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Industry and academia in convergence: Micro-institutional dimensions of R&D collaboration

Toke Bjerregaard *

Centre for Organizational Renewal and Evolution, Aarhus School of Business, University of Aarhus, Haslegaardsvej 10, DK-8210 Aarhus V, Denmark

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ABSTRACT

Research on university–industry (UI) collaboration has addressed how cultural differences between firms and universities tend to impede knowledge exchange and impose challenges on project control if not properly addressed. Relatively little research has examined in-depth how changing institutional logics of R&D practice shape concrete UI collaborations at the micro-level of interacting researchers. The purpose of this study is to examine how conflicting and converging institutional logics of R&D work enable and constrain the process of R&D collaboration between small and medium sized enterprises (SMEs) and public university departments. This qualitative study covers the total population of public university departments and firms involved in collaborative research projects sponsored by a programme under the National Strategic Research Council (NSRC) in Denmark. The findings show that many of the collaborating researchers experienced an institutional convergence constituting a shared cultural space for knowledge exchange and communication in their joint projects. In some cases this lack of normative conflict was due to a blurring of institutional logics governing R&D in the two sectors. Furthermore, some researchers were able to use their social skills to bridge perceived institutional gaps. Implications for future research and UI collaboration are addressed.

1. Introduction

Building new alliances between universities and industry has become a cornerstone of research and innovation policies throughout the OECD area (Etzkowitz et al., 1998; Geisler and Rubenstein, 1989). The enabling and constraining factors on UI collaborations are consequently becoming the object of a burgeoning scientific literature (Burnham, 1997; Fontana et al., 2005; Hall et al., 2001; López-Martínez et al., 1994). Within the literature on the management of UI collaboration, the cultural differences between private firms and public university departments are often portrayed as barriers to collaboration and a constraining factor on the transfer and diffusion of knowledge (Gassol, 2007; Siegel et al., 2003). Different institutional premises for conducting R&D in public universities and SMEs may affect the establishment and process of collaboration. Hence, the literature shows how institutional gaps between firms and universities tend to give rise to differences in goals, interests and time horizons informing R&D behaviour. Researchers like Bloedon and Stokes (1994) have thus pointed out how the cultural differences between universities and firms are likely to impede collaboration. Following these, Davenport et al. (1999) have discussed the significant role of the cultural differences between universities and firms as obstacles to the development of trust as well as on the transfer of technological knowledge. Thus, according to Davenport et al. (1999) the cultural division between universities and firms often requires an 'honest broker' (see also Dodgson, 1992) acting as an intermediary mechanism, so 'the partners come to respect the cultural differences' (Davenport et al., 1999, p. 38). Where research interactions are embedded in pre-existing social exchange relationships of mutual obligations, trust should thus overwrite some of the impediments to research collaboration derived from culture clashes between universities and firms (Davenport et al., 1999). The vast body of literature on the effective management of UI collaboration and technological knowledge transfer has altogether discussed how the often a priori assumed cultural differences between universities and firms tend to constitute barriers to collaboration and give rise to 'managerial gaps' if not carefully addressed prior to collaboration (Johnson, 2008; Liyanage and Mitchell, 1994; Turpin, 1999). Thus, coming to grasps with cultural tensions manifested in the duality of project control requires the development of management strategies that are able to negotiate and manipulate the cultural differences to the benefit of the UI collaboration (Liyanage and Mitchell, 1994).

However, tendencies towards institutional change within private firms and academia may lead to changes in this picture (Liyanage and Mitchell, 1994; Perkmann and Walsh, 2007), but, as

* Tel.: +45 89 48 64 59; fax: +45 89 48 61 25.
E-mail address: toke@asb.dk

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pointed out by amongst others Webster and Etzkowitz (1998), relatively little empirical research on UI collaboration has addressed how institutional logics shape concrete collaborative R&D work in such contexts. The institutionalization of entrepreneurial norms in universities has become a topical theme of many historical or macro-level studies (Benner and Sandstöm, 2002; Colyvas and Powell, 2007; Etzkowitz, 1998; Owen-Smith, 2003). The lion's share of these research efforts has, however, taken a segmented approach towards the UI relationship by examining the conduct of science in either the private or the public sector (cf. Vallas and Kleinman, 2007). Consequently, relatively little research has addressed how such institutional dynamics shape and become salient during the actual process of R&D project collaboration between university researchers and private firms and the implications for managing collaborative R&D work (Perkmann and Walsh, 2007). The present research aims to fill parts of this void. Accordingly, the research question to guide this article is: how do institutional logics enable and constrain the process of R&D collaboration between public university researchers and SMEs? Rather than viewing the logics underlying R&D behaviour of researchers in university departments and private firms as merely constituting possible impediments on collaboration and technological knowledge exchange, the perspective of the present study is that they may as well facilitate UI interaction. The objective of the present research is thus to contribute to a more nuanced understanding of the complexities of institutional cultures in shaping UI collaborations at the micro-level of collaborating researchers.

The research reported in this article is thus based upon an exploratory qualitative study examining the total population of collaborative R&D projects between public university researchers and SMEs sponsored by a new strategic governmental programme under the NSRC in Denmark. The context of the collaborations is thus a triple helix environment (Benner and Sandstöm, 2002) investigated at the ground-level of the researchers partaking in collaborative R&D.

This article is structured as follows: Section 2 presents the conceptual background of the study; Section 3 explains the research method applied; whilst Section 4 presents the empirical findings. Section 5 provides conclusions and implications for future research and for managing collaborative R&D work at the UI interface.

2. Institutional logics of UI collaboration

To allow for a sensitive and nuanced approach to the role of institutional culture in UI collaboration, the conceptual background of this research draws inspiration from recent developments in institutional theories addressing the logics governing interactions in institutional fields. The notion of institutional logic was initially brought forth by Friedland and Alford (1991) in order to conceptualize the specific substantial contents of institutional cultures. The institutional logics approach thus deals with the ways in which the differentiated contents of institutions affect both individuals and organizations (Thornton and Ocasio, 2008). Institutional logics may be conceived of as governing interactions by both facilitating and constraining behaviour through systems of incentives and sanctions (Nee and Ingram, 2001; Thornton, 2004).

DiMaggio and Powell (1983) summarized the distinguishing features of the varieties of institutions by differentiating between institutional elements containing a coercive (e.g. upheld by public bureaucracies), normative (e.g. evaluative norms of professions), and mimetic (cultural-cognitive) dimension. Scott and Davis (2007) proposed a similar distinction between institutions comprising regulative (rule-based sanctions), normative (evaluation and norms), and cultural-cognitive (shared frames for perception) elements. While much of the extant research on changes in the institutional foundations of UI relations focuses on formal regulative structures (IPR, licensing conventions), less research has addressed the two 'softer' normative and cultural-cognitive pillars of institutions shaping research work (Vallas and Kleinman, 2007). Residing with Scott and Davis (2007), the conception of institutional logics underlying the present research consequently comprises the rule-based, normative and cultural logics shaping the possible differential premises for research work in public universities and SMEs.

A long and persistent tradition of research within the sociology of science describes the historically constituted differences in the institutional cultures of scientific institutions and industry, representing two different institutional archetypes (Merton, 1942/1959; Mitroff, 1974; Ziman, 1996). The classic view of the distinctive normative structure of academic science is encapsulated in the formulations of Polanyi (1962) and Merton (1942/1959). The four institutional norms of communalism, universalism, disinterestedness and organized skepticism thus constitute what Merton referred to as the normative ethos of academic science (Merton, 1942/1959; Ziman, 1996). A strong open science norm structuring research practice within academic research fields is expressed in the publishing norm upheld by the peer review system and resource allocation principles based upon publications and citations, whilst R&D in firms by being close to market often is guided by a commercial profit making logic. Such institutional norms are potential sources of incentive misalignments between the reputation-based reward system of open science and commercial imperatives (Perkmann and Walsh, 2007).

Recent research agendas, which revolve around institutional changes in universities, are often conducted in historical or macro-level perspectives (Benner and Sandstöm, 2002; Colyvas and Powell, 2006; Etzkowitz, 1998; Jacob et al., 2003; Owen-Smith, 2003; Vallas and Kleinman, 2007). This macro-perspective is e.g. reflected in a study of institutional change in universities by Czarniawska and Genell (2002) who have analyzed the normative and imitative logics making universities comply with changes in the field of academia. Representative studies of this line of inquiry into institutional changes have addressed:

- institutionalization of entrepreneurial norms in universities (Czarniawska and Genell, 2002; Etzkowitz, 1998, 2003; Etzkowitz et al., 2000; Kleinman et al., 2009; Slaughter and Leslie, 1997).
- differential positions taken by university researchers towards entrepreneurial norms in university contexts spanning from accommodation to resistance (Bercovitz and Feldman, 2008; Boardman and Ponomariov, 2009; Jain et al., 2009; Lee, 1996; Owen-Smith and Powell, 2001; Tuunainen, 2005).
- adoption of academic norms by science-intensive firms (Godin, 1996; Hicks, 1995; Vallas and Kleinman, 2007).

Many of these studies follow the tradition of institutional studies, which were directed at institutional logics at the macro-level of societal sectors or at the trajectories of historical changes. However, in recent years, the institutional research programme has gone through a progressive problem shift towards also addressing how logics are carried into micro-interactions by individual human actors, often in situations with co-existing, potentially contradictory logics (Kraatz and Block, 2008; Reay and Hinings, 2009; Scott and Christensen, 1995; Thornton and Ocasio, 2008). In order to examine the role of institutional cultures in

collaborative R&D work, the perspective of the present study elaborates on these developments. More specifically, it draws inspiration from parts of Bourdieu's (1990) theory of the logics of fields, and how such opposing or convergent logics play out in micro-level interactions.

2.1. Institutional doxa and heterodoxy: convergence and conflict in UI collaboration

As noted by Powell (2007), Bourdieu's field conception provided the foundation for the concept of the organizational field in new organizational institutionalism. Whereas many early new institutional arguments addressed how unitary institutions draw structures and practices in converging directions, more recent studies (Lounsbury, 2007; Marquis and Lounsbury, 2007) inspired by Bourdieu address the possible conflicting logics that prescribe and proscribe action within one field or in interactions penetrating different realms (see also Currie and Guah, 2007; D'Aunno et al., 1991). According to Bourdieu, fields are defined by their distinctive logics which govern how actors compete for various types of capital, e.g. academic capital comprising symbolic value and distinction through peer recognition in the field of university research (Bourdieu, 1975, 2004; Ringer, 1992).

R&D interactions between researchers in university departments and private firms may thus be conducted under the impression of differential logics. When such interactions are shaped by different, potentially conflicting logics, they can be analyzed as being in a state of *heterodoxy* according to Bourdieu (1990). Being in a heterodoxical state implies that the logics upon which interaction is based become objects of reflection and negotiation and may eventually lead to a breakdown of interaction and communication (Bourdieu, 1977), e.g. creating an experience of a culture gap. Thus, different, potentially contradictory logics motivating R&D practice in public university departments and SMEs may give rise to differences in motives, goals and perceptions of how an R&D project should be managed and may in turn impede the ongoing exchange of knowledge. Shared or complementary logics are likely to operate on the level of *doxa*. According to Bourdieu, doxa can be defined as a situation in which logics are tacitly taken for granted thereby giving rise to mutual consent about the premises for interaction (Bourdieu, 1977). In such situations, the cultural and normative conventions governing action are seldom discussed or 'negotiated' by interacting actors in the sense suggested by the symbolic interactionists (Fine, 1984; Strauss, 1978). In other words, even though translation and negotiation of institutional differences may be required for reconciliation of competing cultural values associated with the entrepreneurial and scientific ethos (Liyanage and Mitchell, 1994), the logics governing research practice in UI collaboration are not necessarily constituted as an object of reflexive negotiation.

The concept of institutional doxa enables us to conceive of circumstances in which institutional cultures of research institutions and private firms intersect, and resolutions to possible competing norms do not require extensive negotiation or formalization in written agreements (Bourdieu, 1977). Thus, even in successful UI collaborations which are not complicated by normative conflicts, interactions are never entirely subinstitutional (Nee and Ingram, 2001). Only when the logics upon which UI interactions are based do not operate on a tacit, pre-reflexive level, they are experienced as barriers to collaboration. Thus, Bourdieu's conception of the logics as structuring principles for action enables an analysis differentiating between 'negotiated' and heterodoxical logics in R&D interactions with inter-institutional contradictions and shared logics constituting an interaction doxa of shared, taken for granted knowledge.

2.2. Researchers' social skills

Bourdieu's (1990) notion of skilled human actors opens an analytical bridge to the level of interacting researchers and their experience-based skills. Bourdieu conceptualized the social skills of actors through the notion of *habitus*. Krais (1996) drawing on Bourdieu, has examined how researchers acquire a field and discipline-specific habitus through participating in social fields such as academic disciplines. Habitus comprises the institutional competences and norms acquired by actors through their previous experiences with participating in given fields. Such competences guide actors about how to act and communicate in a specific institutional field. Extensive cross-sector circulation of researchers may thus lead to a commingling of culture-codes and logics (Vallas and Kleinman, 2007). This perspective thus offers a view of R&D collaboration as being informed by social skills, which may e.g. allow actors to take account of the point of views and interests of other actors and induce cooperation in them based on previous participation in the field of the partner (Cooney, 2007; Fligstein, 1997).

The gains achieved by introducing elements of Bourdieu's perspective to the research field of UI collaboration are thus to open up analytical space for analyzing both the discussed, conflicting logics and the tacitly, taken for granted logics, whilst at the same time making institutional theory operational at the micro-level of concrete collaborative R&D projects. In the following, the usefulness of this analytical approach for understanding the micro-institutional dynamics of UI collaboration is examined.

3. Research methodology

This article is based upon an in-depth qualitative study of the total population of SMEs (19) and public universities (9) involved in R&D collaborations sponsored by a newly established strategic governmental programme. The 19 SMEs were primarily located within nanotechnology and -science, biotechnology, ICT, and environmental science. All SMEs employed less than 100 employees. Each project involved a research group of university faculty members and one or more SMEs.

A qualitative research design was chosen in order to generate in-depth data on the interaction between the collaborative partners. A qualitative and interview-based methodology was appropriate to capture patterns of institutional convergence or divergence as perceived by the interacting actors (Suddaby, 2006; Suddaby and Greenwood, 2009). Different data types were collected comprising semi-structured interviews and archival material about each of the projects. 26 semi-structured interviews were conducted on the basis of a semi-structured interview protocol (Maxwell, 2005). Most interviews had a length of one and a half hour. The researchers and project managers who were directly engaged in the collaborations were all interviewed.

The overall research strategy was informed by an iteration between theory and analysis of data (Charmaz, 2006; Orton, 1997). The semi-structured interview protocol was based on a review of the extant literature as well as written material regarding the joint projects. The interview protocol contained questions addressing different aspects of the collaboration process from the contact phase (contact making mechanisms, motivating reasons for collaboration, kind of agreements made prior to collaboration, how the collaboration was initiated) to the actual phase of collaboration (research management, institutional

aspects of the collaboration, interests and goals, IPR, language, culture) and considerations concerning the capitalization of the outcome. Central research questions thus pertained to the impact of possible differences in institutional cultures and the extent to which disagreements in projects stemmed from such differences. As the iterative process of data collection and analysis progressed, it became evident that differences in culture played a minor role in the collaborations. Interview questions probed further into the factors behind the seemingly lack of normative conflict between interests, goals and institutional cultures in the joint projects.

The validity of the study was ensured throughout the research process from the research design to the robustness of the final findings (Brinberg and McGrath, 1985). Data source triangulation was applied for cross-confirmation by comparing data from different actors involved in the collaborations as well as data from the archival material. All interview transcriptions were coded using Nvivo to establish common and dividing patterns in the collaborations. The coding procedure was discussed by two researchers to increase the rigour of the analytical generalization of empirical data to analytical insights. The limited sample size inhibits generalization from the study, which primarily serves an explorative and illustrative purpose.

4. Institutional logics and the process of UI collaboration

The following sections present the findings on the ways in which institutional logics of R&D behaviour shaped the establishment and process of collaborative R&D. The findings illustrate how institutional tensions in a few of the collaborations induced the partners to follow conflicting courses of action in the joint R&D projects. This impeded the ongoing exchange of knowledge and imposed challenges on the project management. Persistent researchers, however, attempted to convince the partner to extend the collaboration and create shared meanings about the goal and content of the collaboration. However, in most of the collaborations, the interaction was based upon shared or complementary logics facilitating the exchange of knowledge.

4.1. Establishing UI collaborations

The collaborations were established between partners with different institutional backgrounds, which had different implications for the process of establishing the joint projects. In some cases industrial researchers had work or educational experiences from the collaborating university. Partners in the SMEs had thus in a few cases occupied positions as associate professors. Furthermore, some of the SMEs were newly established spin-outs by academics coming from universities. This led to a blurring and overlap of the institutional boundaries between the public university departments and SMEs, which enabled the establishment of the joint projects. Hence the contact making and establishment of the projects were in some cases facilitated by a short institutional distance between the partners, shared understanding and expectations to the project. As one university researcher experienced it:

> We were on the same wavelength with all the SMEs and we had no misunderstandings. The professional culture was perfect in each of the firms.

In a few cases the establishment of the collaboration was even facilitated by the private researchers being part of and contributing to the public science base through previous co-authored publications with university researchers (Hicks, 1995). Thus, signalling willingness to engage in reciprocity in knowledge exchange by subscribing to academic norms facilitated some industrial researchers' access to the university partner. As noted by a private researcher:

> I took a course run by this professor, while I was doing my Ph.D. at another firm. Afterwards we published an excellent article, in fact. Then we were not in contact for a few years. But this of course implies that there was a trust relationship between us before we started the collaboration.

Hence, some projects within the advanced technologies of nano- and biotechnology were embedded in socio-technical communities of mutual socialization, shared educational or work experiences where shared institutional norms could thrive. However, due to the small institutional gaps between university departments and SMEs in these sectors, the university researchers were relatively successfully using public advertisements for contact making as well. Since these SMEs were already oriented towards public research, social ties therefore seemed to be less critical for contact establishment in these cases. As one university researcher described the use of public advertisement for contact making:

> The contact making went better than expected… In fact, there are many more researchers, than I had expected, doing what we are doing in the outskirts of our field. We started from zero firms, so there are none of the nine firms on our contact list which we knew beforehand.

In less science-intensive fields where the extent of cross-sector circulation of researchers is more limited, the possibility of using informal contact mechanisms such as social networks was perceived to be more critical for establishing the collaborations. Likewise, the participating SMEs in less science-intensive areas experienced considerable gaps to be bridged in order to establish contact with the universities. However, the general pattern is that the partners relatively easily established the collaborative projects, often without addressing different, potentially conflicting interests or goals related to differential institutional norms. In the words of one university researcher:

> There were no misunderstandings. But we did not talk about such things prior to the collaboration. But it is a good question why.

Consequently, in 14 of the 19 collaborations no written agreements were signed concerning the joint projects and e.g. IPR. Rather the establishment of the collaborations was to a high degree based upon shared role expectations and perceptions of the project. As the projects were formed with SMEs from different sectors with different institutional gaps to the public universities, the SMEs partaking in the joint projects fell into a typology comprising the following types:

- 'Academic firms' which have adopted academic norms and practices, e.g. about publishing. Commercial and academic logics co-exist.
- Science-intensive firms in which no special attention is given to academic norms. Commercial logic prevails.
- Firms which are purely dedicated to development and governed by commercial logics.

This had different implications for the actual process of collaboration and the impact of institutional tensions between potentially competing logics on the collaborative projects.

4.2. Opposing logics of UI collaboration

Conducting the joint R&D projects required a continuous interaction process between the public university departments and SMEs. In the words of one private researcher:

> It is an interaction process. We give, and then we wait and see what comes back. Then we make suggestions about what may be done differently, and then we send it back. (…) So research is an interaction process with trials and errors.

This interaction process could easily be impeded by institutional tensions. However, only in two cases the perceived institutional gaps facing the partners during the actual process of collaboration gave rise to conflicting goals, time horizons and interests. Thus, one SME partner in the ICT field experienced that the collaboration was inflicted by the university researchers' orientation by academic norms towards dissemination of knowledge. Conflicting institutional logics manifested in the R&D project shifted the attention and time of the collaborating researchers away from the scientific and technological contents of collaboration to its institutional aspects. The ongoing collaboration was in other words characterized by being in a heterodoxical state (Bourdieu, 1990) whereby the collaborating partners had to reflect upon and confront the conflicting logics on which their interaction and respective R&D practices were based. Conducting research collaboration with SMEs, the university researcher thus had to balance institutional tensions between academic norms about knowledge dissemination and profit making logics requiring commercial applicability. As the SME partner experienced it:

> They have to deliver reports and articles, but we must deliver products. They strive for perfection, where we require applicability. Fundamentally, many of our value sets do not match. It is not impossible to unite them, but we will also like to have applicability which is founded on front research and which is well tested. (…) But we would indeed have liked more commercial thoughts at the university before we met.

In this case conflicting institutional logics gave rise to competing conceptions of the time horizon for the concrete project work. The public researcher attempted to extend the project period for the R&D work in order to ensure the research quality in accord with scientific criteria required for publication, whilst the SME partner initially tried to pull the project in the opposite direction towards fast commercialization and application. In the words of the involved SME manager:

> We saw ourselves as someone who entered the university looking for what they had on their shelves and picking something out which could be commercialized—pack it into our programs and later hand it over the counter and earn a lot of money on licenses. However, if we take the actual project, it is our perception that it was impeded by a difference between our ambitions. It was clear that their academic goals were qualitatively different from our commercial goals.

Institutional tensions further led to communication problems inflicting the ongoing coordination of the project. The SME partner consequently adopted a strategy aiming to reduce and eventually resolve the institutional tensions in order to change the premises for future R&D projects. To overcome the perceived institutional gap, the SME partner engaged in a trial-and-error process of negotiations and adaptations to new information about the collaborating partner during the R&D collaboration. The SME partner who encountered a series of failed R&D interactions due to no prior experiences with university collaboration and enacting a logic of profit making, viewed these adaptations as a means to build up knowledge about the institutional aspects of UI interaction, and thus aimed to reduce the impact of institutional tensions. Rather than viewing the collaborative project merely as a means to acquire new technological knowledge for commercialization, the SME manager utilized it as a measure to exploit the earned goodwill and legitimacy from the project to promote shared meanings about the goal of R&D collaboration (Leca, et al., 2009). The SME manager thus attempted to develop the required skills to interact with university partners and exploit the achieved legitimacy from the specific project to convince both the research manager at the university department and other faculty members about the relevance of establishing new collaborations. Towards the end of the collaboration, the participating university research manager was convinced that the collaboration had changed how they looked upon collaboration with industry, and that they would approach future collaborations in a different way.

Some SMEs which did not obtain immediate results from the R&D collaboration were thus successfully aiming to acquire knowledge about university researchers' collaborative practices based upon other institutional logics and new collaborative relations in order to bridge the perceived gaps between the institutional spheres of university research and industry. Hence, some SME partners followed an approach implying that regardless of the immediate R&D outcome, they had achieved a success criteria concerning learning about interacting with public sector researchers.

In the other collaboration, in which conflicting logics of R&D practice significantly impeded the knowledge exchange, the industrial R&D partner was informed by pecuniary goals. This gave rise to efforts to protect industrial data from being exchanged and protect its confidentiality. Being oriented towards the logic of the reputation-based system of open science, the participating public researcher experienced that the withholding of information from being exchanged impeded the collaboration and their opportunity to meet scientific requirements for publishing. As experienced by the university researcher:

> They did not realize that we are used to working with confidential information. They were afraid that the analyses would be seen by others. Now the question is whether the project can lead to publication or not!

Hence, the project embodied conflicting commercial and academic norms giving rise to different incentives and goals for the concrete R&D work, which consequently impeded the exchange of knowledge. However, only in two out of the nineteen collaborations institutional gaps significantly impeded the collaboration. Thus, even though different logics of R&D practice did affect the process of collaboration constituting a heterodoxical institutional base for interaction between researchers, they did so to a lesser extent than was expected.

4.3. Converging logics of collaborative R&D work: Institutional doxa

In the majority of the collaborations, the cultural division between SMEs and public university departments was perceived to be characterized by minor differences. Thereby the interacting partners were to a high degree able to focus upon the formal scientific and technological developmental challenges of the R&D problem whilst taking the institutional aspects of the R&D interaction for granted. Many of the collaboration partners thus talked about having 'a shared language', which worked as a basis for mutual understanding and communication.

The partners were to a great extent able to rely upon common knowledge about their respective R&D practices. Consequently,

the institutional logics upon which the collaborations were conducted operated on the level of doxa as tacit agreements about the collaboration enabling a smooth exchange of knowledge. This was reflected in the projects' low level of formalization in written contracts, whilst the ongoing coordination of the projects was done ad hoc. This was among other factors enabled by changes in the institutional logics informing R&D practice within the public university departments and the SMEs, which in many respects had given rise to a cultural convergence around shared norms and role expectations. In the words of one SME researcher:

> It has been a difficult paradigm to handle, but I do not think that it is anymore. (…) What was once a paradox—that a university and firm collaborate, while the firm will not share its knowledge and the university have to tell about it. In the beginning, I was a paranoid inventor, and did not want to tell anything about what I was doing.

In addition, academic publishing norms had become adopted by some of the participating SMEs. Thus, one SME's level of research production in terms of research articles per researcher was thus even higher than that of the collaborating university. Thereby, the logics underlying R&D practice in SMEs and university departments were in some fields perceived to be converging in many respects. As a project manager in a physics department characterized it:

> The typical problem is IPR… My bottom line is the output of articles and patents. Firms may aim at a product and have interests in keeping it as secret as possible… However, in practice I think the problems are smaller than they often are being presented (…). The people in the SME are researchers at heart.

Thus, researchers in some SMEs and public university departments subscribed to shared norms about publishing research results as exemplified by a private researcher in the biomedical industry:

> We are now trying to publish the results, indeed in a recognized journal. We just need to have the remaining material analyzed and see how good it is. But we expect to make a publication, and we are working on this now. (…) It is not something we are going to commercialize now, and this would also require extra work. But it would also be nice to publish first.

Contrary to expectations, some SME researchers even expressed regret that the relatively short time horizon for their project risked putting constraints on their opportunities for publishing. Hence, converging institutional logics implied that the researchers experienced a confluence of interest. As one SME researcher characterized it:

> We are purely based on research and do not earn any money on our own. (…) Furthermore, I did know a little about the research group at the university and knew that they had a really good expertise within their area. You can say that it was easy for us, since we shared the same interest.

Moreover, a private researcher even expressed interests in UI collaborations with no immediate commercial goals:

> There are many people at the universities, with whom it could be interesting to share experiences and interesting to link up to a business forum. Not so much to commercialize research, but basically to exchange experiences with methods and expertise.

The observed institutional convergence of academic and commercial norms and practices stemmed from factors at different levels. At the individual level, high cross-sector researcher mobility implied that some researchers had achieved a double institutional embeddedness through socialization in both the public and the private sectors (Boxenbaum and Battilana, 2005; Sewell, 1992). Through prior work experiences they had thus achieved social skills enabling them to easily communicate and interact across the possible different institutional logics of public and private R&D (Bourdieu, 1977; Fligstein, 1997). On the basis of their prior experiences of participating in the field of the collaborating partner, they were thus capable of taking the point of view of researchers in that field. As e.g. encapsulated in the experience of a university researcher in the field of nanoscience:

> I have the advantage of having worked in the private sector and worked on a commercial basis before. So, it is easy for me to understand what these people mean—we speak the same language.

At the organizational level, some public researchers pointed to the changing institutional basis for conducting research at their university, which implied that entrepreneurial norms about practical applicability and commercial relevance were becoming institutionalized in their department. Thereby they were accommodating to changes in the wider institutional culture of the university by integrating practical and commercial objectives into their research work. As one public researcher experienced it:

> Personally, my interest in research has changed. We have had problems at the research institution, which have led to theoretical researchers having been dismissed, so projects like this, which are practical oriented, are a new aspect for me. But I still think it is very important with basic research.

Concerning the contents of the joint projects, most of the partners relatively easily identified a shared motivating R&D problem (Cyert and Goodman, 1997) which could form the basis for fostering development of marketable products following logics of applicability as well as fulfil academic norms about producing publishable research. Thereby, the partners in some cases located a shared problem within Pasteur's quadrant (Stokes, 1997), where scientific knowledge production evolves in a dynamic interplay with technological innovation. In the words of one public researcher:

> There has always been this classic picture of fundamental research on the one side and research oriented towards application on the other side. (…) I think that there is much overlap between them, but there is also research without this overlap. This implies that firms are more and more often participating in research.

The cultural convergence around shared or complementary institutional logics governing the interaction in the joint projects implied that only two collaborations were not perceived as a success. However, in less successful collaborations, the partners experienced that they had acquired valuable skills to interact with partners in the specific sector. Partners in twelve collaborations expected to extend the collaboration e.g. into new projects.

In summary, the logics governing the collaborative R&D practices of researches in SMEs and public university departments intersected in the majority of the collaborations giving rise to shared, tacit understandings about the projects. This was reflected in the low degree of formalization of the R&D projects through contractual arrangements. The findings thereby provide evidence that the collaborating partners' R&D behaviour in some respects was based upon a cultural convergence, whereby institutional

cultures rather than impeding knowledge exchange enabled it. Thus, public researchers shared interests in commercial applicability, whilst some SME partners had adopted academic norms for their R&D practices formerly only attributed to universities, e.g. leading them to publish their research in scientific journals and appreciate scientific quality criteria. In other cases, the partners identified R&D problems that fulfilled co-existing commercial and academic logics without giving rise to institutional tensions.

5. Discussion and conclusion

This article set out to examine how the institutional logics shaping R&D work in university departments and SMEs enable and constrain R&D project collaboration. Contrary to much of the extant literature on the effective management of technology transfer and UI collaboration, which portrays a view of cultural divides and 'cultural clashes' impeding R&D collaboration between universities and firms, the present study shows how the institutional logics in these two sectors to a large extent served to facilitate the ongoing knowledge exchange. The study thereby contradicts some of the stereotypical and stylized characteristics often attributed to SMEs and public university departments, assuming that deeply seated cultural differences will constitute a barrier to the transfer of technological knowledge if not properly addressed ex ante and during R&D collaboration.

The observed lack of normative conflict stems from different factors. The joint projects seemed to a great extent to rest upon intersecting or complementary logics providing a shared cultural micro-cosmos for collaboration, which in most cases was based on tacit rather than written agreements. Opposing institutional logics leading to misalignments of incentives in a few of the joint projects comprised academic open science norms inducing university researchers to pursue publication goals and economic logics reflected in firms' attempts to protect IPR and prevent industrial data from being exchanged. However, whilst many of the researchers recognized that cultural differences once constituted a barrier to collaboration, they were in many cases experiencing a convergence of the institutional logics enacted in the concrete research projects. Amongst the collaborating partners were formerly university employed academics who had now established their own firm, and researchers who once were employed by industry, but now collaborated with firms from the university. They had thereby obtained a double institutional embeddedness and skills enabling them to take the point of view of the collaborating partner into account. The presence of academic norms in firms thus among other factors differed with the institutional background of the SME founders and the science intensity of the firm reflected in the employment of researchers. Thus, while industrial employment of researchers may stimulate UI interactions by enhancing firms' technical capacity to absorb scientific knowledge (Cohen and Levinthal, 1990; Murovec and Prodan, 2009; Tödtling et al., 2009), such cross-sector researcher mobility may as well enhance the normative and cultural-cognitive intersections with the university system. This was in particular evident within the advanced technologies of biotechnology and nanotechnology.

Converging logics that facilitated the collaboration process pertained to academic open science norms subscribed to by private researchers and commercialization norms held by university researchers. The findings thus illustrate that some of the SMEs had gone through a 'scientification' (Campbell and Guttel, 2005) by adopting 'open science' norms similar to those governing R&D behaviour in university departments to such a level that they did not necessarily produce fewer research publications than the collaborating university. This may reflect a tendency identified by bibliometric studies showing that an increasing number of firms in high-technology industries produce an increasing amount of peer-reviewed scientific publications, some of which equal that of 'small and medium sized universities' (Ernø-Kjølhede, 2001; Godin, 1996; Hicks, 1995). This constitutes a partial 'scientification' of industrial R&D giving rise to 'the academic firm' and an 'academia in business' (Campbell and Guttel, 2005; Etzkowitz et al., 1998), being the complementary business organization to that of the 'entrepreneurial university' (Carayannis and Campbell, 2009).

The adoption of academic norms by firms may be motivated by a variety of reasons. Scientific publication serves as a sign of a regarded research lab (Hicks, 1995). Opportunities for publishing may thus leverage a firm's competitive position in recruiting and retaining highly qualified researchers who e.g. have acquired academic norms (Hicks, 1995). Publishing and UI co-authorship furthermore signals willingness of firms to engage in reciprocal knowledge exchange, which enables access to barter-governed scientific networks (Bouty, 2000; Ernø-Kjølhede, 2001; Hicks, 1995; Kreiner and Schultz, 1993; Mauss, 1923–1924). It thus builds the legitimacy and credibility that may facilitate the establishment of new collaborations. Co-authoring with industry personnel is furthermore related to a higher overall research efficiency by university researchers (Abramo et al., 2009).

Additionally, the study corroborates other research showing that some university academics are accommodating to entrepreneurial logics about applicability and commercial objectives in their organizations leading to institutional hybridity and rapprochement of universities and industry in some areas of research (Etzkowitz, 2008; Etzkowitz et al., 2000; Kleinman, 2003; Kleinman and Vallas, 2006; Owen-Smith, 2003; Powell and Owen-Smith, 1998; Zucker and Darby, 1997). Whilst some firms thus have adopted academic open science norms about publishing, other studies show that competition and economic motives among university researchers may lead to withholding of knowledge and relaxation of such norms (Blumenthal et al., 1996; Campbell et al., 2002; Vallas and Kleinman, 2007).

The study thus confirms research indicating that factors pertaining to hybrid knowledge exchange, high cross-sector researcher mobility and university researchers' accommodation to entrepreneurial norms may blur the formerly more discrete and defended institutional boundaries of academia and industry (Gibbons, 1994; Gunasekara, 2006; Vallas and Kleinman, 2007). It may be argued that the findings thereby reflect the emergence of an institutional subfield at the intersection of industry and university defined by its own doxa of shared or complementary logics (Bourdieu, 2004). The confluence of the value-laden codes and practices of R&D work points to the unstable character of the three co-evolving helices of government, university and industry leading to shifting constellations of research user and producer roles (Carayannis and Alexander, 1999; Godin, 1996). As noted by Hicks (1995), what appears as institutional gaps may in some cases partly be a reflection of analytical gaps, creating the picture of two discrete institutions producing, respectively, basic science and technology.

Some limitations of this research stem from the chosen qualitative research strategy. The limited number of collaborative projects and informants inhibits generalization. Rather this strategy opens the opportunity of theoretical generalization.

6. Implications for future research

Understanding how and to what degree university researchers and private firms represent different regulatory, normative or

cultural-cognitive logics, and how such logics converge, calls for more research. Future research could draw inspiration from recent developments in organizational institutionalism (Hargrave and Van de Ven, 2009; Seo and Creed, 2002) or newer sociological and anthropological cultural theories (Turpin, 1999). A particularly worthwhile research avenue may be paved with longitudinal field research on the process of convergence (Jarzabkowski et al., 2008, 2009). Quantitative analyses are needed to further map which sectors are experiencing a cultural convergence, its scope and extent.

7. Implications for managing collaborative R&D work

The findings have different implications for managing border crossing R&D collaboration. In collaborations exposed to tensions emanating from institutional multiplicity and conducted by researchers lacking relevant experience-based collaboration skills or lack of prior relationships between partners, managerial approaches may successfully pursue long-term goals aiming to bridge institutional gaps. Hence, in such situations a long-term approach may be relevant by viewing the collaboration not only as an opportunity for technological knowledge production, but 'an opportunity for learning' (Cyert and Goodman, 1997). However, in collaborations exposed to small institutional distances or conducted by skilled collaborators, more effective management approaches may concentrate on short-term goals by devoting resources and time to the concrete content of the cooperative project to optimize its immediate R&D results.

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