

Subtheme 3.2.: Research-intensive clusters, technopoles, science cities

Internationalization of triple helix structures: who internationalizes, why, and what risks exist?

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Abstract:

The internationalization of clusters is increasingly a topic of economic policy. The accompanying support programs require usually the existence of some sort of institutionalization of the clusters. This follows a widespread attempt at creating clusters through the formation of cluster initiatives, the main form of institutionalization. We discuss some aspects of cluster initiatives and their relation to clusters in a traditional sense. Secondly, internationalization of clusters will be put into the context of Triple Helix formation and the accompanying aspects of internationalization will be explored. These are especially the objectives of the different cluster actors and their relations. Some first preliminary empirical results show, that our hypothesized objectives seem to be of relevance to the respondents. They also confirm our assumed breadth of different actors participating in cluster initiatives, which might require a refinement of current support policies in acknowledging the variety of competing objectives within a cluster initiative.

Keywords:

Research cluster, Internationalization of triple helix structures, Institutionalization of European R&D clusters

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I Introduction

In recent years, public policies to support the establishment and development of cluster initiatives and networks proliferated (Kiese 2008, OECD 2007). General target audience of such support policies are companies as well as research institutes. The aim of these policies is to initiate and further collaborative activities among all participating actors as a means to create and exploit economies of scale and scope in the areas of research and development (henceforth: R&D), market development and customer/supplier relationships (vertical value chains). One essential requirement for potential beneficiaries of such support policies is the formulation of a joint strategy and, following, the implementation of truly cooperative research or innovation activities. Often, this implies the creation of some form of management institution that coordinates and leads the strategy development, supervises the implementation of projects and acts as central contact point for the political support programs as well as external communications. As a result of this multitude of support programs, the number of networks and cluster organizations with a professional management structure has multiplied. In Germany alone there exist somewhere between 200 and over 1000 such initiatives, depending on the inclusion criteria of such counting exercises.

Also, besides commercial enterprises most of these institutionalized initiatives include a number of (semi-) public and private research institutes as well as a variety of different intermediary organizations such as (public) business support agencies, legal or finance specialists or chambers of commerce. Therefore, such networks and cluster initiatives should be regarded as triple helix structures. However, their members as well as most of the support policies refer commonly to the term “cluster” or “network”. The specific institutional arrangement and the often rather narrow regional extent of these initiatives result in structures that exclude a large part of triple helix structures. They are thus a specific type of triple helix structures, and we will use the term “cluster” for them in the rest of the paper, fully aware that this is just one usage of that term.¹

Currently, a number of policy discussions and programs involve the internationalization of clusters and R&D in general. One example is the German “Strategy for the internationalization of science and research” (BMBF 2008), where one aim is to further international activities of federally funded clusters (*Spitzencluster*). The stated political goal on the European level is the promotion of European research and the respective research institutes (European Commission 2008, Sjövell 2009). Another one is the encouragement of initiating export activities.

The ways in which the goal “internationalization of clusters” might be realized, are somewhat less clear than it might seem. Internationalization of companies entails a range of activities, which include direct trade relationships, foreign direct investments (henceforth: FDI), or customer/supplier relationships (EIM 2010). However, clusters include not only companies but also research institutes and other participants whose cross-border activities do not always correspond with those of companies. Research collaborations in particular, but also joint product or market development projects as well as platforms for information exchanges are examples of international activities. Neither the public support programs nor relevant policy papers include a comprehensive discussion of activities that should be promoted or pursued.

In this paper we will first discuss some elements of the ongoing institutionalization process of clusters (next part), and follow this with a first sketch of the inclusion of internationalization as a determinant of the triple helix interaction processes (part III). In the fourth part we present some qualitative results from a survey of German cluster managers concerning the

¹ See Graffenberger, Rauch, Ulrich (2010) for a discussion of the term “cluster” and its usage.

internationalization of their cluster. The paper ends with a discussion of possible policy implications and directions for further research.

II Institutionalization – establishment of independent cluster organizations

The by now traditional concept of clusters as regional concentrations of companies belonging to a certain industry (e.g. Porter 1998) has seen numerous extensions and refinements in the last 20 years. One reason is certainly the variety of sciences that are active in the definition and analysis of clusters, e.g. economics, sociology, (economic) geography. Nevertheless, a number of general characteristics of clusters emerged. Beyond a strong regional concentration of specific industries closely connected to each other, a certain degree of interconnectedness of the related companies is often mentioned. Besides industries also value-adding production chains (Roelandt, den Hertag 1999), supply chains (Simmie, Sennet 1999) or technologies (Mossig 2008) are used as the relevant clustering topic around which the cluster actors are subsumed. All of these topics are fairly similar with regard to their essential substance or content. Accordingly, these varying definitions might be used more or less interchangeably.

Another widely debated characteristic is the existence and degree of interdependence among companies and other actors forming a cluster. Early definitions were almost exclusively based on geographical proximity without mentioning any interconnections (e.g. Enright 1996, Swann, Prevezer 1996). Most current definitions of clusters weigh specific interactions of cluster actors at least as high as close geographical proximity. A number of authors goes even further and uses the term innovation cluster with a particular emphasis on interconnections and collaboration among the participating companies (Simmie, Sennett 1999).

Furthermore, some authors include not only private enterprises as cluster members or actors but also specialized supporting organizations and institutions (Porter 1998, Feser 1998, van den Berg et al. 2001). In summary, central to the cluster definition are geographical proximity, specialization in an industry or technology, a broad constellation of actors as well as intensive co-operation relations between the actors.

The main cause for the development cluster is realizing and exploiting agglomeration advantages. These advantages include economies of scale and scope in a wider sense. Specifically, technical infrastructure such as laboratories, special transport and telecommunication infrastructure or social infrastructure like higher education institutions or continuing education providers are only viable when the number of companies and employees reach a critical mass. This also creates a market for a highly specialized labor force, which in response enables companies to further their own specialization and thus increase their competitiveness. This in turn can lead to the development of a highly specialized supplier-customer network whose existence reduces transaction costs and increases the flexibility and profitability of producers through economies of scale and scope. These result from the higher specialization of suppliers and the possible diversification of customers reducing *hold up* risks (i.e., the risk of becoming dependent on a single customer due to customer-specific sunk cost investments) (Holmström, Roberts 1998). All these agglomeration advantages reduce the costs for companies located in the respective agglomeration area and thus improve their competitiveness compared with companies outside the respective area.

Knowledge spillovers are a second source of higher competitiveness in clusters (Pinch et al. 2003). The diffusion of knowledge through spillovers is credited with higher rates of innovation. Such spillovers depend on the high rate of personal interactions between associates of different, maybe competing, companies in clusters. Such personal interactions are especially

important in the transfer of tacit knowledge, e.g., about market developments or technological developments. Clusters increase the chances of such personal contacts through the high density of possible contacts but also through the existence of specialized institutions such as lobby groups and industry or area associations.

To make these advantages available to actors outside of traditional clusters, public policies aim at initiating and advancing close collaborations and the creation of networks as a formalized type of interconnection between companies. Since the 1990s the cluster concept gained prominence and popularity among economic policy makers because of its perceived potential to increase the competitiveness of the local or regional economy through the encouragement and establishment of networks and collaborations. The prime argument for political support measures is the creation and enhancement of knowledge spillovers because most of the other advantages of clusters emerge in a market economy endogenously and therefore need no further political support (Andersson, Serger, Sörvik, Hansson 2004).

As a result of the administrative need to act through formal relationships, many support policies require some sort of institutionalization of clusters to be supported. This entails the creation or assignment of a central contact point for the cluster. The difference between a cluster in the traditional sense and a cluster initiative lies in the fact that, whereas the former describes a regional or local economic phenomenon, the latter is an entity actively created by some specific actors and does not necessarily have to be located in a traditional cluster. A cluster initiative in the view of *Sölvell, Lindqvist and Ketels (2003)* is a policy instrument to increase growth and competitiveness of clusters.

Possible participants of cluster initiatives are not only private enterprises but also a variety of intermediary organizations and, in the case of research oriented cluster initiatives,² public and private research organizations. These include universities and other higher education institutes as well as public and private institutes solely pursuing basic and applied research. Very often, also (semi-) public intermediaries like business support agencies, chambers of commerce and trade as well as representatives of local or regional administrations³ are participants of cluster initiatives. The areas of expertise of the different actors vary and so do their possible responsibilities and activities within the cluster initiative. Research institutes and universities provide access to new knowledge and support the creation and implementation of new technology as well as new processes for the private enterprises in the cluster. Additionally, the higher education organizations are vital for the creation of human capital through educating current and prospective employees.

The roles of intermediary organizations are manifold and an important determinant in the development of the most appropriate and fitting structure of a specific cluster initiative. Therefore, the inclusion of the right intermediary organizations represents a significant decision in the establishment of a cluster initiative. As independent institutions, intermediaries can facilitate information and knowledge sharing and, especially, aid and stimulate the establishment of trusting relationships among the networked cluster entities, thus lowering transaction costs (Intarakumnerd 2005: 23). The creation of trust is of special importance in transition economies and countries with comparably unstable business environments, so that foreign organizations often lead the induction of cluster initiatives (Ketels, Lindqvist, Sölvell 2006). Furthermore, intermediary institutions play an important role in linking users and suppliers of knowledge as well as of products in a cluster; they bridge the divide between research and applica-

² In Germany and the European Union in general, many cluster initiatives are research oriented because of generous public support for research projects from industry-research cooperation. Additionally, some public funding programs for research are specifically targeted at cluster initiatives, e.g., the “Leading-Edge Cluster Competition” of the German Federal Ministry of Education and Research.

³ In some cases, the local or regional administrative unit acts as initiator or founder of an initiative; see e.g. Ketels, Lindqvist, Sjövell 2006.

tion, and—depending on the intermediary's nature—even in directing research activities toward implementation.

Intermediaries can include education and training institutions, public institutions and authorities, chambers, business and professional associations, trade unions, technology transfer institutions, banks, seed and venture capital organizations, interest groups, public-private partnership initiatives etc. As this (incomplete) list illustrates, in addition to the aforementioned functions of intermediaries, access to financing as well as financial consulting and support can also be important roles for intermediary organizations. Which of the functions an individual cluster requires and therefore which intermediaries are essential participants of a cluster initiative depend on the respective characteristics and framework conditions.

The diversity of cluster actors, their functions and the individual circumstances of clusters results in an equal variety of organizational setups of cluster initiatives. They range from more or less informal agreements on the assignation of a cluster speaker to the incorporation of an association or the formation of a cluster company. Often, the management of a cluster initiative is assumed by a dedicated office, alternatively by one member of the cluster or other arrangements.

On the basis of the three spheres of the Triple Helix concept, namely industry, university, and government, and their fusion or interaction process creating a knowledge economy system (Etzkowitz, Leydesdorff 2000), we propose the description of this interaction process as governed by motion vectors. Additionally to other elements influencing this interaction process, the geographical and topical objectives of the different spheres are elements of the respective motion vectors. E.g. in a cluster the geographical objectives of all actors are comparably well aligned, therefore all three spheres move in that dimension in the same direction and allow the creation necessary interaction zones. Below we will discuss the internationalization process of clusters in these terms.

III Internationalization of Clusters

The internationalization of clusters is a fairly recent phenomenon in so far as not individual activities of an actor of the cluster are of interest but instead the activities of the entire cluster. In terms of cluster initiatives, one important impetus for internationalization are political support schemes. These arose from the intermingling of fostering small and medium sized enterprises (henceforth: SME) through encouraging international trade relationships (e.g. see the recommendations for political support in EIM 2010: 71-75) and the support as well as induction of clusters respectively cluster initiatives to increase national or regional competitiveness through innovation fostering (ECPG 2010b).

The theoretical foundations for such policies are to be found in the idea of global pipelines of knowledge (Bathelt, Malmberg, Maskell 2004). The argument goes as follows: traditional clusters realize knowledge benefits, and as a result also technological and economical benefits, through intensive utilization of explicit and implicit communication channels. These information channels come in two varieties. One, in the form of *local buzz*, represents all communication flows among the actors of a local or regional cluster. Local buzz is an essential part in the formation of localized capabilities (Maskell, Malmberg 1999) (i.e. the existence of a shared knowledge base and the resulting common interpretive context and technological base), as it represents the spread of a myriad of information pieces in social, professional as well as leisure related personal interactions (Storper, Venables 2004). The other, in the form of *global pipelines*, represents directed, specifically established, communication channels

from one actor of the cluster towards an external source of complementary knowledge (Owen-Smith, Powell 2004). These channels have to be consciously established and require permanent investments to keep them open (Harrison 1992). Such pipelines enable access to new and different knowledge not available within the cluster, which is then distributed within the cluster through local buzz and consequently enhances the competitiveness of the whole cluster. However, due to their costly establishment these external communication channels are limited in their number and accessibility. A single company can only establish a few such pipelines and will likely restrict access to the respective pipeline destination and its knowledge to its own employees (Bathelt, Malmberg, Maskell 2004).

Another, closely related argument for fostering international activities of clusters or cluster initiatives is the reduction or avoidance of lock-in effects. These effects are understood as the loss of awareness of broader market developments caused by increased inward-looking of the respective actors (Sautter 2004). This could be the result of an increasingly exclusive community of participants of a cluster that over time closes itself against outside influences. Up to a certain extent, increasing exclusivity of relations among cluster actors might enhance trust, local buzz and the accompanying knowledge spillovers. But beyond that, a closed shop of collaborating companies inhibits participation of new entrants as well as fully exploiting outside relations (Uzzi 1996). Consequently, innovative capacity and competitiveness are diminished (Narula 2002).

The aims of individual cluster actors in establishing international activities differ in varying degrees from those of a cluster or a cluster initiative. Partly, these activities are driven by the same motivations as those just mentioned, especially for research institutes and R&D intensive companies. But a large part of the more market and sales oriented activities of companies, most of the activities of intermediaries as well as most of the activities of governmental actors are grounded less in the demand for knowledge and more in the demands for efficiency and profits. These are naturally also the ultimate motives for R&D and innovation oriented activities but the involved time-frames and approaches differ substantially.

Private businesses as primarily market oriented cluster actors are foremost interested in economic survival and growth. Therefore, activities outside the home market (i.e. international activities) are likely the result of favorable profit expectations based on perceived market opportunities in product as well as in factor markets. This follows from the assumptions of profit maximizing firms and bounded rationality of decision makers within the firms. International activities of firms can include onetime trade arrangements, long term supplier and buyer relationships with foreign companies, joint ventures and other forms of collaborations as well as the establishment of offices or affiliates through FDI. The establishment and utilization of global pipelines in the above mentioned sense is possible in long term relationships with foreign companies but not in onetime trade relations and FDIs. However, the use of FDI could be one instrument to establish or foster such pipeline through the establishment of local communication channels. The company is then able to spread the acquired information through its own internal communication channels and thus circumventing the problems of long distance communication such as trust or language barriers.

In contrast to private companies public (as well as private) research organizations are mainly knowledge driven. Their interests are assumed to be focused on broadening and furthering their knowledge base and thereby to increase their chances of creating new knowledge. As a result of this, the geographical scope of their activities is primarily influenced by the supply of (and demand for) knowledge. International activities are pursued when the respective cooperating institution can deliver knowledge, skills or expertise not available (or only with higher costs) within the research organization or its geographical vicinity. Accordingly, their interna-

tional activities are primarily collaborations in R&D projects and related activities like exchange and education programs, workshops, etc.

Similar arguments apply to universities and other higher education organizations, but here also education related motives have to be taken into account. International activities therefore aim not only at access to knowledge but also at the development of skills and access to students or educators. Both types of actors are well placed to establish and maintain global pipelines through long term research collaborations (Miotti, Sachwald 2003). However, the quality of the required following diffusion process of knowledge from these global pipelines towards the other cluster actors depends critically on the degree of embeddedness of the research actors (Thune 2007).

Public administrative and government institutions are assumed to have no direct interest in international activities with relation to clusters. Naturally, foreign policy is one of the key elements of government institutions as is the promotion of the national economy, e.g. in the form of general export promotion or the negotiation of free trade arrangements. But regional and local government institutions, as the relevant cluster actors, are unlikely to pursue international activities out of their own institutional motivation. There are no direct collaboration partners as well as no direct economic or scientific interests for government institutions, so they do not follow an internationalization agenda of their own. Nonetheless, through their interest at economic prosperity of their home region such actors are indirectly interested in the international activities of cluster actors.

Motivations and specific instruments for international activities of other intermediary cluster actors are almost impossible to exhaustively specify because of their very wide ranging functions for the cluster as well as their equally wide variety of types of organizations involved. Some general remarks still seem possible. It can be assumed that their activities for the cluster usually comprise only part of their work portfolio. Correspondingly, international activities of intermediaries are assumed to follow more their other work activities than those related to the cluster. Especially with respect to possible global pipelines it is conceivable that even if they exist for a specific intermediary, they bear no relations to the cluster topic, technology or product, respectively.

This heterogeneity of objectives and motivations is likely to result also in heterogeneous strategies and actions concerning internationalization activities of the individual cluster actors. Activities and strategies aiming at enhancing sales potential differ substantially from those enhancing knowledge or those that are associated with minimization of production costs.

Hence, one result of this variety could be the existence of different preferences by the respective actors regarding international activities or target regions. Both areas, activities as well as areas or regions, are important for the analysis of cluster internationalization. Incoherence or even conflicts of strategy can arise in the choice of target regions or in the choice of activities to be pursued or in both together, i.e. activities that are generally in the interest of all cluster actors are pursued by some actors in regions where they are not in the interest of the whole cluster, or vice versa. Nonetheless, public policies place a high emphasis on the establishment as well as the expansion of international relations and collaborations (ECPG 2010, EC 2010). Then again, a conflict of objectives is not always inevitable. Particularly the exploitation of external product market opportunities by businesses is likely in the interest of local and regional governmental institutions, too, whereas this is less plausibly explained by factor market opportunities associated with outsourcing and off-shoring.

The presence of different objectives of cluster actors has implications for the fusion process of the Triple Helix. As proposed above, geographical target regions and preferred international-

zation activities should be considered as an element of the motion vector. Close alignment of target regions and activities furthers collaborations among different actors, especially actors from different spheres as they are non-competitive against each other and therefore able to pool resources and know-how. If cluster actors differ in their international target areas or activity they are more likely to follow only their own agendas, thereby missing valuable collaboration possibilities. This is aggravated in cluster initiatives as they are dependent on some degree of consensus among the participants to formulate and follow strategy. The resulting differing motion vectors reduce the intensity and likelihood of fusion and interaction zones of the spheres, thereby also reducing knowledge spillovers and in the end the competitiveness of the Triple Helix.

IV Empirical findings

To gain some preliminary insights about relevant actors, objectives, strategies, and regions of interest of internationalization activities of clusters, a survey among German cluster managers was conducted (Graffenberger, Wappler, Ulrich 2011). The survey population was managers of German cluster initiatives and regional networks. They represent institutionalized clusters, mostly with significant political input in the formation process of the initiative as described in chapter II. All responding clusters included private companies, research institutions and intermediary organizations. Even though, not all possible actors were represented in all clusters the mixture of participating actors was in every case broad enough to be recognized as a Triple Helix structure. Cluster managers were asked to provide information with respect to the whole cluster; therefore activities of individual actors are not represented in the results.

The survey was conducted as an e-mail survey with a written questionnaire attached. This survey method seemed to be appropriate, because the cluster management, as the target audience, is accustomed to e-mail inquiries, the questionnaire was relatively short and quick responses were necessary. Target population were around 220 cluster managers of well established, nationally or regionally important initiatives and networks. The response rate was around 1/3; the minimum response for an individual question was 58. Altogether 12 questions were asked of which 9 were asked twice with different regional focus because of a special interest on Central and Eastern Europe (henceforth: CEE). This allowed a comparison of the general assessment of cluster internationalization and, specifically, activities in the CEE region.

The most important objectives of international activities were *market development* (average rank 4.2)⁴ and *strengthening competitiveness* (3.9) as well as *participating in knowledge and technology transfer* (4.1). Hence, the hypothesized main interests of companies and R&D institutions are both well represented, which is also the case for more intermediary targets. The assumption of consistency in the orientation on these interests is also supported by the differences of the responses for the CEE region compared with the general results. All objectives are rated lower for that region with the decrease in importance most pronounced for *participating in knowledge and technology transfer* (from 4.1 down to 3.0). To a certain amount, a decrease is to be expected because the introduction of a specific area reduces the degree of freedom for the respondent, i.e. the geographical area for possible activities is much smaller now. The particular large drop in importance for knowledge and technology transfer is likely a result of the lower innovative and research capacity of the CEE region (Radosevic 2005) compared with other world regions of comparable importance to German cluster managers (e.g. Western Europe and North America).

⁴ Importance was measured on a 1-5 scale with 1: no importance and 5: high importance.

Interestingly, this equivalency in interests is less the case for actual instruments. Direct collaborative and resource intensive activities (such as joint project works (mentioned by 48%)) are significantly less common than more non-committal activities (such as visits (80%)). The latter require comparatively few resources. In addition to that, they are easy to implement, and, thus, likely of higher interest to companies than to research institutions. While the objectives of companies and research institutions seem well balanced, this seems less the case for the actual internationalization process.

The initiation and implementation of international activities was mostly the realm of companies (mentioned by 65%; resp. 66%) and the cluster management (79%; 70%), while R&D institutions (44%; 51%) were comparatively seldom mentioned. The same is true for the choice of external partners. Here, companies (77%) were mentioned more than twice as often as (non-) university research institutions (34% each) and still considerably more often than research institutions in general (49%). This fits well with the observation of preferred instruments and the implied importance of actors' objectives.

The most surprising result was that only a quarter of all respondents have formalized an internationalization strategy. Furthermore, only half of the participants without a strategy plan to elaborate one. Yet, almost all respondents have already initiated or are actively preparing international activities (94%).

V Policy implications and directions for further research

Current policies still focus on the establishment of cluster initiatives while paying less attention to necessary preconditions or bottom up initiatives. Too often, top down approaches at cluster development are not as successful as possible because objectives of potentially participating companies and research as well as other organizations are not well enough understood or known. One such area is the establishment of international activities and an international agenda or strategy. Policies aiming at increasing the international profile of a cluster through supporting related activities should pay more attention to the different actors of clusters and their respective objectives of participating in the cluster. More focused policies might avoid the occurrence of competing objectives and preferences or at least simplify negotiations through the provision of an implicit hierarchy of objectives.

A number of further research questions arise with respect to the institutionalization of clusters and, conversely, with respect to the attempts at creating economic clusters through the support of initiatives between private companies, government, and research organizations. Cooperation of companies in bottom-up initiatives raises the question why such activities require an institutionalized setting and in case the institutionalization is important to the success of the cooperation, would an even tighter integration of the companies, e.g. cross-ownership or even a merger, be a viable alternative. Not to mention the question of competition law and the controlling of cartels, respectively.

Given the high share of initiatives in high-tech or comparably fast-changing industries more information about the dynamics of participating companies is needed. Especially the degree of fluctuation of participants and its impact on strategy and joint projects of the cluster is not well understood. In this respect, also information about survival rates of participating companies against non-participating ones are important to assess the impact of institutionalization in and on fast-changing industries. Information about demographics of cluster initiatives are also important for the study of cluster communication, the development of strategies as well as general analysis of cluster dynamics and success.

The knowledge base regarding internationalization of clusters is even less developed than that for cluster initiatives. To understand strategies of cluster initiatives and the development of internationalization of clusters, further information regarding the aims and objectives of the individual participants and their interplay in setting the internationalization agenda of the cluster are needed. Also, do companies and research organization pursue different agendas within a cluster initiative than on their own account and is a possible separation the result of diverging interests among cluster actors or of the attempt to keep the cluster activities coherent and consensual? Investigation of these questions might also further our understanding of success factors of top-down cluster initiatives and provides hints for their management.

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