

## **Network formation amid multiple logics: a micro-level perspective on UI search and collaboration strategies**

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### **Abstract**

The present study investigates how a high-tech-small-firm (HTSF) can carry out an inter-organizational search of actors located at universities. Responding to calls to study how firms navigate multiple institutional norms, this research examines the different strategies used by a HTSF to balance adopted academic norm-sets, commercial imperatives and formal regulations to support formation of networks and collaborations with universities. The findings show how the significance of weak and strong ties for the formation of collaborations and networks with universities is relative to the institutional embeddedness in different industries. The research thus illuminates how a HTSF effectively can combine different search and collaboration strategies depending on institutional contexts and logics governing R&D work. The concluding section outlines implications for future research and the management of sphere-straddling collaborations and network formation.

**Keywords:** university-industry collaboration, institutionalism, social networks, weak ties, search.

### **1. Introduction**

The formation of networks and collaborations with universities is of strategic importance for science-intensive firms as they are sources of new knowledge, access to students, solutions to specific R&D problems, reputation and higher order knowledge (Fontana, Geuna, & Matt, 2006). However, university-industry (UI) search and collaboration processes can in various ways be impeded and enabled by the surrounding institutional arrangements and logics. A topical theme in the UI collaboration literature thus concerns the degree to which institutional gaps between the reputation-based reward system of open science in academia and commercial imperatives to produce applicable products of private firms constitute sources of potential incentive misalignments (Perkmann & Walsh, 2007). Research on UI relationships conveys different views of the nature and direction of the institutional changes. Hence, studies show how the institutional logics of university and industrial research are converging in many respects (Vallas & Kleinman, 2008), mutually reinforcing (Owen-Smith, 2003) or often conflicting and best kept separate (Perkmann & Walsh, 2007).

The lion's share of research on institutional structures of university and industry has concentrated on long-term or macro-level changes and is informed by large-scale surveys (Perkmann & Walsh, 2007). Even though this research indicates that structural and contextual aspects of UI collaboration related to, for instance, the specific field of research and firm size affect the process and outcome of UI collaboration, there are also micro-level discretionary considerations and choices involved, affecting collaborative research behavior (Liyanae & Mitchell, 1994; Bozeman & Corley, 2004; Laursen & Salter, 2004; Belkhdja & Landry, 2007). Institutional arrangements do thus not determine R&D collaborations but contain 'zones of manoeuvre' that allow some kinds of activities to occur more easily than others (Clark, 2000). Relatively little has been done to elucidate these 'zones of manoeuvre' and the micro-level search and collaboration strategies of firms that operate across multiple institutional settings simultaneously.

Furthermore, as stated by Breschi and Catalini (2010) most UI studies portray academia as 'one' profession subscribing to one norm set. Research that focuses on a singular industry will, however, not capture that some science-intensive firms collaborate with university academics in many different industries and hence often operate across pluralistic institutional settings where it is more about navigating and juggling multiple institutional logics and zones of manoeuvre simultaneously rather than bridging one given institutional divide. Moreover, large shares of the extant research have been devoted to institutional changes within universities, faculty responses and implications for university research behavior (Etzkowitz, 1998; Owen-Smith & Powell, 2001; Tuunainen, 2005; Colyvas & Powell, 2007; Anderson, 2008; Bercovitz & Feldman, 2008; Jain, George, & Maltarich, 2009). Search strategies employed by firms to establish linkages with universities constitute an under-researched topic (Oliver, 2004; Perkmann & Walsh, 2007).

Generally, the significance of and need for close ties for UI collaboration is emphasized in the literature while the implications of open academic norms in universities are highlighted as well (Kreiner & Schultz, 1993; Liebeskind, Oliver, Zucker, & Brewer, 1996; Bouty, 2000; Partanen, Möller, Westerlund, Rajala, & Rajala, 2008). In contrast, research on inter-organizational networks within industry has shown the potential implications of weak ties and how the strength of ties (Granovetter, 1973; Uzzi, 1997) significantly shape exploration and exploitation processes (March, 1991; Rothaermel & Deeds, 2004; Greve, 2007). These contingent factors have received far less attention in the UI literature (Perkmann and Walsh, 2007) and their relative importance for search and collaboration processes is likely to be shaped by the institutional settings and logics of R&D work (Owen-Smith & Powell, 2008).

The present article is thus a response to a call to study the strategies employed by private firms to adopt and navigate different institutional norms to facilitate collaborations and network formation with universities (Perkmann & Walsh, 2007; Devereaux Jennings, Greenwood, Lounsbury, & Suddaby, 2009). Simultaneously it responds to a call for research that combines institutional theory with network theory (Perkmann & Walsh, 2007; Owen-Smith & Powell, 2008). Accordingly, based on a longitudinal ethnographic field study, the aim of the present article is to examine the strategies devised by a High-Tech-Small-Firm (HTSF) to balance multiple, potentially opposing institutional logics represented in adopted academic norm-sets, commercial imperatives and formal regulations to support network formation and collaboration with universities.

The remainder of the article is split into 4 sections. Section 2 outlines the conceptual background. Section 3 explains the research design applied, whilst section 4 presents the findings. The closing section concludes and outlines implications for the management of sphere-straddling R&D collaborations and network formations by HTSFs.

## **2. Conceptual background**

The theoretical background of this study draws inspiration from i) institutional theory on institutional logics enabling and constraining UI interactions and ii) theory on networks and embeddedness. These streams of research are employed to examine the search and collaboration strategies used by a HTSF to balance multiple logics to facilitate R&D collaboration and network formation.

### *Institutional logics of UI collaboration*

Institutional logics govern appropriate forms of action and interaction in a given field of activity. The notion of institutional logic refers to a means-end relationship (Boxenbaum & Battilana, 2005), i.e., the appropriate means to achieve a given goal. Institutional scholars distinguish between regulatory (e.g., IPR, legislation), normative (e.g., professional norms about publishing) and ‘softer’ cultural-cognitive logics or pillars of institutions (Scott, 2008). Co-existing logics can both be opposing and reinforcing, marginalized and submerged (Friedland & Alford, 1991; Thornton & Ocasio, 2008). In the early sociology of science, the four Mertonian open science norms of communalism, universalism, disinterestedness and organized skepticism were portrayed as constituting the institutional structure of academic science (Merton, 1973). Academic open science norms are upheld by the peer review system and resource allocation principles. Industrial R&D is often guided by commercial imperatives to produce exploitable products and a profit making logic (Perkmann & Walsh, 2007). The different institutional logics that underlie R&D behavior in universities and private firms shape mutual roles expectations, project goals and time horizons in collaborative UI projects. They may thus have implications for appropriate search strategies and how inter-organizational networks can be formed.

### *Institutional embeddedness and network formation*

In the literature on social networks it has been established that different network formations entail different constraints and opportunities. Weak ties are usually not part of your dense network and therefore provide access to new knowledge and resources. Strong ties on the other hand are usually embedded in a denser network. Such embeddedness is typically associated with cultural similarities and willingness to offer feedback which provides an opportunity to exchange and generate even very complex knowledge (Granovetter, 1973; Hansen, 1999; Uzzi & Lancaster, 2003; Mors & Lynch, 2010). These interrelations

between type of network and outcome are fairly general, but as argued by Granovetter (Krippner et al., 2004) the relative significance of the various forms of social relations (e.g., strong and weak ties) for the establishment and process of UI collaborations would be shaped by their embeddedness in given institutional contexts and logics (Polanyi, 1957; Owen-Smith & Powell, 2008). Rowley, Behrens & Krackhardt (2000), for instance, point out how the significance of weak ties depends on industrial setting (steel vs. semiconductor industry). Hence, appropriate search and collaboration strategies are likely to be shaped by the institutional contexts and logics surrounding UI collaboration.

Institutional arrangements such as formal regulations and commercial imperatives requiring collaboration partners to withhold knowledge from the public domain may thus compel firms to embed collaborations in dyadic interpersonal ties of trust (Cook et al., 2005a) and hence rely on a long-term, trust-based collaboration style (Perkmann & Walsh, 2007). A number of studies have emphasized the significance of embedded inter-personal relations. In particular in biotech, a history of previous inter-personal interaction seems to constrain how and with whom new knowledge is exchanged and generated (Kreiner & Schultz, 1993; Liebeskind et al., 1996; Oliver & Liebeskind, 1997; Bouty, 2000; Laursen & Salter, 2004) which leads to dense networks (Powell, 1999). Studies on high-tech in general have emphasized the role of inter-personal embeddedness as well, e.g. Allen (1983).

However, in contexts where UI collaborations more clearly are based on the governance mechanisms associated with open academic norms, more open-ended search strategies based on weak ties network formation may prove fertile. In von Hippel's (1987) study on the trading of informal know-how among engineers, the importance of the strength of the tie is e.g. less significant. The inter-personal tie are partly based on acquaintances from conferences, which is a much weaker basis than, for instance, Bouty's (2000) 'heart partners'. Von Hippel (1987) does specify though that the ties are reciprocal and hence implies some form of embeddedness (Granovetter, 1985; Uzzi, 1997). The adoption of academic-like open science norms by firms may enable open forms of UI search and collaboration strategies based on weak ties.

Perkmann & Walsh (2007) speculate whether different kinds of networks relate to different kinds of search processes. They briefly introduce March's (1991) distinction between exploration and exploitation to the field of UI linkages, a distinction which the literature on UI collaborations, both biotech and general high-tech, has done relatively little to elucidate. In the general literature on inter-organizational networks the distinction between exploration and exploitation is associated with the strength of ties, where the former is related to weak ties while the latter is enabled by strong, embedded ties (Rothaermel & Deeds, 2004; Gilsing, Lemmens, & Duysters, 2007; Greve, 2007). It is thus conceivable that, in contrast to claims in previous UI literature, an open search strategy aimed at forming networks of weak ties and a short-term collaboration style based on frequent partner shifts may prove fertile in an explorative setting and in contexts where potential university partners' R&D behavior is highly governed by open science norms of knowledge exchange and unbinding forms of research interaction. This might have been missed in previous studies that do not rely on the distinction between different kinds of knowledge search.

Finally, industrial researchers' ability to balance and manoeuvre across multiple institutional logics and contexts of UI collaboration and devise different search and collaboration strategies is likely to be shaped by their social or institutional competences. Actors are more or less capable and knowledgeable in navigating across different institutional logics depending on their social skills (Giddens, 1979; Whittington, 1992). Researchers with a double institutional embeddedness (Boxenbaum & Battilana, 2005), i.e. work experiences and socialization from different institutional settings, may more easily navigate and instigate different norms sets to facilitate different search and collaboration processes. Industrial researchers with work experiences from universities may, for instance, employ academic open science norms to facilitate non-embedded network formation with universities.

In summary, the conceptual background of the present study combines theory on the institutional logics governing partner role expectations, time horizons and project goals in collaboration across institutional settings and theory on network formation. In the following section, the research design is detailed.

### **3. Research design**

According to Perkmann & Walsh (2009) most research on UI linkages has focused on patents, IPR, co-publications and other formal measures of UI interactions (see e.g. Cohen, Nelson, & Walsh, 2002; Zucker, Darby, & Armstrong, 2002; Owen-Smith,

2003; D'Este & Patel, 2007; Breschi & Catalini, 2010). In accordance with the character of the research problem, a micro-level perspective that includes informal search and collaboration processes and normative and cultural-cognitive logics of research behavior is called for. Original field data have been collected, since a field study provides rich empirical insight into the micro-level search and network formation strategies employed by a HTSF amid various institutional logics (Perkmann & Walsh, 2007; Swan, Goussevskaia, Newell, Robertson, Bresnen, & Obembe, 2007; Bjerregaard, 2010).

The study investigates norms in multiple industrial settings, in contrast to most studies where industrial norms are compared to academic norms per se (see e.g. D'Este & Patel, 2007; Perkmann & Walsh, 2009) and often focus on biotech (Kreiner & Schultz, 1993; Liebeskind et al., 1996; Owen-Smith, Riccaboni, Pammolli, & Powell, 2002; Owen-Smith, 2003; Oliver, 2004; Smith-Doerr, 2005; Mosey, Lockett, & Westhead, 2006; Vallas & Kleinman, 2008). Some exceptions do exist, e.g. Giuliani & Arza (2009) and Tuunainen (2009). But in contrast to the latter two studies, we have chosen one case organization that forms networks with universities across multiple institutional settings. The study hence departs in one HTSF that interacts with two different academic fields. In this way it is possible to illuminate the different strategies employed to facilitate UI search and collaboration processes, since the organizational characteristics are similar. Similarly to Laursen & Salter (2004) we apply a perspective from the firm, and do not depart in the university perspective, as most studies.

### **3.1. Data sources, collection and analysis**

The significance of multiple institutional contexts and logics for the formation of networks emerged during the collection of the data. The analysis and data collection has thus co-evolved through an iterative process where new questions emerged during the research process (Yin, 2009). The empirical material consists of interviews, observations and different kinds of archival data. One of the authors spent one day a week for +50 weeks at the case organization (2008-2009). Regular internal meetings, inter-organizational interactions and the general organizational workflow have been observed while numerous informal conversations have been engaged with the employees of Unisense and some of the external visitors.

Nine formal interviews have been carried out. The CEO, CTOs and head of sales of Unisense and actors from the local and global academic field have been interviewed, the CEO being interviewed three times, where the first was of an explorative and grounded nature (Glaser, Strauss, & Cohen, 1969). The rest of the interviews have been semi-structured (Kvale, 1996) starting out with a rough guideline. The themes have been open innovation, inter-organizational relations in general and UI linkages in particular and during the interviews a focus on the different norms in different academic settings emerged. All interviews have been performed by one of the authors, and lasted 35-90 minutes. All interviews have been transcribed, except for the one from the global academic field, on the request of the interviewee.

Different kinds of archival data have been collected. The homepage of Unisense has been analysed and compared to a random selection of 100 other, similar (mainly based on NACE codes) Nordic HTSFs. When studying publication records it is usually co-publications and patents that are being examined (see e.g. Zucker et al., 2002; Breschi & Catalini, 2010). In addition to looking at co-publications we have included how often Unisense are being referenced, as an organization, in scientific documents. We know of no other study that has included such data. The analysis of the data is based on a content analysis, going from fine-grained descriptions to higher-level theoretical interpretations.

### **3.2. Research setting**

In 1998 Unisense A/S was founded and has been profitable every year since: The average net profit the past five years is 14% (Unisense, 2010). The organization is, in terms of a legal perspective, divided into two organizations. These comprise Unisense Science A/S (general high-tech) and their daughter company, Unisense FertiTech A/S (fertility, life sciences). The organizations share office space, core technologies, employees and R&D strategy and hence function as one organization. The original founders are still employed in key positions in R&D and top-management (CTOs and CEO). Combining both legal entities, Unisense has 35 employees with a highly educated and wide-ranging background, including Masters and/or PhD degrees in biology, chemistry, medicine, mathematics, mechanic and electronic engineering, electronics or computer science, which creates a strong academic culture (Gundersen, 2006). Unisense is positioned in both the academic and commercial world, since it both carries out basic science and publishes and sells products and services to the global research community.

Generally, Unisense specializes in micro-sensors with a tip of only 0.002 mm, which is a fraction of the thickness of a human hair (Gundersen, 2006). Unisense thus produces new kinds of ‘images’ of very small things. Their technology-base is a kind of multi-purpose technology, where Unisense has a solution and are looking for problems to solve (Kim & Kogut, 1996).

## 4. Findings

### 4.1. Academic and industrial norms

Adoption of academic open science norms by Unisense is expressed in a high publication level. This has resulted in a number of co-publications with different actors in the research community (+35 in the last decade). Furthermore, Unisense is often referenced as an organization in scientific publications. Whilst most studies have highlighted the value of the in-depth collaborations that co-publications and co-patenting can entail (Bouty, 2000; Zucker et al., 2002; Oliver, 2004; Breschi & Catalini, 2010) being referenced signals the publishing scientists’ willingness to acknowledge the value of the state of the art products that have been part of a given research project. Since the use of Unisense’s products requires a collaborative effort, such references do indicate prior collaborations, albeit not necessarily as in-depth as a co-publication would be. Via a search of the Scirus database, 455 references in academic documents have been identified<sup>1</sup>. These references are due to the extensive network activities of different kinds.

#### 4.1.1. Unisense and academia: Us or them?

Unisense has managed to remain part of academia by importing and upholding academic-like open science norms and practices:

*A lot of companies undergo a transition. They start as an ‘us’ [academia] and then they become a ‘them’ [business]. When you become a “them”, then there begins to be suspicion, so instead of a scientist saying ‘do you want to co-develop this with me?’, you become someone who might steal their idea. It’s a very fine line of being truly considered a research partner, where you can bounce ideas off and come up with something, or someone who is just out to take your idea and profit of it. This company has managed to stay on the ‘us’-side, and they don’t want to lose that. (Head of Sales, Unisense)*

The above quote illustrates how Unisense strategically has tried to remain part of the institutional sphere of academe in order to facilitate interaction with universities and be a collaborator that participates in the same game of scientific publication. As noted by a CTO: “we would like to make the customers conceive of us as a scientific partner”. The outcomes are co-publications as well as the before mentioned references in academic papers.

Although an abstract us-them distinction for the general relationship between universities and industry can be identified among Unisense scientists and university partners, the actual UI interactions vary, depending on whether they take place in field of high-tech (Unisense Science) or life sciences (Unisense FertiliTech). Unisense thus devises very diverse search and collaboration strategies in different fields of research.

## 4.2. UI search and collaboration strategies amid multiple logics

### 4.2.1. Unisense Science

Unisense Science is involved in very different high-tech markets, e.g. aeronautics, bacteriology, Antarctic exploration, neurology just to name a few. Some projects relate to human life sciences, but the following points all relate to Unisense’s research and development within a non-life science high-tech field. Unisense has in-depth collaborations, via, for instance, co-

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<sup>1</sup> Search performed in December 2009 in the Scirus database that scans scientific documents on the internet. The search is performed using the proximity operators “Aarhus”, “Århus” or “Denmark” in order only to locate references to the Danish organization. No other Danish organization is called Unisense. Without the proximity operators the number is 675.

publications that are based on some form of strong ties. Their main search strategy (according to the CEO and CTOs of Unisense Science) is, however, to openly invite external scientists, in particular from academia, to visit Unisense in order to network extensively with as many heterogeneous actors as possible. As stated on the front of their website: “**We welcome you at Unisense: Visit Unisense for an introduction to microsensor work, training in the use of our equipment, or a discussion of your ideas**” ([www.unisense.com](http://www.unisense.com)). These visits would usually consist of 1-2 days of meetings and with scientists that are not embedded in previous inter-personal or inter-organizational relations, and can thus not be characterized as strong ties. The visits are not based on contractual arrangements. Clicking on a link indicates the purpose of these meetings:

*You are welcome to bring your own samples so we can discuss the experimental set-up and make sure that it matches the research question that you are interested in... You are also welcome to visit us for a discussion of any new measurement ideas you might have or specific equipment you might need. Many of our products are indeed results of such fruitful discussions and subsequent collaborations with scientists around the world.*  
([www.unisense.com](http://www.unisense.com))

As indicated, the aim is to see and test Unisense’s state of the art products, by bringing and testing the products on the visitors own samples that usually originate in an ongoing research project. On this basis, many publications by the visiting scientists have emerged and the visits illustrate complementary and potentially reinforcing UI interests. The visits originate from many different industries and countries:

*We get scientists from all over the world as visitors, and they work with all sorts of things. I can’t offhand identify an area within the natural sciences and medico-sciences where we do not get visitors from* (CEO, Unisense)

The fact that Unisense (all founders have PhDs from the same local university) originate in the academic community is clearly important:

*Naturally, we also have the engineers who have the technical expertise, but because I originate in the world of research I become a link that senses what their research- and natural science interests are. Maybe I have a sense for how to talk with these people, because I come from the same environment, so to say. I talk to them as a biologist to biologist* (CTO, Unisense).

To be considered a part of and be familiar with the norms of the academic community thus facilitates scientific discussions and knowledge exchange with university faculty members. For Unisense the value of these meetings is two-fold. In part they interact with potential customers and lead-users (von Hippel, 1988) which can enhance immediate profit, while they also get confronted with new, complex knowledge that can form the basis for Unisense’s future knowledge brokering. As noted by the CEO:

*We operate in many different professional fields, and when an idea emerges based on something we see in one field, then it will typically be applicable in a totally different field. I also think that this is the reason why people often think, that as long as they can stick to their research on clams and they can’t use our idea because it doesn’t deal with clam research, then they don’t care about this [brokerage].*

On top of this, Unisense also attains knowledge on research strategies, new markets and brand their organization.

#### **4.2.2. Unisense FertiliTech**

Unisense FertiliTech is developing medical devices in the fertility sector. They are thus positioned within the life sciences that specifically deal with human beings. The search and collaboration strategy within this part of the overall Unisense organization comprise a) long term collaborations based on b) formation and participation in dense networks c) of relatively strong ties. Weak tie interactions are uncommon and seen to be unfeasible. As the following quotes illustrate, there are a number of reasons for this:

*We can't just go to a store and buy human embryos to play with. We need to have close collaborations with IVF clinics, because they are the only ones that have access to the embryos...they are doing research – they want to publish papers on new embryology parameters, which can be used for scoring. Those are the ones that are interested in research...It will be necessary for us to have clinical data in the future, but like I said: we don't have easy access to the material, we need to generate it. So it is very important for us to have **very strong ties** with respected embryologists.* (Head of Sales, Unisense FertiTech, author's emphasis)

Unisense FertiTech needs access to embryos, and only research institutions have the relevant samples. In order to be able to further develop the FertiTech product, access to this clinical data is crucial and strong tie collaborations are necessary in order to get access. On the other hand, the embryology research institutions get access to new state of the art products that can potentially enhance future fertility processes. Many of these interactions take place in multi-party workshops, as advertised on [www.unisense.com](http://www.unisense.com). In this sense both parties in the collaboration benefit.

The general form of interaction is fairly open, cf. the CTO of Unisense FertiTech who multiple times (at Monday Morning meetings and in direct informal conversations with one of the authors) emphasized the number of situations where a strategic decision to reveal interesting information to partners was carried out, in order to gain access to other resources and speed up collaborative processes. Naturally, he adds, they are not naïve and do not give away their competitive edge.

#### 4.2.3. Multiple logics, search strategies and outcomes

Besides merely stating that there are differences, the following quote illustrates how these different network formation strategies are shaped by different institutional settings, more specifically regulative differences and commercial imperatives:

*[Unisense FertiTech] is a medical device. You require much more proof of the product, when it is a medical device. It is clinicians spending money and it is a scientific research product. It is a clear difference....it really depends on the sector....[in Unisense Science] you just publish something about bacteria, and **if you get it wrong nobody dies**. If you have a wrong oxygen measurement in a sediment layer nobody dies...but again, that wasn't a medical product. A science product, but not a medical...We [Unisense FertiTech] have to be a little more careful.* (Head of Sales, Unisense, authors emphasis).

The above perception has been validated with several of Unisense's key employees (CTO's and CEO). Hence, both commercial imperatives (selling products, cost of materials), different regulations (proof of products, life science products pose risks to human lives) and academic publishing norms (us vs. them) impact the search and collaboration strategies of Unisense Science and Unisense FertiTech.

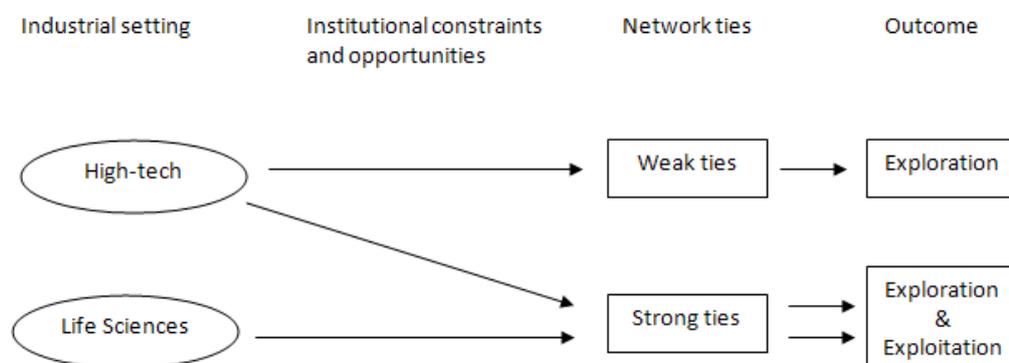


Figure 1: Institutional logics, network formations and outcomes

In summary, very diverse search and collaboration strategies are effectively employed in different research fields to form networks and collaborations with universities across the institutional logics of academia, commercial imperatives and formal regulations.

## 5. Discussion

The reported findings illuminate how a science-based firm navigates and balances multiple regulatory, normative and cultural-cognitive logics of R&D work simultaneously to facilitate UI search and collaboration processes. Different institutional settings thus provide very different constraints and opportunities (zones of manoeuvre) for establishing R&D collaborations with universities as illustrated in figure 1.

Different, potentially opposing logics governing R&D work in universities and industry are reflected in classificatory schemes held by industry and university scientists. A general us-them logic is expressed in the statements and perceptions of public and private scientists, indicating a potential normative barrier between university and industry. If an industrial organization is not perceived to be part of the 'us-category', different, potentially contradictory norms may impede the networking and collaboration process (cf. Perkmann & Walsh, 2007). This apparent institutional gap can be mediated if the industrial organization is subscribing to open academic norms, e.g. expressed in scientific co-publications and openness about R&D activities, thus giving rise to a lack of normative conflict in concrete collaborations. In such situations institutional logics of UI collaboration may be mutually reinforcing (Owen-Smith, 2003) or converging (Vallas & Kleinman, 2008).

However, even when a firm, like Unisense, is perceived to be part of the 'us-category', very different institutional settings and logics are likely to be in play shaping the relative significance of the different types of social ties for the establishment and process of collaborations with universities in different research fields. In, for instance, a life science setting, commercial imperatives and in particular formal regulations restrict collaboration opportunities. Simply put, people can die and public regulations significantly impacts possibilities for forming networks and collaborations with universities. Strong ties are deemed necessary in order to build up the relevant trust and opportunity to collaborate on the lengthy process (as argued by Kreiner & Schultz, 1993; Liebeskind et al., 1996; Oliver & Liebeskind, 1997; Bouty 2000; Partanen et al., 2008).

In a general (non life science) high-tech setting, however, other constraints are in play. A firm can form weakly based ties with universities and search broadly among these without relying on a long-term, trust-based collaboration style. In such situations, the adoption and maintenance of an academic-like culture of open science norms may facilitate open, explorative UI interactions based on frequent partner shifts. This may support UI collaboration in fields where university scientists' role expectations are purely governed by academic open norms about public knowledge dissemination and unbinding, informal forms of research interaction. Hence, inter-personal embeddedness or contracts are not necessarily the most effective means for Unisense to explore university-resources (Liebeskind et al., 1996; Perkmann & Walsh, 2007). The present findings thus go against a main thrust in the literature that emphasizes the need for strong ties of trust and reciprocal relations to facilitate formation of networks and collaborations (Kreiner & Schultz, 1993; Liebeskind et al., 1996; Oliver & Liebeskind, 1997; Bouty, 2000; Partanen et al., 2008). Rather, to optimize collaboration with universities, a HTSF may more effectively shift between explorative search and collaboration styles based on weak ties and exploitative, trust-based collaborations based on existing partners depending on the specific goals and contextual circumstances of particular R&D projects. The relative importance of weak and strong ties in search and collaboration processes is thus shaped by the specific institutional settings and logics of R&D work.

The present study has followed up on Perkmann and Walsh's (2007: p. 273) call for research that account for the significance of weak and strong ties for firms' search processes and the establishment of UI collaborations, i.e., whether collaborators benefit from variety effects and exposure to a large number of individuals as in a weak ties scenario or sustained knowledge production in a socially bounded research community (cf. Perkmann and Walsh 2007: p. 273).

The ability of scientists to effectively navigate across diverse, potentially contradictory logics of industry and academe and thus carry out different search and collaboration styles are, among other factors, shaped by their social skills. Some Unisense

researchers have, for instance, achieved a socialization in both industry and public universities, i.e., a double institutional embeddedness (Boxenbaum & Battilana, 2005). They subscribe to professional norms of scientific publication and reputation as well as commercial goals about practical application. However, adoption of academic norms by firms may as well have commercial implications (Vallas & Kleinman, 2007).

Most studies have focused on the signaling (cf. commercial implications) value of patents and publications (Zucker et al. 2002; Fontana et al., 2006; Breschi & Catalini, 2010). Such outcomes drive branding and network formation. This study adds to previous research by further elucidating the value of an organization being referenced in a scientific publication. Unisense's products are very difficult to use, which means that a reference to having used Unisense's product in a research project is based on some form of (potentially weakly based) collaboration. It also signals an acknowledgment of the significance of Unisense's contribution. The status of an organization (seen from an academic perspective) is thus not just based on patents and publications, but can be indicated by the number of times an organization is referenced. Finally, it is noteworthy how Unisense has been able to integrate their search and signaling strategy (Laursen & Salter, 2004; Fontana et al, 2006), since it is the 1-2 day visits that constitute the basis of both activities.

## 6. Concluding remarks and implications

This paper set out to examine the strategies employed by a HTSF to optimize the formation of networks and collaborations with universities across multiple institutional settings characterized by pluralistic logics. Adoption of academic norms and practices by HTSFs constitute a form of innovation in innovation by opening up new collaboration roles and forms of interaction with the university system (Etzkowitz, 2003). This study contributes to the extant body of knowledge on the adoption of academic norms in science-intensive entrepreneurial firms by combining inspirations from research in social networks and institutional theory (cf. Owen-Smith & Powell, 2008) to elicit the various strategies employed by a HTSF to balance different logics to support the process of network formation and exploration. Cf. figure 1, different institutional settings imply different constraints and opportunities. Responding to a call by Perkmann & Walsh (2007) the present study shows how only a general high-tech setting allows for the formation of weak ties and exploration outcomes, while strong tie formations are possible within both high-tech and human oriented life sciences.

Whilst many different factors underpin the establishment and process of successful UI collaborations, an important aspect pertains to the management of the institutional logics surrounding sphere-straddling collaborations and network building. The present study has contributed by eliciting the diverse challenges faced and strategies employed by firms operating across differential institutional contexts where they have to navigate and juggle pluralistic, often opposing logics simultaneously to optimize the process and outcome of UI collaboration and network formation (Kraatz & Block, 2008; Devereaux Jennings et al., 2009).

This study is based on one, potentially unique, HTSF that navigates across multiple logics. While the single case setting is an advantage in terms of highlighting different conditions for search and collaboration processes across different institutional settings, a particularly fertile research avenue would be comparative, multi-case studies that cut across nations and specify more fine grained industrial boundaries.

## 7. References

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