Making university-industry collaboration work - a case study on the Deutsche Telekom Laboratories contrasted with findings in literature

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11 June 2006

ISPIM 2006 Conference – "Networks for Innovation" 11th-14th June 2006

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Abstract: The growing competition in consumer as well as business customer markets is forcing industry to explore new ways to foster product and service innovations. To increase the clock speed of incremental innovations and raise the number of radical innovations, university-industry collaborations (UIC) are a powerful means discussed by practitioners as well as by scholars. This paper discusses the approach of the Deutsche Telekom Group (DTAG) of building a UIC by creating a separate organization. This organization consists of R&D personnel both from industry and academia and proves to be effective in channelling innovation potential. Being an organization with its own identity and situated on university premises, the Deutsche Telekom Laboratories (DT Laboratories) offer different ways to overcome the cultural, institutional and operational barriers associated with UIC. The case study validates and challenges findings on UIC in literature. The paper closes with practical advices for the establishment and management of UIC and suggestions for further research in this field.

Keywords: university–industry collaboration; technology transfer; technological innovation; basic research; applied research; innovation development; radical innovations; incremental innovations; technology intelligence; explorative capabilities.

1 Introduction

Companies operating in the information and communication technology (ICT) market are currently facing a number of challenges. Among these are ever-growing competition, the increase of technological choices to be made, and deregulation which also strengthens the previous two. In order to maintain their profitability and competitiveness, companies are also looking at R&D for help. Some technology based firms are able to generate more than 50% of their revenue from products that are less than two years old. This potential is one of the reasons for the growing interest from both practitioners and scholars to find

new methods and means to foster the innovation potential. The new methods and management suggestions that are named in this context are often labelled as methods of the fourth generation of R&D and technology management [1, 2]. One of these methods is collaboration. Teaming up will allow to gain competitive advantage in today's fast moving markets and complex technological environment [3].

Through collaborations, a company can improve its exploration and exploitation capabilities and consequently improve its innovative capacity [4]. Furthermore, collaborations with customers and suppliers contribute most effectively to the exploitation of results [5, 6], while collaborations with universities rather address the explorative capabilities [7].

Therefore, University-Industry Collaborations (UIC) are especially appealing for companies, that aim to stay up-to-date concerning the latest technological developments. Literature reflects a broad discussion on how to make UIC succeed [8-14]. This paper aims to advance this discussion by shedding light on a special form of UIC: The creation of a separate organization that joins industry and academia in one organisation and one physical site. Building this separate organization is believed to be an especially successful means in overcoming the barriers associated with UIC [15]. The most prominent examples of such organizations have been the Bell Labs or the Microsoft Laboratories in Cambridge (UK). This paper draws conclusions for practitioners and implications for further research from a case study on the Deutsche Telekom Laboratories in Berlin, Germany.

2 Methodology

Literature review on UIC

As a first step, a literature review has been conducted on UIC. The relevant motivation sources, barriers and solutions for overcoming these barriers were identified. The data has then been clustered and a preliminary questionnaire designed. A pre-test has been conducted to ensure that all relevant aspects of UIC were discovered and well described in the questionnaire.

In-depth interview with founding and current top management

Gathering of the main data consisted of four qualitative in-depth interviews in which the questionnaire was used as a guideline. Three interviews have been done with the present management team and one with a senior manager who was part of the initial team to set up the organization. In addition, quantitative data has been collected in order to prepare a comparative study with more than one company.

3 Motivation for UIC

There exists a large variety of potential motivations for university and industry to collaborate. They have been found to vary regarding firm size, company culture and geographic location of the firm. On the university side, categories could be found

especially regarding the culture towards collaboration with industry [13, 14, 16, 17]. The motivational aspects to collaborate are listed in table 1.

Table 1 Motivation for University-Industry Collaboration

University	*Industry*
Enhancement of teaching	Sourcing latest technological advances
Funding/ financial resources	Laboratory usage
Source of knowledge and empirical data	Personnel resources/ cost savings
Political pressure	Risk sharing for basic research
Enhancement of reputation	Stabilising long term research projects
Job offers for graduates	Recruiting channel

Source: Own collection.

University motivation for collaboration

In the Hurmelinna's study based on input from 49 managers and academics from Portuguese and Finnish companies and universities, the most frequently cited motivation for collaboration was the *enhancement of teaching* followed by *funding/ financial resources* and *reputation enhancement* [14]. *Knowledge gain* from industry researchers and the access to *empirical data* from industry was also documented as a strong motivation source [18]. This source was supported by Davidson who showed, that professors that cooperate strongly with industry are performing better concerning publication and entrepreneurial activities [19]. Laukkanen added to the list of reasons for engaging in UIC the *political pressure* applied to the university to become a driving force for the regional innovation and economic growth [20]. Another motivational aspect is the enhancement of *job opportunities for graduates* that foster both the reputation of the university and the readiness of its students to pay a premium on the tuition fees compared with other universities [14].

Industry motivation for collaboration

On the company's side the motivation factors are *early access to scientific or technological knowledge*, *risk reduction*, *access to unique research skills* [10, 18] and *cost reduction* through delegation of selected activities, especially in the field of basic research [7]. Furthermore Hall, Link and Scott have shown that the collaboration with a university also has a *stabilising effect*, in the respect that projects with collaborations are stopped less frequently [12]. In addition to the possibility to recruit personnel with unique skills, Azaroff notes that the collaboration on projects might also *reduce the recruiting costs* and *increase its efficiency* [8].

4 Barriers of UIC

Although the potential gains from UIC have been well recognized, there are obstacles remaining on the road to the successful realization of these gains. These obstacles have

been discussed in literature under the name of *collaboration barriers* and have been categorized by Van Dierdonck and Debackere in cultural, institutional and operational barriers [21]. This categorization helps to identify the right measures to help overcoming the different barriers. A summary of barriers of UIC is given in Table 2.

Table 2 Barriers of UIC

Cultural barriers
Divergent missions and goals
Conflicting interests concerning secrecy and IPR
Different languages and assumptions
Institutional barriers
Different nature of work
Divergent perception of what the "product" of R&D is
Structure change and change of responsibilities on the company's side
Operational barriers
Lack of knowledge about the partner and his processes
Insufficient coordination and project management
Lack of acceptance for results generated by the partner

Source: Own collection.

Cultural barriers of UIC and solutions

In general terms, the mission of universities is to advance science and therefore to advance a public good. Industry's mission on the other hand is to make profit and advance the private good of its stakeholders and shareholders. This *conflict in the mission* is also present on the level of *goals*. The universities need to produce scientific results that are thoroughly validated in order to advance their scientific reputation. Industry needs products and services which can be sold with profit in the marketplace; an extensive validation of research results is therefore not the main interest of industry, but fundamental for the achievement of the goals of the universities [22].

The conflicting goals lead directly to the *conflict concerning secrecy policy*. Companies usually believe that treating R&D results as confidential is the best way to maintain their innovative competitiveness. The universities need to publish results in order to gain reputation and therefore would also like to publish the results from the collaborative research activities. Also universities would like to publish the results fast to ensure that they are still novel while the industry wants to profit from the temporal head start [23].

Because of the different environments cultural barriers in form of *different language* and *basic assumptions* [22] develop. Such assumptions are for example that in industry - reaching results fast - is generally regarded as desirable. It is generally assumed to be the result of effective project management and execution. In academia the assumptions are

often opposite. Fast results are associated with research being rushed by project management and erratic and not validated enough.

Institutional barriers of UIC and solutions

The *different nature of work* consists of the following aspects. One is that universities are usually more engaged in basic research with diffuse, abstract and complex goals while industry R&D is motivated by clear deliverables and thus generally starts with applied research or even on the development stage [22]. In addition, companies are looking on short term profit, quarterly result tracking being the rule. In contrast, reporting cycles in academia are much longer and less-well defined in terms of technical results [14, 24].

When starting and managing projects, having a clear idea what the ideal output would be is one of the most important success factors. In UIC there usually persist *different perception what the product of R&D is.* For universities any advance in knowledge is a result and would be regarded as a success. In industry, a marketable product is the least that is expected and only a product that is successful in the marketplace will be regarded as an overall successful execution of the R&D project [25].

In practice the change of *responsibilities and the organizational structure* within companies remains an important challenge. This is especially true for cases, where the UIC was initiated and run by a single person or when the UIC was only in place for a short time when the responsible person on the company's side changes [22, 24].

Operational barriers of UIC and solutions

The fundamental difference on the operational level is that universities are still mostly public organizations and are therefore organized very differently from the companies that are profit driven and have well established management structures. Most companies have well defined incentive systems to align their employees' interests with the corporate strategy and interests. Universities are much more bureaucratic without explicit incentives offered to the professors and researchers. In consequence the processes of budgeting, task definition and task execution are very different [13].

For UIC, the *lack of knowledge of the partner's processes* remains a major barrier. Especially in time-critical situations, the university researchers are much more reluctant to work the extra hours to keep the deadlines, because they are not directly committed to them or profit from complying with them [10].

In situations where results from the two partners are building on each other, coordination of the work is crucial. But frequently an *insufficient project management* is reported from UICs which often leads to project delay or failure [10].

In the moment of transfer or implementation of project results another barrier frequently stated is a lack of acceptance of the results generated by the partner. This barrier has become known in literature under the term *"Not-invented-here-syndrome" (NIH-Syndrome)* [13, 14]

5 Motivation for the founding of the Deutsche Telekom Laboratories

Initiation phase and overall goal

The idea of founding the Deutsche Telekom Laboratories was generated out of a wider program to further improve the innovation capability of the DTAG. The aim of the DT Laboratories is to research and develop information technologies and communication technologies in order to enable the DTAG to generate new business and expand its existing operations and to dynamise innovative processes by fostering collaboration between science and industry.

Motivation sources

The results of the analysis of the importance of the motivation sources for the founding of the DT Laboratories are summarized in table 3.

Table 3 Importance of motivation sources for the founding of the DT Laboratories

Importance	*Industry*
Main reason	Open-up innovation
	Sourcing latest technological advances
High	Constant renewal of know-how
	Recruiting channel
Medium	Risk sharing for basic research
	Stabilising long term research projects
Low	Cost savings
	Laboratory usage

Source: Interviews with management team from DT Laboratories

From the motivation sources discovered in literature, *cost savings* and *laboratory usage* were the least important. Laboratory usage is not so much an issue in the ICT industry as for example in medical research. Therefore this motivation source does not apply that much for the ICT industry. The cost savings motivation although possible and realistic in the fields of human resource costs and outsourcing of project tasks was not an important issue in the decision phase.

Motivation sources of medium importance have been the aspect of *risk sharing in basic research* and to a smaller extend the *stabilizing effect for long term research projects*. Prior to the founding of the DT Laboratories, DTAG had reduced its R&D almost entirely to development. Today the R&D activities reach down to applied research with sometimes a strong link to basic research activities in universities. With Deutsche Telekom as a telecom operator and IT integrator, the company is often dealing with the downstream end of technological advance driven by suppliers. It is essential to carefully select the area of activity for its own R&D to avoid duplication and address areas with maximum potential for competitive differentiation. By now, DT Laboratories' motivation source would be more accurately described as *risk reduction in applied research through*

the closer linkage to basic research. The stabilizing effect can be found in government co-financed projects. Taking part in such projects is not only a contractual commitment to the funding organization but also to consortia partners. Therefore these projects are less frequently aborted. In addition, academic partners require a longer project perspective, because researchers are often financed by one or a few – but never many – research projects. Unlike industrial cooperation partners, universities cannot do flexible resource management.

The *recruiting channel* and the *constant renewal of know-how* from the university turned out to be the motivation sources of high relevance. In today's fast-moving technological environment, R&D faces the challenge to employ staff with constantly changing skill sets. On the organisational level this means that R&D has to become more project driven and less department orientated. In academia short to medium term contracts are the rule and fit well in the academic CV for example at the postdoctoral level and therefore contribute well to the renewal of know-how required in the contemporary R&D.

The main reason however for founding the DT Laboratories was to *open-up innovation*. The increasing technological complexity implies that no single person can stay up-to-date in a technological field. Therefore DTAG was looking for ways to leverage a larger community of experts that would help to identify technological opportunities and threats and provide feedback on the technical solutions developed by R&D. Even in a large company as the DTAG, the internally perceived level of novelty of a product or service might still be misjudged, because of limited information. By opening a gate to the academic world an improvement of technology intelligence was expected and also supported by a specific tool [26].

Furthermore the scientific community allows *sourcing latest technological advances* generated in universities. In order to be early in the market with latest technological solutions, activities in research and activities in development must be parallelised. This can only be achieved by getting early knowledge of the research activities being conducted in universities.

6 Overcoming the barriers of UIC in a separate organization setting

The organisation of UIC as a separate entity already facilitates the collaboration of industry and academia by creating a common identity with a mutual vision and mission. On top of this, a number of measures to further reduce the barriers of UIC are in place at DT Laboratories which are summarized in Table 4.

Solutions for cultural barriers

In order to reduce the conflict of interest between advancing public and private goods, the DT Laboratories employ as academic staff *exclusively post-docs that have a natural interest in application orientated R&D work*. After completing their PhD, researchers have a period for their own orientation which some of them use to get to know the industrial context.

In addition, the DT Laboratories have a well *defined policy on publication and IPR*. After a scientific discovery the DTAG has a clear defined time span of several weeks to decide on whether to claim interest in the IPR.

To further reduce cultural barriers *co-location*, *bi-yearly off-sites* and a *central coffee shop* are used to facilitate informal links between the academic and industry staff. Also the *transparency policy* is a powerful tool to create trust and understanding. This transparency policy is reflected both in the knowledge management systems architecture as well as in the interior architecture of the building itself, where all meeting rooms have glass doors and all DT Laboratories share an open office space – even the management team.

Table 4 Solutions of the DT Laboratories for overcoming the barriers of UIC

Solutions for cultural barriers
Employment of post-docs that have a natural interest in application orientated R&D work
Defined publication and IPR policies
Collocation, bi-yearly off-sites, one central coffee shop, transparency policy
Solutions for institutional barriers
Organization according to focus of work in strategic research and innovation development
Clearly defined deliverables, different KPIs in strategic research and innovation development, initial productization or even spin-off support for researchers
Stability through separated organization with allocated staffing
Solutions for operational barriers
Clear definition of processes
Coordination through quarterly project reviews and progress presentations
NIH-Syndrome reduced through mutual projects

Source: Interviews with management team from DT Laboratories

Solutions for institutional barriers

To reduce institutional barriers a clear *organization according to focus of work in strategic research and innovation development* is used. The academic staff is working in strategic research on academic and applied research while the industry staff in innovation development focuses early pre-development and product and service oriented development activities. In this way, both groups can focus on what they are best at and simultaneously use the interdependencies between their domains to leverage their own work.

To ensure that both groups have a clear idea of what is expected from them, *deliverables are clearly defined* and it is described in the R&D projects how the different results build on each other. Strategic research and innovation development have their own set of key performance indicators (KPIs) that provide further guidance. Another very important measure is to *support the researchers with initial productization or even spin-off* by market estimation and business case building work. This enables the researchers to focus on the work they prefer and prevents frustration.

The organization of DT Laboratories in a separate entity increases stability towards short-term shifts in corporate directions. Thus change in responsibilities on the

company's side is strongly reduced as compared to a conventional UIC which is managed directly through a person from within a monolithic organization. This contributes to stability in the staffing and therefore reduces the risk of compromising the collaboration, because the driver of the collaboration on the company's side would move to another position.

7 Conclusion

Implications for practitioners

Creating a separate organization to engage in an UIC is perceived by the stakeholder as very successful. First sign suggest that through the founding of the DT Laboratories the *explorative potential* of the DTAG and *technology intelligence has been improved* resulting in better project selection, increased output of relevant scientific work as well as state-of-the art technical results to be transferred to the operating units of the corporation. The organization has gained reputation as being innovative in itself while producing "fresh" and relevant results both academically and for practical implementation.

Drawn from one and a half years of experience some best practices have been identified:

- Creation of a *mutually shared mission* and *goals*
- Creation of an *environment of trust and transparency*
- Clear *policy on publication and IPRs*
- *Co-location, shared and open office space* and *team-building activities*
- *Clear division of* labour and management with *different key performance indicators*

Suggestions for further research

There are several interesting questions that remain to be answered. One suggested extension of research of UIC with a differentiation of the different levels of a collaboration. Here, Birley identified three which are organisation, department and individual level [27]. On each level, there are different barriers that should be studied separately in order to identify the right measure to overcome them. For example, trust was identified as one of the key influence factors on the success of a UIC [25, 28, 29]. In addition, it would be very helpful to identify the barriers that prevent trust building in an UIC context.

Another extension could be testing the effectiveness of UIC management techniques for different degrees of innovation. It has been shown that success of radical innovation might be reduced if the innovation management techniques are to rigid [30]. Therefore the question to ask would be if UIC management techniques can be fine tuned to foster research with high or low degree of innovation.

References and Notes

1. Miller, W.L. and L. Morris (1999) *4th generation R&D: managing knowledge, technology, and innovation*, New York: John Wiley.

2. Edler, J., F. Meyer-Krahmer, and G. Reger (2002) *Changes in the strategic management of technology: results of a global benchmarking study*, R & D Management, Vol. 32, No. 2, pp. 149-164.
3. Soh, P.-H. and E.B. Roberts (2005) *Technology Alliances and Networks: An External Link to Research Capability*, IEEE Transactions on Engineering Management, Vol. 52, No. 4, pp. 419-428.
4. Faems, D., B. Van Looy, and K. Debackere (2005) *Interorganizational collaboration and innovation: Toward a portfolio approach*, Journal of Product Innovation Management, Vol. 22, No. 3, pp. 238-250.
5. Christensen, C.M. and M. Overdorf (2000) *Meeting the challenge of disruptive change*, Harvard Business Review, Vol. 78, No. 2, pp. 66-+.
6. Frishammar, J. and S.A. Horte (2005) *Managing external information in manufacturing firms: The impact on innovation performance*, Journal of Product Innovation Management, Vol. 22, No. 3, pp. 251-266.
7. George, G., S.A. Zahra, and D.R. Wood (2002) *The effects of business-university alliances on innovative output and financial performance: a study of publicly traded biotechnology companies*, Journal of Business Venturing, Vol. 17, No. 6, pp. 577-609.
8. Azaroff, L.V. (1982) *Industry-University Collaboration: How to Make It Work*, Research Management, Vol. 25, No. 3, pp. 31.
9. Bloedon, R.V. and D.R. Stokes (1994) *Making university/industry collaborative research succeed*, Research Technology Management, Vol. 37, No. 2, pp. 44.
10. Bonaccorsi, A. and A. Piccaluga (1994) *A theoretical framework for the evaluation of university-industry relationships*, R & D Management, Vol. 24, No. 3, pp. 229.
11. Bowie, N.E. (1994) *University-Business Partnerships: An Assessment*, Lanham: Rowman and Littlefield Publishers, Inc.
12. Hall, B.H., A.N. Link, and J.T. Scott (2003) *Universities as research partners*, The Review of Economics and Statistics, Vol. 85, No. 2, pp. 485-491.
13. Siegel, D.S., et al. (2003) *Commercial knowledge transfers from universities to firms: Improving the effectiveness of university-industry collaboration*, Journal of High Technology Management Research, Vol. 14, No. 1, pp. 111-133.
14. Hurmelinna, P. (2004) *Motivations and Barriers Related to University-Industry Collaboration - Appropriability and the Principle fo Publicity*, *Seminar on Innovation*, UC Berkeley.
15. Marques, M.J., J. Alves, and I. Saur (2005) *Creating and Sustaining Successful Innovation Networks*, *DRUID Tenth Anniversary Summer Conference 2005 on Dynamics of Industry and Innovation: organisations, networks and systems*, Copenhagen, Denmank.
16. Shane, S. (2002) *University technology transfer to entrepreneurial companies*, Journal of Business Venturing, Vol. 17, No. 6, pp. 537-552.
17. Azagra-Caro, J.M., et al. (2006) *Faculty support for the objectives of university–industry relations versus degree of R&D cooperation: The importance of regional absorptive capacity*, Research Policy, Vol. 35, No. 1, pp. 37-55.
18. Meyer-Krahmer, F. and U. Schmoch (1998) *Science-based technologies: University-industry interactions in four fields*, Research Policy, Vol. 27, No. 8, pp. 835-851.
19. Gulbrandsen, M. and J.C. Smeby (2005) *Industry funding and university professors' research performance*, Research Policy, Vol. 34, No. 6, pp. 932-950.

20. Laukkanen, M. (2003) *Exploring academic entrepreneurship: drivers and tensions of university-based business*, Journal of Small Business and Enterprise Development, Vol. 10, No. 4, pp. 372-382.
21. Van Dierdonck, R. and K. Debackere (1988) *Academic Entrepreneurship at Belgian Universities*, R & D Management, Vol. 18, No. 4, pp. 341.
22. Cyert, R.M. and P.S. Goodman (1997) *Creating effective university-industry alliances: An organizational learning perspective*, Organizational Dynamics, Vol. 25, No. 4, pp. 45-57.
23. Rappert, B., A. Webster, and D. Charles (1999) *Making sense of diversity and reluctance: Academic-industrial relations and intellectual property*, Research Policy, Vol. 28, No. 8, pp. 873-890.
24. Rosenberg, N. and R.R. Nelson (1994) *American universities and technical advance in industry*, Research Policy, Vol. 23, No. 3, pp. 323.
25. Bruhn, J. (1995) *Beyond discipline: creating a culture for interdisciplinary research*, Integrative Physiological & Behavioral Science, Vol. 30, No. 4, pp. 331-341.
26. Rohrbeck, R., J. Heuer, and H.M. Arnold (2006) *The Technology Radar – an Instrument of Technology Intelligence and Innovation Strategy*, *The 3rd IEEE International Conference on Management of Innovation and Technology*, Singapore: IEEE Conference Publishing, 445 Hoes Lane, Piscataway, NJ 08854 USA.
27. Birley, S. (2002) *Universities, Academics and Spinout Companies: Lessons from Imprial*, International Journal of Entrepreneurship Education, Vol. 1, No., pp. 133-153.
28. Gomes, J.F.S., et al. (2005) *Managing relationships of the republic of science and the kingdom of industry*, Journal of Workplace Learning, Vol. 17, No. 1/2, pp. 88-98.
29. Bstieler, L. (2006) *Trust formation in collaborative new product development*, Journal of Product Innovation Management, Vol. 23, No. 1, pp. 56-72.
30. Loch, C. (2000) *Tailoring Product Development to Strategy: Case of European Technology Manufacturer*, European Management Journal, Vol. 18, No. 3, pp. 246-258.