Chapter 18
Policy Induced Innovation Networks: The Case of the German "Leading-Edge Cluster Competition"

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Abstract The last decades saw a pronounced shift in innovation policy in Germany and many other countries towards increased funding of cooperative R&D. Over the last years, competitions between regional initiatives pushed this trend even further by adding a regional perspective, by increasing the scope of funding, and by fostering interaction between a large number of actors. In 2007 the German ministry for education and research (BMBF) started the Leading-Edge Cluster Competition (Spitzencluster-Wettbewerb) in which 15 clusters were selected in three waves (2008, 2010, 2012) and are funded for a 5-year period with up to 40 million Euro each. Our paper presents selected results regarding the influence of government funding on cooperation networks within four of the clusters that were successful in the first wave of the Leading-Edge Cluster Competition. More specifically, we analyse the extent of policy influence on the network of most important cooperation partners, its geographic reach, and the changes of network structure in general. Our empirical analysis is based on original data that was collected in 2011 with cluster actors (firms and public research) who received government funding. Our results indicate that the program was quite effective in initiating new cooperations between cluster actors and in intensifying existing linkages. The vast majority of the linkages which are influenced by the cluster program are between actors located in the cluster region. With respect to the influence of the cluster policy on network structure, we find an increase in network centralization. Small and medium

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sized enterprises used the chance to connect with the local ‘stars’, but not as much among each other.

18.1 Introduction

The introduction of the BioRegio contest in the early 1990s marked the beginning of a new era of R&D funding programs. The German innovation policy experienced a paradigmatic shift away from traditional R&D funding measures towards contests between regions with a special focus on collaborative R&D projects. Central to these new competitive approaches were the stimulation of interregional competition, promoting the establishment of regional clusters and the improvement of the functionality of the regional innovation system (Eickelpasch and Fritsch 2005; Staehler et al. 2007). In this context, the presumed economic and technological benefits of clustering serve as a main rationale for modern cluster policies. The main current national cluster funding program – the Leading-Edge Cluster Competition (Spitzencluster-Wettbewerb) – was launched in 2007 by the German ministry for education and research (BMBF). 15 clusters were selected in three waves (2008, 2010, 2012) and have been funded for a 5-year period with up to 40 million Euro each. One of its main goals is the stimulation of regional networking as a lever for innovation and economic growth.

With the rising number of these programs, one major question arose: Does the public promotion of clusters provide an effective and/or efficient measure to achieve the defined goals? Currently, only a few studies try to provide an answer to this question by evaluating cluster policies. To fill this gap, the present chapter examines the impact of the Leading-Edge Cluster Competition (hereinafter referred to as LECC) on networking in the selected clusters. In analysing a unique dataset gathered from a survey of the beneficiaries, we are able to directly attribute the creation of linkages to policy influence. In particular, we contribute to the literature in two ways: first, we enrich the discussion on the effectiveness of policy endeavours and add to the rare empirical evidence on the impacts of cluster policies. Second, this study is one of the few which analyses the effects of a specific cluster policy on the linkages and the related network structure by means of social network analysis (SNA).

The remainder of the chapter is organized as follows: In Sect. 18.2 we provide the basic theoretical rationales for cluster policies and discuss the results of existing studies that focused on the evaluation of cluster policy impacts. Subsequently, we briefly introduce the concept and objectives of the LECC and describe the research methodology, focusing on the network aspect, in Sect. 18.3. We present our results in Sect. 18.4 and conclude in Sect. 18.5.

18.2 The Leading-Edge Cluster Competition, Clustering and Cluster Policies

In 2007 the German ministry for education and research (BMBF) followed up previous successful devices by launching the LECC, an initiative that aims at strengthening Germany's innovation potential and economic success by means of promoting regional clusters. The support of "Leading Edge Clusters" should result in the exploitation of regional innovation potentials and finally in innovation and economic growth. The program was open for all types of technologies and focused on the funding of clusters with the most promising strategies for future markets that have the potential to count among the "Leading Edge" in their respective industry (BMBF 2012).

Overall, 15 clusters were selected in three waves (2008, 2010, 2012), to be labeled as "Leading-Edge Clusters" and to be funded for a 5-year period with up to 40 million Euro each. The selection was consigned to an independent jury of publicly renowned experts from industry and academia.

Moreover, an accompanying evaluation is conducted to monitor the achievement of the declared goals and to derive concrete recommendations for the advancement of the measurement. Therefore, timely evaluations, especially of innovative funding schemes, are a crucial learning mechanism for the adaptive policy maker (Metcalfe 1995).

One main claim of the program is the support of regional networks. The idea is that the creation of an innovative environment, including intensive R&D collaboration between research institutes and industry, should boost an eminent innovative performance that allows for reaching an international leading position.

The entering of regional networks as a focal point of the national research and innovation policy rooted in the increased perception of innovative activities exhibiting a strong regional component and that embeddedness in networks is crucial to firms' innovativeness and competitiveness. Thus, theoretical concepts that account for the regional character of innovation, such as the cluster approach (Porter 1998) or the idea of the regional innovation system (Cooke and Morgan 1994; Braczyk et al. 1998), constitute the rationale for modern innovation policy.

Since the end of the ninetieth century, scholars theorize on the economic benefits that arise for firms locating in geographic agglomerations of related industries (Marshall 1890; Porter 1998). In addition, several empirical studies provide evidence on the positive effects of co-location on innovation (Audretsch and Feldman 1996; Baptista and Swann 1998; Beaudry and Breschi 2003; Aharonson et al. 2008; Lecocq et al. 2009).

The reasons for clustering are manifold. Theorists argue that firms in clusters exploit the advantages of low transaction costs as they are located close to specialized suppliers and clients and have access to a specialized labor pool or are exposed to competitive pressure which drives profitability (e.g. Porter 1998). Furthermore, the proximity to scientific institutions and firms within the same or related industries results in the existence of a common knowledge spillover pool. Nevertheless,

spatial proximity per se is neither a necessary nor a sufficient condition for knowledge spillovers (Giuliani 2007; Breschi and Lissoni 2009). The exploitation of existing innovation potentials in certain regions and the efficiency of the regional innovation system depends heavily on the degree of networking among regional actors (Koschatzky 2000; Sternberg 2000; Fritsch and Eickelpasch 2005).

Innovations develop during a collective learning process of several actors in which common knowledge generation, accumulation and diffusion are crucial ingredients (Asheim and Gertler 2006). Especially in the early stages of technology development, when knowledge is specific and complex, continuous communication and face-to-face contacts are indispensable for the efficient transmission of knowledge (Feldman 1994; Breschi and Lissoni 2001). The ease and costs of linkages and knowledge exchange are in turn related to the geographical distance of the correspondent actors. Moreover, spatial proximity allows for the development of trustful relationships and decreases the social distance among related actors (Boschma 2005). Hence, a firm's integration into the regional innovation network providing access to external knowledge sources is a crucial determinant of the firm's learning process and resulting innovative capabilities (Koschatzky 2000).

Although these insights constitute the core rationale for regional cluster policies fostering joint R&D projects, potential gains from clustering do not suffice as a legitimization for political intervention. According to economic welfare theory, political interference is justified when the market coordination mechanisms are not able to result in efficient/optimal outcomes. Evolutionary economists complement these classical arguments by pinpointing to the existence of system failures. Related to this view, the malfunctioning or ineffectiveness of innovation systems provides a reason for political action. Particularly, the presence of network failures in the sense of a deficiency of an optimal degree of linkages among actors in the innovation system formulates a rationale for cluster policies (Carlsson and Jacobsson 1997; Andersson et al. 2004). Hence, the declared aim of the current German cluster policy, the LECC and related programs is the generation of value added for the region and for the national economy by stimulating the creation of regional networks.

With the expiration of the early pioneer programs and the subsequent introduction of new expanded instruments, such as the LECC in Germany, questions regarding the effectiveness and/or efficiency of the public promotion of clusters came up. Evaluation studies of cluster policies were introduced with the purpose to analyse the surplus for the region and the economy that is attributable to the funding measure. Due to the long term character of these effects and the infancy of evaluation concepts, quantitative impact studies on cluster policies are relatively rare and there have been only few attempts to apply SNA in the context of cluster policy evaluation (see Giuliani and Pietrobelli 2011 for a review). Moreover, the few existing analyses provide ambiguous results.

Martin et al. (2011) evaluate the impact of cluster policy on certain firm variables (for instance production and employment) and find no robust effects compared to non-funded firms. In fact, the policy measure which was included in their examination, the French "Local Productive Systems" program, focused rather on

the idea of the industrial districts and merely interfirm collaboration than on the concept of the regional innovation system. Nishimura and Okamuro (2011) find that mere participation in the Japanese Industrial Cluster Project has no significant effect on the R&D productivity of firms. Only if cluster participants collaborate with national universities in the same cluster region positive effects were observed.

In a more general framework, Fornahl et al. (2011) evaluate how R&D subsidies, network embeddedness, and locational factors are related to the innovative performance of biotech firms in Germany. Their findings suggest that location in a cluster, even after controlling for embeddedness into knowledge networks, has a positive effect on patent performance. In contrast, R&D subsidies have no effect when given to single firms, and only a slight effect when R&D collaborations are supported. Counterfactual analyses of specific cluster funding programs in Germany show that the success of BioRegio and related programs is grounded above all on the mobilization of long-term cooperations that would not have existed without the program. In this process, primarily collaborations between firms and research institutions were initiated (Staehler et al. 2007). Similar results are obtained by Falck et al. (2010), who find that firms in targeted industries of a regional cluster initiative are more likely to become innovators despite a reduction of their R&D expenditures. Engel et al. (2012) compare the performances of winning regions to non-winning regions in the BioRegio and BioProfile contest in terms of patents and public R&D projects. They find strong short-term effects, but these effects seem to diminish in the long run.

Overall, it appears that only cluster policies that lead to increased and/or intensified collaboration have an impact on innovative and economic performance of funded actors. It remains unclear how policies change the structure of interaction in form of collaboration networks and how these changes influence knowledge flows and subsequent performance. Since we evaluate an on-going program, we focus on the former, i.e. on the policy effect on the structure and intensity of interaction as an intermediate outcome rather than on economic impacts. With the application of SNA, we are able to observe the underlying network structures in the selected clusters and the ramifications originated by political influence. This allows us to provide a hint whether first politically desired effects occurred.

18.3 Data and Research Methodology

Our empirical analysis is based on a survey of actors (benefiting firms and public research organizations) of four clusters (labelled A to D) that were chosen as "Leading-Edge Clusters" in the first wave of the competition at the end of 2008.[1] The survey was conducted in late summer of 2011, almost 3 years after the

[1] The response rate, especially of firms, in one cluster was too low for a meaningful analysis. For reasons of confidentiality, we have to refrain from characterizing the clusters in more detail. Even

announcement of the winning cluster regions of the first wave, to capture first effects on the network structure. Additionally, in autumn 2011 face-to-face interviews were conducted with a small sample (6) of actors per cluster (24 in sum) in order to add to our understanding and complement the interpretation of the results from the survey.

We construct R&D networks on the basis of survey data by means of a free recall method with a fixed choice design (Guliani and Pietrobelli 2011). Thereby, beneficiaries (firms and research institutes) were asked to list the names and address of their up to ten (strategically) most important R&D cooperation partners. The address information was used to assign actors to be located in the cluster region, in the rest of Germany, in the rest of Europe, or outside Europe. The cluster regions are defined as those regions which host the majority of the respective beneficiaries. All clusters span several NUTS 3 regions (Kreise) and some cross boundaries of NUTS 2 regions (Länder). Therefore, the cluster regions are individually defined as combinations of NUTS 3 regions.

Even though it is argued that the roster recall method is to be preferred (ter Wal and Boschma 2009; Giuliani and Pietrobelli 2011), we chose the free recall design for mainly two reasons. First, the generation of a fixed list of actors (roster) would have led to large differences in the size of the clusters (imposed by the empirical design), since the cluster managements define their boundaries in quite different ways (e.g. only funded actors, only formal members of the cluster association, all actors that somehow participate in cluster activities). Secondly, with a roster recall linkages to R&D partners who are not cluster actors could not be observed. However, such extra local (and extra cluster) linkages are of high relevance for cluster success (Bathelt et al. 2004). Our decision for the fixed choice approach in limiting the number of partners to the ten most important ones followed primarily two considerations. On the one hand the acquisition effort of sufficient data for the network analysis is still within the bounds of feasibility for the respondents. On the other hand, the focus on the most important R&D partners allows us to assume an equal weight of the mentioned linkages and prevents the overestimation of linkages with lower intensity.

The formation of R&D cooperations is based on the expected benefits of both partners arising from collaborative activities. These benefits can arise in different ways depending on the type of strategies partners pursue.

To grasp in more detail the nature of the observed network and to understand the underlying motivations that lead to the choice of the partner or the maintaining of a link, we collected information on attributes of these linkages, namely the reason for the strategic importance of the link. Motives to cooperate are manifold: collaboration partners might be chosen as a valuable source "of applied knowledge" or "of basic knowledge". In both cases, learning from the partners' competencies is a central rationale for collaboration. Cooperations might also be formed because

though the clusters differ with respect to technological specialization, age, and location, we cannot make use of this information in our analysis.

partners supply their specific capabilities to a common task, i.e. "complementary competences" are the source of strategic importance of a partnership. Partners might also be valuable because of their specific "research infrastructure" not present in firm's own facilities. To account for these different motives for partner choice, we asked the firms[2] to indicate, for each partnership, the motives that qualify it as strategically important.

Furthermore, to attribute the observed network dynamics to the influence of the policy, the actors were explicitly asked, whether the mentioned relations have existed before 2007 (date of the announcement of the LECC and if they were initiated or intensified by the cluster initiative). Hence, our analysis relies on the comparison of the network structure before and after the policy started. We have to acknowledge that this is only an artificial dynamism since we do not have the information about the most important R&D partners in 2007, but can only observe a subset of those that were active at that time, namely those that were still present at the time of the survey.

18.4 How Policy Influences Cluster Structures

18.4.1 Actor Structures

Describing the actor structures in the four clusters, we distinguish four groups. First, *beneficiaries* are those organizations that receive subsidies from the LECC. Second, those beneficiaries who replied to our survey are the *respondents*. Third, *actors* are all the nodes in the network, i.e. all respondents and all organizations that were named by the respondents. Fourth, *cluster actors* refer to those actors that are members of the respective cluster association. This group encompasses all beneficiaries but also organizations that receive no direct funding.

A first view at the composition of the networks of strategically important R&D partners in the four clusters (Table 18.1) reveals that the network size as measured by the number of nodes (actors) varies between 44 (cluster B) and 97 (cluster C). Some of this variation can be attributed to the different number of respondents, which ranges from 12 (clusters B and D) to 17 (clusters A and C).

Regarding the regional distribution of actors, it can be seen that the majority is located within the cluster or national boundaries. Only a small fraction of actors is located outside Germany, with some differences between the clusters. The consideration of the distribution of linkages exposes an almost similar picture. Most of the linkages are directed into the cluster region, followed by national linkages. Nevertheless, the clusters display remarkable differences concerning the focus on intraregional linkages and the embeddedness in international networks. It is

[2] We did not ask the research institutes since the motives to cooperate differ between the private and the public sphere.

Table 18.1 Composition of the clusters and their networks of strategically important R&D partners

Cluster	A	B	C	D
Beneficiaries: no. of organizations that received a questionnaire	24	19	33	35
Respondents: no. of organizations that provided information about their R&D partners	17	12	17	12
Response rate (2)/(1)	71 %	63 %	52 %	34 %
Actors: no. of nodes in the network	61	44	97	48
Cluster actors: no. of nodes that are members of the cluster association	24	20	41	25
Share of actors located in cluster region	36.1 %	50.0 %	45.4 %	47.9 %
In Germany	50.8 %	20.5 %	37.1 %	47.9 %
In Europe	8.2 %	11.4 %	7.2 %	4.2 %
Outside Europe	4.9 %	18.2 %	10.3 %	0.0 %
Number of linkages	101	43	126	58
Into cluster region	53.5 %	48.8 %	55.6 %	55.2 %
To Germany	38.6 %	20.9 %	31.0 %	41.4 %
To Europe	5.0 %	11.6 %	5.6 %	3.4 %
To outside of Europe	3.0 %	18.6 %	7.9 %	0.0 %

noticeable that while cluster B seems to find a number of R&D partners internationally, cluster D is almost exclusively cooperating on a regional and national scale.

18.4.2 Network Structure and Effects of the Leading-Edge Cluster Competition

In Table 18.2, structural indicators and their changes in the course of the LECC are presented; in Fig. 18.3 (Appendix) network visualizations are displayed. To infer on the effect of the cluster policy, we compare the measures for the network based on all reported linkages with those for the network consisting only of those linkages that were present before 2007 (when the LECC was announced).

One of the first important findings from the network analysis is that the policy has a significant positive impact on the intensity of networking.[3] On average, more than half (52.5 %) of the existing linkages were affected by the LECC in the sense of initiation or intensification, with a minimum of 42.9 % in cluster C and a maximum of 65.3 % in cluster A. The majority of these links (35.6 %) was initiated by the program, indicating a strong impact of the policy measure on networking.

[3] Since we cannot observe the whole network in 2007, one could expect that some past linkages dissolved and the policy effect on the intensity is overestimated. However, being asked about the change in total number of cooperation partners, 80 % of the beneficiaries reported an increase.

Table 18.2 Structural indicators for each network with and without policy impact

Cluster	A	B	C	D	Ø
Linkages initiated by cluster program	45.5 %	41.9 %	20.6 %	34.5 %	35.6 %
Linkages intensified by cluster program	19.8 %	11.6 %	22.2 %	13.8 %	16.9 %
Linkages initiated or intensified by cluster program	65.3 %	53.5 %	42.9 %	48.3 %	52.5 %
Density (among respondents)	0.154	0.068	0.132	0.106	0.115
Density (among respondents before 2007)	0.063	0.023	0.081	0.030	0.049
Components (weak)	1	3	1	3	
Centralization (indegree)	0.141	0.024	0.081	0.104	0.088
Centralization (before 2007)	0.053	0.034	0.042	0.048	0.044
Mean outdegree (only respondents)	5.941	3.583	7.412	4.833	5.645
Mean indegree (whole network)	1.656	0.977	1.278	1.208	1.304

Accounting only for the linkages among respondents, network density (all active linkages divided by the number of possible linkages) increased in all four clusters (on average from 4.9 % to 11.5 %). In cluster C, the increase from 8.1 % to 13.2 % is the lowest in relative terms, indicating that the cluster was already well connected before participation. According to face-to-face interviews with some of the actors, this increase of linkages is mainly a consequence of the increased visibility of potential partners and synergy potential triggered by the LECC; i.e. the policy measure mitigates the problem of intermediation within the clusters (Cantner et al. 2011). Furthermore, new partners entered projects via reputational advice from already known partners. The newly established contacts were initiated with the expectation to cooperate in the long run and beyond the own core competences.

Besides this policy effect on the intensity of collaboration between actors, we also observe a structural change with respect to the concentration of partnerships on few central actors. Attributable to the public funding, the extent of the centralization (based on the indegree) (Freeman 1979) increases in three of the four clusters and on average from 4.4 % to 8.8 %. This suggests that the newly established ties are preferentially formed with actors who were already central before the clusters decided to participate in the LECC.

The clusters exhibit certain differences concerning their interior network structure. Cluster A and C form in each case a connected network since their network consists of only one component. That is to say that each actor is directly or indirectly connected to the network. The remaining clusters display a more fragile network topology. Moreover, clusters A and D seem to be more concentrated on few central actors, while cluster B displays a less hierarchical structure. The average number of connections also shows some differences between the clusters. In cluster B, the average respondent named 3.6 important cooperation partners (outdegree) while in cluster C more than twice this number (7.4) was reported. The mean indegree tells us how often the average actor is being named as a R&D partner. In cluster B this measure is below one (0.98), indicating that some actors are not named at all (of course, these can only be respondents). The maximum is observed in cluster A, in which actors are named 1.66 times on average.

Table 18.3 Policy affected linkages to cluster actors (percentages)

	A	B	C	D
Share of policy initiated linkages to cluster actors	71.7	66.7	84.6	90.0
Share of policy intensified linkages to cluster actors	65.0	80.0	82.1	75.0

In Table 18.3, we report the share of policy initiated (intensified) linkages to cluster actors in all policy initiated (intensified) linkages. For the induced (intensified) linkages, these shares range between 67 % and 90 % (65 % and 82 %), indicating that new cooperations are mainly established among cluster members. However, these figures also show that the cluster policy also mobilizes partnerships beyond the cluster boundaries.

In summary we find that the LECC has proven successful in meeting the objective to foster the networking activities in the regions. The basis for an intensified and broader knowledge transfer is founded, which may lead to a higher innovative performance of the system in the future.

18.4.3 Geographic Reach

A clear-cut direction of the policy influence becomes evident when analysing the geographical reach of the cooperation links. Although certain cluster specificities in the regional focus of the ties exist (see Table 18.1 and the discussion in Sect. 18.4.1), the overall picture reveals a strong effect on regional and national linkages. Table 18.4 compares policy induced linkages with non-induced linkages for each cluster and in total. In all clusters we observe a significantly higher share of local linkages for the induced linkages compared to the non-induced links. In most cases this goes hand in hand with lower shares of linkages at higher geographical distance. Exceptions are worldwide linkages in cluster A and national linkages in cluster B. A comparison of the regional distribution of all linkages reveals that roughly 75 % of induced linkages are local, while only 44 % of non-induced linkages are local. The majority of the remaining induced linkages are national with few international linkages being triggered by policy. The shares for the non-induced linkages to the rest of Germany and to outside Europe are significantly higher, while the difference for linkages to European partners is large but not significant.

Consequently, and corresponding to the declared aim of the policy, the LECC primarily stimulates local connections among actors and affects to a lower extent the creation of ties on a national and international level. Hence, in a first instance the LECC is effective in fostering intraregional networks.

Table 18.4 Regional distribution of policy induced vs. non-induced linkages (percentages)

Cluster	A		B		C		D		Total		
Share of linkages induced by LECC	45.5		41.9		20.6		34.5		33.5		
	Induced		Induced		Induced		Induced		Induced		
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	t-statistic
Geographic reach thereof											
Into cluster region	67.4	41.8	72.2	32.0	80.8	49.0	85.0	39.5	74.5	43.6	(−5.78)
To Germany	23.9	50.9	22.2	20.0	15.4	35.0	15.0	55.3	20.0	40.8	(4.10)
To Europe	4.3	5.5	5.6	16.0	3.8	6.0	0.0	5.3	3.6	6.9	(1.31)
To outside Europe	4.3	1.8	0.0	32.0	0.0	10.0	0.0	0.0	1.8	8.7	(2.99)
Pearson's Chi-squared	8.4 (df = 3)		10.2 (df = 3)		9.1 (df = 3)		11.1 (df = 2)		29.1 (df = 3)		

18.4.4 Science-Industry Interaction

Another important goal of the LECC is to connect industry and science to increase the speed of transfer of scientific discoveries into marketable products (BMBF 2012). Figure 18.1 shows the shares of all linkages within and between industry and science in the first bar for each cluster while the respective shares in the second bar are restricted to the linkages induced by the LECC. In three of the four clusters, research cooperations between firms and public research dominate. The connections that were induced by the LECC show a relatively stronger focus on interactions between firms, which is actually quite surprising given the stated goal of the policy. Across all clusters, 25 % of the non-induced linkages are between firms compared to 35 % firm-firm linkages among the induced linkages. Accordingly, linkages among public research as well as linkages between firms and public research are less frequent among the induced linkages then among the non-induced partnerships.[4] Overall, the differences between clusters imply that the motives to cooperate with specific partners are to be found in the regional and technological environment rather than in some (presumed) requirements stated by the policy maker. At the same time, the policy seems to favour market oriented research collaborations between firms rather than science-industry interactions.

18.4.5 Relevance of Linkages

To grasp the nature of the existing and newly established links, we asked the beneficiaries to substantiate the strategic importance of their links according to the four motives discussed in Sect. 18.3. With respect to cluster specificities in the motives to cooperate, we observe some generalities but also some notable differences. The responses are summarized in Fig. 18.2 for each cluster distinguishing between all partnerships (dark grey) and only those that were initiated by the cluster policy (light grey). This allows us to identify differences between clusters in their motivation to cooperate and also gives us the opportunity to observe any systematic deviations of policy induced linkages from the overall picture.

First of all, access to sources of applied knowledge is, with one exception, the most important reason for the strategic importance of R&D collaborations. This is followed by the technical infrastructure that is available with the R&D partners. The acquisition of basic knowledge is especially important in cluster A, while complementary capabilities are of high importance in cluster D.

In general, the policy induced linkages are not biased towards any of these motives. A statistically significant difference only arises for the use of research infrastructure, which shows to be of lower strategic importance for policy induced

[4] A Chi-squared test comparing the two distributions shows a significant difference at the 10 %-level.

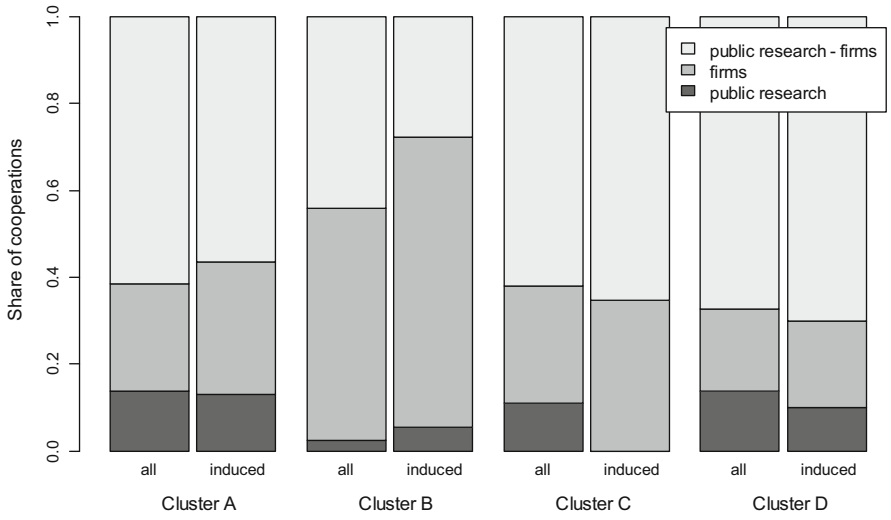

Fig. 18.1 Interaction between science and industry

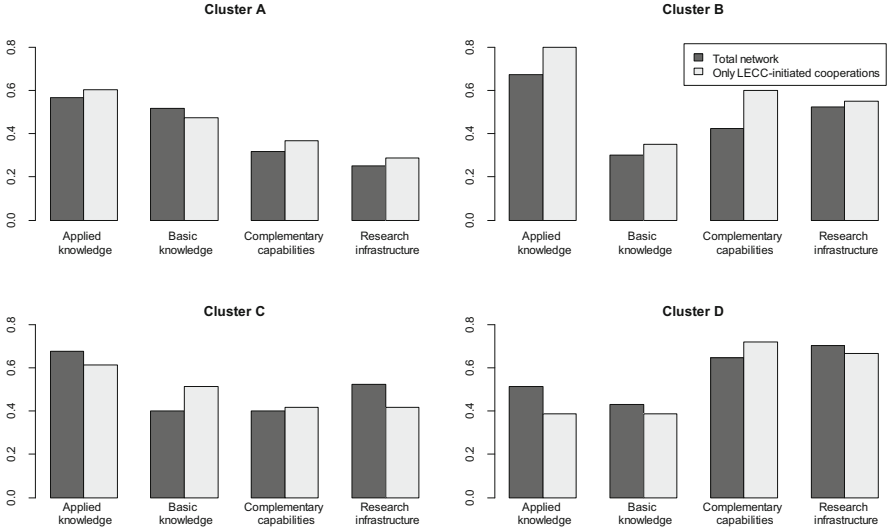

Fig. 18.2 Reasons for strategic importance of R&D partners

cooperations.[5] In cluster B, it seems that the LECC managed to bring together actors with complementary capabilities and strengthened the exchange of applied

[5] For 53.2 % of the pre-existing partnerships and 38.2 % of the policy-induced partnerships, the use of research infrastructure was mentioned as a strategic asset. A t-test shows that this difference is significant at the 5 % level.

knowledge. In cluster C the acquisition of basic knowledge was reinforced. From an evaluation perspective, this result reflects the high flexibility of the policy measure since it is open for various types of partnerships.

18.5 Discussion and Conclusion

Policies aiming at the promotion of clusters are frequently conducted but only seldom evaluated (Martin and Sunley 2003; Brenner and Schlump 2011). The aim of this study was to add to our understanding of the effects and mechanisms of cluster policies by analysing the impact of the German Leading-Edge Cluster Competition on the underlying network structure. Since the LECC is an on-going initiative, we could only report intermediate effects on networking within the funded clusters. By means of Social Network Analysis on the basis of a carefully constructed questionnaire it was possible to identify effects on the network of strategically important R&D partners within the clusters that are attributable to the policy instrument.

Our results show a significant effect on the network structure in terms of density, centralization and geographical reach. Measures on structural effects in terms of number (breadth), weight (intensity) and distribution of linkages (centralization) indicate policy influences already 3 years after starting the funding.

First, on average more than half of the existing linkages were either initiated or intensified by the LECC with the consequence of an increased density of the networks. Second, since the majority of these policy-affected linkages are within the cluster regions, the LECC shifted the focus of collaboration towards local networking. While such an effect is quite natural for a cluster oriented policy, it is not to be judged without some scepticism. Experiences of a Japanese cluster initiative show that local firms have a higher R&D productivity if they collaborate with partners outside the cluster (Nishimura and Okamuro 2011). Moreover, path-dependencies for firms and regions which can lead to spatial lock-in in the long run inhere in the mere search for internal collaborations (Sternberg 2000). These concerns have also been brought up in the discussion on local buzz and global pipelines (Bathelt et al. 2004) and have been related to the stage of the cluster within its life-cycle by Brenner and Schlump (2011). They suggest that a network renewal by means of increased cluster external linkages is especially important in more mature phases of cluster development. Since the four clusters analysed in this paper differ considerably with respect to age or maturity of technology, the dimension “stage in a cluster life cycle” requires further scrutiny.

A third result is concerned with the distribution of linkages within the networks. In three out of four cases the network becomes more centralized, i.e. it exhibits a stronger orientation towards a few, central actors. Interviews with selected beneficiaries in the clusters suggest that this development is rated particularly important for the integration of SMEs within the cluster. For small firms, which in general struggle with difficulties to get in contact with large firms, the LECC offers

opportunities to connect to these; the firm representatives value these contacts of crucial importance for their long term integration into the network and finally their innovative performance. However, more centralized networks are also more vulnerable, since their dependence on the functioning of single actors is higher as compared to other network structures. With respect to the rate of knowledge diffusion, Cowan and Jonard (2004) could show that small world structures are the superior form of organization. The results of Schilling and Phelps (2007) on the structure of industry networks add to the difficulties in evaluating this development towards increased centralization. They find negative effects of network centralization on future patenting in the short run but positive effects in the long run.

Fourth, with respect to the interaction between science and industry, we find that the majority of connections that were affected by policy link firms with universities or research institutes. However, the LECC does not increase the relative frequency of science-industry linkages but slightly favours linkages within industry. We interpret the differential policy impact among the clusters as a sign of flexibility of the policy measure as it leaves the choices of partnership to the beneficiaries.

With respect to our research design, we have to acknowledge some limitations. While we can observe cooperations that were established as a consequence of the LECC, we are unable to make statements about linkages that were present before the policy started and have become obsolete. We cannot exclude that newly formed partnerships substituted previous relationships, which would imply that we overestimate the impact of the LECC on the interaction intensity. However, this problem is somehow mitigated since additional sources of information indicate an overall increase in collaboration intensity.

Overall, while we can state that the LECC has met its objective to intensify collaboration among innovative actors, our intermediate evaluation does not allow us to infer, that this will lead to a better performance of the selected clusters in the future. At this stage, we are unable to provide evidence on correlations between the observed structural changes and the innovative performance of the cluster regions. Statements in this direction will require a subsequent long term analysis including comparisons to non-funded clusters.

Appendix

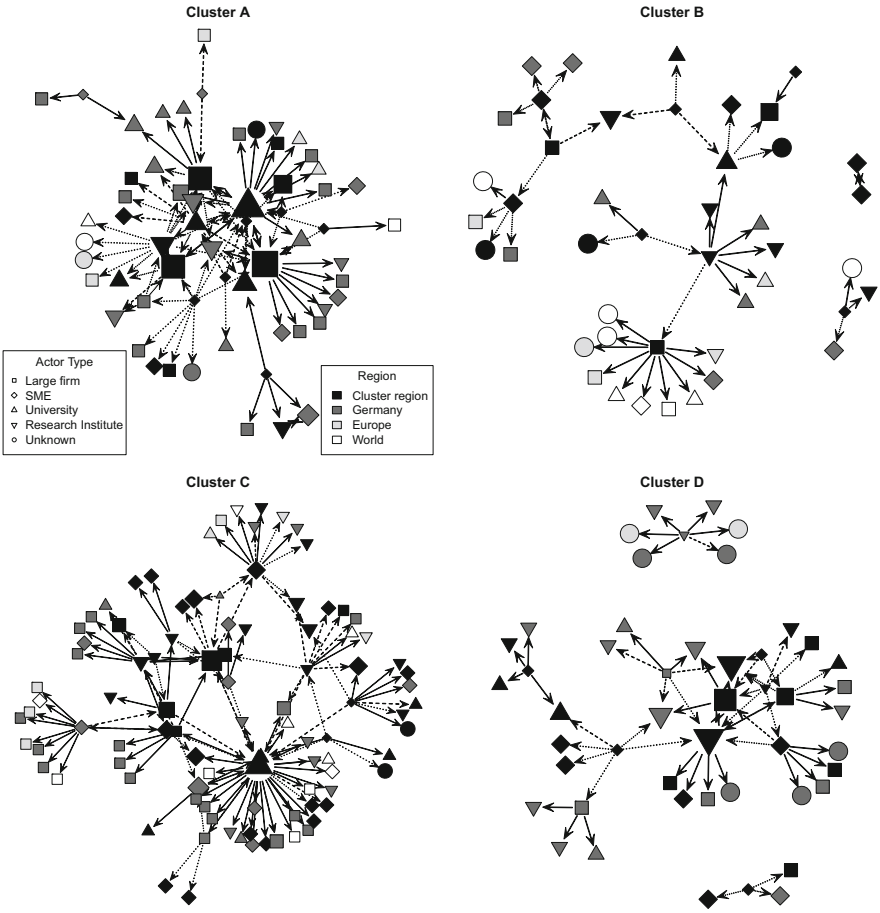

Fig. 18.3 Networks of strategically important R&D partners in clusters A to D. Arrows indicate a partnership from the respondent to one of the most important R&D partners. Dotted arrows indicate that the partnership was initiated through participation in the LECC, dashed blue arrows indicate that the partnership was intensified through the policy, and solid arrows indicate partnerships that were not influenced by the policy. Node size is proportional to indegree, i.e. to the frequency of being named as a partner. The colours and the shapes of the nodes indicate the actor's geographic location and type according to the legend.

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