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Understanding University Industry Technology Transfer: Relationship Management Approaches of Leading Universities in Europe And USA

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Abstract

The importance of university technology transfer has widely been brought to the center of attention over the last decades. Research and practice thereby often concentrate on issues related to patenting and licensing or entrepreneurship but abstract away from relationship- and network-focused initiatives. In this paper, we argue that efforts to systematically develop close, long-term collaboration partnerships – although complex and resource intensive – are likely to be more beneficial for both universities and industry in the long run. Drawing on data derived from interviews with technology transfer executives of 22 leading European and U.S. universities, we analyze and discuss well-established practices of network and relationship management and their possible impact on technology transfer success. Our findings indicate that dedicated relationship management approaches can yield a sustainable competitive advantage for universities. We thereby shift the focus away from transaction-orientation towards more forward-looking relationship-centric approaches and discuss their institutionalization in great detail.

Keywords

University technology transfer, Patenting and licencing, Entrepreneurship services, Relationship management, Matchmaking, Internal networking, Technology & relationship marketing


1. INTRODUCTION

Sustainable innovation today often originates from inter-organizational collaboration (Hagedoorn 2002; Powell et al. 1996). Especially university industry collaboration (UIC) is considered to be advantageous due to complementary core competences (Balconi & Laboranti 2006; Belderbos et al. 2004; Mansfield 1998). Universities increasingly come into the focus of innovation policy (Bielig & Haase 2004), since they play a crucial role in

the creation and transfer of knowledge and technology and thus economic development in general (Adams 1990; Jaffe 1989; Rosenberg & Nelson 1994). Numerous empirical studies point to the positive effects of technology transfer (TT) from academic research to the business sector (Anselin & Varga 1997; Cohen et al. 2002; Mansfield 1998; McMillan & Narin 2000; Schmoch et al. 2000). Transfer mechanisms include exchange of personnel, joint research and development projects, licensing or patent sale, and also business development in the form of start-up firms (Di Gregorio & Shane 2003; Feldman et al. 2002; Sampat 2006; Schmoch et al. 2000). In this context, universities are increasingly confronted with the demand to establish structures that ease interaction with industry and enable a rapid and efficient transfer of knowledge and related technologies into the business environment. These structures are often institutionalized in the form of technology transfer offices (TTOs). They serve as

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intermediaries and handle certain activities related to the technology transfer process (e.g. patenting, licensing, dissemination of new knowledge, matching of project partners). Efficiency and management requirements of TTOs and their impact on the TT process have been of wide interest in past research (Anderson et al. 2007; Jones-Evans et al. 1999; Markman et al. 2005; McAdam et al. 2005), as UIC and TT have been in general (Bozeman 2000; Perkmann & Walsh 2007). Research and practice thereby often emphasize issues related to patenting and licensing or entrepreneurship (Kale et al. 2001; Link et al. 2007; Rothaermel & Deeds 2006; Thursby & Thursby 2002; Weston et al. 2001) but abstract away from relationship and network management activities. However, increasing customer orientation and interaction in today's highly competitive, global business lead to a growing interest in managing those relationships (Srinivasan & Moorman 2005). Practitioners and researchers agree on the basic thesis that a long-term relationship focus in customer interaction yields increased success (Palmatier et al. 2006), especially due to higher levels of trust, commitment, loyalty, and relationship quality (Crosby et al. 1990; Gummesson 2002; Morgan & Hunt 1994). This is particularly the case in B2B relationships. An organization's ability to manage networks and interorganizational relationships is fundamental in enhancing collaboration success (Koza & Lewin 1998; Lavie 2006; Rothaermel & Deeds 2004) as well as relationship stability and satisfaction (Provan et al. 2007; Tomkins 2001).

Accordingly, we argue in this paper that efforts by TTOs to systematically develop close, long-term collaboration partnerships are likely to be more beneficial for both universities and industry in the long run than more traditional TT mechanisms. We draw upon data derived from interviews with technology transfer executives of 22 leading universities and research institutions, conducted in Europe and the United States. The paper thereby complements existing literature in that we analyze and discuss well-established practices of network and relationship management and their possible impact on technology transfer success. For that, we describe common technology transfer approaches in detail. We then discuss how aspects of relationship management can foster a bi-directional flow of knowledge and thus enhance overall collaboration intensity and success. We thereby shift the focus away from transaction-orientation towards more forward-looking, relationship-centric approaches and discuss their institutionalization in detail.

The paper proceeds as follows: The next section describes the theoretical background of technology transfer and relationship management, followed by an illustration of the induc-

tive method we used to derive our data. We then demonstrate common technology transfer strategies and approaches to patenting and licensing and explore relationship management activities and investigate their institutionalization. Finally, we discuss how relationship management can yield a sustainable competitive advantage for universities. We conclude with implications for research and practice.

2. THEORETICAL BACKGROUND

2.1. Relationship Management

Over the last decade, growing interest in managing relationships to customers or collaboration partners lead to a plethora of studies in the fields of relationship marketing, customer relationship management, key-account management, and management of networks and alliances (Kale & Singh 2009; Srinivasan & Moorman 2005). Key antecedents for the increase in customer orientation are shortening technology cycles, growth in the service sector, and increasing competition. Moreover, keeping existing customers is often far less expensive than attracting new ones (Sheth & Parvatiyar 1995).

In this vein, relationship marketing (RM), which Morgan & Hunt (1994, p.22) define as "all marketing activities directed towards establishing, developing, and maintaining successful relational exchanges", is seen to be fundamental in developing long-term win-win relationships and thus enhancing potential relationship outcomes such as coordination and joint actions between partners, positive referrals to other customers, customer loyalty, and overall relationship performance (Anderson & Narus 1990; Doney & Cannon 1997; Gummesson 2002; Hennig-Thurau et al. 2002; Palmatier et al. 2006; Reynolds & Beatty 1999). This connection between RM activities and success is believed to be fully mediated by relational constructs of trust, commitment, relationship satisfaction and especially relationship quality (Crosby et al. 1990; Morgan & Hunt 1994; Palmatier et al. 2006). RM becomes even more important when relationships are crucial for customers and when interaction happens on an individual rather than firm level (Palmatier et al. 2006).

Having its origin in information technology, customer relationship management (CRM) is also a strategic approach to interact with customers (Payne & Frow 2005). It relates to "managing the dual-creation of value, (...) the development of appropriate, long-term relationships with specific customers and/or customer groups, and the integration of processes

across many areas of the firm and across the network of firms that collaborate to generate customer value” (Boulding et al. 2005, p.157).

However, since customer orientation can be quite resource intensive, it is impossible to equally consider every partner and hence it becomes necessary to select partners of special importance. While many firms focus on large customers with high sales volume (Pardo 1999; Ryals & Rogers 2007), others select key customers depending on their strategic importance for the firm (Millman 1996). Key-account management (KAM) is therefore seen as a company’s approach to offer special products and services to a selected set of customers in order to establish long-term relationships. In order to be effective, key-account managers should excel in coordination, planning, external and internal relationship management, negotiation, and intercultural communication (Millman 1996).

The network and alliance management literature discusses similar issues. Besides their many potential benefits, networks also have downsides and carry risks (Lunnan & Haugland 2008). Studies have shown that interorganizational collaboration frequently fails to meet initial targets, often due to the managerial complexity and high coordination costs (Park & Ungson 2001). An organization’s network management capability – its ability to manage inter-organizational relationships (Anand & Khanna 2000; Kale et al. 2002; Lambe et al. 2002) – is key in managing interdependencies and uncertainties. By building trust, countering opportunism, and encouraging relational behavior between actors, these activities can ultimately enhance collaboration success (Koza & Lewin 1998; Lavie 2006; Rothaermel & Deeds 2004) as well as relationship stability and satisfaction (Kale & Singh 2009; Provan et al. 2007; Tomkins 2001). Network management tasks include coordination, communication, and evaluation (Kale & Singh 2009; Schreiner et al. 2009; Tiwana 2008). Opposed to the discrete, one-time interactions in a market place, partnership quality – the quality of shared value creation in a network (Dwyer et al. 1987; Kale et al. 2000) – becomes more critical in the case of ongoing collaborations, because they can have a significant influence on collaboration success (Cook & Emerson 1978). The most prominent partnership qualities are trust, relational behavior (the extent of mutual commitment, forbearance, and cohesion between network actors) and a low level of opportunism (Artz & Brush 2000; Bercovitz et al. 2006; Lavie 2006; Mohr & Spekman 1994). Moreover, similar to the principles of KAM, alliance management literature suggests that establishing strong ties can foster the integration of knowledge and the

generation of useful innovations. But strong ties also reduce interaction with other partners and diminish responsiveness to new market trends, while weak ties can enhance a firm’s knowledge base but demand mutual trust (Granovetter 1973; Levin & Cross 2004; Tiwana 2008; Uzzi 1997). Establishing a mix of strong and weak ties with alliance partners is therefore crucial (Ahuja 2000; Capaldo 2007; Padula 2008; Rost 2011).

The question however remains, whether and how the principles of RM, CRM, KAM and network management are suitable for interactions between industry and universities in technology transfer and how technology transfer offices can implement those approaches and foster customer-orientation of universities.

2.2. University Technology Transfer

Technology transfer (TT) is a process in which knowledge and technology are distributed within or across organizations (in case of this study from a university to industry) and afterwards are integrated and absorbed (Bozeman 2000; Teece 1977; Wong et al. 1999). In recent years, many universities began to establish a third pillar in addition to research and teaching: generating practically relevant knowledge and transferring it to make it available for the public. This changing role away from an institution purely dedicated to basic research and education towards universities as a major player in the innovation process is often called “third mission” of universities (Etzkowicz & Webster 2000; Gibb 1996; Johannisson et al. 1998). Additionally, the decrease in government support makes it necessary for universities to seek alternative funding sources (Wright 2008). UIC plays an important role in this context, as it provides universities with additional financial resources to acquire expensive equipment or to hire additional staff (Barnes et al. 2002; Fritsch & Schwirten 1999; Jones-Evans et al. 1999; Meyer-Krahmer & Schmoch 1998). Further sources of additional budget can be selling of patents or licensing (Barnes et al. 2002).

UIC is also beneficial for companies, because it provides access to basic research through which firms can develop innovations (Cassiman & Veugelers 2006; Decter et al. 2007; Feller et al. 2002; Sáez et al. 2002; Tödtling et al. 2008). UIC offers the opportunity to reduce R&D costs and risks, to gain access to qualified researchers and well-equipped laboratories, and to fulfill recruiting and marketing objectives (Dyer & Singh 1998; Hagedoorn et al. 2000; Meyer-Krahmer & Schmoch 1998). Yet, collaborations often fail (Dyer et al. 2001), caused by differences in modes of operation, time scopes and culture, lack of

trust, and improper project management (Barnes et al. 2002; Bruneel et al. 2010; Schartinger et al. 2001). A major obstacle is often intellectual property, which may hinder collaboration from taking place at all (Hall et al. 2001). Furthermore, the geographical proximity of collaboration partners seems to influence the efficiency of the cooperation, because a far distance limits knowledge spillover and regular communication (Beise & Stahl 1999; Davenport et al. 1998; Santoro & Gopalakrishnan 2001). Bureaucracy seems to hinder successful transfer as well (Decter et al. 2007; Der-Juinn & Chao-Chih 2005), and successful transfer is more likely if the collaboration partners have been in contact prior to the research joint venture (Harmon et al. 1997).

Thus, bidirectional and regular communication between the collaboration partners is of major importance during a project (Brown & Eisenhardt 1995), because strong connections are associated with a higher scientific performance (Balconi & Laboranti 2006). Mutual understanding and trust are fundamental in order to help a collaboration to succeed, especially when it comes to the exchange of so-called tacit knowledge (Decter et al. 2007). Moreover, high quality project management, commitment and continuity are crucial and the technology transfer process demands skilled personnel, adequate resources, and incentive structures (Rogers et al. 2001). These success factors of university industry collaborations demand for a high level of relationship quality, which can be achieved through pro-active relationship management approaches as described above.

Conflicting demands from their stakeholders in technology transfer (researchers, university administrators, and industry) are a problem for universities (Siegel et al. 2003). A technology transfer office (a dedicated functional unit to manage technology transfer activities for a university, henceforth TTO) can address these conflicts and act as a mediator between customers (industry) and suppliers (researchers), who operate in different environments (Weston et al. 2001). TTOs also handle various tasks related to the TT process like patenting, licensing, dissemination of new knowledge, connection of project partners, and entrepreneurship support. But while a TTO's business also includes establishing a link between university and industry (Debackere & Veugelers 2005; Jones-Evans et al. 1999), at the same time scientists in universities and industry are embedded in the same formal and informal networks, thus limiting the TTO's role in facilitating these relationships (Colyvas et al. 2002). Nevertheless, in comparison with individual scientists or departments, a TTO has lower costs of searching

for potential collaboration partners or buyers of IP, due to specialization and lower opportunity cost of time. TTOs also emerge to reduce uncertainty when firms seek to invest in technology, whose value they cannot estimate (Corbin et al. 2008).

A strong divergence exists between opinions on what constitutes TT performance. Common measures of TT performance include the number of licensing agreements and licensing revenues (Florice & Ibanescu 2008; Fryxell et al. 2002; Jensen et al. 2003), the number of invention disclosures and the amount of contract research agreements (Thursby & Thursby 2002; Youtie et al. 2006). Indirect effects like the effects of relationship management activities on future partnerships are rarely investigated. Some authors however argue that the reason why TTO age seems to be correlated with the invention disclosure rate lies in the internal relationships that require time to develop (Xu et al. 2011).

3. METHOD AND DATA

Due to the high complexity and explorative nature of this study, we chose an inductive research approach and interviewed senior technology transfer managers of 20 technological universities (15 in Europe and 5 in the United States) and 2 large research institutes. We also considered additional archival material. The semi-structured interviews lasted two hours on average and were conducted face to face at technology transfer offices or – if none existed – at central university departments like a university's research administration. An individual search on the universities' homepages allowed the identification of TTOs and contact persons. All interviewees were centrally responsible for the collaboration processes and thus had extensive knowledge about each university's approach from a general perspective. Background data on the individual technology transfer approaches was collected from published sources and from the universities. There is considerable variation with respect to the size of the TTO (number of professional, full-time equivalent staff members) and the extent of licensing activity, as measured by the number of licensing agreements or licensing revenue. There is also substantial variance of technology transfer experience with some TTOs still in rapid development and some with more than 30 years of experience. This variance enables us to generate insights into the general landscape of technology transfer and to

demonstrate the importance of relationship management activities in relation to TT maturity. Please see <Table 1> for further information about the universities interviewed.

Following the suggestions of Eisenhardt (1989), we conducted our semi-structured interviews using pre-developed interview guidelines that helped the interviewees to describe

the TT approach thoroughly. The interview guidelines were based on an analysis of existing literature on university industry collaboration, technology transfer and innovation networks, and our own experiences from prior projects in this field. The guidelines contained 21 open questions grouped into six sections: General Collaboration Strategy, Institutional-

Table 1. Overview of Interview Partners

University	Country	Interviewee	Budget ¹	Publ. ²
Aalto University School of Science and Technology	FI	Director of Business Innovation Technology Research Center	305	968
Berlin Institute of Technology	GER	Head of Research Department	359	858
Braunschweig University of Technology	GER	Head of Technology Transfer Office	250	615
Columbia University	USA	VP of Intellectual Property and Technology Transfer	2,244	4,649
Darmstadt University of Technology	GER	Deputy Director of Research Department, Head of Technology Transfer	330	822
Delft University of Technology	NL	Director of Valorisation Centre	480	1,443
Dresden University of Technology	GER	Director of Department 5 - Research Promotion and Public Relations	500	1,328
Fraunhofer Society	GER	Department for Strategy & Research Programs, Headquarters Munich	1,355	449
Georgia Institute of Technology	USA	Director Office of Technology Licensing	766	2,190
Harvard University	USA	Senior Associate Provost and Chief Technology Development Officer	2,567	10,595
Humboldt University of Berlin	GER	Head of Humboldt Innovation GmbH	255	1,304
Karlsruhe Institute of Technology	GER	Head of Innovation Department	707	1,619
University of Oxford	UK	Managing Director of ISIS Innovation Ltd	1,001	4,350
Pennsylvania State University	USA	Director, Industrial Research Office	2,992	3,912
RWTH Aachen University	GER	Head of Department 4 - Technology Transfer and Research Promotion	590	1,929
Scientific Community Gottfried Wilhelm Leibniz	GER	Head of Department for Knowledge- and Technology Transfer	1,128	686
Stanford University	USA	Director, Office of Technology Licensing	2,504	5,119
Swiss Federal Institute of Technology Zurich	CH	Head of Group for Research Agreements and Industrial Collaborations at ETH transfer	862	2,217
Technical University Munich	GER	Head of Patenting and Licensing Office	473	2,258
Technical University of Denmark Copenhagen	DK	Chief Consultant, Head of External Collaborations - Research & Innovation Department	482	1,257
University of Hanover	GER	Head of TTO	301	695
University of Manchester	UK	Head of Knowledge Transfer	854	3,403

¹ Yearly average of overall budget in 2008 in million €

² Yearly average of scientific publications with university authorship from 2005 to 2009 (Source: ISI Web of Science, Articles and Conference Proceedings)

ization: Technology Transfer Office, Tasks of the Technology Transfer Office, Patents, Entrepreneurship, Conclusion and Outlook. Interviewees were promised a study report of aggregated findings, a procedure that often serves to motivate involvement (Park & Leydesdorff 2010). All interviews were recorded and transcribed. In addition to the interviews we included secondary data derived from university websites, newspaper articles, provided presentations, and other internal documents. Finally, we used a cross-case analysis to explore differences and similarities in the firms' approaches (Eisenhardt 1989; Yin 2009). The study relies on methods suggested by Miles & Huberman (1994) to develop common and differential factors. Conceptual insights were drawn out and refined during an iterative process as the case studies progressed. To perform a within-case analysis each university's technology transfer approach was described using interview data complemented with archival material and a two to three page summary of each case was written.

4. ANALYSIS

In the following, the paper continues with an overview of the observed TT strategies and structures as well as patenting/licensing and entrepreneurship approaches, in order to provide a context for the detailed analysis of relationship management approaches.

4.1. Common Technology Transfer Approaches

4.1.1. Strategy and Structure

Verbalizing a specific strategy for their technology transfer approach is often difficult: "I was flipping with you when I said 'we have no strategy', but we have no strategy." In nearly all the interviewed universities TT is regarded as a "third pillar" besides research and teaching, and fostering collaboration with external partners is seen as a crucial factor for successful universities. Exemplary mission statement by an interviewee: "Cooperation as a principle – we work as a team. Our research position is strengthened by cooperation agreements with other universities and research institutions. By working closely with industry we play our part in the development of region and state." Though many universities have the clear goal to transfer knowledge and technologies to industry and society, only a few of them pursue a clear strategy to do so. This lack of clear strat-

egies is typical for the younger, less experienced offices. These offices mostly try to pool activities already established at other places in the university. They also try to be a point of first contact for external partners, in order to refer to experts inside the university. More experienced transfer offices focus not only on administration (e.g. patent applications), but also on business development. These offices offer a more comprehensive support for researchers, which often includes checking each patent application and spin-off idea for commercializing potentials. It further covers the entire process of commercialization and involves the services of consultants and advisors inside and outside the university. All of the interviewed transfer offices are responsible for handling (at least a part of) the patenting process and each university offers some sort of start-up support, but the range of these services differ quite a lot.

The technology transfer structures implemented by the interview partners are very different, ranging from dedicated (centralized) TTOs to decentralized TT units for specific scientific fields. Sometimes the transfer unit(s) are set up as an external entity, in particular if they cover transfer activities of several research institutes. The degree of involvement varies between a quite passive, reactive and a proactive approach. Many TTOs pursue a passive strategy, which ensures freedom of research and intrinsic motivation of researchers: "You cannot force professors to start a collaboration. If they do not want to collaborate with industry they just don't want to". Unfortunately this limits collaboration and does not acknowledge a lot of opportunities for technology transfer. Hence, more experienced universities often have a more proactive and formalized approach.

4.1.2. Patenting and Licensing

In 2002 management of patenting and licensing became a major task of German TTOs. Similar to the US Bayh Dole Act universities got the right to claim ownership of research results, to patent them on their own behalf, and to commercialize them. Since then, universities began to set up own patent portfolios and to commercialize IP or cooperate with newly established patent exploitation agencies. Similar changes in public law led to this changing role of universities in other European countries.

While some universities solely offer licensing models (exclusive and non-exclusive), others also sell patents: "It's not always the best option to keep the IP because then you have the maintenance costs." In contracting with industry, IP seems to be a major issue, since all three parties - universities, research-

ers, industry - have differing goals: "I stand between two parties - the industrial partner hides behind the professor, who says, 'Now, sign the contract. I need the money to be able to employ my staff.'" Still, IP often gets assigned to industry partners prior to a project for a small fee, but some universities try to keep all IP or at least renegotiate the terms of transferring IP after inventions are made and can be evaluated. Only very few of the interviewed TTOs state that they are generating profits with their IP business: "We are not promising that we will make big money or that we are going to earn on the IP portfolio. Our ambition is to put costs and benefits in balance." However, benefits can come in various forms: "It is also about the mission to transfer. The other thing is that patents are a way of improving our relationship with a company."

In the United States patenting and licensing is quite different compared to Europe. Starting with the Bayh-Dole Act in 1980, a U.S. law that allows universities to own and control intellectual property, universities began to engage in IP management and have expanded industry collaboration activities, because Bayh-Dole "increased the incentives on the university side to innovate, to invent, to protect and to transfer". Nowadays, it is very common among U.S. universities to have central TT units that handle patenting and licensing activities in a very professional way. Almost every university claims the right to own the IP which has been generated by their faculty (even for contract research) and refrains from selling it to industry: "People who come and do business with American universities know that it's a non-starter. You cannot even bring it up because then the meeting ends after 30 seconds." The reason to keep IP ownership is not only to generate potential revenues but rather to protect freedom of ongoing and future research: "Because by assigning ownership, it means that you can no longer work on it since every project is layers and layers of research." Companies then commonly have the option to choose between exclusive or cheaper non-exclusive licenses.

4.1.3. Entrepreneurship Services

Supporting students and researchers in setting up new companies is another important task of TTOs, but the types of activities offered by TTOs are very diverse. Most universities provide basic consulting to interested students and researchers: "We generally help the faculty to figure out how to get started. We have open office hours for anyone in the community to come by for help." A lot of offices also match prospective entrepreneurs with possible investors: "We do a lot of introductions to venture capital, to angel investors. We help

them do networking in the community, point out where all the events they should go to are." Moreover, many universities offer entrepreneurship education. Some TTOs, especially from the UK and the U.S., pursue a rather business development oriented approach, particular combining entrepreneurship and commercializing patents: "Two thirds of the inventions made by the university are transferred in contracts with industry. One third is still in ownership of the university. With this one third we try to build business cases to establish companies either through students, graduates from our university or our researchers." Part of building those business cases is bringing in experts using their networks: "Because research culture is very different from business culture, it is actually very difficult for researchers to move across. And they won't have experience of running a company. We put a lot of effort into finding people who can manage the companies.", "Our role is to start with researchers and science and try to find money and management. When we're doing a spin-out we build a team of people that becomes the new company."

Supporting spin-off companies can be beneficial for the university: "Our spin-off companies are very important for us. Not all of them but many are licensing some IP from us." Licensing to those companies does not only result in licensing fees but in most cases also leads to further cooperation agreements. However, entrepreneurship sometimes contradicts patenting/licensing and contract research agreements because IP given to start-up cannot be used in other forms of TT: "If we attract research collaborations with a patent and we are granting the sponsor all rights to it, that often makes it mutually exclusive of being used for economic development. So the folks who are trying to do entrepreneurship are often times in contradiction to our other activities."

4.2. Relationship-Oriented Technology Transfer Approaches

4.2.1. The Importance of Relationships

Though all of the TT officials interviewed for this study agree upon the importance of personal relationships, few of their offices offer a comprehensive, pro-active, relationship-oriented TT service. Some even question the effectiveness of centralized relationship management activities in general: "So we could be following up on the 200 research projects going on with industry across campus, but somebody would have to do that and I'm not sure the added benefit would make it worthwhile.", "We go to conferences and industry will come to us and want to meet the faculty members and

we'll take them around. I tell you, there isn't usually much that comes out of those, but it does happen.", "You could easily spend a lot of time on a relationship, that doesn't deliver anything. It's also a question of resources."

Nevertheless, many universities see a big value in relationship management and argue that these activities could have the potential to generate a lot more value through new contract research agreements than possible future licensing deals: "It's all about relationships. If you think about our roles, we're all about helping relationships." In fact, many universities only generate small licensing revenues on average if any: "We have every once in a while something that kicks off. But what's interesting is that most universities fall within this area here. Few earn a lot of money with their patenting and licensing activities." Although many universities engage in licensing and technology transfer for many years now, only some of them have been very successful in terms of licensing revenues generated. Out of more than 150 U.S. universities benchmarked in the AUTM survey 2007 for instance, only 20 generate licensing revenues greater than \$15 million per year. And even for those top 20, the annual research budget is on average 14 times the licensing income, for all universities 240 on average. Moreover, the large income of those successful universities is mostly built upon the success of only very few patents: "We've been disproportionately lucky. We've had something like 4 or 5 big hits from a revenue perspective, and 10 to 15 pretty good ones. But that's out of 4,000 inventions. So 20 patents out of 4,000 inventions.", "We've seen about 9,000 inventions in 4 years and we think 3 of them are a big winner. And a big winner we define as \$50 million or over, accumulative." Additionally, only a low percentage of inventions become actually licensed: "We file on about 50% to 60% of the inventions that we see and then we license about 25 to 30% of those." Furthermore, the long time lag between patenting efforts and revenues is commonly seen as a challenge: "It's hard to find a good measure because our royalty income is very time skewed. The money we're getting today has to do with deals that were done 10 or 15 years ago. Everybody praises you for this year's money, but it wasn't this year's work.", "It's expensive to do this and nothing I do today will generate a dollar for a decade at least." The same holds for entrepreneurship activities. Many universities invest a lot of resources and time in the support of start-up companies, often supported by government initiatives to foster entrepreneurship, but – income wise – the universities benefit very seldom.

The high potential but low average return on investment of traditional TT instruments like patenting/licensing and entrepreneurship raises the question about the relevance of economic motivations to support TTOs. In contrast to the low average licensing and patenting revenue, universities often receive between 5 and 25 percent of their total research budget from industry-sponsored research projects, which is often millions of dollars per year. In total, the U.S. licensing income, which mostly comes from a few lucky universities, accumulated to 2 billion US\$ in 2009, while industry sponsored research reached 4 billion US\$ (AUTM Survey, 2009). In addition to the direct incomes through contract research the involvement of industry partners contribute to the access to public funding. In Europe, where industry sponsored research and joint university industry consortia in public funded projects are more common than in the U.S. and at the same time the licensing income is often negligible this divergence is even stronger. On average, 193 R&D agreements with companies per university in 2008 stand against just 1.58 million US\$ licensing income (ASTP Survey 2009).

Hence, many interviewees argue that efforts to foster long-term relationships with industry may present a higher and less risky return on investment than patenting activities: "That's why we really started focusing on account strategies and account management, trying to get deeper into these companies and truly develop a relationship. We're focused on sponsored research and focus solving the companies problems, based on our research and our expertise, utilizing university facilities." Maintaining company relationships is important to ensure close connections between faculty and companies, to secure future collaborations, and to connect people: "Very rarely does a faculty member tell a company about somebody else within the university that they should be working with, usually it's a one on one relationship. If a fellow may leave a company for whatever reason, that ties is broken. With us managing the relationship, it maintains that cohesiveness. Plus we're looking for multiple connections."

In this context, IP is often seen as an enabler for future collaborations rather than a product for sale: "We are strategically setting aside some of our patent budget to pursue some fundamental patents, even though they may not have a direct commercial benefit in the next 5 or 10 years, but will be a foundation that attracts further research." This shift in perspective away from a transaction-focus on immediate TT outcomes like licensing revenue or number of new license agreements, filed patents or start-ups also yields a shift in TT performance indi-

cators: "People do what they're measured to. I could double the number of start-ups this year. It's not a very difficult thing. But that doesn't tell me whether that was the right thing to do.", "We look at the number of new master agreements, the number of task orders under those master agreements, and the number of new contacts."

Also on a project level, good relationships are very important, especially for a proper transfer of knowledge and technologies: "I can license IP all day long, but I can't transfer it. What ends up happening is that the majority of our successful transfers based on our researchers becoming consultants to the company."

4.2.2. Matchmaking and Formal Industrial Liaison Programs

While realizing the value of relationship management is an important first step, its implementation is much more difficult. Many of the universities interviewed for this study are still in premature stages of relationship management.

Many TTOs try to bring faculty and industry partners in contact with each other, though sometimes this matchmaking only means simple forwarding contacts: "80% of the new contacts are still initiated directly between faculty and companies, only 20% go through us. Sometimes we just forward contact details, since we do not have the capacity to check up on everything." More mature approaches often include a dedicated business relations team within the TTO or a separate organizational unit responsible for industrial relations. "They are responsible for matchmaking, listening to companies, understanding trends, and then: bringing researchers from different fields together to solve those problems." Another university for instance established a very professional unit for industrial relations as part of their TTO that engages in relationship management for more than 15 years. Several employees, who are required to have prior industry experience, concentrate on the development of long-term relationships to industry partners and so established more than 50 framework agreements: "We follow a sales-structure in the office where we have tier 1 and tier 2 accounts. Those are managed on a very regular basis with monthly calls to follow up. We're very much a broker or an agent for our faculty and their IP. We do not go after master agreements with everybody. It's a select group of companies that match our research expertise, show willingness and commitment of time and money." To enhance effectiveness, the team is using a professional customer relationship management tool containing extensive information about faculty, research projects and

industry partners and even offers online project and portfolio management for large collaborations: "It's a fabulous tool for us to do the follow up and make sure that we know who's doing what and manage contacts."

Many universities also establish central responsibility for strategic partner companies, which are often handled at university board level: "We have a key account management for big companies where we steer the relationship, establish close contact and just be present." These strategic relationships can either be established top-down, when university and company executives set-up a formal relationship, or bottom-up as integration of several existing collaborations between one company and different university departments. It is also seen to be important to maintain these relationships and to keep in contact on a regular basis: "I have a monthly call with our strategic partners. We'll go over any new activity, any new workshops, or things that I think they need to be invited to. We talked about bringing people to campus for a day and meet with senior folks within our different institutes to talk with them about our capabilities and see if we can make further matches." To even more formalize strategic partnerships, especially in the last years universities often establish joint laboratories (so called affiliated institutes), which are co-located at the university campus and in which company and university research staff work jointly on collaborative projects.

Moreover, some universities established formal relationship programs where companies can become a member and receive a special treatment for a membership fee. The most famous among them certainly is the MIT's industrial liaison program, where companies can become participate for a 60,000 US\$ annual fee and get dedicated key account manager assigned, who's job it is to establish further contacts between this company and the MIT labs. Other universities have similar programs: "For a membership of \$10,000-15,000 you can meet more students, find out what research we're doing, and have a closer relationship." Firms participating in such programs also get personal support by dedicated agents and joint strategy development on management level. As a part of that portfolio management project management can be offered. Often universities also offer informal meetings like dinner parties. But although these programs are famous and might initiate many new contacts, there is also critique. It is argued that these programs do nothing more than to ease initial contact: "Once you've established the relationships, it becomes a less valuable service." Moreover, the required fee is a big issue: "We just don't think we could go from provid-

ing all these services for free to charging for it.” Moreover, initial goals might be misaligned: “One of the things we find the most difficult is maintaining and fostering a long term relationship when the expectations of that relationship are misdefined up-front.” Also, the return of those initiatives is quite uncertain: “We worked very hard with some companies, where we introduced them to tons of faculty, fly people to meetings, have them come in and have fancy lunches. And there’s never been anything valuable that comes out of it.” Hence, other universities follow a different approach and offer services like matchmaking, competency analyses, and laboratory tours for interested companies for free and only charge for more extensive services like multi-day workshops to generate ideas for joint projects.

Despite these efforts to matchmaking, many companies still establish new collaborations driven by a certain need: „Collaborations generally emerge from certain task that needs to be fulfilled.“ And many select their partners based on personal ties: “95 percent of our collaborations are based on personal relationships. Who do you call first? Your doctoral advisor!” This raises the question how TTOs can partly institutionalize personal relationships and ensure continuity even if the faculty member or firm contact leaves, in order to let the whole university benefits from those.

4.2.3. Internal Networking

Internal networking is another important relationship-oriented task of TTOs. Promoting their own services to faculty is crucial, since researchers often do not know which support they can get and how. A way of building those relationships includes internal training events: “We organized a negotiation course for them and that was very much appreciated because they are sometimes fully part of the negotiating. The direct contact to the scientists is very important, just to be present at faculty level. We are not a central ivory tower.” It is seen to be crucial to spread out through the university and have regular faculty meetings and laboratory visits: “It was a requirement that you had to get out of your office and go to the faculty’s lab to meet with them. Meeting other people, seeing what’s going on and being on campus.”, “We have to build a relationship with our internal customers, which is the faculty, so that they know us and can bring us in when there is a company wanting to talk with them about research. We bring a new faculty member in every couple of weeks and introduce them to our services and learn about their research.” Having good relationships to the

faculty also has a potential impact on all TT performance dimensions. If a scientist has a good relationship with the TTO and knows about and appreciates its services, he or she is far more likely to report an invention in time, to seek help when evaluating start-up opportunities, and to engage in new industry-sponsored research projects initiated by the TTO. Hence, a broad acceptance of the TTOs work throughout the university is crucial: “Our biggest concern is that we don’t know the people we don’t work with. Which is why we try to make sure that the entry point to the funnel is as broad as possible. We spend a lot of time trying to get faculty to know what we do and submit inventions to us.”

4.2.4. Technology & Relationship Marketing

Another important task of TTOs is marketing of technologies: “All of our technologies are instantly published to the web. We’ve actually gotten quite a few deals off the website, so it worked. We do email marketing campaigns. We hold conferences where we invite venture capital to come and see our new technologies.” But technology marketing via brochures to a broad audience is rarely effective. Hence, many universities concentrate their activities on already established partnerships: “Fostering long-term relationships is also very useful in the marketing of intellectual property. That’s one of the reasons why we were able to transfer 120 technologies last year. Most of those didn’t go to new companies, they went to people we had existing relationships with.”, “With us managing these companies the way we do, talking to them regularly, bringing them to campus regularly, we get their attention when we send something to them. It’s not just sending it to people we don’t know.” Accordingly, concentrating marketing activities on prior collaboration partners has two effects: “It maintains the relationship and we’re actually getting a better target.” Again, personal interaction is mentioned to be essential: “We have a lot of events, dinners, receptions because people generally do business with people they know and like. People talk about this as a contact sport, as a people activity.”, “They know it’s targeted for them. Because of our relationship and that trust and what goes along when you work with someone for a long time, there’s a willingness to try and make things happen.”

Marketing technologies has also an indirect effect on possible future collaborative research agreements: “It may not just go to a company who wants to license that IP, but in a way it tells a company what your capabilities are and the research that is tied to it. That’s really what I’m selling.”, “For certain companies we work really closely with we post agendas on a

secure website, put quarterly reports for projects they're funding and presentations from faculty on there." Moreover, there might be an effect on a university's reputation: "The university sees that it gets a lot of money from sponsored research. It's

important for the university's vision of its role in the regional economic development, and the branding of the university as a leader in this area."

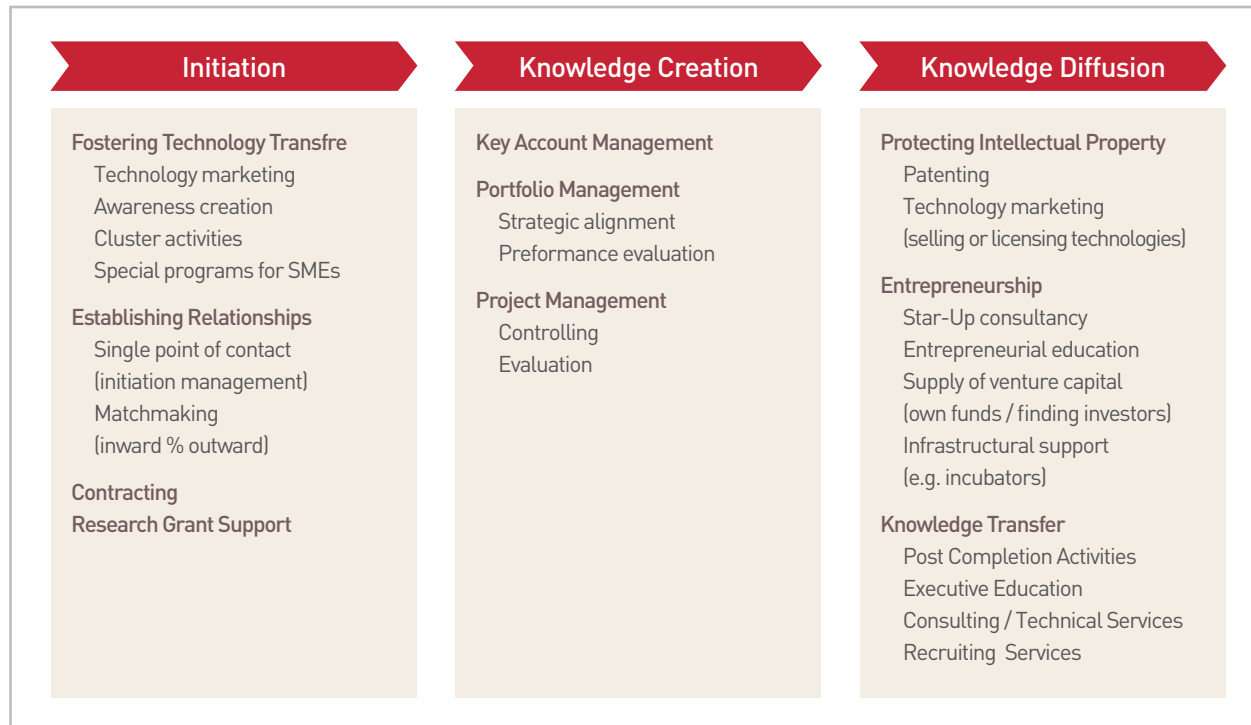


Fig. 1. summarizes the heterogeneous activities performed by TTOs.

5. DISCUSSION & CONCLUSION

Technology transfer is a people's business. While many universities still have a transaction-focus and devote their work to marketing of intellectual property or supporting spin-out companies, more and more universities begin to realize that long-term relationships with strategic industry partners might offer much additional value in terms of research opportunities and funding. Although the effects are often indirect and long-term, a comparison between the average licensing income and industry sponsored research expenditures of European and U.S. universities reveals the latter to be the greater lever (see AUTM and ASTP Surveys 2009). Many of our interviewees argue that relationship management activities have a positive effect on the development of these long-term research collaborations. Similar issues are discussed in relationship market-

ing literature in that they enhance coordination and joint actions between partners, positive referrals to other partners, loyalty, and thus overall relationship performance (Anderson & Narus 1990; Doney & Cannon 1997; Gummesson 2002; Hennig-Thurau et al. 2002; Palmatier et al. 2006; Reynolds & Beatty 1999).

Analogous to the issues discussed in CRM (Boulding et al. 2005), KAM (Millman 1996) and management of strategic alliances (Kale & Singh 2009; Schreiner et al. 2009; Tiwana 2008), crucial relationship management activities in the context of university industry collaboration and technology transfer include communication and coordination. TTOs act as a first point of contact to the university for industry partners, offer matchmaking between faculty and industry project partners, and internal networking. Moreover, marketing of technologies and research collaboration opportunities, regular interaction

with key partners as well as coordination of collaboration projects are important. Regular interaction with external and internal partners and professional communication will ultimately enhance trust between collaboration partners, counter opportunism, foster commitment, and encourage relational behavior, and thus lead to a higher quality of the relationship between a university and its industry partners, like suggested by prior research (Crosby et al. 1990; Dwyer et al. 1987; Kale et al. 2000; Morgan & Hunt 1994; Palmatier et al. 2006). Due to the long-term nature of university industry interaction, a high level of partnership quality, bidirectional regular communication between collaboration partners, and mutual trust are particularly important in the context of TT as they can enhance collaboration success (Balconi & Laboranti 2006; Brown & Eisenhardt 1995; Cook & Emerson 1978; Decter et al. 2007; Koza & Lewin 1998; Rothaermel & Deeds 2004) as well as stability and satisfaction with the collaboration (Kale & Singh 2009; Provan et al. 2007; Tomkins 2001).

Many of the interviewed institutions pursue a form of key-account-management and treat relationships to strategically important partners with a special attention, often on university board levels. As discussed in KAM literature, this is a common approach to establish long-lasting, close relationships to selected specific partners (Millman 1996). Furthermore, some universities established a formal industrial liaison program. Companies participating in those programs can receive a special treatment for an annual fee, often including a dedicated contact person (key-account-manager) who handles all interaction between the university and the company. These programs are believed to be a very effective ‘door-opener’ when set up right, but also demand a highly professional staff and seem also only possible for universities with good reputation. Especially for SMEs not present in the immediate geographical region of the university these programs might ease access to the university, provide a good overview, and establish initial contacts (Beise & Stahl 1999; Davenport et al. 1998; Santoro & Gopalakrishnan 2001).

The effects of relationship management are also related to a university’s strategy and performance in patenting/licensing and entrepreneurship. First, for universities with a low level of licensing income and entrepreneurship activities, a concentration on relationship management activities that may lead to new industry sponsored research agreements or even new affiliated institutes might be valuable sources for additional funding. That way, they can build up a larger research base and increase their research performance. Second, for universities with a large patent portfolio and high licensing income, relationship management activities might also lead to further collaborative research and thus additional patents. The good patent portfolio might attract companies to pursue further joint research in an area the university also holds certain key patents. Hence, IP can also be seen as a marketing instrument. Third, universities with many entrepreneurship activities might also profit from a relationship orientation of the TTO, since those activities are also important to establish strong partnerships with the local entrepreneurship community and ease access to venture capitalists and infrastructure providers such as incubators and science parks.

In sum, one can conclude that efforts directed towards TT relationship management conducted by TTOs are likely to enhance the quality of the relationship between a university and its industry partners. This higher quality yields a higher TT performance on a broad basis in that it may have direct and indirect effects on patenting and licensing revenue, establishment of start-ups, the amount of industry sponsored research, and a university’s reputation as a major TT player in a region (see <Fig. 2>).

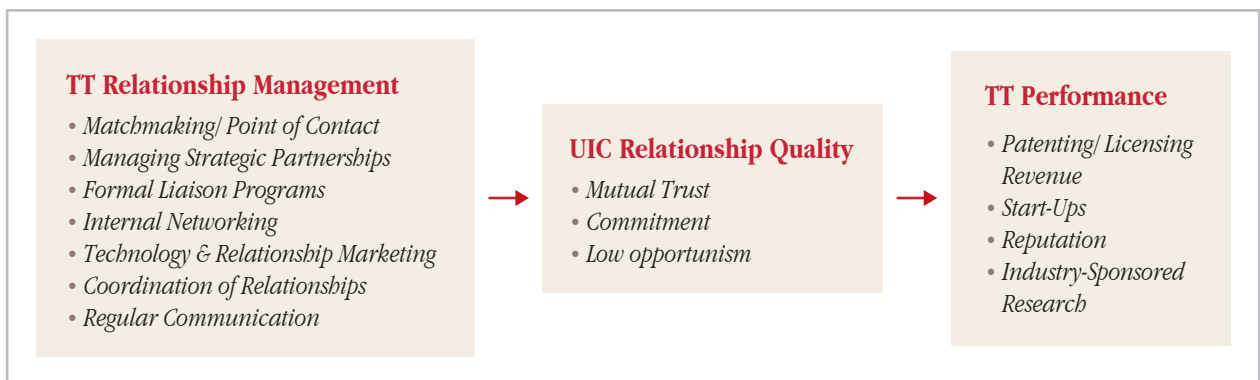


Fig. 2. TT Relationship Management and TT Performance

This study contributes to existing research on university industry collaboration and strategic alliances in that we analyze common practices of network and relationship management. We show that proper relationship management plays an important role in the generation of mutual trust, which is necessary for long-term collaboration partnerships (Balconi & Laboranti 2006; Brown & Eisenhardt 1995; Decter et al. 2007). Moreover, we introduce concepts of RM, KAM and network management to the context of UIC and discuss the particular importance of relationship quality (Anderson & Narus 1990; Crosby et al. 1990; Doney & Cannon 1997; Dwyer et al. 1987; Hennig-Thurau et al. 2002; Kale et al. 2000; Morgan & Hunt 1994; Palmatier et al. 2006; Reynolds & Beatty 1999). We thus explore how relationship management can enhance overall collaboration intensity and success and thus have a direct economical impact on university performance. That way, UIC relationship quality can act as a predictor for long-term UC success, which is often hard to determine. All in all, we were thus able to shift the focus away from traditional transaction-orientation of patenting/licensing and entrepreneurship TTO activities towards more forward-looking relationship-centric approaches.

Future research could try to assess the success of different relationship management approaches in a quantitative study in order to be able to validate our arguments about the impact of relationship management activities on relationship quality and thus on overall collaboration success. Thereby it is important to not only concentrate on traditional measures of TT performance such as licensing revenue or number of start-ups but also relationship oriented measures like framework agreements and new contacts. Also, indirect effects have to be taken into account. However, appropriate measurement of performance requires a long-term, multi-faceted, and multi-level perspective (March & Sutton 1997; O'Connor 2008) and will thus be hard to show in a quantitative study. Moreover, it has to be taken into account that the participants of the study are mainly large technological universities. Those have been selected because it can be assumed that they have profound technology transfer experience. Hence, future research could investigate also non-technological universities or extend analyses to other countries. Furthermore, since European universities are quite different from U.S. universities in structure, management style, and environment (e.g. legally, in business orientation and freedom of researchers), future research could also supplement our findings by deeper analyses in other areas such as Asia.

As for the managerial implications of our study, we generally suggest that universities take a relationship-oriented approach

towards university collaboration. For that, central coordination of the portfolio of collaboration partners and regular interaction with key partners is crucial in enhancing collaboration quality. The same holds for regular interaction with faculty. But this changing role of TTOs not only requires different processes, services, and TT success measures, but also a different mindset in TT staff. While they were often seen as administrators in the past, their work today has to be customer-focused and relationship-oriented. Also, prior industry experience in addition to a scientific background can be helpful.

Although many universities still regard patenting and licensing as well as entrepreneurship services as major tasks of their TTOs, efforts to establish long-term strategic partnerships with companies are likely to produce high additional revenues in terms of future collaboration opportunities. Moreover, enhanced trust and better communication will not only affect a university's TT performance but also enhance the success of ongoing collaboration projects. It is therefore important that TTOs begin to establish relationship-oriented services in addition to the more traditional forms of TT.

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