, J. & Mudambi, R. 2000. The location of MNE R&D activity: the role of investment incentives. *Management International Review*, Special Issue 40 (1): 127-148.

Cantwell, J. & Mudambi, R. 2005. MNE competence-creating subsidiary mandate. *Strategic Management Journal*, 26: 1109-1128.

Cantwell, J. & Piscitello, L. 2000. Accumulating technological competence: Its changing impact on corporate diversification and internationalization. *Industrial and Corporate Change*, 9 (1): 21-49.

Caves, R. & Mehra S. 1986. Entry of foreign multinationals into U.S. manufacturing industries. In *Competition in Global Industries,* Porter M. (ed.). Boston: Harvard Business School Press.

Cho, K. & Padmanabhan, P. 1995. Acquisition versus new venture: the choice of foreign establishment mode by Japanese firms. *Journal of International Management*, 1 (3): 255-285.

Coff, R. 1999. How buyers cope with uncertainty in knowledge-intensive industries? *Organization Science*, 10 (2): 144-161.

Cohen, W. & Levinthal, D. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly,* 35: 128-152.

Doz, Y. & Prahalad, C. 1991. Managing DMNCs: A search for a new paradigm. *Strategic Management Journal*, 12: 145-164.

Dougherty, D. & Hardy, C. 1996. Sustained product-innovation in large, mature organizations: Overcoming innovation-to-organization problems. *Academy of Management Journal*, 39 (5): 1120-1153.

Dunning, J. 1994. Multinational enterprises and the globalization of innovatory capacity. *Research Policy,* 23: 67-88.

Dunning, J.H. 2000. The eclectic paradigm as an envelope for economic and business theories of MNE activity. . *International Business Review*, 9 (2): 163-190.

Ezell, M., Land, K. & Cohen, L. 2003. Modeling multiple failure data: A survey of variance-corrected proportional hazard models with empirical applications to arrest data. *Sociological Methodology*, 33: 111-167.

Feinberg, S. & Gupta, A. 2004. Knowledge spillovers and the assignment of R&D responsibilities to foreign subsidiaries. *Strategic Management Journal*, 25: 823-845.

Feldman, M. 2000. Location and innovation: The new economic geography of innovation, spillovers, and agglomeration. In G. Clark, M. Feldman & M. Gertler (Eds.), *The Oxford handbook of economic geography*. Oxford: Oxford University Press.

Felsenthal, D. 1980. Applying the redundancy concept to administrative organizations. *Public Administrative Review*, 40: 247-252.

Fischer, W. & Behrman, J.1979. The coordination of foreign R&D activities by transnational corporations. *Journal of International Business Studies*, 19 (3):34.

Forsgren, M. 1990. Managing the international multi-centre firm: case studies from Sweden. *European Management Journal*, 8: 261-267.

Forsgren, M. & Pedersen, T. 2000. Subsidiary influence and corporate learning – centers of excellence in Danish – owned firms. In Holm, U. & Pedersen, T. (eds.), *The emergence and impact of MNC centres of excellence: a subsidiary perspective*, Macmillan Press: London, UK.

Forsgren, M., Holm, U. & Johanson, J. 1992. Internationalization of the second degree: the emergence of European-based centres in Swedish firms. In: Young, S. & Hamill, J. (eds.), *Europe and the multinationals*. Edward Elgar: Aldershot.

Frost, T. 2001. The geographic sources of foreign subsidiaries' innovations. *Strategic Management Journal*, 22: 101-123.

Frost, T., Birkinshaw J. & Ensign, P. 2002. Centers of excellence in multinational corporations. *Strategic Management Journal*, 23 (11): 997-1018.

Galunic, D. & Eisenhardt, K. 1996. The evolution of intracorporate domains: Divisional charter losses in high-technology, multidivisional corporations. *Organization Science*, 7: 255-282.

Gaynor, M. 1989. Competition within the firm: theory plus some evidence. *RAND Journal of Economics*, 20 (1): 59-77.

Groningen Growth and Development Centre and the Conference Board. 2006. *Total Economy Database*, September 2006.

Ghoshal, S. & Nohria, N. 1989. Internal differences within multinational corporations. *Strategic Management Journal*, 10: 323-337.

Hagedoorn, J. & Cloodt, M. 2003. Measuring innovative performance: Is there an advantage in using multiple indicators? *Research Policy*, 32: 1365-1379.

Håkanson, L. & Nobel, R. 1993. Determinants of foreign R&D in Swedish Multinationals. *Research Policy*, 22: 397-411.

Hamel, G. & Prahalad, C.K. 1994. *Competing for the future*. Harvard Business School Press.

Haspeslagh, P. & Jemison, D. 1991. *Managing acquisitions: Creating value through corporate renewal*. New York: Free Press.

Harzing, A-W. 2002. Acquisitions versus greenfield investments: international strategy and management of entry modes. *Strategic Management Journal*, 23 (3): 211 – 227.

Hedlund, G. & Åman, P. 1984. *Managing relationships with foreign subsidiaries - Organization and control in Swedish MNCs*. Stockholm: Sveriges Mekanförbund.

Hennart, J. & Park, Y. 1993. Greenfield vs. acquisition: the strategy of Japanese investors in the United States. *Management Science*, 39 (9): 1054-1070.

Hitt, M., Hoskisson, R., Ireland R. & Harrison J. 1991. Effects of acquisitions on R&D inputs and outputs. *Academy of Management Journal*, 34: 693–706.

Hitt, M., Hoskisson, R., Johnson, R. & Moesel D. 1996. The market for corporate control and firm innovation. *Academy of Management Journal*, 39: 1084– 1119.

Hofstede, G. 2001. *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations* (2nd ed.). Thousand Oaks: Sage Publications.

Hood, N. & Young, S. 1979. *The Economics of Multinational Enterprise*. Longman.

Huber, G. 1991. Organizational learning: The contributing processes and literatures. *Organization Science*, 2 (1): 88-115.

Jaffe, A.B. 1986. Technological opportunity and spillovers of R&D: Evidence from firms' patents, profits, and market value. *American Economic Review*, 76: 984-1001.

Jiang, S., Landers, T. & Rhoads, T. 2005. Semi-parametric proportional intensity models robustness for right-censored recurrent failure data. *Reliability Engineering and System Safety*, 90: 91-98.

Johanson, J. & Vahlne, J-E. 1977. The internationalization process of the firm – a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies*, 8 (1): 23-32.

Kalnins, A. 2004. Divisional multimarket contact within and between multiunit organizations. *Academy of Management Journal,* 47 (1): 117-145.

Kelly, P.J. & Lim, L. L-Y. 2000. Survival analysis for recurrent event data: An application to childhood infectious diseases. *Statistics in Medicine,* 19: 13-33.

Khanna, N & Tice, S. 2001. The bright side of internal capital markets, *Journal of Finance*, 56 (4): 1489-1528.

Kogut, B. & Singh, H. 1988. The effect of national culture on the choice of entry mode. *Journal of International Business Studies*, 19 (3): 411–432.

Lamont, O. 1997. Cash flow and investment: evidence from internal capital markets. *Journal of Finance*, 52: 83-109.

Larimo, J. 2003. Foreign direct investment form of investment by Nordic firms in world markets. *Journal of Business Research*, 56 (10): 791-803.

Lerner, A. 1987. There is more than one way to be redundant. *Administrative Science,* 18 (3): 334-359.

Meyer, M., Milgrom, P. & Roberts, J. 1992. Organizational prospects, influence costs and ownership changes. *Journal of Economics and Management Strategy*, 1 (1): 9-35.

Miller, R. 1994. Global R&D networks and large-scale innovations: The case of the automobile industry. *Research Policy*, 23: 27-46.

Mudambi, R. 1998. The role of duration in multinational investment strategies. *Journal of International Business Studies*, 29 (2): 239-62.

Mudambi, R. 1999. Internal capital markets and subsidiary strategic independence. *International Business Review*, 8 (2): 197-211.

Mudambi, R. & Navarra, P. 2004. Is knowledge power? Knowledge flows, subsidiary power and rent-seeking within MNCs. *Journal of International Business Studies*, 35: 385-406.

Nadler, F. & Tushman, M.. 1999. The organization of the future strategic imperatives and core competencies for the 21st century. *Organization Dynamics*, 47: 45-60.

Nelson, R.R. & Winter, S.G. 1974. Neoclassical vs. evolutionary theories of economic growth: critique and prospectus. *Economic Journal*, December: 886-905.

Nohria, N. & Ghoshal, S. 1997. *The differentiated networks: organizing multinational corporations for value creation*. CA: Jossey-Bass.

Ouchi, W. G. 1979. A conceptual framework for the design of organizational control mechanisms. *Management Science*, 25, 838–848.

Pearce, R. 1994. The internationalization of research and development by multinational enterprises and the transfer sciences. *Empirica*, 21: 297-311.

Pearce, R. & Singh S. 1992. Internationalization of research and development among the world's leading enterprises: survey analysis of organisation and motivation. In *Technology Management and International Business - Internationalization of R&D and Technology*, Granstrand O, Håkanson L, Sjölander S (eds.). Chichester: John Wiley & Sons.

Papanastassiou, M. 1999. Technology and production strategies of multinational enterprise (MNE) subsidiaries in Europe. *International Business Review*, 8: 213-232.

Papanastassiou, M. & Pearce, R. 1998. Individualism and interdependence in the technological development of MNEs: The strategic positioning of R&D in overseas subsidiaries. In J. Birkinshaw & N. Hood (Eds.), *Multinational corporate evolution and subsidiary development*. Houndmills: MacMillan Press Ltd.

Patel, P. & Pavitt, K. 1998. The wide (and increasing) spread of technological competencies in the world's largest firms: A challenge to conventional wisdom. In A. Chandler, P. Hagström & Ö. Sölvell, (Eds.), *The dynamic multinational firm.* Oxford University Press.

Pavitt, K. 1988. Uses and abuses of patent statistics. In A. van Raan (Ed.), *Handbook of quantitative studies of science and technology.* North-Holland: Elsevier Science.

Porrini P. 2004. Can a previous alliance between an acquirer and a target affect acquisition performance? *Journal of Management*, 30 (4): 545-562.

Prentice, R., Williams, B. & Peterson. A. 1981. On the regression analysis of multivariate failure time data. *Biometrika*, 68 (2): 373-379.

Reger, G. 2002. Internationalisation of research and development in Western European, Japanese and North American multinationals. *International Journal of Entrepreneurship and Innovation Management*, 2 (2/3): 164-185.

Randoy, T. & Li, J. 1998. Global resource flows and MNE network integration. In J. Birkinshaw & N. Hood (Eds.), *Multinational corporate evolution and subsidiary development*. Houndmills: MacMillan Press Ltd.

Ronstadt, R. 1978. International R&D: The establishment and evolution of research and development abroad by seven U.S. multinationals. *Journal of International Business Studies*, 9 (1): 7-24.

Roth, K. & Morrison, A. 1992. Implementing global strategy: characteristics of global subsidiary mandates. *Journal of International Business Studies*, 23 (4): 715-735.

Rugman, A. & Verbeke, A. 2001. Subsidiary-specific advantages in multinational enterprises. *Strategic Management Journal*, 22: 237-250.

Scharfstein, D. & Stein, J. 2000. The dark side of internal capital markets: divisional rent-seeking and inefficient investment. *Journal of Finance*, 55: 2537-2564.

Schmookler, J. 1950. The interpretation of patent statistics. *Journal of the Patent Office Society*, 32 (2): 123-146.

Serapio, M. & Dalton, D.1999. Globalization of industrial R&D: an examination of FDI in R&D in the US. *Research Policy*, 28: 303–316.

Stein, J. 1997. Internal capital markets and the competition for corporate resources, *Journal of Finance*, 52 (1): 111-133.

Shin, H. & Shulz, R. 1998. Are internal capital markets efficient? *Quarterly Journal or Economics*, 113: 1531-552.

Studenmund, A. 1992. *Using econometrics: a practical guide*. Harper Collins, New York.

Taggart, J. 1996. Multinational manufacturing subsidiaries in Scotland: strategic role and economic impact. *International Business Review*, 5 (5): 447-468.

UNCTAD, 1993. *World investment report: transnational corporations and integrated international production*. New York: United Nations.

UNCTAD, 2000. *World investment report*: *cross border mergers and acquisitions and development*. New York: United Nations.

Wallmark, T. & McQueen, D. 1986. *100 viktiga innovationer under tiden 1945-1980* [100 important innovations over the period 1945-1980]. Studentlitteratur.

Williamson, O. 1991. Strategizing, economizing, and economic organization. *Strategic Management Journal*, 12: 75-94.

Wolf, J. & Egelhoff, W. 2002. A reexamination and extension of international strategy-structure theory. *Strategic Management Journal*, 23 (2): 181-189.

World Bank, 2001. *Global development finance 2001*. Washington, D.C.

Zander, I. 1999. Whereto the multinational? The evolution of technological capabilities in the multinational network. *International Business Review,* 8 (3): 261-291.

Zander, I. & Sölvell, Ö. 2002. The phantom multinational. In *Critical Perspectives on Internationalisation,* Havila, V., Forsgren, M. & Håkansson, H. (eds.). Pergamon.

FIGURE 1
Competence-creating overlaps in the MNC

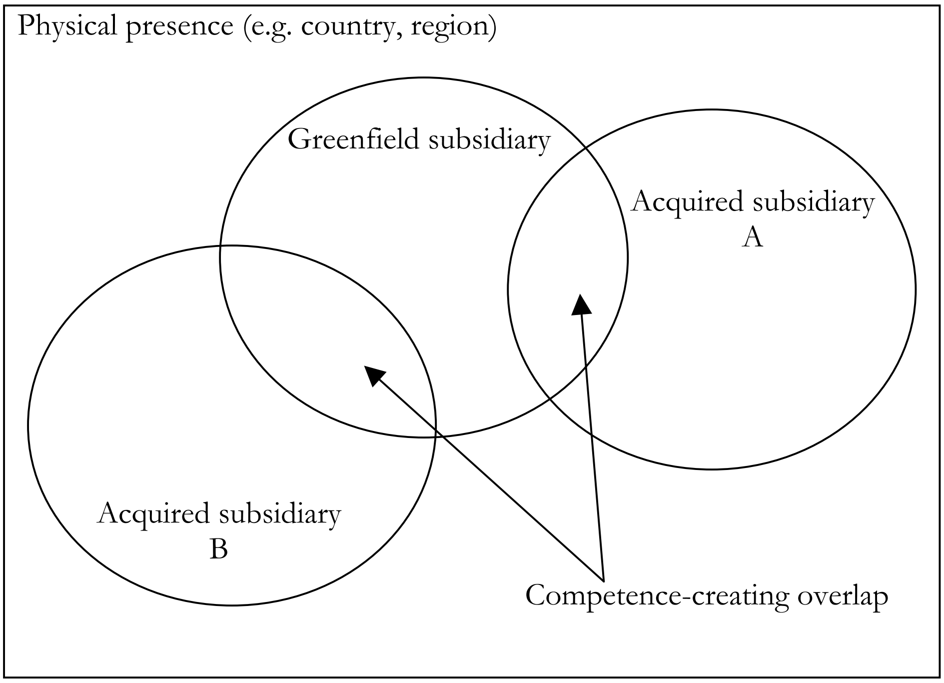

FIGURE 2
Stylized example of subsidiaries A, B, and C experiencing 0, 1, and 3 events respectively

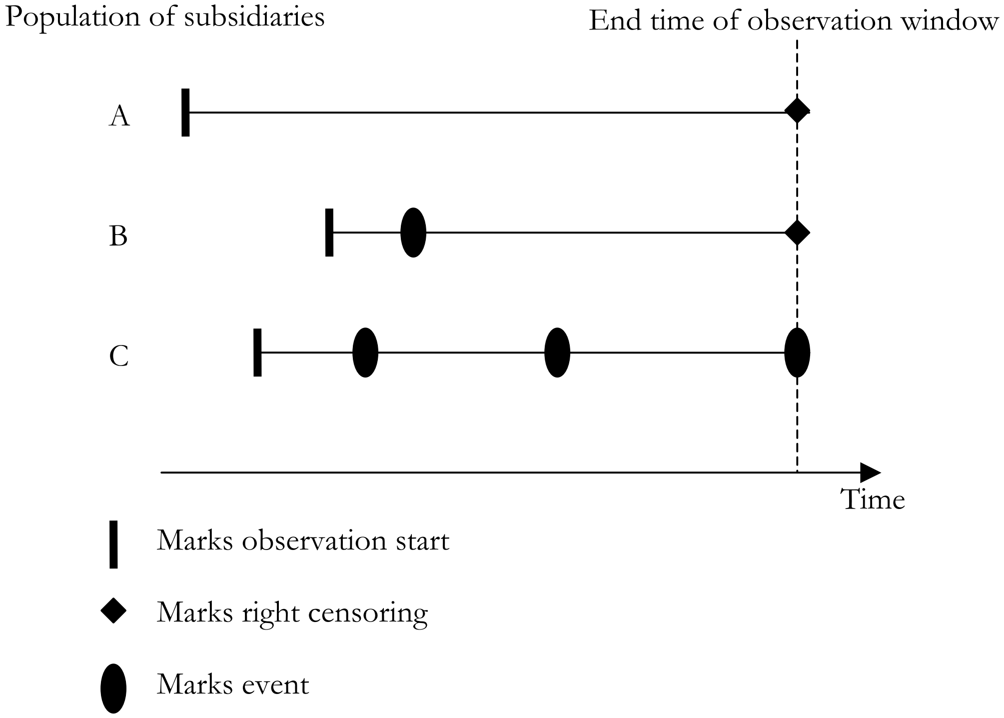

TABLE 1
Comparison of the Andersen-Gill (AG) and Prentice-Williams-Peterson models for repeated events

Characteristics	AG	PWP
Risk intervals	Counts time since start of observation or from prior event	Counts time since start of observation or from prior event
Baseline hazard	Identical baseline hazard for all events	Event specific baseline hazards
Risk set	Unrestricted	Restricted
Estimates robust standard errors	Yes	Yes
Allows for time-varying covariates	Yes	Yes
Allows for stratification by event number	No	Yes

TABLE 2
Descriptive statistics of the sample multinational firms

Multinational corporation	Number of competence-creating greenfield subsidiaries	Number of entries into new technologies by greenfield subsidiaries	Median age of greenfield subsidiary [a]
AGA	7	2	29
Alfa Laval	13	45	33
ASEA	14	7	27.5
Astra	14	9	16.5
Atlas Copco	11	15	24
Electrolux	12	11	20
Ericsson	14	2	22.5
ESAB	2	2	10.5
Fagersta	1	1	18
MoDo	4	2	15
Perstorp	3	1	19
Pharmacia	8	3	16
PLM	2	2	8.5
Saab-Scania	2	1	23
Sandvik	14	18	16
SCA	4	2	15.5
SKF	10	39	26
Stora	2	0	19
Tetra Pak	10	4	6.5
Trelleborg	3	1	9
Volvo	7	2	12

[a] Median age of subsidiary refers to the time of first recorded patenting activity to the first entry into a new technology.

TABLE 3

Variable statistics

	Mean	St. dev.	Min.	Max.
Variable				
Competence-creating overlap	0.075	0.267	0	1
Size of local market [a]	12.587	1.512	8.644	15.573
Cultural distance	1.961	0.824	0.113	3.427
Subsidiary experience	18.132	16.786	0	97
MNC technological diversity (greenf.)	2.352	1.798	0	11
MNC technological diversity (acquired)	0.573	0.960	0	5

[a] log transformed

TABLE 4

Correlation diagnostics [a]

	1.	2.	3.	4.	5.	6.	VIF [b]
Variable							
1. Competence-creating overlap	1.000						1.179
2. Size of local market	0.271	1.000					2.047
3. Cultural distance	0.108	0.574	1.000				1.787
4. Subsidiary experience	0.067	0.139	-0.039	1.000			2.751
5. MNC technological diversity (greenf.)	0.173	0.111	0.082	0.216	1.000		2.104
6. MNC technological diversity (acquired)	0.207	0.114	0.052	0.204	0.497	1.000	1.735

[a] Pearson correlation estimates based on the complete sample of 3,804 annual observations. Correlations greater than 0.03 are considered significant at the 0.05 level. [b] Variance inflation factor (VIF) scores extracted from an ordinary least squares regression using the total time duration for each event (industry and period dummies included) as the dependent variable.

TABLE 5
Repeated partial likelihood models: Andersen-Gill (AG) and Prentice-Williams-Peterson (PWP) regressions with multiple events [a]

	Model 1a (AG)		Model 1b (AG)		Model 2a (PWP)		Model 2b (PWP)	
Main covariates [b]	est.	s.e.	est.	s.e.	est.	s.e.	est.	s.e.
Competence-creating overlap	-1.183***	0.361	-1.926**	0.795	-0.923**	0.349	-1.787*	0.749
Competence-creating overlap*duration			0.115*	0.054			0.134*	0.057
Controls								
Size of local market	0.395***	0.077	0.395***	0.077	0.365***	0.087	0.363***	0.084
Cultural distance	-0.186	0.162	-0.189	0.163	-0.167	0.176	-0.175	0.173
Subsidiary experience	-0.012*	0.005	-0.012*	0.006	-0.008	0.011	-0.001	0.011
MNC technological diversity (greenf.)	0.168***	0.048	0.165***	0.046	0.178**	0.063	0.176**	0.062
MNC technological diversity (acquired)	0.109	0.095	0.101	0.096	-0.087	0.129	-0.011	0.125
Industry dummies included	Y		Y		Y		Y	
Period dummies included	Y		Y		Y		Y	
Diagnostics								
Number of annual observations	3804		3804		3804		3804	
Number of events	169		169		169		169	
LR test (d.f.) [c]	151.355*** (19)		156.827*** (20)		52.829*** (19)		59.631*** (20)	

[a] Robust (sandwich) standard errors clustered on MNC and subsidiary reported. [b] The main covariate, competence-creating competence overlap, is measured as overlap (coded 1) or not (coded 0) in every year the observation is at risk. [c] The LR test statistic is a likelihood ratio test of the included covariates with d.f. being the degrees of freedom. Estimates considered significant at the 0.1, 0.5, 0.01 and 0.001 level are indicated with †, *, **, and *** (two-tailed).

TABLE 6
Repeated partial likelihood models with alternative specifications: Andersen-Gill (AG) and Prentice-Williams-Peterson (PWP) regressions with multiple events [a]

	Model 3a (AG)		Model 3b (AG)		Model 4a (PWP)		Model 4b (PWP)	
Main covariates [b]	est.	s.e.	est.	s.e.	est.	s.e.	est.	s.e.
Competence-creating overlap	-0.919**	0.291	-1.537*	0.487	-0.677**	0.260	-1.561**	0.576
Competence-creating overlap*duration			0.039†	0.023			0.098*	0.039
Controls								
Size of local market	0.388***	0.077	0.398***	0.077	0.360***	0.087	0.369***	0.086
Cultural distance	-0.179	0.162	-0.193	0.162	-0.163	0.175	-0.182	0.178
Subsidiary experience	-0.012*	0.005	-0.013*	0.006	-0.008	0.011	-0.007	0.011
MNC technological diversity (greenf.)	0.168***	0.049	0.170***	0.047	0.174**	0.061	0.173**	0.060
MNC technological diversity (acquired)	0.109	0.093	0.102	0.097	-0.086	0.129	-0.095	0.129
Industry dummies included	Y		Y		Y		Y	
Period dummies included	Y		Y		Y		Y	
Diagnostics								
Number of annual observations	3804		3804		3804		3804	
Number of events	169		169		169		169	
LR test (d.f.) [c]	150.342*** (19)		153.790*** (20)		51.925*** (19)		58.889*** (20)	

[a] Robust (sandwich) standard errors clustered on MNC and subsidiary reported. [b] The main covariate, competence-creating competence overlap, is measured as a continuous variable based on the number of acquired subsidiaries in the overlap for every year the observation is at risk. [c] The LR test statistic is a likelihood ratio test of the included covariates with d.f. being the degrees of freedom. Estimates considered significant at the 0.1, 0.5, 0.01 and 0.001 level are indicated with †, *, **, and *** (two-tailed).