HEADQUARTERS VALUE-ADDING IN SUB-UNIT TECHNOLOGY DEVELOPMENT PROJECTS IN THE MULTINATIONAL CORPORATION

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ABSTRACT

This paper addresses headquarters involvement in the technology process by exploring its role as potential value-adders by reallocating resources among technology projects hosted by sub-units in the multinational corporation. We argue that headquarters because of their possibilities to have a more holistic view have an important role in deciding which projects that should be pursued, which also could impact the performance of the specific developments. In acknowledging the view that it is imperative for new technologies to become available to the rest of the multinational group in order to fully leverage their competitive advantage, we use event history analysis on a sample of intended technology transfer projects to evaluate headquarters picking decisions in terms of the timing of technology development to transfer initiation speed. The main results provide support for the existence of well performing headquarters in terms of reallocating resources directed towards technological developments among sub-units and lends support for the theorizing that headquarters should have control rights to reallocate resources within the multinational corporation.

Keywords: technology development, technology transfer, headquarters - sub-unit relationships, resource reallocation.

INTRODUCTION

Later years' writings on the multinational corporation (MNC) have underscored two views of importance for our theorising of the organization. First, it has pictured the organization as more dispersed and diversified than was assumed in earlier views. Ghoshal and Bartlett, for instance, have argued that in MNCs, "actual relationships between the headquarters and the subsidiaries and among the subsidiaries themselves tend to be more federative because….issues of competency and power tend to be more contested within the MNC and interdependencies among the units tend to be reciprocal as well as sequential" (Ghoshal & Bartlett, 1990, p. 607). More than 25 years ago the strategic roles of sub-units (Hedlund, 1980) and the issue of complexity for headquarters to remain in control of sub-units and influence the long term strategy (Doz & Prahalad, 1981) was raised. Second, scholars have also progressively interested themselves in the ability of MNCs to innovate and transfer their new technologies, not least with the current surge of intra- and inter-firm relationships (e.g. Darr *et al*., 1995, Powel *et al*., 1996). The implication for the MNC is that it is increasingly difficult to obtain and sustain a competitive advantage through rationalization and standardization alone. It has been proposed that those who have gained a competitive advantage over their rivals have increasingly done so through new additions in the technological portfolio and successful transfer of them, thereby providing incentives for MNCs to enhance their abilities in such actions (Argote & Ingram, 2000, McEvily *et al*., 2004, Nonaka & Takeuchi, 1995).

In the networked MNC, where sub-unit competence and diversification of operations is prevalent, a large part of value adding in terms of new technology is performed at the sub-unit level. Indeed, it has been put forth as one of the competitive advantages of the MNC that it has units in diverse locations and thereby has a widened scope of its knowledge sources compared to domestic companies. The more the sub-units, compared to headquarters, are put forth as the origin of new technology the less important the role of headquarters in the value adding process concerning technology development. It has been suggested that the headquarters through the implementation of suitable strategies and differentiated control mechanisms can enhance the MNCs capabilities to innovate and transfer technology (Nohria & Ghoshal, 1997). But less has been said about headquarters' direct influence on new developments, conducted in the more peripheral units of the MNC, through the involvement in and support of these development projects in its day to day operations.

With only modest knowledge regarding how dedicated support of development projects within the MNC impacts project performance this paper aims to explore this gap and will try to contribute by asserting differences of characteristics in technology development projects, thereby evaluating headquarters possible value-adding role in these processes by means of performance. More precisely, it analyses characteristics of projects which have received resources, in terms of human resources and capital, from headquarters. In doing so, it aims at addressing the following issues. Initially, what is the value-added by headquarters in the technology development process? That is, should the headquarters have the control rights and option to reallocate resources to a desired destination instead of having sub-units financing and backing their own projects? In this paper it is our aim to study the headquarters direct involvement in the technology development process by exploring its role as supporters of new developments. We argue that headquarters because of their possibilities to have a more holistic view may have an important role in deciding which projects should be conducted and also impact the performance of the development process.

The paper is outlined as follows; first we will sketch the theoretical framework and state our hypotheses. Following, we will describe the data and methods used to collect the sample of the development projects used in the subsequent econometric estimations. The paper ends with a discussion of the results, limitations, managerial implications and directions for further research.

THEORETICAL FRAMEWORK

Headquarters value-adding in the technology development context

In acknowledging that MNCs operate in a resource-constrained environment implies that all NPV>0 projects cannot get resource support. The headquarters thus has the ability to dedicate resources to whichever project it figures has the most potential. The ability for projects to get picked is hence not only decided by its own merits, but also on its relative merits to other MNC projects, making all projects considered at a certain time period interdependent. This draws upon the perception that projects, as well as the sub-units hosting them, are involved in a network of sometimes vast geographic distances (Bartlett & Ghoshal, 1989, Hedlund, 1986, Nohria & Ghoshal, 1997). The reason for headquarters to engage in the development process is the possibility to create additional value protected from the external markets and the ability for the headquarters to choose the most promising projects to support and further increase profits in the MNC (Stein, 1997). Hence, profits from one sub-unit may be extracted and spent on another sub-unit, in the belief that it will add value to the MNC as a whole. Also, if the headquarters spend more of its time, capital and human resources on one subsidiary it means, inevitably, that other subsidiaries get less of those. However, this action is not without its concerns. First of all, the projects supported by headquarters should in general perform better than in-house sub-unit project investments since the headquarters can actively choose which projects to support, or even terminate. It would otherwise be more efficient to simply let the sub-units keep their own resources and the reallocation from sub-unit to headquarters back to another or the same sub-unit would not have to be (Scharfstein & Stein, 2000). This highlights the notion that every reallocation of resources also consumes resources. Secondly, this type of reallocation may cause potential harm to the MNC since it could possibly create an atmosphere of competition for available resources. Thus sub-units may engage in rent-seeking activities, diverting time from productive effort (Mudambi & Navarra, 2004). Contrary, in the situation where support includes operational monitoring, sub-units may want to protect themselves from headquarters involvement.

As previously suggested, synergistic advantages could be based on the reallocation and sharing of resources in the MNC which makes it important to separate the performance from sub-unit self-backed projects and performance produced by reallocation of corporate resources. In detangling these resources, we focus on two strategic events of growing importance, namely technology and transfer projects of MNCs. This highlights a rather recent body of research that has focused its attention on the growing dispersal of technology development within the MNC. Further, the MNC has been characterized as decentralized knowledge management systems (Cantwell, 1989) or even as federations (Andersson, *et. al.*, 2007). It is frequently stated that MNCs can enhance their innovation development processes and create capabilities by stimulating flows between sub-units in order to make better use of the fragmented technology (Buckley & Carter, 1999, Gupta & Govindarajan, 1991, 2000). Moreover, it is suggested that technology transfer within the firm is easier to accomplish than the transfer of technology between independent firms (Grant, 1996, Kogut & Zander, 1992). This also underlines the increasing sub-unit operational responsibilities and the dispersal of technology creating and transferring activities within firms which have loosened the traditional assumptions of hierarchical structures of modern MNCs (Mudambi & Navarra, 2004). The implications of this is that MNCs have become more like political coalitions and less of what can be referred to as army formations (Holm & Pedersen, 2000).

While the industrial organization perspective of strategic management often places context in the centre of attention, the resource based view emphasizes the importance of intra-firm characteristics. That is, the competitive advantage is derived from resources secured by a MNC and its capabilities to reallocate those resources (Amit & Schoemaker, 1993). However, firstly, we acknowledge that there exists resource heterogeneity between the sub-units hosting projects. Secondly, while most studies operationalize on an aggregation level of the corporation, we focus directly on the characteristics of technology projects and implicitly the sub-units hosting them in exploring headquarters possible value-adding. We acknowledge that technology projects may fall outside the sub-units original R&D budget. Therefore, this paper does not explicitly focus on how sub-units allocate available resources but more accuratly on how headquarters reallocates firm-wide resources for the potential benefit of the MNC.

Headquarters involvement in reallocating resources and its implications as a phenomenon is arguably not something new with the original concept of so called smarter-money being discussed by scholars such as Alchian (1969), Williamson (1975), and Donaldson (1984). The general scenario depicts the headquarters as possessing superior knowledge concerning both internal and external markets, thus enabling them to develop strategies and allocate resources towards the most promising activities (Forsgren *et al*., 2005). However, as Stein (1997) importantly highlights, if headquarters observes the prospect with error, it is in risk of not being able to rank-order the project better than the external market would have, making the actual value of reallocation flexibility zero. Moreover, the risk of using or reallocating resources inefficiently have been suggested to increase by rent-seeking sub-unit managers pursuing available resources or the notion of the headquarters being able to derive personal benefits from its reallocations (Scharfstein & Stein, 2000).

HYPOTHESES

We have depicted the MNC as an entity that operates under resource constraints and as a result, the headquarters has the opportunity to engage in resource reallocation activities across sub-units, anticipating to add firm-wide value. The rationale of this action is the belief that the headquarters has a better view of the operations of the multinational group, thus enabling better informed decisions. This would imply that the headquarters may have an important task in operating an internal capital market in terms of having the control rights to reallocate resources to the perceived most promising technology project. The headquarters thus has power to provide and distribute a portion of its time, capital and human resources to different sub-units. Moreover, with every reallocation of resources also consuming resources, whenever the headquarters engages in this sort of resource reallocation, the favoured project should always, ceteris paribus, perform better than non-favoured technology projects. It has been postulated that it is imperative that a technology, especially major ones, become available for the rest of the multinational group as soon as possible in order to leverage the competitive advantage a useful new technology brings (Zander & Kogut, 1995). In line with this reasoning, the performance dimension of special interest to technology projects for the particular paper is the development to transfer initiation speed, i.e. the time it takes for a project to be developed and transfer initiated. A reason for headquarters to engage in the development process is the possibility to create additional value protected from the external markets and the ability for the headquarters to choose the most promising projects to support and further increase profits in the MNC (Stein, 1997). In order to be successful, the headquarters has to have some additional knowledge of where it is most beneficial to reallocate the resources (Forsgren *et al*., 2005). If such a rationale holds, it is reasonable to suggest additional resources outperform local resource deployment and we can thus hypothesize that:

> *Hypothesis 1:* The stronger the MNC headquarters support of technology projects, the shorter the development to transfer initiation times.

In response to increased international competition it has been asserted that MNCs face a task of being both internationally integrated and responsive simultaneously. As the MNC grows, a single headquarters solution could possibly become increasingly difficult to manage that task. To tackle this, MNCs have progressively employed the so called transnational strategy as presented by Bartlett and Ghoshal (1988, 1989). This draws upon the concept of divisional headquarters as a means to create a more efficient organization by concentrating human resources to certain acknowledged important areas. Subordinate headquarters have also been suggested to act as an intermediate in the sometimes complex relationships between MNC headquarters and sub-units (Paik & Sohn, 2004). Furthermore, divisional headquarters have the possible advantage of reducing attempts of fully standardized policies and structures throughout the multinational group, practices which have been linked to decreased firm performance (Doz & Prahalad, 1986). In terms of technology development projects, belonging to the same division may provide a better foundation for one another’s needs and in terms of resource reallocations to such projects, divisional headquarters may be able to provide superior support. Thus, we have disentangled the headquarters involvement into two dimensions in order to better distinguish between top headquarters involvement and divisional headquarters involvement and in line with the divisional headquarters reasoning we hypothesize that:

Hypothesis 2: The stronger the divisional headquarters support of technology projects, the shorter the development to transfer initiation times.

DATA AND METHODS

Data collection: The study uses cross-sectional and longitudinal data collected during 2002-2004 comprising 104 intended technology transfer projects derived exclusively at sub-unit level belonging to 22 different MNCs. In collecting the data, large and established firms with international presence that likely undertook technology generating and transfer activities were approached, using snowball sampling. The selection of the studied technology projects was made in agreement with the local sub-unit manager and had the criteria of being a major technology, not older than 20 years, with transfer potential. The focus on major technologies increased the precision of the sampling of the longitudinal history of each technology, i.e. in neglecting less important technologies we reduce possible reconstruction issues. On the downside, it may produce a success bias in the data, but since it reflects all the observations, it is less likely that it will pose any major concerns in interpreting the estimations. In having a similar approach in studying major technologies as Zander & Kogut (1995) we also expect that those kinds of technologies to create an implicit control of variations in demand, importance and profitability.

The analysis and following estimations are derived from sub-unit level, indicating that observed variables all correspond to a specific answer to the constructs presented below. The multinationals and their sub-units from which the sample is derived from are highly international, constituting representations from various countries spread out over Asia, Australia, Europe and the US (see Appendix 1). The geographical distributions of the sub-units are dispersed, widely distributed between all the compass directions. The studied sub-units are operating in a variety of businesses such as manufacturing, telecommunications, retailing, power systems, chemistry and transportation.

The data was collected through structured face-to-face interviews with top managers at sub-unit level. The working language of all interviews was English, given the variation in country representations with the aim of reducing bias which could occur if multiple languages were used and that all respondents were fluent in the specified language. Prior to the interview the respondents were briefed in the aim of the study, and had their anonymity guaranteed. Each of the interviews, which were recorded, lasted around 60-90 minutes, during which the respondent could elaborate on their answers and ask questions eliminating potential misunderstandings. Obviously, this was a time consuming method but compared to mail surveys it reduces certain problems of non-response and other structural biases. However, there is always a possibility of bias when performing face-to-face interviews and even though this approach can be seen as a hybrid; it still suffers from the same potential hazard. It is problematic studying relationships and complex contexts alike, having to depend on subjective interpretations and reflections. Nevertheless, the face-to-face approach includes exclusive benefits such as obtaining a deeper understanding of the problem at hand and the ability to reach the exact wanted respondent (Andersson *et al*., 2002). The initial part of the questionnaire drew upon basic facts of the hosting sub-units, asking descriptive questions of e.g. size, main line of business. The second part of the questionnaire explored the technology at hand, asking questions such as the development to transfer time, what type of technology base it was derived from. Moreover, several 7-point likert scales were used to obtain data on technology characteristics and headquarters involvement, as recommended by Cox (1980).

Statistical method: In order to investigate the development to transfer time of technologies, and the fact that several of the technologies never got transferred (at the time of the interviews), we rely on event history analysis using the PHREG statement in SAS 9.1. Event history analysis[1] models time to event data (i.e. survival time), which in our case are factors effecting the likelihood of a technology being developed and consequently transferred. If a technology never experienced a transfer, those observations are referred to as right censored[2]. Since all observations ultimately end in 2004, a technology which never got transferred is typically right censored. Each factor effecting the development to transfer time has an individual probability function (i.e. hazard rate). An example of the two different kinds of technologies, transferred and non-transferred are presented in figure 1.

*****INSERT FIGURE 1 AROUND HERE*****

As the empirical exploration of the data obliges us for methods which account for count data, which also should be able to handle censored observations, ordinary least squares regressions and binary regressions fit poorly. Ordinary least squares cannot efficiently estimate information from censored observations, i.e. observations which in our case have not experienced the event of a transfer while still remaining at risk of such an event at the end of our observation period. Binary regressions on the other hand, could possibly overcome the shortcomings associated with ordinary least squares, but does poorly in measuring the

[1] Moreover, it allows for the inclusion of both cross-sectional and time-dependent data (Allison, 1984, Blossfeld & Rohwer, 1995).
[2] Consequently, left censored observations occur when an event takes place before the window of observation. However, since the current study has no pre-defined starting point, issues with left censoring will not interfere with the estimations (Allison, 1995).

disparity in time every period a technology in the sample is subject to the risk of being transferred.

The specific model used relies upon partial likelihood for the functional specification. The maximum likelihood specification is disregarded since we are more interested in the speed, i.e. the order, of an event, than the exact timing of it. Partial likelihood separate events into a common baseline hazard function given by:

$$\lambda(t) = \lim_{\Delta t \to 0} \frac{P(t \le T < t + \Delta t \mid t \le T)}{\Delta t},$$

where T is the time of transfer and $\lambda(t)$ is the rate thereof, i.e. the hazard rate. Hence, the hazard rate is a function of the probability that a transfer will occur between t and $t + \Delta t$, assuming that it has not yet taken place at time t. The maximization procedure of the partial likelihood estimation is dependent only on the estimated values of the hypothesized variables (covariates), since the estimation does not oblige specifying the form of the baseline hazard. The hazard rate function for a technology at time t>0 takes the following proportional form:

$$\log \lambda(t) = \alpha(t) + \delta X,$$

where $\lambda(t)$ is the hazard rate for a technology to become transferred at time *t*, $\alpha(t)$ is an ex ante unspecified function of time, and X is a vector of covariates for a specific technology. A positive parameter estimate represents that an increase in the studied variable increases the hazard of transfer. The goodness of fit of the specific models is tested by the score statistic, i.e. the chi-square, which compare our specified model with an empty equivalent. The degrees of freedom represent the actual number of parameters specified in the model[3].

Variables

Dependent variable: In exploring the development to transfer time of technology projects a single dependent variable was used in the form of the hazard rate of a technology project being transferred from the hosting sub-unit. We coded a dummy, which took the value 1 at the time of transfer initiation, and 0 otherwise. The duration was measured in yearly intervals. Duration start data was obtained by asking the respondents at what year the technology project was initiated and duration ending what year it was released and consequently transferred. The partial likelihood regressions then handle the observations that never experience a transfer initiation in order to correct for potential censoring bias.

Covariates: The variable of particular interest is headquarters involvement. We have separated the involvement into two dimensions in order to better distinguish between top headquarter involvement and divisional headquarter involvement. It conceptualizes the headquarters support in terms of its time, capital and human resources allocated to the sub-unit as to the respondents had to answer the questions to what degree the MNC headquarters/divisional headquarters financed the technology process, to what degree the MNC headquarters/divisional headquarters initiated the technology process, to what degree the MNC headquarters/divisional headquarters has taken initiatives for the development of the technology, to what degree the MNC headquarters/divisional headquarters has supported the sub-units interests in developing the technology and finally to what degree the cooperation with the MNC headquarters/divisional headquarters has been characterized by frequent

[3] For further reference relating to partial likelihood estimations, see Cox and Oakes (1984) and Allison (1995).

interaction. All the questions were considered by the respondents on scales ranging from 1=very low to 7=very high. These five indicators were consequently summed up and averaged to create the scale used in the estimations. The internal reliability of the two scales was 0.782 for the headquarters involvement covariate and 0.670 for the divisional headquarters covariate. Through the face-to-face interviews and discussions conducted with the sub-unit managers, we feel that these indicators give satisfying information concerning the allocation of headquarters and divisional headquarters resources. The covariates aim to, within the notion that every reallocation of resources also consumes resources, capture the headquarters ability to choose and support the most promising technology developments to support and thus possibly create additional value for the multinational group.

Control covariates: The partial likelihood estimations include a number of control covariates to ensure the influences from the posited hypotheses could be adequately evaluated. We control for host sub-unit attributes, specific technology characteristics and a possible macroeconomic influence.

With regard to sub-unit attributes, we coded two dummies (1 0) pertaining to specific sub-unit location characteristics. In investigating headquarters support we control for if proximity to MNC headquarters and divisional headquarters respectively affect the speed of technology development to transfer times. In reflecting on how the headquarters initially decided to set-up the sub-unit, we coded a dummy on the mode of entry of the host sub-unit. This dummy was coded (1 0) and conceptualizes a potential entry mode effect on technology development and transfer initiation speed.

The individual age of sub-units could be influential to the speed of technology development. A scenario where a sub-unit has gained considerable independence (Forsgren 1990) through age and accumulated understanding and experience which younger sub-units may lack in technology coordinating activities is not farfetched. To control for this scenario, we included sub-unit experience in the estimations as the logarithm of the numeral years a specific sub-unit has been in operation. R&D intensity was included in the estimations as the relation of R&D expenditures to sub-unit size in terms of number of employees.

Following Tyre (1991) who measured technical complexity as "…the number, novelty, and technological sophistication of new features and improved concepts introduced" in a technology and later Zander & Kogut (1995) we operationalized the variable by asking the respondents to what degree the technology could be characterized as high tech, to what degree new numbers of core features in terms of new materials and new components were employed in the technology, to what level the innovation comprises technology that is new to the sub-unit and finally to what extent the sub-unit had to invest in human resources as well as specialized equipment and facilities in order to develop the technology. Thus, we try and capture several different but related dimensions of technology complexity. These six items were all measured on seven point scales (1=very low/not at all/strongly disagree to 7=very high/very much/strongly agree) and when added together, offering a coefficient alpha of 0.722. With this covariate, we postulate that the more complex a technology is, the more difficult and time consuming it will be to develop and package it so that it can be disseminated to other parts of the multinational group.

We controlled for the size of the host sub-unit market by incorporating GDP measured in 1990 USD (PPP) at the initiation of the technology development. The data was obtained through the GGDC database (2007). This macroeconomic influence on the dependent variable is not obvious, but we broadly anticipate a positive influence on the development to transfer times by operating in a more developed market. This is because of the potential for more advanced business opportunities could call for more sophisticated development partners and environment. However, inequality in economic development could be argued is an incentive for technological growth by itself.

ESTIMATION OUTCOMES

Data description: Out of the sample of 104 observations 5 were difficult to observe the year of transfer initiation due to missing values so the total sample had to be reduced to 99 observations. Overall, the degree of missing values was low, figuring around the five percentages mark. 9.1 percent of the observations were right censored in that the technologies never got transfer initiated. Concerning the covariates that are comprised by several items, we tested for reliability by calculating the Cronbach alphas for each construct, using the often recommended 0.7 as a guiding cut-off point (Nunnally, 1978). The coefficient alphas for the constructs ranged from 0.670 to 0.782.

In examining the characteristics of the sampled technologies we found that ~49 percent of the 99 technologies had been awarded patents or was under review at a patent office. In having an evenly distributed technology sample in terms of patents, this study captures both the variation of technical importance which patents have been shown to work as an indicator for (Albert et. al., 1991), and the dimension of incremental versus radical technologies (Trajtenberg, 1990). Concerning the functional categories, ~22 percent were considered as core technologies, ~79 percent as product technologies, ~35 percent as production technologies, and ~4 percent as administrative technologies. The average number of initiated transfers per technology was two. The average time between initiation and transfer of the innovation was 3.4 years, not taking those observations that never experienced a transfer into account[4]. With the exception of three observations, the technology projects were transfer initiated internally to a sister sub-unit. The three outside this category were transfers flowing towards the MNC headquarters[5]. The correlation matrix and descriptive statistics are available in table 1. The table reveal some modest correlations among the predictor covariates so in order to check for possible multicollinearity issues the variance inflation factor (VIF) was calculated. Multicollinearity is an indicator of correlation between two or more independent covariates and if present, may make them shrewd to the data used. The calculated VIF values (min=1.126, max=1.927, mean=1.193) indicate that the predictor covariates 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 2, with a normal cut-off point around 5 (see for example Studenmund, 1992).

*****INSERT TABLE 1 AROUND HERE*****

Technology development to transfer initiation time: Table 2 shows the proportional hazard regressions, modelling the hazard rates of technology development to transfer initiation times with focus on MNC headquarters and divisional headquarters effects. Model 1a-b shows the results from the MNC headquarters effect on the technology development to transfer initiation times whereas model 2a-b reflect the divisional headquarters impact. The hazard functions for the development to transfer times controlling for all the specified covariates, isolating the headquarters effect and the divisional headquarters effect are presented in figure 2 and 3

[4] Noteworthy is that we do not know if the transfer of a particular project was initiated ex ante completion of the technology, i.e. it is possible that some projects were transfer initiated before being totally completed in the development phase.
[5] Had there been more observations flowing towards headquarters, we could have considered a competing risks model to test for different types of events.

respectively. The hazard functions are presented using a smoothening macro provided in Allison (1995) for easy viewing.

*****INSERT TABLE 2 AROUND HERE*****

*****INSERT FIGURE 2 AROUND HERE*****

*****INSERT FIGURE 3 AROUND HERE*****

Model 1a introduces those covariates that are treated as controls and holds three significant relationships. As suggested, a complex technology takes longer time to develop and to reach transfer initiation date (hazard ratio 0.785). Moreover, data suggests that sub-units originating from acquisitions tend to have longer development times to release than greenfield sub-units (hazard ratio 0.484). The only significant facilitator in the control model was the developing country's GDP (hazard ratio 1.283).

Model 1b adds to the prior model by introducing the headquarters involvement covariate. This covariate has a hazard ratio 1.451 which means that an increase of headquarter involvement by 1 unit increases the development to transfer initiation speed by 45.1 percent. This result holds at the 1 percent level and is thus supportive of hypothesis one. The control covariates stay consistent with the previous model. The goodness-of-fit of the two models are satisfying and significantly increasing ($p<0.01$), both significant at the 1 percent level with the Wald χ^2 ranging from 21.446 (d.f. 6) to 42.862 (d.f. 7).

Models 2a-b are replicas of 1a-b with the exception that the divisional headquarters affect is investigated instead of the MNC headquarters. Model 2a introduces only those covariates that are treated as controls and hold four significant effects on the likelihood of transfer initiation event. As in the previous models, technology complexity and sub-unit entry mode has a negative effect on the likelihood of transfer initiation (hazard ratios 0.788 and 0.472) with host country of the developing sub-unit has a positive influence (hazard ratio 1.869). Notable is the covariate that control for the location of the sub-unit which shows a significant effect on the likelihood of transfer initiation (hazard ratio 0.427) suggesting that being co-located with divisional headquarters slows down this particular process. This effect becomes slightly moderated (hazard ratio 0.500) in model 2b when introducing the divisional headquarters involvement which show a significant positive effect on the likelihood of transfer initiation (hazard ratio 1.370). This suggests that divisional headquarters add to the MNC in terms of speeding the development to transfer initiation times of major technologies, and thus supports hypothesis two. The control covariates remain rather consistent with all previous models. The goodness-of-fit of models 2a-b are satisfying and significantly increasing ($p<0.01$), both significant at the 1 percent level with the Wald χ^2 ranging from 26.776 (d.f. 6) to 35.581 (d.f. 7).

DISCUSSION

The aim of this paper was to explore the headquarters direct involvement in the technology process by exploring its role as supporters of new developments and thus evaluate resource reallocation decisions by means of performance. The main results provide support for the existence of well performing MNC headquarters as well as divisional headquarters in terms of reallocating resources directed towards technological developments among sub-units. Given the general rather fast development to transfer initiation times in the sample, the positive effect of headquarters support could be considered strong. This highlights the notion of headquarters as having a more holistic view of the MNC and accentuates its role in the decision making processes regarding resource reallocations. Based on the limited sample provided here, the data points towards the importance of headquarters control rights and option to reallocate resources among different sub-units.

Results regarding the specific technology characteristics show anticipated significant results with complex technologies taking a longer time to develop and package to become transfer initiation ready. Regarding the sub-unit attributes, in essence the mode of entry, market experience and R&D intensity, the data provides some interesting insights. In reflecting on how the headquarters decided to set-up the sub-unit, we coded a dummy on the mode of entry of the host sub-unit. The results from this dummy covariate were all negatively influencing the technology process throughout the different specification of the models, indicating that there seem to be a tendency for acquired sub-units to develop and transfer initiate technologies slower than greenfield established sub-units. There is a possibility that acquired sub-units are affected by post-acquisition integration issues not necessarily delaying the development process as much as the willingness to spread the technology to other parts of the multinational group. Sub-units that had enjoyed a longer tenure in operation were expected to have gathered capabilities and routines to facilitate technological developments. However, but although not significant, it seems that experienced sub-unit are immobile and slow when it comes to developing and starting to spread new technology. The explanation for these results could vary, but there is a possibility that the independence obtained throughout the years as business active that Forsgren (1990) suggested could have made these sub-units isolated, thus the time for technologies to start intra-MNC transfers could be delayed. The R&D intensity covariate did not provide any significant explanations to the analysis, having hazard ratios around one suggesting that the effect, even if it would have been significant, would be limited in increasing the likelihood of a transfer initiation event. Lastly, we controlled for a possible macroeconomic effect on the technology process, namely development country GDP. The result came out positive and significant throughout all models implying that operating in certain prosperous geographical areas may benefit the organizational technological environment. The effect is may not necessarily be directly causal but interesting and could show tendencies of spill-over effect or the increased sophisticated linkage alternatives available for the sub-units.

The observed findings have both theoretical and practical implications. The inter-organizational approach (Bartlett & Ghoshal, 1990) depicts the emergence of MNCs not because of failures in the buying and selling of resources but rather because of the MNCs superiority in reallocating resources efficiently across borders and consequently sub-units. We build upon the notion of the headquarters control rights to reallocate resources within the multinational group and try and bridge the gap of knowledge concerning specific resource reallocations directed towards technology projects and their transfer initiations. We analyse two types of modes of resource reallocations in that we explore characteristics of projects which have received resources from MNC headquarters and divisional headquarters. Naturally, a critical issue arising from these results regards the choice of management to handle the resource reallocations of the MNC. In doing a good job in the resource reallocation situation, they may add value to the MNC, but if performing poorly, the MNC may lose the potential value of redistributing resources.

CONCLUDING REMARKS

While we only offer some initial insights regarding the performance of headquarters picking certain technology projects to support, we leave several theoretical and empirical issues unanswered and open for future research. Along with the many different types of issues arising we feel that it would be interesting to see how different organizational structures influence the picking performance, and if so, what are the drivers? Moreover, since we adopt the network view of the MNC, the next natural step would be to observe how the sub-units network configurations impact the speed of technology development and transfer.

To the extent that the sampled MNCs are representative for a larger population, they pinpoint the multifaceted dimensions of resource reallocations and that the headquarters do seem to comprise a view wide enough to make rather well informed picking decisions in the technology context.

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FIGURE 1
AN EXAMPLE OF DIFFERENT TYPES OF TECHNOLOGIES IN THE SAMPLE

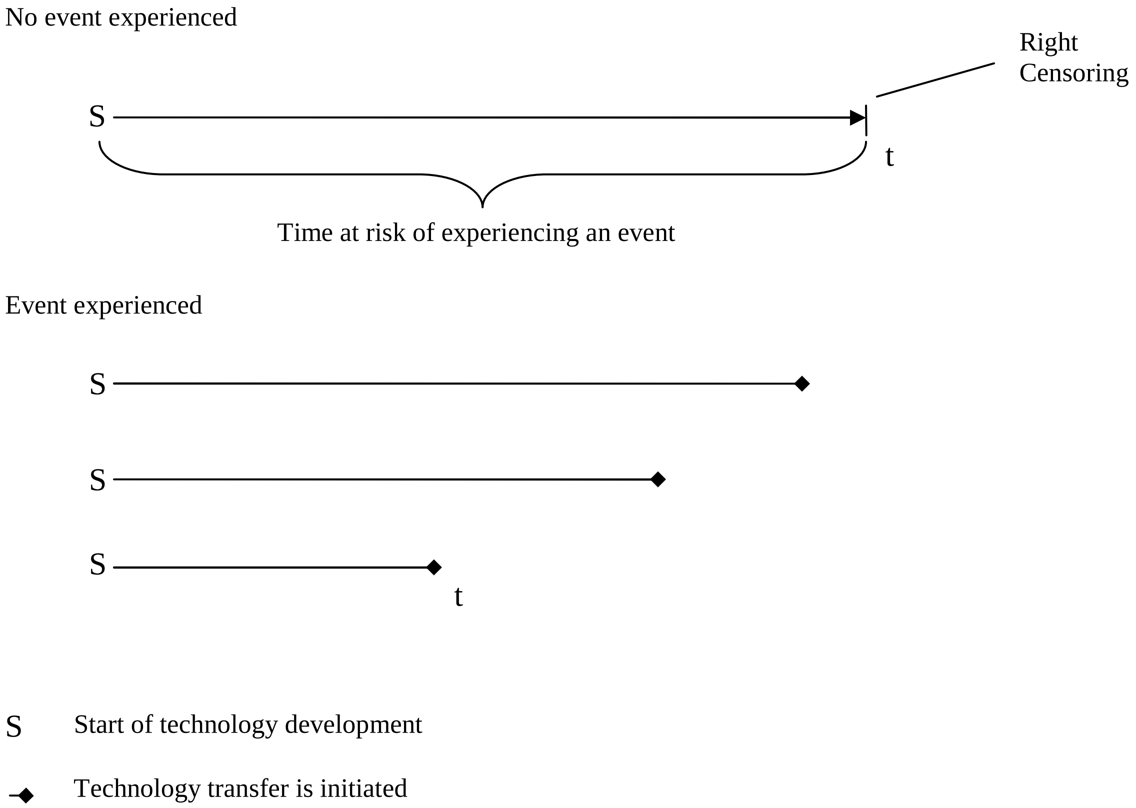


FIGURE 2

HAZARD FUNCTION FOR THE DEVELOPMENT TO TRANSFER TIMES CONTROLLING FOR ALL THE SPECIFIED COVARIATES: HQ EFFECT

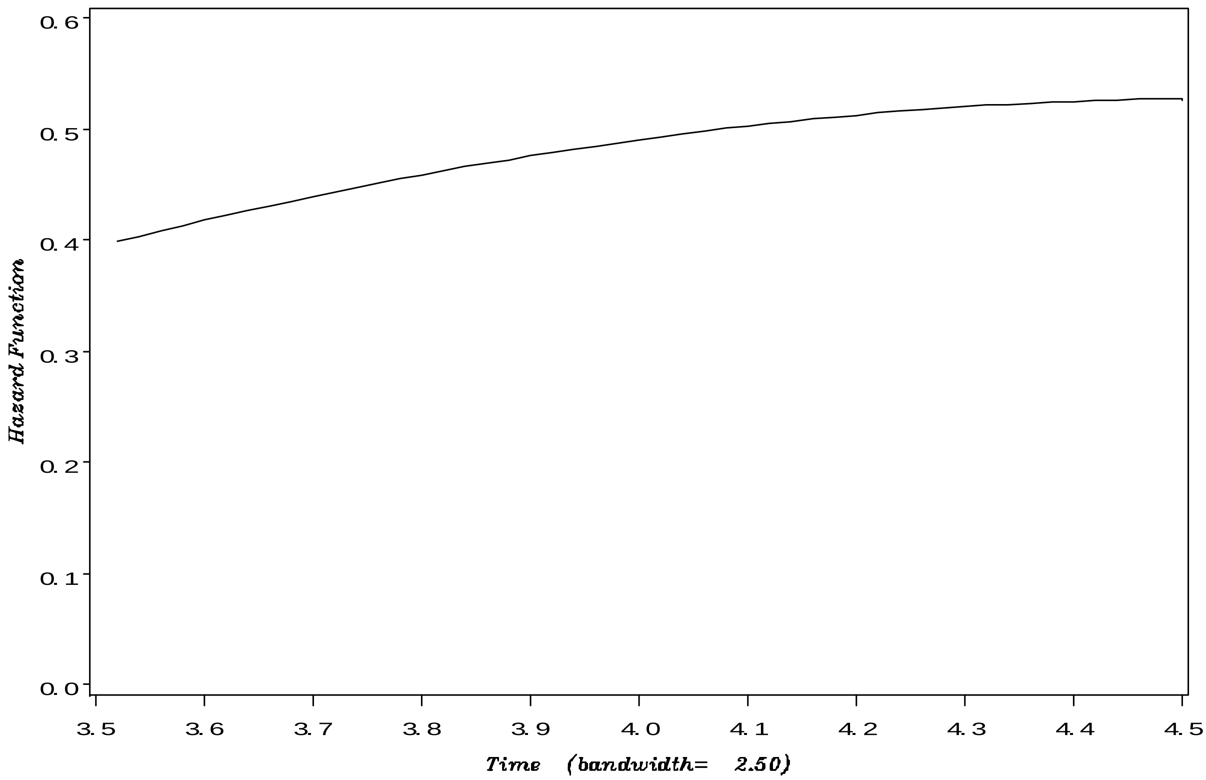
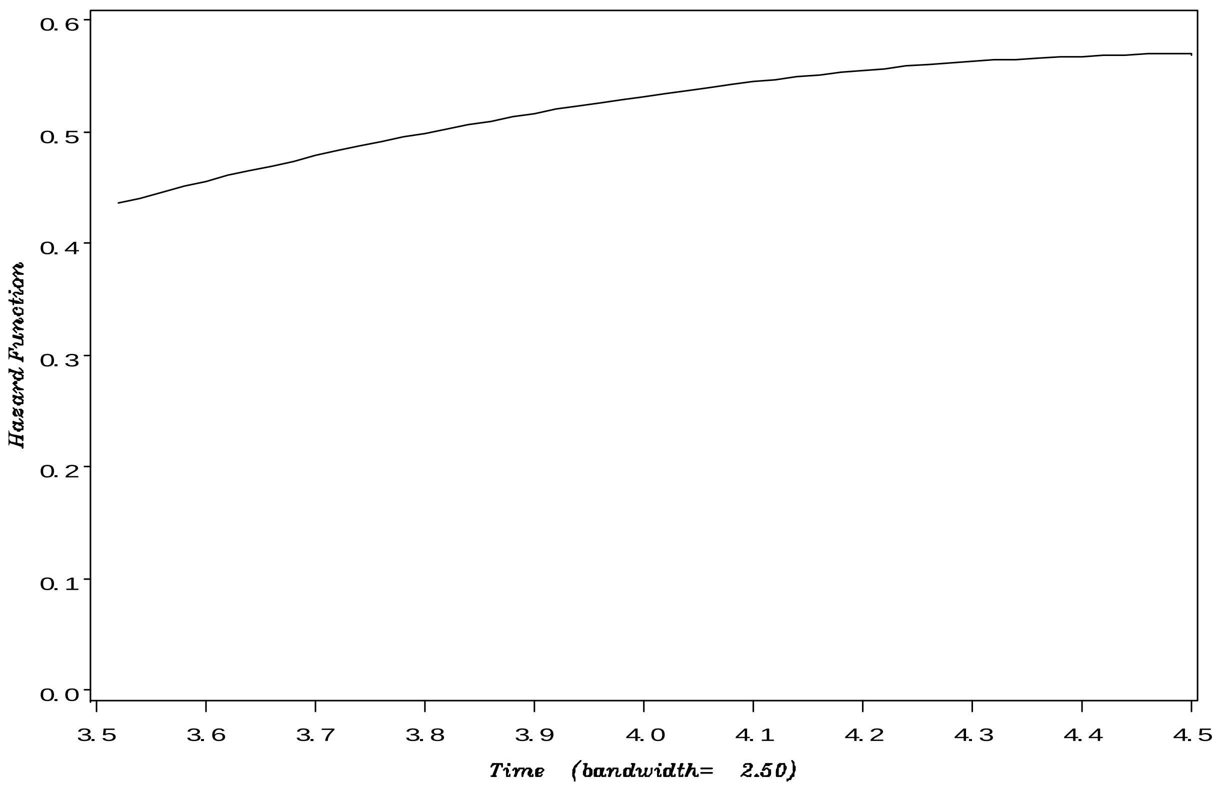


FIGURE 3

HAZARD FUNCTION FOR THE DEVELOPMENT TO TRANSFER TIMES CONTROLLING FOR ALL THE SPECIFIED COVARIATES: DIVISION HQ EFFECT



APPENDIX 1:
THE SAMPLED FIRMS, DIVISIONS AND SUB-UNITS

Mean values	MNC	DIVISION[a]	SUB-UNIT
Size	61000	9904	786
Sales	16763	2123	203
R&D expenditures	771	129	12

MNC countries represented in the sample: Finland, France, Germany, Italy, Netherlands, Sweden, Switzerland, and USA

Sub-unit countries represented in the sample: Australia, Austria, Finland, France, Germany, Great Britain, Italy, Netherlands, Italy, Switzerland, Taiwan, USA

Note: Size is measured as number of employees. Sales and R&D figures are in million euros.

[a] The division referred to is the division to which the studied sub-unit belongs to.

TABLE 2

PROPORTIONAL HAZARD REGRESSION MODELLING

THE HAZARD RATES OF TECHNOLOGY DEVELOPMENT TO TRANSFER TIMES: HEADQUARTERS EFFECT [a]

Variable (N=99)	Model 1a			Model 1b			Model 2a			Model 2b		
	Parameter Estimate	Hazard ratio		Parameter estimate	Hazard ratio		Parameter estimate	Hazard ratio		Parameter estimate	Hazard ratio	
Headquarters involvement				0.372	1.451	***						
				(0.100)								
Divisional headquarters involvement										0.315	1.370	***
										(0.131)		
Sub-unit located at headquarters	0.025	1.025		-0.042	0.959							
	(0.306)			(0.349)								
Sub-unit located at div. headquarters							-0.850	0.427	***	-0.694	0.500	**
							(0.289)			(0.323)		
Sub-unit entry mode	-0.726	0.484	*	-1.311	0.270	***	-0.752	0.472	**	-1.415	0.243	***
	(0.387)			(0.454)			(0.370)			(0.412)		
Sub-unit market experience	0.073	1.075		0.195	1.215		-0.041	0.960		0.230	1.258	
	(0.159)			(0.165)			(0.138)			(0.162)		
Sub-unit R&D intensity	-0.001	1.000		-0.002	1.000		0.003	1.000		0.007	1.001	
	(0.002)			(0.002)			(0.003)			(0.003)		
Complexity of technology	-0.242	0.785	**	-0.551	0.576	***	-0.251	0.778	***	-0.405	0.667	***
	(0.098)			(0.120)			(0.095)			(0.112)		
GDP of developing country	0.249	1.283	**	0.538	1.712	***	0.384	1.469	***	0.625	1.869	***
	(0.119)			(0.133)			(0.125)			(0.136)		
Wald χ^2 (d.f.)	21.446*** (6)			42.862*** (7)			26.776*** (6)			35.581*** (7)		
Akaike's information criterion (AIC)	631.493			543.077			630.983			511..841		

[a] Standard errors are in parantheses. * p<0.10 ** p<0.05 *** p<0.01 (two-tailed).

TABLE 1
CORRELATION MATRIX: PEARSON CORRELATIONS [a]

	Headquarters involvement	Divisional headquarters involvement	Sub-unit located at headquarters	Sub-unit located at div. headquarters	Sub-unit entry mode	Sub-unit market experience	Sub-unit R&D intensity	Complexity of technology	GDP of developing country
Headquarters involvement	1.000	0.221	-0.183	-0.301	-0.003	-0.014	0.287	0.619	-0.119
Divisional headquarters involvement		1.000	-0.016	0.036	-0.053	-0.299	0.170	0.301	-0.139
Sub-unit located at headquarters			1.000	-0.512	-0.225	0.357	-0.017	-0.060	-0.159
Sub-unit located at div. headquarters				1.000	0.027	-0.266	0.202	-0.052	0.204
Sub-unit entry mode					1.000	0.307	0.196	-0.062	0.252
Sub-unit market experience						1.000	0.145	-0.053	-0.231
Sub-unit R&D intensity							1.000	0.409	0.039
Complexity of technology								1.000	-0.257
GDP of developing country									1.000
Mean	3.041	2.410	0.242	0.495	0.253	3.328	28.566	4.147	12.976
s.d.	1.657	1.255	0.431	0.503	0.437	0.925	46.029	1.379	1.092

[a] Correlations greater than 0.2 are significant at $p<0.05$.