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Cluster quo vadis? The future of the cluster concept

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1 How to understand current clusters

In order to assess how the cluster concept fits into the catalogue of other present-day funding approaches, it is necessary to briefly consider how the modern understanding of clusters arose and how the cluster approach became popular. At the end of the last century, the British economist Alfred Marshall in his book "Principles of Economics" already mentioned the 'concentration of specialized industries in particular localities' and thus the significance of localization advantages for industrial development (Marshall [1890], 1927). In 1826, the farmer and economist Johann Heinrich von Thünen already showed that agricultural utilization does not take place homogeneously in space, but, depending on transportation costs and market proximity, concentric circles of different agricultural uses appear around a village (market). Also in Alfred Weber's industrial location theory, type and weight of raw materials, transport costs and the location of the place of consumption determine the optimum location of the production site, in view of transportation costs. According to August Lösch's theory of market networks, despite homogeneity assumptions with regard to production and demand conditions, due to profit- and benefit-maximizing behaviour, market areas develop in a given area around a central large town, which differ according to urban rich and urban poor sectors (for an overview of the various location theories, cf. Schätzl 2001: 29-97).

It was already theoretically proven at an early stage that spatial concentration is a fundamental characteristic of economic activities. Based on the insights of early location theory, Ohlin (1933) and Hoover (1937) continued to develop the concept of agglomeration factors and differentiated these into internal savings that result from production expansions, as well as external savings from localization advantages (or disadvantages) and urbanization advantages (or disadvantages). Localization advantages result from sectoral concentrations, while urbanization advantages come from having a mix of branches which is characteristic for towns. In this context, empirical studies address the question of which promotes growth more – urbanization advantages (Jacob’s externalities) based on inter-industrial knowledge spillover effects, or localization advantages (Marshall-Arrow-Romer externalities) with their intra-industrial knowledge spillover (cf. Koschatzky 2001: 106-107).

The underlying mechanisms of spatial concentration have been addressed since the late 1950s in the theories of sectoral and regional polarization (e.g. growth poles, centre-periphery models) and implemented in regional economic policy and development policy. The concept of sectoral concentration or clustering is therefore not new, but has been around for a while, both empirically and theoretically (cf. Borrás/Tsagdis 2008 for different case studies). However, the modern understanding of clusters is based on

new insights from innovation economics and the new growth and trade theory, and no longer argues exclusively using classical location factors (localization advantages), but also includes access to new knowledge, the advantages of regional proximity in knowledge exchanges and innovation-oriented interactions (Koschatzky/Lo 2007).

This new interpretation was triggered by the advances made in innovation economics since the beginning of the 1970s. Once the paradigm of a dominating innovator (pioneer entrepreneur, large firm, state) had been replaced by a more differentiated understanding of innovation processes, diverse empirical studies were made of the innovation patterns in small and medium-sized enterprises, the characteristics of technology development, the complexity and cumulativeness of technology change and innovation activities (see Grupp 1997). Subsequently, these empirical findings were subsumed in diverse theoretical approaches to explain technology development and economic change in evolutionary terms (Dosi 1982; 1988; Freeman 1982; Nelson/Winter 1977). However, this innovation economic setting did not give rise to a comprehensive and consistent theoretical framework (Grupp 1997: 51).

More consistent theoretical approaches were developed in economics by critically questioning the suitability of classical growth and foreign trade models to explain and predict the processes of the global division of labour. The foundations for this were formed by the model of North-South trade published by Krugman 1979, the centre-periphery model published in 1991, and the equilibrium, innovation and product variety models of the new theory of growth (Grossman/Helpman 1990; 1991; Krugman 1979; 1991; Romer 1986; 1990). These approaches have in common that they fall back on innovation and polarization theory insights. Technological progress is no longer regarded as exogenously given (as in neoclassical theory), but modelled as an endogenous growth determinant. Alongside these developments, new approaches also emerged from innovation research which dealt with the systemic, creative and learning-oriented aspects of innovation processes (national, regional and sectoral innovation systems, innovative and creative milieus, industrial districts, see Aydalot 1986; Breschi/Malerba 1997; Carlsson 1995; Cooke 1992; Dosi et al. 1988; Freeman 1987; Lundvall 1992; Nelson 1993; Pyke/Sengenberger 1992).

The work of Porter (1990) on the principles of the comparative advantages of nations and their companies also falls into this theoretical research setting, as does the formation of a "New Economic Geography" based on the work of Krugman. These studies or theoretical concepts emphasized the significance of regional factors of influence on economic development and introduced geographical (spatial) components into economic models (Koschatzky 2002). Apart from this, economic concepts of network and

transaction costs as well as knowledge and learning concepts also enriched the spectrum of different approaches dealing with the global, national, regional and sectoral-technological implications of technological change and of innovation processes (Håkansson 1987; Nonaka 1994). During the 1990s, analyses increasingly focused on actor groups and organizations and their role in innovation systems (e.g. universities as knowledge-generating organizations, see Etzkowitz/Leydesdorff 1995).

Looking at the genesis and popularization of the cluster concept, the following theses can be derived from these developments:

- The 1980s and 1990s were characterized by a large number of new economic, innovation economic and social scientific theories and models.
- The evolutionary idea became generally accepted that changes to innovation patterns and the development of new technologies proceed in a path-dependent way and require sufficient time. Short-term changes are not expected.
- Apart from quantitative economic models of new growth and foreign trade theory, the basic arguments of many of the new (regional) innovation concepts were simple to understand (spatial proximity and specialization create advantages (clusters); synergies occur if the actors of an innovation system form networks (national and regional innovation systems)).
- Based on the political proximity of leading researchers and the openness of the administration and policy-makers to new concepts, the new body of thought quickly found its way into policy actions (e.g. at EU level, but also in individual countries).
- Network promotion as a key innovation policy paradigm of the 1990s (at EU level as well as nationally/regionally) created the basis for the rapid absorption of the cluster approach, by directing cluster policy towards supporting networks in clusters.
- Cluster support diffused widely (nations, regional levels) and within a short period of time due to diverse cluster analyses at national level and adaptation effects.
- The very catchy terms (cluster, networks, competition) which could be used without requiring long explanations or questions helped to promote diffusion. However, this also led to the problem of theoretical fuzziness which is mainly responsible for the very different interpretations of the cluster concept and the conclusions for cluster policy derived from them (Fromhold-Eisebith/Eisebith 2005; Martin/Sunley 2003).

2 Idiosyncrasies of the cluster concept and current developments

It can be seen that the cluster concept fits in well with the spirit of the times which helps to explain its popularization. On the one hand, it emphasizes the importance of compe-

tition for economic development, on the other, also the relevance of regional or local issues for knowledge creation and knowledge exchange (cf. Koschatzky 2009). The insights from new economic geography helped to pave the way for this, or from economic theory that economic processes do not play out in a one-place economy, but that spatial differentiation has a major effect on economic development and at the same time economic behaviour determines the spatial structure. Simultaneously, with its medium to long-term development perspective, the cluster concept also fits in with the realization in economics, innovation economics and economic geography that structures can only be explained dynamically and that they change over time. Boschma and Martin (2010: 3) comment on this in their introduction to the 'Handbook of Evolutionary Economic Geography', that "… a new evolutionary geographic perspective on the economic landscape has begun to emerge among geography and economics scholars …". In this context, Staber (2010: 221) refers to the fact that the social evolutionary method can provide a linking framework for the theoretical fragmentation which is an unavoidable consequence of analyzing a fuzzy concept like the cluster approach.

It is true that this fuzziness is a problem from a scientific perspective, because it does not create a consistent theoretical foundation and leads to different conclusions about cluster policy measures, but, on the other hand, it does allow a broad interpretation of the various cluster-based promotional approaches. This is the only explanation for politically promoted clusters and cluster development processes being found on different spatial scales, that these encompass large number or only a few cluster actors and that clusters can be active locally, regionally, inter-regionally or even nationally and internationally. Promoting clusters is done at a local level as well as a national one.

The somewhat blurred specifics of the cluster concept, e.g. with regard to starting conditions for cluster development and necessary minimum sizes for the number of cluster actors, offer ample room for wishful thinking. These ideas are characterized by the hypothesis that clusters are politically feasible and designable, they can develop under all possible framework conditions (as there are already many examples) and that clusters promise success via the focusing of resources and activities, not only for the cluster actors themselves, but also for the location. As the network paradigm (Cooke/Morgan 1993) was the precursor of cluster promotion, the transition from network promotion to cluster promotion took place smoothly. Although many of the promotional measures emphasize the significance of developing competitive structures, cluster policy is organized as the promotion of networks within clusters. The more intensively cluster actors are networked, cooperate together in information and knowledge exchange, jointly innovate and develop value-added chains in clusters, the more successful a cluster is

regarded to be by policy-makers. What is not considered here is that dynamics and competition, the establishment of firms which do not cooperate together in a location and the displacement of existing companies through start-ups are equally important success factors of a cluster (Enright 2003).

After the theory dynamics in the 1990s and early 2000s, no essentially new models and theories emerged. Innovation research is characterized by conceptual refinement and new perspectives. Among these belong, among others, the discussion of the issue which mechanisms are conducive to innovations, even if no research and development are carried out, what significance the low-tech sector has for the innovative capability of an economy, which status social innovations possess in the whole context of innovations, and which interactions exist between creativity, innovation activities and economic success. Further analyses are directed towards fine-tuning measurement methods or improving databases, in order to be able to apply a broader set of indicators to measure different innovation dimensions. In economic geography, ideas like 'regional resilience' are recently introduced (Pike et al. 2010), but at the same time critically discussed as being similarly unspecific as the cluster concept (Simmie/Martin 2010). Referring to the cluster concept, the conditions for cluster emergence and development are increasingly put into the scientific focus (cf. Fornahl et al. 2010). Besides, the importance of processes at cluster rims and the potentials of cluster networking are being addressed, approaches in cluster promotion and cluster policy continue to be further developed and, from the cluster benchmark, as well as implications derived for the limited transferability of one cluster development to other intended cluster developments. The general scientific debate is momentarily dominated by topics such as climate change, sustainability and eco-innovation, globalization and economic development (e.g. World Bank 2009), emerging economies in South America, South and East Asia as well as multinational enterprises. Although the subject of creativity (creative industries) is increasingly the focus of political interest, a new promotional paradigm, similar to the cluster approach, is not yet recognizable.

3 Current impressions from cluster promotion

The critical discussion in cluster literature is perceived by funding organizations, but ultimately only realized in the fact that the cluster concept is designed differently in different promotional programmes. Whereas, taking Germany as an example, in Bavaria and in North Rhine-Westphalia state-wide clusters with a strong network character exist, in North Rhine-Westphalia there are in addition 'RegioClusters', which are intended to play a complementary role within the state clusters, and because of their lo-

cal/regional focus fulfil this function of the cluster concept better than state-wide networks (clusters). There is still no coherent understanding of the term cluster within cluster policy, so that it can be agreed with the conclusion of diverse studies that "the" cluster policy does not exist (e.g. Enright 2003; Kiese 2008; Martin/Sunley 2003). In cluster policy it can be observed that, due to the promotion of cooperation and networks which include different groups of actors (enterprises, research institutions, intermediaries), the funding measures are transfused by the idea that functioning clusters develop from policy-induced clusters. On the part of politics and funding administration, clusters appear "feasible" (Brandt 2006). The list of approaches collected by Enright (2003) represent key design elements of cluster policy, such as e.g. bringing together players (catalyst), supporting private sector structures (supportive), implementing funding programmes (directive) and assuming decisions and control (interventionist), e.g. by building up cluster management.

Now that Germany has been promoting cluster-building for several years, the first evaluation studies of cluster promotion are emerging. Thus, for example, in Bavaria in 2008 the interim evaluation of the Cluster Offensive Bavaria and in 2010 the evaluation of the first funding phase of the Cluster Offensive Bavaria were presented (Bührer et al. 2010). Since 2009 the scientific monitoring process of the federal government's Leading-edge Cluster Competition has been running. Important issues to be addressed in this context are:

- How have the work and organizational structure of the promoted clusters developed?
- What impacts of the cluster funding were observed? Were the intended objectives achieved?
- Were the target groups reached?
- Has a sustainable structure been created, i.e. are the cluster activities largely self-financed, funded by the cluster actors?
- Have the clusters contributed to more competition and increased income as well as creating (new) jobs?
- Has an economic value added been generated by promoting clusters?

In addition, the adaptability of 'role models' is increasingly being critically discussed by the funding agencies. Findings about considering the respective cluster specifics are slowly catching on, in particular via a national and international exchange of experiences with cluster-policy measures among the funding providers. Thus new insights are available, not only in the scientific discussion, but also for funding organizations, into the modifications and further design of the promotional approaches necessary to

achieve the intended impacts, taking the respective regional and cluster-specific context conditions into consideration. After many years of promotion, first ideas are emerging as to how cluster structures or cluster platforms could be utilized for further funding measures, e.g. for internationalization purposes, for locational marketing, to recruit staff and qualify employees, to encourage associations/alliances and networks and to create framework conditions for 'open innovation'.

In this overall context, various questions are being presently discussed which address current challenges and to which clusters could significantly contribute:

- Is the science and education system sufficiently prepared for globalization?
- Must (European) science and research networks be further expanded?
- Can universities play a more active role in the task of knowledge transfer?
- What tightening of promotional policy is required against the background of the constraints in public budgets?
- What qualification requirements result from the consequences of demographic change?
- Are the existing models of research cooperation between science and industry sufficiently flexible, to generate sufficient innovations to guarantee income and employment?

Against this background, several new approaches, respectively ones utilizing cluster and networking ideas, have emerged in innovation policy and innovation promotion, which will be dealt with briefly below.

4 Developing new promotional approaches

Clusters as an economic and innovation policy approach do not stand alone in the promotional landscape, but can be classified among a plethora of other funding concepts which have either been in existence for several years or have just been put in place recently. Some examples are (Koschatzky/Stahlecker 2010a):

- Competence centres and networks
- Metropolitan regions and creative cities
- Promotion of excellence (e.g. like the excellence initiative of the German federal government)
- Public-private partnerships
- Innovation and technology platforms (e.g. in the Netherlands)

- Industry-research-campus models (e.g. 'Industry on Campus' in Baden-Württemberg, Science Enterprise Challenge in the United Kingdom, Research Studios in Austria), and
- Industry-University Cooperative Research Centers in the US.

Common to many of these funding approaches is the fact that they react to the increasing flexibility in the research and science system, respectively, are themselves pillars of this flexibilisation process. Outstanding German examples for this process are the fusion of the University of Karlsruhe with the Research Centre Karlsruhe, sparked off by the Excellence Initiative, to form the Karlsruhe Institute of Technology, or the Jülich-Aachen Research Alliance (JARA) between the RWTH Aachen and the Research Centre (Koschatzky/Stahlecker 2010b). These developments were only possible because in the past few years the level of freedom and autonomy in the German higher education landscape has (drastically) increased, and this greater autonomy has impacts on the entire science system. Simultaneously, the non-university research organizations are under increasing competitive pressure, on the one hand, due to changes in the German research landscape (e.g. universities and research centres are increasingly invading the contract research market), and on the other hand, through international competitive shifts (foreign organizations as contractors of German ministries and authorities). Moreover, a change in strategy can be observed in industry, in that even strategic research and development is no longer carried out exclusively within companies, but in flexible collaboration with external partners from science and industry. This is reflected, for instance, in the increased share since the end of the 1990s of external expenditures on research and development in the total R&D expenditures of German industry. In the year 1997 the external R&D expenditures amounted to a share of 13.5%, while in 2007 they were 19.5%. The share of external R&D expenditure which flowed to domestic higher education institutes and professors rose from 9.3% to 11.1%, the share to domestic state research institutes from 5.6% to 9.1% (Stifterverband 2009). Admittedly, the cooperation within the industrial sector continues to play the greatest role (award of R&D contracts to domestic and foreign firms), but the statistics make abundantly clear that the division of labour in industrial R&D has significantly increased in the past 10 years.

In this context, new approaches to collaboration have emerged in addition to the cooperation in clusters. These are principally directed towards cooperations in which actors from formerly separate organizations respectively sub-systems of the research system engage in exchanges and try out new forms of collaboration, or even completely new sub-systems originate (Kaufmann/Tödtling 2001). These so-called "heterogeneous cooperations" have different characteristics. They can be organized both at a lo-

cal/regional and also at a national/international level. Their time frame ranges from a short-term duration (a few years) up to a longer-term partnership (10 years and more). We find contractually secured cooperations, as well as informal collaborations or cooperations without a (separate) legal form. The cooperation can take place between two partners, but also in a consortium with several players. Examples are to be found, not only for cooperations in strategically oriented basic research, but also for applied and market-oriented research and development work. Quintessential feature of these heterogeneous cooperation models is that they do not necessarily require a political impetus and public promotion, but develop as self-organized interest groups. This does not preclude that examples of public support are also found in this area (Koschatzky et al. 2008; Koschatzky/Stahlecker 2010a).

5 Conclusions

Although other regional- and sector-oriented promotional approaches exist alongside cluster promotion, from today's perspective the popularity of the cluster approach appears undiminished. At the global scale, no funding approach is as much discussed and implemented as the cluster concept. It must therefore be assumed that cluster support will still be a central innovation policy approach in the coming years. This view is strengthened by the fact that at present no successor for cluster promotion is apparent in the recent scientific theoretical discussion. Although improvements in the conceptual clarity and in the cluster policy approaches are being discussed, a new paradigm at a comparable level (as for instance the concept of innovation systems or also network funding before the diffusion of the cluster approach) is not recognizable.

Cluster funding will however in future have to be more specific (and selective) than previously and have to network with other funding levels and funding approaches (e.g. European excellence clusters; promotion of excellence in universities in clusters; collaborative research and network promotion; new (heterogeneous) cooperation models). All empirical evidence shows that successfully operating clusters are characterized by a great diversity of actors and activities. These qualify the cluster as a platform to develop new cooperation forms and partnerships, as well as for further education and training measures, by learning from the experiences gathered in the cluster promotion programmes and building on the interactions in clusters. In this sense, new cooperation forms at the micro level, i.e. between single partners, and at the meso level in regional partnerships are not a substitute, but rather a supplement and extension of cluster promotion.

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