Elite European Universities and the R&D Subsidiaries of Multinational Enterprises

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KNOWLEDGE ENVIRONMENTS OF TOMORROW – NEW CONDITIONS FOR UNIVERSITIES AND THEIR EFFECT ON INNOVATION AND SOCIETY (UNIKNOW)

This three year research project is part of SISTER’s strategical institutional program, a joint effort between SISTER, RIDE at IMIT and Chalmers and CIRCLE/FPI at University of Lund. (www.sister.se, www.chalmers.se/tme/SV/centra/ride, www.chalmers.se/, www.circle.lu.se/)

This project has analyzed Swedish universities, set in terms of internationalization and new demands.

The project addresses questions about the on-going structural changes to the Swedish research and education system. There are three themes. The first theme raises the question about financing, the second about the universities as strategic actors and thirdly how universities interact with society, in particular the knowledge link between universities and businesses.


The financiers are: the Knowledge foundation, Riksbankens jubileumsfond, Swedish Foundation for Strategic Research and The Swedish Foundation for International cooperation in Research and Higher Education

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Abstract

This chapter addresses the workings and the benefits of university-industry interactions between global firms and leading research universities in Europe. In specific, this chapter will analyze firms which are R&D subsidiaries of MNEs. Our specific focus here is the role of elite universities within regions, which may be wishing to attract more foreign direct investment within R&D and multinational innovation activities, in order to compete. The results are in line with existing literature, but they also generated new insights, especially two dichotomies of firm behaviour when formally collaborating with elite universities. The first dichotomy is the type of university knowledge asset most relevant for the R&D subsidiary. Here, the aggregate empirical results suggest that they may be primarily interested in science and technology or else in market, customers and branding. The other dichotomy lies in whether collaboration with the university is a primary mechanism to reach company goals, or a complementary one.
Introduction

Open innovation, research and development activities (R&D) as well as science are recognized as very important prerequisites for many types of corporate innovations. As noted by Tidd et al. (2001), “it would be hard to find anyone prepared to argue against the view that innovation is important and likely to be more so in the coming years.”

Following both academic studies and the examples set by regional success stories such as Silicon Valley or the two Cambridges, many have argued that higher education and public research activities of a region also increase its attractiveness for private investments (Anselin, Varga & Acs, 1997; Davies & Meyer, 2004; Furman et al. 2005). Consequently public policy makers are trying to find ways to encourage locally based cooperative relationships, often seeing the university sector as the engine for growth.

This chapter therefore addresses the workings and the benefits of university-industry interactions between global firms and leading research universities in Europe.

In specific, this chapter will analyze firms which are R&D subsidiaries of MNEs. Our specific focus here is the role of elite universities within regions, which may be wishing to attract more foreign direct investment within R&D and multinational innovation activities, in order to compete. This study therefore draws upon results from two fairly separate bodies of literature addressing our topic, namely international business and innovation, as further discussed in Section 2.

Section 3 addresses research design and methodology. Of all firms located around a university, R&D-performing subsidiaries of multinational enterprises (MNEs) with substantial R&D activities seem particularly likely to benefit from the university’s R&D capacity, as they have the resources necessary to exploit such opportunities (Cantwell & Piscitello, 2005).

Empirically we examine 16 firms which collaborate with three European research universities. The firms are subsidiaries of multinational enterprises (MNEs) with headquarters located in a different country, although some of the firms in our population have been acquired by foreign firms. These firms are located close to and have formal alliances with the following universities, respectively, Karolinska Institutet in Stockholm, Sweden; ETH Zurich in Switzerland; and Cambridge University in the United Kingdom.

Section 4 presents the results at an aggregate level, and Section 5 presents the results in terms of four ideal types, and illustrative case studies, which are presented from the perspective of the firm. From this, Section 6 discusses the role of European elite universities...
within the regions in order to outline some alternative strategies for policy-makers and university leaders interested in stimulating university-industry interaction.

**R&D localisation and university-industry linkages**

This section considers relevant literature from international business and from innovation studies, including parts of economics.

**R&D as part of international businesses**

Within the international business literature, many studies explore topics such as the mechanisms behind the MNEs choice to locate R&D, the reliance on R&D outside the boundaries of the firm, and increasingly the out-sourcing and off-shoring of R&D. The decisions of multinational enterprises (MNEs) to locate R&D activities to a region outside their country of origin have been explained as the possibility to benefit from localised flows of knowledge, with universities as a particularly important source (Dunning, 1994; Kuemmerle, 1999). Moreover literature has identified two trends in the re-organization of corporate R&D activities, namely 1) Increasing globalization of R&D spending patterns and 2) Increasing reliance upon external organizations, such as networks and outsourcing. While many studies have examined American university-industry interactions, a few have examined European ones, such as Davies and Meyer (2004).

These studies thus provide insight into why MNEs behave globally to access new knowledge and markets, and only occasionally provide particular focus on universities per se. Hence while studies of the localisation of MNE R&D often state that “access to knowledge infrastructure” of a certain region is a factor of locational advantage, the questions of how and why firms benefit from such access often remain unanswered. The specific role of research universities is also not explicitly studied to a large extent in this management-oriented literature. Furthermore our research question diverges from the dominant stream of literature, in that we study the immediate proximity (NUTS3-region) of three European renowned research universities. Other studies generally deal with differences between locations on a country level, or in large regions within a specific country (Heimann, 2005 and Cantwell & Piscitello, 2005, constitute notable exceptions from this observation).
The globalisation of MNE R&D is accompanied by corresponding changes in corporate organisation. In recent years, even larger firms have abandoned central R&D functions in favour of R&D tied to products or divisions or imposed greater demands on that central R&D functions coordinate their research agenda with division- and product managers (Gerybadze & Reger, 1999). As a consequence the room for “blue sky” research from corporate budgets has shrunk significantly which makes the need for managed relations to universities and to academic research increasingly important.

The literature offers a rather large number of motives for why MNEs internationalise R&D. According to Chiesa (1996), a more dispersed corporate R&D structure is usually associated with a longer time horizon of research activities. Furthermore the structure also seems to depend on the degree of dispersion of (industry- and firm-specific) external sources of knowledge and the degree of dispersion of the key internal R&D resources. Gerybadze & Reger (1999) emphasize market characteristics of the foreign location, as for example regulatory designs and sophisticated customer demands that can provide impulses for “global” innovation. Dunning (2000) claims that the OLI-framework which suggests that decisions about foreign direct investments are driven by factors of Ownership, Location and Internalization can be generalized to R&D activities. In Dunning’s framework ownership-specific advantages let the firm exploit its assets whereas location-specific advantages enable the firm to exploit local capabilities and internalising advantages are related to enhancing the knowledge base.

Literature strongly suggests that a region’s attractiveness for R&D investments of MNEs is affected by 1) local market characteristics, 2) presence of scientific and educational infrastructure and 3) the presence of other R&D-performing firms (Cantwell & Piscitello, 2002, 2005). A number of studies highlight that a market’s size and the business opportunities offered there may not be the only determinants of its attractiveness.

Gerybadze & Reger (1999) find that locational choices in some cases are affected by a need to work in “lead markets” where impulses for innovation can be picked up and create advantages in other markets of the MNE. While earlier studies emphasized market factors (Ronstadt, 1978, Teece, 1976), more recent studies stress factors related to knowledge and knowledge flows. Narula & Zanfei (2005) related this development to two pressures. One is an increasing innovation pressure in the form of increasing cost and complexity of technological development and shorter product cycles and the other pressure is from public customers to
locate R&D in their region. Kuemmerle (1999) contributed to the analysis of MNE R&D location by differentiating between *home-base augmenting* subsidiaries and *home-base exploiting* subsidiaries. For the former type of subsidiaries whose purpose are related to the adaptation of existing assets to local prerequisites, output and input indicators of R&D and science are found to determine the attractiveness of a location (country). For the home-base exploiting type of subsidiaries the attractiveness of a country’s market determines its attractiveness as R&D location. LeBas & Sierra (2002) offer a somewhat expanded taxonomy of four strategies explaining why a MNE locates R&D to a certain location. In addition to *home-base exploiting* and *market-seeking* (market access, etc), the authors identify two types of strategies related to knowledge flows: *home-base augmenting*, which is complementary R&D to that done at the home-base, and *technology-seeking* strategies which is R&D that the firm given its technological level and that of its home-location is not able to perform otherwise. In their empirical study, LeBas & Sierra find that technology-seeking strategies are not common in Europe. Perhaps more fitting with the realisation that truly global MNEs may not have a single “home-base” to which one can relate Narula & Zanfei (2005). They draw on Dunning & Narula (1995) in their alternative terminology of “home-base augmenting” or “asset-seeking” activities on the one hand and exploiting activities of a subsidiary on the other. Criscuolo et al. (2005) find that US MNEs in Europe do not have a tendency towards either one but strike a balance between both types of activities. The exception is the pharmaceutical industry, which is dominated by exploitation activities. Similarly European MNE subsidiaries in the US are found to be dominated by exploitation for all five industries investigated. Simultaneous exploitation and augmentation in R&D subsidiaries is also reported by Kuemmerle (2002).

**Role of universities in innovation**

Within the innovation literature as well as parts of economics, we can find taxonomies for university-industry interaction per se as well as explanations of the linkages between knowledge spill-overs and regional growth. University-industry relationships are the subject of a huge number of studies, especially focusing on commercialization as patents and start-up companies (Mowery & Sampat, 2005). Other studies address the mechanisms and rationale for university-industry relationships within different countries and sectors, the differential
importance of applied and basic research within different industries, and the importance of universities within regional clusters (Salter and Martin, 2001; Mansfield, 1998; Feldman, 1994). These studies thus provide insight into how university-industry relationships work and the effects on regional growth, but only occasionally provide insight into corporate strategy. R&D-investment decisions dominated by knowledge-seeking/asset augmenting motives are increasingly focused on very few locations described by Meyer-Krahmer & Reger (1999) as “worldwide centers of excellence”. Such excellence is generally meant to be measured in the form of input factors such as skilled labour and R&D spending and output factors such as patents, publications, innovation-related exports etc. These factors are generally found to attract foreign investment (Chung & Alcácer, 2002). However it is interesting to note that Almeida & Phene (2004) in their analysis of subsidiaries of MNEs in the semi-conductor industry do not find any proximity benefits on innovation from shear strength in innovation (as measured by a country’s share of annually awarded patents) but do find that the diversity of a country’s science base (as measured by a division of twenty patent classes) significantly contributes to proximity effects on innovation. Adams (2002) and Arundel & Geuna (2004) both find that proximity is more important for the exploitation of academic R&D than industry R&D. Davies & Meyer (2004) investigate four aspects of local business environments and find that only the presence of scientific institutions has a consistent, positive effect on a region’s attractiveness. A number of studies by Edwin Mansfield (Mansfield, 1991; Mansfield, 1995; Mansfield and Lee, 1996) find evidence supporting the importance of proximity in the transfer of knowledge between universities and firms. Hussler & Rondé (2007) trace university-industry linkages through patent application data and find that academic knowledge diffuses locally in particular when delimited to the kind of patents that the researchers classify as not possible to "immediately apply". We conclude that the empirical evidence points to possible albeit not automatic benefits from proximity to academic R&D for the R&D activities of MNEs (for a more extensive review of such evidence, see Varga, 2002).

Should we interpret these findings so that universities are somehow attracting the R&D investments of MNEs? Feinberg & Gupta (2004) clearly associate locational choices with discrimination with regard to locations on the behalf of MNEs. Supporting evidence is provided by Davis & Meyer (2004) who survey 950 R&D subsidiaries to investigate four aspects of locational advantage, and find that only the presence of scientific institutions has a
consistent, positive effect on the incidence and level of subsidiary R&D. Hegde and Hicks (2005), who find that R&D subsidiaries of MNEs headquartered in the US are strongly drawn towards countries with strong knowledge bases in science and engineering (S&E), are sceptical towards such an interpretation. They write: “we do not argue that global R&D is initially attracted by S&E capability; rather we expect that market factors predominate in the early stages of globalizing R&D. However, we do expect that once an R&D base has been established, growth of innovative global R&D requires indigenous world class scientific talent”.

Given that proximity effects exist, how should we understand the nature of such benefits? A popular interpretation has been to allude these effects to the impact of cooperative relationships within a region. In fact most explanations for beneficial effects from proximity focuses on the value of direct, inter-personal contacts primarily in order to acquire tacit knowledge (von Hippel, 1987; Maskell & Malmberg, 1999; Siegel et al. 2003). However such interpretations of the positive effects of proximity are rarely backed by solid evidence. Some recent contributions question the importance of research linkages as a media for proximity benefits. Andersson, Gräsjö & Karlsson (2004), who analyse the location of industry R&D in Sweden and Fagian & McCann (2006) who undertake a similar analysis for Great Britain, find that while R&D location is partly determined by a region’s access to students in higher education, the region’s level of academic R&D is an insignificant factor. In summary, our interpretation of these two literature streams is that although they provide convincing evidence that MNEs may gain advantages by locating R&D close to research universities, few studies have explicitly addressed the relationship between R&D subsidiaries and the geographically proximate university. It is therefore not clear to what extent the firms can identify and articulate rationale that supports arguments like localised learning and tacit knowledge, those of recruitment and labour mobility or other ones.

Research design and methodology

In order to make a reconceptualization of when and why firms may decide to interact with universities we have chosen an exploratory case study design. The case study firms are all engaged in formal collaboration, with one of three elite research universities of University of Cambridge (UK), ETH Zurich (Switzerland), and Karolinska Institutet (Sweden). Sixteen
R&D subsidiaries of MNEs with headquarters located in other countries have been selected as cases.

Our research methodology is hence based upon a grounded theory approach (Glaser and Strauss 1967, Yin 1989), but with an exploratory theoretical aim. More specifically our cases are used to strengthen and explain the theoretically derived propositions, rather than derive and create new theory directly from empirical work (Eisenhardt, 1989). The previous section defined how and why MNE subsidiaries could be expected to interact with research universities. We use these theories and the empirical case based research as exploratory in the sense of being part of an iterative process to further strengthen and highlight important issues. These cases can thus be seen as the combination of our theoretically based propositions and initial exploratory findings.

One aim has hence been to develop and generate a more coherent and detailed set of categories of how and why firms actually interact with leading research universities. Based on this literature we decided to address four issues. These correspond to four variables which were identified and used to structure the interview guide and archival evidence: (1) the R&D activities of the subsidiary, (2) the rationale for cooperation with the university, (3) the perceived effects from that cooperation and (4) organizational forms of collaboration with the university. Based on the combination of literature and case study interpretation, we therefore set out to identify the intensity and organizational forms of collaboration, the perceived benefits, the main purposes of collaboration for each case, before moving on to examine whether these variables varied systematically.

**Case selection and methodology**

Two points of selection for the cases are important. The first choice is the universities to define the total population of firms with whom they collaborate formally and the second choice is the firms working with those universities.

The first set of choices has to do with European regions and elite research universities. The seminal research on university-industry interaction has been on the American universities (Mowery & Sampat 2005; Thursby et al. 2007) and hence we chose to focus on Europe. To decrease the risk of producing results valid for only a specific region, we choose to study three different regions centred on three elite universities. The choice to concentrate
our studies to “elite” universities can be described as an “extreme case sampling” (Patton, 1990). The underlying assumption behind this choice is that it will allow us to capture a greater variety of relationships. The universities are similar in terms of rankings, but they differ in terms of research scope and in terms of country.

Three universities were selected from ranking lists produced by the British newspaper The Times (THES), based on 2005 year rankings.\textsuperscript{11} The University of Cambridge repeatedly tops these lists, and thus is a natural choice. To avoid studying only British universities, which often top the European ranking lists, we selected Cambridge but left out Edinburgh, Imperial College, London School of Economics and Oxford. We also decided to concentrate on Switzerland and Sweden as two small but leading European economies where the regions surrounding the universities are much smaller and more defined than in other major metropolitan areas such as Paris or Barcelona. We therefore left out leading universities from other European countries and took the top from Switzerland and Sweden. ETH Zurich is constantly ranked among the top universities of Europe; in the THES 2005 lists, ETHZ is ranked fourth European university in science and third in technology. In the same list Karolinska Institutet was ranked fourth best biomedical university in the world surpassed only by Cambridge, Oxford and Harvard.

The three selected universities clearly have different profiles as well. We chose diversity here, as our purpose was to confirm and generate categories to define the different rationale and mechanisms for why firms collaborate with research universities. The University of Cambridge is active over almost the entire academic palette, the research efforts of ETHZ are heavily concentrated on science and engineering and Karolinska Institutet is devoted to medical research in combination with life-science research in biological and chemical sciences. Hence we are comparing one broad university with two specialized ones in, respectively, engineering and life sciences.

The second set of choices has to do with the selection of firms which make up the case studies. Section two explained why we focus on MNE subsidiaries with headquarters located in another country and doing R&D in formal collaboration with the university. We first made a list of all known such collaborative relationships, as known from the university. To identify the set of firms matching these criteria for each university and region we have used the assistance of university corporate liaison officers and regional enterprise officers. Extensive web-searches and access to university registers on collaboration (for Cambridge and
Karolinska Institutet) has also been used in the search process. This gave us the total population of known firms. More specifically we defined the population of firms matching the following criterion:

C1: The firm is an R&D subsidiary of an MNE which is located in Stockholm County, the Canton of Zurich or Cambridgeshire County.

C2: The firm belongs to an MNE group with more than 2000 employees, distributed over at least six countries, with its headquarter located in another country than that of the subsidiary.

C3: The subsidiary has at least five employees designated to R&D activities.

C4: The subsidiary has been involved in a formal agreement on collaboration (e.g. contract research, facility sharing and/or personnel sharing) with the local university at some point in the period 2003-2006.

These four criteria were used in discussion with the university and regional officers, to identify firms. All firms interviewed match the four criteria.

As a result of applying these criteria, we have identified 11 firms in Zürich, 12 firms in Stockholm and ten firms in Cambridgeshire. Hence, the total identified population was 33 firms. We contacted all of these firms and gathered published material about them, but some declined to participate in this study. We interviewed sixteen firms for the case studies, about half of the population. Table 1 specifies the firms interviewed:

| Table 1: Firms interviewed, classified by university |
| INSERT TABLE 1 HERE |

We interviewed one to three representatives for the specified sixteen MNE subsidiaries who are identified as cooperating with the universities of Cambridge, ETH Zurich and Karolinska Institutet respectively. Interviews and companies were contacted for validation.

These interviews were performed in a semi-structured manner following an interview guide. Four main topics were addressed, namely: (1) the R&D activities of the subsidiary, (2) the rationales for cooperation with the local university, (3) the effects from that cooperation and (4) on collaborative modes with the university organisation and its researchers. Interviews were done on-site at the firm; each took one to two hours; they were noted and placed in the interview guide; and the data was matched to theoretical concepts through exercises in Excel sheets. Complementary information has been gathered through interviews with
representatives for regional economic agencies and the three universities and from written or otherwise published material from firms and regions. We have gathered information on the R&D subsidiaries through interviews with R&D managers and complemented this information with interviews with the manager of the industry liaison office of each university and a manager at one agency for regional development at each region. Corporate websites and annual reports of all studied companies have provided further information.

**Description of the universities**

The description of the universities includes their most important features and presents the regional context in which they are operating.

*Karolinska Institutet in Stockholm.*

Founded in 1810, Karolinska Institutet is today one of the largest medical universities in Europe. It is also Sweden’s largest centre for medical training and research, accounting for 30 per cent of the medical training and 40 per cent of the medical academic research that is conducted in the country. Five scientists from Karolinska have received the Nobel Prize in physiology or medicine. In 2005, the University had a turnover of approximately 520 million USD and employed about 3500 people.

The Science Park Novum was founded in 1984 and is located nearby the Karolinska Campus in Huddinge. Here university research is performed together with companies, mainly smaller firms but also some larger corporations such as Baxter have invested in research facilities here. Novum is currently expanding, Novum BioCity is an extension that aims to focus on basic research and attract more companies to the region. vii

*Cambridge University*

Often described as Europe’s leading research university, the University of Cambridge combines a commitment to fundamental research with an interest in commercializing its research. The 800 years old university is surrounded by one of the strongest science park clusters in the world. The University had a turnover of 1.3 billion USD in 2004 and teaching
and research activities makes up about 80 percent of these expenditures. It employs around 8000 people.

The University of Cambridge has been cooperating with industry for a long time. For instance Rolls Royce, has located much of its jet engine research at the University during the last 50 years. More recently the university has become more aware of the importance of these links and therefore, they have sought to create a support structure for this. The University created a centralized Research Service Division (RSD) in 2000. A Corporate Liaison Office was founded in 2001, merging with the RSD in 2005. About 17 percent of the University’s research income comes from companies. Interestingly most of these companies are multinational and have headquarters outside the UK.

**ETH Zurich**

ETH Zurich was founded in 1855 and has been a leading research university for a long time. Together with ETH Lausanne and four research institutes ETH forms a federally directed institution committed to research, mainly in technical fields such as engineering sciences, mathematics, natural sciences and architecture. In total about 8200 people are employed by ETH Zurich and the university has a turnover of about 800 million USD.

ETH has sought to be close to the economy cooperating with many corporations in the region. The most renowned example is the relation to IBM which has one of its largest research facilities located close to the university. ETH is taking a further step in this direction by creating the Science City. This initiative will improve the partnerships with business and society. Firms and donors can participate in the financing of the entire university. Start-up companies and established corporations will find not only office space in Science City but also services and international networks.

**Collaboration with European elite universities**

The first descriptive question is whether the intensity and rationale for collaboration is similar for all the firms or whether it differs.

The first theme discussed in our interviews was to establish how intensively the R&D subsidiaries work with the universities. We interpret the statements of the respondents as fitting into either of two rough categories. Five firms perceive that they have what was
referred to in an interview as ‘occasional’ or what we call ‘on-demand’ collaboration, whereas the remaining eleven firms maintained what was perceived as continuous relationships. Continuous relationships between firm and university are the most common which we interpret as a high intensity of relationships, or what could be expected to be a dense set of linkages in the network. Many of these R&D subsidiaries of MNEs do interact intensely with the local university.

However the five firms that have specified their relationship as ‘on-demand’ collaboration are also quite interesting. These firms only interact when they need a specific kind of research. Among these five respondents several stated that the university which has geographical proximity is not a very relevant partner for R&D. Two refer to mismatches between the research profile of the specific local university and that of the firm subsidiary. Moreover four of these managers do not see universities as a particularly important type of R&D collaborator. Hence, despite being organizations with clear “absorptive capacity”, these firms do not necessarily think that universities have something specific to offer.

Let us look more closely at the eleven firms which identified a continuous relationship with the elite university in their region. Table 2 specifies the number of firms mentioning any of the following rationale for collaboration.

| Table 2: Of firms stating continuous relationship with university, rationale given |
| INSERT TABLE 2 HERE |

As shown in Table 2, ten of the eleven firms expressed in interviews that an important rationale was the need to obtain access to scientific networks, in particular international contacts, and seven of eleven mentioned access to local networks. Other key areas were recruitment (8/11) and possibilities to strengthen the brand of the firm and/or product (7/11). Note that only three of the eleven firms mentioned the continuous need for consultation or the desire to affect the overall agenda of research at the university.

Access to people and networks are thus important. In the interviews several R&D managers perceived the close geographical proximity university as gateways to a wider academic community. Through these nodes the R&D subsidiary felt it could obtain access to a community of researchers that could be relevant to them. It is particularly noteworthy that these managers stressed the unique nature of collaboration with the specific university and
research team. They underlined the particular nature of that collaboration, and stated that it is unique for the firm, in terms of form, intensity and scope. In other words they go to one elite university to fulfill this function of access to international networks.

The second descriptive question is what organizational forms of collaboration are visible in the cases. Formal relationships between universities and firms can be organized in different ways, reflecting different purposes of the collaboration and different funding arrangements (Tidd et al. 2001). As with the previous question, existing literature suggests a number of organizational forms, which were used in the interview guide in combination with open-ended questions. Table 3 below shows the results.

Table 3: Organizational forms for collaboration

The most common forms for the R&D subsidiaries are joint venture research (12/16), consulting (12/16) and joint staffing (11/16). Our interpretation is that the most common organizational forms include types which involve very direct and long term collaboration (joint venture, joint staffing) as well as types which mainly involve arms-length relations in the market (consulting, commissioned R&D).

The least common organizational forms for collaborative R&D are quite interesting, given the current emphasis in public policy and in the literature. Only 5/16 emphasize patents and only 3/16 mention jointly owned centres. Note that we expected more patents, given that policy stresses changing institutional patterns to facilitate IPR and given that patents are the main measurement of university impact on society (McKelvey et al. 2008). We also expected more centre-form collaboration because this has been a key policy instrument of the innovation policy agencies of both Sweden and Switzerland (Arnold et al., 2004). At least for this set of R&D subsidiaries of MNEs our results indicate that intellectual property and jointly-owned centers are not that common.

The most common organizational forms seem to involve primarily either people and networks (joint venture research, joint staffing) or specific problem solving on scientific and technical issues (consulting, commissioned).

We also wanted to use the interviews to more specifically identify the effects and benefits for the firm, in their own words. Hence respondents at the subsidiaries were asked to evaluate and
describe the effects of its collaborative relations to their geographically proximate university. We have classified these statements in six categories, which were later discussed with the respondents, and these are presented in Table 4.

Table 4: Managers’ View on Relative Importance and Types of Benefits for collaboration

To us some of the benefits from collaboration were expected, as they have been identified in previous literature. Freeman (1994) suggests that universities keep open options for the future. Of the studied firms 11/16 found benefits in ‘helping the firm to identify opportunities for innovation’. Other benefits were unexpected, and generated by the case studies. In particular, we did not expect that so many (13/16) would state that collaboration has important branding and/or marketing benefits for the firm. In contrast to the university-industry literature which assumes universities to be the primary motor of regional development, this result is more in line with international business literature which emphasizes that R&D may be adapted to local markets (Le Bas & Sierra 2002).

In summary this section has examined the sixteen R&D subsidiaries of MNEs by answering two questions. The first one was whether the intensity and rationale for collaboration is similar for all the firms or whether it differs, and the second one was the mechanisms and organizational forms for R&D. Our results are valid for a very small but important subset of firms – namely R&D subsidiaries of MNEs with headquarters elsewhere and with formal collaboration with elite European universities. The results are in line with existing literature, but they also generated new insights, especially two dichotomies of firm behaviour when formally collaborating with elite universities. The first dichotomy is the type of university knowledge asset most relevant for the R&D subsidiary. Here, the aggregate empirical results suggest that they may be primarily interested in science and technology or else in market, customers and branding. The other dichotomy lies in whether collaboration with the university is a primary mechanism to reach company goals, or a complementary one.
Four ideal types of firm strategies

The two dichotomies outlined above, which were generated through our reading of the literature and the aggregate empirical results, suggest that firms may follow four ideal types of strategy, when collaborating with elite universities. Firms involved in running clinical trials are primarily interested in market, customers and branding, but see collaboration as a primary mechanism to reach a firm goal. Firms involved with universities as solution demanders are also primarily interested in market, customers and branding, but see collaboration as a complementary mechanism. Firms involved with universities as competent buddies are primarily interested in science and technology, but see collaboration as a complementary mechanism. Firms involved with universities as seamless network are also primarily interested in science and technology, and see collaboration as a primary mechanism to achieve their goal. Hence, these four ideal types are described below, namely Seamless Networks, Competent Buddies, Solution Demanders and Running Clinical Trials.

Running clinical trials

The first ideal type is the Running Clinical Trials or R&D subsidiaries with an orientation towards clinical activities. The firms categorized as such are Wyeth (Stockholm) and Merck (Stockholm). The illustrative case is of Wyeth in Stockholm. Clinical trials of firms in the pharmaceutical sector constitute something of a ‘special case’ in terms of U-I relations. Clinical activities of pharmaceutical firms are almost totally dependent on the access to the clinical expertise and patients of university-hospitals and thus generally maintain continuous contacts with universities. However this is a separate category because firms that seek to perform clinical trials are not necessarily drawing on university research capacity.

Wyeth in Stockholm provides an illustrative example. The company is primarily in Stockholm in order to run clinical trials, in order to test new drugs in accordance with regulation. The firm is interested in drug approval for Sweden and Europe, and relevant clinical trials are easily organized in this population. According to Göran Skoglund, the R&D manager in Stockholm, the subsidiary otherwise only collaborates with a few professors, whom are approached when special consultation is needed.

In summary, Clinical Trial firms can be found collaborating with Karolinska Institutet. These firms are looking for a type of long-term contacts with clinical doctors, in
order to run large scale clinical trials for pharmaceuticals. This is the only ideal type which is specifically restricted to one industrial sector, namely pharmaceuticals which is subject to extensive regulation.

**Solution demanders: R&D subsidiaries with an agenda dominated by development**

The second ideal type is the Solution Demanders or R&D subsidiaries with an agenda dominated by development. The firms categorized as such are Arla foods (Stockholm), Pfizer (Stockholm), Google (Zurich), Elan Microelectronics (Zurich), and Alcan (Zurich). The illustrative case is of Alcan in Zurich.

The firms in this ideal type have more loosely organised collaboration with the geographically close university, with limited numbers of organizational forms and lower intensity of contacts. Moreover the linkages to the university tend to be related to applied development rather than basic research. They also often focus upon existing R&D projects within the firm and consultations rather than exploratory activities. Some of these firms collaborate with universities in order to get access to equipment and facilities that they do not have.

In the interviews the R&D managers were asked why they did not have more interactions with the universities. We interpreted the responses from these five firms as falling within three themes: Limited funds on behalf of the firm, Limited need for external expertise and Mismatches between the R&D needs of the subsidiary and the current research expertise and interests of that university.

One illustrative case is Alcan which is a global corporation headquartered in Canada. Following the acquisition of AluSuisse in 2000 the corporation has restructured its R&D. The corporation today runs research laboratory and engineering centres in Canada, Switzerland, France and the US. The research laboratory in Neuhausen, just north of Zurich, and the Engineering centres of Zurich are among the largest R&D facilities of the group. The lab has two emphases: aluminium fabrication and packaging. The engineering centre is responsible for development for the mass transportation industry within the group.

From a central perspective, Alcan’s Director of Innovation Management Dr Ernst Lutz states that the firm does not have much contact with the ETH. The respondent argues that the distance between the continuous improvement R&D of the firm and the research-oriented
university generally is too great for regular collaborations to be set up. The firm has much
greater relations to less well-known academic institutions throughout Switzerland. However,
the respondent is also responsible for a new initiative called Future Options, which is set up to
run R&D projects meant to provide the firms with new impulses and an “early warning
system” for technological changes that may disrupt the firm’s current markets or open up new
business opportunities. The respondent plans to fund “leading professors and places”,
demanding regular consultancy and discussions to guide the firm’s R&D but not imposing
demands on for what specific research agendas the academics use the firm’s funding. However
Dr Gerald Rebizter, who is responsible for Life Cycle Management within Alcan, reports
different experiences. He works with academics all over the world but has a particularly strong
relationship to a group at ETH. Except for informal contacts, Alcan provide some
sponsorship money for conferences and seminars within the area (networking and brand
benefits for the firm).

To conclude, the formal relationship between the firm and the ETH is restricted to a few
organisations forms (only some sponsorship contracts confirmed in interviews). While a few
individual R&D employees such as Dr Rebitzer may work with the ETH on a regular basis,
this is an issue of informal contacts and networking. The contact we identified is restricted to
a narrow field (life cycle analysis). Dr Lutz describes the relationship in general as weak / not
intense.

In summary Solution Demander firms can be found collaborating with ETH
Zurich and Karolinska Institutet. These firms are looking for a type of problem-solving
activities, related to specific areas of expertise of the university and in this case they do not
give a preferred position to the geographically proximate university.

**Competent buddies: R&D subsidiaries with research-intensive agenda**

The third ideal type is the Competent Buddies or R&D subsidiaries with research-intensive
agenda. The firms categorized as such are Kodak (Cambridge), Linde Therapeutics
(Stockholm), AstraZeneca (Stockholm) and IBM (Zurich). The illustrative case is of IBM lab
in Zurich.

These R&D subsidiaries differ in organizational characteristics from those found in
the solution demanders type, in that they are significantly larger, more complex organisations.
As compared to the seamless network firms discussed below, these competent buddies are
slightly less oriented towards research and somewhat more towards product development. At the same time, they tend to be major centres of R&D expertise within the MNE globally. Here the interaction with the specific elite university which is geographically proximate is considered a more unique knowledge asset to the firm than in the ones discussed above.

For *Competent Buddies*, they see themselves as competent within the field of science and technology within they are collaborating, and likely have complementary knowledge to that of the university. The geographically proximate university and its researchers are a natural partner with whom both formal collaboration and informal networking can be practised. The creation of network contacts and access to people is facilitated by the continuity of relations and significant recruitment. The university close to the subsidiary is presented as a preferred partner in the subsidiary’s often extensive academic network. While the subsidiary may recruit extensively from the local university, however, there is generally no room in R&D budgets to set up collaborations focused primarily upon recruitment and support of the local knowledge base at the research level; instead, these factors are seen as an outcome, and a long-term added-value of local collaboration.

Note that these firms likely interact with many universities and the geographically proximate university is only one of many. In the words of one interviewee: “We are allergic to ‘regional’ initiatives and do not want to establish special relationships to universities: we want to pick the best available university researcher for each and every need that we may have rather than staying with some kind of preferred ‘local supplier’”.

One illustrative example of the competent buddy strategy is IBM’s research lab in Zurich; a classic example of a large, R&D-oriented MNE subsidiary fostering strong linkages to the local university environment. Among the most notable forms of current collaboration are a commonly owned research center (ZISC) and a programme for utilisation of IBM technological assets in academic research (CASE).

The ZISC and CASE initiatives represent the two most structured forms of collaboration between ETH researchers and IBM, an opinion supported by both respondents and by IBM’s local public relations manager. ZISC is a research centre that is jointly funded by IBM and other partner companies associated to ETH. CASE is a programme for utilisation of IBM technological assets in academic research.

The lab was established in 1955 as IBM’s first R&D initiative outside the US. Today, the Zurich lab is one of eight IBM corporate research labs in an organisation that the corporation
describes as “the largest industrial research organization in the world” (IBM, 2005). The lab has a strong position within the IBM research organisation and hosts the full range of R&D activities; from research to product development. In recent years, the focus has shifted from internal R&D to collaboration in teams of researchers, developers and marketing managers in client-related projects. However, as opposed to the corporation’s R&D labs in China, Japan and Israel, the Swiss lab is perceived as serving the needs of the IBM corporation in general more than serving a ”local” market (Schär, 2006). ZISC coordinator Günter Karjoth describes the rationale for establishing a center as follows:

"We already had some collaboration with ETH in the area of information security, but it was not different from the relations that we have with other universities, where we follow research work and attend talks. But we realised that we had two world-class research teams sitting close to each other without talking very much to each other. We wanted the two teams to learn about the works of each other, in particular we wanted the PhD students at ETH to learn about our work. Where we have students interested in our topics, we see an opportunity to influence their research agenda by cooperating on particular topics.”

Besides these benefits from collaboration, the ZISC coordinator describes a need “to look ahead, not to get insights in new technologies, but to prepare the avenue for new technologies.”

Both collaborative initiatives are described as “interaction between peers”, which can be interpreted as a confirmation of the high level of the research done at IBM. However, while ZISC represents an initiative oriented towards “basic” research, the second initiative discussed here has a focus on IBM technology.

In 2001, IBM launched a new collaborative programme called CASE for the design of novel high-frequency analogue circuits for the advance of wired and wireless communication technologies. Initially IBM sponsored the centre with about one million Swiss franc and then close to half a million annually in the following years. While the CASE programme not is exclusively associated with ETH, the proximity allows ETH researchers who work on issues that are relevant for IBM to participate very actively. The director of CASE explains:
“IBM has a very strong technological base in certain technological areas, such as transistor design. Our basic idea with CASE was that in order to educate key people in using our state-of-the-art technology, we need to enable access to it. Obviously we also wanted to make use of any important research results that come out of this initiative.”

CASE offers a mix of limited direct funding and more indirect values. The chairman of the board, states that this is “an exemplary of the type of collaboration IBM seeks with academia”, mainly since it is done in a technical area of increasing importance for IBM. The collaboration requires powerful computer systems and therefore IBM has donated six workstations that will be part of the computer infrastructure used. While IBM gets access to skilled researchers and a pool of talented students ETH obtains knowledge and equipment that they can’t host on their own. IBM funds doctoral students and masters students that are involved in the projects undertaken and IBM researchers lecture at ETH regularly. The firm has also, through the lab, participated in recent ETH fundraising initiatives.

In summary Competent Buddies firms can be found collaborating with ETH Zurich, Cambridge University, and Karolinska Institutet. These firms are looking for a type of interaction, which is quite close and depends upon specific competencies in both partners.

Seamless networks: integrated research units

The fourth ideal type is the seamless networks or integrated research units. The firms categorized as such are Intel (Cambridge), Unilever (Cambridge), Hitachi (Cambridge), Baxter (Stockholm), Microsoft (Cambridge). The Hitachi Cambridge Laboratory located close to Cambridge University will here be used as an illustrative example.

Five firms are thus cases where corporate R&D resources are closely integrated - often even physically embedded and integrated through people - in university environments. These R&D subsidiaries have a high intensity and variety of organizational forms for collaboration with their specific elite university. They engage over a longer period of time in recruitment, access to university researchers, staff sharing as well as formal and informal collaborative arrangements.

Four of the five subsidiaries with a ‘seamless network’ strategy are fairly young, having existed about 5-10 years. Hitachi is the notable exception which has had an embedded laboratory in Cambridge since 1989. This unit of Hitachi is oriented towards basic research
and performs it together with the Microelectronics Research Centre in Cambridge. The laboratory specialises in advanced measurement and characterisation techniques, and the university department specialises in nanofabrication techniques. At the intersection of these fields, Hitachi seeks to increase its knowledge about semiconductor physics for future electronic and optical devices.

The director of the laboratory, Dr David Williams, states that this form of close collaboration makes it possible for Hitachi to get access to the university’s researchers on a daily basis. By collocating to such an extent, a firm like Hitachi can get access to more researchers than they are paying for themselves. Conversely, the university gets access to about 25 researchers in the Hitachi Cambridge Laboratory.

Several firms of this seamless network type describe their collaboration as a way of obtaining the “blue sky” research that they are usually not willing or able to perform themselves. In the interviews and also theoretically, one main rationale for these R&D subsidiaries is linked to aspects of ‘listening posts’ or ‘preparing for future disruptive innovations’. To do so the R&D managers stress the need to engage in, access results, equipment and networks concerning the latest basic research findings.

Another rationale appears to be the attempt to achieve a critical mass of research staff and equipment, where partial payment from each actor helps to create an organizational form where both parties benefit. The MNE can leverage its internal research investment with public resources and the university can augment and develop specific lines of research.

In summary, four of the five seamless network firms are collaborating with Cambridge University, and the fifth with Karolinska Institutet. These firms are looking for a type of continuous, multi-dimensional interaction with the university, where they access networks and people in relation to scientific and engineering knowledge.

Can elite European research universities attract the knowledge economy into their region?

The paper has so far focused on the organizational forms and benefits that R&D subsidiaries of MNEs perceive, when collaborating with one of three elite European universities in their respective region. This section asks how the results from three universities which are all considered leading in their fields should be interpreted, relative to public policy goals to attract
the knowledge economy into their region.

Our interviews suggest that the R&D subsidiaries are located close to these elite European research universities for very different reasons. Moreover, though, these differences across variables are systematic in a manner that has enabled us to propose four ideal types for firm strategies for collaboration with universities. In one ideal type, that of Seamless Network, the interview results suggest that these elite research universities can exert a clear attracting force on R&D investments that are embodied as R&D subsidiaries. Similarly firms acting as Competent Buddies also find a lower level but still multifaceted rationale for being geographically proximate to their university. However for Solution Demanders and Running Clinical Trials these firms identified only minor direct benefits of proximity to the research university. These results thus suggest that only some types of MNEs will be attracted to elite European research universities for activities that require intense collaboration, multiple organizational forms, and long-term ‘windows’ into scientific results and networks.

With the exception of the category of clinical trials for pharmaceuticals, this classification extends beyond commonly used sectoral divisions. This may be surprising, as the heterogeneity of needs for collaboration between industries is a stylized fact of previous literature on U-I relations (Meyer-Krahmer & Schmoch, 1998; Nelson, 1986) and the differences between sectors is documented in the literature on R&D-localisation of MNEs (Hegde & Hicks, 2005). However, we have been able to identify these three ideal types of firm strategy, which transcend industry specific factors, as well as one ideal type which is specific to the pharmaceutical industry.

Our results thus suggest that firms go to elite research universities to access particular types of international scientific knowledge, which have a high value to the firm. Only a few universities can offer this even amongst the elite ones. Firms access these universities because they find it more beneficial than to develop all these competencies in-house and firms appear to be located close to the respective universities for similar reasons. In each case the R&D managers were clearly reflecting upon what they get out of any specific university or collaboration. Depending upon the answer to that, they developed different strategies, goals, and outcomes of the university-industry interactions. From the firm’s perspective, they are clearly placing their R&D investments in a specific region, as a part of the strategy of a global company.

A related issue is the overall importance of the being close to elite universities. The
results raise questions about our current understanding of the value of “knowledge flows” as a driver for co-location, as emphasised in the literature about localised knowledge spill-overs. Direct and strong flows of knowledge between university research and corporate R&D activities are only found to be relevant for the understanding of one of our four identified ideal types, namely Seamless Networks. In fact, our tentative conclusion that Seamless Networks subsidiaries are mainly found in the vicinity of only one of our three elite universities, Cambridge University, suggests that even the academic excellence of a university in itself does not guarantee R&D investments from foreign MNEs.

This empirical result has implications for public policy and for university leaders. Our results suggest that universities are not ‘magnets’ for Foreign Direct Investment (FDI) in general, but only for specific reasons which are set in relation to the global corporate strategy. Depending upon the firm’s rationale, it may be looking for very different ways and benefits of collaboration. Moreover, if not even the top ranked and well-renowned universities Karolinska Institutet and ETH Zürich can attract subsidiary R&D by direct power of research excellence, then opportunities for other universities to do so seem dire. It is also interesting that global firms can go to a leading university like Karolinska in order to run clinical trials, although they also have other types of formal collaboration.

Therefore, policy-makers and university leaders must have a more nuanced understanding of firm’s differing rationale for collaboration. One aspect involves contracts, access and specific agreements. Special arrangements in terms of facilities and legal contracts may need to be arranged for Seamless Network firms, whereas Solution Demanders may be handled with the technology transfer instruments which have been developed the past ten years or so. All in all, elite research and teaching universities may be very important to help develop the region as a whole, but in taking strategic decisions about R&D location, firms will differ in their assessments of the value of opportunities to local academic collaboration.
References
Cantwell, J. and L. Piscitello (2002), ‘The location of technological activities of MNCs in
European regions: The role of spillovers and local competencies’, *Journal of International Management*, 8, 69-96.


Dunning, J. (1994), ‘Reevaluating the Benefits of Foreign Direct Investment’, *University of Reading, Department of Economics*.


von Hippel, Eric (1988), *The Sources of Innovation*, Oxford University Press


Siegel, D., D.A. Waldman, L.E. Atwater and A.N. Link (2003), ‘Commercial knowledge
transfers from universities to firms: improving the effectiveness of university-industry collaboration’, *The Journal of High Technology Management Research*, 14, 111-133.


**Web references**


This book chapter has been financed through SISTER research institute and RIDE research network at IMIT, in a collaborative research project involving three universities. Anders Broström is a PhD student at SISTER Research Institute and Royal Institute of Technology; Maureen McKelvey is Professor of Industrial Management, School of Business, Law and Economics, Göteborg University; and Christian Sandström is PhD student at CBI Research Center at IMIT and Chalmers University of Technology. Many thanks to organizers and participants of special sessions, where earlier versions of this chapter were presented, at the 2007 Uddevalla symposium and the 2007 Academy of Management, in Philadelphia.

Public policy-makers have also been encouraged to interact with MNEs, because R&D subsidiaries not only create attractive jobs, but also form networks and act as customers which can potentially improve the business climate of a region (Ylinenpää and Lundgren 1999).

This paper addresses issues relevant to a very specific type of firm, because for the great majority of firms, regardless of sector of activity, universities are not regarded as the main source for innovation but rather as a complementary activity (von Hippel, 1988).

These universities are also high for European universities on the other major rankings..

An alternative criteria would be to include only firms in particular sectors, which are assumed to be working in areas known to exist at the university. However, we do not feel that either the NACE-code system nor the Frascati manual provide sufficient grounds upon which to match the R&D needs of particular industrial sectors with research. Moreover, by making this assumption, we would have missed any ‘unexpected’ collaboration, in other areas, such as suggested in literature on technology search.

Details of the interview guide are presented in Broström (2007).

Based on previous literature, the interview guide provided some examples but respondents were also free to answer in their own words. We then grouped their answers. The following is therefore partly based on theoretically-derived categories and partly on empirically-derived ones, found as a result of the interviews.

We do not know the reason, but we could speculate that it may be related to the foreign ownership status of our firms, as funding agencies that set up such centres might possibly favour firms perceived as “national” or ‘regional’. Another rationale might be that the university researchers tend to find national and regional partners, due to asymmetric information and search.

All the subsidiaries in this category except Microsoft are in fact integrated research units. The Microsoft Research Laboratory is located in a different building, next to the Computer Science Laboratory in Cambridge.