Clusters in Germany

An Empirical Based Insight View on Emergence, Financing, Management and Competitiveness of the Most Innovative Clusters in Germany

Dr. Gerd Meier zu Köcker
Institute for Innovation and Technology, iit

The document presents some important outcomes of the work done in the framework of the Initiative Competence Networks Germany (www.kompetenznetze.de). This Initiative is owned by the Federal Ministry of Economy and Technology (BMWi) and brings together about 100 of the most innovative German competence networks which focus on technology. The Initiative offers a common platform to the highest-performing networks in technology, and provides its members with various benefits. Members of the Initiative stand out due to innovative partners, intensive co-operations and the goals they share. Outstanding proximity to markets and industry, regional integration, dynamics in their development and flexibility, are qualities characteristic for them.

Preface

The experts from the Institute for Innovation and Technology (iit) also contributed by providing the methodology and scientific approach used to this cluster paper. The aim of the iit is to leverage the complementary expertise of academia, industry and government to facilitate new systems for innovation and novel collaborative processes on behalf of its clients. The work of the iit is based on a broader understanding of innovation, which also regards, besides the core technological development itself, the economic and social preconditions and impacts of techno-logical innovations. Cluster and regional innovation policy plays an important role for the work of the Institute (www.iit-berlin.de).

The contents of this publication are responsibility of the author on behalf of the Institute for Innovation and Technology, Berlin.

Table of Contents

Introduction

Economic policy can be considered as one of the major tasks of a national approach to increase the wealth of a domestic economy. It aims at different objectives, like economic growth, full employment, stable prices or positive balance of payments from international trade. Insufficient innovation was recently considered a major cause of Europe's disappointing growth performance[1]. As a consequence, European regions need more innovation and economic growth to catch up with to the global challenges. National and regional governments have recognised the potential of regional networks and clusters as a real driver in regional development policy. Many of them have proven a significant contribute to strengthening local economies, creating new jobs and attracting new investors. For this reason many clusters initiatives have been launched. Some countries included clusters policy in national development plans, others pursue regional policy models.
When clusters were analysed in academic literature, the basic definition of Michael Porter was mainly used. It defines clusters as "geographically proximate groups of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities"[2].

The positive impact of evaluating such innovation related programmes on the development of the targeted industrial sectors is impressive. Those sectors may include the companies as well as the societies addressed by these measures. Firstly, clusters are important because they allow companies to be more productive and innovative than they could be in isolation. And secondly, clusters are important because they reduce the barriers to entry for new business creation relative to other locations. As a consequence, clusters and networks (in the following consequently named as clusters) have become more and more the focus of public debates, national supporting initiatives, and academic research. Many studies have been published, analysing different aspects of governance, structure, growth poles, competitiveness, internationalisation issues and so forth. Some comprehensive reviews of literature on clusters have been made in the past, providing a good survey[3].

The emergence of clusters is often a specific result of a certain initiative, based on a national or regional clusters policy, especially if the emergence is based on a top-down approach, clusters organisations often play an important role as service providers for the support of their members. The set-up of cluster organisations is often supported by a clear mandate and public funding from authorities on regional or national level. During such an emergence phase many parameters are set up, which may have a long-term impact on the governance and performance of all the clusters. One crucial parameter is the clusters organisation or management itself, since it is playing an important role in providing specialised services and added-values to their members. Therefore, the level of their quality and professionalism of the clusters management, matters, which is often underestimated in many discussions related to clusters.
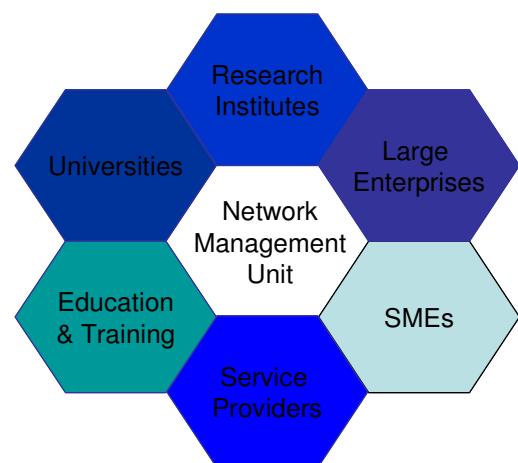

Figure 1:   Main types of partners gathered in a cluster.

---

[1] See European Commission (2006f). The Aho report is available at http://ec.europa.eu/invest-in-research/action/2006_ahogroup_en.htm

[2] Porter, M. E. (1990) The Competitive Advantage of Nations, New York: The Free Press.

[3] Porter, M. E. (1998) On Competition, Boston: HBS Press.

For a better understanding of the findings, it seems to be important to clearly distinguish between clusters, clusters policies and respective clusters initiatives. We consider clusters as a real economic phenomenon that can be economically measured. In addition, the clusters we have regarded in this paper all fulfil high requirements, which are mandatory to become members of the Initiative Kompetenznetze Deutschland[4] (Initiative Competence Networks Germany). All of them, 107 clusters in total[5], have passed an evaluation procedure by an external scientific board of experts, and thus can be considered as the most competitive and innovative clusters in Germany (league of the best innovation clusters). This cluster portfolio can be considered as an excellent target for our investigations, and avoids issues other publications have partly had, when analysing a greater number of clusters, which differed very much in terms of structure and quality. Altogether, the clusters represent more than 6.500 members, coming from different areas, as described in Figure 1. More than 4.000 SME as well as around 700 global players are members of these clusters, and last, not least around 1.300 R&D institutions and universities.

In the following we will mainly present and discuss our findings related to the kind and impact of clusters emergence on the structure and governance of clusters, the financing, the management, as well as the current main tasks and future challenges of the clusters we have analysed.

[4] This initiative is funded by the Federal Ministry of Economics and Technology (BMWi), gathering the most innovative, mainly industrial driven regional networks in Germany and supports them in different areas. The membership to the initiative is a quality label only for the best networks. Members must fulfil mandatory requirements, e. g. a dedicated thematic focus, strongly industrial driven, high regional concentration, clear organisation and high identification of the network, complete gathering of the representatives of the value chain, minimum size and number of members, strong collaborative development of technology, providence of added value for the members, good sustainability of the network, high innovation potential and strong international orientation.

[5] Status at June 2008

2. Aims and Objectives

Previous investigations by van der Linde[6] revealed, that based on the diamond approach of Porter[2], not only factor and demand conditions were the most common cause of good clusters establishment. Also other determinants, like related & supporting industries, context for strategy and rivalry as well as other reasons, were reported of having a certain impact on the competitiveness of clusters. The determinants "other reasons", like type of cluster emergence, management, financing & funding, and others, are of special interest in our consideration, since they can be influenced, to a certain extent, by the actors themselves or by setting up appropriate framework conditions within cluster initiatives.

Clusters practitioners, policy makers, economic development agencies, as well as clusters managers themselves, are concerned with the reason of the initial establishment of clusters. Why do certain clusters develop better than others? How do the perfect framework conditions look like for clusters development? Is it only a financial question? Is it usually due to favourable local factor conditions, demand conditions, or the presence of other related or supporting industries close by (when the Porter diamond approach is applied)[2]? What kind of impact could public activities make, or can policy makers trigger the emergence of clusters? Are clusters comparable and can they be benchmarked in order to learn from the best?

The main objective of this Cluster Paper is to look at the most competitive clusters in Germany in more detail, and to discuss the main findings of an empirical evaluation. All information we gained so far were collected and stored in our internal database. In addition, we turned a lot of information into quantitative indicators in order to make them comparable with each other. By means of this approach, we are now able to define practical benchmarks of the clusters / cluster outputs, based on about 60 indicators we have defined. The corresponding benchmarking of clusters and cluster outputs have been started since mid 2008. First results will be published at the beginning of next year. The experiences we made so far by this benchmarking approach are very promising.

3. Methodology Used

By an analytical point of view, the cluster portfolio we have chosen can be considered as an excellent starting point for this analysis, since the structure and quality of the clusters in terms of innovation capability and competitiveness is quite comparable. Many previously published papers suffered from having a comparable quality base of clusters when running any kind of metaanalysis or metastudy. Very often there is no common definition for a cluster. Many of such quantitative studies involving clusters are usually restricted to individual clusters or have a narrow focus[6].

The analytical approach presented here is based on empiric data of 75 out of the 107 cluster members (not all members have been regarded in this study due to various reasons, e. g. quality of primary data, completeness of data, etc.). They have been visited in 2007 or in the beginning of 2008 by experts from the Agency of the Initiative Competence Networks, who also acts as their key contact partner since May 2007. All of these technical cluster experts have appropriate technical knowledge in the respective innovation field the clusters are operating in as well as in cluster matters. This is very important in order to get a better understanding of the development of certain clusters compared to others. Additionally, to judge whether the information provided by the cluster managers was in full conformity with the impression of the technical clusters expert. During these visits many aspects have been discussed in order to better understand the development of the clusters, the key success factors, their current status as well as the future challenges and needs.

The overall aim is to better understand why certain clusters developed better than others, and how the framework conditions should be structured to create a perfect surrounding for the development of clusters. The findings are structured according to the main aspects we were looking for: The impact of different types of cluster emergence on their development (chapter 4.1), the financing of clusters organisation (chapter 4.2), the clusters' management (chapter 4.3) as well as the clusters' competitiveness (chapter 4.4). In the beginning we described how a typical cluster is structured, and what the key indicators in terms of number of members, financing, benchmarks, etc. look like. Our insight view will reveal the change of funding sources for the clusters over the time.

---

[6] Van der Linde, (2003), Demography of clusters – findings from the Clusters Meta-Study, in Dohse and Soltwedel (eds.), Innovation Clusters and Interregional Competition, Berlin, Heidelberg, New York: Springer-Verlag.

4. Findings

Our clusters in general considerably vary in terms of age, size, structure, governance, services provided, etc. Average values therefore are only conditionally meaningful. The fact sheet (Table 1) shows the respective maxima and minima data of our analysed cluster portfolio to give a rough impression.

The share of public funding of cluster organisations (or of the cluster managements) varies drastically; between 100 % (in 23 % of all cases) and 0 % (in 19 % of all cases), whereas the average public funding rate is 57 %. In the following we will have a more specific look at aspects like type of cluster emergence, financing of clusters and cluster management.

Key data	Max.	Min
numbers of members in total	450	20
- share of SME (%)	89	7
- share of big companies (%)	90	0
- share of R & D institutions or universities (%)	74	5
- share of financial institutions (%)	15	0
- share of others (%)	29	0
age (years)	17	3
number of staff working in a cluster organisation	12	1

Table 1: Fact sheet of some key data of the analysed cluster portfolio

4.1 Type of cluster emergence

Cluster policies often result in specific cluster initiatives. In consequence, cluster initiatives can be understood as "organised efforts to increase growth and competitiveness of clusters within a region, involving clusters firms, government and/or the research community.[7, 8] In Germany cluster funding is conducted on two levels: on federal level (mainly provided by the Federal Ministry for Economy and Technology, BMWi, and the Federal Ministry of Education and Research, BMBF) and on federal state level (Bundesländer), where many different regional ministries are running cluster initiatives. As a consequence, Germany has a parallel system of cluster funding.

Figure 2 gives a good overview of some of the most relevant cluster initiatives in Germany in the recent past (on federal as well as on federal state level), which resulted in many successful clusters that are members of the Initiative Kompetenznetze Deutschland nowadays.

Clusters which have been set up and initiated by means of such clusters initiatives, can be considered as top-down, externally initiated clusters (s. also Figure 3). Other approaches of cluster emergence outside of any cluster initiative, without significant support of regional or federal policy makers, are bottom-up clusters as well as top-down, internally initiated clusters. Of course, in reality there are mixtures of these three scenarios, but in most cases, one of these is predominating. In the following we summarise the main characteristic features of clusters according to the three types of cluster emergence (Figure 3).
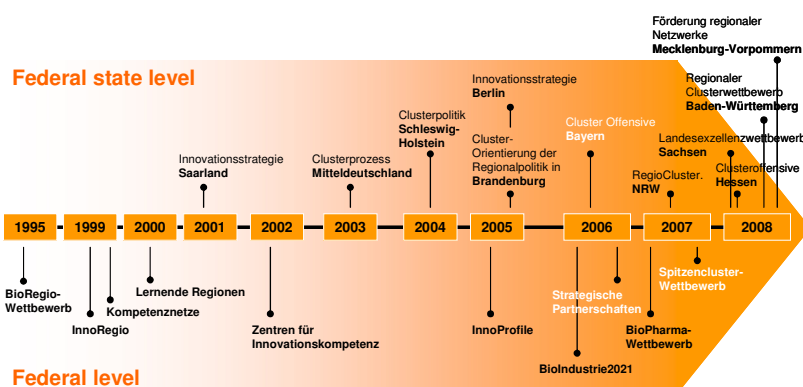

Figure 2: History of the selected German clusters Initiatives on federal state and federal level (no complete list)

---

[7] Sölvell, Lindqvist & Ketels (2003) The Cluster Initiative Greenbook, http://www.cluster-research.org/greenbook.htm.

[8] Andersson et al. (2004) define clusters initiatives as "conscious actions taken by various actors to create or strengthen clusters".
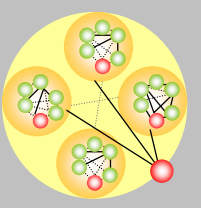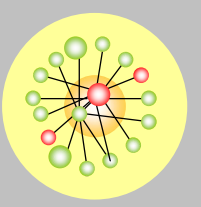
	Bottom-up cluster ➢ decentralised governance ➢ network coordinator mostly selected by any member of the cluster, acting as a kind of service provider ➢ political influence: low
	Top-down cluster, externally initiated ➢ mostly centralised, but externally governed ➢ cluster organisation or manager mostly nominated by the initiator ➢ political influence: high, mostly initiated by cluster initiatives ➢ usually strongly depending on public funding
	Top-down cluster, internally initiated ➢ centralised, internally governance ➢ lead organisation (typically R&D institution or university also acts mostly as cluster coordinator and dominates the work; ➢ political influence: varying, usually strong dependence on public funding

Figure 3: Prevailing types of cluster emergence

Bottom-up clusters

Bottom-up clusters are typically characterised in that they emerged by a gathering of industrial and scientific partners to intensify the mutual co-operation in order to gain competitive advantages for their daily business. Of course, there may be other reasons for setting up such kind of clusters. The governance is typically decentralised, and the cluster organisation in charge has been selected by the cluster members themselves. The political influence is low since the setting-up was typically realised without consider-able involvement of regional or federal policy makers. This does not automatically mean that no governmental institutions are involved or direct members, but they do not have a leading role, and can be considered as ordinary members.

The cluster organisations raise the majority of their operating costs themselves by membership and service fees, partici-pation fees for conferences, sponsoring etc. The financing model might differ quite a lot. From the very beginning fee based financing urges the cluster organisations to provide demand-oriented services and added values for their members.

Top-down, externally initiated clusters

The set-up of such a type of cluster is typically supported by a clear mandate, and publicly funded by authorities on federal or federal state level (sometimes by both in parallel). Often cluster initiatives facilitated or stimulated the emergence of such type of clusters (s. Figure 2). Sometimes it is spontaneously initiated within the triple helix of industry, university and government, in order to overcome obstacles of co-operation and allow trust building between partners. In the beginning, such clusters receive public funding, at least during the embryonic phase (over 3 – 5 years), whereas the funding concepts and funding rates differ very much. When mature and successful, clusters or their respective management organisations tend to raise the majority of their operating costs themselves by membership and service fees, participation fees for training and conferences, sponsoring and so forth. As far as the analysed clusters are concerned, in chapter 4.3 the change of funding sources over time is described more detailed. The amount of fees is often lower than those of bottom-up clusters, since these fees are intended to co-finance the cluster organisation, since the other (significant) financial part is

provided by public sources.

The political influence concerning such clusters is typically quite high, since policy makers consider these clusters as appropriate tools to successfully increase the innovation capability and competitiveness of a certain region.

Top-down, internally initiated clusters

As far as such a type of cluster is concerned, the main driving force is typically an institution, like a research institution or university. This institution takes over the governance and management of the whole cluster, and also provides the cluster organisation. The initiator often follows certain objectives he wants to achieve by means of such a cluster. It is no surprise that later on the initiator dominates the actions and themes the whole cluster is working with. When looking into our clusters portfolio, in such cluster types, in more than 70 % of the cases the activities and topics the clusters are dealing with are dominated and set by the clusters organisation (which is in fact in all cases the original initiator of the clusters). The initiator uses the cluster approach as a tool to increase its reputation and to gather members to acquire funds for joint R&D activities.

When studying the literature, there are different publications available describing different categories of cluster structure / governance.[9] Unfortunately, there is no link described between the history of cluster emergence and the governance. We found three main scenarios of how clusters typically emerge in Germany. As far as our investigated clusters are concerned, most of them are top-down, externally initiated ones (about 70 %, s. Figure 4). Many of them are a result of clusters initiatives on federal or federal state level, described in Figure 2. Only about one quarter of the clusters have been bottom-up initiated, and never been influenced by any public cluster initiative.

The type of cluster emergence seems to have a certain impact on structural items related to clusters. One important topic is the financing of the cluster organisation and management, which will be discussed in the next chapter. We found a clear tendency towards cluster emergence and
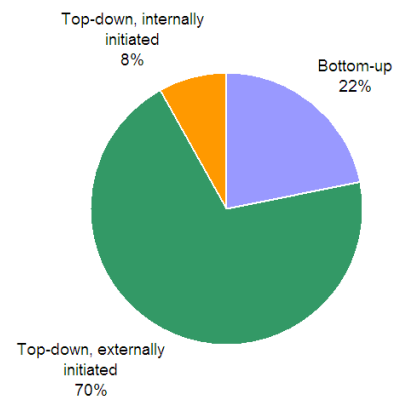

Figure 4: Distribution of the three prevailing types of cluster emergence

the commitment of the clusters members in terms of legal constitution of the clusters. Based on Figure 5, it can be assumed that those cluster members who are strongly committed to a cluster, select a certain kind of legal constitution, like an association, which is beneficiary for their work and the overall objectives of the cluster. By choosing a certain legal constitution, a cluster gains higher liability and predictability for its members. Tasks and duties of all members, as well as of the management, become more transparent. The selection for a type of legal constitution firstly depends on the level of close co-operation among the members, secondly on who dominates the cluster work, and thirdly on the issue whether there is a certain (commercial) interest or not. Those who are not really committed or intend to be only loosely involved in a cluster-based co-operation will not spend too much efforts in implementing a certain legal constitution within the clusters. Bottom-up and externally initiated top-down clusters more often selected a certain legal constitution than those, which are top-down, but internally initiated.

---

[9] Keith et. al. (2007) Modes of Network Governance: Structure, Management, and Effectiveness; Journal of Public Administration Research and Theory Advance Access.

Our analyses have also shown that the kind of cluster emergence seems to have an impact on the grade of their internationalisation some year later. We internally rated the clusters according to certain levels of internationalisation[10]. In Figure 6a the different levels of internationalisation of clusters operating in the innovation field "Micro / Nano / Opto" are presented, separated according to cluster emergence. It can clearly be seen that bottom-up clusters are much more internationalised (level 6 out of 7, levels are explained in the appendix) than both other types of cluster emergence. Figure 6b reveals the same effect for the innovation field "Manufacturing". The tendency is also the same for other innovation fields, whereas the absolute values slightly differ[11].
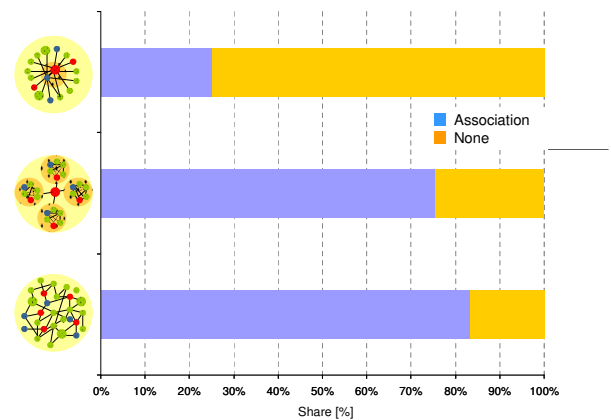

Figure 5: Percentage of clusters that have chosen the legal status of association compared to those that did not select any legal constitution (depending on their history of emergence, data source: 60 out of 75; 15 selected another type of legal constitution, like Ltd. or Inc.)
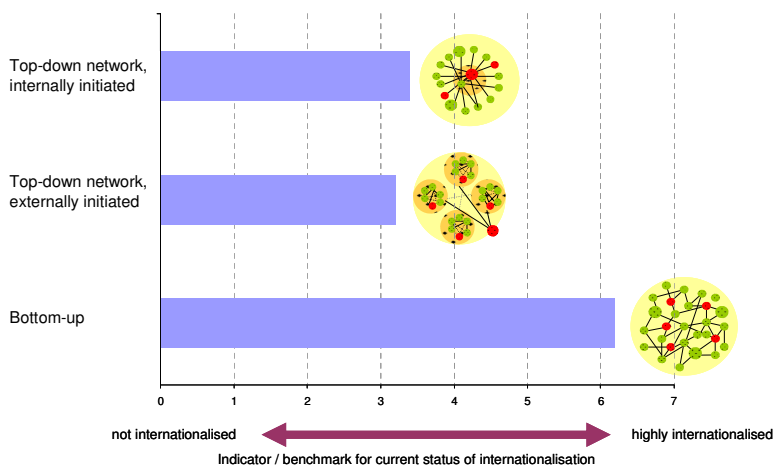

Figure 6a: Dependence of the level of internationalisation of clusters on their type of emergence (field of innovation: Micro / Nano / Opto, indicators are explained in the appendix)
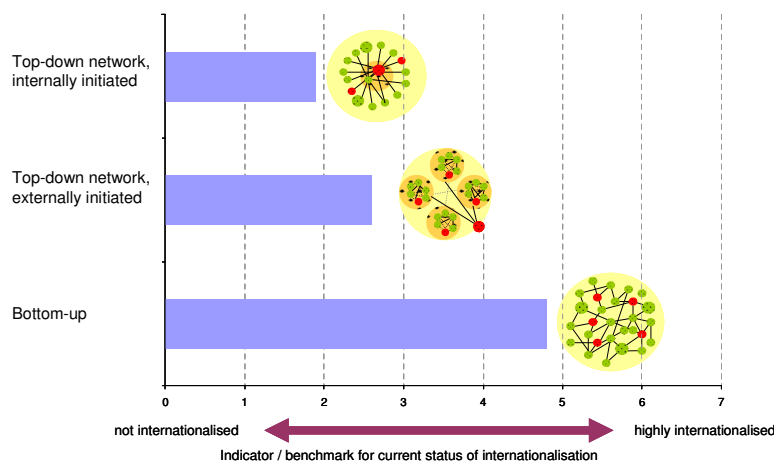

Figure 6b: Dependence of the level of internationalisation of clusters on their type of emergence[10] (field of innovation: Manufacturing, indicators are explained in the appendix)

---

[10] Markusen, Ann (1996), Economic Geography, Vol. 72, No. 3.

[11] Meier zu Köcker, Gerd, The Development of Clusters in Europe, INTERCLUSTERS Conference, December 6th, 2007,

http://www.intercluster.eu/images/Programmes/InterCluster2007/MEIERzuKOCKER_RT1.pdf

4.2 Financing of the clusters

The set-up of cluster organisations is often supported by a clear mandate and public funding from authorities on federal or federal state level. As part of this, cluster organisations often play an important role as service providers for the support of the cluster members. Cluster organisations can be defined as the legal entity engineering, steering and managing the clusters, usually including the participation and access to the clusters' premises, facilities and activities as well as service providers. When looking all over Europe, many clusters which have been set-up in the past received or are still receiving public funding, dedicated to the cluster organisation or management. Especially during the embryonic phase of a cluster, it often gets considerable public funding, typically in the framework of certain cluster initiatives. In the ideal case, matured and successful cluster organisations tend to raise the majority of their operating costs themselves by membership and service fees, participation fees for training and conferences, sponsoring etc. In practice, private based financing is still a big challenge for many clusters world-wide. As a consequence, sustainable financing of (matured) clusters, preferably combined with a low share of public funding, is a hot topic in Germany. Although most clusters have been set up in the framework of certain cluster initiatives, policy makers are generally interested in reducing the amount of public funding as soon and as much as possible. On the contrary, cluster organisations have to provide as much added values and demand-oriented services to their members as possible, in order to turn a membership within a cluster into a competitive advantage. However, such services and men power behind are expensive.

Coming back to our cluster portfolio, it is of considerable interest, what their financial situation looks like (even as the most successful clusters), how they are currently financed, and how the share of financing (private or public) changed over time. Figure 7a reveals the development of the financial sources of the clusters at the time of emergence compared to that in the year 2007. When emerged, on average 78 % of cluster financing came from public sources, 22 % were based on private sources. The main sources are federal and federal state funding. This average value of public funding decreases to 57 % in 2007 for all respective analysed clusters. When looking closer to Figure 7a, it becomes obvious that the share of federal-based funding of the clusters considerably changes over time. It decreases on average from 27 % at the time of cluster emergence to 9 % in 2007. On the contrary, the share of EC-based funding, as well as federal state funding, remains almost the same over time. The latter one remains on quite a high level of about 30 %.
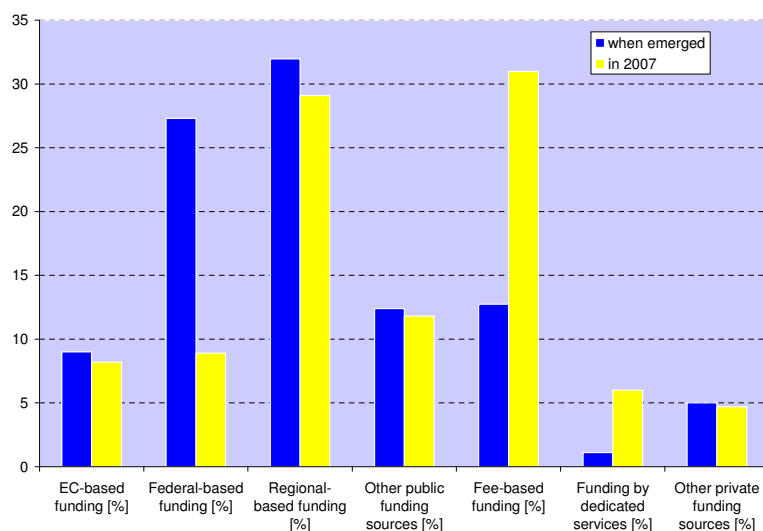

Figure 7a: Development of the average financing source of clusters over time (figures given in %)
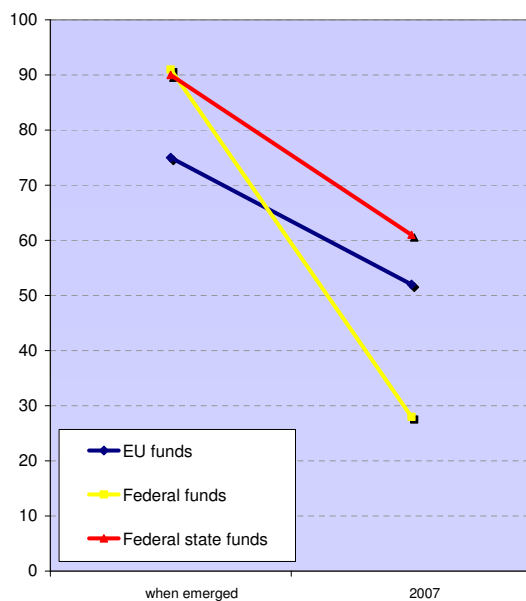
Figure 7b: Development of different prevailing funding sources of clusters over time

Figure 8: Share of public funding of the cluster management against the type of cluster emerge

Figure 7b reveals that federal state cluster funding seems to have a more institutional character (long-term funding) than federal funding. In the respective figure the development of funding rates of the prevailing funding sources (EU, federal and federal state) overtime, is shown. When emerged, clusters funded on federal, as well as on federal state level, receive comparable high funding rates (85 – 90 %). But in 2007, the funding rates of federal funded clusters are considerably lower than those of federal state funded ones. The rationale is the following: in most cases in Germany, the funding schemes of federal cluster initiatives significantly reduce the funding rates over time by imposing pressure upon the cluster organisations and management from the very beginning, in order to find other private funding resources. This approach is not so common for federal state cluster initiatives, where the funding rates often remain quite high over a long period of time, or the degree of the digressive funding is quite low.

In chapter 4.2 we have seen that three main types of clusters emergence prevail in Germany. The share of public or private financing also strongly depends on the type of cluster emergence (definition s. Figure 3). As shown in Figure 8, bottom-up initiated clusters have a much higher share of private financing than top-down clusters. As far as bottom-
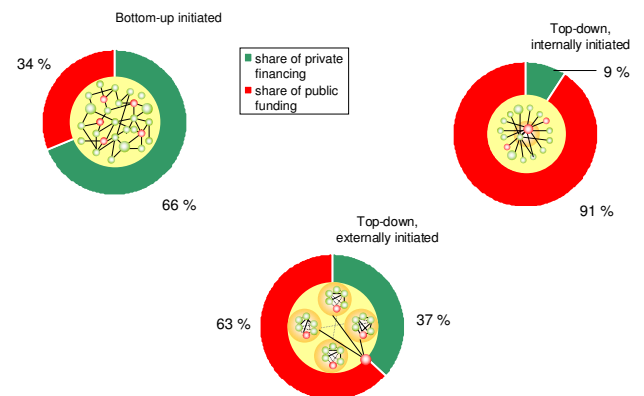
up clusters are concerned, the main financial sources are membership fees (73 %), followed by fee-based services (17 %). The rest is coming from other sources. The internally initiated ones in particular, considerably depend on public funding (a public funding rate of over 90 % on average). It can be argued that such a kind of cluster is mainly operated by universities or R&D institutions in Germany which often follow their own R&D strategy. The services and added values are more directed to attract public funds for initiating collaborative R&D projects. Such activities are much more in the focus of the clusters' activities than providing demand-oriented services for the industrial members. The cluster organisations are typically located in the universities themselves, and either paid by them or in the framework of public funded R&D projects. We learned from those cluster managers that member fees or private financing sources are not on top of the list of priorities of such types of clusters. Since demand-oriented services or other added values (besides potentially joint R&D programmes) are often missing, the industrial members are also not willing to pay fees. Since the membership is mainly free of charge, and the access to public R&D funds is better when being a member of such a cluster, industrial members appreciate to be part of a cluster (since there are no costs or disadvantages), but mostly not very active.
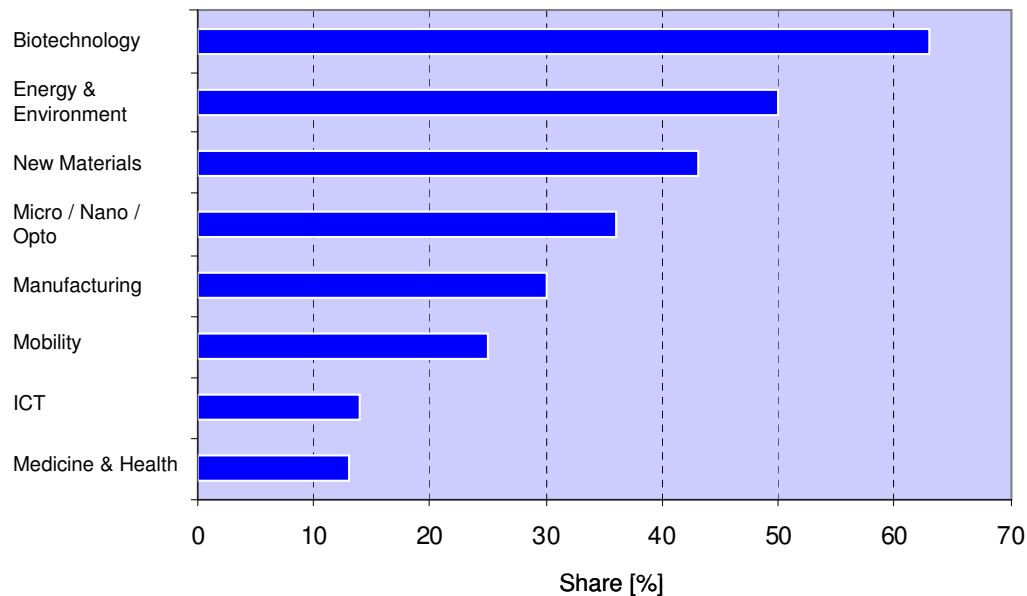
Figure 9: Share of clusters receiving at least 75 % public funding (in 2007), depending on the innovation field they are operating in

As seen in Figure 9, the amount of funding does not only depend on the type of cluster emerge, but also on the innovation field, where the clusters are operating in.

More than 60 % of all Biotechnology clusters received at least 75 % of public funding in 2007. This is mainly caused by the fact that many excellent Biotechnology clusters have been established in the framework of public funded cluster initiatives or public competitions in the Biotechnology area in Germany (e. g. BioRegio). On the contrary, clusters in the field of manufacturing, Mobility or ICT seem not to depend so strongly on public funding since less than 30 % of these clusters receive more than 75 % of their budget out of public funding sources. This leads to the conclusion that federal and federal state funding schemes considerably shaped the cluster landscape in Germany.

Although all clusters regarded in our analysis belong to the most successful and competitive ones in Germany, the sustainability of the financing of the cluster management differs among them. We selected four different categories of sustainable financing of the clusters management (s. Figure 10 for more details) and rated them accordingly. Most of the clusters, in total 89 %, reported of having a very sustainable financing, regardless which type of clusters emergence they

belong to. About 21 % assessed their own financial situation at least to be critical.
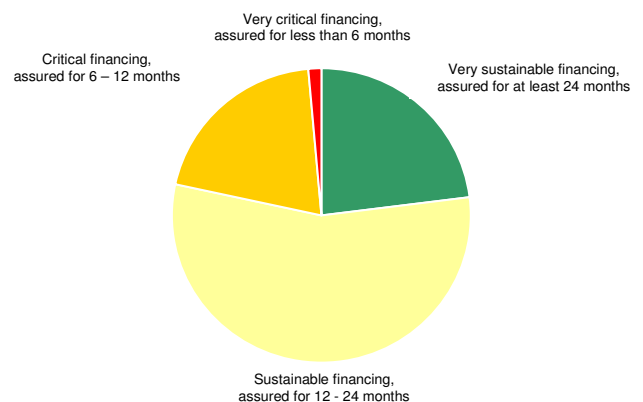

Figure 10: Sustainability of financing of the cluster organisations in 2007

When comparing the growth of the clusters in terms of size, those that have an assured financing tend to grow up better on average than those having financial issues. According to Figure 12, about 70 % of all clusters having an assured financial situation grew up significantly (at least 20 % per year) and only 10 % did not grow during the last two years.

Contrary to that, almost 30 % of those cluster organisations not having gained a well assured sustainable financing, did not grow in the recent past and only around 20 % grew up significantly.

When assessing the future growth potential of the clusters[12], we also found out that those with a good financial situation are considered to have a better growth potential on average than those suffering a reliable financial base (Figure 11).
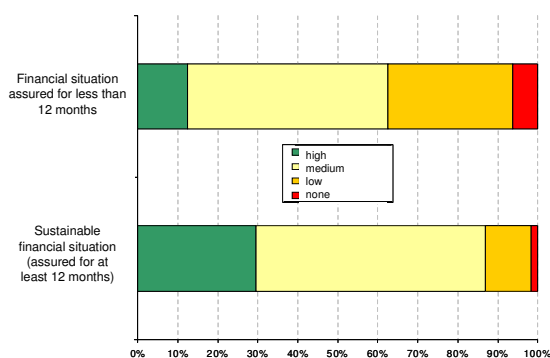

Figure 11: Expected future growth in terms of size (two groups are compared: those with sustainably financial situation and those not having a financing assured situation)

Those clusters having a solid financial base expect in almost 90 % a medium or high growth rate in terms of size over the next two years. On the contrary, only 60 % of those with financial issues expect a comparable growth rate in the future. Almost 40 % expect a low growth rate or no growth at all.

4.3 Management of clusters

According to our experience, the management of clusters plays a decisive role for the success of the respective cluster. The cluster management serves a functional purpose to provide a range of specialised and demand-oriented services to the members. Clusters organisations help to channel, facilitate or provide access to facilities and services, which may include specialised research and test centres, consultancy, training, and so on. Due to the importance of the clusters management for the overall competitiveness of the regional actors, we therefore discuss some of the related results we have drawn out of our statistical analysis.

Figure 12: Growth of clusters in the past (two groups are compared: those with sustainably financial and those not having a financing assured situation)

[12] The assessments have mostly been done by the cluster managers themselves and were verified by our experts. In some cases, the assessment was only done by our experts. Category high means at least 20 % growth per anno in terms of size (for a period of two years time), medium means 10 %, low means below 10 %, none means no growth.

The communication among the clusters members, among others, very much depends upon the clusters manager, respectively the clusters coordinator is linked to and how he is accepted by the clusters members. There are several entirely different approaches to that being practised in a similar fashion throughout Europe. One approach consists of the cluster manager or the cluster organisation itself being member of the cluster. In another approach the manager / organisation is no direct member of the clusters, but is entrusted with this responsibility by the cluster members. The third variant an external service-provider (or business development or funding agency) takes the lead being appointed by a third party (which often funds or initiated the cluster set-up). Figure 13 shows which of these three options dominates in our clusters portfolio.
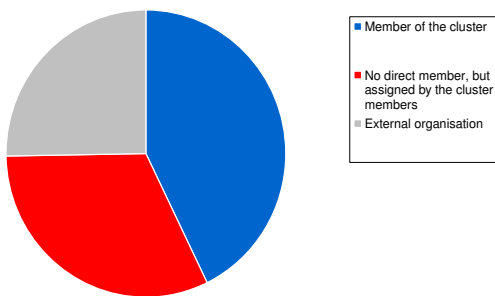

Figure 13: Relation between cluster managers and clusters

Based on the assumption that the cluster management plays an important role in identifying and implementing demand-oriented services and added values for the members, the corresponding cluster organisation should have sufficient staff to do so. But, what seems to be the optimal number for an efficient cluster organisation? Too little staff means that the number and spectrum of services performed may be low or the clusters organisation cannot take sufficient care of the demands of the clusters members. Too much staff may unnecessarily increase the costs of the cluster organisation.

Looking at our cluster portfolio reveals that 73 % of cluster organisations have between one and three employees, with a relative maximum at two (overall average: 3,1 employees).

Capacities based on voluntary support of certain persons of a cluster (e.g. by member of the board, chairmen of working groups, etc.) are not regarded in Figure 14.

Figure 15 shows that the number of staff working for cluster organisations slightly varies between the different types of cluster emergence. Bottom-up initiated and top-down internally initiated clusters have on average 1,8 employees working for the cluster organisations, whereas in those cluster organisations which were top-down externally initiated, on average three staff are employed.
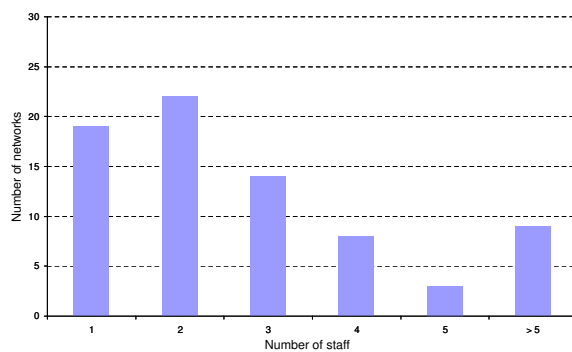

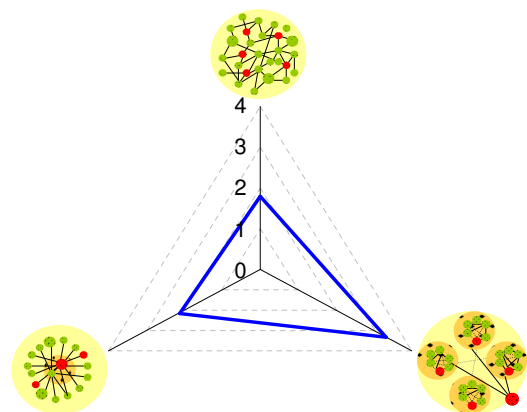Figure 14: Distribution of number of staff of the clusters organisation

Figure 15: Average number of staff depending of the kind of clusters emergence

It has been mentioned before that the management of a cluster and the services provided are very important for the additionality a cluster can offer to its members. Therefore it can be assumed that cluster managers have identified certain main tasks which are in the centre of activities. The respective services and added values provided by the clusters

management then should be the result of the main tasks identified. We asked the cluster managers to select the two most relevant tasks they consider for their clusters out of several different options we offered. In total, the acquisition of public funds, internationalisation issues, stimulating information and experience exchange among the members as well as training and qualification (incl. recruiting) were the most named tasks (s. Fig. 16).

Again, we identified that the type of cluster emergence does have some impact on the main tasks dominating the clusters works. As can be seen in Figure 16, bottom-up clusters tend to concentrate on different tasks than top-down internally initiate ones. The latter ones mentioned the acquisition of R&D funds and training as well as qualification as their main task they have to follow. This is no surprise, since most initiators and clusters organisations are universities and R&D institutions and these tasks are those they can do best. They tend not to pay much attention to issues like internationalisation of their industrial members. Bottom-up clusters named a quite well balanced spectrum of main

tasks (at around 20 % each) they have to complete, like to support their members in internationalisation issues, training & qualification, acquisition of public funds as well as to stimulate the information and experience exchange among the members. Top-down externally initiated clusters tend to have a similar spectrum of main tasks like bottom-up clusters.

We are aware that even successful clusters face certain challenges in the future. For sure, these challenges will differ according to the individual situation of the clusters. Nevertheless, we asked the cluster managers for the main challenges they will face over the next two years and offered them 12 different options for voting. We were surprised that the most answers concentrated on only 7 options we provided. Figure 17 reveals the overall results, pointing out that "sustainable financing" and "collaborative technology development" were considered to be the main challenges. Followed by "internationalisation issues", "increasing the co-operation between the members" and "acquisition of public R&D funds".
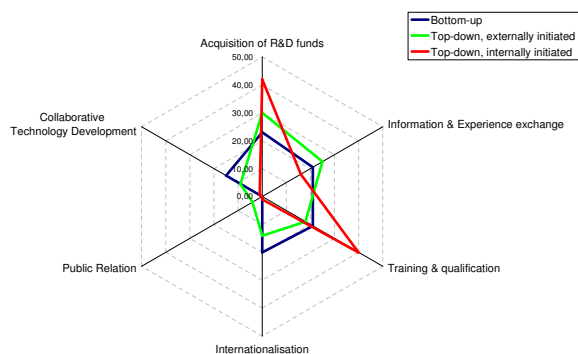

Figure 16: Main current tasks of the clusters according to their category of emergence (cluster managers were allowed to vote for the two most relevant tasks, figures in percentage)
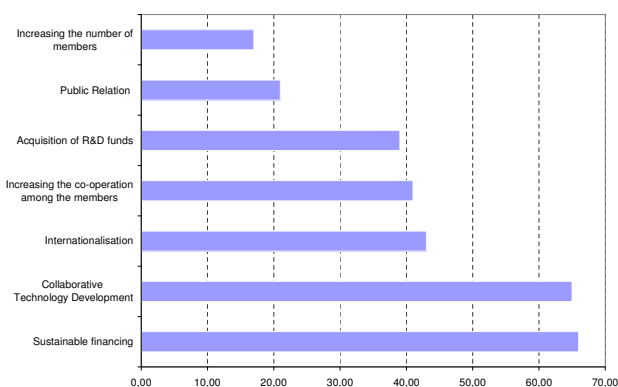

Figure 17: Relative importance of future challenges by cluster managers point of view (up to two options per clusters allowed, figures given in percentage)

Again, clusters with a similar type of emergence tend to face similar priorities concerning future challenges, as can be seen in Figure 18. Top-down internally initiated clusters mainly consider "sustainable financing" as well as "acquisition of R&D funds" to be main challenges, whereas bottom-up clusters see the main challenges in increasing the co-operation among the members, the strengthening of collaborative technology development as well as internationalisation issues as main challenge. Financing issues seem not to be of high priority for those clusters. Likely because of the fact these clusters already gained fee-based financing. Top-down externally initiated clusters also consider "collaborative technology development" and "sustainable financing" as the main future challenges.

In the previous chapter, we discussed the issue of sustainable financing and the potential impact on the cluster development. We investigated a potential tendency between the skills and experiences of cluster management and the financial situation of the clusters organisation. Our suggestion is that the financial situation of a cluster, especially when it does not receive sufficient public funding

and it depends on fee-based membership, may also depend on the performance and capability of clusters management itself. Cluster organisations which are able to offer added values and demand-oriented services that are of worth for the members, may easier receive sustainable fee-based financing than those not being able to provide appropriate services.

Based on the finding revealed in Figure 19, cluster managers working for cluster organisations with assured financing more often have experiences as professional networker (with or without additional experiences in the corresponding technical area the cluster is operating in). In those clusters, which are suffering sustainable financing, more often cluster managers having good technical experiences are employed, but not so much as professional networkers. We are aware that the results presented in Figure 19 are forcing us to treat them with caution, since there may be other rationales in behind. But the findings are in line with investigations which were done by experts of ZENIT some years before.[13]
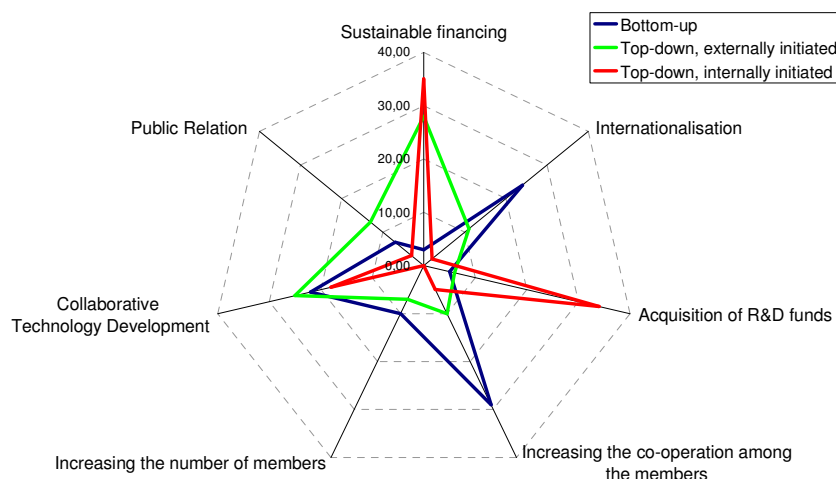

Figure 18: Future challenges of the clusters according to their category of emergence (clusters managers were allowed to vote for the two most relevant challenges; figures in percentage)

[13] Iking, 2004, Erfolgreiche Netzwerkarbeit - Vorbedingungen und Erfolgsfaktoren-, published by ZENIT GmbH (in German only).
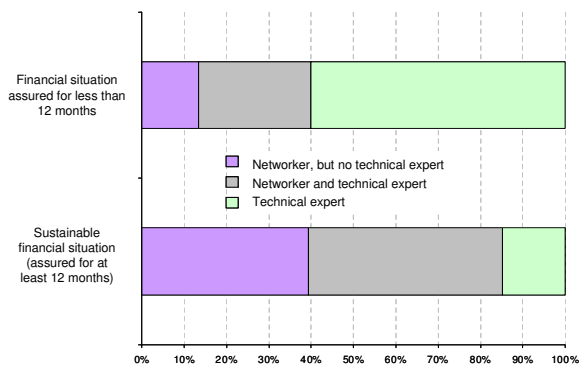
Figure 19: Skills and experiences of cluster managers of clusters with sustainable as well as without sustainable financing

4.4 Clusters performance

In this chapter we are dealing with one of the main question: does any of this three parameters (kind of emergence, financing and management) may have any significant impact on the output performance of the clusters themselves. If so, how strong is it? For policy makers and clusters practitioners this would be of considerable interest to better understand, why certain clusters developed better than others and how a cluster can perfectly be designed from the very beginning, in order to maximise the microeconomic impact afterwards.

Cluster performance can be measured both in terms of outputs, as well as economic outcomes. Cluster-specific outputs can include things like reduced costs (from labour-pooling or technology-sharing) and innovation (from knowledge-sharing and networking). Cluster-specific outcomes include general economic measures such as employment, wages and exports. Outcome measures illustrate the cluster's impact on the regional or national economy.

In our approach we concentrated on the cluster out-put performance and rated our clusters according to four different categories (very good, good, acceptable and some weaknesses), depending on the degree the membership criteria of the Initiative Kompetenznetze Deutschland were fulfilled as well as on other output related indicators, like quality and intensity of clusters management, collaborative projects initiated within the cluster, the reputation of a cluster in the region or within the scientific community.

All the analysed clusters fulfil the mandatory membership criteria, but it is quite obvious that the respective criteria can be fulfilled to a different extent which becomes visible when using benchmarking indicators (s. Figure 20).
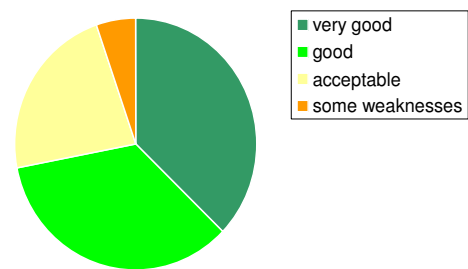

Figure 20: Assessment of the overall performance of the analysed clusters

Most clusters can be assessed to have shown a very good or good output performance over the past (almost three quarter). About 20 % have shown an acceptable performance, but did not perform as well as clusters of the two other categories. Only few clusters have shown some weaknesses in the past.

In the previous chapters we have seen that the type of clusters emergence seems to have an impact on the legal constitution, internationalisation, financing, etc. Taking these aspects into consideration, it could be assumed that the type of clusters emergence may also have some impact on the overall clusters performance. This assumption is confirmed by Figure 21, where we separated the cluster performance according to the type of cluster emergence.

Slightly over 75 % of all bottom-up and top-down externally initiated clusters reveal a very good or good performance, whereas the share of clusters rated with "very good" is much higher for bottom-up clusters. Top-down internally initiated clusters show a complete different picture. Most of them have shown an acceptable performance and more than 25 % have shown some weaknesses in the past. Only about 10 % can be rated with "good".

In a next step, we looked whether the sustainability of financing performance have an input on the output performance of clusters. According to Figure 22, clusters having a very sustainable or at least sustainable financing

show a much better overall performance than those without any sustainable financing. More than 80 % of the clusters revealed a very good or good performance when the financing of the clusters management is at least sustainable (which means assured for at least 12 months). If critical or only assured on short-term (less than 12 months), less than

50 % showed good, none a very good performance. In those cases when financing is considered to be very critical, the distribution of the four performance categories is even worse. Thus, a relationship between the clusters' performance and financial situation is traceable, whereas the reasons are not fully clear and need further investigations.
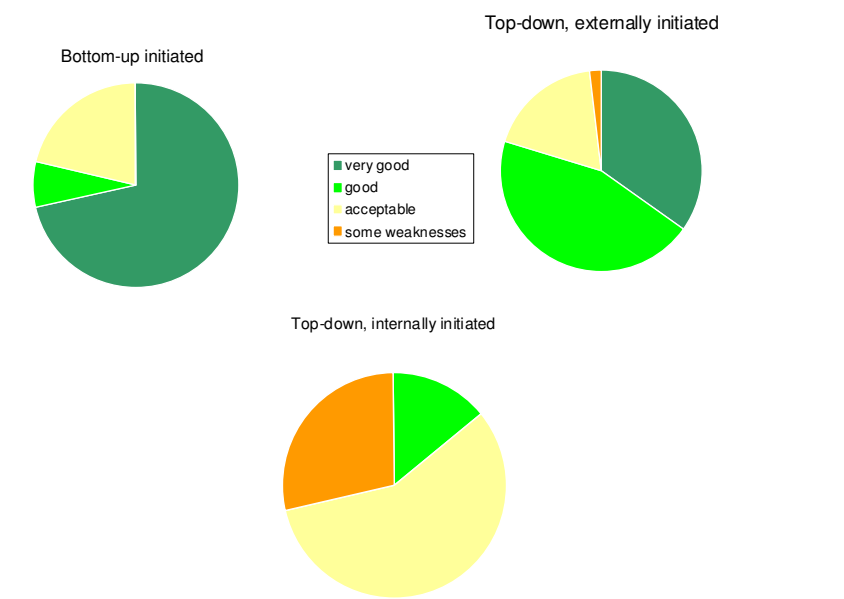

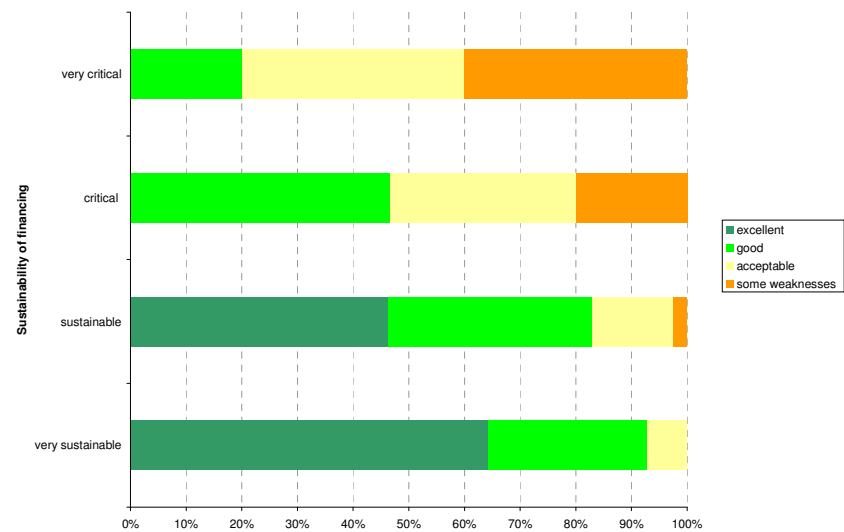Figure 21: Cluster performance according to the type of cluster

Figure 22: Distribution of the output performance of clusters according to the financial situation of the clusters management

5. Conclusion

This paper represents work in progress and its findings are preliminary results. While we have assembled a considerable sample of clusters, many variables and their relationship are not finally evaluated. Further investigations together with the Freie Universität Berlin (FU Berlin) are ongoing, and very likely to be published in beginning of the year 2009.

In the following the most relevant findings of the empiric analysis will be summarized and discussed. It is important to note that these findings are based on a cluster portfolio analysis with regard to 75 most innovative clusters. It is quite clear that these findings are mainly valid for the clusters we have analysed, but we are convinced that some of the relationship and interdependencies are principally transferable to others as well.

Germany's clusters very much vary in terms of size, age, financing etc.

The 75 German clusters we have analysed differ very much in terms of structural data or indicators as mentioned in Table 1. This is indeed no surprise, but the minima and maxima values partly appear to be quite interesting. The membership structure of the clusters (SME, R&D institution, global player, financial institutions, etc.) also differ very much, mainly according to the innovation field the clusters are active in. ICT clusters reveal the highest share, the SME-members the average, whereas in Mobility clusters reveal the lowest one. The biggest share of R&D institutions can be found in Micro / Nano / Opto clusters, the smallest ones in Mobility clusters.

Top-down, externally initiated clusters are the prevailing type of cluster emergence in Germany.

We identified three different main types of clusters emergence as described in chapter 4.2. It should be noted that a mixture of two types is also common in some cases, but in those cases one out the these categories is prevailing. Nevertheless, the dominating type of emergence in Germany are clusters which are top-down, externally initiated. These clusters were often set up in the framework of cluster initiatives on federal state as well as on federal level as mentioned in Figure 2. These different cluster initiatives have shaped a specific cluster landscape in Germany.

Many federal and federal state cluster initiatives, which were realised in the recent past, led to the setting up of many excellent top-down, externally initiated clusters. The fact that around three quarter of Germany's most innovative clusters are originally politically initiated, shows that this kind of cluster emergence, stimulated on federal as well as on federal state level, is in many cases a promising approach. Nevertheless, it is worth to notice that almost one quarter of the most innovative clusters in Germany were initiated outside of funded clusters initiatives, called bottom-up clusters. This shows that there are many excellent examples that clusters can be set-up by the interested community itself without any political influence or funding.

Bottom-up and top-down externally initiated clusters tend to chose a legal constitution for the clusters, mostly association (s. Figure 5). Discussions with cluster managers revealed that cluster members who are strongly committed to a cluster, tend to select an association as a legal cluster constitution, which is beneficiary for their work and rules the tasks and duties of all the members. On the contrary, top-down internally initiated clusters often do not chose a certain legal constitution which we understand as a lack commitment of all partners involved, since in many cases there is also no formal membership and commitment mandatory.

Bottom-up clusters tend to be more internationalised than others.

We found out that bottom-up clusters tend to be more internationalised on average than other top-down clusters. Such analyses were done specifically for certain innovation fields since we also found out in previous investigations that the innovation field the clusters operate in may have a certain impact on the level of internationalisation of the clusters. Fig. 6a and 6b show that bottom-up clusters are clearly more internationalised than top-down clusters. The rationale for this finding might be, that in bottom-up clusters firms which are very much interested in internationalisation rather than other types of members, are dominating. Thus, the cluster management puts dedicated efforts in internationalisation activities for the benefits of the industrial members. Such services are considered to be an added value the industrial members are willing to pay membership fees for. This often results in the fact that such

types of clusters are more internationalised than others. These findings are very much in line with the fact that internationalisation of the members is one of the top four priorities bottom-up clusters have defined for their current work.

Federal state based funding of clusters last longer than federal funding.

We spend a lot of attention to the issue of funding of cluster organisations, which are in charge of managing the clusters. Figures 7a and 7b clearly show that public funding of clusters based on federal funds is faster reduced than in case of federal state funding. We found out that the public funding rate of those clusters which receive a share of federal state funding of at least 50 % is extremely high when they emerged, and was only slightly lower in 2007. As far as clusters are concerned, financed to at least 50 % by federal funds, the funding rate went significantly down over the years. Clusters funded by federal funds mostly substituted the reduced amount of public funds by acquiring private, fee-based funds. Top-down internally initiated clusters depend mainly on public money, whereas bottom-up clusters was a real lower share of public funding (s. Figure 8).

Sustainable financing seems to have a significant impact on the development and performance of a cluster.

Regardless whether the financial budgets of a cluster are public, private or a mixture of both, the issue of sustainable financing is of high priority for the most cluster managers. Although most of the clusters were the result of any clusters initiative and therefore mainly publicly funded when emerged, the clear majority reported of having gained a sustainable financing which means, according to our categories, that the financing is assured for at least 12 months. Not only most of the bottom-up clusters reported that, but also most of the top-down initiated ones told us that their financing is currently assured.

In the cases where sustainable financing was not assured in the past nor it is nowadays, we found out that the growth in terms of size so far, as well as the growth perspectives, are considerably lower than for those gaining a sustainable

financing (s. Figures 11 – 12). Even more, we found out that clusters tend to perform much better when they have a good financial situation compared to those suffering from financial problems (Figure 22). As a consequence, financial issues rank top under future challenges by the clusters managers' point of view, especially for top-down initiated ones (s. Figure 18).

The five main future challenges

When asking the cluster managers about the main future challenges of the clusters and their work, they named five main challenges. Sustainable financing ranked top under the five most named challenges (s. Figure 17), mainly named by top-down clusters. Intensifying the joint collaborative technology development (also interdisciplinary co-operations) just followed. Internationalisation of the clusters and their members, increasing the co-operation among the members as well as the acquisition of additional public R&D funds were ranked of high importance, too.

It is interesting to notice that clusters with a similar type of emergence tend to identify challenges with similar priorities. As far as bottom-up clusters are concerned, their managers mainly consider the increase of mutual co-operation among the members, internationalisation issues as well as collaborative technology development (also interdisciplinary co-operations) to be the main challenge. The latter ones are also one of the two main concerns for top-down externally initiated clusters, the other one is sustainable financing of the clusters work in the future. Sustainable financing is also considered to be a challenge for top-down internally initiated clusters, whereas they will also concentrate to acquire sufficient public R&D funds (Figure 18).

The type of clusters emergence as well as the sustainability of financing of the clusters tend to have an impact on the output performance of clusters.

Although the analysed clusters are all member of the Initiative Kompetenznetze Deutschland and therefore they can be considered to be the most competitive ones in Germany, there are some clusters, which show a better output performance than others (see our performance categories in chapter 4.5). It is interesting to notice that the

output performance also differs according to the types of clusters emergence (Figure 21) as well as the sustainability of financing (Figure 22). Bottom-up as well as top-down externally initiated clusters tend to perform much better than top-down internally initiated ones. Clusters which have assured a sustainable financing of at least 12 months, show a much better performance than those facing financial issues.

Appendix

Categories of Clusters' Internationalisation

In this appendix an approach for possible categories describing a cluster's internationalisation is presented. These categories are meant as basic distinction revealing the differences concerning the level of internationalisation clusters have achieved. There is no direct link between the categories and the clusters interviewed in the study.

7 Obviously internationally acting cluster: both the cluster itself as well as its members demonstrably act successful on an international level. The cluster is recognized as such acting primarily international. Also foreign partners are members of the cluster. A large number of examples for successful international co-operations exists resulting in improved innovative dynamic, a strengthened market position and improved financial figures of the cluster and its members.

6 Intense cross linking / partnership with one or more foreign clusters. A lot of measures and activities both on behalf of the management and of most of the cluster's members point out the international orientation of the cluster. A large number of examples for successful international co-operations exist resulting in improved innovative dynamic, a strengthened market position and the financial figures of the cluster and its members.

5 Active, regular and intense participation of the cluster and its members in European projects and other events, partially also initiated by the cluster itself. The cluster is internationally present and accepted by likewise foreign partners. There is a basic strategy / implementation plan.

Members and management can report on first successes in international co-operations. Still, there is potential to adjust to a more international orientation.

4 Punctual co-operations with international partners exist (cluster manager, institution or company), but are unspecific and rather sporadic. Single members are already internationally active and linked, but the cluster itself is not recognized as acting internationally. In spite of first successes there is still a high potential for further internationalisation that is yet to be implemented in specific strategic measures.

3 First participation in and / or organisation of international events by the cluster's management are visible. The management and most companies have the intention to internationalise, but there are no strategies or concrete options for action. The topic internationalisation does play a minor role to date, even if singular companies have advanced more in internationalising their focus.

2 No international activities by the cluster's management are visible, but are basically intended. Concrete measures or plans do not exist, because other priorities prevail. Independent thereof, cluster's members might have eventual international contacts.

1 No international activities by the cluster's management are visible or intended. There are no ideas, no concrete measures or other plans. Independent thereof, cluster's members might have eventual international contacts.