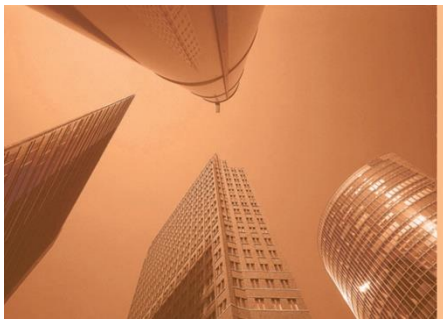
Working Papers Firms and Region
No. R2/2017



Knut Koschatzky

A theoretical view on public-private partnerships in research and innovation in Germany

Fraunhofer ISI

Contact:
Fraunhofer Institute for Systems
and Innovation Research ISI
Competence Center "Policy – Industry – Innovation"
Breslauer Strasse 48
76139 Karlsruhe, Germany
Phone: +49 / 721 / 6809-138
Fax: +49 / 721 / 6809-176
E-Mail: christine.schaedel@isi.fraunhofer.de
URL: www.isi.fraunhofer.de

Karlsruhe 2017
ISSN 1438-9843

Contents Page

Table

Abstract

Many case studies about public-private research partnerships (PPP) between academia and industry provide useful insights into the establishment and operation of these collaborative ties. Nevertheless, many of these studies follow their own perspective of analysis. According to Bozeman (2013: 312) "the scholarship on this topic remains relatively atheoretical or, more precisely, that it is "pre-theoretical" in the sense that much knowledge is accumulated but it has not been integrated into a matrix of empirical explanations". Taking the funding initiative of the German Federal Ministry of Education and Research (BMBF) "Research Campus – public-private partnership for innovation" (Forschungscampus – öffentlich-private Partnerschaft für Innovationen) as an example of a public-private partnership in research and innovation, it is the objective of this paper to develop a theoretical framework for the empirical analysis of this kind of PPP, and to apply this framework to the specific case of the German "Research Campus" initiative.

Keywords

public-private partnership, research and innovation, theory-based framework, research campus, Germany

1 Introduction

Short-term oriented market developments are not sufficient to cope with new technologies and to utilise new findings from basic research. They must be accompanied and enriched by strategic basic research (Grupp 1998). In this context, cooperations with the scientific community in the field of strategic basic research offer companies the opportunity to carry out respective research without building up own resources and infrastructures. Based on discussions about the triple helix model (Etzkowitz and Leydesdorff 2000), the willingness increased in public administration, politics and industry to support partnerships between the public and the private sector, for example in the form of public-private partnerships (PPP). We define a public-private partnership as a public service and/or a private economic activity, which is jointly financed and operated by the public sector and industry on the basis of a contract which regulates financing and operation (Koschatzky 2013: 21-22). PPPs in the context of strategic research are modes of cooperation between publicly funded research organisations and companies, and are characterised by a long-term institutional and strategic cooperation in order to achieve complementary goals by jointly operated research activities (Buckland 2009). Both sides bring in own resources and jointly share risks and possible income from the exploitation of research results (Becker 2003).

The funding initiative of the German Federal Ministry of Education and Research (BMBF) "Research Campus - public-private partnership for innovation" (*Forschungscampus – öffentlich-private Partnerschaft für Innovationen*) is an example of a public-private partnership in research and innovation. As Bozeman (2013: 312) argues about studies on university-industry research partnerships, that "*the scholarship on this topic remains relatively atheoretical or, more precisely, that it is "pre-theoretical" in the sense that much knowledge is accumulated but it has not been integrated into a matrix of empirical explanations*", many case studies in this field present anecdotic evidence, but do not contribute to a theoretical framework composed by either a new theoretical approach or theoretical explanations from different strands of the theoretical debate. The objective of this paper is therefore to develop a theoretical framework for the empirical analysis of PPP in strategic research, and to apply this framework to the case of the German "Research Campus" initiative.

As a first step, we point to theoretical work which deals with public private partnerships, innovation economics, coordination of networks and the chances and risks of such kind of transactions (transaction cost economics perspective), and the proximity dimension in exchange processes (economic geography), and derive conclusions for the analysis of the "Research Campus" initiative. In Section 3, we present "Research Campus" as an example of public private partnerships in strategic research in Germany. Section 4 analyses recent developments of the funding initiative by reflecting the theoretical conclusions. Finally, we draw conclusions regarding the implications of "Research Campus" for the German research and innovation system, but also regarding the underlying theoretical conceptions.

2 Public-private research partnerships: underlying theoretical conceptions

The paper develops a theoretical framework for the empirical analysis of PPP in strategic research. It explores three theoretical perspectives, namely transaction cost economics, innovation economics and economic geography. Transaction cost economics deal with coordination, control, governance, and regulation, with hierarchy in cooperation relations, with trust, opportunistic behaviour, and the absorptive capacities of the partners. Innovation economics can be applied for analysing the kind of distributedness of innovation processes, the openness of innovation, knowledge generation and exploitation processes, the role of human resources, and market orientation. Economic geography, finally, brings in the perspective of spatial and cultural proximity in exchange processes, the role of embeddedness, and the kind of knowledge which is relevant for face-to-face contacts. This third theoretical perspective has to be included because the

funding guidelines of "Research Campus" demand close spatial proximity of the collaborative ties of the involved partners in this form of a PPP. Main conclusions from the theoretical discussion are summarised in a heuristic approach which will be used as a framework for the analysis of public-private research partnerships funded by the German "Research Campus" programme.

2.1 Transaction costs perspective

From a theoretical point of view, strategic research partnerships can, among others, be explained by the transaction costs approach (Williamson 2002). This approach examines the circumstances under which cooperation agreements are the most efficient form of organisation. According to this theoretical approach, science-industry linkages can be explained by the fact that with increasing vertical disintegration, the necessity of exchange processes increases and thus the number of required transactions. Differentiation, technological complexity and interdependence lead to the increase in costs of activity coordination within enterprises, so that the pressure to search for external arrangements rises as well. But not only the firm internal transaction costs are rising, but also information asymmetries are increasing, resulting from production segmentation and bounded rationality of economic agents. As a matter of fact, the market - through the price mechanism – is not longer the most efficient form of resource coordination. The resulting question is that under what conditions companies opt for (firm internal) hierarchical coordination, for the market or for hybrid forms of cooperation. The answer is that in each case the most cost-effective variant should be sought. In this interpretation, transaction cost efficiency can be regarded as a motivation for public private partnerships.

The formation of network and partnership structure is a mode of coordination that enables flexible access to external resources and is a suitable tool for companies to save internal resources (Hunt and Morgen 1996; Aldrich and Zimmer 1986; Becker and Dietz 2004). With regard to knowledge and innovation, external acquisition can increase the coordination effort. As already pointed out, internal knowledge and skills must be available to use external knowledge ("absorptive capacity") (Cohen and Levinthal 1990; Lichtenthaler and Lichtenthaler 2009). Furthermore, networks and PPP can lead to rigid relations and can become encrusted ("weakness of strong ties"). So therefore flexible relationships with various partners and openness to new partners are important (Granovetter 1973; Granovetter 1985; Grabher 1993).

According to the transaction cost approach, PPP are one form of coordination in the field of research and development. As all market transactions, they are not free from risks and they pose a spectrum of challenges to the partners involved in such relation-

ships (Bapuji et al. 2011; Caloghirou et al. 2004; Escribano et al. 2009; van de Vrande et al. 2010; Du et al. 2014). One risk is the loss of strategically important knowledge for the firm, e.g. through opportunistic behaviour of network or cooperation partners (Williamson 1990: 54). The fear of loss can prevent or reduce the exposure to research partnerships. This leads to the necessity to regulate confidentiality and the utilisation of intellectual property rights (IPR). Usually, this is one of the core points in joint collaboration agreements. In particular small companies (but not only this group of firms) have a disadvantage here. Additionally, they have a lack in absorptive capacity which limits the use of knowledge from outside and the utilisation of this knowledge for internal activities. Missing internal knowledge and skills are a disadvantage for these firms in strategic research partnerships or even excludes them from this form of interaction. Another disadvantage could be limited resource endowments, especially with regard to the financing of R&D and innovation activities.

Within public private partnerships, transaction costs may be reduced internally, but could rise externally. In addition to the management of the innovation process itself, the management of the research partnership is a challenge. With regard to the development of a dense network, too close connections to the partners can lead to lock-in situations (Koschatzky 2001: 145). Flexibility and openness to new partnerships should be aspired. Another challenge and risk of failure is that usually power asymmetries evolve in partnerships with an unequal financial participation of the partners. Big companies which are able to invest more resources or to bring in own infrastructure are mainly much closer to strategic decision making processes than companies (or other partners) which are unable to contribute a similar amount of resources. As a result, hierarchies emerge with resulting impacts on the definition of the research agenda and implications for the whole network.

2.2 Innovation economics

According to innovation economics' recent understanding, innovation is an interactive and systemic process that creates novelties (Bathelt and Glückler 2012: 51-52). These novelties (inventions) become an innovation when they successfully reach the market stage and create demand. Innovation can be technological, process-related, organisational, social and cultural. A major difference to older interpretations of the innovation concept (e.g. the one defined by Schumpeter in 1911 [Schumpeter 1993]) is that nowadays innovation is regarded as a non-linear and cumulative process which is influenced by socio-cultural factors and which is characterised by interactivity between many stages and many agents contributing to the realisation of an innovation. As a matter of fact, innovation can also be interpreted as a distributed knowledge sourcing

and combining process between different agents. Both tangible and intangible (social) interactions with firms, research institutes, intermediaries, clusters, networks and others play a prominent role in the transfer of information, implicit and explicit knowledge to new technological, social and organisational solutions (Heidenreich et al. 2012: 272; Kline and Rosenberg 1986).

A quite recent paradigm, which is at least partially based on the distributed character of innovation, is the open innovation approach (Chesbrough 2003). Chesbrough argues that while in the past, innovation resulted from closed processes in the laboratories of large firms using own research and development facilities, nowadays successful innovation relies on the strategic integration of external ideas, knowledge and cooperation partners. A basic rationale for this openness is that the increasing complexity of technological development and thus innovation processes demands a strategic decision in firms to minimise technological and financial risks through collective efforts.

According to Chesbrough et al. (2006), open innovation is the strategic use of "knowledge inflows" and "knowledge outflows" in order to accelerate internal innovation activities in the context of the use of external knowledge in the company ("inbound"). Additionally, knowledge created in the firm will be provided to external use ("outbound") (Gassmann and Enkel 2006). The opening of the enterprises' innovation process therefore involves the systematic and targeted use of internal and external knowledge bases and "ideas" to create added value, with simultaneous definition of internal mechanisms that make use of this value (Chesbrough et al. 2006). According to van der Meer (2007), there are numerous mechanisms, methods and structures which enable knowledge inflows and -outflows. Creative workshops with universities or in-licensing promote, for example, knowledge inflows, while cluster (projects), public private partnerships or out-licensing favour knowledge outflows.

To sum up, major characteristics of open innovation processes are the integration of customers, users, and heterogeneous external experts in all phases of the innovation process in order to contribute jointly to the search for a solution of a specific problem. This process can be seen as interactive value creation (Reichwald and Piller 2009). Through open innovation, substitution effects by external research and capacity building by the partners can be realised in order to develop and to integrate ideas together (Dahlander and Gann 2010). Public private partnerships in strategic research are an organisational mode of open and distributed innovation processes.

2.3 Economic Geography

The distributedness of the innovation process depends on different influential factors: the modes of interrelationships between agents (knowledge base and specialisation), the dynamics in the distribution patterns of the agents (changes in the distribution patterns), and the scales which address the levels of innovation (incremental steps up to fundamental changes) (Coombs et al. 2003: 1126). Regarding strategic research collaborations in fields which are characterised by a high degree of uncertainty (which is often the case in basic research activities distant to the market), the kind of the involved knowledge base and its implication on the necessity to interact in close social and geographical proximity is of great importance. Usually, economic geography regards proximity as a relevant factor in innovation (Boschma 2005; Carrincazeaux and Corris 2011). Proximity can have different dimensions of which geographical and social proximity are the most relevant in the context of this paper. Geographical proximity refers to the spatial or physical distance between economic actors, while social proximity is related to the fact that economic relations are always embedded in a social context (Boschma 2005: 66-69). Nevertheless, there is no strict rule about the importance of each proximity dimension and depending on the content of innovation processes (technological, social, incremental, and radical) and the used and newly generated knowledge, different proximity configurations emerge. Referring to the classification of different knowledge bases, it is especially synthetic knowledge creation which has a tendency to be more sensitive to proximity effects between the actors involved, favouring local/regional collaboration (Asheim et al. 2011: 899). Synthetic knowledge refers to the application or combination of existing knowledge in new ways and is characteristic for the engineering field. But also analytical (science based) and symbolic (arts based) knowledge might include elements of local collaboration. Besides the kind of the involved knowledge, also intra-organisational resources affect the distributedness of the innovation process. On the one hand, the absorptive capacity of organisations (firms, research institutes) influence their ability to handle collaborations, to utilise own knowledge and to make use of external knowledge for internal purposes (Cohen and Levinthal 1990). This, on the other hand, demands a proper gatekeeper function in the organisation through which all relevant persons and departments are informed and included in knowledge exchange and innovation activities (Tushman and Katz 1980).

2.4 Analytical framework

The main conclusions from the theoretical reflections can be summarised in a heuristic approach which serves as a framework for the analysis of strategic research partnerships (cf. Table 1).

Table 1: Heuristic approach to analysing strategic research partnerships

Approach	Analytical focus			
Transaction cost economics	coordination, control, governance, regulation	hierarchy versus market, cost efficiency	trust, opportunistic behaviour	absorptive capacity
Innovation economics	distributedness, open innovation, interactive process, uncertainty	knowledge generation and exploitation	human resources	market orientation
Economic geography	spatial and social proximity	kind of knowledge, relevance of face-to-face contacts	regional potential and attractiveness	local/regional impacts and visibility

Source: own draft

The main statements of Table 1 can be summarised as follows:

- Transaction cost economics: In the transaction cost perspective, coordination, control and governance are basic principles of research partnerships. They are also the outcome of a selection process between hierarchical and market coordination. Firms opt for a firm external solution because they expect a more cost efficient result of this type of coordination. This includes a weighting between challenges, risks and the form of external collaboration and reflects the motivation structure of the firm.
- Innovation economics: Innovation is a distributed process and this distributedness is a central element of the open innovation approach. Open innovation is defined, among others, by the strategic use of knowledge inflows and outflows for interactive value creation and R&D activities targeted to established and new markets.
- Economic geography: Distributedness is also related to different proximity dimensions of which geographical proximity plays a special role, especially when newly generated knowledge is involved in exchange processes. Confidentiality and tacitness demand fact-to-face contacts between the researchers involved in the knowledge creation processes. In the combination of PPP and open innovation, partnerships like the "Research Campus" can be interpreted as nodes of open innovation in a protected space focussed on one location.

This analytical approach serves as a framework for the analysis of the German "Research Campus" programme.

3 Research Campus – basic characteristics

The funding initiative "Research Campus - Public-Private Partnership for Innovation" of the Federal Ministry of Education and Research (BMBF) goes back to a recommendation of the German Expert Commission on Research and Innovation (EFI), which demanded a greater use of PPP between science and industry in its report from 2009:

> "*Public Private Partnerships offer considerable opportunities, because they are frequently long-term projects and bring together complementary strengths in research and development. Active political support should be provided for further partnerships. Experience with Public Private Partnerships should be made available for a wide group of companies and research institutions*" (EFI 2009: 41).

The objective of the funding initiative is to promote collaboration between partners from industry and research organisations by combining resources in order to develop new research fields in a middle to long-term perspective in the way of public-private partnerships located at the campus of a university or research institute. Strategic precompetitive research should be strengthened and leverage effects by public funding for an increased private investment be created. Therefore, research campuses are a partnership between academia and industry focused on one location (Koschatzky 2014: 91).

Based on the EFI recommendation, the BMBF issued a call in August 2011 for the funding of research campuses. The funding initiative is part of the German Hightech Strategy (BMBF 2014a). Up to two million Euros of funds in the form of grants are available per research campus and year. This amount of funding has at least to be complemented by private funds in order to achieve the greatest possible leverage effect from public support. The maximum length of funding is 15 years. Applications could be made for the development of research campus models (pre-phase) as well as for the establishment of collaborations (main phase). In September 2012, an independent jury proposed ten proposals for funding (BMBF 2014b):

- Aachen: Digital Photonic Production (DPP), Electric Networks of the Future (FEN)
- Berlin: Mathematical Optimization and Data Analysis Laboratory (Modal AG), Connected Technologies, EUREF - Mobility2Grid
- Jena: InfectoGnostics
- Magdeburg: Stimulate - Solution Centre for Image Guided Local Therapies
- Mannheim: Mannheim Molecular Intervention Environment (M2OLIE)
- Stuttgart: ARENA2036 - Active Research Environment for the Next Generation of Automobiles
- Wolfsburg: Open Hybrid LabFactory (OHLF).

At that time, with the exception of ARENA2036 in Stuttgart, all research campuses started with the pre-phase, in most cases for one year. A central task was the establishment of the partnership "under one roof" in which both the spatial aspects of cooperation as well as the regulation of the organisation and the management of intellectual property rights were included. In summer 2014, one research campus left the funding programme. From 2015 onwards, nine research campuses are in the first main phase of five years funding.

The central features of the funding initiative are

- proximity, i.e. the pooling of activities and competencies of research in one place (on the campus)
- medium to long-term perspective for a special research topic, and
- mandatory public-private partnership.

These features can be confirmed regarding the underlying assumptions by analysing comparable cooperation programs in the US, Sweden and Austria, as well as appropriate evaluation studies (Kaplun 2013). Geographical and social proximity are a success factor for long-term collaborations between academia and industry. A medium to long-term perspective is essential in basic research. However, long-term relationships that exceed the strategic planning horizon of many companies can be an obstacle for them. The liability of legally secure regulated public-private partnerships is a central basis of long-term cooperation and reduces conflict potential. However, it can not always be realised on "eye level", because, for example, at least some universities and small and medium-sized enterprises (SME) have less bargaining power and sometimes also a lower interest in the own regulation of intellectual property rights (e.g. patents) compared to large companies.

The research campuses are active in diverse fields like energy, health/medicine, automotive/mobility. Several companies should be part of a research campus, ideally SMEs; but large (multinational) companies are drives in most cases. The partners of a research campus shall contribute at least 50% of the total budget together. Various forms of organisation and contracts are established suiting the specific demand of each research campus. One very important aspect is the regulation of IPR issues on "eye level".

4 Theory-based analysis of recent developments in the Research Campus initiative

4.1 Empirical background

The analysis is based on research work carried out in the project "Research Campus – pro active", funded by the German Ministry of Education and Research between 2012 and 2016. Empirical analyses include an annual collection of empirical data about structure and development of the research campuses, personal interviews with the research campus managers in 2014, 2015 and 2016, personal interviews with the presidents or rectors of the involved universities and mainly telephone interviews with two to three companies per campus in seven of the nine research campuses in 2015. Additionally, we analysed PPP models in Germany that were not funded by the Research Campus programme, and made case studies of similar funding models in Australia, Austria, Sweden and the United States (Koschatzky et al. 2015).

In the following we will focus on analytical aspects which we addressed in the discussion of theoretical conceptions in section 2, namely the transaction costs perspective, innovation economics, and economic geography.

4.2 Transaction cost perspective

Research Campuses are a long-term mandatory partnership based on reliable, contractually regulated relations. Their organisational status differs (association, limited liability company, non-profit company) and thus their coordination is regulated and organised differently as well (campus offices, board of directors, campus coordinators). Hierarchical relationships exist, depending on scientific excellence of the research partners and the financial abilities of the companies to invest in the Research Campus. Resources are pooled through the "under one roof" concept and complementarity exists regarding the partners' specific competencies in pursuing a jointly formulated research agenda. The partnerships are strategic networks with a high degree of central powers shared between mainly large firms and academic organisations.

The main reasons to opt for "Research Campus" as joint research platform were the institutionalisation and the liability of the cooperation as well as the clear governance rules and the "under one roof" concept. It allows the realisation of complementary objectives like training and further education, and the attraction of students and possible future employees. Additionally, the long-term perspective is an attractive option both for firms and research institutes. Nevertheless, many companies and research institutes maintain other forms of collaboration. But for this specific purpose, i.e. collaboration in

strategic basic research with a wider time perspective than usual, the "Research Campus" initiative was regarded as the best option.

Another important challenge, at least during the preparatory phase, was the regulation of IPR and informal communication processes. Depending on the internal structures within each research campus, different requirements led to different arrangements. The pre-phase was seen to be very helpful in this respect, because it allowed to develop a mutual understanding of the respective situations and to agree on regulations which fulfilled the interests at least of the negotiating core partners. At the beginning of the main phase, IPR problems did not yet occur because of the early stage of research and development activities. However, the need for regulation over time could be changed, because projects reach their application stage and patenting becomes a topic. Therefore the practicability of the IPR regulations has yet to be proven.

4.3 Open innovation perspective

Within a research campus, knowledge flows openly between the partners, even though it is regulated by confidentiality agreements. The aim is to generate innovation in new (technological) fields in order to create new markets and applications. Research campuses are regarded as a platform for defining new bilateral or multilateral projects, which can be carried out in or outside the campus. In this respect, the campus is open. On the other hand, it is a protected space because this kind of collaboration is based on trustful, sometimes long-existing relationships between the partners. These relationships have to prove their stability and sustainability within this new form of cooperation. Therefore there is an inherent tendency, at least during the start-up phase, to focus on the stabilisation of the existing network and not to open it up too quickly to other organisations, especially possible competitors.

4.4 Economic geography perspective

Geographical proximity is a mandatory funding principle, so the participating organisations do not have the choice to search for other spatial arrangements or even virtual forms of collaboration. Some companies criticised this rigid principle, but the majority of the interviewed partners are confident that close personal exchange in one laboratory or one building is a success factor (combination of geographical and social proximity). Some companies practice this kind of close collaboration also in other partnerships, so that it is not fundamentally new to them. The proximity principle is implemented differently in a way that university personnel is nearly fully present on the campus (four or five days a week), while company personnel prefers two or three days per week at most in

order to secure the knowledge exchange by an approximately two or three days presence per week in the company.

A positive aspect of proximity is that the cooperation in the research campus allows companies to get in touch with other companies much easier than outside the campus and to use these contacts for the arrangement of new projects. These projects can be carried out inside or outside the research campus. In these cases, the proximity dimension has a synergy function and acts as a seedbed for creative ideas.

4.5 General considerations

With regard to the three theoretical perspectives of the analytical framework, the following theory-based considerations are possible:

Transactions

Partner constellations differ, although not too much because most of the presented models are organised around a partnership between small, medium and large firms, universities and sometimes also non-university research institutes. On average per campus, 20 partners are involved, of which are eight SMEs, seven large firms, and five universities and research institutes. Explicit *governance modes* developed by the partners as obligatory requirement demanded by the BMBF are a necessary element of the PPP. These modes differ according to the *organisational status* of each campus. Some are organized as association, some as limited liability company, some as non-profit company. *Absorptive capacities* of the partners are sufficiently developed. Even small firms are fully integrated in the research projects and contribute to joint research objectives through own personnel or equipment. Especially in constellations which open new research avenues, *trust* between the partners is essential. Nevertheless, with regard to the involvement of large firms, also *hierarchy* and power plays a role. Core partners, which mainly are large companies or universities, can pay a higher membership fee and have thus more rights to influence the research agenda.

Innovation

Open innovation is at least a core assumption in all PPP-models. Tasks are *distributed* among the partners in this form of partnership. Nevertheless, the *degree of openness* depends on the interests of all partners. There exists an inherent tendency to focus on the stabilization of the existing network and not to open it up too quickly to other organisations, especially possible competitors. Openness can therefore be an internal openness but an external closeness. In the context of innovation, learning and qualification

of *human resources* are key elements in PPP, especially with regard to the qualification of Master and PhD. students, post doctoral students and further qualification. *New markets* should be created, but in most cases are not yet developed.

Geography

Spatial proximity is mandatory, plays sometimes a role, but is not always necessary. *Regional or social proximity* between the partners in a collaborative network matters, especially in early phases of the cooperation experience and research activities. In cases where distinct centres are established it is more a technical characteristic that partners are located close by. Personnel from the companies is not always present in the labs, because these researchers have to maintain the link with the research department in their company through weekly personal visits. PPP of a certain size usually have a high *regional or sometimes national visibility* and could also be a policy instrument to support regional specialisation and development, especially in regions which do not possess a dense research infrastructure.

5 Conclusions and recommendations

In this paper we pursued the approach to analyse recent developments in the research campus initiative on the basis of explanations stemming from PPP organisation, transaction cost economics, innovation economics, and economic geography. We believe that this is a starting point for the combination of empirical findings with the development of a 'matrix of empirical explanations' (Bozeman 2013). The theoretical approaches define fundamental principles which offer sufficient possibilities to develop a theoretical framework around research collaborations between industry and academia. In our case, the economic geography perspective had to be included because the proximity dimension plays a specific role in the research campus programme. In related activities in other countries, this might be different.

Organisational theory (choice and implications of the modes of organising and regulating strategic research partnerships) (e.g. Bolton and Dewatripont 2005) and behavioural approaches are other aspects which should be looked at in more detail in further studies. Our study results can be seen as a first attempt to contribute to a shift from pre-theoretical to theoretical analysis of strategic research partnerships. Nevertheless, we recommend more theory-based case studies of different PPP models in research and innovation in order to formulate an analytical framework which contributes to the advancement of theoretical and empirical research in this field.

Regarding "Research Campus" we can conclude that an already well developed culture of cooperation between scientific organisations and industry, which is the case in Germany, favours the pooling of different interests and competences in long-term oriented strategic research fields. As often stated in interviews with companies or the research campus management, existing contacts and trust between the major actors in a research campus were the main foundations for establishing this kind of partnership.

Nevertheless it is still unclear whether the research campuses will become a successful and sustainable PPP-model in Germany. It has to be noted that "Research Campus" is so far an experiment based on expectations, but not on extensive empirical evidence, especially regarding the achievement of objectives. What can be observed until now are the first steps in a longer process with imponderables and challenges. This affects, among others, the question of how open innovation processes will be in times when market implementation comes closer, or the interpretation and handling of IPR regulations when exploitation potentials become more visible. These aspects demand further research in the coming years.

Note: This paper draws on research which was funded by the German Federal Ministry of Education and Research (BMBF) under the research grant number 03FO1E01. The preparation of this paper was made possible by a research grant from the Stifterverband für die Deutsche Wissenschaft, project number H410 7106 9999 28329. Parts of the results are published in Koschatzky, K. and Stahlecker, T. (eds.) (2016) Public-private partnerships in research and innovation: Trends and international perspectives. Stuttgart: Fraunhofer Verlag.

The paper was awarded as "Best Conference Paper" at the 2017 University-Industry Engagement Conference, Adelaide, 15-17 February 2017.

References

Aldrich, H.E. and Zimmer, C. (1986): Entrepreneurship Through Social Networks. In: Sexton, D. and Smilor, R. (eds.): The Art and Science of Entrepreneurship. New York: Ballinger, 3-23.

Asheim, B.T.; Boschma, R. and Cooke, P. (2011): Constructing Regional Advantage: Platform Policies Based on Related Variety and Differentiated Knowledge Bases, Regional Studies, 45, 893-904.

Bapuji, H.; Loree, D. and Crossan, M. (2011): Connecting external knowledge usage and firm performance: an empirical analysis, Journal of Engineering and Technology Management, 28, 215-231.

Bathelt, H. and Glückler, J. (2012): Wirtschaftsgeographie. Ökonomische Beziehungen in räumlicher Perspektive. 3. Auflage. Stuttgart: Ulmer.

Becker, R. (2003): Zielplanung und Kontrolle von Public Private Partnership in der Forschung. Wiesbaden: Deutscher Universitätsverlag.

Becker, W. and Dietz, J. (2004): R&D cooperation and innovation activities of firms – evidence for the German manufacturing industry, Research Policy, 33, 209-223.

BMBF [Bundesministerium für Bildung und Forschung] (2014a): The new High-Tech Strategy. Innovations for Germany. Berlin: BMBF.

BMBF [Bundesministerium für Bildung und Forschung] (2014b): Forschungscampus – öffentlich-private Partnerschaft für Innovationen. Berlin: BMBF.

Bolton, P. and Dewatripont, M. (2005): Contract Theory. Cambridge, MA: The MIT Press.

Boschma, R. (2005): Proximity and Innovation: A Critical Assessment, Regional Studies, 39, 61-74.

Bozeman, B. (2013): In Conclusion: What Research is Missing for Cooperative Research Centers? In: Boardman, C.; Gray, D.O. and Rivers, D. (eds.): Cooperative Research Centers and Technical Innovation. Government Policies, Industry Strategies and Organizations Dynamics. New York, Heidelberg, Dordrecht, London: Springer, 311-318.

Buckland, R. (2009): Private and Public Sector Models for Strategies in Universities, British Journal of Management, 20, 524-536.

Caloghirou, Y.; Kastelli, I. and Tsakanikas, A. (2004): Internal capabilities and external knowledge sources: complements or substitutes for innovative performance?, Technovation, 24, 29-39.

Carrincazeaux, C. and Coris, M. (2011): Proximity and innovation. In: Cooke, P., Asheim, B.; Boschma, R.; Martin, R.; Schwartz, D. and Tödtling, F. (eds.): Handbook of Regional Innovation and Growth. Cheltenham, Northampton: Edward Elgar, 269-281.

Chesbrough, H. (2003): Open Innovation: The New Imperative for Creating and Profiting from Technology. Cambridge, MA: Harvard Business School Publishing.

Chesbrough, H.; Vanhaverbeke, W. and West, J. (eds.) (2006) Open Innovation: Researching a New Paradigm. Oxford: Oxford University Press.

Cohen, W. and Levinthal, D.A. (1990): Absorptive capacity. A new perspective on learning and innovation, Administrative Science Quarterly, 35, 128-152.

Coombs, R.; Harvey, M. and Tether, B.S. (2003): Analysing distributed processes of provision and innovation, Industrial and Corporate Change, 12, 1125-1155.

Dahlander, L. and Gann, D.M. (2010): How open is innovation?, Research Policy, 39, 699-709.

Du, J.; Leten, B.; Vanhaverbeke, W. and Lopez-Vega, H. (2014): When Research Meets Development: Antecedents and Implications of Transfer Speed, Journal of Product Innovation Management, 31, 1181-1198.

Escribano, A.; Fosfuri, A. and Tribó, J.A. (2009): Managing external knowledge flows: The moderating role of absorptive capacity, Research Policy, 38, 96-105.

Expert Commission Research and Innovation [EFI] (2009): Report 2009. Research, innovation and technological Performance in Germany. Berlin: EFI.

Etzkowitz, H. and Leydesdorff, L. (2000): The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations, Research Policy, 29, 109-123.

Gassmann, O. and Enkel, E. (2006): Open Innovation: Externe Hebeleffekte in der Innovation erzielen, Zeitschrift Führung + Organisation, 3, 132-138.

Grabher, G. (1993): The weakness of strong ties: the lock-in of regional development in the Ruhr area. In: Grabher, G. (ed.): The embedded firm. On the socioeconomics of industrial networks. London: Routledge, 255-277.

Granovetter, M. (1985): Economic action and social structure: the problem of embeddedness, American Journal of Sociology, 91, 481-510.

Granovetter, M. (1973): The strength of weak ties, American Journal of Sociology, 78, 1360-1380.

Grupp, H. (1998): Foundations of the Economics of Innovation. Theory, measurement and Practice. Cheltenham: Edward Elgar.

Heidenreich, M.; Barmeyer, C.; Koschatzky, K.; Mattes, J.; Baier, E. and Krüth, K. (2012): Multinational Enterprises and Innovation. Regional Learning in Networks. New York, London: Routledge.

Hunt, S.D. and Morgan, R.M. (1996): The Resource-Advantage Theory of Competition: Dynamics, Path Dependencies, and Evolutionary Dimensions, Journal of Marketing, 60, 107-114.

Kaplun, A. (2013): 'Forschungscampus' - ein neues BMBF-Förderinstrument im internationalen Vergleich. Freie wissenschaftliche Arbeit zur Erlangung des Grades eines Master of Arts Wirtschaftsgeographie (M.A.) am Institut für Wirtschafts- und Kulturgeographie der Leibniz Universität Hannover. Hannover: Leibniz Universität Hannover.

Kline, S.J. and Rosenberg, N. (1986): An Overview of Innovation. In: Landau, R. and Rosenberg, N. (eds.): The Positive Sum Strategy. Harnessing Technology for Economic Growth. Washington: National Academy Press, 275-305.

Koschatzky, K. (2014): Die Rolle von Hochschulen in regionalen Partnerschaften mit Wirtschaft und Wissenschaft. In: Koschatzky, K., Dornbusch, F., Hufnagl, M., Kroll, H. and Schnabl, E. (eds.): Regionale Aktivitäten von Hochschulen - Motive, Anreize und politische Steuerung. Stuttgart: Fraunhofer Verlag, 79-118.

Koschatzky, K. (2013): Heterogene Kooperationen im deutschen Forschungs- und Innovationssystem. Stuttgart: Fraunhofer Verlag.

Koschatzky, K. (2001): Räumliche Aspekte im Innovationsprozess. Ein Beitrag zur neuen Wirtschaftsgeographie aus Sicht der regionalen Innovationsforschung. Münster: Lit-Verlag.

Koschatzky, K.; Kroll, H.; Meyborg, M.; Stahlecker, T.; Dwertmann, A. and Huber, M. (2015): Public-private partnerships in Research and Innovation – Case studies from Australia, Austria, Sweden and the United States (Working Papers Firms and Region Nr. 2/2015). Karlsruhe: Fraunhofer ISI.

Koschatzky, K. and Stahlecker, T. (2015): Neue Kooperationsmodelle in Deutschland – Einleitung. In: Koschatzky, K. and Stahlecker, T. (eds.): Neue strategische Forschungspartnerschaften zwischen Wissenschaft und Wirtschaft im deutschen Innovationssystem. Stuttgart: Fraunhofer Verlag, 1-6.

Lichtenthaler, U. and Lichtenthaler, E. (2009): A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity, Journal of Management Studies, 46, 1315–1338.

Reichwald, R. and Piller, F. (2009): Interaktive Wertschöpfung. Open Innovation, Individualisierung und neue Formen der Arbeitsteilung. 2nd Edition. Wiesbaden: Gabler.

Schumpeter, J.A. [1911] (1993): Theorie der wirtschaftlichen Entwicklung. Eine Untersuchung über Unternehmensgewinn, Kapital, Kredit, Zins und den Konjunkturzyklus. 8th Edition. Berlin: Duncker & Humblot.

Tushman, M. and Katz, R. (1980): External Communication and Project Performance: An Investigation Into the Role of Gatekeepers, Management Science, 26, 1071-1085.

van de Vrande, V.; Vanhaverbeke, W. and Gassmann, O. (2010): Broadening the scope of Open Innovation: Introduction to the special issue, International Journal of Technology Management, 52, 221-235.

van der Meer, H. (2007): Open Innovation – The Dutch Treat: Challenges in Thinking in Business Models, Creativity and Innovation Management, 16, 192-202.

Williamson, O.E. (1990): Die ökonomischen Institutionen des Kapitalismus. Unternehmen, Märkte, Kooperationen. Tübingen: J.C.B. Mohr/Paul Siebeck.

Williamson, O.E. (2002): The Theory of the Firm as Governance Structure: From Choice to Contract, Journal of Economic Perspectives, 16, 171-195.

The series "Working Papers Firms and Region" presents research work of the Competence Center "Policy – Industry – Innovation" of Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany.

No.	Authors	Title
R2/2017	Knut Koschatzky	A theoretical view on public-private partnerships in research and innovation in Germany
R1/2017	Henning Kroll	The Challenge of Smart Specialisation in less favoured Regions
R3/2016	Henning Kroll, Niclas Meyer	Analysing FP7 from a Systemic Perspective What Role for the Delineation and the Set up of the Sub-Programmes?
R2/2016	Henning Kroll	Supporting New Strategic Models of Science-Industry R&D Collaboration – A Review of Global Experiences
R1/2016	Henning Kroll	Understanding the "Regional Policy Mix" - A Classification and Analysis of European Regions' Support Policies
R2/2015	Knut Koschatzky, Henning Kroll, Mirja Meyborg, Thomas Stahlecker, Anne Dwertmann, Monika Huber	Public-private partnerships in Research and Innovation - Case studies from Australia, Austria, Sweden and the United States
R1/2015	Henning Kroll	Exploring Pathways of Regional Technological Development in China through Patent Analysis
R4/2014	Knut Koschatzky Esther Schnabl Andrea Zenker Thomas Stahlecker Henning Kroll	The Role of Associations in Regional Innovation Systems
R3/2014	Knut Koschatzky	New forms of regional interaction between universities and industry Evidence from Germany
R2/2014	Henning Kroll Emmanuel Muller Esther Schnabl Andrea Zenker	From Smart Concept to Challenging Practice – How European Regions Deal with the Commission's Request for Novel Innovation Strategies
R1/2014	Henning Kroll Torben Schubert	On universities' long-term effects on regional value creation and unemployment The case of Germany
R6/2013	Friedrich Dornbusch Thomas Brenner	Universities as local knowledge hubs under different technology regimes – New evidence from academic patenting

No.	Authors	Title
R5/2013	Elisabeth Baier Henning Kroll Andrea Zenker	Templates of smart specialisation: Experiences of place-based regional development strategies in Germany and Austria
R4/2013	Thomas Stahlecker Henning Kroll	Policies to Build Research Infrastructures in Europe – Following Traditions or Building New Momentum?
R3/2013	Elisabeth Baier Henning Kroll Andrea Zenker	Regional Autonomy with regard to Innovation Policy: A Differentiated Illustration of the European Status Quo
R2/2013	Henning Kroll	Patterns of Technology Transfer in Chinese Hotspots of Innovative Development – The Perspective of the Recipient Firms
R1/2013	Esther Schricke	Occurrence of cluster structures in knowledge-intensive services
R6/2012	Friedrich Dornbusch Henning Kroll Esther Schricke	Multiple Dimensions of Regionally-Oriented University Involvement – How Motivation and Opportunity Prompt German Researchers to Engage in Different Ways
R5/2012	Natalia Irena Gust-Bardon	Regional Development in the Context of an Innovation Process
R4/2012	Natalia Irena Gust-Bardon	The Role of Geographical Proximity in Innovation: Do Regional and Local Levels Really Matter?
R3/2012	Thomas Stahlecker Henning Kroll	The cluster concept as a multi-dimensional thematic field: Methodological and substantive perspectives
R2/2012	Henning Kroll Esther Schricke Thomas Stahlecker	Developing new roles for higher education institutions in structurally-fragmented regional innovation systems
R1/2012	Knut Koschatzky	Cluster quo vadis? The future of the cluster concept
R3/2011	Knut Koschatzky Miriam Hufnagl Henning Kroll Stephanie Daimer Nicole Schulze	Relevanz regionaler Aktivitäten für Hochschulen und das Wissenschaftssystem
R2/2011	Joachim Hemer	A Snapshot on Crowdfunding
R1/2011	Emmanuel Muller Jean-Alain Héraud Nina Menz Mickael Benaim Andrea Zenker	La mesure de l'impact des clusters – quelques éléments de réflexion et de bibliographie
R1/2010	Thomas Stahlecker Knut Koschatzky	Cohesion policy in the light of place-based innovation support: New approaches in multi-actors, decentralised regional settings with bottom-up strategies?

No.	Authors	Title
R8/2009	Martin Fischer Björn Wolf	Entstehungsbedingungen und Gestaltungsformen von Public-Private-Partnerships als Ausgestaltungsform strategischer Forschungskooperationen zwischen Wissenschaftseinrichtungen und Unternehmen in Deutschland
R7/2009	Emmanuel Muller Andrea Zenker Jean-Alain Héraud	Entering the KIBS' black box: There must be an angel! (or is there something like a knowledge angel?)
R6/2009	Knut Koschatzky	The uncertainty in regional innovation policy: some rationales and tools for learning in policy making
R5/2009	Bärbel Hüsing Thomas Stahlecker	Impact of regionalised RTDI policy measures in Germany: The "Network RNA Technologies Berlin (RiNA)" as an example
R4/2009	Knut Koschatzky Elisabeth Baier Henning Kroll Thomas Stahlecker	The spatial multidimensionality of sectoral innovation – the case of information and communication technologies
R3/2009	Knut Koschatzky Thomas Stahlecker	Cohesion policy at the interface between regional development and the promotion of innovation
R2/2009	Henning Kroll	Spillovers and Proximity in Perspective A Network Approach to Improving the Operationalisation of Proximity
R1/2009	Henning Kroll	The Regional Development of Science and Innovation in China – A Brief Review of Current Evidence on Matches and Mismatches –
R3/2008	Arlette Jappe-Heinze Elisabeth Baier Henning Kroll	Clusterpolitik: Kriterien für die Evaluation von regionalen Clusterinitiativen
R2/2008	Arlette Jappe-Heinze Knut Koschatzky	The spatial embeddedness of multinational enterprises' research activity A bibliometric analysis
R1/2008	David Doloreux Andrea Zenker Emmanuel Muller	Services à forte intensité de connaissances, contexte régional et comportements d'innovation: une comparaison internationale
U1/2007	Emmanuel Muller David Doloreux	The key dimensions of knowledge-intensive business services (KIBS) analysis: a decade of evolution
R1/2007	Knut Koschatzky Vivien Lo	Methodological framework for cluster analyses
U2/2006	Björn Wolf	Das Finanzierungsumfeld junger Unternehmen in Deutschland

No.	Authors	Title
U1/2006	Björn Wolf	Empirische Untersuchung zu den Einflussfaktoren der Finanzierungsprobleme junger Unternehmen in Deutschland und deren Auswirkungen auf die Wirtschaftspolitik
R1/2006	Emmanuel Muller Arlette Jappe Jean-Alain Héraud Andrea Zenker	A regional typology of innovation capacities in New Member States & Candidate Countries
U1/2005	Björn Wolf Birgit Ossenkopf	Kapitalschonende Entwicklungswege – Ansätze zur Lösung der Finanzierungsprobleme junger innovativer Unternehmen
R2/2004	Thomas Stahlecker Knut Koschatzky	On the significance of geographical proximity for the structure and development of newly founded knowledge-intensive business service firms
R1/2004	Thomas Stahlecker Andreas Koch	On the Significance of Economic Structure and Regional Innovation Systems for the Foundation of Knowledge-Intensive Business Services A Comparative Study in Bremen, Munich, and Stuttgart, Germany
R1/2003	Bodo Kubartz	Wirtschaftliche, soziale und geographische Aspekte in Innovationsnetzwerken – Eine Untersuchung des Nähekonzeptes am Beispiel von Forschungs- und Entwicklungsdienstleistern
R2/2002	Knut Koschatzky	Innovationsorientierte Regionalentwicklungsstrategien: Konzepte zur regionalen Technik- und Innovationsförderung
R1/2002	Ralph W. Bruns Jens Görisch	Unternehmensgründungen aus Hochschulen im regionalen Kontext – Gründungsneigung und Mobilitätsbereitschaft von Studierenden
U1/2001	Rana Adib Frank Gagelmann Knut Koschatzky Klaus Preiser Günter Hans Walter	An Integrated Microfinancing Concept for Rural Electrification by Photovoltaics in Developing Countries
R3/2001	Knut Koschatzky	The role of higher education institutions for entrepreneurship stimulation in regional innovation systems – Evidence from the network-oriented "EXIST: Promotion of university-based start-ups" programme in Germany
R2/2001	Emmanuel Muller Andrea Zenker	Business services as actors of knowledge transformation and diffusion: some empirical findings on the role of KIBS in regional and national innovation systems

No.	Authors	Title
R1/2001	Knut Koschatzky Casper Merkle Martin Berger Volker Meyer	Innovation und Kooperation bei unternehmensnahen Dienstleistern in Baden, Gironde und Südholland – Ein Vergleich zwischen jungen und alten Betrieben
R2/2000	Ulrike Broß Günter H. Walter	Socio-economic Analysis of North Rhine-Westphalia Joint Research Project INCO-COPERNICUS
R1/2000	Knut Koschatzky	The regionalisation of innovation policy in Germany – Theoretical foundations and recent experience
R4/1999	Knut Koschatzky Ulrike Broß	Struktur und Dynamik von regionalen Innovations-netzwerken unter Transformationsbedingungen – das Beispiel Slowenien
R3/1999	Emmanuel Muller	There is no territorial fatality! (or how innovation interactions between KIBS and SMEs may modify the development patterns of periph-eral regions)
R2/1999	Knut Koschatzky Andrea Zenker	The Regional Embeddedness of Small Manufacturing and Service Firms: Regional Networking as Knowledge Source for Innovation?
R1/1999	Ulrike Broß Knut Koschatzky Peter Stanovnik	Development and Innovation Potential in the Slovene Manufacturing Industry First analysis of an industrial innovation survey

Address to order (print version):
Fraunhofer Institute for Systems
and Innovation Research ISI
Library
Breslauer Strasse 48
76139 Karlsruhe, Germany
Phone +49 / 721 / 6809-217 / -219
E-Mail: bibl@isi.fraunhofer.de