Aviation Clusters: New Opportunities for Smart Regional Policy

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Abstract

This paper addresses clusters – and in particular, aerospace clusters – as an important strategic concept for regional development policy. It argues that such clusters are deriving their economic significance from smart specialization. The paper offers illustrations from various European countries and concludes with some policy lessons.

1 Aviation as a Smart Specialization

Over the past decades, regional development has sought to remove the deficiencies in the economic structure of less developed regions through the development of effective infrastructures and the use of appropriate knowledge and innovation systems. Likewise, modern regional development policy seeks to exploit the economic potential of promising – though not necessary lagging−regions through the creation of accessible transport and communication systems and transmission of advanced knowledge (see Acs et al. 2009). An important intervening opportunity for an effective use and dissemination of knowledge is formed by social capital (see Westlund 2006).

It is clear that universities – and in general, higher education institutes − play a critical role in supporting new technology industries (see Calzonetti and Reid 2013), especially since they need open and multi-user network accessibility. Against this background, regions in an advanced knowledge economy and an open systems' network may act as an engine for accelerated knowledge-based spatial development.

Nowadays, there is an increasing awareness that regions should exploit their competitive advantage through a focus on those activities in which the regions concerned can excel. This has prompted the notion of *smart specialization.* The rationale of this concept is based on the idea that in an open world regions have to compete for the most efficient market strategy, so as to maximize their revenues through a specialization in the most productive or efficient activities. Consequently, regional clusters of industries should not specialize in a broad portfolio of

industrial or service activities, but should aim to optimize their market position on the basis of a smart choice of a limited number of specialized industries (see Batabyal and Nijkamp 2015).

A good example of regional smart specialization is formed by the airline industry. Aviation is world-wide a rapidly growing industry. For example, it is sometimes argued that in the decades to come at least some 30,000 new aircraft would have to be built. In view of this large-scale development, this offers of course a great opportunity for regional development, provided a proper specialization is strived for.

Central and Eastern Europe has a long standing tradition in the development of aircraft, in particular the Czech Republic, Romania and Poland. After the fall of the iron curtain, these countries have aimed to employ the historical roots of the aviation industry as an anchor point for developing new regional spearheads in the aerospace industry (see for a review Bochniarz 2007). One of the regions which has in recent years played an active role in the development of a modern aviation sector is the Podkarpackie region in the South-Eastern part of Poland. It has heavily invested in new infrastructures, advanced knowledge and international linkages so as to build up a modern aerospace industry. To emphasize the smart aviation specialization in this region, it has been baptized as the Aviation Valley (see Kaszuba 2012).

The smart specialization in aerospace activities is based on the assumption that this knowledge-intensive and innovation-driven activity may form a cornerstone for new advanced activities in the area concerned. This modern cluster specialization may generate high revenues, many new jobs and a high international profile. This calls of course for a thorough (mainly quantitative) assessment of all relevant effects of such an aviation cluster. A good example of such an impact study on the Boeing aviation cluster in Washington State (USA) can be found in CAI (2013) and Sommers et al. (2008). In recent years, also various studies in Europe have been carried out on the (regional-) economic significance of the aviation sector. Some interesting examples can be found in a study for the European Commission (ECORYS et al. 2009), and in a study on aviation networks (Zuliani and Jalebert 2005). A policy-oriented study on the regional aerospace cluster policy in Europe can be found in Schönfeld and Jouallec (2008).

It goes without saying that – in the light of the economic importance of high-quality regional aviation initiatives − proper choices have to be made on the choice of the portfolio of activities, on the skill levels needed, on the necessary infrastructural provisions, and on the set of innovation strategies needed to ensure the highest performance of the cluster concerned. The next section will be devoted to the design of a conceptual framework for assessing the performance of effective clusters in general, and for the aviation sector in particular.

2 An Assessment Framework for the Performance of Clusters

Over the past decade spatial clusters have become a cornerstone of smart regional policy. Clusters are not only technological engines, but also social and learning machines. The performance of such learning organizations depends according to Van Geenhuizen and Nijkamp (1998a,b, p. 10) on the following factors:

- *Consensus* among the regional actors involved. Learning as a collective action needs to be accepted as a meaningful strategy. In addition, a certain level of trust is necessary, so that the benefits of learning are also contingent on its acceptance.
- *Networking to advance knowledge creation and flow*. Innovation is an *interacting* process within firms, between firms (suppliers, contractors), and between firms and various institutes. Accordingly, networking is important to enhance serendipity.
- *Transformation of knowledge*. Knowledge cannot always flow smoothly, due to differences in vocabulary and frameworks. Thus, transformation is necessary in flows, for example, between basic knowledge and applied knowledge, and between different disciplines.
- *Management of human capital*. This refers to the resident population and the workforce in local firms. There need to be sufficient investment in skills for learning and skills for management, and for learning itself in art and science, at different levels, in different combinations, and by using formal as well as informal education.
- *Management of (public) stocks of knowledge*. This includes the updating of archives, libraries etc., and providing access to them.
- *Identification of new learning and knowledge needs*. This condition is concerned with the monitoring of needs while anticipating new developments. Producing early warning signals is important here.

These factors may assist in building up a self-organizing regional and local socio-economic and political power which may reinforce the regional window of opportunities, while taking into account the socio-economic potential and the spatial-environmental sustainability conditions. Regions are not abstract geographical units, but represent a force field of competitive performance, in which the business sector − and in general terms − private and public organizations play a key role.

It is of course an important challenge in regional development policy to assess the economic performance of clusters. Performance measurement has become an important tool in regional planning. In many branches of business science and management we find a great variety of efforts to assess the performance of firms or organizations. Examples of such tools are:

- *Cost-effectiveness* analysis: a scientific evaluation method to investigate whether the use of scarce resources (as cost components of inputs) lead to the achievement of certain desired effects.
- *Goals-achievement* analysis: a related multi-criteria method to trace whether pre-defined goals are − or can be − achieved with the implementation of various policy or management measures.
- *Comparative cost* analysis: a scientific approach to find out which strategy offers the highest revenue by minimizing the necessary cost involvement.
- *SWOT* (Strength-Weakness Opportunities-Threats) analysis: a systematic study into the pros and cons (both present and future) to identify the most promising future strategy.
- *Balance score card* analysis: a systematic comparative analysis of the performance of a complex organization by comparing their performance along multiple dimensions with competing organizations.
- *Strategic performance* analysis: a systematic operational measurement – often in comparison with relevant actors – of the economic achievement position of an actor or corporate organization. It serves to assess performance not only from an economic perspective but also

from an evolutionary, partly non-economic valuation perspective, in order to suggest solutions for actors to have a competitive edge in a global network economy (Kourtit 2014a,b; Kourtit and Nijkamp 2014).

In many performance studies a high degree of systematics is achieved by using operational KPIs (Key Performance Indicators). They can in principle also be used in benchmarking exercises for clusters. Clusters have become a popular and widely recognized economic-geographical constellation over the past decades in many countries all over the world. Many of such concepts were inspired by Michael Porter's (1990) seminal contributions to industrial sector policy from a managerial perspective, with the aim to find successful role models for focused sectoral and/or regional policy. According to Porter (1998), a cluster may be regarded as "geographically proximate groups of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities ". Necessary conditions for clusters to emerge are (see Ketels et al. 2008): (i) geographical proximity, (ii) joint economic interests, (iii) business interactions, and (iv) critical mass. Thus, clusters are based on technological and economic symbiosis at a local level, are supported by knowledge-based initiatives and strategies, and are favoured by network alliances ranging from local to global levels.

Cluster concepts have gained much popularity over the past decades, mainly because of (i) the wealth of scale and agglomeration advantages associated with a spatial iuxta-position of both complementary and competitive activities, and (ii) the innovative potential of a geographical concentration of high-tech or creative activities (including SMEs) as a result of image or brand factors or (formal or informal) inter-firm connections (or alliances) in a local milieu. Localized learning processes (e.g., in the form of 'social capital' in the business sector) may stimulate knowledge spillovers in a cluster, which may provide the seedbed conditions for industrial agglomeration benefits (see also Wang et al. 2014). From this perspective, the geography of proximity matters (see also Saxenian 1994 and Torre and Wallet 2014).

The cluster concept has sometimes been used as an ex post explanation for the spatial concentration or the emergence of innovative activities in so-called 'new industrial areas' (Scott 1988), for instance, in Silicon Valley, Route 128, North-Carolina Research Triangle, the Third Italy or the Cambridge Science Park. In other cases however, the cluster concept has been used as a navigation tool for an explicit and dedicated regional innovation policy, especially for high-tech firms, for example, Sophia Antipolis or the Zelenograd Cluster. In most cases, we find an interesting mix of many flexible SMEs and a limited number of dominant players, which altogether shape an 'innovative milieu' (Camagni 1995). The planning principles for such clusters may range from free market forces facilitated by local or regional institutional support frameworks to 'command and control' ramifications with more direct public policy interventions. Further interesting reflections on cluster thinking can be found in Gordon and McCann (2000).

A newly emerging − but as yet less well-known −example of a cluster can be found in the pilot Innovation Territorial Cluster Zelenograd in Russia, situated 37 kilometers North-West of Moscow. Zelenograd is the Russian centre for domestic electronics, including information technology and microelectronics. The cluster itself has close liaisons with the National Research University MIET. Over the past years, the market orientation was broadened towards aerospace industries, aviation and space research, advanced instruments, military equipment, IT-security

systems and so forth. A connecting chain of the cluster activities is found in the National Research University MIET, both through training programs and advanced technological research. The cluster is supported through various institutional and financial support systems, such as acceleration programs, business incubators, and innovation and technology center, a network of multi-access centers, and a Spatial Economic Zone facility.

An interesting policy study on Polish clusters was performed by Holub-Iwan (2012), on behalf of the Polish Agency for Enterprise Development (PARP). We will offer a concise summary of this cluster study. The definition of a cluster adopted in this study was the following: " a geographic concentration of interrelated enterprises, highly specialized suppliers, service providers, enterprises operating in related industries and associated institutions (universities, standardization units, professional associations, supporting institutions) in specific areas, competing with one another, but also cooperating. A cluster is closely connected with the territory in which it operates; it is regionally rooted. Clusters are a specific form of the organization of production, where there is a concentration of flexible business operating in the vicinity of one another on a complementary basis. These entities simultaneously cooperate and compete with each other, also liaising with other institutions operating in the same area. The basis for the creation of a cluster are cooperative relationships existing between entities, generating processes creating specific knowledge and increasing their adaptive capacity. The total number of clusters investigated in the PARP report was 35; they were spread over various regions in Poland. Their choice was inter alia based on duration of operation, size and composition, legal status etc. This benchmark study was undertaken on the basis of an extensive survey questionnaire for an each cluster by addressing two respondents: a cluster coordinator and a cluster leader. In the survey questionnaire 4 main areas were covered:

- Cluster processes
- Cluster resources
- Cluster performance
- Cluster growth potential.

These 4 areas were next further subdivided into 15 sub-areas, for which a total of 49 indicators were collected. The general findings from this cluster analysis were interesting:

- Most clusters were initiated by private enterprises
- Recently developed clusters are based on PPP models and R&D institutions
- The origin of clusters is mainly bottom-up
- Most clusters are industrial-oriented
- The legal framework of clusters is often based on an association, though limited liability companies and joint-stock companies are also on the rise.
- Most cluster members are enterprises, often of an SME type.

The strategic objectives of the clusters surveyed focused often on:

- Creating innovative solutions and new technologies
- Obtaining external funding
- A growing market value of the cluster's brand
- Reinforcing the position of a cluster as a local partner for development
- Improving the flow of information and knowledge.

A subsequent strength – weakness analysis led to the following results:

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Internal and external communication	Low innovation level
Participatory knowledge creation	Low number of patents
Access to cluster facilities	Low joint market activity
Availability of laboratories	Weak links with science
Local community linkages	Low share of external cluster funding
Importance of cluster coordinator	Modest job growth of cluster members
Interaction with external environment	Weak public financial support
	Weak institutional cooperation

This cluster benchmark study brought to light interesting findings, in particular: the importance of up-to-date information (needed for monitoring a cluster's performance), the importance of local (private and public) cooperation and linkages ('social capital'), the importance of anchoring cluster initiatives in R&D and academia, the importance of a legal framework supporting a cluster's performance, the importance of a professional cluster management, and the importance of effective marketing strategies for the cluster concerned.

3 Aerospace Clusters in Europe

The aerospace industry in Europe has become a key industrial sector of a great strategic and economic importance. This industry is a typical example of a knowledge-driven high-tech sector which is of critical importance for the competitiveness of nations and regions in Europe. Aviation is part of a persistent globalization trend and therefore often a leading sector in technology-based and knowledge-oriented clusters. In the present section, we will offer three illustrations of aerospace clusters in − and related policies − in Europe, viz. in France, the Netherlands and Poland.

3.1 French Aerospace Cluster Policy

France has for several decades already a dedicated cluster policy, which was called in the past sometimes 'centre de croissance' (growth centre) and in more recent times 'pôles de compétitivité (competitiveness pole). Such clusters were meant to spur industrial and technological innovation and to encourage cooperation or partnerships between industry, public R&D, and governments (the 'Triple Helix'), so as to stimulate regional growth based on global market activities.

The French 'Aerospace Valley' has already a long history. It is situated around the Toulouse metropolitan area in the South-Western part of France, but with connections to adjacent regions (Midi-Pyrénées and Aquitaine). The Aerospace Valley forms a major European concentration of space and aeronautics industries, but also many research centres, universities, graduate schools and engineering firms.

The Aerospace Valley has already a long history. It commenced more than fifty years ago with a decision of the French president Charles de Gaulle to develop in France a strong nuclear and aerospace industry. The CNES (Centre National d'Etudes Spatiales) was founded in Toulouse.

Later on, Toulouse became the natural habitat for the location of Airbus and related aerospace technologies.
The Aerospace Valley contains nowadays more than 700 enterprises, many of them of a foreign origin. The Valley offers a great diversity of jobs; at present, about one quarter of the total employment in the European aerospace industry can be found in the broader Toulouse area. These knowledge workers come from all over the world. For example, the area is the home for more than thousand engineers from India. The Aerospace Valley is no doubt a critical catalyst for innovative aviation and spatial industries in Europe. The total number of jobs in this cluster is around 100.000.

Clearly, the major player in the Aerospace Valley is Airbus, which does not only build civil airplanes, but also military aircraft, helicopters, satellites, radar systems and space rockets (or parts thereof). According to Schönfeld and Jouaillec (2008), the core activities of the Aerospace Valley comprise 9 core R&D sectors:
1. Aero-mechanics, materials, structures
2. Energy, propulsion, engines, environment
3. Air transport safety and security
4. Living Earth and space
5. Navigation, positioning, telecommunication
6. Embedded systems
7. Architecture and integration
8. Maintenance, service, training
9. Access to spatial and orbital infrastructures

The experiences from France demonstrate clearly that the interests of the aviation and aerospace industry are well served through a geographical clustering (including R&D).

3.2 The Dutch Aerospace Cluster Policy

The Netherlands has a long tradition in aviation. The airport of Amsterdam (Schiphol) is one of the largest in Europe, with more than 55 million passengers in recent years. This is mainly due to the smart logistics concept of this airport. But the Netherlands has also a strong industrial tradition in the production of aircraft, aircraft particles and aerospace activities. It used to have its own aircraft industry (Fokker) until the late 1990s, but for a small country like the Netherlands it turned out to be impossible to maintain an independent aircraft industry in a highly competitive and largely monopolistic world market, with giant players such as Boeing, McDonnell or Airbus. After the loss of Fokker as an independent aircraft builder, several new aviation activities have started, with a focus on sophisticated expertise and aircraft particles.

These activities all belong to a varied aircraft cluster in the Netherlands, in which from a sectorial perspective they are all complementary, but from a geographical perspective they are dispersed (in the western, southern and eastern provides). Furthermore, the Netherlands is also the home base of ESTA, The European Space Technology Agency, based in Noordwijk, which employs a few thousand high-skilled aerospace experts. Thus, the Dutch aerospace cluster forms an economic spearhead of high-tech activities that are largely geographically dispersed. However, it has to be added that this spatial dispersion is of a relative importance, as all these firms – with more than 100 companies and generating more than 20,000 jobs – are located at a distance of less than one-and-a-half hour from each other. The economic importance of the aviation sector in the

Netherlands is significant, with a total revenue of about 3 billion enercts annually. It has also become a spearhead of high-tech industrial policy in the Netherlands. Despite the economic recession, it has shown a remarkably stable development over the past years, with great perspectives for the years to come.

3.3 The Polish Aviation Valley

The Polish Aviation Valley, located in the South-Eastern Podkarpacie Region in Poland, has a long aviation industry history. The region itself, with a population of more than 2 million inhabitants (comparable to Latvia or Slovenia in size), is a great example of smart specialization, namely in the aviation sector. Multinational companies, such as United Technologies, Safran, Goodrich or MTU, have located some of their plants in this area. The reasons to choose this area as a centre of the aviation industry were: cooperation benefits among individual firms through cluster formation, the advantages of regional self-organization, and the opportunities to create an efficient network of sub-suppliers. The Podkarpacie is also a source of high-skilled personnel, in particular engineers and technicians in the aerospace industry. Public policy aims to attract foreign investors through Special Economic Zones (tax and investment reliefs) and close interactions with the Aeropolis Park of Science and Technology and technological universities in the region (in particular, Rzesnow). At present, more than 100 aviation companies are based in the area, performing R&D in aircraft building, developing telecommunication technologies in aviation and avionic systems, design of materials chemistry and surface engineering products, and building of aircraft components and helicopters. More information on this aviation cluster can be found on www. aviationvalley.pl., as well as in Sienko-Kulakowska and Pisarczyk (2012) and Kaszuba (2012).

It should be added that in the meantime also another new cluster initiative has started, namely to turn the Podkarpacie Region into a life Quality Cluster, given the nearby presence of unique and high-quality natural areas. This will be further developed in the years to come.

4 Lessons and Conclusions

Regional development policy has over the past decades been characterized by a search for strategic economic and technological opportunities that offer an added value for all stakeholders involved. In the European space-economy we observe an emerging interest in aviation and aerospace activities as a spearhead for new technological pathways characterized by a high degree of innovativeness and creativeness. These activities are in accordance with the principle of smart specialization and ensure a high degree of scale and agglomeration advantages, if these are performed in the context of a spatially demarcated industrial cluster. Regional development policy may consider geographic industrial clusters as a stepping stone for accelerated economic regional development, provided dedicated support policies are executed (e.g., in terms of infrastructure, connectivity, education, entrepreneurship, policy consistency and support).

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