

# The Triple Helix balancing act: Industrial research institutes as knowledge intermediaries

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ABSTRACT

Processes of innovation are in this day and age increasingly turning into collaborative efforts where different types of external actors are involved at various stages of development. These efforts potentially involve cooperation between actors embedded in the commercial institutional set-up and actors from the academic sphere. Therefore, differences in policies and practices regarding management of knowledge, research results and intellectual property rights (IPRs) pose an important factor to consider and handle in collaborative innovative processes.

In this paper semi-public industrial research institutes are studied empirically. Since such institutes are most often established with contribution of public funds they are expected to operate in both the commercial and the academic spheres, diffusing knowledge to a wider audience while at the same time being engaged in activities like contract research for private firms (Bienkowska et al 2010). Research institutes are placed right at the center of the networks between academia, business and government and can thus for example contribute to commercialization of research that otherwise might not have reached the markets (Dzisah & Etzkowitz 2008). However, they also have to deal with diverse and contradictory goals.

The results show that institutes are facing a trade-off between academic publishing on the one hand and protection and commercialization of their research on the other. They tend to develop their organizational capabilities towards excelling at either one of these objectives, not both simultaneously.

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## **Introduction and Research Focus**

Processes of innovation are in this day and age increasingly viewed as collaborative efforts where different types of actors, representing the spheres of academia, business and government, are involved at different stages of development (Leydesdorff & Etzkowitz 1998). Collaboration has contributed to making processes of innovation more flexible and efficient, allowing various actors to specialize and combine their resources in accordance with current needs. At the same time, R&D collaboration, sharing of resources and exchange of information between organizations that is necessary for most innovation processes also give rise to considerable new challenges, for example in the fields of management of knowledge and intellectual property (Teece 1986, Arora & Gambardella 1994). Since collaboration often involves actors with differing institutional set-ups, goals and knowledge management strategies, like for example private firms and public research departments, differences regarding for example the handling of intellectual property (IP) are to be expected.

In this paper semi-public industrial research institutes are studied empirically. This type of knowledge intermediary is owned jointly by the government and private firms (often through an owners' association) and is supposed to transfer industry-relevant research results in a particular area of science to a wide audience while at the same time being engaged in activities like contract research for private firms (Bienkowska et al 2010). Research institutes are placed right at the center of the networks between academia, business and government and can thus for example contribute to commercialization of research that otherwise might not have reached the markets (Dzisah & Etzkowitz 2008). However, they also have to deal with an inherent risk of conflict between contradictory goals. Questions concerning knowledge management and IP strategies of research institutes are thus vital with regard to the use and commercialization of research results.

The following research questions are analyzed in the paper:

- 1) What types of strategies for management of knowledge, research results and IP are available to industrial research institutes?
- 2) How are these strategies shaped and how do they influence possibilities for commercialization of research results?

## **Theoretical background**

Since a couple of decades an increasing "division of labour in inventive activity" has been observed in ever more industries (Arora & Gambardella 1994, Arora et al 2001). Innovations are today commonly conceptualized as being developed in networks and systems of different actors rather than by separate, isolated corporate units (Lundvall 1992, Freeman 1995, Powell et al 1996, Edquist 1997).

### **The role of knowledge management and IP strategies in collaborative innovation and commercialization processes**

Collaborative processes of R&D and innovation require an agreed-upon common ground regarding issues like ownership of knowledge and appropriation of results. Such common ground can be reached through negotiation and both formal and informal agreements of various kinds (Powell et al 1996).

Since organizations have an inherent interest in predictability, control and informed decision-making, the agreements are crucial in order to make the rules of conduct governing collaboration explicit, especially when there are low levels of trust between actors (Lorenz 1999, Gambardella & Hall 2006). The processes of forming these agreements can be considered fundamental to innovation since they shape the collaborations and their outcomes, as well as the possibilities for exploitation and commercialization of research results.

Aspects such as IP strategies and capabilities of organizations interested in collaboration, power balance between actors involved in the negotiations and the broader institutional arrangements in which the organizations are embedded are in turn important for the formulation of agreements. When the organizations involved differ a lot regarding the institutional set-up, for example when universities and firms choose to collaborate, particularly intricate IPR negotiations can be expected (Hertzfeld et al 2006).

### **Commercial vs. academic institutional arrangements**

It is widely acknowledged that the norms and institutions guiding the pursuit of scientific research in the academic system are considerably different from those prevalent in the commercial R&D system (Dasgupta &

David 1994, Gittelman & Kogut 2003). Transfer of knowledge between these systems does not occur easily or naturally because of these fundamental differences.

It has been reported that distinctive logics and norms in firms and universities often have led to outright breakdowns when negotiating collaboration agreements (Hall 2004). As universities develop a more proactive approach towards IPRs the potential for conflict with the commercial sphere increases even further (Siegel et al 2003, Gambardella & Hall 2006, Hertzfeld et al 2006). Previous research suggests that small and research-intensive firms rather than large international corporations seem to have the capability to form bridges between commercial and academic spheres (Gittelman & Kogut 2003).

### **Between the commercial and the academic sphere: semi-public research institutes**

The idea of specialized research institutes was most likely inspired by the work of Pasteur in France and von Liebig in Germany in the middle of the nineteenth century. Their particular style of research and education was characterized by a fusion of academic scientific pursuit and industrial applicability, and was initially funded privately (Paul 1980, Mazzoleni 2005). Albeit controversial, this way of organizing research spread across universities in France and Germany, and the institutes received gradually increasing public support for their activities. Towards the end of the nineteenth century, public research institutes were also established in other, at that time, industrializing countries, for example Japan (Mazzoleni 2005).

Like many other countries, Sweden followed in the footsteps of France and Germany and set up research institutes, although rather late. The first Swedish industrial research institutes were formed in the early 1900s following initiatives from private firms in the fields of pulp & paper and steel production respectively. These institutes, Wood Pulp Research Association and The Swedish Institute for Metals Research, provided a knowledge transfer function from academia to business in the two most important export industries in Sweden during that time (Kaiserfeld 2008).

Today, a combination of private and public funding and a mix of applied and basic research characterize the sort of research institutes that this paper focuses upon. They are considered as important channels of technology transfer since they are positioned between the commercial and academic spheres of R&D (Harding 2001). At the same time, many institutes have been subjected to criticism for not fulfilling their mission to transfer knowledge and technology effectively enough (Beise & Stahl 1999).

Currently, institutes in nearly all European countries are under pressure to reassess their activities and change in accordance with the needs of actors in the innovation systems while using their resources more efficiently (Preissl 2006). However, this development is also considered as increasing the risk of institutes losing their identity and becoming too similar to either university departments or technical consultancies (Preissl 2006).

An alternative way to diffusing knowledge that has received a lot of attention lately consists of Technology Transfer Offices (TTOs) which have the specific role of identifying, managing and protecting the intellectual property of public research organizations, mostly universities (EIF, 2005). TTOs are generally expected to reap the benefits of commercialisation of research results and be supportive in bringing innovations to markets, thus applying a more narrow focus than research institutes. They are also most often a part of academic organizations and acting on their behalf. Like the institutes TTOs have been criticised for lack of effectiveness and their performance is considered difficult to evaluate (Tahvanainen & Hermans 2008). Furthermore, the TTOs are characterized by considerable diversity and constant change (Conti et al 2007). Therefore it can be concluded that the role of a bridging organization between industry and academia is a difficult and ambiguous one, for both TTOs and industrial research institutes.

## **Methodology**

In this paper knowledge management and IP strategies at two Swedish industrial research institutes are studied empirically through semi-structured interviews with key personnel at the institutes, the study of their internal documents and publications and a survey of Swedish institutes performed at the Division of History of Science and Technology at KTH - Royal Institute of Technology. The studied institutes are both part of the Swedish ICT innovation system, active in the fields of computer software (Institute A) and optics, electronics and communication technology (Institute B).

## Findings

Institute A is involved in research in computer science, as well as in activities such as processes of standardization. The institute was created in the 1980-ies, following an initiative from academia, a large private firm and a state-owned telephone company. Inspiration for the setting up of institute A was gathered during visits to private research institutes in the US, for example the Microelectronics and Computer Technology Corporation in Austin, Texas. However, in contrast to the US institutes institute A relied on public funding for its existence from the start.

In 2007 institute A had almost 100 employees, around a quarter of them with PhD education, as well as some PhD students. Majority share of institute A is owned by the Swedish government, the institute is also partially owned and financed by a “members’ association” consisting of large firms and a public agency.

Institute A has a general principle that the institute owns the results of its research. Nonetheless, the organisations in the members’ association enjoy free rights to use the results of the institute’s research as they find appropriate. Only large organisations, mostly Swedish, with considerable bargaining power are members of that association. This means that tensions can arise if the institute and the members have differing opinions on the use of results, and the ways to transfer knowledge or commercialise R&D output. The members also have an influence on the choice of institute’s collaboration partners.

The main channel for knowledge transfer at the institute is through scientific publications. A few of the results of institute A’s research have been patented. This is partly a consequence of the fact that the institute is active in the software field, where patents are difficult to obtain. Another obstacle to patenting and forming patent-based spin-offs is the fact that the organisations in the members’ association have to give up their universal rights to free use of the results before a patent can be sought by institute A. This can lead to discussions based on divergent views on the most appropriate means to put results to use so that they are beneficial to the Swedish society at large. Some results are also released by institute A as open source software that can be used freely by anyone. However, it is not unusual that the member firms are reluctant to releasing results as open source; they can therefore sometimes block such knowledge transfer.<sup>1</sup>

Institute B is active in fields such as optical systems & components, sensor technologies and microelectronic process technologies. It was created in the 1990-ies through the fusion of two other research institutes, one of which had been in operation since the 1950-ies and was started following a public initiative. Institute B had slightly more than 100 employees in 2007, about a third with PhD-degree. Swedish government owns the majority share in the institute, and it is also partially owned by a members’ association, consisting of both large and small firms with an interest in the institute’s fields of research and development as well as a public agency.

Institute B states that the ownership of results from its research and development projects depends very much on the financing structure of specific projects. Normally, for a totally privately sponsored project, the firm financing it owns the results, for example in the form of a pre-defined product, but the background knowledge and general know-how are properties of the institute. In partially privately sponsored projects firms contributing to the financing can have the right to free use of results, which are nonetheless owned by the institute. In practice however, it is not uncommon for collaboration partners, especially large firms, to try and claim ownership of all results in specific areas although they only partially finance research at the institute. When that happens, usually a round of negotiations follows where a mutual agreement can be reached.<sup>2</sup>

The members’ association of institute B has had a limited influence on its activities according to its managing director.<sup>3</sup> This may be related to the fact that institute B was created relatively recently through a merger of different institutes which can be viewed as a disruption in relations with member organisations. Still, institute B is interested in interaction with active partner organisations and has decided to form groups of actors with interest in particular fields of technology that can focus their efforts on these fields. This move has been somewhat upsetting to members of the owners’ association since firms in these focus groups do not have to be paying members of the association.

An active IP strategy is used by institute B in order to detect patentable innovative steps early on in the research process so that they can assure proper protection for research results with commercial potential. From this

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<sup>1</sup> Interview with CEO of institute A, in April 2008.

<sup>2</sup> Interview with Manager of Sales, Administrative Support & Quality of institute B, in October 2008.

<sup>3</sup> Interview with Managing Director of institute B, in March 2008.

strategy follows that patenting is most often chosen over early publishing of potentially valuable results. Competence has been developed internally to manage legal aspects of agreements and IPRs, but the institute also relies on external resources in the form of a law firm and a patent consultancy. Institute B has created several spin-off companies based on protected technologies developed at the institute.

## Conclusions

Considering the possible strategies for management of knowledge, research results and IP available to industrial research institutes this study shows that institutes face a trade-off between publishing and patenting which may manifest itself through either leaning towards the commercial side, developing the organization in accordance with commercial principles of successful R&D or towards the academic side.

Institute A is dedicated towards knowledge transfer through publishing of research results internationally while Institute B is geared towards detecting patentable innovative steps early on in the research process in order to protect them (see table 1 for an overview). At Institute B, patenting is in most cases chosen over early publishing, due to a strong commercial focus. Institute B has also managed to spin-off several companies based on patent-protected technologies.

Table 1. Measurable output of knowledge transfer activities of case study institutes'.

<b>Output of industrial research institutes' activities</b>	<b>Institute A</b>	<b>Institute B</b>
Papers in scientific journals published in 2007	36 papers (0,37 per employee)	16 papers (0,14 per employee)
Ownership of patents in 2005	Owner of 4 patents	Owner of 22 patents
Spin-off firms	No proper spin-offs, 10 "competence spin-offs" since 1997 <sup>4</sup>	15 spin-offs since 1995
Open source software programs available in 2008	19 publicly available programs	-
Turnover/employee in 2006	900 000 SEK	1 350 000 SEK

The formation of strategy and decision-making processes considering means of transferring knowledge from the research institute to other firms and the society at large differs considerably between the studied institutes. The relationship to and balance of power with the owners' association seems to play an important role.

Institute A seems to be influenced by its owners' association in a much more profound way than Institute B, which has effects on how activities are organized and research results used. While Institute B can make important decisions relatively independently and can focus on its own mission and results, Institute A has to take its owners' association into consideration to a higher degree and tread carefully when exploring commercial possibilities. Releasing research results as open source software has been used by Institute A as knowledge transfer mechanism in some cases. That has not been uncontroversial however, as firms in institute A's owners' association have expressed concern over providing unmerited advantages to their competitors.

## Contributions and Implications

Research institutes are potentially very important in Triple Helix networks, as they act as knowledge intermediaries between the spheres of academia, business and government while focusing on particular areas of industry-relevant science and technology and connecting together various types of organisations. The main contribution of this paper is the highlighting of the "balancing act" of industrial research institutes and showing two different ways in which the role of research institute can be played with varying approaches to commercialization and management of research results. The institutes presented here can be characterised as adopting one of the two established "sets of institutional arrangements" – the academic or the commercial one.

There is a need for a continued debate on the role of industrial research institutes in society and the types of knowledge transfer they can be expected to deliver. In cases where the state constitutes the majority owner of an

<sup>4</sup> Competence spin-offs are defined by Institute A as firms started by former employees of Institute A after they quit working at the institute.

institute there is scope for providing clearer guidelines and support in negotiations with members' associations where such exist. Patenting and commercialization through spin-off firms is one possible mode of transferring research results to the economy, academic publishing is another. These modes have to some extent contradictory demands which may be difficult to fulfil for one organisation. Open source constitutes a third option and could potentially be adapted for both software and hardware. A move towards open source would encourage the development of actual products and services while making them available for others to use and develop further.

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