CRAFTING UNIVERSITY-INDUSTRY INTERACTIONS: A TYPOLOGY AND EMPIRICAL ILLUSTRATIONS FROM UPPSALA UNIVERSITY, SWEDEN

Competitive paper submitted to IMP2013

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Abstract

Relying on an embedded case study over two interaction-stimulating tools of Uppsala University (AIMday and SMURF), this paper addresses four research questions concerning (1) the types of university-industry interactions, (2) the way this university crafts such interactions, (3) the perceptions and assessments made of these interactions by the various involved actors, as well as (4) the differences in such perceptions and assessments. As for the first question, we formulate a typology of university-industry interactions including "participation", "cooperation", "collaboration" and "relationship". As for the second question, the paper develops a process model connecting these four types of interactions and revealing the importance of a fifth type of "potential" interactions between researchers and companies, namely "contacts". As for the third and forth question, we identify both convergence and divergence in the perceptions and assessment of university-industry interactions made by the three involved parties – researchers, companies and university management: there is convergence in researchers' and companies' appreciation of contacts, cooperation and collaborations, on the one hand, and the key performance indicators applied by university management to measure such interactions, on the other hand; but a divergence appears in the relative lack of indicators measuring relationships in exhaustive ways, despite the great value that both researchers and companies attribute to them.

Keywords: university-industry interaction, typology, cooperation, collaboration, relationship, KPIs.

Acknowledgment: financial support for this study has been provided by Handelsbanken's Research Foundation within the frame of the project "The Innovating University".

INTRODUCTION

When it comes to commercializing science Sweden makes an interesting case as Swedish universities are mandated by law to commercialize their science, while a national regulation, known as "the teacher's exemption" grants all rights of a scientific discovery to the researcher (Nilsson, Rickne & Bengtsson, 2010). This situation makes the traditional linear spin-out funnel (Clarysse et al., 2005), based on the sequence "select discoveries/patent them/license them-exit", less of an obvious choice for Swedish universities, and induces them to apply also alternative mechanisms to diffuse science to industry. Several of these mechanisms are instead based explicitly on stimulating various forms of university-industry interactions (cf. Jacobsson & Perez Vico, 2010).

However, as stressed by Perkmann and Walsh (2007), current research seems to lack *deep descriptions and analyses* of university-industry interactions, especially of universities' efforts to craft such interactions from start, that is, *before they are established relationships*. Therefore, this study adopts an exploratory approach and analyses how a specific university, Uppsala University, Sweden, operates to stimulate university-industry interactions. Our purpose is addressing four questions: (1) what types of interaction can be identified between these parties? (2) how does a university practically operates to craft these interactions? (3) how are the results of these efforts perceived and assessed, including formal measures in terms of KPIs (key performance indicators), by the involved parties, namely the university management, researchers and companies? (4) are there differences and similarities in the various parties' assessments and measurements of university-industry interactions?

Relying on theory over inter-organizational relationships (Johanson & Mattsson, 1987; Håkansson & Snehota, 1995; Håkansson & Ford, 2002), we penetrate the key features, components and processes of university-industry interactions in abstract terms. Key dimensions are for instance the depth, formality, mutuality, involved resources, intensity and duration of these relationships (Ibid). This theoretical review is the starting point for developing a typology of university-industry interactions, which we refine from the analysis of two case studies, centred on two different interaction-stimulating mechanisms implemented by Uppsala University, AIMday and SMURF. AIMday is a tool stimulating researchers and industry to meet unconditionally and discuss topics that interest both parties; whereas SMURF's purpose is that companies and researchers collaborate on a joint project with concrete goals. The two cases are expected to stimulate different types of interactions between university and industry, and display accordingly different KPIs.

The remainder of the paper is organized as follows: the next section reviews theories on university-industry interactions and builds our theoretical frame; then comes our methodology, followed by a joint empirical section featuring our two case studies. The next section analyses the cases by applying our theoretical concepts in order to define our typology of university-industry interactions, as well as to identify similarities and differences in how these interactions are perceived and measured by university management, researchers and companies. The paper concludes with policy implications and avenues for future research.

THEORETICAL FRAMEWORK

This section starts by reviewing the concept of university-industry *interaction*, as viewed from the literature on the commercialization of science and technology transfer. Our

theoretical review moves then to the IMP perspective, which investigates the general issue of *inter-organizational* interaction. University-industry interaction can in fact be considered as a sub-category of inter-organizational interactions and relations, phenomena for which the IMP approach provides several useful analytical tools, dimensions and models. Finally, we discuss the parties involved in university-industry interactions, stressing the perceptions and assessments of these actors about the ongoing or hoped for interactions between academia and industry. We conclude this section by combining the key concepts reviewed into a theoretical frame over the role of KPIs in crafting university-industry interactions.

University-industry interactions

According to the Triple Helix model (Etzkowitz, 2004b; Etzkowitz & Leydesdorff, 2000) university-industry interactions are important to promote knowledge diffusion from the latter to the former and to the broader society. Such interactions intervene also in more detailed and variegated ways in the various mechanisms followed by universities in order to diffuse or commercialize their science (for a review of these mechanisms see e.g., Nilsson et al., 2010; Jacobsson & Perez Vico, 2010; Clarysse et al., 2005; Mowery, 2005; Etzkowitz, 2004a: 72-3).

Negotiations, such as those required for licensing out a discovery or taking stake in a spin-off, entail rather close interactions between universities and companies. An even deeper and closer relation, lasting longer than just a set of negotiations, is instead necessary when industry and academia conduct joint research, share personnel or equipment or are bound by long-term consulting, education and contract research agreements. In these situations, interaction is substantiated by the two parties – university researchers and the company – getting directly involved in each other's activities and resources (see Plewa Quester & Baaken, 2005). In some cases, interaction transforms into full blown industry-university *collaborations* (Santoro, 2000), and in even fewer cases into research *alliance* (Bercovitz & Feldman, 2007).

Even if he does not provide a clear definition of the "collaboration" type of interaction, Santoro (2000: 258-60) starts from the broad notion of "working together" and includes in the concept of "collaboration" such elements as (1) financial support of academic research by industry, (2) "cooperative" research conducted by university staff, either contracted by the company or together with company staff, (3) "knowledge transfer" in terms of dedicated education programs for companies, shared personnel or recruitment of university-trained students and PhDs, and (4) "technology transfer" including such activities as solving company-specific problems and licensing out particular inventions. Similarly, Bercovitz and Feldman (2007) do not define explicitly what type of interaction a research "alliance" is, but they (Ibid: 933-4) suggest that an alliance-like interaction can entail both a *single transaction* (e.g., only one research project or the purchase of just a specific patent) and *in-depth long-term relationships* including multiple transactions performed over several years (e.g., multiple sponsored projects, regular hiring of graduate students, personal ties with faculty members).

Therefore, even without a clear definition of the "collaboration" and "alliance" types of university-industry interactions, we can consider them as more advanced and sophisticated types of interactions between industry and academia compared to simply "meeting", "creating contacts" or "communicating" with each other. However, focusing research only on the more advanced type of interactions restricts the attention to a very narrow number and type of interactions (those that survived or appear as strongest), while neglecting a very large number

and several other forms of interactions (those that are a precondition for the former). Therefore, this paper explicitly considers also the "weaker" or shorter-term types of interactions between universities and companies, namely those interactions including only communication activities or simply acquaintances.

University-industry interactions, irrespective of their strength and duration, include several types of links (Vedovello, 1997, 1998): formal (e.g., contracts) and informal ones (e.g., personal contacts), or human resource links (e.g., shared personnel). How many and how deep these links will be between a specific university and a company depends on the *characteristics* and *strategies* of these two parties. For instance, companies conducting intensively own R&D, especially if of explorative character, tend to have deeper and multifaceted interactions, with multiple links to their university partners (Vedovello, 1998: 224 Bercovitz & Feldman, 2007).

As for the characteristics of universities, there are at least two relevant organizational levels that impact on interactions with industry: the *academic researchers* and the *university administration* (including especially Technology Transfer and Industrial Liaisons Offices). As for the first level, individual researchers' status and previous experience strongly impacts the type of interactions with industry they promote, with a clear preference for direct interactions (e.g., consulting or joint research) instead of patenting and spin-out activities (D'Este & Patel, 2007). Researchers with increasing experience of interacting with industry, higher academic status and of younger age are typically involved in more variegated types of interactions with industry (Ibid: 1309). Prestige and research quality of research groups and departments do not imply necessarily increased variety or depth of interactions with industry, since less prestigious groups are more prone to accommodate any request from industry (Ibid).

As for the university management, Technology Transfer and Industrial Liaisons Offices facilitate university-industry interactions, but only if they balance the *centralization* of competences (e.g., in technology scouting and IPRs) and of common incentive schemes with the *decentralization* necessary to provide dedicated service to single research groups and companies (Debackere & Veugelers, 2005). Moreover, a university's strategy giving priority to the "spin-out funnel" (Clarysse et al., 2005) as opposed to more interactive and informal mechanisms (Jacobsson & Perez Vico, 2010, Nilsson et al., 2010) has a great impact on the type, depth and duration of interactions with industry.

An IMP perspective on university-industry interactions

The IMP (Industrial Marketing and Purchasing) Group (www.impgroup.org) is a research community and theoretical perspective which has been analyzing, both empirically and conceptually, inter-organizational interactions, relationships and networks for the last 30 years (see Ford, 1980; Gadde & Mattsson, 1987; Axelsson & Easton, 1992; Håkansson & Snehota, 1995; Araujo, Dubois & Gadde, 1999; Ford & Håkansson, 2006; Mattsson & Johanson, 2006, Håkansson et al., 2009). The very empirical background of IMP is an in-depth analysis of the interactions going on between industrial customers and suppliers, conducted by means of the early "Interaction Model" (Håkansson, 1982: 15-22) featuring the following key constructs: 1) the *parties* involved in interaction, both the organization (including their strategy, technology and structure) and the individuals (represented by their aims and experience); 2) the very *interaction process*, divided into *short-terms exchange episodes* of products/services, information, financials and social nature, and *long-term relationships* encompassing institutionalization of exchanges and especially *adaptations*;

3) the *atmosphere* enveloping the interacting parties and process, in terms of mutual power/dependence, cooperation, cultural closeness and expectations.

According to this model (and the IMP view in general) a "business relationship" is a special type of inter-organizational interaction, which emerges when, next to simple exchanges of resources and information (the classical "transactions"), also *adaptations* appear (Ibid: 19). Admittedly, even repeated transactions without any adaptation from either party would not qualify an inter-firm interaction as a relationship. Adaptations are concrete changes in the activities, routines, resources or organizations of the two parties involved. Adaptations can be viewed as investments made by one or both parties with the expectation of obtaining some benefit in the future: for instance, more efficient internal processes geared towards a certain counterpart or solutions better fitting the need of a counterpart. Hence, an important dimension of the inter-organizational interactions that turn into full-blown relationships is the *commitment* to make such investments and adaptations specifically for a counterpart and the *trust* that the counterpart will behave favourably (keeping promises, increasing future volumes, respecting confidentiality etc.).

Håkansson and Snehota (1995: 7-10) identify a set of common characteristics of inter-organizational interactions, especially when they turn into ongoing business relationships. Four characteristics are of "structural" nature: *duration/continuity* (meaning that relationships are long-term phenomena that exist over years), *reciprocity/symmetry* (meaning that the resources, power and commitment brought by the interacting parties are typically balanced or at least tightly connected), *complexity* (meaning that relationships include several and multifaceted connections at social, economical and technical level), and *informality* (stressing the prevalence of informal exchange norms, based more on mutual trust than formal contracts and penalties). Four characteristics of business relationships are instead related to their "processes": next to the already mentioned *adaptations*, *cooperation and conflicts* (stressing how the interacting parties both cooperate and engage in conflicts as part of the normal life of a relationship), *social interaction* (indicating that alongside economic and technical dimensions also personal bonds among individuals are created), and *routinization/institutionalization* (referring to the emergence in established relationships of common norms and routines which might be hard to change).

When inter-organizational interactions move from simple negotiations and transactions to long-term relationships, they assume a "substance" which can be analyzed by breaking down interactions, and especially the ongoing adaptations, into three levels of connections between the interacting parties: *Activity links*, *Resource ties* and *Actors bonds*, according to the so called ARA-model (Håkansson, 1987; Håkansson & Snehota, 1995). Activity links refer to how the two organizations have connected their activities and routines across their organizational boundaries; resource ties to how they have combined their resources such as equipment, products, personnel and competence; and actor bonds to how the perceptions, goals and strategies of the two companies are related (including the issue of mutual trust and commitment). The strength of these links, ties and bonds varies greatly from a relationship to another and moreover, a relationship can present strong actor bonds but weak activity links and resource ties, or vice versa.

Moreover, the strength of links, ties and bonds typically varies over time for one and the same relationship, signalling how it changes and develops (Ford, 1980; Medlin, 2004; and Shurr, Hedaa & Geersbro, 2008). A "relationship development" model proposed by Ford (1980) and elaborated in Ford et al. (2003: 51-8) identifies four development stages ("pre-relationship",

"exploratory", "developing" and "stable"), whereby the parties move from low commitment and no common routines to increased mutual learning and trust, built thanks to investments and informal adaptations. However, the model is not deterministic in the sense that one stage must not be followed in a sequence by the next (e.g., exploratory by developing), because the relationship can always revert to a previous stage because of changed requirements, insufficient resources or lack of commitment (Ibid: 51, 56).

The models and concepts from the IMP perspective are particularly adequate when investigating inter-organizational interactions and relationships between industrial customers and suppliers, typically in the form of firms or public organizations (e.g., hospitals or utilities). But the same concepts and dimensions of interactions that we reviewed above (e.g., trust, adaptations, commitment, short Vs. long-term, power & dependence, conflicts & cooperation, routinization/institutionalization, formality & informality) are also highly relevant for university-industry interactions. Nonetheless, university-industry interactions are likely to present different "values" of these dimensions if compared to a typical business relationship between for instance a steel producer and a shipyard. For instance, academic regulations delimits the level of adaptations in administrative processes and rules a university can make for a specific industrial partner, while academic autonomy probably constrains the degree of dependence it can accept in relation to a single firm. Another difference concerns the exchanged resources, which are likely to embrace more immaterial and knowledge-related elements than physical products. Issues such as tightly coordinated activity links (e.g. in JIT arrangements) are also exceptions in university-industry interactions, where the "products" delivered by universities to companies are unlike to enter directly in their routine production activities.

Still, several *dyadic* constructs (i.e., embracing both parties) operate in similar fashion in both B2B and university-industry interactions. For instance, Santoro (2000: 267) found a positive spiraling effect in the development of university-industry relationship whereby the more the tangible outcomes (e.g., publications or patents) and the more intense the relationship becomes. He found instead that the history or length of a relationship is not related to its intensity and depth (Ibid: 268), which are instead more driven by current production of tangible outcomes. Reflecting the interaction atmosphere concept we reviewed above, Plewa and Quester (2007) found that compatible organizational cultures between a university and a company improves trust, commitment and satisfaction in the relationship. Moreover, the barriers to cooperation deriving from diverging motives, time orientation and core values between universities and companies can be easier overcome if trust is built via extensive interactions, especially informal ones (e.g., staff exchange and mixed team building), and if senior management supports and empowers employees operating in the very relationship (Plewa et al., 2005: 449). Another commonality with B2B relationships, is that also in university-industry relationships some of the values created are common to both parties (e.g., new knowledge creation), whereas other values are aimed at mostly by researchers/universities (e.g., obtaining additional funding) or mostly by industry (e.g., direct technology gain or contacts and networks, Ibid: 447).

The actors involved in university-industry interactions

University-industry interactions, similarly to business relationships (Håkansson & Snehota, 1995) can be complex phenomena, involving several types of actors. As already mentioned in our review of this type of interactions in section 2.1, these interactions involve at least three groups of actors: the *university management* (i.e., the organizational units fostering industrial

liaisons and technology transfer), single *researchers* (conducting actual research or education) and *companies*. This three-party game can become even more complicated if other organizational layers within academia intervene, such as the university department employing a researcher (and which may be involved in signing some contracts as it owns the equipment that researchers use in their interactions with companies), or specific units within the company (which become relevant especially for large divisionalized firms, with clear a distinction between R&D and production units).

For the purpose of our study, namely to analyze how university-industry interactions are crafted by universities, while we can consider the company as a single counterpart, it is necessary to consider university management and university researchers as separate parties in these interactions. The main reason is that the roles and the goals of university management are different from that of researchers: the former include Technology Transfer Offices (TTOs) and Industrial Liaisons Offices which do not perform research but are responsible for *diffusing science* to external parties, typically by stimulating and creating interactions with industry; the latter do perform research and are expected to use their knowledge and capabilities while interacting directly with companies. Moreover, the very mission of those offices belonging to the university management clearly includes *crafting interactions between academia and industry*, as a way to diffuse or commercialize science – which is motivated in the US and UK by an attempt to compensate for slower growing public funding (Mowery & Sampat, 2005: 211) and in Sweden by an explicit legislative mandate to universities to support national innovations (Henrekson & Rosenberg, 2001). In order to achieve this mission, TTOs and Industrial Liaisons Offices, both in Sweden and elsewhere, have introduced specific *tools and mechanisms* aiming to identify and contact companies, bring them closer to academic researchers, and foster connections between these two parties, in the hope that this will then lead to actual collaborations (cf. Debackere & Veugelers, 2005: 339).

A key question is therefore: is the university-industry interaction (or relationship) an interaction between a company and the university management or between a company and the researcher? We argue that it is both (cf. Bercovitz & Feldmann, 2006), because there are different layers, levels, dimensions and time horizons in one and the same interaction, making it complex and involving several specific actors (Ibid: 182). For instance, while Industrial Liaisons Offices and TTOs are typically engaged in formal (e.g., negotiations and contracts), long-term oriented but intermittent interactions, researchers typically take part in the informal day-to-day interactions with one and the same company (cf. Debackere & Veugelers, 2005: 325).

In their role and mandate of stimulating university-industry interactions, TTOs and Industrial Liaisons Offices may also actively engage in those same interactions also third parties acting as external financiers or controllers: for instance, National Research Councils or national and transnational innovation agencies, such as the Swedish Governmental Agency for Innovation Systems (Vinnova) or the Swedish Agency for Economic and Regional Growth (Tillväxtverket), all the way to EU-related bodies. Within the Swedish context, the latter agencies have a key role in the emerging university-industry interactions as universities' TTOs and Industrial Liaisons Offices are increasingly financed by them. The presence of external financers for the operations of university management requires the latter to report on the actual outcome of their interaction-enhancing activities, which is made according to a growing variety of key performance indicators, ranging from number of meetings with companies to number of initiated fruitful collaborations (Baraldi, Ingemansson & Launberg, 2012).

As so many different actors intervene in university-industry interactions (TTOs, Industrial Liaisons Offices, public innovation agencies, companies, university departments and single researchers), they all bring into the process their different *perceptions* and *assessments* of the interactions between the two focal parties, the researchers and the companies. Each actor evaluates in its own way the results and effects of these interactions, typically informally and according to own idiosyncratic preferences and experiences. However, these evaluations are becoming increasingly explicit and formalized, in the form of KPIs (Ibid). These *formalized evaluations* are in focus in our investigation of university-industry interactions. In fact, it is especially the "crafted" interactions, that is, those externally stimulated by the intervention of university management, that are exposed to being monitored and evaluated in increasingly formalized way, just because specific tools have been created and investments (often via external funding) have been made to foster them. KPIs become thus a way for university management (and also higher up in the policy making/implementation hierarchy) to measure the performance of TTOs and Industrial Liaisons Offices in terms of ensuing university-industry interactions. However, KPIs represent the university management's perception and assessment on these interactions, which may or may not be aligned with the perception and assessment of the involved researchers and company. This is indeed one of our research questions, namely investigating differences and similarities in the assessment and measurement of university-industry interactions made by the different actors involved.

Based on this theoretical review, our theoretical frame, depicted in Figure 1, includes *three main actors* ("university management", "researcher" and "company") and focuses on the *interaction* between (1) "researcher and company", but also includes the interaction (2) "university management-company" (the two thick arrows in Fig. 1). University management devises and applies specific *tools* (such as AIMday and SMURF, the two cases analysed in this paper), which have the specific purpose of *stimulating, shaping and crafting interaction* nr (1), but also possibly nr (2). These tools have also built-in *KPIs* applied by university management as a way to measure and steer the creation and development of university-industry interactions. These KPIs reflect and focus on several types of effects and results in these interactions (see the single-headed arrows in Fig. 1), which can be related to the interaction dimensions taken from IMP studies (depth, duration, adaptation, cooperation, values created). However, the company and the researcher may have different goals, perceptions and assessments on their mutual interactions than those included in the KPIs applied by the university management.

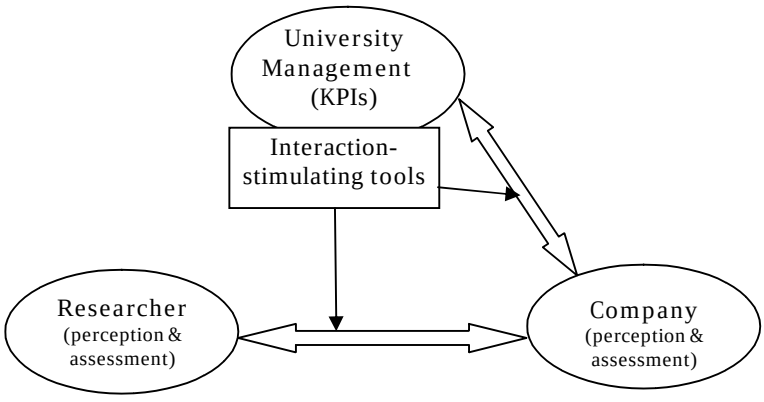

Figure 1: A three-party framework over university-industry interactions

METHODOLOGY

This paper relies on a comparative case study methodology (Yin, 1994), based on two cases over two different interaction-stimulating mechanisms, AIMday and SMURF, devised and applied by Uppsala University. As the two cases are extracted from the same organizational context, they reflect an "embedded case" method, which is viewed as particularly useful in unravelling the complexity of inter-organizational interactions and networks (Easton, 1995: 480). The two cases where selected according to a theoretical sampling logic (Eisenhardt & Graeber, 2007: 27), since our approach is exploratory and we do not aim at a statistical, but at analytical generalization (Yin, 1994): in fact, these two innovation-stimulating mechanisms address *different types of university-industry interactions*, which are one of our key theoretical concepts and relate with our paper's purpose of identifying a typology of such interactions.

More precisely, AIMday is a tool stimulating researchers and industry to meet, often for the first time, unconditionally and simply discuss topics that interest both parties with the purpose of *initiating* any type of interaction, no matter their depth. The purpose of SMURF purpose is instead that companies and researchers build collaborations on a joint project with concrete outputs. The two cases display accordingly different KPIs, another of our key theoretical concepts. Therefore, the two cases are complementary from a theoretical point of view. They are moreover *comparable* because they are not only embedded cases sharing the same context, but they have also been constructed following a common data collection logic searching for the same theoretical issues (nature and process of the applied innovation-stimulating tool, actors involved and their perceptions and assessment, as well relevant KPIs).

Our empirical materials (see Appendix) was collected between 2010 and 2012 by means of several sources of data: *participant observations* to 6 AIMday events (including active participation to the discussions in 4 AIMdays) and to all 17 project and steer group meetings of SMURF (as two of the authors act as "ongoing evaluators" of this project); over 40 *qualitative interviews* conducted with representatives of UU Innovation, ÅMA, UUAB, SLU Holding, and several companies and researchers involved in AIMday and SMURF; an online *surveys* distributed to 30 SMURF companies, 15 of whom answered and among which three were selected for in-depth interviews (see Appendix); *documents* such as brochures, official applications, internal reports provided by university organizers, researchers and companies. We view our data as sufficiently rich to cover the multiple aspects of the phenomenon we investigate. As for AIMday for instance, all persons involved in developing and organizing the event have been interviewed on several occasions, while for SMURF interviews were conducted with all members of the project group at least twice, and with some key persons even more often.

The main themes in the interview guides we used with representatives of the university management (UU Innovation, ÅMA, UUAB SLU Holding) were the organization and process of the two interaction-stimulating tools, their goals, effects and key performance indicators, as applied by the university management. The interviews with companies and researchers covered instead the actors' perception of the interactions and effects created by AIMday and SMURF, with a focus on how these interactions are evaluated by these actors.

One of the first steps in the analysis of the empirical material was to build the two cases. However, while the cases were built with a similar structure (background, organization and process for creating university-industry interactions, perceptions and measures/KPIs), as a way to enable a straightforward comparison, it became then evident in our ongoing analysis

that they were indeed more *complementary* than simply comparative. In fact, they provide variation and overlap in the types of interactions featured rather than pure differences. Therefore, our next step of analysis was searching *across both cases* for different types of interactions, based on the theoretical concepts above (mostly the ARA model, but also depth of interaction, level of adaptation and type of exchange). From this search, four types of interactions emerged immediately, while the fifth type ("contacts") emerged only when building a descriptive model over Uppsala University's process for crafting various types of interactions. Therefore "contacts" have not been included as a type of interaction per se in our typology, but are kept more as a sort of "potential" interaction, which contributes to the *movements* between different types of interactions in the model. We developed this model after applying our typology of four/five interaction types back to the two cases, which we at this point considered even more explicitly jointly and as complementary aspects of Uppsala University's approach to crafting interaction with industry. Finally, our analysis of the perceptions and assessments of the various actors was made first case by case, and then over the two cases jointly, as it appeared that the actors focussed on different but complementary types of interactions in each of the two cases.

THE CASES OF AIMDAY AND SMURF AT UPPSALA UNIVERSITY

The empirical material starts by presenting the common background to the two interaction-stimulating tools AIMday and SMURF (4.1), then focuses on the specific background, process, perceived results and measurements of AIMday (4.2) and SMURF (4.3) respectively.

Uppsala University's history of interacting with industry

Uppsala University was founded in 1477 and has probably always interacted with its surroundings through different constellations. Since the 1970's Uppsala University has had an Industrial Liaison Office, which however did not perform as expected. Nevertheless, the university's contemporary interaction strategies, especially aimed at industry, did not start to take shape until the year of 2000 when the Swedish Foundation of Technology Transfer decided to place the Industrial Liaison Office as a subsidiary to the university's holding company (UUAB) in an attempt to improve the liaison office's performance. The reorganization also meant that all personnel were replaced by a new manager that had a long industrial experience.

The new manager of the Industrial Liaison Office quickly perceived a negative view, wide spread throughout industry, when it came to collaborating with universities: researchers did not deliver in time and when they did it was rarely what had been agreed upon. This problem needed to be solved in order to enable the liaison office's mission. The manager found a group of researchers at the university's Materials science division that seemed to have overcome the problem as they had established relationships and frequent collaborations with industrial partners. In 2002, the Industrial Liaison Office, together with professors of the Materials division formed "Ångström Academy", an organization aimed at creating university-industry collaborations using the Materials researchers' experience. Ångström Academy succeeded in launching a few collaboration projects. Therefore, in 2004 the Swedish Agency for Innovation Systems (Vinnova) offered Ångström Academy 100 000 € for being part in a one-year pilot project for the so called Key Actor's Program. This national program aimed to facilitate general "cooperation" between academic research, industry and society through the creation of a professional infrastructure and entrepreneurial culture within

the universities. Ångström Academy had experience in interacting and even concretely collaborating with industry, and therefore acted as a reference group to Vinnova's discussions on how to shape a program for university-industry cooperation.

In the year 2005 new directives came from the Swedish government demanding a "Plan of action" from the Swedish universities on how they would support the commercialization of academic research. Together with UUAB and the Industrial Liaison Office, Uppsala University management formulated an action plan that did not only involve traditional technology transfer, through the licensing and creation of new companies via patents, but also an alternative "proactive" approach emphasising the utilization of science by crafting closer and long-term interactions with companies. The action plan later became an important part in the university's application, submitted in 2006, for Vinnova's 8-year-long Key Actor's program. The application emphasised and described a new innovation support unit, placed directly under the University management and closely related to the holding company, which aimed to develop platforms that facilitated university-industry cooperation.

In 2007, this unit, named Uppsala University Innovation (UUI), started its operations and, with its five-year history and a few established relationships to industrial partners, Ångström Academy, renamed "Ångström Materials Academy" (ÅMA) became UUI's first academy-industry cooperation platform. Today ÅMA is more than simply a platform to stimulate general cooperation, because it is an organization of its own with members, from both industry and Uppsala University, all paying an annual fee. ÅMA assumes the features of an alliance between selected industrial partners and Uppsala University, with a board composed of representatives from five of Sweden's largest corporations in the steel and power industries, from three of Uppsala University's research departments and from the University management.

AIMday

UUI is responsible for the university's cooperation efforts, generally speaking, designed to foster economic growth in the society (www.uuinnovation.uu.se). These efforts are promoted primarily through strategic cooperation platforms, like ÅMA, in which physical meeting places are arranged, where academic researchers and representatives from industry meet. It is a proactive approach in that it promotes academic-industry interaction prior to, or irrespectively of the disclosure of a commercially potential scientific discovery. Instead it strives to facilitate the creation of *long-term academic-industry relationships* by involving industry in academic research and vice versa. The idea is that academic research is more directly utilized in this way, in addition to the linear commercialization process provided by the University's holding company. One physical meeting place arranged by UUI is AIMday (Academy Industry Meeting day), which in practice is a one-day conference where academic researchers and industry meet to discuss issues formulated by the participating companies. The conference was developed by ÅMA, which however, as already mentioned, had already been running for five years as Ångström Academy and had industrial partners closely related to it. Nevertheless, from its start in 2007 ÅMA was not a finished concept as it still lacked tools that efficiently could promote additional forms of university-industry cooperation.

The background of AIMday

It would take a study visit to Massachusetts Institute of Technology (MIT) in Boston to formulate the concept of ÅMA. During the study visit the UUI managers were briefed about a

conference called the “Materials Day” where researchers and industry presented their latest research and work in seminars and during which innovation awards was granted to innovative researchers. The idea was to create something similar within ÅMA, which was an assignment given to the manager of the platform. According to the manager, it was not enough with traditional presentation where academic researcher and industry presented their work to each other since these kinds of meetings rarely where efficient to promote the creation of university-industry cooperation or even more concrete collaborations. The reason for this, according to the manager, is that meetings in terms of traditional presentations are strongly affected by barriers hindering academic researchers and companies to find each other, as they do not fully understand and grasp each other. Researchers tend to go into detailed technological aspects, while industry is more interested in getting something to work, good enough, and make it profitable as fast as possible. Researchers also tend to use technical research terms that industry does not understand.

Thus, to make ÅMA’s concept as effective as possible and overcome barriers like these, ÅMA’s manager chose to divide the “Materials Day” into different activities running at different occasions during a one year period. The traditional presentations were transformed into lunch seminars where people with different backgrounds give a presentation for researchers and other actors that choose to attend. Once a year innovation awards are granted to Uppsala University researchers connected to materials research that has proven to develop commercially valid research. The third main activity, AIMday, became the key component for the facilitation of university-industry cooperation as it, according to the UUI and ÅMA managers, make researchers and companies meet on equal conditions by focusing on industrial problems and issues instead of progress within research. In addition to these three main activities ÅMA focus on connecting the university’s education with industry through, for instance, finding student projects within companies.

Since its starting point in late 2008, AIMday has spread to other research areas than Materials sciences via UUI’s other two cooperation platforms focused at Life Sciences and Humanities and Social sciences (HumSam) respectively. AIMday has also successfully attracted the interest from various actors in what can be term as the Swedish innovation system. As a result, AIMday has become a very important interaction-stimulating tool for UUI.

The process behind AIMday

AIMday is a one-day conference composed of a number of workshops running in parallel. In each workshop a company, together with a multidisciplinary group of academic researchers, discuss a question or issue formulated by the company. According to the managers, a multidisciplinary group of researchers is important to generate more than one view on the issue at hand. All companies that associate themselves to the theme of the conference are welcome to participate as long as they submit at least one question. For each AIMday, the organizers put a lot of effort in marketing the event and its topic to receive questions from industry. According to the managers, this process requires both a good knowledge about different companies’ operations and a good contact network with industry. When questions from industry are received, researchers with knowledge or interest in the topic can register their participation to the questions at hand. Researchers from all universities are welcome.

However, for the organizers it often takes hard work in terms of pitching the questions to make them both understandable and interesting for the researchers. Organizers often need to contact researchers they think have knowledge in the question to get some feedback about his

or her perception of the question. Thereafter, the organizers contact the company responsible for the question and discuss how to pitch it to the researchers without losing its meaning to the company. This often requires some knowledge around the topic from the organizers themselves. When all questions finally are pitched the organizers still often need to contact researchers, whose competence they feel fits the questions' different topics, to simply ask or remind them to register, as the researchers often prioritise other work than their participation to AIMday. For this, a good contact network between the cooperation platform managers and researchers is needed. According to the managers a workshop group should consist of 1-3 company representatives and 6-10 researchers ranging from PhD students to professors and should not last for more than one hour. This approach is important to get a rewarding discussion that focuses on the issue at hand. As soon as all questions from industry have been submitted and researchers have started to register, a schedule is outlined, fitting with both companies that have submitted and researchers that have registered to more than one question. The schedule is based on a number of sessions comprised of a number of workshops each.

From start, AIMday was organized by ÅMA once a year and aimed at industry and university research connected to the area of Materials science. However, the activity soon started to spread to other research areas: AIMday is now a key component in all of UUI's cooperation platforms, and has been adopted by other Swedish universities. The rapid evolution and expansion of AIMday created problems for UUI. They feared that the concept would become diluted and lose its attractiveness for industry and researchers, as it would transform when moving between different organizers and scientific areas. Thus, UUI has chosen to protect the AIMday concept by trademarking it and formulated guidelines specifying how an AIMday should be organized and operated. Today, other universities than Uppsala University have organized "their own" AIMday in areas like Energy, Sustainability, Image analysis and Patient safety, while UUI can keep control of its usage. AIMday continue to spread as an interaction-stimulating tool across actors belonging to the national innovation system and in 2012 an AIMday-organizing-committee was created, comprised of a number of support organizations belonging to different Swedish universities. Figure 2 shows the actors involved in AIMday.

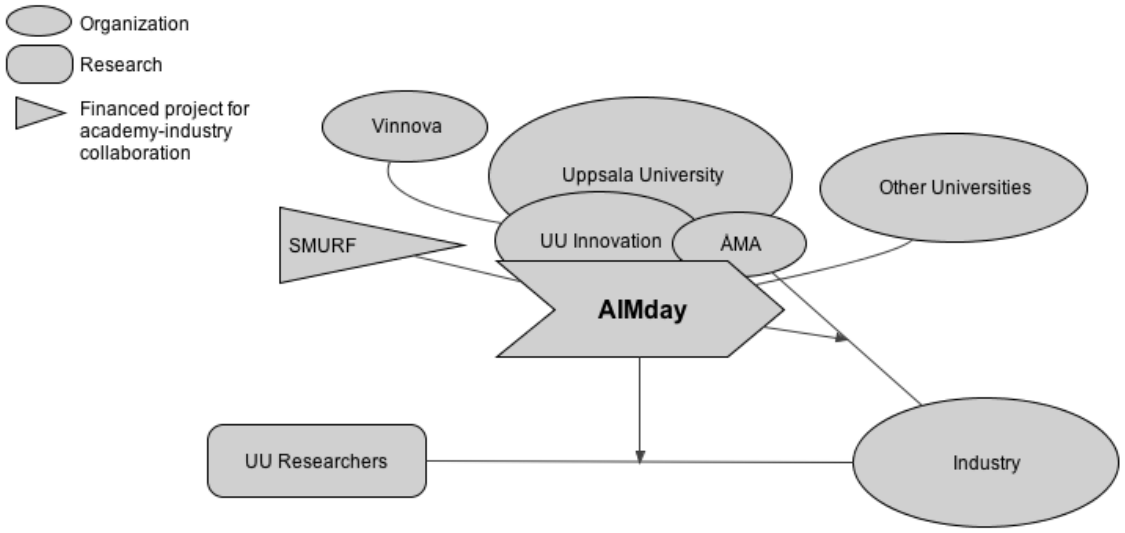

Figure 2: The different actors involved in AIMday

Perceptions and results of AIMday

The overall objective of AIMday is not to give answers and/or solutions to industrial problems, but to bring together companies and researchers and thereby stimulate cooperation during rewarding discussions, which might even open up for the creation of concrete university-industry collaborations in the future (aimday.se). AIMdays have been run 16 times in total, since 2008: on average these AIMdays involved 15 companies with 35 representatives and 70 university researchers in about 25 discussions of the submitted questions. An interesting question is what AIMday has resulted in, when it comes to concrete outputs and other effects for the involved parties? Even though AIMday has led to a couple of dozen small university-industry collaborations, this is not what the majority of participants stress as the most important value emerging from the meetings.

Researchers emphasize that the discussions generate mutual knowledge transfer between academy and industry. In other words, discussing industrial issues and problems broadens the researchers' competence by learning from the "real world". Thus researchers also feel that they can reframe their research agenda to better fit industrial needs. Having a research agenda fitting industrial needs opens the possibility to find collaborations and to be granted funding, and AIMday works as a shortcut for researchers to find favourable industrial contacts. Researchers also emphasize that AIMday promotes learning from other research areas, as the workshops are comprised of multidisciplinary groups of researchers. Another important aspect with AIMday, emphasised by the researchers, is that the activity makes a good opportunity to market and sell the actual use of laboratory equipment to industry.

Companies emphasize the value of expanding their network of contacts with academia, by getting to know new researchers, and strengthening their current relationships with those they already know. A common perception for the participating companies is also that there seldom is a direct utilization of science to solve a concrete industrial problem. Instead they underline that, through the discussions on AIMday they can expand and deepen their understanding of a problem, which can save them both money and time. Most companies also feel that researchers are very good at providing insights on new relevant literature and key articles on a certain topic. Another important value expressed by industrial participants is that AIMday opens the opportunity to utilize new analytical methods, tests and laboratory equipment, which are resources most companies do not possess in-house.

AIMday is a key component in UUI's mission to facilitate the diffusion of science to society. Thus, it is essential for the unit to be able to control and measure what the activity contributes to in terms of concrete outputs, like collaborations, as an indicator of the utilization of science. As one of the UUI managers expresses it: *"One day we will get the question of what our activities, e.g. AIMday, actually has contributed to and we will have to be able to show concrete results"*. Looking at more concrete effects of AIMday, both researchers and industry identify that via their participation they more easily keep in contact with current research partners and also can get inputs for finding new ones. Industry thinks that several interesting and highly relevant ideas are generated during the workshop discussions, but due to time constraints and other prioritization within industry (and probably also academia) the great majority of ideas are not followed up and simply wane out.

However, some collaboration between researchers and companies has been initiated as a result from the meetings at AIMday. Still, the greatest majority are short-term and small projects whereby a company is helped with some kind of analysis through testing and

measurement via the use of university equipment. If these collaborations actually are a result from AIMday and what they actually contribute to is difficult for UUI to quantify, as they often are initiated a few weeks, or even moths, after the AIMday event, when participants have had time to contemplate on all meetings and discussions. In an attempt to boost the creation of collaboration projects at AIMday, UUI has chosen to offer pre-study grants via a project called SMURF (described in greater detail below) to promising projects initiated at AIMday. The hope is that a small grant of 5.000 Euro, will be enough to initiate a pre-study that can further develop into a full blown collaboration. This approach has generated around 5 university-industry collaboration projects that are, at least, in a pre-study phase.

Multifaceted measures oriented towards long-term interactions

Both researchers and companies participating on AIMday emphasise that the main value of AIMday is "networking for networking's sake". In other words, AIMday seems to foster the opportunity to expand, strengthen and deepen their network of contacts for future needs. The participants do not prioritize finding answers, solutions or collaborations when attending AIMday, but the creation of an open channel through which they easily can find and use each other when issues may arise in the future. However, since UUI operates mainly through third party funding (e.g., from Vinnova), it needs to be able to measure concrete effects and outputs from AIMday. But this has proven difficult, as researchers' and companies' priority about networking for longer-term purposes has not always resulted in "hard" and easily quantifiable outputs – especially outputs indicating a direct utilization of science for industrial development and national economic growth. Even though UUI's external financing pressurizes them to produce traditional short-term effects, they are well aware that when it comes to the utilization of science through university-industry interaction a long-term approach is needed. Measures and indicators of various sorts have nonetheless emerged in the operations of UUI, especially when it comes to AIMday: these indicators concerns quantifiable direct results such as the number of participants and questions discussed, the number of university-industry collaborations, but also softer aspects such as if participants feel that they found new contacts and their overall impression of AIMday.

At present UUI applies the following indicators, which have all progressively emerged and are gauged via surveys and internal records, in order to evaluate informally AIMday: number of AIMdays, number of questions submitted, number of participating companies, number of participating researchers (PhD and senior faculty respectively), number of participating research divisions, number of participating universities, number of participants who created new contacts, number of participants who developed new knowledge about the topic(s) discussed, number of participants who felt the discussion were relevant for their future work, participants' overall impression of the AIMday and willingness to attend to it again, number of joint applications researcher-company to get funding for pre-studies (via SMURF), number of collaborations initiated via AIMday.

SMURF

SMURF is a joint project between Uppsala University and the Swedish University of Agricultural Sciences (acronym in Swedish, SLU) running between 2011 and 2014 with the aim of enhancing small businesses' development and long-term survival by improving their relationships with the universities of Uppsala. The target group are companies within Life science, Material sciences, Sustainable technologies and in the knowledge-intensive social science service sector. These industries were chosen to reflect and match the expertise of

UU's and SLU's researchers. The focus is however on companies with high growth potential but with limited resources and thus perhaps greatest need for support from the universities. The project aims to create a platform that facilitates and finances *collaborations* between a SME (small and medium sized enterprise) and a researcher manifested in concrete research projects. SMURF has 22 million SEK (about 2,2 million Euro) available to distribute to such collaborations during a timeframe of three years. Half of this sum is provided by Swedish Agency for Economic and Regional Growth (Tillväxtverket, TvV) and half "in kind" by the two organisations operating the SMURF platform, UU Innovation and SLU Holding (whose tasks are similar to those UUI, even if it is smaller in size).

The background of SMURF

According to UUI one of the most important factors for a sustainable economic growth is the region's knowledge-intensive SMEs. The two universities in the Uppsala region can provide knowledge to these firms, but are today an untapped source for the regional SMEs. In fact the most of these companies lack contacts and, even more, long-term relationships with universities, since these companies basically have no capability to fund basic research. Uppsala has not only one but two universities, SLU and UU. SLU has a different research profile than UU, with the largest part of its research and education based in Life science with an emphasis on agriculture and ecology. UU Innovation's conviction was that by also including SLU in the SMURF-project the uptake capacity of SMEs will increase, while broadening the scientific expertise within the project.

UUI and SLU Holding, the unit within the universities' management which operate the SMURF platform, comprise of employees with experience both in industry and in academic research. Hence, their staff's know-how, expertise and contacts are essential in carrying out several tasks and separate projects, most of which are financed with external capital, all aiming to diffuse or commercialize academic research. In the case of SMURF, Tillväxtverket (TvV) is the main financier. The role of the governmental agency TvV is to strengthen regional development and facilitate enterprise and entrepreneurship throughout Sweden. The agency is beneficiary of large financial resources from the European Union's structural fund, intended to reduce the economic and social differences between European regions and its inhabitants. TvV funds SMURF with 11 million SEK and expects that this project will reach a clear goal in terms of regional growth, 20 new employment opportunities.

The explicit goal of SMURF is strengthening SMEs' sustainable economic growth through increased interaction with the region's two universities: this interaction is meant as collaborations within research projects involving smaller companies and researchers at UU and at SLU, as well as the establishment of new contacts between the various partners involved in the SMURF-project.

The organization and the processes within SMURF

Including the coordinator for the entire project, there are seven project managers working with SMURF, five employed by UUI and two by SLU holding. They have higher academic degrees in the areas covered by this platform. The UUI employees are also involved with AIMday enabling a connection between the two interaction-stimulating tools. Each project manager deals primarily with companies within her area of expertise and experience. SMURF follows a loosely structured work procedure that starts with rallying SMEs to the project via information activities aimed at getting them in contact with UUI, SLU Holding or SLU and

UU researchers. There are two basic ways in which companies are brought into the SMURF platform: (1) information activities that can range from spreading information about SMURF out to relevant actors (via e.g., the homepage) to informing about SMURF during a specific AIMday; (2) personal contacts taken from the project managers' large network of connections with companies, if these were considered to fulfil SMURF's requirements and needed to have a problem solved which could be interesting also for an academic researcher.

Engaging a researcher to interact with an SME in a specific collaboration project can follow two different paths: (a) a researcher and an SME have made the connection on their own, for instance through an AIMday, so that the researcher already has an interest in the project; or (b) the project managers exploit their knowledge of the university organisation and scientific areas and asks a specific department or even individual researcher if they are interested in the problem or need expressed by the SME. If the SME is brought in without any prior relationship with any researcher at all, there is often the need to re-formulate the initial problem specified by the SME as to establish sufficient research height so as to be able to engage a researcher.

An application to SMURF's funding can be disqualified for several reasons, one being conflicts of interest, such as ownership of the SME by UU's holding company (UUAB), as a way to avoid funding own spin-offs. Another reason for disqualifying an application is if it is obvious that the SME and the researcher have had a previous relationship with one another, since one of SMURF's goal is to stimulate only *new* collaborations.

After the SMURF project group has agreed that a collaboration project fulfils the formal requirements and has potential to bear useful results to the SME, a project manager from UUI or SLU Holding, the researcher and the SME, cooperate in order to write together a project plan that fits all of their different agendas: The proposed collaboration project has to be relevant for the researcher in a way that is both interesting and useful for her research. It has to specify how and in what way the SME will benefit, namely that a need is met or a problem is solved. Lastly, SLU holding or UUI has to verify that a project plan for the collaboration is specified in such a way that it both fits the regional growth goal of SMURF (20 new employments) and helps reach a set of specific, more detailed key performance indicators stipulated for SMURF platform (see below).

When a collaboration project application is formally approved by the SMURF project group, UUI and/or SLU Holding are no longer involved, except for occasional follow ups through e-mails or phone calls concerning how the collaboration project is progressing. Collaboration between one of the universities and the company is accordingly formalized in the project, which receives financial aid from SMURF. However, no financial flows move from SMURF (or Tillväxtverket) to the SMEs. SMURF pays instead invoices coming from the involved university departments including the following costs: the salaries of the academic researchers working in a specific collaboration together with the SME, as well as other material costs or laboratory rent. Each individual collaboration project can be financed either as a smaller "pre-study", receiving a maximum of 50.000 SEK (about 5.000 Euro), or as a larger "full project", receiving a maximum of 300 000 SEK (about 30.000 Euro).

The invoices from the researchers' own department are the main formal mechanism used by the managers of the SMURF platform to follow up on single collaboration projects. Upon its conclusion, the SME and the researcher summarize the collaboration project's proceedings and results in a final rapport, stating also if the value for the actors has been achieved

according to the project plan. At this stage, the SMURF project managers in charge of a project inquires if the SME can apply for additional funding for continuing the collaboration with the academic researcher, either within SMURF (if the first collaboration was a "pre-study") or some other type of funding from regional or national agencies. The activities conducted after a collaboration project's completion are termed by SMURF managers "networking", and are viewed as a pivotal component of SMURF. In this context, "networking" is specified from the project managers as either a deepened relationship with the same researcher that has been collaborating with the SME or the SME applying for additional funding with a new contact from the universities or for some other financial support scheme that requires R&D connected to a university.

All in all, the process within SMURF follows a work procedure going from (1) finding SMEs that participate in some kind of information meeting, (2) engaging them and (3) formalizing a collaboration project with a researcher. There is then hope that this collaboration project can establish a deeper relationship that over time can result in such results as scientific publication, technical developments for the companies or even new employment opportunities for the company. Figure 3 shows the actors involved in SMURF.

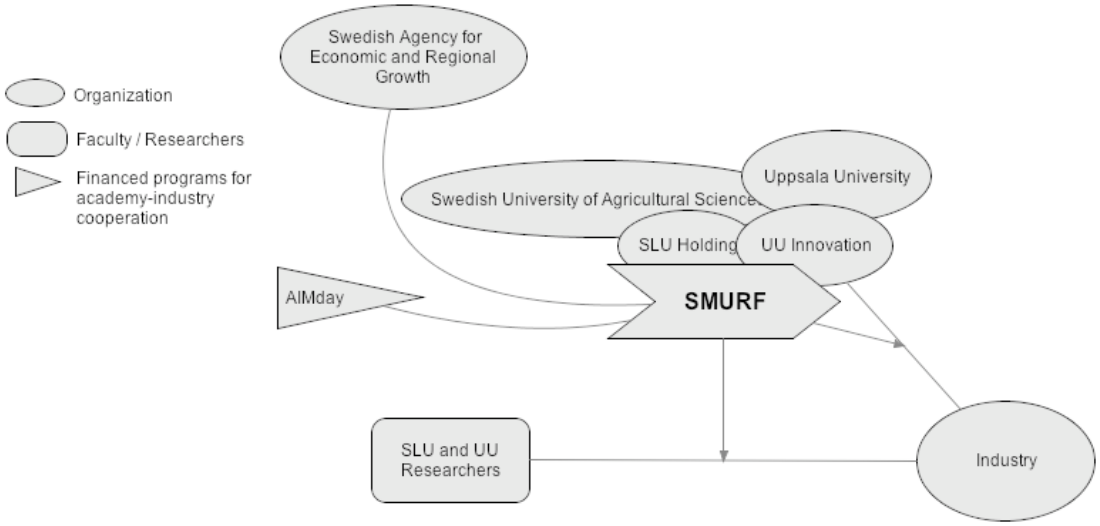

Figure 3: The actors involved in SMURF

The effects and the value of the SMURF platform for the actors involved

As of February 2013, over 500 SMEs had participated in various information events promoting SMURF, about 50 had applied together with a university researcher for project funding, and about 30 collaboration projects had been approved by the SMURF project group and started.

The researchers involved in SMURF attribute several values to engaging in a project with an SME. Some consider as valuable the fact of evaluating their expertise in real-life case studies and of getting relevant industry related examples for students. Some other stress the value of establishing a long-lasting and deep relationship with relevant industry and at the same time

of being able to create good connections for their student master-theses with the business community. Some researchers also express that collaborating with firms within SMURF is a relevant way of fulfilling the "third mission" attributed to Swedish researchers, more so than other activities because SMURF collaborations provide them with a more direct return. More precisely, researchers involved in such collaborations view as very important obtaining financial compensation for the time spent working with the SMEs. In this sense it should be stressed that SMURF collaboration projects appear as relevant both for their own research and for a financial return.

Differently from the researchers involved in AIMday-stimulated interactions, the researchers interacting with industry via SMURF seem to prefer the strict and steered form of SMURF collaborations, with a clearly stated start and finish, rather than a more loosely open ended discussion with an industry partner. However, one must have in mind that AIMday is different from SMURF in many ways, as SMURF requires a greater commitment and longer duration of interaction from the researcher, while AIMday is per se a one-day only interaction event.

The companies involved with SMURF stress also a variety of values deriving from these interactions with researchers: they can get new perspectives on the problem that they together with the researcher work on; some of the SMEs involved with solving a technical problem get access to lab equipment through the project which they would never afford; many companies also consider that by connecting a researchers to their business they can increase their reputation. Moreover, the SMEs express how useful it is to have the chance to work with a researcher without taking the risk to spend their own resources, as especially the small or micro firms would never hire an external agent as it would be too expensive regardless of the value of the project.

In sum, it seems as the value of SMURF for the SMEs are twofold: firstly, it is very important that the there is a clear goal to work with so that the pay-off of collaborating with a researcher is evident. Secondly, the companies also expresses the importance of establishing a good and deep connection with an expert from a university, that is, someone to "put on the shelf" and use later when there is a need for it, or someone to use as a reference when doing a sales pitch towards possible investors.

As for the companies' expected contribution of working with a researcher towards employing more staff (the underlying goal of SMURF), most companies are sceptical: they cannot at present forecast if working with a researcher will enable them to employ more staff. Furthermore as the target group are SMEs and some of the companies are very small, with several only having one or even no employees, it is highly unlikely that they will employ anyone in the short time-span of the SMURF-project.

Differently from AIMday, UUI and SLU Holding defined from the very beginning an explicit set of *key performance indicators* for SMURF, which were also formally approved by the funding agency TvV. The very goal of the whole triennial SMURF project (creating 20 new employments in the region) is accordingly related to more specific indicators representing more specific effects of utilization of science, such as number of fruitful meetings between SMEs and academic researchers. SMURF's project managers direct their marketing and information efforts to fulfil some of these indicators: for instance, they can choose companies that they think will, with the help of an academic researcher, succeed in reaching such indicators as collaborations within the Life science area, patents or publications.

However, the main goal of SMURF is expressed in terms of industrial growth, which makes it very difficult for SMURF's project managers to direct their efforts to accomplish it. The same holds for such other indicators as patents. It will always be the other actors, and especially the SMEs, who have the direct power to act in such a way that the overall goal or specific indicators are met. As stated by one of SMURF's project managers working at UUI: *"These types of project will have effect later, it is incredibly hard to measure those types of effect in such a short-sighted project. The preferred type of goal would be to have a focus on establishing a contact area between companies and researchers."*

Nonetheless, this quote indicates that UUI sets a high value in the very *tool* of SMURF: it enables in fact to establish a contact between a SME and a researcher regardless if the performance indicators are reached or not. To accomplish this, to strengthen the SMEs via a contact with a researcher from UU or SLU, fits well with UU Innovation and SLU holding's overall missions in their undertakings of diffusing academic knowledge. However, it should not be forgotten that the SMURF-project per se will be eventually evaluated by an external party, Tillväxtverket, with a focus on how well the project has exploited its financial means for meeting its overall regional development goal and the specific KPIs reviewed below.

Specific measures of university- industry interaction

The main goal of SMURF is creating 20 new employments, a KPI intended to show economic growth within the SMEs enrolled in the project. This goal has been set by UUI and SLU Holding in concert with Tillväxtverket, the main external financer of SMURF, to measure how the SMURF-project has contributed to economic growth within its three-year timeframe (2011-14). Therefore, UUI and SLU Holding are externally accountable for reaching this growth goal. Moreover, these organizations also defined a more specific set of goals more directly connected with the diffusion and utilization of science, as expressed in the following KPIs:

-Number of SMEs met in information purposes	200
-Number of participants in different events (AIMday, SME meetings etc.)	
-Companies	50
-Researcher	200
-Number of fruitful meetings between SMEs and academic researchers	42
-Number of project initiated after AIMday or similar meetings	42
-Number of project/companies conducting networking activities as a result of participating in SMURF	10
-Number of patents and scientific articles with the academic researcher as well as employees in an SME listed as authors/inventors	10

These KPIs also reflect the process applied by SMURF's project managers in their daily work of engaging researchers and SMEs. First, there is the initial information towards SMEs for the purposes of laying the foundation for cooperation and collaboration via fruitful meetings and/or SMEs participating in AIMdays. There is then a KPI specifying how many collaboration projects SMURF should accomplish, representing the next step in SMURF's process. As of February 2013, the first two KPIs in the list above had been easily reached. Reaching the 42 "fruitful meetings" is also soon within the project managers' grasp, which also holds for the closely related goal of creating 42 collaboration projects between academic researchers and SMEs.

The two last KPIs, “networking activities” as well as “patents and scientific articles”, can be viewed as forms of interactions that are closely related to a deeper researcher-company relationship. In fact, with “networking” SMURF managers mean the fact that a researcher and a company proceed after the completion of the SMURF-financed collaboration project and search for additional funding for continued collaborations. Like co-publishing and co-patenting, networking entails increased interactions, with deeper connections in the involved resources compared to a short-term collaboration project, such as the 42 which are SMURF’s goal. These last two KPIs, as well as the overall goal of 20 new employments, have not yet been reached and are the object of growing concern within the project management group as to if they will be met by the end of the SMURF project in 2014.

ANALYSIS AND DISCUSSION

We now analyze our empirical materials in order to answer the four research questions that we raised in the Introduction about the types of interactions that Uppsala University has with industry, how this university operates to craft such interactions, how they are perceived and measured by the involved parties, including the differences in their assessment. Our discussion relies on the concepts we introduced in the theoretical framework (the three actors involved in university-industry interactions, the KPIs applied and the effects in terms of type of interactions obtained), which are now applied to the two cases. We start from discussing the first question in order to build a typology of interactions visible in our empirical materials and then move to the other three research questions.

A typology of university-industry interactions

The AIMday and SMURF cases illustrate how Uppsala University interacts with companies in many different ways. A first type of interaction actually pre-existed the introduction of these two interaction-stimulating tools: these interactions are the *long-term, deep relationships* which connect some of Uppsala University’s Departments with five selected companies within ÅMA (Ångström Materials Academy). These interactions are *long-term* in the sense that the companies involved with Uppsala University signed agreements oriented to the long-term, as they became members of an association such as ÅMA. The same interactions are also *deep* because they have a wide range of contents that embraces most of the typical mechanisms to diffuse science: sponsored research, industrial PhDs, joint board participation, equipment and laboratory access, student degree collaborations etc.. These interactions are deep also because they involve several interfaces from both sides of the relationship: the university management, namely UU Innovation and the project managers who drive ÅMA on a constant basis, several departments of Uppsala University and many individual researchers, next to several individuals from the company’s side. Finally, this type of interaction can be qualified as a true *relationship* (Håkansson & Snehota, 1995) because it has a *history* filled with several recurring interaction episodes in the past few years, which have led both parties also to make *adaptations* (Håkansson, 1982: 19) clearly manifested in the creation a joint organization such as ÅMA.

Interestingly, these types of long-term, deep relationships are not only part of the background leading to AIMday and SMURF, but they are also the type of interactions which the university management expects these two tools will create in the future. However, at the time of our investigation, the interactions crafted by the two tools are of a few types which are different from true relationships. First of all, AIMday appears to be an efficient tool in

generating two types of interactions: *participation* (“med-verkan” in Swedish) and *cooperation* (“sam-verkan” in Swedish). “Participation” refers to those meetings where both researchers and company representatives “participate”, in the sense that both parties are present together: this type of interaction is however rather weak, as the counterparts might exchange nothing more than a superficial acquaintance, in the sense that they get to know each other but no resources are exchanged or activities conducted in concerted ways. The interaction type “participation” involves both single researchers, whom companies get to know, but also the university management, as they are typically the arrangers of the events wherein the meetings, which are the minimum requirement for “participation”, occurs. In this sense, also the SMURF tool contributed in its early stages with events to which it invited several SMEs and generated therefore participation-type interactions.

“Cooperation” is another type of interaction which appears through both SMURF and AIMday: its main feature is that it involves some form of *action conducted together* towards a goal, which might or not be shared by both the company and the university representatives, be it researchers or administrators. At its most basic level, this joint action is information exchange, such as the discussions conducted in AIMday’s closed meetings, whose goal is to address the problem suggested by the company, even if researchers might be oriented to entirely different goals, such as finding funding for own research. Also the SMURF tool entails “cooperation”, such as when researchers and companies discuss together and jointly formulate the project applications to the SMURF project group. “Cooperation” is accordingly a deeper form of interaction than “participation”, even if the activities involved are only of communicative character and the resources exchanged are mostly information and knowledge.

The next type of interaction, *collaboration* (“sam-arbete” in Swedish), is stronger than “cooperation”, but it is widely visible so far only in the SMURF case, and appears more seldom and mostly indirectly in the AIMday case. It is in fact a key feature of SMURF to match researchers and companies and have them conduct a joint research project, entailing a common goal which is at least formally accepted by both parties and which entails conducting some form of work together. This work is also of practical character and includes also activities such as research, testing, prototyping, that is, not only communicative activities. Next to information and knowledge-related resources also physical ones such as laboratory and equipment can be involved, next to financial ones which assume a central place as a large amount of time or other resources is dedicated to each other and need to be paid for.

As mentioned “collaboration” is a deeper type of interaction than “cooperation”, but it is not yet the same as a full-blown relationship. The reason is that “collaboration” might be a rather short-termed phenomenon, such as a project lasting only a couple of months, without being followed by any other episode. “Collaboration” typically generates tangible outcomes, such as a prototype for a new product or key inputs for a company’s R&D, but it stops at the moment when the parties receive these outcomes. It is only when other interaction episodes follow each other, either several cooperation or even several collaboration-episodes, that we can trace the emergence of a real relationship. And the presence of positive tangible outcomes coming from a specific collaboration in progress is recognised by the literature as one of the main reasons for repeating interactions in such a way that can create a long-term and deep relationship, even more than the previous experience of interaction between the two parties (Santoro, 2000: 267).

In summary, the four typologies of university-industry interactions that emerge from the analysis of our empirical materials are, in order of increasing depth and long-term orientation:

- *Participation* ("med-verkan"): is the simple taking part to a meeting and getting to know each other. It is typically very short-term and only if the contacts created are turned into one of the interaction forms below "participation" leaves any traces in the future. This type of interaction involves only superficial *actors bonds* (Håkansson & Snehota, 1995: 192-99)

- *Cooperation* ("sam-verkan"): entails a joint communicative and intellectual activity of short-term character organized around a possibly common goal. In this type of interaction, next to stronger actor bonds also some *activity links*, although superficial ones, appear (Ibid: 50-6)

- *Collaboration* ("sam-arbete"): entails joint work of both communicative/intellectual and practical character oriented towards a commonly agreed goal, conducted within a short timeframe, but with tangible outcomes that can create a bridge for long-term interactions between university and researchers. In this type of interaction, all three layers of the ARA-model, including *resource ties* (Ibid: 132-8), appear, even if within a time constrained interaction episode such as a research project.

- *Relationship*: emerges when several interaction episodes, such as the three types above, are repeated over a longer period of time. But in order to become a *deep* relationship also *adaptations* (Håkansson, 1982: 19) between the parties are necessary.

The process of crafting university-industry interactions at Uppsala University

We can now turn to our second research question, namely how does a university craft these types of interactions? The cases of AIMday and SMURF illustrate somewhat different approaches to the process of crafting university-industry interactions. AIMday is a tool aimed primarily at creating rewarding meetings in terms of *cooperation*, whereas SMURF is a tool providing funds for establishing *collaborations* between researchers and businesses. However, taking a broader perspective on the overall process of crafting university-industry interactions, a common starting point for both interaction-stimulating tools, and for Uppsala University's overall strategy, are superficial interactions which the university management aim to transform into deeper, long-term relationships between academic researchers and industry. Moreover, the university management aims to create such relationships not only between the two parties, companies and researchers, but also between companies and the university management itself, in the form of such interaction enablers as its UUI and ÅMA unit. Illustrated below is how the process of crafting interaction works, relying on the interaction typology described above. We also highlight how this process can take on different routes in the hope of creating long-term and deep relationships between academia and industry.

Even though there are researchers and companies that do have long-term relationships with each other, the following analysis focuses on Uppsala University management's efforts of crafting *new* interactions of this type. UUI is a key enabling actor that operates such tools and platforms as ÅMA, AIMday and SMURF as attempts to initiate interactions between researchers and companies and steer them towards becoming deeper and long-term relationships.

1. Fostering participation: showing value and creating interest

The interaction-enabling actors are very important especially when it comes to creating the superficial type of interaction that we termed *participation*. They have the specific task of *contacting* and *showing* to researchers and industry the relevance of *meeting* each other,

thereby enabling the creation of participation. AIMday and SMURF are fundamental here because they materialize and substantiate several values of participating in university-industry interactions: in fact, these two innovation-stimulating tools make it possible for the university management to illustrate benefits for both parties, such as deepening one's understanding of a problem, but also obtaining additional funding for own research or even starting a collaboration project. The two interaction-stimulating tools focus on industrial problems, a strong argument for *creating interest* and *attracting* companies which are traditionally hesitant to spend resources on interactions if these do not give them something concrete in return. In other words, by marketing the very AIMday and SMURF concepts and informing both researchers and companies about the advantages of interacting, UUI manages to craft a will to participate from both sides.

By using these two tools as a way to relate to both researchers and industry, UUI also constantly creates *new contacts*, which act as starting point for possibly deeper types of interaction, which UUI can further stimulate. When deeper interactions between researchers and companies happen through UUIs' tools and platforms, the university management also gains more knowledge about the specific counterparts, their needs and agendas, which makes it easier to directly connect them to each other on a deeper level of interaction than participation. ÅMA, with its members and joint university-industry board, shows how this can happen.

2. Fostering cooperation: promoting exchanges
When researchers and companies engage themselves to the level of being present together (i.e., participating), the next step for UUI is to stimulate a deeper form of university-industry interaction whereby the two parties start exchanging something valuable, typically knowledge. The interaction-enabling actor UUI stimulates such an exchange via AIMday by strictly orienting the discussions towards industrial problems and then identifying researchers for whom those very same problem are interesting, so that they are not simply willing to "participate" (the previous level of interaction), but also to "contribute" something to the discussions which is hopefully valuable to the industrial party. Even though SMURF seems to aim directly to the creation of an even deeper form of interaction, namely collaboration, it still does not get there immediately, but the collaborations it fosters are preceded by some form of cooperation, namely when a researcher and a company engage in a rewarding exchange while they attempt to formulate a project plan hoping to receive funding. Just as the discussions occurring during the meetings on AIMday, the joint writing of a project application is a way for UUI to more actively steer and push researchers and companies to match each other, and ensures that both parties will benefit.

3. Fostering collaboration and something more?
As described above, collaboration is a deeper type of interaction than cooperation as it also entails the exchange or even sharing of several resources, including physical and financial ones. This also means that collaboration is more concrete and measurable, when it comes to the utilization of science, than both participation and cooperation. Thus, the creation of collaborations is very important for interaction enablers such as UUI and its ÅMA unit. However, looking at AIMday, this is where the organisers start to lose control, because the step from discussions (cooperation) to the creation of collaboration between the same researcher and the same company is difficult to steer. There seems to be here, at the boundary between "cooperation" and "collaboration", other values, such a broader contact network or better technical understanding, that may make the two parties fully satisfied and uninterested to proceed further. However, by connecting AIMday and SMURF, UUI hopes to increase its

control over the creation of collaborations: in fact, offering funding during an AIMday increases the interest of moving from cooperation to collaboration, especially for academic researchers, which also increases the number of promising collaboration applications coming to SMURF.

Therefore, UUI explicitly applies a set of specific incentives aiming to influence the very nature and depth of interaction between a researcher and a company, making implicitly this interaction part of a sequence of interactions that, in the hopes of the interaction enablers, might prolong in the future. And when interactions have both a history and a future, we would face a potential relationship (Håkansson & Snehota, 1995). However, in such a relationship, the university management units (e.g., UUI) remain a third-party in relation to the dyad "researcher-company" (see figure 1, 2 and 3), thereby further reducing their possibility to influence the dynamics of this interaction (Salo, Tähtinen & Ulkuniemi, 2009).

In fact, if the creation of collaborations is difficult to control, the creation of real relationships is even harder to control (Håkansson & Ford, 2002), including its quantification and measurement. As described above, for real relationships to develop, several interaction episodes need to follow each other across time and the deeper these interaction episodes are, such as a collaboration, the bigger the probability is that they will lead to a relationship. However, there is no guarantee that deeper interactions will lead to even deeper ones, as the development of inter-organizational interactions and relationships can always revert to a previous interaction stage (Ford, 1980; Ford et al., 2003: 51-8). UUI's current interaction-enabling tools may not provide the possibility of surgically intervening in a specific researcher-company interaction with ad hoc solutions to boost it, but they do create a regular basis for interactions which simply increases the chances for some interactions to take the direction of becoming relationships. Moreover, UUI and especially its AIMday tool constantly generate what may be viewed as the weakest form of interaction (which therefore was not included in our four types), namely *contacts* (i.e., acquaintances) between academic researchers and industry. Contacts are indeed "potential interactions", which may be activated or not in the future, but which in the present result into a *broader network of new contacts* or *deeper existing contacts*. These contacts are viewed as highly valuable by both researchers and companies, simply thanks to their potential to lead to the creation of both collaborations and relationships if needed in the future. The connections between the various types of interactions crafted by Uppsala University management are shown in figure 4 below.

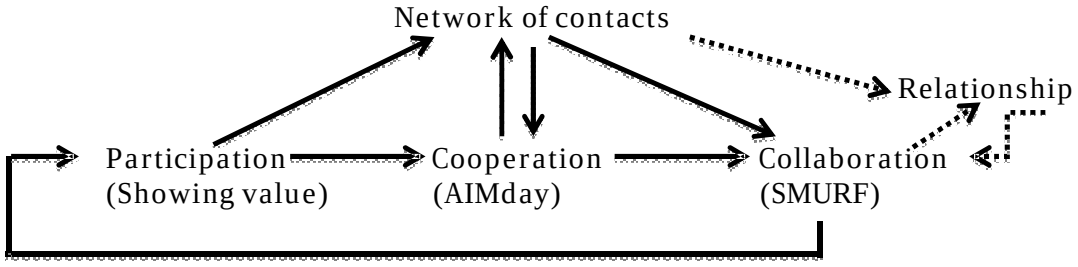

Figure 4: A model over the crafting of university-industry interactions

The model should not be taken as linear and deterministic, because two interacting parties can always exit from the sequence and maybe delimit themselves in the future to simple "participation" instead of moving towards a relationship, which remains a hard won trophy in

this context. Moreover, the instruments applied by the interaction-enabling units do have their limitations making the strength of the arrows in the model even weaker: for instance, AIMday seems to be a tool more apt to create cooperation than collaboration, while UUI's tool specifically addressing collaborations, that is, SMURF, can only finance collaborations between researchers and companies that have had *no previous deep interaction*. SMURF cannot either finance the next development steps following a concluded collaboration, those that could lead to more joint activities and deeper resource combinations and even a long-term relationship. Quite interestingly, SMURF does include explicitly a relationship building phase (somewhat incorrectly termed "networking" in the official documents), but this phase is conducted by that platform only as a match-making and consulting activity, with no direct financial resources to boost long-term relationships. The rationale seems to be here that if the parties really value their collaboration and intend to continue for the longer-term, they should be able to either finance it themselves or make the effort to find third-party financing, for which SMURF can provide only consultation.

Perceptions and measurements of interactions by the involved actors

We now turn to our third research question, that is, how the involved actors perceive, assess and measure the interactions resulting from AIMday and SMURF. This analysis will also help us address our fourth research question, namely which differences exist between these perceptions and assessments.

Starting from the interactions related to AIMday, researchers perceive a set of effects and values included in the *cooperation* type of interaction: mutual knowledge exchange, learning from the "real world" of industrial companies as a way to adjust their research agenda to fit industrial needs and obtain additional funding for it (even if these effects do not happen during an AIMday, but take certainly some time to emerge), and marketing their equipment. Researchers view also *contacts* as another important type of interactions (or "potential interaction", see above) that can result from an AIMday. As for companies, their perceptions of AIMday partly match and complement, from the other side of the interaction type *cooperation*, those of researchers: for instance, also companies evaluate positively the knowledge exchange (insights in new literature, better understanding of problems), promoted by AIMday's discussions, as well as the purchasing channel opened for the researchers' equipment. Similarly to researchers, also companies view AIMday as a tool generating new *contacts* to broaden and deepen their network. However, a difference from researchers is that companies consider AIMday as a fruitful tool also to strengthen their already *existing relationships* with specific researchers. Probably, companies view the AIMday cooperative discussions as additional episodes in the stream of interactions that binds them with selected researchers. Finally, both companies and researchers downplay instead the role of AIMday in creating *collaborations*, as these does not seem to be the value they search for or experience during the interactions initiated by this platform.

Against this background stand instead a long list of performance indicators that UU Innovation has informally started to apply for evaluating AIMday. Table 1 below presents these performance indicators and relates them to the values and effects that they aim to evaluate. KPIs from 1 to 6 indicate direct and easily quantifiable effects of an AIMday, deriving from the simple fact of organizing such an event, while KIPs from 7 to 10 indicate more indirect and softer effects that relate more with the values pointed also by both companies and researchers (i.e., *contacts* and *cooperation*). KPIs 11 and 12 address instead

concrete collaborations and the related outputs, which were not however identified as relevant values of AIMday by either companies or researchers.

Table 1: Emerging indicators applied to AIMday

	KPI	Value measured
1	Number of AIMdays	The support organisation's general facilitation of university-industry interactions
2	Number of questions submitted	Industry's interest of meeting with academic research
3	Number of participating companies	Perceived value of meeting with academic research
4	Number of participating researchers	Perceived value of meeting with industry
5	Number of participating research divisions	Utilization of multidisciplinary research
6	Number of participating universities	Growing interest in AIMday
7	Number of participants that created new contacts	Potential interactions usable for future deeper interactions
8	Number of participants that developed new knowledge about the topic(s) discussed	Utilization of academic knowledge (cooperation)
9	Number of participants that felt that the discussion where of relevance for their future work	A further utilization of academic knowledge (cooperation)
10	Participants' overall impression of the conference: and willingness to attend again	Perceived value of AIMday and its interactions
11	Number of SMURF-funded applications for pre-studies to collaboration projects	Perceived value of collaborating and of funding projects via SMURF
12	Number of collaborations initiated via AIMday	Concrete outputs

As for SMURF, similarly with AIMday researchers stress the importance of exchanging knowledge with industry, indicating a form of *cooperation*, and creating *contacts* (mostly for educational purposes). However, an important difference between SMURF and AIMday-stimulated interactions, is that researchers prefer the former's ability to create *concrete returns* (including financial ones) within steered and well defined, indeed time-constrained, *collaborations*, if compared to loose and open-ended discussions with industry (i.e., a general type of cooperation). Interestingly, researchers do consider these SMURF-based collaborations as conducive to long-lasting and deep *relationships*. The companies' perceptions of these interactions only partly match those of researchers: companies too appreciate the new perspectives deriving from *cooperation* with researchers, but especially the *concrete results* as well as lab access obtained via these *collaborations*. Companies view SMURF-interactions also as a way to create deeper connections to be used for future collaborations, which we can interpret as *relationships* of *low intensity* (Håkansson & Snehota, 1995: 344; 370-1). But an important difference between companies' and researchers' perspectives is that the small companies involved in SMURF appreciate the *contacts* with researchers more as a way to improve their *reputation* in relation to third parties in their network (Anderson, Håkansson & Johanson, 1994: 4; Håkansson & Snehota, 1995: 32), rather than only as a ground for developing the dyadic relationship (Ibid) with that same researcher. Finally, no companies are able to evaluate such long-term effects as new employments derived from SMURF collaborations.

Against this background, UU Innovation evaluates formally the interactions stimulated by SMURF on the basis of the key performance indicators presented in Table 2. These indicators capture mostly the *cooperation* and *collaboration* types of SMURF-initiated interactions, including also some concrete and long-term outputs such as *patents* and *publications.* In this sense the KPIs applied by UUI correspond by and large to the values stressed by researchers and companies. As for long-term *relationships*, mentioned as important by researchers and by companies, there is only one KPI (nr 6) that measures them, but it simply counts their number

without penetrating into their features. This lack of explicit and detailed indicators for business relationships does not mean, however, that UUI is not concerned about long-term relationships: the problem is instead one of control, as UUI reckons that the development of business relationships is outside their control and depends on the choices of companies and researchers. It becomes accordingly more feasible for UUI to provide a tool that permits the first contact, some form of cooperation and a somewhat deeper interaction, although a time-restricted one, via a concrete collaboration.

Table 2: Key performance indicators applied to SMURF

	KPI	Value measured
1	Number of SMEs met for information purposes	The value of reaching out to the business community
2	Number of participants in various events (companies and researchers)	Industry's interest in meeting academic research. Understanding interests and needs within industry
3	Number of fruitful meetings between SMEs and academic researchers	Utilization of academic knowledge
4	Number of projects initiated	Utilization of knowledge via collaborations leading to concrete outputs
5	Number of patents/scientific articles jointly created by an academic researcher and SME employees	Concrete as well and long-tem outputs from the collaboration
6	Number of companies involved in "networking" activities as a result of participating in SMURF	Count of long-term relationships
7	Number of employment opportunities created	Long-term effects for regional economic growth

Bringing together our observations on how companies, researchers and UU Innovation evaluate both AIMday and SMURF-initiated interactions, a *first finding* is that, by and large, companies and researchers have convergent or matching views on these interactions. In fact, both researchers and companies value positively the opportunity provided by AIMday to create *contacts* (cf. "networking for networking's sake") and to *interact cooperatively*, while downplaying its role in fostering *collaborations*, which they both view instead as a major value of SMURF. Both researchers and companies also stress the importance of *concrete collaborations* with a restricted timeframe and direct outputs. But here is where the perspectives of companies and researchers start to diverge, which is our *second finding*: while researchers value collaborations with industry for their direct, short-term returns (including financial ones), companies value collaborations (but also cooperation) not only for these direct effects, but also as means for *building long-term relationships* or even to be used in relation to *third parties* in the network for *reputational* purposes. Even though this finding needs to be further validated, it seems to point to the fact that companies utilize all types of interactions with researchers more "strategically", that is, by relating them to the larger context and the long-run strategy of their business.

If we compare these views of companies and researchers with the KPIs applied by UU Innovation, formally (in the SMURF case) or informally (in the AIMday case), our *third finding* is that most KPIs focus either on *superficial* forms of interaction (contacts, participations and cooperation) or on *deeper* although *time-constrained* interactions (one-shot collaborations), while neglecting *long-term deeper* interactions, namely full-blown *relationships*, which were instead considered as valuable by both companies and researchers. In fact, while the applied KPIs focus mostly on such types of interaction as contacts, cooperation and collaborations, which companies and researches certainly appreciate (even though for different purposes, as discussed above), there is only one indicator (nr 6 in Table 2) which focuses on long-term relationships, despite the value that all three parties actually attribute to them. In fact, not only companies and researchers view relationships as valuable,

but also UU Innovation does so, as witnessed also by the alliance platform ÅMA. However, in the case of ÅMA, UU Innovation are themselves directly involved as party to this long-term relationship and therefore implicitly apply to it KPIs that correspond more to the expectations and assessment that companies and researchers would make of a long-term deep relationship.

CONCLUSIONS

This paper has contributed firstly a *typology* of university-industry interactions including four main types, namely "participation", "cooperation", "collaboration", and "relationships", to which a fifth "potential interaction" type can be added, namely "contacts". This typology is based on such dimensions as depth, type of exchange, involved resources, intensity and duration. These five interactions can also be analyzed by means of only two dimensions: *depth* and *duration*, as shown in figure 5 below. While "participation" is both short term and superficial, its opposite is "relationship", which is both long-term and deep. "Collaboration" is instead deep, but short-term, while "contacts" are long-term although superficial interactions. Finally, "cooperation" is somehow in the middle when it comes to depth and duration: while its depth is contained between the extreme of participation and collaboration, the duration of cooperation can vary considerably between short-term and long-term cooperation.

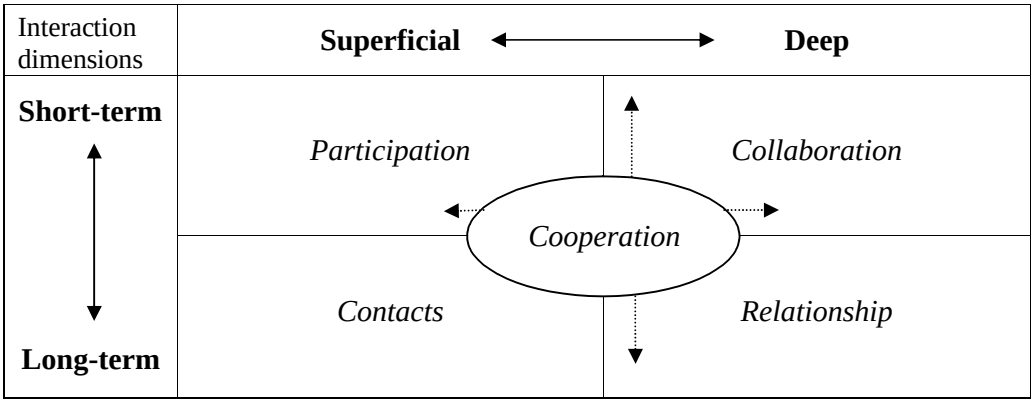

Figure 5: Five interactions type in terms of depth and duration

The second contribution of our paper is a model showing how a university's management works in order to craft these five types of interactions towards the hoped-for for result of creating *long-term relationships* with industry. In this sense, it appears that a relationship requires the presence of all other four types from which it eventually emerges, but crafting all of them is no guarantee to obtaining a real, long-term relationship. In fact, university management is at best one of three parties in such relationships, which makes them even more difficult to control than "simple" dyadic relationships, or even worse university management may be only a third party in relation to researchers and companies.

Finally, our results indicate that whereas the official KPIs applied by the university focus either on *abstract* or on *short-term & concrete* interactions (i.e., participation, contacts, cooperation and collaborations), companies pay less attention to short-term results from collaborations with researchers and more to the future development of a deep relationship

with researchers. For companies, concrete short-term interactions and results are not a goal per se, but a tangible means for building a long-term relationship.

Our findings also suggest avenues for further research: Firstly, our typology and the process model on crafting interactions needs to be validate by analyzing other cases from other universities. In particular, the "relationship" type of interaction deserves to be investigated more closely, as well as the connections between the other types of interactions and relationships. Secondly, further research is necessary also on the *reasons for* the differences in the perceptions and assessments of interactions made by companies, researchers and university management.

This paper also suggests policy implications for agencies and university units engaged in the diffusion of science to society or in stimulating economic growth based on academic research. Applying Uppsala University's "proactive" approach based on building relationships, or at least collaborations, with industry should not be seen as a simpler alternative to playing the "market game" which is necessary for commercializing patented discoveries. While the "market game" is difficult and risky because no licensors, customers or financiers might be found for a scientific discovery, the relationship-building approach faces the difficulties implicit in creating relationships. It is relatively easy to create contacts, participation and even cooperation between researchers and companies, but things become more complicated when the goal is crafting actual collaborations.

And finally relationships are very hard both to create and control, especially by a third party, which often university management is in such constellations. Still, the ÅMA experience briefly touched upon in our empirical material show how this can work: university management takes a very active role in "handling" this multi-party relationship, which in turn relies on previous cooperation and collaboration episodes between single researchers and companies. However, the resources the university management had to invest in order to build, develop and handle such a relationship are considerable, with at least one project manager acting as a sort of dedicated Key Account Manager. This suggests that such highly focused efforts can be motivated only for interactions/relationships that can become potentially very large, for instance with very large corporations or with a restricted pool of similar companies that can be held together within an alliance revolving around a common theme (e.g., within a specific sector or technological area). Most of the interaction-stimulating efforts reviewed in this paper, especially those supported by EU or national agencies' funds, imply instead blanket-like interventions that aim to capture as many companies as possible in a generalized way, according to the idea that the more companies participate or create contacts or cooperate, the better it is. Probably, "the law of the large numbers" plays some role in finding adequate interaction partners for superficial interactions, some of which might then turn into long-term relationships, but what is really needed for getting there is more focused efforts and resources to be allocated to single relationships rather than to the whole population of potential relationships.

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APPENDIX: Sources of data

1. AIMday case

Interviews to AIMday participants, Jan-March, 2011. (1-1 ½ hour long)

Year	Organization	Respondent	# Interviews
2011	Global company I	Project manager	1
2011	Global company II	Corrosion Specialist	1
2011	Large company	Senior Specialist	1
2011	Global company III	Department manager	1
2011	SME I	Director of R&D	1
2011	SME II	Project manager, owner	1
2011	SME III	Project co-ordinator	1
2011	SME IV	Project manager, equipment engineer	1
2011	Solid state physics, UU	Professor	1
2011	Solid state Electronics, UU	Professor	1
2011	Materials sciences, UU	PhD student	1
2011	Solid state physics, UU	PhD student	1
2011	Materials sciences, UU	Associate Professor	1
2011	ÅMA	Project manager	2
2011	UUI	Director	1
2011	UUI	Deputy Director	1
			Total: 17

Interviews about AIMday's expansion (1-1 ½ hour long)

Year	Organization	Respondent(s)	# Interviews
2012, Jan and Apr.	UUI	Director	2
2012, Jan and Apr.	UUI	Deputy Director	2
2012, Jan	UUI	Project manager of LifeScience platform	1
2012, Jan	ÅMA	Project manager	1
2012, Apr	Uppsala University	Vice principal of the Med-Pharm. Faculty	1
2012, Oct	UUI	Project manager of AIMday	1
2012, Nov	Royal Institute of Technology (KTH), Business Liaison Office	Project Manager for Clean-tech	1
2012, Nov	Royal Institute of Technology (KTH), Business Liaison Office	Cooperation manager, Project manager of Life Science	1
2012, Nov	Lund University Innovation System	Project manager	1
			Total: 11

Participation to AIMdays:

- Active participation to discussion panels in 6 AIMday conferences (2011-12)
- Participation in the organising group of AIMday Cancer 2011.

2. SMURF case:

15 Replies to questionnaire (companies):

Nils Hyllienmark, **Vasa Tech**	Daniel Johansson, **Parans**
Bo Tiderman, **Tolpagorni Product management**	Ann-Sofie Andersson, **Mercodia**
Kiell Tofters, **Destination Tämnaren**	Marih Jonsson, **Skogsbackens ost**
Peter Kempinsky, **Kontigo**	Jan Magnusson, **Svenska Aerogel AB**
Claes Lagelius, **Bästa arenan**	Mia Ulin, **Apostel Consulting**
Sven-Olov Holm, **Metahyd AB**	Charlotte Säfström, **Charlottes Hotell**
Rune Ringom, **Synartro**	Åsa Kallas, **Cebix**
Erik Walum, **Glucox Biotech**	

Interviews (2012)

1- Ann-Sofie Andersson, Product manager, Mercodia
2- Sven-Olov Holm, Founder and owner, Metahyd
3- Peter Kempinsky, Partner and senior advisor, Kontigo
4- Peter Bergsten, Prof. in Med. Cell biology, Deptartment of Medical Cell Biology, UU.
5- Johan Lyhagen, Prof. in statistics, Department of Statistics, UU.
6- Åke Nordberg, Researcher, Department of Agricultural and Environmental Engineering. Assistant
7- Researcher at the department of Energy and Technology, SLU.

Interviews (2011-12)

8- Lars-Eric Larsson, responsible SMURF and Deputy Director, UU Innovation (several interviews)
9- Andy Browning, project manager, UU Innovation (several interviews)
10- Torbjörn Fängström, project manager, UU Innovation (several interviews)
11- Anna Grönberg, project manager, UU Innovation
12- Andreas Scheibenpflug, project manager, SLU Holding AB.
13- Björn Ingermansson, project manager, SLU Holding AB
14- Martin Rogberg, project manager, UU Innovation and Managing director at IPF AB.

Participation to SMURF-meetings:

SMURF project group meetings:	**SMURF steering group meetings**
20110509	20111214
20110523	20120326
20110607	20120605
20110623	20120926
20110826	20121211
20110922	
20111017	
20111111	
20111206	
20120207	
20120319	
20120529	
20120626	
20120913	
20121120	
20121217	
20130215	
Total: 17	**Total: 5**