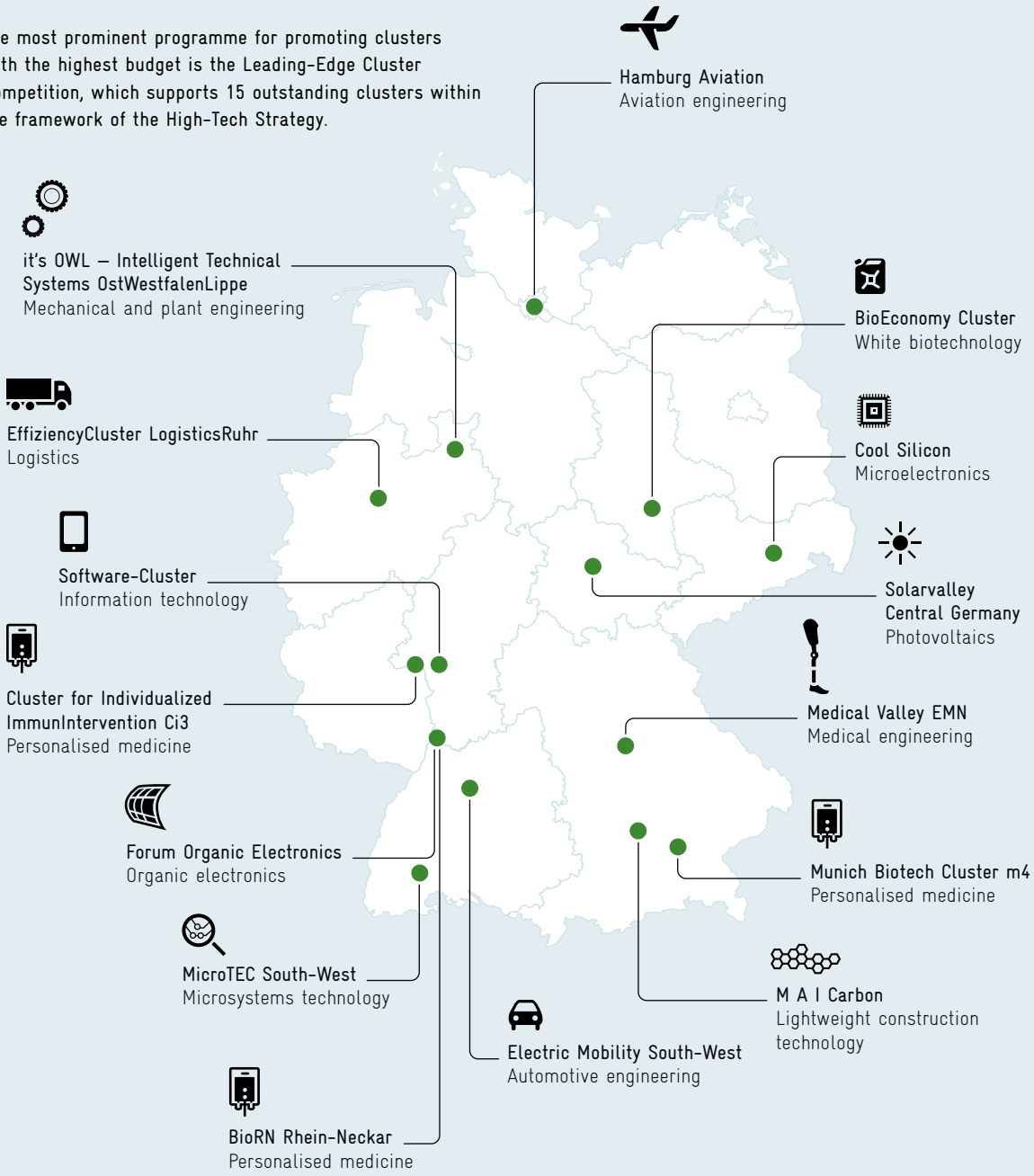
Promoting innovation through cluster policy

Cluster policies aim to connect geographically close actors such as businesses, tertiary education institutions, and public and private research institutions in order to generate and disseminate knowledge and thus increase a region's innovative capacity.

Germany's leading-edge clusters

The most prominent programme for promoting clusters with the highest budget is the Leading-Edge Cluster Competition, which supports 15 outstanding clusters within the framework of the High-Tech Strategy.

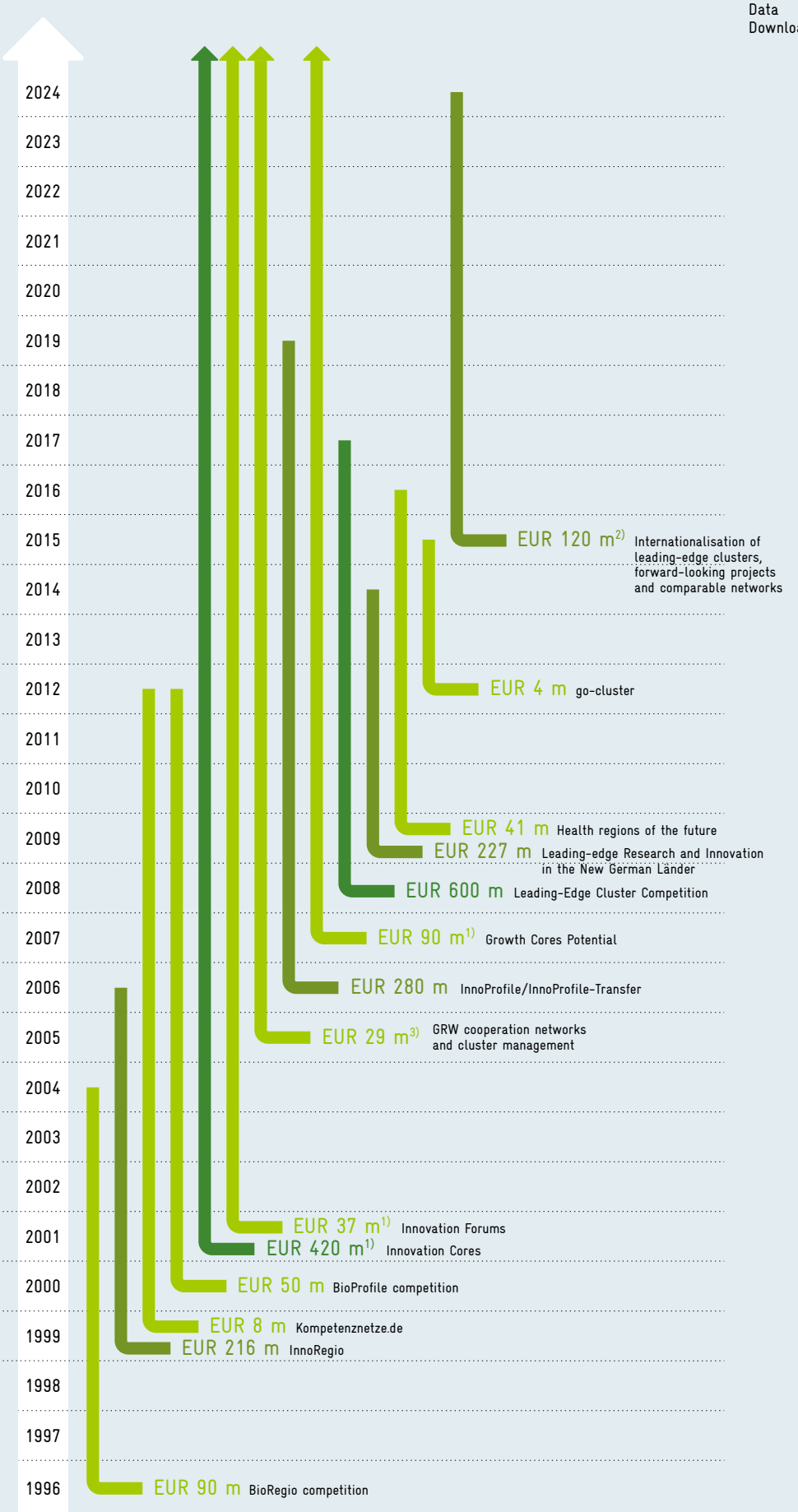


Source: Own depiction based on BMBF (2012).

Data Download

Overview of the Federal Government's cluster-policy measures

Numerous programmes to promote clusters have been carried out over the last 20 years.



1) Projection up to 2019. 2) Projection up to 2024. 3) BMWi's share; approvals until the end of 2014.
Source: Own depiction based on written information from BMBF and BMWi.

B 1 Promoting innovation through cluster policy

B 1-1 Wide use of cluster policy

Numerous cluster initiatives have been launched in Germany at both federal and state levels during the last 20 years. Clusters can be defined as "geographic concentrations of interconnected companies and institutions in a particular field."[95] This understanding of clusters highlights the importance of geographical proximity and local systems of cooperation, competition and knowledge diffusion for the genesis of innovation.

Important cluster programmes at the federal level with a focus on innovation include the Leading-Edge Cluster Competition and the Entrepreneurial Regions initiative (cf. Box 3).[96] Furthermore, all the 16 German Länder have launched cluster initiatives across all technology sectors.[97]

Parallel to this policy development in Germany, a wave of cluster policies has swept across the rest of Europe (and elsewhere), imposing a certain public intervention model in favour of the constitution of technological clusters, inspired by the works of Michael Porter[98] and the success stories from Silicon Valley.

In general, the aim of cluster policies is twofold: first, to encourage the spatial agglomeration of firms and other organisations belonging to a particular sectoral or technological field; and second, to support cooperation among firms that are spatially or technologically close in order to generate positive network effects. The European Cluster Observatory has identified more than 2,000 regional clusters which are supported by some kind of policy.[99] However, under the heading "cluster policy", one can see a great variety of policies, ranging from intervention from governments to develop a particular science or technology field in a specific region to more generic support of entrepreneurship and innovation at the regional or local level. Moreover, the term cluster has also been applied to networks spanning several regions. This great diversity of policy in terms of goals, design and implementation makes it difficult to compare and assess the effectiveness of these different policy measures.

In this chapter, the Commission of Experts first reviews the rationale of cluster policies as an innovation driver and then discusses two important cluster policies undertaken in Germany.

Box 03

Current cluster programmes at the federal level

The "Leading-Edge Cluster Competition – More Innovation. More Growth" (Leading-Edge Cluster Competition) was launched by the Federal Ministry of Education and Research in 2007 as part of the High-Tech Strategy. It addressed high-performance clusters formed by both business and science. Three rounds of competition were held, and in each round up to EUR 200 million was made available to five leading-edge clusters to fund R&D projects and the activities of the cluster management. Funding for the third round ends in 2017.

"Entrepreneurial Regions – The BMBF Innovation Initiative for the New German Länder" (Entrepreneurial Regions) was launched in 2001 with the programme Innovative Regional Growth Cores. So far, EUR 827 million has been spent or budgeted for cluster-oriented measures of the Entrepreneurial Regions initiativ.[100] The initiative promotes the creation and expansion of special technological, scientific and economic competencies in East German regions to generate positive effects for innovation, economic growth and employment.

B 1-2 Spatial concentration of innovation

Reasons for spatial concentration

Innovation is more geographically concentrated than most other economic activities, e.g. production. This has been a key result from seminal works in innovation geography.[101]

The tendency towards spatial concentration is due to two essential factors:

First, the resources required to produce innovation are typically not confined to the boundaries of a single firm. Firms frequently contract for external resources. While this can be done at great distance, spatial proximity can generate opportunities for observation, interaction and mutual learning. Moreover, agglomeration strengthens factor markets for labour or specialised services. This process allows for the local development of a rich innovation ecosystem, capable of providing the resources that are needed by innovators.[102] These include well-trained skilled workers, infrastructures for basic and applied research, and specialised technical, legal and financial services. Second, spatial proximity enhances knowledge and information spillovers through lower communication costs and a greater likelihood of chance meetings (serendipity). At the same time, the likelihood of social relationships increases, e.g. between suppliers, buyers and lead users. The importance of positive local knowledge externalities for innovation are widely observed and measured in the empirical literature.[103] These factors are particularly important when the considered firms are part of the same or related and interconnected industries.[104]

Spatial concentration as a dynamic process

The cluster framework is based on the idea that economic performance is the result not only of an individual firm's efforts, but also of a series of factors external to the firm. The spatial concentration of innovation is a dynamic process which exhibits increasing returns.[105] The net benefits to being in a location together with other firms increase with the number of firms in the location. These agglomeration effects provide the rationale for a policy aiming at reaching the "tipping point"; i.e. the size of a cluster above which increasing returns cause a self-reinforcing growth of the cluster.[106]

Spatial proximity not sufficient for the development of clusters

Physical proximity among firms alone does not suffice to characterise a cluster. Beyond concentration of similarly specialised firms, other characteristics of a region are important:

- Anchor tenant:[107] A large R&D-intensive company specialised in a given field that creates externalities in the local system. It makes the whole system more innovative, enhances local university research, thickens factor markets, and absorbs research results by universities and smaller firms.
- Universities and public research institutions:[108] They provide skilled labour and innovative ideas. Especially in knowledge-intensive industries, the presence of a strong university or public research institution represents a key asset for a cluster belonging to the same region. It is an instrumental institution that advances knowledge, trains skilled graduates, increases the capacity for problem solving, and spurs the creation of new firms.
- Institutional diversity:[109] This enhances interdisciplinary learning processes and entrepreneurship. For example, scientists in a cluster can acquire management skills if co-located research institutions, business companies, banks and business schools collaborate.
- Openness:[110] An open attitude towards foreign skilled workers or companies is an important aspect of clusters. Agents from other regions are often more effective than local agents when introducing disruptive innovations.
- Firm-size diversity:[111] Start-ups, SMEs and large established enterprises provide different kinds of innovation externalities, which – if recombined within the region – contribute to the genesis and development of a cluster.
- Relational density:[112] Frequent communication and the establishment of as many relations as possible between the agents in a cluster increase the potential availability of information and resources. Thus the possibilities for generating and recombining ideas increase.

The studies mentioned in Box 4 document the economic effects of agglomeration and spatial concentration when these phenomena occur naturally, i.e. without policy intervention. They do not allow an assessment of cluster-policy measures. The effect of cluster policies will be discussed in the following.

Box 04

Empirical evidence for the effect of clusters on firm productivity, innovation and industry dynamics

Clusters matter a lot for firm productivity.[113] A recent study has found that the relocation of a plant from an area with no other plant in the same industry to an area with around 1,000 employees of the same industry (excluding the plant itself) will generate significant gains in total factor productivity (TFP). Furthermore, a doubling of employment in neighbouring firms of the same industry increases TFP by 5–6 percent.[114] This confirms results of earlier studies that found that a doubling of employment in a region increases labour productivity by 4.5 percent.[115] Evidence is even stronger in studies focusing on young firms.[116] A possible explanation is that young, and still small, firms may profit more from co-location than large, established firms as a means of accessing complementary capabilities they do not have in-house. Moreover, a number of studies show that co-location with firms active in related industries is beneficial for firms in the same region.

A recent study analysing the relationship between clusters and industrial dynamics, found that clusters promote firm entry.[117] Entry rates also increase with cluster size. Moreover, the current phase in the industry or product life cycles plays an important role for the relationship between a firm's performance and its localisation. Firms in emerging innovative industries profit most from being located in large diversified cities, while firms in mature routinized industries profit more from being in a cluster, typically in smaller specialised cities.

The effects of agglomerations on inventions, entrepreneurship and innovation have been clearly described in the meantime, although the underlying mechanisms have not yet been fully explored. Agglomeration effects can be studied relatively well with the help of patent data. Patent activities develop especially quickly in agglomerations.[118] These results can be considered as confirmation of the theoretical model of agglomeration development.[119] Furthermore, it can be proved that entrepreneurial activities are stronger in agglomerations than in less spatially concentrated regions. A recent survey of innovation activities by 1,300 SMEs in the UK finds that SMEs in local economies with a high proportion of creative industries develop completely new products and processes significantly more frequently than SMEs in other regions.[120] There is also empirical proof that new start-ups in the high-tech sector are particularly common in clusters.[121]

B 1-3 Rationale and effects of cluster policies

Economic rationale for cluster policies

Based on the premise that a cluster can provide a platform to organise resources and relationships for innovative activities,[122] a cluster policy aims to correct market and coordination failures that are likely to impede the formation of a cluster and its early growth. Market failure can take the following forms in this context: i) increasing returns lead to a tipping point, above which the process of agglomeration is likely to be self-reinforcing and which cannot be reached without policy intervention; ii) coordination and collective-action problems among complementary private investments and services; iii) the lack of industry-specific public goods, e.g. skills, basic research, test facilities or marketing infrastructure, that may require specific institutions and public co-funding.

A further reason for cluster intervention can occur at a later stage if clusters suffer from over-specialisation and lock-in. Such effects are likely to narrow down the range of options for the future development of the firms and the cluster as a whole and can generate collective inertia.

From an economics view, one can make a strong case for policy intervention during the emergence and early growth phases of a cluster. By the time a cluster already exists and has reached maturity stage, the argument for subsidies or other interventions are considerably reduced. There is again an economic rationale for policy interventions during the final phase of a cluster's life cycle, during which a renewal process can be supported.

Fixing market failure at reasonable cost

The fact that market failures are identified does not suffice to justify a policy intervention. It has to be possible to fix the market failure at reasonable costs. The choice of appropriate policy tools requires a detailed technical grasp of the externalities and complementarities of the innovation system. Economists have emphasised that the informational requirements at a practical level limit the scope for government policy to correct coordination problems at reasonable cost.[123]

Effect of cluster policies

The number of academic works devoted to the evaluation of cluster policy is very limited,[124] and only few studies apply modern techniques of evaluation. The many measurement problems make it very difficult to undertake evaluations that are rigorous enough to satisfy academic standards.[125] The few methodologically convincing studies deal with Japanese, German and French cluster initiatives respectively.[126] All these studies find a positive, but rather small impact on regional patenting activities.

An evaluation of the French cluster initiative from 1999, which employs modern econometric methods (difference-in-difference estimation), finds a small and temporary effect on total factor productivity (TFP) growth.[127] Yet in general, the French cluster initiative did not succeed in reversing the targeted firms' relative decline in productivity. No effect on employment or exports was found. A few other studies focus on the cooperation and networking effects of a cluster policy. In particular, one study on the German Leading-Edge Cluster Competition shows positive and significant cooperation effects – the study is presented below. Very little is known about the long-term effects of cluster policies on innovation. Time lags in realising effects are lengthy and can vary significantly between different fields and programmes. So far, none of the studies has found evidence of significant long-term effects.[128]

Huge variability of policy approaches

There are many ways to help the formation or growth of a cluster, and the specific policy measures vary considerably. There are two policy approaches at the extremes of a continuum of policies: top-down and bottom-up.

The top-down approach is used by national, regional or local governments that aim at promoting the growth of designated fields within a specific location. This approach raises the well-known issues of government failures, policy capture and picking winners by politicians. The bottom-up approach, by contrast, relies more on self-organisation and local entrepreneurial initiatives and limits policy interventions to identifying and correcting a few market failures that are likely to impede market dynamics towards cluster formation and growth.

Cluster policies are implemented in different industries, different time and life-cycle circumstances, and different socioeconomic and development contexts.[129] This huge heterogeneity may explain why the literature is inconclusive regarding the effect of cluster policy. It is very difficult to know whether a non-positive evaluation merely reflects the inaccuracy of the policy in this particular case or manifests a more general flaw of cluster policy as an instrument of innovation policy.

Cluster policy in Germany: selected measures and their assessment B 1-4

The forces underlying the emergence of an industrial cluster differ from those needed to ensure its continued growth.[130] This distinction between the emergence and growth of a cluster provides a useful framework for discussing two policies designed and implemented in Germany. The initiative "Entrepreneurial Regions – The BMBF Innovation Initiative for the New German Länder" (Entrepreneurial Regions), which addresses the problems of cluster emergence, and the Leading-Edge Cluster Competition, which addresses the problems of improving and developing existing clusters.

Entrepreneurial Regions

The Federal Ministry of Education and Research (BMBF) launched the Entrepreneurial Regions initiative to promote the creation and expansion of special technological, scientific and economic competencies in East German regions. The initiative succeeded the InnoRegio programme for the New Länder, which had been in place from 1999 to 2006. Within the scope of this initiative, the BMBF has developed several programmes that address different aspects of regional innovation systems; they are described in Box 5.

Box 05

Programmes included in the Entrepreneurial Regions initiative [131]

Entrepreneurial Regions was launched in 2001 by the Innovative Regional Growth Cores programme (since 2007 supplemented by the Growth Cores Potential programme). Until 2019, the programme has a budget of EUR 420 million for the Innovative Regional Growth Cores and EUR 90 million for the Growth Cores Potential. The programmes support alliances of firms, universities and research institutions that have a common technology platform or the potential to develop one. During the three-year support phase, funding is provided for research projects, training measures and innovation consulting for SMEs and entrepreneurs.

The Innovation Forums programme was initiated in 2001 and has a planned budget of EUR 37 million until 2019. It targets regional alliances between the business sector and scientific and research institutions in the early stages of development. The alliances are supported over a six-month period with the aim of triggering an ignition spark. The core of the programme is an innovation forum. This two-day event provides a basis for promoting knowledge transfer, establishing contacts and determining the position of the alliance in the competitive landscape.

In 2002, the Centres for Innovation Competence programme was launched with a budget of EUR 266 million until 2017. The purpose of this programme is to establish interdisciplinary centres of excellence at universities and research institutes. In these centres, young researchers from Germany and abroad work together with a focus on making commercial use of their results in the medium to long term.

The InnoProfile programme is also directed towards young scientists. Yet, the focus here is on cooperation between a region's young scientists and regional businesses. Since the programme began in 2006, a total of 42 initiatives has been selected for support. With InnoProfile-Transfer, which was introduced in 2010 and has supported 45 initiatives to date, the focus shifted to technology transfer. Overall, the programme has a budget of EUR 280 million until 2019.

Launched in 2007 with a budget of EUR 59 million until 2013, For-MaT – Research for the Market in Teams, aimed at expediting the availability of public research results for businesses. To achieve this, the programme supports interdisciplinary cooperation between science and technology departments and economics or business departments. Partners from the different departments are then encouraged to jointly develop concepts for exploitation and marketing and put them into practice.

In 2012, the new programme Twenty20 – Partnership for Innovation was launched to support national and interdisciplinary cooperation projects. It aims to expand economic and scientific competencies in the New German Länder and create novel innovation structures through new forms of networking and transparent network management. It has a budget of up to EUR 500 million until 2019.

The amounts of public funds earmarked for the programmes described in Box 5 are considerable. As in previous reports, the Commission of Experts therefore underlines its call for systematic evaluations that are planned at an early stage: evaluation processes must always be already considered and planned when new measures are being designed. It is crucial to already collect the data required for evaluation while the measure is being implemented.

Significance of the Entrepreneurial Regions initiative

For almost two decades, this policy and its predecessor programme have addressed the innovation deficit in the new German Länder. Entrepreneurial Regions tries to grasp factors that are central to the genesis and early phase of successful clusters (entrepreneurial projects, fast-growing firms, subsequent spinoffs), as well as to increase the cohesion and coherence of value chains at the regional level. The main policy question, therefore, is how to increase the level and rate of entrepreneurial initiatives and development.

The various programme components of the Entrepreneurial Regions initiative aim to improve framework conditions for entrepreneurship and knowledge transfers between universities and the business sector.

A historical shift in focus can be observed from the initial programme to the subsequent ones: the Innovative Regional Growth Cores programme (launched in 2001) clearly focused on building or improving complete and coherent industrial ecosystems associated with one particular industry. By contrast, the subsequent programmes focus on promoting functional instruments or structures, such as forums or structures for accelerating technology transfer.

Evaluations of the precursor programme of the Entrepreneurial Regions initiative, InnoRegio, and the programmes InnoProfile and Innovation Forums suggest that they had positive effects on several different targets in the supported firms e.g. network development, R&D results and the development of employment.[132] In the course of these evaluations, interviews were conducted in the supported companies and – in the case of InnoRegio – also in companies that were not supported. However, the Commission of Experts points out that, in addition, a careful evaluation of the medium- and long-term effects of the various programmes using control-group analysis is necessary in order to gather well-founded knowledge to aid the future design of innovation policy.

The Leading-Edge Cluster Competition

The Leading-Edge Cluster Competition was launched by the Federal Ministry of Education and Research in 2007 as part of the High-Tech Strategy. It addressed high-performance clusters formed by business and science. Three rounds of competition have been held based on a two-stage selection process, and in each round five clusters were chosen to become a Leading-Edge Cluster. In each round up to EUR 200 million was made available to five Leading-Edge Clusters (EUR 40 million per cluster) to fund R&D projects and the activities of the cluster management to support young talents and training measures. Firms that receive funding within the framework of the Leading-Edge Cluster Competition are required to match the funding sum with at least the same amount.

After the call for proposals, the applicants had three months to submit project outlines describing the goals, members and projects of the clusters. Based on these outlines, an independent jury selected the finalists, who were given another three months to develop a more detailed strategy for their clusters and the opportunity to present their strategy to the jury. Finally, the jury chose five Leading-Edge Clusters in each round. The central criteria of the Leading-Edge Cluster Competition were as follows: a high level of technical expertise; a critical mass of internationally operating enterprises and renowned research institutes in the cluster's technology field; the position in the international market and competition; the research dynamic; the potential for increasing competitiveness; and the focus of the profile. Unsuccessful applicants were allowed to re-apply for the next round, a possibility that was used frequently.

The 15 selected clusters cover a wide range of different technology fields (from aeronautics to software, renewable energies and biomedical products).

Assessment of the Leading-Edge Cluster Competition

A first economic evaluation was produced in 2014,[133] which allowed an assessment of the short- and medium-term effects of the Leading-Edge Cluster Competition. The policy does not focus on the initiation or early phase of a cluster dynamic. All the winning applicants that have been awarded the title Leading-Edge Cluster are existing clusters which already exhibited strong characteristics of spatial agglomeration – of similar and complementary organisations and performances – prior to receiving support. All the winning clusters already included large and small companies, universities and public research organisations that showed quite a high relational density. This means that the goal of the policy was not to support a process of cluster formation, but rather to improve existing clusters both quantitatively (in terms of their size) and qualitatively (in terms of cooperation, science-industry linkages, internal markets for specialised resources and cluster-management capabilities).

Two aspects of the Leading-Edge Cluster Competition will be discussed here: first, the policy's effects on the agents in the respective regions, and, second, the effect of the organisation of the policy as a competition.

Policy effects on the development and performance of clusters

The recent evaluation of the programme documented several important effects.[134] There were positive effects on the provision of resources for innovation that all firms in the cluster could draw on. In most cases, the selected clusters improved significantly both the quantity and the quality of supply in terms of human capital, resulting in a thickening of labour markets for specialised and high skilled workers and in the development of new training institutions. Moreover, the selected clusters improved relational density – between firms in general, but especially between small and large firms and, finally, between public research and industries. For instance, an analysis on the impact of the Leading-Edge Cluster Competition on the formation of innovation networks showed a significant effect on the network structure in terms of density, centralisation and geographical reach. On average, more than half of the existing linkages were either initiated or intensified by the cluster policy, leading to an increased density of the network.[135] According to firm representatives, the cluster policy also offered opportunities to SMEs to connect with large companies.[136] However, in several cases the cluster policy resulted in too strong a shift in focus towards local networking.[137] Since it has been shown that extra-regional partners are likely to play a central role in generating radical innovation within a regional cluster,[138] an excessive focus on the regional network may be detrimental. Finally, the evaluation showed that the selected clusters have become more attractive to researchers and companies from outside the region.[139]

The evidence on the effects of the Leading-Edge Cluster-Competition on R&D and innovation is mixed. In a few cases, the R&D intensity of the companies in the clusters is much higher than R&D intensity in similar companies not located in one of the clusters. However, in most cases the R&D intensity of companies in the clusters is not significantly higher. The effects on product and process innovations are slightly positive with the exception of two clusters. In addition, 36 spin-offs were created during the first and second round – but only two of these were attributable to companies, while the others spun off from universities or research institutes.

Effect of the organisation of the policy as a competition

When designing the Leading-Edge Cluster Competition, the BMBF decided in favour of a competitive organisational form. Although the tightly organised competition procedure only produced a small number of winners, the losers in one competition round were given a chance to re-apply for the next round. Such a mechanism allows a rigorous selection process, while at the same time also motivating the applicants who do not win to improve their application and even implement parts of the project without support. The Leading-Edge Cluster Competition thus had a mobilising effect. The design of the Leading-Edge Cluster Competition proved to be effective in this respect.[140]

Cluster policy in Germany and the EU's Smart Specialisation Policy

These different policies[141] together with their own cluster policies have enabled the German Länder to gain experience with regional innovation strategies. They have also taken the opportunity to design and implement innovation policies at the regional level. This may explain, why German regions – in contrast to regions in other EU member states – have not experienced the new EU policy approach of smart specialisation as a major cultural change in their policy practices.[142]

Recommendations B 1-5

At present, the long-term innovation effects of federal cluster policy cannot yet be estimated. However, the accompanying evaluation of the Leading-Edge Cluster Competition suggests that the support measures have had a positive impact in some of the regions supported: e.g. greater availability of skilled workers, a higher network density and size, and greater cooperation between SMEs and large companies. Against this background, the Commission of Experts recommends the following:

- As the organisational form of a multi-staged technology-open competition has proved successful, future policy initiatives should adopt this organisational form.
- The carefully executed initial evaluation of the Federal Government's Leading-Edge Cluster Competition should be used as a benchmark for also systematically evaluating the great number of regional cluster initiatives.

- The evaluation of the Leading-Edge Cluster Competition has demonstrated the great innovation potential emerging from financing R&D cooperation projects between large companies and SMEs. Such collaborations should therefore also be supported as part of other measures, i.e. beyond cluster policies.
- The Commission of Experts welcomes the introduction of different exchange formats, which will give policy-makers at federal and regional levels and cluster managers the opportunity to share their experience and to learn from each other. These new opportunities should be fully exploited.
- With regard to the clusters supported, the Federal and Länder governments should aim to avoid an excessive focus on regional partners and potential isolation from external stimuli. Cluster initiatives at state level should aim to create transregional networks. Against this background, the support programme for the internationalisation of clusters announced by the BMBF advances and complements the Leading-Edge Cluster Competition in a consistent manner.
- If the Leading-Edge Cluster Competition were to be continued further, one can expect that its positive effects will weaken considerably. The Commission of Experts therefore advises against continuing the Leading-Edge Cluster Competition beyond the third funding round.
- The Commission of Experts further calls for an evaluation of the medium- and long-term effects of the Leading-Edge Cluster Competition. To assess the effects of funding in an objective manner, systematic monitoring should be implemented. This will also require the collection of data beyond the funding period.