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Collaboration for competitiveness

Towards a new basis for regional innovation policy

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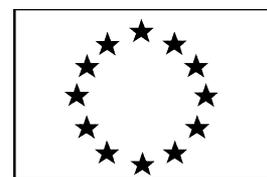




COLLABORATION FOR COMPETITIVENESS

Towards a new basis for regional innovation policy

Editor: Anders Broström



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EXECUTIVE SUMMARY

Outdated ideas still characterise many policy ambitions in the area of university-industry linkages. In particular, there is still the idea that the main policy aim is to bridge the gap between the commercial and the academic worlds. This study investigates firms' motives and rationales for cooperating with universities as well as university's efforts to attract industry in order to illustrate that such views of contemporary university-industry relations are misinformed.

Cooperation between firms and universities has been studied before using surveys, and the type of firm that is involved in such cooperation is quite well known. Our understanding of the *rationales* behind cooperation, however, is often based on single case studies or anecdotal evidence, usually from firms in 'typical' sectors. For this study, representatives from 45 European firms were interviewed to shed new light on the current demand for university cooperation. Drawing on this material, a number of distinctive roles that firms take on in cooperation with universities have been identified:

1 ... *Collaboration on product and process development outcomes, of four types:*

1.1 *Commercialisation of academic research:* a firm cooperates with a research group with the aim of producing research results that can be commercialised, i.e. codified as intellectual property, or, similarly, a firm seeks to transfer technology directly to its products or processes.

1.2 *Traditional applied research:* collaboration is centred around a problem specified by a corporate partner, which expects to obtain results that are useful for product or process development. This type of cooperation might take the form of standard commissioned research, including clinical trials, but might also be structured as a joint research project.

1.3 *Orientation, learning and broadened perspectives:* a firm seeks orientation and competence development, which are necessary components of innovation rather than innovation per se.

1.4 *Supportive research:* a firm collaborates to carry out a defined task that is *only indirectly* associated with the firm's products or processes. The difference between this type of collaboration and collaboration where direct results are expected can be understood, for example, as the difference between developing a product and developing technology or a methodology or, in medicine, studying the pathology of a disease.

2 ... *Access to academic networks;*

Firms enable future research by 'screening' for critical areas for cooperation on the group of motives listed above. Moreover, firms draw on the expertise of their collaboration partner's colleagues, benefit from interaction on 'neutral ground' with competitors and customers and are sometimes able to establish new strategic relations.

3 ... *Human capital management*

These groups of motives are related to recruiting and retaining qualified personnel, as well as to motivating and supporting academic groups to secure the availability of scientific cooperation partners in critical areas for the firm.

4 ... *Direct business opportunities*

In some cases the motives for cooperation follow a straightforward business logic: firms that 'repackage' and sell academic knowledge or special competences, firms for which

academe is an important customer group, and firms for which academics are important opinion formers.

5 ... *Opportunities to leverage research investment*

The possibility of having research projects of interest to the firm co-funded by a government or EU programme and/or by other firms is, not surprisingly, found to motivate firms to collaborate with universities.

The empirical material suggests that the types of collaboration rationales that may be supported by a policy intended to bridge a gap between industry and academe (types 1.1 and 1.2) only correspond to a small fraction of industry's needs. The diversity of rationales and the indirect nature of the dominating types of rationales call for a different kind of policy. In our examination of an additional set of firms in Cambridge, Stockholm and Zurich, we were able to validate these conclusions and to provide more concrete examples of how regional leaders can attempt to build on university-industry relations to strengthen a region's attractiveness as a business location.

To promote understanding about contemporary university efforts to create strong industry linkages, ten prominent European universities were also studied. Among them are some of Europe's oldest and youngest as well as some of the most established and the most innovative. A number of trends in these universities' efforts to attract industry partners can be identified:

- Universities are experimenting with increasingly professional support for industry relations.
- An obvious commitment to outreach and collaboration is changing academic culture.
- Universities form alliances with other universities in order to attract industry.
- New forms of organisation for research create stronger collaboration partners for firms.
- Co-location between industry and universities creates new environments and mutual benefits.

These trends demonstrate that the academic institutions of Europe are undergoing great changes. Universities are under pressure from new expectations and increased competition for students, faculty members and funding, and are in the process of developing the new capacities and competences required to manage such pressures. It is suggested that the time is ripe for the emphasis to shift from the introduction of 'intermediate' structures for university-industry linkages to interaction with universities. A priority task for regional leaderships must be to assist the universities with their efforts to attract industry partners, thereby strengthening their potential as hubs of the innovation society.

However, the study also reveals that the 'entrepreneurial' development of an academic institution is a complex process that is very difficult to manage. Any attempt to revolutionise a university risks facing opposition from faculties and industry alike. It is therefore important that any ambition to form a new kind of partnership is guided by two principles: 1) that the region will support the capability and the will to experiment in respect of industry relations rather than implement new external schemes; and 2) that the region will seek to support capabilities that have the potential to both attract industry interest *and* serve the traditional interests of a university such as an increased capacity to attract research funding and high-achieving academics.

The findings of this study indicate that collaboration between industry and academe must be designed in such a way that it promotes the competitiveness of both the partners involved, i.e. in ways that allow researchers to meet the differing sets of collaboration rationales. The same

principle must apply to a collaborative partnership between regional leaderships and regional universities—it must be designed so that regional development ambitions and the university's ambitions are mutually facilitated. That is the characteristic of *collaboration for competitiveness*.

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Arguing that a large portion of the beneficial effects from research are strongly limited in their geographical scope, a large literature has contributed to our understanding of the role played by proximity between the agents in university-industry linkages.³ Although seemingly paradoxical in an interlinked world of advanced information and communications technology (ICT) tools and globalisation, the spatial dimension of university-industry relations is impossible to neglect. The main argument focuses on the nature of knowledge, stating that knowledge characterised by its high level of complexity and ‘tacit’ nature (also referred to as non-codifiable knowledge or know-how) is much more efficiently transmitted between proximate actors.⁴ However, the kind of university-industry linkages in which the geographical barriers have a real impact is not fully clear.⁵

1.2 An outdated policy rationale

While the scientific literature still has many questions to answer, it is becoming obvious that the regional dimension of university-industry linkages is too important to be dismissed and that national and transnational policy on supporting linkages must be complemented by activity at the regional policy level. For European regions pressured by the structural transformation of their economies, hopes of regional turnaround have long been directed towards the positive influence of regional university-industry linkages. A new aspect is that even prosperous and growing regions are starting to pay greater attention to this area. As this interest grows, it is important to review the mental models behind previous attempts to create policy for university-industry relations and to promote the innovative capacity of industry.

One prevalent idea about university-industry linkages states that the necessary flow of ideas does not happen because the industrial and academic spheres have separate cultures (interests, incentive systems, etc). In its simplified form, this idea perceives universities and industry as two hilltops in a landscape of knowledge with a gap in between. The necessary task of regional and national policy makers is thought to be that of building bridges between these hilltops. These types of ideas are typically inspired by the notion of commercialisation in the ‘classical’ sense, where research results manifested in intellectual property rights are transferred from the academic to the commercial sector. The ‘bridges’ that regions or nations can attempt to construct will therefore typically be organisations for technology transfer, technology parks, support schemes for academic spin-off companies, and so on.

A number of objections can be made to this suggestion. Recent research contributions indicate that ‘classical’ commercialisation has been overemphasised in relation to its economic relevance.⁶ A second objection is that relations between the commercial and the academic spheres are

³ See e.g. Audretsch and Feldman (1996) for a view of how geography was introduced into the literature on innovation studies. Anselin et al. (1997) examines spatial spillovers between university and industry in particular.

⁴ Breschi and Malerba (2001); Harhoff (2000), Arundel and Geuna (2001); von Hippel (1994).

⁵ Audretsch and Lehmann (2006).

⁶ Mowery and Sampat (2005); Agarwal and Henderson (2002); Kline and Rosenberg (1986)

substantially different in nature over the whole set of academic disciplines and business models, respectively.⁷ This proposition is difficult to fit with a notion of policy as a tool for bridging gaps, since it implies that it will be impossible to find a bridge that fits more than a single gap.

Having reason to believe that outdated ideas still characterise many policy ambitions, it becomes necessary to study contemporary university-industry linkages in a way that illustrates where the concept of ‘bridge building’ fails to be useful as a policy objective, and that at the same time allows analysis of how an updated view of university-industry relations can be reflected in regional development ambitions. Chapter 2 describes how this need is reflected in the design of this study.

⁷ Foray and Steinmueller (2003); Cohen et al. (2002); Laursen and Salter (2004)

2 PURPOSE AND METHODS

The overarching purpose of this study is to contribute to the understanding of how regional leadership can promote university-industry linkages. From an industrial perspective, several types of linkages are possible, including the unfacilitated ‘spillover’ of research results and accumulated knowledge from academe to the industrial sector, the kind of knowledge flows embedded in people that come with the recruitment of students and graduates, the introduction of new research-based spin-off companies, and so on. While acknowledging that knowledge flows linked to human mobility is the area with the greatest economic potential, we chose to delimit the scope of this study to the type of linkage that is found in formal research collaboration.⁸ Formal collaboration, where both sides signal their commitment to the collaborative effort, is seen as a basic feature of ‘the networking society’ in a modern economy. It has been claimed that the direct influence of science is primarily realised through joint R&D projects.⁹ We feel that the challenge of developing regional innovation networks in their regional context remains unexplored to a much higher degree than the labour market-related efforts through which a region benefits from flows of human capital. We thus address the more specific question of *how regional leadership can promote university-industry collaboration on research*, believing that the answers are significant for the broader issue of fostering stronger university-industry linkages.

Insights into the demand for collaboration are needed in order to address this question. However, although cooperation between firms and universities has been thoroughly studied (we know quite well the types of firms that are cooperating) our understanding of firm’s rationales for cooperation is limited and somewhat fragmentary.¹⁰ The studies that we have reviewed are based on studies of firms in ‘typical’ sectors such as manufacturing or biotechnology. The first aim of this study is therefore:

Aim one: *to describe industry demand for university cooperation*

Understanding the *demand-side* alone is not enough to accomplish our primary purpose. We also need to understand the *supply-side* of collaboration. Our second specified aim is therefore:

Aim two: *to describe how universities work to become more attractive to industry.*

The second aim supports the first because it allows us to interpret the rationales for industry collaboration from the perspective of contemporary models for collaboration at universities. The first aim supports the second because it allows us to reflect specific aspects of universities’ attempts to attract firms in the attitudes of firms.

The duality of the aims calls for a dual approach to data collection. The commonly used survey-based approach is unable to deliver a deeper contextual understanding of what motivates collaboration. Furthermore, we believe that a survey approach runs the risk of oversimplifying the complex matter of a firm’s research strategy. A classic in-depth case study approach would, of

⁸ Eliasson (1996); Eliasson and Braunerhjelm (1998); Salter and Martin (2001)

⁹ Kaufmann and Tödtling (2001).

¹⁰ Large R&D-intensive firms are the most frequent collaborators, see e.g. Mohnen and Hoareau (2002)

necessity, have to draw on the experiences of a very limited set of firms, making it impossible to avoid bias with regard to sectors and firm sizes. In order to gain a broader understanding, we used semi-structured interviews with respondents at firms identified as having collaborated on R&D with universities to meet the first aim. We used a case study approach to achieve the second aim. Once again most studies investigating the characteristics of university-industry cooperation either use survey material or draw on a single case study. By combining data from ten case studies, and a broad set of interviews and other data sources in each case study, this research is able to test previous findings and examine the validity of prevalent regional policy thinking on university-industry linkages.

2.1 The use of interviews to study the demand side

A random sampling method was used to control the selection of firms in order to avoid biased results. We used the full lists of firms collaborating with the Royal Institute of Technology (KTH) and the Karolinska Institute (KI) as a starting point for this selection for reasons of availability.¹¹

From the data supplied by the two universities, we identified 138 firms that paid at least 100.000 SEK in connection with their research collaboration with either of these universities in 2003–2005. A small number of firms with fewer than 50 employees were removed from the sample because it was thought that the rationale for cooperation in these firms might be too heavily related to the characteristics of key personnel to be meaningfully compared with the cooperation rationales of larger firms. From this total, 34 firms collaborating with KTH and 32 firms collaborating with KI were randomly selected, giving a stratified group of 67 firms.¹² The relative sizes of the two strata correspond to the relative size of each group in the total sample.

A university researcher collaborating with the firm was identified for each of these firms. The researcher was asked to identify a contact person at the firm—a person who was personally involved in the collaboration and who had had significant influence over the decision to enter into it. The contacts at the firms were asked to participate in semi-structured research interviews, which lasted between 45 and 120 minutes. Most of the questions were open-ended and respondents were asked to assess a statement or an effect using a four-point Likert scale.

It was not possible to conduct interviews with 12 of the firms collaborating with KI. Either the KI researcher or the contact person at the firm declined our request for an interview, or the information about a contact at the firm was not provided or incorrect. This gave us a final stratum of 20 firms. Most of the unsuccessful contacts were identified as clinical trial collaborations. Because clinical trials are well defined collaboration projects, it is unlikely that the inclusion of these respondents would have given us reason to question the typology of rationales

¹¹ Universities are often unwilling to provide full lists of their industrial collaboration partners and details of how much money has been paid by these firms to the university. Swedish universities are obliged to provide such information under Swedish law.

¹² The stratification was motivated by a need to balance the study between the needs of firms collaborating with a typical engineering university (KTH) and a typical medical university (KI) respectively.

that resulted from our research. Negative results were also obtained from attempts to contact six firms that work with KTH, giving a final stratum of 28 firms. The data presented here thus represents 48 firms, which is almost one-third of the total group of collaborating firms that met our requirements.

The random selection methodology and the relatively large number of firms studied allow us to present our results as reasonably valid for the set of larger European firms collaborating with universities. To improve the reliability of the data, a further set of interviews using the same interview guide were conducted with 15 firms collaborating with three other universities: the University of Cambridge (UK), ETH Zurich (CH) and the Hsinchu University (TW). These interviews confirm the findings obtained using the main approach.

2.2 A targeted study of the demand side

The extended set of interviews was also designed to allow us to study the specific issue of firms' demand for collaboration with universities. We wanted to pay closer attention to how firms located close to a European university perceive their need for collaboration, while the main study makes a specific point of including relationships maintained from both a distance and in close proximity to universities.

We study firms located in Stockholm County, the Canton of Zurich or in Cambridgeshire that form part of a 'foreign' multinational enterprise (MNE), that is, their headquarters is located in a country other than that of the subsidiary studied.¹³ Only those subsidiaries that have 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 were selected for the study.¹⁴

To identify a set of firms matching these criteria for each university/region, we sought 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) were also used in the research process. As a result, we identified 11 firms in Zürich, 12 firms in Stockholm and 10 firms in Cambridgeshire that match all four criteria. Our attempts

¹³ The regions were selected as the NUTS3-region (The Nomenclature of Territorial Units for Statistics of the EU, see http://ec.europa.eu/comm/eurostat/ramon/nuts/home_regions_en.html) hosting the respective university. Of these, Canton Zürich is the smallest region at 1700 km² and Stockholm County, at 6500 km², is the largest. Stockholm is also the most populous, with a population of 1.8 million. The County of Cambridgeshire is the least populated region with 750,000 inhabitants.

¹⁴ The last criterion is mainly used to filter out any subsidiary matching the first three criteria that is active in fields in which the studied research university in each region has no competence or interest. It would, for example, not be relevant to study the relation between an engineering R&D subsidiary in Stockholm and Karolinska institutet, which does not undertake engineering research, in the absence of some form of formal collaboration, since the firm cannot be assumed to gain any benefits from working in the proximity of the university. An alternative criterion with a similar effect would be to include only firms in particular sectors that are thought to be related to the activities of the university. However, we do not feel that either the NACE-code system or the Frascati manual provide sufficient grounds on which to match R&D needs with particular industry sectors and therefore prefer to use the criterion C4 for this study.

to contact and set up interviews with appropriate R&D managers at these firms led to 19 interviews in 16 firms that were evenly spread over the three locations.

The three universities were selected as the three case study universities for this report (see section 2.3) because of their prestigious research reputation, identified in the widely used ranking list produced by *the Times* newspaper in London. The University of Cambridge repeatedly tops this list and ETH Zurich is also constantly ranked among the top universities in Europe. In the 2005 *Times* list ETHZ is ranked the fourth European university for science behind Cambridge, Oxford and Imperial College London; and third in technology behind Imperial College and Cambridge. In the same list Karolinska Institutet was ranked fourth best biomedical university in the world, surpassed only by Cambridge, Oxford and Harvard. For more information on the universities see appendices IV, VIII and X.

2.3 A multiple case study approach to study the supply side

To ensure that our findings had general relevance for regional policy in Europe, it was necessary to include case studies from both eastern and western Europe, to include younger and older universities, and to include universities in central and more peripheral regional settings. We thus selected ten universities: the University of Cambridge (UK), the University of Surrey (UK), TU Delft (NL), the University of Twente (NL), the Royal Institute of Technology (SE), Karolinska Institutet (SE), EPF Lausanne (CH), ETH Zürich (CH), the University of Tartu (EE) and the University of Szeged (HU). This selection of universities also allowed us to include the experiences of ‘polytechnics’ such as TU Delft and EPF Lausanne, ‘traditional’ universities such as Cambridge and Tartu and universities with a particular focus on the life sciences, such as Karolinska Institutet and the University of Szeged.¹⁵

Each university was visited in October 2004–March 2006 and participants from the studied universities discussed their experiences at a series of seminars and workshops.¹⁶ A number of follow up interviews with participants from the universities visited in the early part of the project took place in the winter of 2005–2006. The 18-month study period allowed us to study developments from and the outcomes of initiatives taken by the universities during that time. The cases are constructed from a large number of interviews, discussions and workshop contributions by respondents employed by the universities or by regional organisations in their vicinity.

Interviewees included leading academics in the central administration (e.g. rectors, vice-rectors and special advisers) as well as those in faculties, departments and institutes (e.g. deans, directors

¹⁵ Although the University of Szeged is a ‘classical’ university with a broad set of disciplines, much of the efforts around commercialisation and industry collaboration are focused on biotechnical research, which is also an important niche for regional development plans.

¹⁶ This study has benefited from the work of the KTH Entrepreneurial Faculty Project, reported in VINNOVA Report 2005:13. Six of the studied Universities were visited by a large group of leading KTH Faculty and administrative personnel. Much that was learned through that project, as well as the international contacts it initiated, has been of benefit to this study.

and professors). Particular attention was paid to employees in technology transfer/research services/industry liaison functions (a group described as ‘professional support staff’ below). Complementary interviews were conducted with people in regional development agencies.

Complementary information was obtained from the annual reports, strategic reviews, and so on, provided on the websites of universities and regional entities or by the interviewees. A compilation of comparative data on the universities is found in appendix XIII. Furthermore, a number of reports from different EU bodies and networks were used to facilitate understanding of the system of higher education in the respective regions and, to some extent, the different conditions for regional authorities. Finally, Eurostat regional data was used to describe the different macro-economic contexts of the regions in which the universities studied work. This data is presented in appendix XIV.

2.4 The structure of the report

Chapter 3 presents an empirical investigation of firm’s rationales for collaboration with universities (aim one). Chapter 4 presents a complementary study of how MNEs interact with universities through their local subsidiaries. Chapter 4 then describes the results of an examination of how universities work to become more attractive to industry (aim two). Chapter 5 discusses the role of regional leaders in the fostering strong university-industry relationships. Chapter 6 summarises the results of the research and discusses the basis for a modern policy that promotes university-industry collaboration to improve long-term regional competitiveness.

3 WHY DO COMPANIES COLLABORATE WITH UNIVERSITIES?

This chapter presents the rationales that underlie firms' ambitions to collaborate with the academic sector.

3.1 Increased importance and new frameworks

A large majority of the 45 firms in this study, from a wide diversity of sectors, believe that having a connection to university research has become more important to their future success than it was in the past:

'Collaboration with universities has not been an issue of great strategic importance to us in the past, but we think it will be in the near future.'
(a large pulp and paper company)

Only one firm indicates that such collaboration is likely to be less of a priority in the next ten years than it was in the past decade:

'We hope to grow and to expand our resources, which should reduce our dependency of universities even further.'
(a small firm in a processing industry)

The observation that universities are becoming more important to the daily operations of firms should be understood in the light of a number of trends that are currently affecting businesses in large parts of the world.

Economic trends set new terms for collaboration

Trends such as globalisation and increased competition have had the general effect of reinforcing the importance of effective linkages to maintaining a firm's competitiveness. These trends have become obvious in our discussions with the firms participating in this study.

First, and perhaps foremost, firms tend increasingly to concentrate their activities on core areas, forcing them to rely more heavily on their networks. R&D activities are not exempt from this behaviour, not least because the volume of available knowledge continues to increase in an exponential fashion, thereby increasing the risk and cost of projects focused on innovation.¹⁷

'We seek greater focus in our R&D. It will thus become even more important for us to access the most interesting university networks.'
(a large pulp and paper company)

'It will generally become more important to reach out. We continuously refine the balance between the competencies we must have ourselves and those we must be able to outsource competently.'
(a large firm in a processing industry)

Second, product cycles are becoming shorter and competition is increasing, thereby heightening the imperative for innovation and renewal. At the same time, increased pressure means less room

¹⁷ Gerybadze and Reger (1999)

for research, in particular for the kind of ‘basic’ research that is not tied to existing products or ongoing product development. However, firms that do not undertake basic research of their own risk loosing out on the stream of new opportunities arising from R&D all over the world. The solution: more collaboration and stronger management of external relations to reduce the cost and the risk of investment in innovation.¹⁸

Working with universities is going to be even more critical in the future, as competition pressure is growing. We believe that the characteristics that distinguish our products from those of our competitors are likely to stem from R&D.
(an engineering company)

The EU framework programmes are a driver for our development; if we are not part of some important consortia, we will lose critical platforms for both market and technology needs’.

(a large firm in the defence industry)

It should be noted that while the increased pressure for collaboration seemingly plays into the hands of universities, increasing the demand for their attention, general business trends also present new challenges for the university that seeks to conduct ‘industry relevant’ and attractive research. Universities may find that the skills they provide are no longer sufficient for existing collaboration partners because these partners are developing new needs. An example from our study, which is relevant for most if not all multinationals,¹⁹ is the respondent from the large engineering firm who states that some projects will have be developed in collaboration with university researchers in India because they have a monopoly on the local knowledge about standards that is necessary to create new products for this growing market.

Faculties may also find that traditional collaboration partners want more than purely technical solutions to well defined problems. One interesting case from among our interviewees is the large telecommunications firm that has abandoned old contacts because its business focus has changed from technology to services.

Nowadays, our business is operating far from the technological front. Competition is in the realm of services, and we have therefore rethought old collaborative patterns, establishing some new collaborative projects in the areas of cognition and behavioural studies’.
(a large telecommunications firm)

In order to continue to be relevant to this partner, and to other firms in this business sector, the university would clearly need to rethink its research (and education) agenda.

Changes to the organisation of corporate R&D

To understand better the new needs for collaboration, it is useful to study how the general trends described above are reflected in the way R&D is managed and organised in firms. While small firms can still organise R&D functionally, larger firms have in most cases either abandoned the central R&D function in favour of R&D tied to products or divisions, or imposed greater demands on that central R&D function to coordinate their research agenda with divisional and

¹⁸ Chesbrough (2003).

¹⁹ Le Bas and Sierra (2002).

product managers.²⁰ Through these changes, corporate R&D has become ‘deregulated’ and researchers are forced to sell their services in an internal market. As a deliberately planned consequence, the funding for ‘blue sky’ research in corporate budgets has shrunk significantly.

These organisational changes affect the collaboration options for universities. Many of the most experienced respondents in our interviews describe developments in the past 15–20 years as a movement to more structured demands on external research and an introduction of the professional management of R&D networks, which affects the demands placed on universities and on the type of research collaborations that firms undertake with universities. However, it should be noted that these patterns differ between disciplines because the R&D-intensive sectors professionalised their collaboration activities much earlier, and because the diverging development paths of sectors affect the motives for and the form of collaboration. When asked about the changes in collaboration rationales between 2001 and 2006, some respondents answered that:

‘We have less room for new ideas and narrower interests’. (a large company in the paper industry)

‘Compared to that time, the whole sector has lost some interest in [the direct commercial use of] basic research. Back then, high long-term potential could be enough to attract investors and collaboration partners, which is no longer the case’. (a biotech company)

Another noteworthy theme that emerged from the interviews is that universities are involved in a constant struggle over the allocation of R&D funds inside multinational corporations. R&D units have a tendency to favour local universities for collaboration projects, sometimes even ahead of foreign R&D labs inside the corporation. We note that the international character of flows of corporate R&D funds to universities is thus greater than might be apparent if using the commonly applied distinction between ‘national’ and ‘international’ collaboration partners for universities, a point to which we return below.

Concrete outcomes from university-industry cooperation

Although it is clear about the fact that successful collaboration is steadily becoming more important, and positive about the general effects of such collaboration on the average R&D-intensive firm, the academic literature related to university-industry relations is not explicit about *how* such success comes about. The general references to benefits such as access to new research and support for the development of new products leave many questions unanswered. Why do firms need access to new research? Which types of research are sought? How can the relationship with a university help a firm to introduce new products and processes?

Strong evidence from a number of studies can be interpreted as a confirmation that cooperation with universities does help firms to develop new products (at least as regards large manufacturing firms).²¹ Furthermore, exploratory studies from the 1990s show that industrial innovations that

²⁰ Gerybadze and Reger (1999).

²¹ For an overview see Pavitt (2003). More recent studies include Laursen and Salter (2004) and Lööf and Broström (2007).

could not have been developed without a delay of a year or more without academic research accounted for approximately five per cent of the total sales of major firms.²² The number of academic citations in US industrial patents increased threefold in the mid-1990s and this has also been interpreted as evidence that academic research is relevant to modern product development.

Thus, such reasons to collaborate with universities—to promote the development of new products—seem to be strongly supported by empirical evidence. The question remains, however, through which mechanisms does cooperation result in innovative products? The ‘linear’ model of innovation cited in the introduction above suggests that firms take up research results, which are then turned into innovation and manufactured products. Obviously, this simplified theoretical model requires refinement. A modern strand of the academic literature makes a distinction between whether academic research is used by a firm to generate new ideas or to ‘complete innovation’, that is, to solve problems associated with the introduction of new products or processes identified by the firm.²³ It seems that the latter scenario is at least as common as the first. For both new ideas and completion, sources such as the firm itself, its customers and its suppliers are found to be more important than academe.

Again, however, the level of simplification appears to be too high. An increasing body of evidence indicates that the major benefits for industry derived from university research probably emerge from indirect and hard-to-measure processes. Some attention has been paid to how collaboration can be understood in the light of a firm’s ambition to broaden and/or deepen its set of competences or *dynamic capabilities*, which is the source of all the major competitive advantages of a firm.²⁴ An recent influential study finds that while smaller firms, particularly in high-tech sectors, use universities mainly to solve problems in ‘essential areas central to the business’, large industrial firms mainly use cooperation with universities as a means to build competences in areas that are different from the core competence of the firm.²⁵ However, the authors of that study do not provide explicit reasons for the rationale behind this pattern.

A partly similar view of knowledge-related capabilities is developed in an influential pair of studies by Cohen and Levinthal, which introduce the term *absorptive capacity*.²⁶ The strategic choice to undertake R&D in-house, they suggest, should be seen as both a means for creating new knowledge of importance to the firm and a way to maintain the competences needed to absorb external knowledge. This absorption includes the ability to recognise the value of new, external information, assimilate it and apply it for commercial ends. The authors emphasise that continual absorption of knowledge is vital to maintaining absorptive capacity in an organisation. Building on this concept, Lim claims that a firm’s absorptive capacity depends on both internal R&D and its’ connectedness to external sources of technical knowledge.²⁷ These include: (1) funding

²² Mansfield, 1998; Beise and Stahl, 1999.

²³ Cohen et al. (2002), Fontana et al. (2003) and Klevorick et al (1995)

²⁴ The notion of dynamic capabilities has been developed in Barney (1991), Teece et al. (1997) and a strand of literature following on from these contributions.

²⁵ Santoro and Chakrabarti (2002).

²⁶ Cohen and Levinthal (1989, 1990).

²⁷ Lim (2000).

research at universities, maintaining relationships with faculties and hiring graduate students; (2) forming alliances with companies that possess a given technology; and (3) obtaining memberships of research consortia. These alternative resources are at least as important as internal R&D. Is an ambition to build absorptive capacity an important reason behind some firms' decisions to cooperate with universities?

3.2 A typology of rationales for cooperation

A central theme of this study is to understand the demand for collaboration between universities and private firms. A number of the questions in the interviews with firms' decision makers therefore dealt with motives for cooperation and their perceptions of the effects sought (for a list of the questions to respondents on which the analysis of this section is based, see appendix I). The answers to these questions were analysed in conjunction with the search for distinct sets of motivations and effects. Thus, we are able to draw up a classification of motivations and collaboration.²⁸

Five distinct categories of motives for cooperation with universities on innovation are identified. These are motives related to...

... *cooperation outcomes for product and process development* (type 1)

This is the most typical and also the most common group of motives, where the knowledge-related outcomes of the particular collaboration are the prime motivating factors

... *access to academic networks* (type 2)

Partly to maintain critical competences and enable future search ('screening') for future cooperation on the first group of motives, and partly to draw on the expertise of the collaboration partner's colleagues.

... *human capital management* (type 3)

These groups of motives are related to recruiting and retaining qualified personnel, as well as to motivate and support academic groups in order to secure the availability of scientific cooperation partners in areas critical to the firm.

... *direct business opportunities* (type 4)

In some cases, the motives for cooperation follow a straightforward business logic: firms that 'repackage' and sell academic knowledge or special competences, firms for which academe is an important customer group, and firms for which academics are important opinion formers.

... *opportunities to leverage research investments* (type 5)

The possibility of having research projects that are of interest to the firm co-funded by a government or EU programme and/or by other firms motivates the firm, not surprisingly, to collaborate with universities.

Most firms have several motives for cooperation that may cause the firm either to set up different projects to meet each need or to try to design projects that allow them to benefit from several

²⁸ In the context of this study, the effects of collaboration are perceived as strongly related to the long-term motives for collaboration. In the data collected from the interviews, we have not compared expectations with short-term outcomes.

types of cooperation effects at the same time (the material in this study provides many examples of the latter choice). Similarly, a firm seeking effects of one type may find that the cooperation brings about unforeseen effects in other categories.

Type 1: motives related to cooperation outcomes for product and process development

The motives related to knowledge are the most complex and the ones with the greatest long term economic potential. The material allows us to discuss two separate aspects of these motives.

The first concerns the nature of the effects of cooperation. We find that in some collaboration projects firms strive for results that are immediately available for improving the firm's products or processes, although some form of 'translation' to firm and market conditions is usually necessary.²⁹ In other collaborations, however, there are no expectations of directly applicable results. The effects sought in the latter category are orientation, learning and broadened perspectives. Cooperation projects can usually take only one of these two positions and particular firms or corporate units tend to make similar demands with regard to this aspect in all the university collaboration projects they engage in. The disposition of each firm is typically affected by its size and sector and, as is noted below, by the geographical relationship between the firm and the university.³⁰

The second aspect is inspired by the concept of the difference between 'ideas for project' and 'project completion' found in Cohen et al. (2002). In the context of our study, this aspect concerns the level of precision of the remit provided by the firm when it engages its research partner. We find that some collaborative projects are motivated by a general hope that cooperative research will create new opportunities for innovation, while others are motivated by the need to work on a specific problem or technological opportunity identified and defined by the firm. More often than in the first aspect, the same firms tend to engage in both types of cooperation projects. Patterns with regard to size, geography and sector are also more difficult to find.

²⁹ In this context, we do not differentiate between physical products and services but instead use the term 'product' in a more general way. For a discussion about 'direct' vs 'indirect' effects see Lee (2000) and Cohen et al. (2002).

³⁰ See Santoro and Chakrabarti (2002)

		Level of precision at engagement	
		Search for new innovation opportunities	Develop defined technological or business opportunity
Effects of cooperation	'hard' results that are directly available for improving the firm's products or processes	Type 1.1	Type 1.2
	'soft' results with no expectation of their direct applicability	Type 1.3	Type 1.4

Type 1.1: the commercialisation of academic research

This category contains motives that fit the 'linear model' of knowledge transfer. A firm cooperates with a research group that they perceive has a very high potential to create commercial research in the hope of acquiring intellectual property (IP) assets and/or creating technology transfer that will be directly available to improve the firm's products or processes. In some cases a new venture is created by the firm as a result of this type of commercialisation.

Examples:

- The high-tech firm that entered into a collaboration project with a different motive but in the end worked with the researchers to set up a new venture.
- The biotech firm spun out from a medical university that has 'grown up' to become something of a commercial channel for university professors who know and trust the firm.

Type 1.2: traditional applied research

The common denominator of what is traditionally called 'applied research' is that collaboration is focused on a specific problem identified by a corporate partner that expects to gain useful results that can be made available for product or process development. This type of cooperation may take the form of standard commissioned research, including clinical trials, but may also be structured as joint research projects. We find such collaboration projects where the motive is a need to verify or evaluate a firm's ideas or research results, and where well-defined tasks within a larger project, such as measurements, are outsourced to a university group.

Examples:

- The high-tech firm which collaborated with a professor and a PhD student to develop a generic technology for which the firm saw potential applications in several product lines.
- The large pharmaceutical firm for which KI and associated university hospitals were a valuable partner in clinical trials.
- The research-intensive medium-sized firm that needed concrete assistance in some areas where it lacked the required competences

Type 1.3: orientation, learning and broadened perspectives

In this category we find exploratory projects carried out with a relatively long perspective. The firm seeks orientation and competence development—necessary requirements for innovative activities—rather than innovation per se.

For firms with innovation processes related to research, creating and maintaining absorptive capacity are important objectives for cooperation. There are also forms of orientation that are related to identifying business opportunities and business threats rather than to the promotion of absorptive capacity. According to Scott (2001), one form of orientation that firms seek in this category is knowledge about changing social conditions and regulatory frameworks. A related form of orientation is an ambition to find new applications for a firm's core competences or technologies.

Examples:

- The large ICT firm that worked with KI to learn more about how the firm's core competences and technologies could be used in the context of gene databanks—an application area that the firm believed to have a large commercial potential.
- The consultancy that worked with researchers to learn certain simulation programmes and techniques, which the firm believed would give them an important advantage over competitors and help the firm to maintain its reputation as business leader.
- The engineering firm cooperating with a university on exploratory research in an area believed to be a major source of competitive advantage in its core business.
- The insurance company that sponsored research into environmental sciences and which took from this research ideas about the introduction of a novel product in environmental insurance.

Type 1.4: supportive research

The last sub-category represents a group of motives where the firm collaborates in order to advance a defined task that is only *indirectly* associated with the firm's products or processes. The difference between this type of collaboration and collaboration where 'hard' results are expected (type 1.2) can be understood, for example, as the difference between developing a product and developing a technology, a methodology or in medicine a pathology of a disease. A second variant is where the firm has a clear objective that cannot, because of the nature of the problem or of stakeholder demands, or, for other reasons, should not be translated into a type 1.2 project (applied research).

Examples:

- The large ICT firm that worked with a university in the field of behavioural sciences to understand how the services of the firm are used and perceived.
- The large pharmaceutical firm that cooperated with researchers with unique competences and facilities in the area of imaging. The firm sought to build up competences of their own in this area, and to investigate new opportunities. By adopting imaging techniques, the firm hopes to improve its ability to recognise less promising projects at an earlier stage and therefore discontinue them.
- The researchers in the biotechnology firm who need to continually discuss their ideas with fresh minds at the university.
- The large pharmaceutical firm that seeks new applications for its existing drugs, and therefore explores the pathology of a specific disease in collaboration with university researchers.

Type 2: motives related to access to academic networks

The networks maintained by successful academics are part of the attractiveness of universities as cooperation partners. When working with a particular academic, the firm can benefit from some of the expertise of her or his contacts, as the academic discusses and learns from colleagues with special expertise. These types of benefits form part of all the motives related to cooperation outcomes for product and process development (type 1) above. However, we find that the prospect of gaining access to academic networks can provide motivation for firms to enter into research collaborations with universities in at least two ways that are not related to the content of the cooperation project per se.

First, for firms with a continual need for expert competences, contacts with academics outside the collaborating group may help the firm to identify important sources of expertise ('screening') and facilitate future searches for critical competences in academe. It should be noted that the interviews conducted for this study found very few examples where contacts with academics that were mediated by cooperation with other academics without personal involvement led to new cooperation projects. In cases where effects of this kind seem important, the effect seems to be mainly valid for a limited geographical area close to the collaborating firm or unit.

Second, there are many examples of firms collaborating with universities by participating in a consortium with other firms benefiting from this interaction. In an academic project discussions with competitors can be held on 'neutral ground' and potential customers can be identified among firms with similar interests participating in the consortium. Similar effects can be gained from participation in research centre organisations such as the Swedish 'competence centre scheme' (see below).

No respondent gives a motive of this sort as the most important objective of collaboration. However, for most cooperation projects in the category 1 motives, access to academic networks is an important side-effect and co-motivation and 70 per cent of respondents state that collaboration allows further contacts with academics or industry, and that this increases the value of university linkages for the firm.

Examples:

- The large pharmaceutical firm for which screening is a daily activity that is taken seriously and managed professionally.
- The engineering firm that found important new clients through its participation in a research consortium sponsored by the EU.

Type 3: motives related to human capital management

This group of motives is related to recruiting and retaining qualified personnel, as well as to supporting certain academic groups in order to secure the availability of scientific cooperation partners in areas that are critical to the firm.

In particular, for large R&D-intensive firms with continual recruitment needs, collaboration with universities to some extent allows the firm to identify potential recruits. Collaboration familiarises PhD students with the firm, its technologies and its organisation—thereby facilitating their transfer to the firm on graduation. Cooperation with universities is in some cases also seen as important for recruitment in an indirect way—by allowing their researchers to interact with university departments, firms are able to increase their attractiveness as an employer of skilled professionals.

On a related theme, firms can collaborate for reasons related to human capital management without explicitly seeking to recruit researchers. By supporting research groups that are active in scientific areas of particular interest to them, firms can influence the university agenda in some respects, and promote activities in areas of importance to the firm. The existence of a competent research group active in an important area can have a number of beneficial effects for the firm. It could: (1) facilitate the recruitment of young researchers with fresh knowledge in important fields; (2) influence undergraduate education, which increases the availability of competent graduates that the firm may recruit; and (3) secure the availability of scientific cooperation partners for the firm.

Three respondents in our sample state that motives related to human capital management are more important than the actual content of the collaboration, and that the firm is so interested in the production of human capital that this interest alone motivates its investment in collaborative projects. One-third of all respondents state that such effects are important side-effects for the firm, even if this reason alone is not enough to motivate sponsoring research or a particular investment in a collaboration project.

Examples:

- The large engineering firm that is clear about its priorities in research cooperation with a neighbouring university: the prime objective is to secure long-term recruitment and to support academic research competences in fields close to the core competences of the firm.
- The large pharmaceutical firm that perceives cooperation with university researchers as important for making the firm an attractive employer of the skilled specialists it needs, since cooperation allows the firm's scientists to work with bright academics with fresh perspectives and to pursue some of their academic interests in co-publications.

Type 4: motives related directly to business opportunities

In some cases, the motives for cooperation follow straightforward business logic without taking the ‘innovation route’. These motives may apply to firms which ‘repackage’ and sell academic knowledge or special competences and to firms for which academics are important opinion leaders. The latter group includes many firms in the biotechnical and pharmaceutical sectors, for which judgements on drugs, methods and firms are extremely important. In highly specialised fields of knowledge, leading experts may play critical roles in such judgements. Finally, researchers and universities are important customer groups for some firms (e.g. laboratory equipment, new drugs, new software, etc).

It is important to note that only a handful of firms have this type of motive as the main driver for collaboration, but that the branding and image aspects of this motive apply to many firms. Almost half the respondents state that they see beneficial effects for the branding of products or for the firm itself or that the firm gains legitimacy in the eyes of important opinion formers as part of the outcome of its collaboration with universities.

Examples:

- The firm that specialises in the organisation of clinical trials, for which the high quality of research hospitals in the Nordic countries is a considerable competitive advantage.
- The engineering consultancy that produces technical overviews and forecasts for paying customers in cooperation with leading university researchers.
- The engineering consultancy that markets the unique competences and special software product of a university researcher to its customers.

Type 5: motives related to opportunities to leverage research investments

A significant proportion of the collaboration projects by which the respondents in this paper were identified were co-sponsored by public agencies and/or by firms other than that of the respondent. A particular form of jointly financed university-based R&D is collaboration under the auspices of a university-industry joint venture research centre with public co-funding.³¹

Although only one respondent cited gaining access to public or other forms of co-funding as the single most important reason for research collaboration with universities, the interviews suggest that this motive is part of the rationale behind many collaboration projects. However, the opportunity to raise co-funding is normally not consistent with the collaboration motives found in type 1.2 (applied research) and type 4 (direct business opportunities). Several interviewees also point out that arrangements that promote cooperation with competitors may be incompatible with the motives in type 1.1 and type 1.3, where firms do not have clear expectations for collaboration outcomes. On the other hand, some respondents state that some kind of leveraged funding is more or less a requisite for being able to ‘afford’ engagement in research in these categories.

³¹ The majority of the firms participating in such centres are referring to the ‘competence centre’ scheme set up and (co-)funded by the Swedish innovation agency VINNOVA.

In sum, there is a limit to the strength of this type of motivation. Some respondents indicate that it is management or researcher attention spans and business needs that set the limits for collaborative ambitions rather than the cost of research.

Examples:

- The engineering consultancy that argues that a publicly funded competence centre scheme brought it great benefits because it allowed it to enter into university collaborations focused on potentially important areas of knowledge development (type 1.3) and allowed access to new academic networks (type 2). Without the 50 per cent public co-funding, the respondents did not think that the firm would have been able to afford such research.
- The engineering firm that believes that the opportunity for research co-funding is the single most important argument for collaboration with universities rather than in-house research.

3.3 The typology in action

Having established a framework for analysing the demand for collaboration with universities, we now proceed to characterise some particularly important groups of firms using the typology. Information about collaborative modes and forms (which was also collected in the interviews) is included where the material highlights significant differences between groups of firms.

How important are the different motives?

While the five basic types of motivation (and the four sub-types in type 1) are reasonably well represented in the empirical material collected for this study, they should in no way be interpreted as equally important to firms. One specific interview questions asks respondents: ‘If you were forced to explain to your board why you spend precious time and resources collaborating with universities, what would be your single most important argument?’. The answers, plotted according to the above typology, are shown in table I.

Table I: Interviewees’ most important reason for collaboration

Type	Motives related to...	Frequency
1	... cooperation outcomes for product and process development	33,5
1.1	commercialisation of academic research	2
1.2	traditional applied research	11
1.3	orientation, learning and broadened perspectives	15

1,4	supportive research	5,5
2	... access to academic networks	0
3	... related to human capital management	3
4	... direct business opportunities	4,5
5	... opportunities to leverage research investments	2
SUM		43

This distribution illustrates that even though most firms benefit from a number of interrelated collaboration effects, few can argue successfully for investment in such collaborations without any expectation that they will benefit product or process development.

Are transnational relations different from intra-national relations?

The material includes 34 interviews with respondents—the person identified as having made the active decision to cooperate with a university—with his or her work place in the same country as that of the firm (intra-national contacts) and 14 interviews where the respondent works in a different country (transnational contacts). This breakdown allows the two groups to be compared. In order to strengthen the analysis, we have also asked all respondents to give a general description of how collaboration with a local university differs from collaboration with a more remote one.³²

Transnational cooperative relations are typically more delimited than intra-national relations, in terms of both the subject and the form of collaboration used by the firm. The most striking difference in terms of collaborative forms is related to the use of researcher consultancies and engagement in research joint ventures (a form of collaboration where researchers from the firm and the university work together), which are less common components of transnational relations than intra-national relations. This is not surprising, considering that short consultancy engagements on the part of researchers and participation in joint ventures are forms where proximity clearly makes cooperation easier.

When asked about the type of researcher they sought in collaborations with universities, almost all respondents representing transnational firm-university relationships (i.e. collaboration with a Swedish university from abroad) mentioned the need for strong academic research competences, while 11 of the 31 respondents representing firms or subsidiaries in Sweden did not specifically

³² This complementary question was only asked where applicable—not all respondents had experience of transnational collaboration.

indicate a need for strong academic research competences. In fact, some respondents in the latter category expressed the opposite opinion:

'We seek down-to-earth people to work with, not prima donnas and not Nobel Prize winners'.

(a large engineering firm),

'[cooperation] mustn't become too narrow and academic—we want to work with people who pay attention to robustness and to applications'

(a biotechnical consultancy).

While this pattern may partly arise from a bias with regard to the position in the hierarchy of the respective types of respondents, because of a tendency for intra-national relations to be associated with a highly positioned R&D managers to a greater degree than are transnational contacts (see chapter 2 for an elaboration on how respondents were identified), we believe that it also reflects differences between the needs and the motives of the two groups.³³ The data indicates that transnational cooperative relations are typically focused on gaining access to expert competences and strong research environments. With reference to the typology of motives, transnational collaborations seem to be motivated mainly by needs belonging to type 1.3 (orientation, learning and broadened perspectives). However, the two smaller firms with transnational relations studied here are also clearly driven by type 1.2 motives (applied research), using universities more as an extra research lab than as a source of extramural learning. Notably, the type-2, type-3 and type-4 motives do not apply to any particular degree to the rationales for transnational collaboration. Type-5 motives apply only to a limited degree, partly because the transnational collaborations are often linked to the possession of a unique competence on the part of the university, which is the motivation for providing unmatched research spending, and partly because many sources of public co-funding remain mainly nationally oriented.

Are the motives of large firms different from medium-sized firms?

Having established that collaboration across national borders is mainly driven by motives of type 1 (in particular type 1.3), it is useful to reflect on how medium-sized and large firms, respectively, relate to universities in their relative geographical proximity. Rather surprisingly, all groups of motives except type 3 (human capital management) seem to apply equally well to smaller and larger firms. Type-3 motives are, quite naturally, more relevant to larger firms because they generally have more money and take a longer term perspective, which motivates them to invest in the maintenance of specific university competences to increase the relevance of collaborating for recruitment reasons.

On a side note, the group of eight firms in the material that do *not* have significant R&D resources of their own, with two exceptions, stand out as having motives that are concentrated in type 4 (direct business opportunities). The two exceptions are large ICT firms which are collaborating with each other to increase their understanding of future market developments rather than to solve technical problems (type 1.3, orientation).

³³ This conclusion is supported by the findings of Meyer-Krahmer and Reger (1999).

To sum up the chapter, we offer some comments on the findings from the policy perspective.

3.4 Is the policy debate sufficiently informed about...

... the breadth of motives for collaboration with universities?

From the material outlined in chapter 3 it is obvious that the motives for cooperation with universities are far more complex than it is possible to measure in the type of purely quantitative study from which policy recommendations are often made. The observed breadth of motives is large enough to advise caution when discussing university-industry linkages: it is probably impossible to find a mode of cooperation, or a way to stimulate cooperation, that is optimal for *industry* as such. Policy makers in universities and in regions must consider which groups of firms they are aiming their actions, and probably formulate parallel strategies to allow a high degree of flexibility. The typology has been constructed in the hope of stimulating such thoughts about what firms need (their types of cooperation motives), whether these needs are served by existing cooperation support schemes, and so on. Are the conditions for cooperation right for attracting certain types of firms, for example, the important foreign firms? Are current policy initiatives set up to attract foreign firms to the region or to engage existing firms in the region?

... the degree to which indirect effects motivate collaboration?

A further finding of this study is that it is generally easier to find support among respondents for the indirect benefits of innovation rather than for effects of the more concrete kind. Table II shows three categories and the percentage of respondents who perceive effects of the each kind.

Table II: The perceived effects of cooperation

Cooperation with universities has...

helped the firm identify new business / innovation opportunities	40 %
helped the firm exploit business / innovation opportunities identified and defined by the firm	52 %
helped the firm to develop new insights and broadened perspectives, more loosely coupled to business / innovation opportunities	69 %

For some firms cooperation with universities also seems to be a way to build the firm's competences—often referred to in the innovation literature as absorptive capacity—partly through human capital management and partly through increased access to academic networks.³⁴ That is, many firms enter into cooperation with universities in order to improve their *internal* ability to recognise the value of external knowledge, assimilate it, and apply it for commercial ends rather than to achieve formal innovation.

³⁴ Similar results are reported by Adams (2006).

Previous research has found that ideas for innovations come from customers, clients and (to some degree) from competitors.³⁵ Our results suggest that, for some firms, cooperation with universities is a way to increase a firm's ability to translate the market opportunities identified through these channels into addressable technical or organizational challenges. These challenges may or may not be tackled in cooperation with universities—the greatest and most unique competence sought from academe is in many cases a wider perspective and a commitment to problem solving.

Policy makers who seek to support universities with strengthening their intermediary functions need to act with caution. If a large part of the benefits from university cooperation is of an indirect nature—connected to absorptive capacity rather than to more easily measurable concrete innovations—it would not be advisable to link support for collaborative linkages too strongly to outcome indicators of a concrete and direct nature (the number of patents, number of spin-offs, etc). In view of the wide variety of rationales for collaboration between industry and universities, and the emphasis on learning and indirect collaborative results, we make the following suggestion: policy makers should not force universities to concentrate on collaborative forms that foster any one kind of results because this might seriously damage their ability to meet the needs of industry in a wider sense.

³⁵ Fontana et al. (2006); Arundel and Geuna (2004)

4 CAN UNIVERSITIES ATTRACT FIRMS TO INVEST IN A 'FOREIGN' REGION?

This chapter expands the analysis in chapter 3 in two significant ways. First, while chapter 3 specifically avoided discriminating between more distant relationships and those fostered with local universities, this chapter explores the R&D-related benefits of working in close proximity to a university. Second, this chapter moves away from the broad brush approach applied above to focus on a set of firms that are regarded as particularly interesting from this perspective: R&D subsidiaries of MNEs. A focus on this group demonstrates how distinct groups of firms can be identified in terms of their objectives and forms of collaboration with universities. In the case of foreign-owned R&D subsidiaries, we show that marketing efforts to 'sell' the opportunity to locate near a research university can be based on four distinct 'market segments'.

4.1 An issue of attraction

Many regions make substantial efforts, often coordinated by organisations created for this specific purpose, to attract corporate investment. In this context, the location of the R&D-related activities of MNEs is a high priority type of investment, from which regions are believed to derive particular benefits. R&D subsidiaries not only create attractive job opportunities, they also form networks that connect a region and part of its business life to international networks, and act as demanding and sophisticated customers for smaller firms in the region as well as role models with the potential to improve a region's business climate.³⁶

In any contest for R&D-related investment, a region's supply of higher education institutions is routinely given as an argument to its advantages as a business location.³⁷ However, only a very limited set of empirical studies provide any guidance on whether firms really obtain any benefits from being located in the proximity of university research. While a large number of studies seem to confirm the existence of some kind of statistical effects ('localised knowledge spillovers'³⁸), little systematic attention has been paid to the question of how firms benefit from being located in the vicinity of a university. This section provides new empirically based answers to this question. We study the particular group of R&D subsidiaries of MNEs in Cambridge, Zürich, and Stockholm using the same interview methodology as that employed in chapter 3. The overarching aim is to study the direct linkages between research universities and R&D subsidiaries located in the same region in order to increase understanding of how a research university can serve as a point of attraction for investment to a region. Results from this study are

³⁶ Lundgren and Ylinenpää (1998)

³⁷ Most academic studies support this notion in one way or another; see Anselin, Varga and Acs (1997), Davies and Meyer (2004) and Furman et al. (2005).

³⁸ This term has its origin in the theory of knowledge production functions. Recent studies that confirm positive 'spillovers' from university research include Cantwell and Piscitello (2005) and Audretsch and Lehmann (2006). Cantwell et al. (2004), Dunning (1994) and Kuemmerle (1999) discuss the particular case of MNEs locating R&D in the vicinity of public research institutions.

then used to discuss how regional leaders can increase the attractiveness of their regions for these types of investment.

4.2 A classification of local collaborative relations

Our interviews provide information about the R&D managers' views on the relationship between the subsidiary and the local university by discussing the forms of collaboration and the intensity and purpose of that collaboration (see appendix II for more information about the interviews and the questions asked).

Table III: A classification of R&D subsidiaries from the perspective of their relation to the local university

	Typical forms of formal collaboration	Intensity	Main purpose of R&D activities (Le Bas & Sierra)	Cases studied
Class 1: <i>integrated research units</i>	Numerous forms	Close collaboration	technology seeking, asset-augmenting	Intel (<i>Cam</i>), Unilever (<i>Cam</i>), Hitachi (<i>Cam</i>), Baxter (<i>Stblm</i>), Microsoft (<i>Cam</i>)
Class 2: <i>research-intensive agendas</i>	Joint venture R&D, sponsor programmes, jointly owned centres	Semi-close intensiveness, differing between parts of subsidiary	mainly asset-augmenting but also technology seeking	Kodak (<i>Cam</i>), Linde Therapeutics (<i>Stblm</i>), AstraZeneca (<i>Stblm</i>), IBM (<i>ZH</i>)
Class 3: <i>agenda dominated by development</i>	Joint-venture research, commissioned research	Less intensive collaboration	asset-augmenting, asset-exploiting	Arla foods (<i>Stblm</i>), Pfizer (<i>Stblm</i>), Millenium-Biologix (<i>ZH</i>), Google (<i>ZH</i>), Elan Microelectronics (<i>ZH</i>), Alcan (<i>ZH</i>)
Class 4: <i>orientation towards clinical trials</i>	Clinical trials, research sponsoring	Continuous relations, albeit limited to clinical development	asset-exploiting, market-seeking	Wyeth (<i>Stblm</i>), Merck (<i>Stblm</i>)

Extending beyond the questionnaire, the interviews also examined the wider activities of the subsidiary. The taxonomy of Le Bas & Sierra (2002) was adopted in order to aggregate the information obtained from the interviews. This differentiates between four types of R&D subsidiaries. *Home-base exploiting* subsidiaries and *market-seeking* subsidiaries both have as their purpose the marketing of existing assets in a foreign location. Unlike market-seeking subsidiaries,

home-base exploiting subsidiaries mainly adapt existing assets to local requirements. The remaining two types of strategies are related to knowledge in-flows. *Home-base augmenting* subsidiaries carry out R&D which is complementary to that done at the home-base, and *technology-seeking* subsidiaries engage in R&D of a kind that the firm would otherwise not be able to perform given its technological level and its home location. We adapt this taxonomy slightly, in accordance with Dunning and Narula (1995), and Criscuolo et al. (2005), by referring to asset-augmenting or asset-seeking activities rather than home-base augmenting or home-base-exploiting.³⁹

Summarising our data, we find that the information on the forms, intensity and purposes of a collaboration with a local university and the taxonomy of subsidiaries' purposes coincide to a surprising degree. Four relatively distinct classes of subsidiaries, characterised by distinctly separate sets of benefits derived from localised collaboration, can be identified from the analysis of each case using the four classes described above. This classification shows that the subsidiaries in the class 1 category are able to draw on the full range of potential benefits from collaboration, the firms in class 2 to a lesser extent (for example not sharing staff and facilities as extensively and not being involved in as extensive knowledge exchange as firms in the class 1 category), and firms in class 3 only use a few of these collaborative forms and derive only a few of the benefits. Firms in class 4 only benefit from the more indirect advantages of co-location with university research associated with clinical activities.

Class 1: integrated research units

As a special class, six of the fifteen case studies are corporate R&D resources closely integrated—or even physically embedded—with university departments. For these subsidiaries, collaboration with local university researchers, staff sharing and formal as well as informal collaborative arrangements are an integral part of their activities. These units can be understood to be motivated by a need to both set up 'listening posts' and derive efficiency gains from the co-location of corporate research and university facilities. Setting up a 'class 1' facility can therefore be seen as an effective option for an MNE to leverage its own research investment with public resources and achieve a critical mass of research staff and equipment. Class 1 subsidiaries describe their collaboration as a way of obtaining the 'blue sky' research that they are usually unwilling or unable to perform themselves. For many of the class 1 firms, local collaboration is a way of obtaining new ideas by accessing and, in some cases, participating in basic research.

³⁹ While this taxonomy seems to us to be the most advanced available, it should be noted that analysis of our cases shows that it is not fully sufficient for discussing location rationales in correspondence to university-industry relations. The Le Bas and Sierra taxonomy leaves no room for non-technological factors other than 'market-seeking' motives, whereas university-industry relations are often associated with a wider set of motives (see chapter 3). Our study suggests that, at least for smaller subsidiaries, cultural factors and options for public funding may play important roles. Examples include the respondent at the Swiss subsidiary (European base of operations) of Elan Microelectronics, who mentions organisational learning in the Swiss/European cultural climate as an important contribution of the subsidiary to the firm's main R&D operations in Taiwan. For the Swiss subsidiary of Millenium-Biologix (also a European base of operations), qualification for Swiss and European public co-funding for collaborative research is a decisive factor for the Canadian-based firm's decision to maintain and develop its subsidiary.

'The research that is pursued in cooperation with the university is mainly beyond the scope of Intel's current business activities. This is a way for Intel to prepare itself for possible future disruptive innovations in our fields.'
(research director at Intel in Cambridge)

Class 2: R&D facilities with research-intensive agenda

Compared to those in class 1, firms in class 2 have a different organisational setup. They are significantly larger and more complex organisations that are slightly less oriented towards research in contrast to development activities than the class 1 subsidiaries. The subsidiaries in this category function as centres of R&D expertise inside the MNE. The researchers in the local university are natural partners for class 2 subsidiaries, and both formal collaboration and informal networking can be practised. Continuity of relations and significant recruitment opportunities through the creation of contacts in the local university make the local university a preferred partner in the subsidiary's often extensive academic network.

'We have two focal points for our contacts with ETH Zurich: a joint research centre dedicated to information security and a scheme for collaboration on circuit design. But we entertain several other contacts with the ETH, such as sponsoring PhD students, teaching some courses and other less regular collaboration in projects.'
(two centre coordinators at IBM in Zurich)

Class 3: R&D subsidiaries with an agenda dominated by development

The firms in this class undertake more loosely organised collaborations with their local university, which are limited to less continual forms such as consulting and informal contacts. This can either be because of limited funds or limited need to collaborate with universities or because of mismatches between the subsidiary's R&D requirements and the current research expertise or interests of the local university. Some firms collaborate with universities in order to gain access to equipment and facilities that they cannot provide themselves. Most of these firms are looking for more applied research rather than basic research that is beyond the scope of the firm's current business activities.

'Our main interest is to develop new designs of integrated circuits and for that purpose universities of applied sciences [Fachhochschulen] are often the most attractive collaboration partner.'
(research director at Elan Microelectronics in Zurich)

Class 4: R&D subsidiaries with an orientation towards clinical activities

Firms in the pharmaceutical sector constitute something of a 'special case' in terms of university-industry relations. They are almost totally dependent on access to the clinical expertise and patients of university hospitals but, while usually in continual contact with university staff, they do not draw on university research per se.

With the exception of class 4, this classification extends beyond commonly used sectoral divisions. This may surprise the reader, because the heterogeneity of needs for collaboration

between industries is a stylised fact in the existing literature on university-industry relations,⁴⁰ and the differences between sectors are documented in the literature on the localisation of R&D by MNEs.⁴¹ However, in the study of collaborative linkages at the local level (the intersection of these fields) in this chapter, industry-transcending factors are found to predominate rather than the specific arrangements and needs associated with the different industries. If the classification were to be refined further into more disaggregated categories, division along sectoral lines would still appear, following the different roles of R&D in innovation between sectors that underlie the analysis of differences in both sets of literature referenced above.

It should be emphasised that almost all the firms studied might enjoy indirect benefits from their proximity to the local research university in the form of an enhanced ability to recruit talented R&D personnel and the positive effects outlined in chapter 3.⁴² Our study reveals two types of illustration of such ‘indirect’ effects. First, we note that four out of five of the firms studied collaborate with other firms in the region. Supposing that the presence of the research university affects the decisions of these other firms about localisation of R&D, even MNEs with subsidiaries who have not developed strong collaborative linkages to the university (class 3) may come to depend on the university in their evaluation of the region’s attractiveness for future R&D investments. Second, four recent green field investment decisions in R&D or designations of ‘R&D-hub status’ to a regional subsidiary (implying increased commitment to the facility and the location by the MNE) in Zurich cite the educational quality of ETH Zurich as an important, and in some cases decisive, factor.⁴³

4.3 Differences between regions

We now turn to the specific question of whether the three studied universities or regions offer similar locational advantages in the form of benefits from co-location with the university. Table III shows the distribution of subsidiaries belonging to the four identified classes across the three regions. We find that, with the exception of the Baxter establishment at the south campus of Karolinska Institutet in Stockholm, class 1 subsidiaries are exclusively found in the immediate vicinity of the University of Cambridge. Furthermore, the case studies in Zurich predominantly fit the class 3 category. Subsidiaries around KI in Stockholm are found in all categories.

The 15 firms studied for this chapter were selected from a group of 35 firms that fit our four criteria (see section 4.1). From documents and the interviews with representatives of regional development agencies, we have been able to make preliminary classifications of the remaining 25 subsidiaries. This analysis seems to strengthen the above indications that class 1 firms are mainly found in the Cambridge area. In fact, while a handful of other subsidiaries in Cambridge seem to fit the class 1 category, no other firms matching this category were identified in Stockholm or Zurich. Preliminary analysis of the remaining subsidiaries also indicates that

⁴⁰ Meyer-Krahmer and Schmoch (1998); Nelson (1986)

⁴¹ Hegde and Hicks (2005)

⁴² Bramwell and Wolfe (2005)

⁴³ Except for the studied case of Google, this applies to the firms Microsoft, Dow and Zimmer.

Stockholm is a popular location for class 4 subsidiaries—of seven subsidiaries identified but not studied in Stockholm, all apparently fit the class 4 category.

To conclude this chapter, we wish to highlight two issues where our analysis suggests that European regions face considerable challenges.

4.4 Is the policy debate sufficiently informed about...

... the harsh global competition between locations?

Integrated research units (subsidiaries of the type classified as class 1) deserve special attention when discussing universities as sources of attractiveness for foreign investment in R&D in regions. These firms, which draw intensively on the research competences and resources of a co-located university, provide a region with attractive jobs, integrate the region into international networks and, by their presence, strengthen the region's reputation as a 'hot-spot' in a certain field. The trends in corporate R&D management discussed elsewhere in this report, such as increased reliance on external partners particularly for research-related activities, indicate that the class 1 subsidiary may become a model to be followed by other firms that have not yet set up such a presence. However, in their search for proper locations, MNEs will seek to identify world-leading excellence in their relevant field, which means that a region that hopes to attract these kinds of investments will face fierce competition. Our findings illustrate this situation. Not even top-ranked and renowned universities such as Karolinska Institutet and ETH Zürich have attracted class-1 R&D to any significant extent through the power of their research excellence alone. To succeed in the face of such competitive pressures, regions must act proactively in partnership with regional research universities.

... the potential of integrated research environments?

In economic literature the benefits of co-location are often analysed at the regional level, that is, the main hypothesis is that firms in the same region as a research university benefit from being co-located.⁴⁴ However, this research finds that for the particular type of R&D subsidiary referred to as 'class 1', the firms' benefits arise from the co-location of firm and university resources under the same roof. This finding suggests that in order to attract certain forms of corporate investment, regions and research universities must create opportunities for direct co-location in a collaborative spirit.⁴⁵ Such location opportunities may attract class-1 type investment, which may eventually grow into significant firms—possibly evolving into class 2 subsidiaries. Furthermore, co-location opportunities may persuade class 2 firms to have parts of their activities more closely joined to the university. Such linkages may, in turn, strengthen the bond between the MNE and the region and secure future corporate commitment.

⁴⁴ Here, we refer mainly to the tradition of new economic geography

⁴⁵ In fact, some of the regions studied in this report are working along such lines (see chapter 6). Notably, both Zurich and Stockholm are among those regions seemingly trying to provide new environments that are expected to attract corporate investment of the class 1 type.

We must, however, urge caution: mistakes associated with the 'linear' type of policy discussed above must be avoided. Creating new buildings is not enough to enable dynamic interplay between universities and businesses. To be successful, policy initiatives must be able to bridge the traditionally separate areas of physical planning and regional development and integrate a number of tools and means in a strategic manner. Furthermore, such ambitions must be firmly built on local competences and opportunities: attempts to merely imitate other successful environments will inevitably lead to failure.

5 NEW ROLES FOR UNIVERSITIES?

We have studied how firms perceive their need for collaboration with universities first in a general setting in chapter 3, and then in the context of local relations in chapter 4. This chapter reverses the perspective by examining how universities organise, work and develop themselves in order to attract industrial cooperation and funding. Ten prominent European universities are studied: the University of Cambridge (UK), the University of Surrey (UK), TU Delft (NL), the University of Twente (NL), the Royal Institute of Technology (SE), Karolinska Institutet (SE), EPF Lausanne (CH), ETH Zürich (CH), the University of Tartu (EE) and the University of Szeged (HU).

5.1 Differing prerequisites for industry collaboration

As is demonstrated in Section 2.2 and in appendices III–XII, the ten universities studied were chosen to represent diversity in age, geography and scientific set-up. This breadth allows us to make some general observations about the types of universities that are apparently more involved in the active promotion of industry collaboration and regional development:

- Universities in non-urban and peripheral regions have generally more ambitious and more explicitly formulated strategies for how they can contribute to the growth of their respective regions than universities in strong economic regional settings. Collaborative linkages between regional leaders and universities are also generally stronger in the more peripheral regions. However, even the strongest European regions are beginning to embrace the idea that universities may be vital partners in efforts to secure future competitiveness and economic diversity.
- Relatively high levels of direct funding (block grants) from government has allowed some of the universities to remain in a state of ‘business as usual’, whereas others have been forced to experiment more frequently with new forms of funding. These new streams of funding often call for new forms of collaborative research.
- The two universities in eastern Europe recognise that they have much work to do in order to catch up with western Europe, not to mention US universities, in the area of university-industry collaboration. They seem to be going through an ambitious search for best practice, which may enable them to jump-start interaction processes. They also seek to provide particularly proactive and comprehensive support for interaction in the hope of building brand new traditions of commercial interlinkages between academe and a developing private sector.

5.2 Two rival stories about university attractiveness to industry

There is no doubt that contemporary universities are pressured by changing environments. Competition between higher education institutions for funding, students and faculty members is increasing. New expectations about contributions in the field of knowledge valorisation are being added to old tasks without the provision of new funding. At the same time, the volume of higher education has exploded leaving little time for research, leave alone maintaining contacts with

other stakeholders such as industry. As a consequence, the entire university sector is going through a phase of structural crisis. In this situation, it is hardly surprising that universities respond by seeking new ways to operate.

The degree to which universities can or should respond to these combined pressures by proactive behaviour or by developing associated professional competences are questions that are currently being debated all over Europe.⁴⁶ Burton Clark Champions a proactive approach and introduced the term *entrepreneurial university* for an academic institution ‘that stands on its own feet in order to adapt, on its own terms, to a highly complex and highly uncertain world’.⁴⁷ Another well known scholar in this field, Henry Etzkowitz, has similar views on the ‘entrepreneurial’ future of universities.⁴⁸ Etzkowitz highlights the apparent conflict between the demands placed on the university—between increased interdependence (interaction with industry and public organisations) and increased independence. He suggests that ‘hybrid organisational forms’ should be created to realise both objectives simultaneously.

This study applies this framework to the study of how universities seek to provide attractive conditions for collaboration, using ten university case studies. However, just as there are clear indications that universities are pressured to change, and are developing ‘entrepreneurial’ features, there remains strong scepticism about their abilities to transform themselves, and about the virtues of such ambitions. Sceptics claim that the only characteristics that significantly influence a university’s attractiveness to firms are those related to the nature and quality of their research and researchers, and that such features are beyond the control of the university leadership. Supporting the latter view, many studies of contemporary universities note that the room for institutional strategies, which has always been small given the large degree of independence traditionally vested in professors, has been reduced further by increased demands for matching research funding.

Table IV: Two views on universities

The entrepreneurial university view	The regional resource view
<i>In order to be an attractive partner for industry, a university...</i>	
... needs more room to act strategically with regard to its research agenda	... needs to avoid introducing rigid management and allow all faculty members full freedom to pursue their

⁴⁶ Lynch and Baine (2004) argue that universities can already be understood as strategic units, each possessing a unique set of competitive advantages.

⁴⁷ In the sense that the word ‘entrepreneurial’ is used by Clark, it is not exclusively meant to describe activities in a new business operation. It is instead supposed to denote a certain mode of operation: ‘a wilful effort in institution-building that requires much special activity and energy’ (Clark, 1998). We use the term ‘entrepreneurial university’ in accordance with Clark (1998, 2001) in this report.

⁴⁸ Etzkowitz (2004)

... needs to actively develop new competences for building relationships with stakeholders in the academic, public and private sectors
... needs to reform

... needs academic leaders who can prioritise

research interests
... needs to leave individual researchers in charge of all relations

... needs to preserve its distinctive character
... needs academic leaders who can administrate

The sceptical view suggests that a university is best thought of as a 'passive' regional resource that may be utilised by firms, thereby increasing a region's attractiveness to industry. We refer to this line of thought as the *regional resource view*, whereas the abovementioned proactive approach is called the *entrepreneurial university view*. These views, simplified and refined for the sake of clarity, are summarised in table IV.

There are thus two opposite sides to the story of university attractiveness to industry, from which two different sets of logic behind regional intervention to promote university-industry linkages can be derived. Inspired by the entrepreneurial university view, a region could be thought to actively support a university in its attempts to bring about greater independence and create new competences. The regional resource view leads us to assume that a region, in order to best reap the fruits of university-industry research cooperation, might seek to secure the availability of the resource (e.g. through supporting regional universities' struggle for governmental research and education grants), but not otherwise interact directly with the academic institution and its leaders.

Concentrating on some strong trends related to the creation of new competences and functions in universities, and new ways to organise research, we provide a basis for discussion about which side of the story holds most true, and thus about how regional ambitions to support a university can best be turned into action. This discussion is found in sections 5.4 and 5.5 of this chapter. More information about the respective case studies is found in appendices III–XII.

5.3 Contemporary trends that allow for stronger industry relations

Previous literature on the university characteristics associated with successful cooperation with industry has emphasised intellectual property rights (IPRs) and/or the policy of technology transfer functions. Some attempts have also been made to show that tradition and culture, as well as rewards for academics, are of great importance at the institutional level as well as at the level of research groups.⁴⁹ Since we believe that a focus on IPRs and dedicated technology transfer units is too narrow for the purpose of providing knowledge that is useful for regional policy makers, we include observations about a wider set of activities.

After analysing the material collected during the case studies, we decided to concentrate on the ways in which attempts were made to create stronger ties with industry. Five trends were

⁴⁹ Friedman and Silberman, 2003; Mora-Valentín et al., 2004

therefore selected, which we see as particularly helpful for gaining an understanding of the development of stronger industry links with contemporary European universities:

- Universities experiment with increasingly professional support for relations with industry
- Demonstrated commitment to outreach and collaboration is changing academic culture
- Universities form alliances with other universities to attract industry
- New ways of organising research create stronger collaboration partners for firms
- Co-location between industry and university creates new environments and mutual benefits

Many components of these trends are well documented in other literature.⁵⁰ The main contribution of this study is: (1) to study these trends from the particular perspective of their impact on relations with industry, which allows us to point out aspects of these themes which we believe to be novel contributions to the literature; and (2) to provide information about recent developments and updates from the—in this particular aspect—fast-changing university world.

We see these five trends as potentially important for policy makers, both in universities and in regional governments, to address. This section outlines the five trends in more detail, with an emphasis on the actions and initiatives that address the challenges of the respective trend. These actions are synthesised from the concrete schemes and initiatives studied in our ten case study universities. For detailed and concrete examples see the case study descriptions in appendices III–XII. For each trend, we also report ‘industry perspectives’ derived from the interviews with the firms collaborating with universities that form the basis of chapter 3 (see section 2.2 for more information about the interview approach).

Trend 1: universities experiment with increasingly professional support for industry relations

To varying degrees, all the universities studied create support functions to increase their ability to work with industry. Even if there are cases where some of the tasks presented below are handled by academics, the more general impression is that these functions are carried out by ‘professional personnel’ dedicated to fully non-academic task. In fact, the general increase in attention to support functions which demands special competences seems to be responsible for the emergence of a new profession. The recruitment of staff for these very demanding functions is a real challenge for all ten universities studied.

⁵⁰ The emergence of new groups of university administrators is discussed by Thursby et al. (2001), who note substantial heterogeneity of objectives for offices dedicated to ‘technology transfer’. Owen-Smith and Powell (2001) study faculty attitudes as a key determining factor of a university’s ability to ‘transfer technology’. Bercowitz and Feldman (2004) characterises ambitions to change university culture as realistic albeit very hard to realise. The use of new forms of organisations for effective collaboration with industry is discussed by Shattock (2001), Adams et al. (2001) and, under the more abstract term ‘hybrid organisational forms’, by Etzkowitz (2004). As is discussed in this report, there is a large literature that discusses the importance of co-location. However, the strategic perspective on how firms can be won for a region or a university is often lacking. There is also, as noted by Deiacio and Melin (2006), a lack of literature on alliances between universities.

We distinguish between three different tasks addressed by dedicated non-academic university personnel, and find clear differences between how universities choose to emphasise different parts of these tasks:

- The most basic tasks relate to supporting academics applying for grants, for example, from the EU. While this task is not specifically directed towards the promotion of industry relations, an increased ability to handle the often complex application processes for research funding programmes may be key to increasing the size of a university's industry collaboration, since many relevant types of funding are associated with co-funding from industry or with 'strategic' research.
- A second type of function is built on 'technology transfer' models which, inspired by US examples, became widespread in Europe in the 1990s. These functions are meant to ensure the proper handling of contracts with industry, especially with regard to intellectual property and overhead costs.
- A third type of tasks to be taken on by an organisation of this kind is the management of relations with industry. In its simplest form, this task is defined as providing potential collaboration partners with a single access point, which can help orientate firms through complex university structures to identify academic partners. In its more advanced form, such professional support may be extended to liaison activity, where relations with particularly important firms are maintained in an active way.

Interesting synergies arise where these tasks can be combined by the same industry interface function. The office that can facilitate matching funding from public or charitable sources and negotiate legal arrangements can clearly increase its relevance as a relationship builder with industry and make a real difference to the creation of new collaborative linkages.

It should be noted that the case studies indicate that in many universities, especially those which actively work to form relationships with industry, emphasis on IPR management is decreasing in favour of relationship building and 'translational' capabilities.⁵¹ The adoption of industry-inspired key-account methods and the assignment of certain staff to the tasks of supporting communication between industry and research groups are examples of this change. Universities are also struggling to get the balance right between supporting existing contacts and a proactive search for new collaborations. In particular, the universities in eastern Europe find themselves called on to actively reach out to firms with suggestions for collaborative efforts.

The greatest challenge, however, is the alignment of these new functions with the traditional academic structure. Our case studies provide a number of examples where the integration of these new functions into universities has been a difficult issue. In particular, the universities that have made the most ambitious and most interesting attempts to develop new competences have also experienced the greatest resistance and a certain amount of controversy. The importance of

⁵¹ 'Translational' capabilities are put in place to mediate introductory contacts between academic researchers and industrial executives in a manner that emphasises the 'translation' of the needs and interests of the firm into researchable problems.

creating support in faculties and a feeling that the kind of services offered by the new functions create significant value for the faculty should not be understated.

Industry perspectives on university efforts to professionalise relations

There is strong resistance to the idea of introducing intermediary bodies between industry and university researchers among the firms interviewed. Fewer than one in five respondents express positive attitudes on the establishment of a Corporate Liaison Function at a university. Most of the positive responses, and some of the negative, strongly emphasise that specific business knowledge is required if a university function is to meet their needs. However, while respondents fear increased complexity, bureaucracy and conflict over legal matters (and, perhaps, better negotiating skills at the university), they also express a clear interest in the kind of functions that professional organisations are often able to carry out: relationship management and orientation (see table V). The answers seem to reflect some room for new services on behalf of the university, but also highlight the tremendous pedagogical challenges.

Some respondents explicitly state that the ability of their university collaboration partners to form and maintain relations with public funding institutions is important to successful long-term relationships. Such remarks, and the prevalence of collaboration motives related to opportunities to leverage research investment (type 5 in chapter 3), suggest that professional relationship-building functions should pay attention not only to industry partners, but also to public funding and charitable institutions. Examples from our university case studies show how such relations can significantly increase the ability of a support unit to attract new industry partners and increase its relevance to existing partners.⁵²

Table V: Attitudes to aspects of collaboration

It is more effective to have a corporate liaison office intermediating contacts with universities than to maintain contacts with researchers only	17 % agree
We are interested in building lasting relations to the university, not only with individual researchers	42 % agree
The contacts that we have enable us to draw on the most useful sources of knowledge in the university	75 % agree

We also asked respondents about whether IPR issues sometimes cause them to choose collaboration partners other than universities, such as other firms or public research organisations, for a specific collaboration need. Although 30 per cent responded that it is easier to arrange for sufficient IP protection in R&D collaborations with other firms than in collaborations with universities, the majority claim that the ability to handle IP issues per se does not normally influence the decision about from which sector to seek R&D partners—the decision is taken on other grounds. However, almost all respondents state that efficient handling of IPRs is critical to successful collaboration. These findings suggests that the relationship-

⁵² A scheme for state funding has enabled an intensified approach of this kind at Cambridge (see appendix VIII).

building capacities of ‘professional’ university functions should be closely linked to legal agreements that are perceived as effective and useful to firms.

Trend 2: a demonstrable commitment to outreach and collaboration is changing academic culture

It should be recognised that in any attempt to create new values for industry through research, a university must build on its heart and soul: dedicated and skilled researchers at all levels. Many initiatives studied here and many of the respondents interviewed emphasise the limits to contributions from alliances, professional support activities and other measures in building more effective industry cooperation if such measures are not aligned with and backed up by the academic environment and its culture. The European academic culture is often seen as a major obstacle to successful research cooperation between academe and industry. We find that some universities actively try to demonstrate their commitment to outreach (e.g. to industry and industry’s needs) both in relation to external and internal actors.

To affect culture in one direction or another is definitely not a well defined management task—particularly in the academic environment. There is a strong consensus that a combination of new incentives and a continual demonstration of a certain cultural mindset is the only possible way forward.

Incentives need to be both long term and short term. Long term incentives for cooperation may be supplied by the creation of alternative career paths for faculty members with an interest in innovation, such as the active promotion of staff on the strength of their cooperation. Short term incentives include funding possibilities, but also access to unique resources such as data or company research facilities. In our case studies, we found examples of how universities seek to provide such incentives by reserving certain internal resources for projects with cooperation potential and by facilitating access to public co-funding as well as industry funding through the ‘professional’ organisations described above.

‘Demonstrations’ of culture can also be described as clear signals from the academic leadership in favour of values associated with cooperation. More concrete examples include seminars for industry, publications, and so on. For some of the universities studied, fairs and events play a substantial role in branding and communication activities, signalling commitment to cooperation, to ‘changing the world’ and/or to a specific collaboration partner in industry. We also find that many universities use magazines, web journals and web pages in a strategic manner for similar purposes.

Industry perspectives on cultural aspects

In discussions about the kind of researchers that firms prefer to collaborate with, a number of respondents indicate that some form of industry experience is preferable. Many respondents state that they tend to look for researchers with a track record of successful collaboration. Trust and confidence is extremely important to creating strong relationships. A university that does not manage to attract and develop successful researchers with an interest in and an ability to collaborate will certainly not have any basis on which to collaborate with industry. One respondent states that the current academic rewards system, which does not value industry experience, is obstructing their collaboration with universities. Another, however, says that the

foremost value of the university as a collaboration partner is the ‘untamed creativity’ found in unconventional thinkers in academe and fears that this value may be lost if too much emphasis on industrial realities is introduced. Similar remarks are heard from other respondents. We believe that this issue touches on a delicate task for a university with ambitions to increase its attractiveness to industry: to preserve its idiosyncrasy while at the same time promoting outreach rather than isolation.

Trend 3: universities form alliances with other universities to attract industry

Working together is a permanent feature of academic work, and forms of formalised academic relationships between universities have a long tradition. However, we see a new emphasis on high-level, formalised relations between universities as institutions. All the ten universities studied are involved in formal alliances. These alliances are often motivated by a number of coherent rationales and can be understood as responses to changes in the international environment of universities. It is notable, however, that many modern alliances are in part responses to the present or possible future demands of industry collaboration partners.

The main benefits for universities of such alliances seem to be opportunities for synergies in teaching, research and cooperation as well as opportunities for mutual learning. However, almost all the alliances studied are in part motivated by a will to increase the attractiveness of the universities to industrial partners. For universities with less experience of organising support for industry collaboration, the chance to participate in learning networks may be the most significant benefit gained from engaging in such alliances. Evidence for actual benefits that increase attractiveness to industry is rare, especially in cases where no additional government funding has been supplied. Despite the lack of realised benefits, we find a number of rationales that seem to have some potential value.

- Perhaps most typically, alliances are seen as a tool by which a university can strengthen and formalise networking, offering corporate partners access to new environments. An alliance with another university in, for example, China or India can allow a university to offer firms contacts to and cooperation starting points with researchers, students and policy makers, access to facilities, further networks, and so on.
- A second major component is the ambition to create critical mass. By combining research competences from a number of institutions in a region or nation, or even on a global scale, universities can seek to strengthen what they offer industry. This is especially true if the universities manage to advance their cooperation to an ability to offer jointly agreed conditions and if effective single-point contacts can be established for industrial partners. Although this is a problematic area, a number of efforts are under way.
- The potential branding effects of alliances are also worth considering in our context. Some of the best known and most prestigious alliances studied here are formed exclusively by universities with a strong reputation. By joining forces, and marketing an alliance, universities with strong brands can seek to strengthen these assets further. They are de facto, among other things, promoting their own abilities to attract industry partners.

- A major aspect of alliance ambitions seems to be to gain access to public funding. National and regional governments, some charities, and bodies such as the EU all have their reasons to support the creation of new networks and to champion the concentration and coordination of resources in a country or region. A number of the alliances studied are made possible by, and perhaps initiated through, public funding.

It is also possible to study alliances from the geographical perspective, distinguishing between national and international alliances. The alliances studied between universities in the same nation are more ambitious in terms of their expected impact and internal priorities as well as the commitment of resources—especially when taking governmental sources into account—than those formed by universities from different countries.

We note some scepticism towards and a lack of interest in the alliance ambitions of their own university in some research departments, and that most alliances thus far involve only a few dedicated faculty members and university administrators. In most cases, however, it is too early to say whether this should be interpreted as a failure of the alliance strategy or as a reflection of the newness of most of the alliances. We also note that alliances at a national level are sometimes perceived as threats by faculty members who fear ‘rationalisations’ or control by ‘outsiders’, and so on, rather than academic motivations and needs.

Industry perspectives on alliances between universities

The issue of alliances between universities was not systematically explored in the company interviews. We note, however, mentions of uniform conditions for collaboration and single-point contacts as preferred characteristics. Should universities be able to arrange alliances that meet these demands, real results may be expected. Some respondents also discuss the possibilities of benefiting from the extended networks of university partners, indicating that such effects may be substantial, at least on relations between large firms and their closest university partners.

Trend 4: new forms of organisation for research create stronger collaboration partners for firms

The manner in which research is organised is perhaps both the most obvious tool for reforming a university to meet new challenges and the most neglected dimension in the study of university-industry relationships. Organisation is also strongly interrelated with both university culture and the development of ‘professional’ university support units. One particularly interesting trait to note is the ways in which universities use the organisation of research activities to achieve similar objectives to those championed by a ‘professional’ relationship building unit: the ability to present research capabilities and collaboration opportunities to firms in an attractive way. To organise research in a novel manner can thus, from the perspective of industry relations, be understood as either an alternative or a complement to the creation of corporate liaison functions of the kind discussed above.

We find that the existing trend of organising research by institute or centre is highly prevalent and gaining strength, and that many of the interrelated rationales for this development are related to cooperation and outreach. Potential benefits include that multidisciplinary research environments led by a responsible person (often with industry experience) may be more attractive research partners for industry than institutions organised by academic discipline and led by

professors without industry experience or interests. Moreover, universities organise research in institutes or centres to create a certain amount of critical mass around an area that is believed to be attractive to industry, rather than having that competences spread around several departments.

By ‘repackaging’ its research in a new organisation, universities can seek to supply industry with a more efficient interface; a reliable partner that is able to give industry matters priority and make long term commitments. This is particularly true for organisations created around a commitment to industry collaboration, such commitment being reflected in both the administrative routines designed to facilitate collaboration and the research environment. This environment may be guided by academic leaders, promoted by measures such as those described above as a demonstration of culture and, at its most the extreme extent, institutionalised through the creation of positions for researchers with a less rigorous list of academic merits but considerable application-related experience. Dedication to cooperation may also be demonstrated in, for example, conditions for royalties for research cooperation with small and medium-sized enterprises (SMEs), partnership programmes, seminar series, and so on. Furthermore, industry relationships at the institute or centre can be managed by dedicated ‘professional’ staff of the kind described above *and* by scientific personnel. All in all, the organisational form allows for the removal of some of the barriers between academe and industry.

The intra-university research centre/institute may be ‘virtual’ or take a more physical form (e.g. co-location in a building). Many organisations use an institute’s name but have no, or only a handful of, actual employees; although there are also many large organisations. Two of the universities studied have organised all research activities into virtual institute form, while responsibility for education and personnel remains with faculties. This form of organisation is motivated by the strategic need to create a scientific focus. It seems clear that this type of organisation has potential benefits for industry collaboration, along the same lines as outlined above. In a similar fashion, universities use the institute form to spread successful research and collaboration practices to whole departments or faculties and to build and scale up ‘professional’ support for cooperation of the kind described above.

It should be noted that the organisation of research into institutes or centres might be seen as focused on the second and third missions of the university. If education is carried out in an organisational form that is separate to research, universities may risk loosening the ties between research and education. However, it can also be argued that if the organisational form can really help to build stronger connections to industry, this may benefit education as well as technical research.

Industry perspectives on organisational forms

Three out of five respondents express a willingness to develop contacts with an institute or organisation at a more ‘central’ level than that of the research group, for example, with a dean of a school or a commercialisation officer in a research institute. Some of these respondents point out that while such contacts can be valuable by giving collaborations more stability and greater flexibility, such benefits come at a cost. Relations need time and mutual commitment in order to become valuable. The remaining respondents do not see particular benefits from regular contact with people other than those academics undertaking the collaborative research.

A similar proportion (three out of five, but not necessarily the same respondents) agrees with the statement that researchers who are used to working across disciplinary boundaries are better collaboration partners than researchers with more narrow experience. Where this attitude is noted, it is often related to the nature of the main research area of the respondent. For many firms there is no clear linkage between their problems and a single field of research, which makes it natural to prefer research partners who are themselves able to span more than a single discipline. A supporting line of argument is that many respondents associate a willingness to work across academic borders with characteristics such as ‘visionary’ and ‘communicator’.

Among the remaining two-fifths of respondents, many indicate that synthesis and integration is undertaken at the firm rather than in universities, and that their needs primarily lie in gaining access to leading research competences. This is typical for firms where the main motivation for collaboration is to overcome known problems rather than explore the unknown (described as types 1.2 and 1.4 in the delineation of motives for collaboration in chapter 3).

Trend 5: co-location between industry and university creates new environments and mutual benefits

We note that university-industry linkages are increasingly obvious in physical co-location arrangements. Most notably, co-location initiatives can arise with or without some kind of active promotion on the part of the university and/or the region. In co-location based collaborations where the firm has initiated and set up a structural model that allows it a high degree of control, there may not be much need for—or even room for—proactive behaviour by the university. However, we find that some universities are active in the promotion of new co-location opportunities and, especially in the cases where the university owns campus facilities, in creating interfaces for effective communication between co-located firms and the university.

The driving force for such developments is sometimes found at the central level of the university, sometimes in a faculty or school, sometimes in ‘professional’ organisations established to support collaborations and sometimes outside the university in regional authorities or other public organisations. The more ambitious attempts to create university-industry environments tend to have champions in several of these functions.

From the perspective of the universities’ ability to attract industry, co-location can be understood as a means for building lasting relations. The relationships between jointly located firms and universities may include shared research facilities—allowing the university alternative funding for expensive research equipment—shared staffing, jointly organised events and different forms of collaborative research.

Having firms and research groups working side-by-side also has positive effects on the university, such as promoting cooperation and affecting the culture of the research environment. Commercial thinking is introduced in a natural way through everyday contacts. These cultural effects may further increase the university’s ability to attract industry partners.

Industry perspectives on co-location

Our interviews support the idea that proximity promotes broad and strong ties. Cases of research sponsorship, where the firm provides financial assets without making specific demands on how

they are to be used, for example, are only found in relations between university-industry partners located relatively close to each other. For some firms, particularly in the life sciences, the opportunities for sharing equipment and facilities are a major rationale for close co-location. For others, the main benefits arise from the facilitation of natural contacts between the firm and the university, enabling participation in academic seminars, informal discussions, and so on. Other empirical studies seem to confirm that the R&D structures in a region, in which universities play a key role, act as a magnet for the MNEs making decisions about locating R&D subsidiaries.⁵³

5.4 Rival views on university challenges in perspective

Having outlined five contemporary trends in universities' relations with industry and interpreted these trends in the light of firm's motives for research collaboration, we return to the two rival views presented in the first section of this chapter. Do the empirical findings support either the *entrepreneurial university* view or the *regional resource* view?

The fact that we are able to identify five broad trends of university activity in the area of industry relations, trends which encompass all ten studied cases, underlines that ambitions to move in the direction of the entrepreneurial university are very widespread. The university sector is clearly undergoing a period of change. Interesting organisational experiments are being implemented, novel tasks are being given to the universities and new types of people are filling the ranks of university faculties and administrations. Obviously, universities feel a need to react to increasing competition for students, staff, collaboration partners and funding and to become more proactive in their behaviour.

However, the five observed trends are certainly not identified from a long list of unambiguous success stories for innovative university behaviour. Many experiments have failed, programmes have been cancelled or redesigned and reformers in and around the university have met mixed fortunes.⁵⁴ Most notably, a common source of failure is clearly that entrepreneurially oriented ambitions are insufficiently rooted in and supported by faculties. Cultural inertia in academe and resistance to anything but collegial (non-)management of academic everyday life seem to have been underestimated again and again.

The ambiguous attitudes of industry to the various aspects of 'entrepreneurial' skill presented in the section above should also be noted as evidence against the adoption of the entrepreneurial university view. It is, however, difficult to argue that one model or the other best describes the way in which a certain group of firms are attracted to a certain university. Instead, we can see that since the needs of different groups are different (as described, e.g., by the typology in chapter 3), the possible set of effective 'entrepreneurial' actions available to universities differs between groups of firms. For example, firms with extensive R&D activities and strong links to a certain university would typically not seem to have a great need for any kind of professional support except for basic legal agreements (suggesting compliance with the regional resource view). On the other hand, these are exactly the kind of firms to which universities hope to become even more

⁵³ Davis and Meyer (2004), see also chapter 4 of this report.

⁵⁴ Appendix III-XII go into the experience of each university in some detail.

available for world-class equipment and facilities, as well as funding for the most important new initiatives or projects, and so on. An emerging realisation that these frameworks for academics are dependent on a set of entrepreneurially minded activities on behalf of the university as a whole may create greater acceptance of the continued need to reconcile new managerial values with traditional academic ones. It seems that the most useful viewpoint is that universities, in order to maximise their value as a regional resource, need to adopt entrepreneurial abilities.

5.5 Is the policy debate sufficiently informed about...

... the breadth and depth of renewal in the academic sector?

If it was previously functional—from a regional development perspective—to leave universities to their tasks of education and research within the framework of the academic systems of funding and incentives, an approach referred to as the ‘regional resource view’ in the section above, there are signs that the relationship between regional authorities and universities must be reconsidered. Pressured by increased expectations from society for an economic ‘return’ on public investment in R&D, and by competition over funding, universities are undergoing widespread changes exemplified by the five trends identified in this chapter. The ongoing transformation of the universities presents new challenges and opportunities for European regions. Regional leadership has traditionally worked together with local industry on regional development issues. These ties are naturally important to foster, but, as industrial structures are becoming less attached to a particular region, the entrepreneurial universities may be a natural partner with which to build the next generation of regional partnerships.

... the delicacy of the balance between the introduction of new competences and the maintenance of unique advantages?

We have concluded that even though universities are developing in an ‘entrepreneurial’ manner, they are not developing into easily ‘manageable’ organisations that can be dealt with in similar ways as either corporations or public authorities. Regional ambitions to actively support a university must be based on an understanding of the intricate ways in which academic institutions in general, and research intensive universities in particular, are governed. Regional partners of universities should gain insights into the complexity of their particular partner institution. It is also important to emphasise that even the narrow aspect of universities examined here—their attractiveness to industry—is harmed by any type of reform that forces corporate values on the universities. Policy ambitions to promote further the attractiveness of a university must be based on ambitions to build on long-term unique advantages such as strong academic research traditions and a mission to break new scientific ground.

6 CHALLENGES FOR REGIONAL LEADERSHIP

Chapters 4 and 5 review industry's demand for collaboration and the evolution of the academic sector into a more attractive and effective collaboration partner for firms. This chapter presents an overview of how previous regional attempts to embolden university-industry linkages have been designed. Section 6.1 outlines a history of regional support for university-industry linkages. Section 6.2 describes the four types of support ambition observed in the ten case studies presented above and in appendices III–XII. Section 6.3 discusses the basic principles of regional policy ambitions.

6.1 A brief history of attempts to stimulate university-industry interaction

As is noted in the introduction to this report, public interest in university-industry linkages as a driver of economic development has been increasing constantly in the past three decades. As the awareness of the localness of many of the benefits from such linkages has spread, it has become logical that both regions and nations have taken an interest in promoting university-industry linkages, with a particular emphasis on research-based linkages. We have thus seen policy models for supporting research collaboration accumulate, without necessarily displacing those which went before.

Inspired by renowned US examples, the kind of initiatives first introduced in the 1970s seek to encourage local economic development by creating 'science parks' and 'business incubators' located near university campuses. Further initiatives in this tradition aim to introduce public 'seed capital' funding and to create or support 'science shops', 'innovation relay centres' and other types of organisation devoted to technology transfer from university to industry. These initiatives can all be seen as originating from the idea that it is the mission of policy to create organisations that can bridge the gap between the separate academic and industrial worlds.

The 1980s saw an emphasis on collaborative research between universities and industry, reflected in the introduction of the European Union's Framework Programmes. From this period onwards, regional policy initiatives were strictly directed at increasing the exploitation of university research and complemented by efforts to subsidise university research centres in fields that were relevant to local businesses. At the same time, a new focus on smaller firms was introduced because this group was perceived to have particular difficulty utilising academic research.

After something of a downturn, the economic boom of the late 1990s caused a revival of interest in policies on innovation and research. A new emphasis was placed on high technology industries and spin-off firms from academic science. Increased interest in the region as an arena for innovation policy centred on university-industry linkages was boosted by a new emphasis on industrial and academic clusters.

6.2 Contemporary regional ambitions

This study uses ten cases to study how contemporary universities deal with the challenge of attracting and collaborating effectively with industry. In each case study, we have paid special attention to links between the universities' industry-related activities (described in chapter 5) and the activities of regional bodies with a responsibility for promoting inward investment and regional economic development.

At a more general level, it can be noted that strong relations between regional policy makers and local universities are important prerequisites for facilitating regional partnerships and mobilising a region across the boundaries of the public, private and academic sectors when particular needs arise. Regions that have been able to create a sense of mutual understanding about strategic directions and priorities enjoy advantages over other regions in relation to the national authorities, transnational public organisations (in particular EU) and regional, national as well as foreign industry—in particular MNEs.

At the more concrete level, we note a number of schemes by which regions try to strengthen university-industry collaboration ties. These schemes, which may be seen as components of a regional policy toolbox, can be summarised under four thematic headings:

Tool 1: facilitate matchmaking and networking

Regions may seek to facilitate matchmaking and networking between universities and industry. Matchmaking ambitions in the cases studied include creating public intermediary organisations, databases describing academic research competences in the region or support for a university's attempts to organise and professionalise its relations with industry.

A variant on this theme, also aimed at facilitating networking, is regional support for conferences, fairs and similar events initiated by regional universities or by industry. A particularly clear example is events where industry representatives and researchers are personally invited in order to facilitate new contacts.

Tool 2: promote regional competence centres and clusters

Regional governments may take the initiative to create, or support the formation of, regional centres (competence centres) or institutes with some form of participation from both university and industry. These may be either virtual or actual (researchers sharing office space, etc).

A particular ambition of this type is to coordinate existing regional research resources and to present a unified organisation for a certain area of industry-relevant research through the creation of a competence centre. This type of initiative could also be described as a regional university alliance of the type described above, except that the competence centre is limited in scope (e.g. material science in the Swiss/Lausanne case) and that industry partners typically would be involved in the conception of a competence centre. In the cases studied, there are examples of competence centres of this type only at the national level, albeit for the relatively small Swiss and Dutch states, but experience shows that these kind of ambitions can be realised at the regional level (e.g. the regional competence centre programme at Baden-Württemberg). Scientific areas suitable for this kind of initiative are perhaps best selected to match the emerging needs of local

industry clusters. Hence, promotion of university-industry relations through the creation of competence-centres may be coordinated with other regional cluster support schemes.

Tool 3: urban infrastructure planning

Infrastructure is perhaps the most obvious area for regional ambitions in the area of university-industry relations. Regional public actors may use urban planning to promote the creation of environments where university and industry activities are physically integrated. Almost all the nine regions in this study show some evidence of regional ambition to actively promote or create such environments in collaboration with local universities. Not unusually, regions hope to facilitate stronger knowledge flows and new collaborations through their support of environments where academic and public research resources belonging to different organisations share offices, facilities and leisure space with commercial organisations. Such environments are promoted by regional development agencies as attractors of firm's R&D investment and our study finds several indications that integrated research environments are attractive to firms.

Tool 4: funding for collaborative research and supplementary training

Regions may run research funding programmes directed at industry (typically SMEs) with special encouragement for collaboration with regional universities, or set up funding programmes for university research that demand industry collaboration and, typically, some matching industry funding. In both cases, research projects will naturally become trans-disciplinary efforts to pursue new knowledge in areas relevant to local firms. Furthermore, regions may act as sponsors and facilitators of special efforts in the area of supplementary training, where university staff competences are made available to regional industry through specially designed education programmes.

6.3 Policy to fit different regional agendas

While the above four themes may be regarded as something of a cookery book, we have learned to emphasise that there are no standard recipes for innovation policy. As is stated by the European Commission in its appeal for an updated innovation policy, policy makers must 'learn from what others are doing, but avoid simple duplication—they must each develop their own specific route to improved innovation capacity, depending on their own unique set of circumstances'.⁵⁷ Regional ambitions to strengthen university-industry collaborative ties should be based on a strategic analysis of the region's economic challenges.⁵⁸ To design policy measures, comparative analysis of possible policy tools, such as the list in section 6.2, may be used for inspiration but not as a check-list.

This study draws on experiences from ten universities in nine regions. The nine regions are located in different national systems, have different histories and face different challenges. Some

⁵⁷ European Commission (2003)

⁵⁸ Mannervik and Arvidsson (2005)

of the types of support initiative deployed by the regions may look similar but table VI provides an overview of the different emphases of regional policy making and regional characteristics.

Table VI: Regional prerequisites for university-industry collaboration⁵⁹

University / Region	Industry structure	Emphasised objectives for regional policy
<i>U. Szeged</i> (Dél-Alföld) <i>U. Tartu</i> (Estonia)	Dominated by non-knowledge intensive firms, very low R&D-investments.	Concentrated on the establishment of structures and traditions for commercialisation and collaborative research.
<i>U. Twente</i> (Overijssel) <i>EPF Lausanne</i> (Region Lémanique)	Dominated by SMEs and, in the case of Region Lémanique, by large firms in the financial sector.	Concentrated on stimulating the creation of SMEs and on attracting SMEs from neighbouring regions.
<i>U. Surrey</i> (South-east England) <i>U. Cambridge</i> (East Anglia)	Mixed. Relatively close to the London metropolitan area, with its widely diversified business life.	Particular emphasis on promoting inward investment.
<i>TU Delft</i> (Zuid-Holland) <i>ETH Zurich</i> (Kanton Zürich) <i>Karolinska inst.,</i> <i>Royal Inst. Tech</i> (Stockholm)	Concentrated metropolitan areas (the Randstadt area for Delft), with a diverse set of firms. Historically dominated by large national firms that have become multinationals.	Uses universities in attempt to brand the respective region as a knowledge society hot-spot. Particular emphasis on ambitions for urban infrastructure around universities.

From the delimited viewpoint on university-industry linkages that is applied in this study (research collaboration), three main types of overarching policy objective can be identified: 1) to engage local firms in the hope that collaboration will improve their competitiveness; 2) to strengthen the ties between knowledge-intensive firms in the region and the regional innovation system, in the hope of securing future commitment and to encourage regional knowledge flows; and 3) to attract non-regional firms to do business and to establish a presence in the region. Based on regional preconditions, regional policy makers should optimally design strategies that allow all three objectives to be achieved.

As temptingly simple as this statement may seem, we urge caution. No policy for university-industry relations can be successful in the long term if it is not carefully modelled on the needs of the actors themselves. Analysis of the region's challenges must therefore be complemented by analysis and thorough knowledge of the challenges and abilities of the respective actors in the academic and business spheres. The concrete actions that come out of such ambitions may (or may not) fit with the four types of tools found to be prevalent in contemporary regional policy

⁵⁹ For statistics see appendix XIV. For examples of activities, seen from the university perspective, see appendices III–XII.

for university-industry collaboration. In sum, as useful as it is to review the kind of concrete measures that other regions are taking, discussions about regional policy should take as their starting point neither a list of tools, nor ambitions to promote the commercialisation of particular types of university research.⁶⁰

Which starting points *should* be used for discussions about regional ambitions to strengthen university-industry linkages in general and research collaboration in particular? The concluding chapter summarises the empirical findings and the policy-related discussion contained in this report and determines the guiding principles for future regional efforts that may be deduced.

⁶⁰ In the words of Eliasson (2000) ‘it is more efficient policy to make sure that all institutions of the competence bloc are in place than to encourage and/or support particular high-tech industries or to attempt to pick winners and commercialize particular technical innovations’.

7 CONCLUSIONS FOR REGIONAL POLICY

The purpose of this study is to provide regional policy with an updated view of university-industry research collaboration patterns. We approached this purpose from the starting point that policy attempts to support patterns of cooperation might be misguided to a large extent because they are still founded on a belief that it is the role of policy to bridge the gap between the two spheres. In earlier times such policy efforts may have served the purpose of introducing new capacities to universities but, as this study has demonstrated, it is now time for a broader and more cohesive kind of policy.

The empirical study of firm's rationales for collaboration reveals a wide variety of rationales—far greater than the basic types of rationales for which the gap-based type of policy is supposed to be effective. Given this variety, it would be difficult to successfully create an organisation that could serve as a broad enough 'bridge' between university and industry to meet the demands and needs of more than a very limited proportion of industry. Even more importantly, we have found that the types of rationales for which gap-based policy provides appropriate support correspond to only a limited proportion of firms' needs. Observing that the effects of learning, orientation and exploration are extremely important for firms, whereas the 'old', 'gap-based' types of support are focused on commercialisation and exploitation, we conclude that these types of support fail to meet the needs of industry.⁶¹ In particular, such a policy fails to satisfy the increasingly important interests of multinational, knowledge-intensive firms. Furthermore, it fails to recognise the emergence of commercial organisations serving as de-facto linkages between universities and industry.

We thus reject the notion that it is the main aim of regional policy to build organisations that can bridge the gap between academe and industry as insufficient and inaccurate. An alternative route for policy ambitions in the area of university-industry linkages emerges from the empirical study of the university (demand) side of collaboration. As is exemplified by the five broad trends, universities are no longer (if they ever have been) the isolated ivory towers to which industry may come knocking to seek advice. Under strong pressure, universities are evolving. They develop professional relations with all kinds of stakeholders, actively promote an academic culture of outreach and strategically redesign academic organisations and campus environments to increase their attractiveness to industry. We conclude that the time is ripe for a kind of policy that, while it does not set out to introduce new intermediary functions between university and industry as a goal per se, supports ambitions for reform in the academic bodies of the region.

The empirical contribution of this study highlights the complexity involved in the 'entrepreneurial' development of academic institutions. Any attempt to revolutionise a universities will risk great opposition from inside faculties and industry alike. It is therefore very important that ambitions to promote entrepreneurial developments in universities are not implemented through externally motivated schemes or as attempts to force new models of

⁶¹ For an analysis of how the impact of university research changes with cycles of industrial dynamics, which facilitates an understanding of why policy adapted to the 'linear' model of innovation fails to meet large parts of the needs of industry, see Mannervik and Arvidsson (2005).

collaboration on universities. The guiding principle for regional partnerships with universities should be to 1) support *a capacity and a willingness to experiment* with respect to industry relations, for example, within the scope of the five trends identified in this study; and 2) support capabilities that have the potential *to both attract interest from industry and serve the traditional interests of the university* (increased abilities to attract research funding and high-potential academics).

Our findings on firm's rationales for collaboration indicate that collaboration between industry and academe must be designed in such a way that it promotes the competitiveness of both the partners involved in ways that allow researchers to meet the differing sets of collaboration rationales. The same principle must apply to a collaborative partnership between regional leaderships and regional universities; it must be designed in such a way that regional development ambitions and the university's ambitions are mutually facilitated.⁶²

No region can 'create' an entrepreneurial university, but it is possible to support a university that makes serious efforts to develop new competences and functions, which will increase the degree of freedom it has over its future development.

At the level of concrete financial support, two types of support are suitable:

- 1) To help the university create new capacities. Examples include strategic analysis projects; strategic investment in ICT, which facilitates collaboration; and investments in new support functions.
- 2) To help universities make strategic research investments to exploit research opportunities in areas with clear relevance to industry or for the public sector.

We believe that such support will provide large returns in the form of increased regional competitiveness in an innovation society. Great caution must be exercised, however, because the task that we suggest regions to take on is not an easy one. A number of questions remain: who is to be supported and with what aims and by what means? What kind of development should be prioritised? The answer to each question will probably be found in each region's and university's specific set of challenges. The task of supporting universities, as opposed to the type of policy that formulates new programmes, does not allow for cohesive, directly measurable targets or quick solutions. Instead, it is a task that demands patience and long-term mutual commitment to common objectives.

If championed at the highest level, strengthened and renewed partnerships between region and university have an important role to play as the driving forces behind economic development and as the foremost arena for the discussion of the modern society. In (western) Europe, these missions used to be an issue between state and industry. As industry is becoming global and

⁶² While we first and foremost have opportunities for regional development in mind, it should not be forgotten that intensified cooperation with universities would be likely to have benefits for the administrative and management operations of regions. Regions could benefit from increasing the efficiency of operations by funding adjunct professors or research centres. Furthermore, just as firms can benefit from locating close to academic environments, so could certain parts of the increasingly knowledge-intensive public sector.

European states redistribute responsibilities to regions and to the European Union, we see a need for new arenas for development. We believe that partnerships between regions and academe have the potential to create the arenas capable of taking on the challenges posed by the contemporary localised knowledge economy.

The new roles for regional leadership that we outline will undoubtedly require new competences and new networks. Apart from the exchange of experiences from policy initiatives and regional development work, we believe that regions with ambitions to promote university-industry linkages may benefit from discussing the guiding principles that underpin their efforts. Furthermore, mutual learning about concrete policy examples is also likely to be important for regional leadership.

On a final note, we would like to point out that, although the particular object of this study has been research collaboration, we believe that our conclusions are valid from the broader perspective of university-industry linkages. If regional policy efforts are able to strengthen academic institutions as places of academic research and as collaborative partners for industry, the potential for spinning off new knowledge-intensive companies and for commercialising research results increases as well. Perhaps most importantly, the successful research university renowned for its cutting edge, industry-relevant research is likely to attract the best and brightest students to its region.

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