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Growth Clusters in European Cities: An Integral Approach

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Summary. This paper analyses and compares the dynamics of clusters in nine urban regions in Europe. The cluster perspective in the studying of growth processes in cities has added value because, increasingly, economic activities cross the boundaries of traditional economic sectors, as networks are becoming the leading organisational principle. The integral approach reveals that the performance and dynamics of clusters depend on cluster-specific conditions and, to a large extent, also on the general spatial-economic situation in the urban region and the quality of urban management.

1. Introduction

Sustainable economic growth is of high interest to European cities: it is indispensable to further the well-being and prosperity of citizens and firms, and to generate employment. Thus, it is important to gain insight into the economic growth opportunities in cities. In this respect, new growth sectors such as information technology, biotechnology, environmental technology, media and tourism are at the centre of interest to academics as well as to urban managers. Many cities invest heavily in developing and attracting industries in these promising sectors. However, little is known about the critical success factors that determine the economic development of cities and regions, and empirical studies that draw lessons for policy are scarce (Nijkamp, 1999). Moreover, there are good reasons to doubt the extent to which a pure sectoral view is adequate to analyse urban economic growth and to design policies. There are many indications that, increasingly, urban economic growth seems to emerge from fruitful co-operation between economic actors, who form innovative complexes of firms and organisations. It is in these geographically concentrated network configurations, or 'clusters', that value-added and employment growth in urban regions are realised. This asks for a new policy approach in urban economic development. The general aim of this paper is to increase the insight into new growth opportunities for European cities and to provide scope for urban policy. We have focused on growth processes (why and how some clusters are growing) rather than growth figures, and we have made a comparison between growth clusters in different European cities. The paper is organised as follows: section 2 introduces the background and methodology of the investigation. Section 3 points at the increasing

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Table 1. Some data on the participating cities

City	Number of inhabitants in the agglomeration	GDP per capita (in ECU, 1995)[a]	Chosen cluster
Amsterdam	1 300 000	12 505	Tourism
Eindhoven	670 000	not known	Mechatronics
Helsinki	920 000	16 441	Telecommunications
Leipzig	502 878[b]	not known	Media
Lyons	1 262 000	13 189	Health
Manchester	2 591 000	11 079	Cultural industries
Munich	1 241 000	17 268	Media
Rotterdam	1 065 000	13 341	Media
Vienna	1 807 000	18 649	Health

[a] *Source:* Ereco, 1997, in Mayerhofer and Palme (1996).
[b] *Source:* Leipzig City Council (1996).

importance of networks as an organising principle in the developed economies of the 1990s, and reviews relevant literature on localised networks (or clusters) in the perspective of urban economic development. Section 4 contains the framework of analysis that was constructed to analyse cluster development. Section 5 includes a synthesis of experiences with 'growth clusters' in nine metropolitan cities in Europe. The paper ends with some concluding remarks.

2. Background and Methodology

This paper is based on the results of an international comparative urban research project on growth clusters and the scope for urban economic policy in nine European cities (van den Berg *et al.*, 1999). These cities are active member cities of the Eurocities network.[1] They are part of a larger group of cities that are interested in the fundamental question of how large urban regions can benefit from the rapid growth of sectors such as biotechnology, medical services, tourism, information technology and the media industry. The group members organised frequent meetings with the aim of exchanging information and good practices. However, the nine cities that appear in this paper wanted to take a step further: they felt the need for a more thorough analysis of new growth opportunities, and asked the authors to execute a systematic analysis of growth clusters in general and potential growth clusters in the individual cities in particular.

We asked the cities to come up with a list of clusters that they considered as promising sources of new economic growth. From that list, we selected one cluster for each city for closer analysis. Since we wanted to focus on factors that could explain growth processes rather than growth figures, we have included very different clusters and cities to get an interesting mix of experiences: we have studied mature growth clusters with high growth figures as well as smaller clusters where previous research in the city has indicated that there is growth potential.

The following cities were included (in alphabetical order): Amsterdam (The Netherlands), Eindhoven (The Netherlands), Helsinki (Finland), Leipzig (Germany), Lyons (France), Manchester (UK), Munich (Germany), Rotterdam (The Netherlands) and Vienna (Austria). The cities differ in size as well as in economic structure and performance, as can be seen in Table 1.

We studied the following clusters. In Lyons and in Vienna, we investigated the health cluster: the complex of health care institutes, medical and biological research, the pharmaceutical industry and medical instruments. Both cities have a great tradition in medical research and health care, and both cities share the ambition to make more out of

their medical complexes in economic terms. In Munich, Rotterdam and Leipzig, we have studied the complex of media and related activities as growth clusters, although there were important differences. In Munich, the media cluster is very large and very well developed. In Rotterdam, the media industry is very small, but the municipality considers this cluster an important element in their strategy to diversify the city's economic base and to create new employment. For Leipzig, the situation is again very different: as a former GDR city, Leipzig seeks to re-establish the media cluster in which it had a great tradition. For Helsinki, the investigation was concerned with the cluster of telecommunications—both the production of equipment and services—characterised by very high growth rates, with Nokia, a world leader in mobile phones, playing a very important role. In the city of Eindhoven, the mechatronics cluster, a high-tech industrial cluster, was surveyed. For Amsterdam, tourism was the target cluster. In Manchester, finally, we have investigated the cultural industries as growth cluster, with a special eye for the potential for urban regeneration.

We started our work by studying the relevant literature on cluster development. To be able to analyse and compare the different clusters in the different cities, we developed a framework of analysis with the help of which we were able to study the clusters not in isolation but in their urban context. Next, for each city, we thoroughly reviewed the available reports and studies on the cluster involved. On that basis, we were able to identify key actors in the cluster. After this, we executed in-depth interviews with key representatives.

3. Urban Growth, Networks and Clusters

Networks play an increasing role in the generation of economic growth. Firms and organisations more and more actively engage in networks as a means to survive in a volatile international market and in a situation of rapid technological change. Engagement in networks has several well-documented advantages (Jarillo, 1993; Castells, 1996; and many more). It makes for flexibility: to benefit from chances, a firm has to be able to react fast and to engage in partnerships with complementary strengths and capabilities. Networks are particularly important regarding innovation. Strong international competition and rapid technological development urge firms to produce new products or services, develop new processes and access new markets. Participation in a network enables a firm to concentrate on core capabilities and provides access to resources (such as specific know-how, technology, financial means, products, assets, markets, etc.) in other firms and organisations. This helps them to improve their competitive position.

Interfirm and interorganisational co-operation in networks have different spatial dimensions. Networks can extend worldwide, as do the global networks of stock exchanges and financial markets. But many network relations between actors can be located in a specific area, region or city. The popular term 'cluster' is mostly related to this local or regional dimension of networks. In the literature, clusters are defined and described in many different ways (see Porter, 1990; van den Berg, van Klink and de Langen, 1997; Jacobs, 1996; Lazonick, 1992; and many others), but most definitions share the notion of clusters as localised networks of specialised organisations, whose production processes are closely linked through the exchange of goods, services and/or knowledge. In particular, the informal exchange of information, knowledge and creative ideas is considered an important characteristic of such networks. This is often referred to as 'untraded interdependencies' (Storper, 1997; see also Yeung, 1994). Unlike a sector, a cluster unites companies from different levels in the industrial chain (suppliers, customers) with service units (financial institutions, production-supporting services) and with government bodies, semi-public agencies, universities, research institutes, etc. Many authors have stressed the dynamics of clusters. As early as 1890, Mar-

shall described the powerful dynamics in industrial districts, where geographically concentrated groupings of firms, large and small, interact with each other via sub-contracting, joint ventures or other collaborative means, gaining external economies of scale in doing so (Cooke, 1995), thus deriving international competitiveness from local sources. Porter (1990) describes how clusters of densely networked firms serve global markets while deriving their strength from a regional basis. He discerns four conditions as essential in that development: factor conditions (quality of labour, capital and knowledge available), demand conditions (scale and quality of the regional home market), supplier industries (globally competitive suppliers, specialised services) and business strategy (rivalry between local firms but also willingness to co-operate in research, sales and marketing). In particular, the interplay of competition and co-operation is fundamental. Too much competition may be destructive, but the same holds for too much co-operation when it degenerates into the formation of cartels (Cooke, 1995; Harrison, 1994). Lazonick (1992) and Boekholt (1994) stress that, in clusters, a major role is played by other than interfirm linkages: links with government-supported scientific institutes, ties with the scientific community and professional associations are important factors in a cluster's performance. Still, the question remains why proximity still seems to matter in networks, where modern communication technology theoretically permits spatial dispersion. Several reasons are put forward. First, face-to-face contacts appear to be very important as sources of (technological) information and in the exchange of tacit knowledge (Leonard-Barton, 1982; Malmberg *et al.*, 1996). Spatial proximity greatly enhances the possibility of such contacts. Secondly, co-operation between actors requires mutual trust. This holds particularly when sensitive and valuable information is exchanged—for instance, in a joint innovation project. Several authors (for example, Piore and Sabel, 1984) argue that cultural proximity—i.e. the sharing of the same norms and values—is an important factor in that respect, since co-operation is a human phenomenon. A very relevant issue concerning the spatial dimension of clusters is how local networks relate to global networks. In the local–global interplay, transnational companies (TNCs) play a special role. Malmberg *et al.* (1996) stress that if a TNC is rooted and integrated ('fledged') in the region and engaging in regional networks, it can act as an important disseminator of new knowledge, information and innovation from abroad into the region. This is particularly relevant for research and development activities: knowledge flows are facilitated by personal relationships, and by mobility of employees or spin-outs from the large firm.

4. Frame of Analysis

The literature on clusters is extensive. Most studies focus on theoretical aspects of clustering or take (very) large regions as their geographical unit. In empirical studies, there is a strong bias towards well-performing regions (the 'Third' Italy, Baden–Würtemberg, Silicon Valley, Route 128–Boston, Cambridge) with high rates of growth and innovation, and dense network structures. However, empirical (comparative) cluster studies in urban regions are scarce.

In our study, we aimed to study clusters in urban regions in an integral way, from the view that clusters are embedded in the spatial-economic, cultural and administrative/political structures of the urban region. We have drawn up a frame of analysis to take several aspects into account and study their interrelations: it should serve as a basis to structure our empirical work in the cluster/city cases and enable us to understand growth processes in clusters in urban regions, provide scope for policy improvement and allow the comparison of different types of cluster. The elements of our framework are derived from existing literature (partly discussed in the preceding sections) and recent insights into the importance of 'organising capacity' as a determinant of the economic development of urban regions (van den Berg, Braun, van der Meer, 1997).

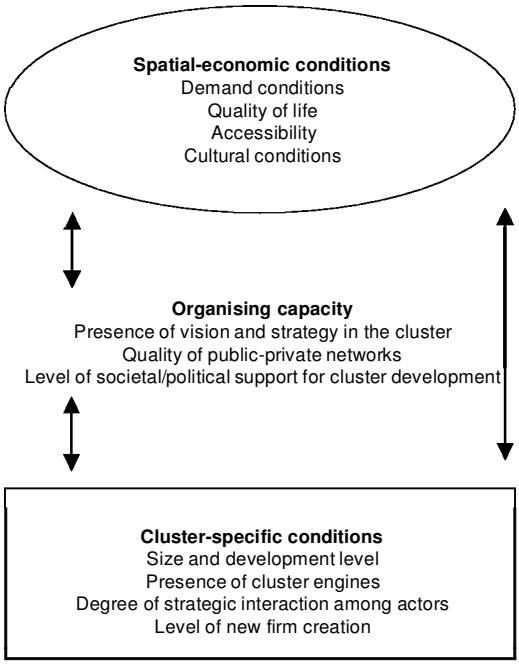

Figure 1. Framework of reference.

In the framework, we assume that three interrelated elements influence the growth of a cluster:

(1) spatial-economic conditions;
(2) cluster-specific conditions; and
(3) organising capacity regarding the cluster

Figure 1 shows the components of the framework and the interrelations between the parts. In the following, the contents of the framework are elaborated.

4.1 Spatial-economic Conditions

We assume that not every large European city has the same chance to develop a certain cluster, because (as stressed by Porter, 1998, and many others) a cluster is embedded in a broader spatial-economic setting. More specifically, we assume that demand conditions are fundamental to the functioning of a cluster: a strong local or regional demand for the cluster's products is likely to have a beneficial impact on the cluster's development. Demand may come from large companies in the region, that indirectly act as stimulators of the cluster as main client, but also from governments.

Secondly, the accessibility of the urban region—internal and external—plays a role in the development of clusters. Bad transport systems within an urban area may seriously hamper interaction in a cluster, particularly if the cluster firms are dispersed. The relative accessibility (rail, road and air connections to other cities and regions) is important as well, in several respects: good (international) connections increase the demand potential. They make it easier for cluster actors to sell their products in a wide geographical market and also to co-operate with complementary partners in other cities. At the same time, good connections may increase competition when cities with similar, competing clusters are easily accessible.

Thirdly, we assume that the quality of life in the urban area influences the growth of clusters. In general, quality of life is a location factor of utmost importance (van den Berg, Braun and van der Meer, 1997). Firms increasingly seem to move to areas where they can find the appropriately skilled people. Highly skilled people, on whom urban development is strongly dependent, attach much value to a high-quality living environment so, in an indirect sense, the quality of the living environment is an essential factor in economic urban development.

In addition to spatial-economic conditions, we also consider 'cultware' as an element of the spatial-economic context, as an institutional variable. Cultware relates to attitudes of people and firms. In particular, attitudes towards innovation are assumed important, because often, in growth sectors, the main driving force of the development of the cluster is innovation. Of equal importance is the willingness of people in the urban region to co-operate. Co-operation is also one of the main sources of innovation, new combinations and, hence, the growth and development of the cluster.

4.2 Cluster-specific Conditions

Next to general spatial-economic conditions, we assume that there are cluster-specific conditions that influence the development of a cluster in an urban region. Based on the literature reviewed in section 3, a first relevant aspect is the initial size and development level of the cluster. An already well-developed cluster constitutes a market large enough to support the (specialist) activities in the cluster; it entails competition within the cluster and thus forces companies to operate efficiently and effectively. The possibility of fast penetration and adoption of all types of innovation increases as the cluster size gets larger. Regional co-operativeness is easier to accomplish as complementary partners in the region are more easily found than in very small clusters. Finally, scale offers prospects for the sharing of resources, the benefits of a shared pool of specialised labour and the scope for a cluster 'superstructure' like joint education facilities.

Secondly, the presence of one or more cluster engines in a region—this may be large multinational firms, but it can be other actors as well—is supposed to be a determinant of a cluster's functioning (Malmberg *et al.*, 1996), given their role as 'spiders' in global and local networks, or as 'flagships' of the cluster as whole.

Thirdly, the degree of strategic interaction is assumed to be largely decisive for a cluster's performance. Strategic interaction implies long-term relations, other than strictly financial, between organisations. Within the region, such interaction can be achieved on various levels: among companies, between companies and institutions of education or research, among educational institutions, etc. As indicated in the last section, strategic interaction can serve a variety of purposes: to create scale, to use one another's knowledge (of markets, technology, organisation), to make use of one another's networks, to solve common problems together or to enhance flexibility.

A final cluster-specific element determining cluster dynamics is the level of new firm creation. Young firms often are dynamic and innovative, and generate jobs; they can be important for large firms as partners in innovation, or as suppliers. They may help to tie young talent to the region, particularly when new firms are strongly linked up in the cluster—for instance, by strategic relations with local universities or large firms. The creation of new firms in European cities generally lags behind the figures for the US, particularly for high-tech starters. Appropriate public–private structures to guide starting firms are assumed to be a very important factor in the degree to which people are inclined to start businesses, but cultural elements (such as the level of 'entrepreneurial spirit') are also likely to play a role.

4.3 Organising Capacity

The final element that presumably plays a part in the performance of the cluster is the degree of organising capacity regarding the cluster. Organising capacity can be defined as the ability of the urban region to enlist all actors involved in the growth cluster and, with their help, to generate new ideas and develop and implement policy designed to respond to developments and create conditions for sustainable development of the cluster (van den Berg, Braun and van der Meer, 1997; adapted). Organising capacity can refer to the development of cluster-specific policy, the attraction of cluster-supporting elements (companies), investment in specific infrastructure, etc. Van den Berg, Braun and van der Meer (1997) distinguished some elements necessary to the organising capacity in general: vision/strategy, political/societal support and public–private partnerships. All these elements are important for the development of a cluster in a city or region.

A well-defined and shared vision and a strategy for the development possibilities of a cluster are indispensable for an efficient allocation of resources and effort to stimulate the cluster. Political and societal support are necessary conditions for a cluster policy as well. Political support helps to bring about positive collaboration at the local level.

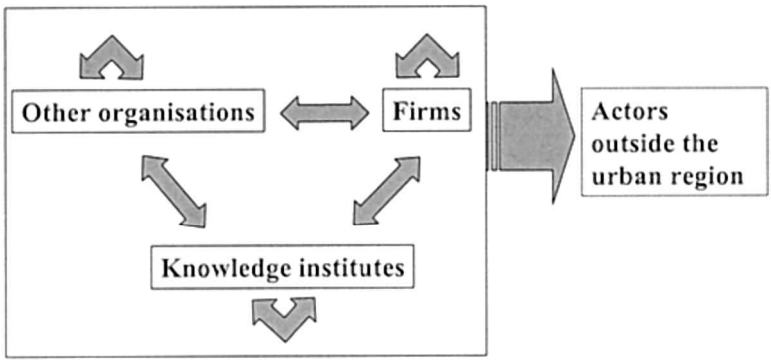

Figure 2. Interorganisational relations.

Proper presentation and communication of policies are of paramount importance to achieve results. Societal support is important for the acceptance of policies aimed at growth clusters. Finally, public–private co-operation—on the strategic, tactical and operational levels—is very important for a successful cluster policy. An essential factor for success is the early involvement of the private sector in the development of locations, the attraction of companies, etc. (see also Knight, 1995). The knowledge, expertise and involvement of the private sector can be very valuable to the decision process and can considerably enhance the chance of success. Besides, government can act as network-broker, stimulating the formation of intersectoral and intrasectoral networks, by bringing people and firms together. Local or regional government can engage in public–private partnerships directed at the stimulation of the growth cluster—for example, by providing facilities or specific education.

5. Results

As already outlined in section 2, in our survey we analysed several types of cluster: two mature health clusters (Lyons and Vienna), two small media clusters (Rotterdam and Leipzig) and a very mature one (Munich), a large tourist cluster (Amsterdam), a specialised cultural cluster (Manchester) and two mature technologically oriented clusters (telecommunications in Helsinki and mechatronics in Eindhoven). At first sight, comparison seems difficult: the cases are dispersed across several countries, entailing country-specific aspects; they differ in type, and in their 'development stage'. However, the frame of reference (described above) proved a fruitful guideline for the analysis of clusters in the urban context and enabled us to look systematically at clusters of different sizes and structures in very different cities.

For each city, we thoroughly reviewed the available reports and studies on the cluster involved. Also, we executed in-depth interviews with key representatives, to find out how the key organisations are strategically linked up with other organisations (firms, knowledge institutes, government) within and outside the region (see Figure 2) and to collect evidence on the presence of formal and informal co-operative structures, joint facilities or joint projects in the growth-cluster in the urban region.

Also, in the investigation, we included the impact of general conditions (accessibility, quality of life and cultural aspects) on the cluster's functioning. We interviewed policy-makers to identify and judge urban cluster strategies. The (semi-structured) interviews proved to be an indispensable and very rich source of information. In this section, we compare the clusters in the aspects that were presented in our frame of reference. We try to investigate whether our framework is appropriate—do the presumed variables indeed play a role in the development of clusters?—

and whether it is applicable to different types of cluster and to different stages of cluster development. The structure of this section follows that of the framework of reference.

5.1 The Role of Spatial Economic Conditions in Cluster Development

In the case studies, we found our assumption confirmed that the functioning, dynamics and opportunities of cluster development are largely dependent on the general economic and spatial conditions that prevail in the city under consideration. Besides, cultural variables seem to matter. In this section, we will elaborate on each of these subjects.

Demand conditions. The impact of local demand conditions on cluster developments depends on the character of the cluster. For some types of cluster, urban demand conditions set the margins for growth. This holds particularly for the media clusters, where substantial demand for media and communication products and services is generated by local firms. New media (and software) development in Munich flourishes, driven by the huge demand from powerful economic actors, whereas in Leipzig, the weak economic basis of the city implies a lack of demand for new media and software products. More specifically, the presence of headquarters of international firms proved to be important in their role as huge and critical demanders. In Munich, the presence of many headquarters (BMW, Siemens, Hypo-bank) is an important stimulus behind the development of media firms active in business-to-business communication. In some cases, like in the media cluster in Rotterdam, the demand potential of the region is felt not to be used to the full. A policy implication is that stimulation of cluster development needs not remain restricted to the cluster actors themselves: the activation of hidden demand potential might in some cases be more effective.

In the health clusters of Lyons and Vienna, the role of local demand conditions is different: health services are predominantly consumed by the local populations. For the pharmaceutical industry located in both cities, regional demand is not particularly important, as most firms produce for the national or even European markets. In the cultural industry cluster in Manchester, the local demand does not play a decisive role in the cluster's development either. In Helsinki, we found that deregulation of the telecoms market (by the 1980s) created a boom in national demand for new telecom services and equipment. The very early deregulation has given the firms in Helsinki's telecoms cluster a lead over others. Many of them (the best known are Nokia and Sonera) currently sell their products, services and know-how on the world market.

Accessibility. In our analytical framework, we hypothesised internal and external accessibility as relevant factors in cluster development. From the cases, we found that good internal accessibility—the ease with which actors in the urban region can get through to one another—enhances strategic co-operation in the cluster, as it brings co-operating actors nearer to one another and thus increases the chance of fruitful (new) combinations. However, it appeared that, in many cases, the friction of physical distance is much less important than psychological barriers. Even the location of actors in the same building does not imply an incentive to co-operate. Personal contact seems to be a much more important determinant of co-operation than distance. Moreover, we found that proximity is positively related to the propensity to co-operate when the actors have 'grown up together' in the same building or location. An illustration of this is the *in situ* co-operation in the Vienna BioCentre, where the pharmaceutical firm Boehringer Ingelheim works closely together with institutes of the University of Vienna in fundamental and applied research. Another example can be found in Finland in the city of Olou, where very close ties between Nokia, smaller firms and the University of Olou have developed since they were located on the same campus.

The ease with which other cities, national

and international, can be reached by all modes—the external accessibility—is also relevant for the growth possibilities of clusters. All the case cities are well connected to rail networks, airports and highways. However, the impact of external accessibility on cluster development depends on the type of cluster. For one thing, good (inter)national connections make it easier for actors in the cluster to 'export' their products. They also increase the exposure of the cluster actors to international competition, which tends to make the cluster stronger. From our interviews, we found that, owing to the internationalisation of R&D and technological developments, international connections are indispensable to clusters in which technology and R&D are important—the health clusters in Lyons and Vienna, mechatronics in Eindhoven, telecoms in Helsinki—to attract international staff and to provide access to international partners. However, it is not just the technology-oriented clusters that put high demands on external accessibility. For the tourist cluster of Amsterdam, the strong position of Schiphol Airport is vital for its success in business tourism. Manchester Airport could be instrumental to the international aspirations of the city's cultural enterprise.

Good connections may have a negative impact on cluster development when strong competing cities are nearby. For Rotterdam, for instance, the nearness of 'media capital' Amsterdam makes it difficult to build up a media cluster of its own. The same holds, to some extent, for Leipzig, that competes with nearby Berlin in the attraction of media activities. Another illustration is the cultural cluster in Manchester, where the attractiveness of London for creative talent is something to be reckoned with. Thus, cluster development in cities with strong 'magnets' in their vicinity will have to focus on a clear specialisation based on local strengths instead of trying to do the same as an already well-developed neighbour. Urban specialisation becomes all the more relevant with the arrival of new fast transport means such as the high-speed rail network.

Quality of life. The attractiveness of a city in terms of housing, cultural and leisure facilities proves a fundamental factor in cluster development, as a means to attract and retain highly skilled people to the region. In that respect, it is interesting to compare the cities of Munich and Leipzig. Firms in the 'booming' media cluster of Munich manage to attract excellent staff from other German cities (and even from abroad) because of the superior quality of life that the city offers. By contrast, for Leipzig, with a much less favourable living climate, it proves very difficult to keep skilled people in the region, let alone to attract them from elsewhere.

The specific demands on the quality of the living environment differ by cluster. In the very technologically oriented clusters—in Eindhoven, Helsinki and, to a lesser extent, Lyons and Vienna—the quality of housing and the nearness of the countryside are considered to be important, while in the media clusters (Rotterdam, Leipzig and Munich), as well as in the tourist (Amsterdam) and cultural (Manchester) clusters, the cultural climate and the metropolitan ambience appear to be somewhat more important.

The unique quality of life and cultural amenities that many European cities can offer can be regarded as a weapon in the global competition for top-level staff. In Vienna, for instance, we found that, for some international top-researchers, the high quality of life in Vienna compensates for high income tax rates compared with other countries (notably the US). Europe's heritage cities in particular are pearls of great economic value in the global competition for talent. Preservation and further amelioration of the quality of life is a long-term investment, with high pay-offs in the long run.

Cultural variables. In our framework, we assumed that 'cultural variables' would be important factors in cluster development. We discerned three types of cultural variable: the willingness of people and firms to adopt new products; the valuation of entrepreneurship in the case-cluster; and, the willingness to engage in strategic co-operation. Although we

made no attempts to quantify these variables, we have strong indications that these cultural variables are indeed important factors in explaining the development of clusters.

The cases of Munich, Helsinki and Manchester show how cluster actors can benefit from an 'early and eagerly adopting' home market, as this entails a market for new cluster products and an ideal testing-ground. In the media cluster in Munich, digital broadcasting techniques are tested in the very receptive local market. In Helsinki, experiments are run allowing the ordering and paying for a can of Coca-Cola by a mobile telephone in the city's airport. In Manchester, the openness to cultural innovation is the basis for the cultural cluster development as such. The valuation of entrepreneurship proved a relevant non-tangible cultural factor. Entrepreneurial people are indispensable to any cluster—to discover new things, to make new combinations, to start new firms and so on. We found very different attitudes in the several clusters. In the health clusters of Lyons and Vienna (to a lesser extent), entrepreneurialism was held in very low esteem by the universities—an attitude that hampers linkages between universities and business in the cluster. At the other end of the spectrum are Eindhoven, Munich and Helsinki, where entrepreneurialism is more appreciated: students and teachers are much more inclined to link up with business, and correspondingly higher numbers of start-ups and spin-offs from universities can be observed. The city of Leipzig is a special case, with a very low entrepreneurial spirit due to the legacy of communism. The municipality has even defined entrepreneurship as the leading principle of its economic policy and seeks to stimulate entrepreneurial activities. Although the attitude towards entrepreneurship is partly a cultural phenomenon, financial and legal incentives can do much to enhance it. In Vienna and Lyons, we found that entrepreneurial behaviour is rare because people have long-term, fixed contracts and virtually no incentive to do something new. A decrease in direct financing may have the positive side-effect of giving universities an incentive to execute contract research and to seek contact with business.

Thirdly, the willingness to co-operate is a key cultural factor of relevance, in a 'network economy' where access to the resources of other organisations is vital. In this respect also, differences among the cities are pronounced, with Eindhoven, Munich and Helsinki leading, followed by Rotterdam, Amsterdam and Manchester. The medical clusters of Lyons and Vienna showed the lowest levels—on the one hand, because of large culture barriers and mutual disrespect between the various cluster actors (large pharmaceutical firms, smaller firms, universities and hospitals) and, on the other hand, because of strong regulation in medical fields compared with the other clusters. We found that dense informal networks in a city generate the necessary mutual trust that is indispensable for co-operation in innovative and risky activities. The most striking case was the mechatronics cluster in Eindhoven, where interorganisational co-operation is much facilitated by the high density of informal networks (sports clubs, unions, study clubs, etc.). Ideally, co-operations emerge spontaneously, but policy-makers could do much to create an environment that stimulates informal interaction. A good example can be found in Munich, where the municipality has invested in the Literaturhaus, a meeting-place for the publishing scene.

5.2 Cluster-specific Conditions

In our empirical analysis, with the help of our framework, we studied several cluster-specific aspects: the importance of scale, the role of large companies as engines of cluster development, the level of strategic interaction amongst cluster actors and the levels of new firm creation. Additionally, we found that the role of history and tradition can hardly be underestimated. Table 2 shows the scores of the cities/clusters involved in the study. They are indicative and based on the information that the authors have collected through reports and interviews, not on a thorough quantification of the several fac-

Table 2. Indicative scores of the case-clusters on cluster specific conditions

City (cluster)	Amsterdam (tourism)	Eindhoven (mechatronics)	Helsinki (tele-communications)	Manchester (cultural industries)	Leipzig (media)	Munich (media)	Rotterdam (media)	Lyons (medical)	Vienna (medical)
History/Tradition	+	+	+	0	+	+	—	+	+
Critical mass	+	0	+	0	—	+ +	—	+	+
Presence of cluster engines	0	+	+	0	—	+	—	+	+
Degree of strategic networking	+	+ +	+	0	0	+	—	—	0
Levels of new firm creation	0	+	+	0	0	+	0	—	0

+ + very strong; + strong; 0 moderate; — weak.

tors. Therefore, they should be interpreted with caution.

History and tradition. Tradition and history matter in cluster development. Many cities included in the investigation have a tradition in the cluster we studied: for instance, Vienna (health) has always had a world-famous medical school; Lyons has long served as the health centre for the whole of southern France; Munich's function as an important media city (particularly publishing) dates back for centuries. The Amsterdam canals have been a tourist attraction since the early days of urban tourism and Manchester has had a reputation in popular (youth) culture since the early 1960s. Tradition and history are the 'sub-stratum' of many of the clusters in the investigation. From the cases, the clusters with a long tradition appear very well developed and complete. Tradition gives a lead because, often, history has created a valuable and well established 'cluster infrastructure' that took years to build: a knowledge-base, education institutes, research units, branch unions and so on. The social-cultural infrastructure in a cluster is of great value, as it determines the levels of mutual trust and willingness to co-operate, but it takes much time for such an infrastructure to come into being.

The absence of history and tradition makes it very difficult to develop a cluster. This has become clear in the case of Rotterdam, where it proves to be extremely difficult to develop a media cluster without having a media tradition at all, as neither buyers of media products nor media production firms regard Rotterdam as a media location. In relation to the issue of tradition, we found that the commitment of influential firms or individuals to a city or region can do much for a cluster. For instance, the commitment of well-known media tycoon Leo Kirch to the city of Munich has contributed much to the development of commercial television activities in that city. In Lyons, the Boiron family, owners of a large homeopathy conglomerate, are strongly attached to the Lyons region. In Eindhoven, partly as compensation for the move of the Philips headquarters to Amsterdam, the company decided to invest in a huge technology campus in Eindhoven. An interesting case in that respect is Leipzig, which is trying to re-establish itself as the media city that it was before the Second World War and the communist period. In Leipzig, traditional ties have survived the decades of communism: some German firms with roots in Leipzig re-open subsidiaries to breathe new life into the ties between the firm and the city. A policy consideration of these observations is that psychological factors such as commitment and 'local attachment' should be explicitly recognised and built upon.

The size of the cluster. The investigation confirms the expectation that large clusters in terms of the number of firms, added value and employment, have an advantage over smaller ones due to externalities. In Munich, for instance, thanks to its size, the media cluster comprises sophisticated suppliers of digital equipment, whereas in the smaller media clusters of Rotterdam and Leipzig, there is no critical mass for such specialised services. Guided by the same logic, large clusters also benefit from a huge and specialised labour pool. In audio-visual activities (film, TV production), people such as directors, actors and cameramen usually work on a project basis and hop from one project to another. Thus, some degree of critical mass has proved necessary to attract such staff to the city.

In the health clusters of Lyons and Vienna, we also found that their large scale allows for specialised health services, enabling them to serve national or even international markets—for instance, a hospital unit in Lyons is very strong in the treatment of sports injuries and attracts patient from all of France and from abroad. Thus, a cluster's size is related to its geographical market: the bigger the cluster, the higher the levels of specialisation ('uniqueness') within the cluster, the greater the cluster's market reach. We indeed found that all of the mature clusters serve the international market (for example, Helsinki and

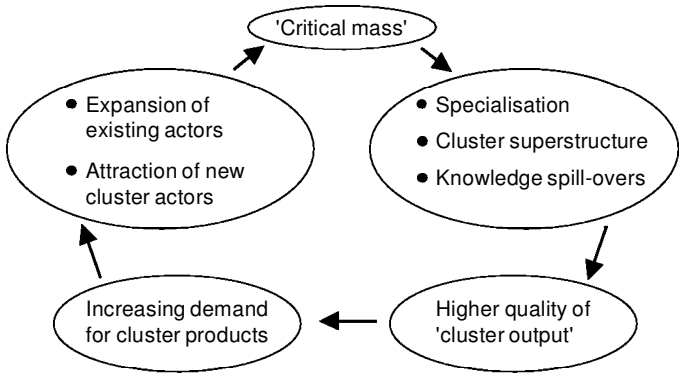

Figure 3. The 'virtuous circle' of cluster development.

Munich). Interestingly, the case of Manchester shows that actors in the cluster can develop international contacts, whereas many of the cultural enterprises still have difficulty developing the local market.

Additionally, we found that clusters can benefit much when 'job-hopping' specialised staff stay within the region: we found this process strongly at work in the mechatronics cluster in Eindhoven, where people are very inclined to change jobs, taking best practice and new knowledge from one firm to another, thereby increasing the clusters' competitiveness.

Also, a sufficient size of cluster is needed to sustain a 'cluster superstructure', such as privately operated education facilities. An example is the Medien-Akademie in Munich that is supported by the many TV stations.

In sum, large clusters seem to have considerable advantages over smaller ones, as a large cluster entails division of labour and specialisation; the large, specialised job market generates knowledge transfer; this permits further sophistication of the 'cluster product' that, in turn, may activate more demand; next, the increase in demand stimulates firms to expand, induces cluster-specific new firm creation and attracts more firms to the cluster, so that the economies of scale increase further. See Figure 3 for a graphical representation of this 'virtuous circle'. Nevertheless, the circle is by no means an automatism. The potential danger is that success could at the same time induce sluggishness and conservatism with (key) players in the cluster.

Presence of cluster engines. In our investigation, we found that clusters can benefit much from 'cluster engines' (large organisations with a dominant position in the cluster) as sources of knowledge and providers of all kinds of spin-off. Examples of cluster engines are Nokia in the telecoms cluster of Helsinki, Novartis (pharmaceuticals) and Boehringer Ingelheim in Vienna and Mérieux (pharmaceuticals) in Lyons. All of the multinationals have linked up with universities and provide much knowledge transfer in the cluster. In some cases, big firms even have an active policy to serve as an umbrella for spin-out firms that are not direct competitors (Novartis), from the wish to develop a set of satellite firms with complementary competencies.

The presence of large firms as part of the cluster is a valuable asset, even if their interaction with the other cluster constituents is limited. In the case studies, we have found wide differences among big companies in the degree to which these firms are 'rooted and fledged' in the region. Some companies—such as Immuno-Baxter (world leader in the production of blood products) in Vienna and, to a lesser extent, Philips (electronics) in Eindhoven—are relatively 'inward-looking' and do not actively regard the presence of

other cluster actors in the region as an advantage. Their degree of strategic networking in the region is generally small. This does not mean that these firms are unimportant: they are valuable sources of knowledge and people and a potential 'breeding ground' for spin-out firms. An example can be found in the mechatronics cluster in Eindhoven of which Philips, the multinational electronics company, forms a part. Although Philips is relatively self-sufficient—it has little direct interaction in the region—the organisation is extremely important as a source of high-grade knowledge (which spills over when people change jobs), as the mother of spin-out companies and as a breeding-ground for talent: many firms in the mechatronics cluster somehow have some Philips background or relationship.

In some cases, a cluster can become too dependent on one single firm, as seems to be the case in Helsinki, where the cluster is strongly dominated by the rapidly expanding Nokia: this firm hires more than half of Helsinki's technical university graduates; many firms in the regions are strongly dependent on assignments from Nokia. A possible downturn of such a dominant firm may have detrimental impact. The lesson is that diversification is important, both within a cluster and in a city as a whole. Not all the clusters studied contain engines: we could not identify cluster engines in Manchester and Rotterdam. This make the clusters in these cities much less 'visible'.

Strategic relations among cluster actors. In the case studies, we found great variety in the nature and intensity of relationships within clusters, which makes comparison among the clusters very difficult. Despite this, we have made an attempt to rank the cities, on the basis of indicative evidence. Table 2 shows that, in general, we found the highest levels of strategic cluster interaction in Amsterdam, Munich, Helsinki and particularly Eindhoven. Manchester holds an intermediary position, as well as Vienna and Leipzig. At the bottom, we found Lyons and Rotterdam, where actors act relatively independently. More specifically, for each cluster, we have focused on regional co-operation between firms and education institutes, among education institutes and among firms and research institutes.

Links among firms and education institutes. In Figure 4, several degrees of strategic interaction between the business community and the educational institutes are illustrated. At a basic level, the universities provide trainees and future staff for the cluster firms. In this respect, we found that the match between education supply and the needs of the cluster differ widely among the cases. In Amsterdam and Manchester, university education is ill-adapted to the needs of cluster firms. To a lesser degree, this holds also for the health clusters of Vienna and Lyons: the firms' representatives complain about a lack of entrepreneurial skills among students and a too one-sided emphasis on old-fashioned scientific education. The more strategic involvement of cluster firms with the university is depicted in the higher layers of the pyramid. Cluster firms can participate in education programmes (this happens, for example, in Helsinki and in Munich), use the university for vocational training or PhD projects, education for their staff, finance chairs (Philips in Eindhoven) or sponsor education programmes.

Strategic linkages among education institutes. In most of the clusters, these are weakly developed. In Rotterdam, three institutes offer media or media-related education on several levels, but the programmes are not compatible. A similar situation prevails in Leipzig. In Helsinki, the potentially complementary universities function in almost complete separation from each other. Our conclusion is that the prevailing 'island mentality' of many institutes means missing chances for cluster development. More co-operation—for instance, in joint marketing of the city as the educational centre for a cluster, or in matching programmes on several levels—can increase the inflow of young tal-

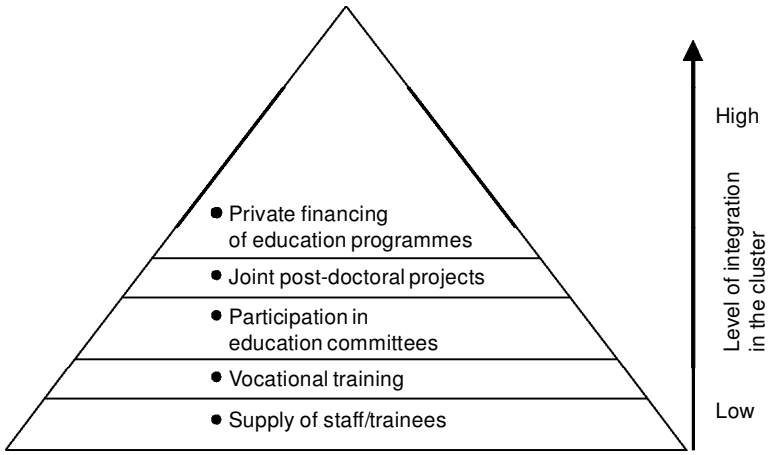

Figure 4. The embeddedness of education.

ent into the cluster, and thus strengthen its position in the future.

Strategic links among firms and public research institutes. For research, just as for education, a pyramid can be drawn up that indicates the level of strategic interaction between cluster firms and research units (see figure 5). At a fairly low interaction level, firms may incidentally outsource research, or engage in discussion/research platforms with a university. A good example is found in Eindhoven, where the university is involved in a platform on embedded systems. At a more strategic level, a university may have more value for a cluster. For instance, the engagement of universities in longer-term contract research and licensing for cluster actors may strengthen the competitive position of firms that co-operate with the university. This holds particularly for 'research-intensive' clusters (the health cluster of Vienna and Lyons, the mechatronics cluster in Eindhoven and telecoms in Helsinki). Fruitful combinations emerge readily where the more fundamental research activities of the university are a very valuable complement to the applied research of firms.

The highest level of integration we found in the case studies was the joint research centre set up by the University of Vienna and Boehringer–Ingelheim Austria. Illustrative of the importance of universities for firms is the strategy of the expanding telecoms multinational Nokia of locating its new research institutes (throughout the world) in the close vicinity of universities. For the marketing efforts of local governments to attract new firms, this implies that universities in the region should be regarded and treated as an important location factor. An important observation is that the benefits of firms–university interaction accrue to the university as well: interaction generates financial resources, helps to focus research activities on matters that are relevant for business or society and thus entails a more efficient spending of (public) money. It may also increase the quality of the research, since the demands of the market are generally high. In Lyons, where university–business interaction is at a very low level, the scientific discoveries of universities often appear useless for the business sector. A major problem hampering fruitful interaction—not only in Lyons but in virtually every cluster—proves to be the cultural difference between the business sector and universities in terms of objective orientation and time-span of activities. Although university-related policies are in most cases made at a national level, there might be a role for urban government to break these barriers: the potential economic spin-offs of

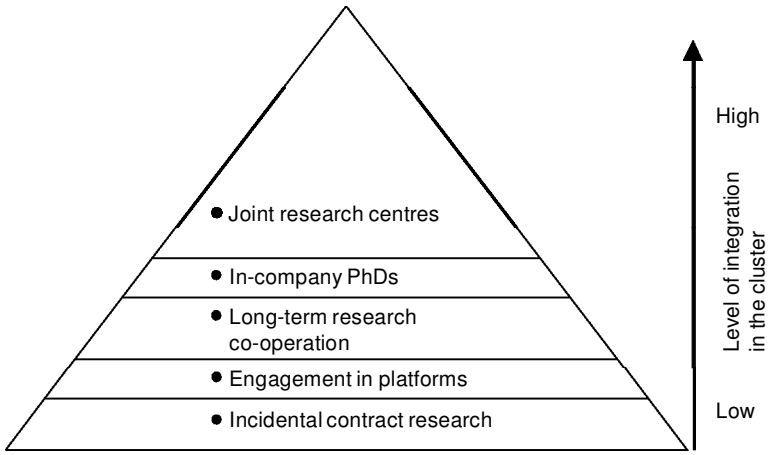

Figure 5. The integration of firms and research institutes.

university–industry co-operation for the region can be high.

In sum, the principal benefit of strategic interaction (at all levels) in a cluster is that it allocates resources more efficiently as it allows for specialisation. Additionally, it helps to 'tie' (international) firms to the region. In the face of mergers, acquisitions and rationalisations in many sectors (notably electronics, automobiles and pharmaceuticals), an international firm is much more likely to remain in the region when it is firmly embedded and fledged. An example is ASMlithography (equipment for chip production) in Eindhoven. As this strongly networked firm is very dependent on suppliers in its vicinity, its propensity to relocate is small. Another example is Boehringer–Ingelheim, a German pharmaceutical firm with a large research facility in Vienna, which has very close ties with the University of Vienna.

Levels of new firms creation. New firms in the cluster create dynamics, as they offer employment, create value added and may act as useful suppliers for existing firms in a cluster. Particularly when active in expanding markets, new firms may grow very rapidly and add even more to the cluster. New firms are started from several sources: from educational institutes, existing firms, universities (researchers who commercialise a scientific discovery) or other educational institutes. We found different levels of new firm creation in the several clusters. The clusters with the highest figures are Eindhoven, Helsinki and Munich. Rotterdam, Amsterdam and Manchester hold an intermediate position. At the lower end, we find Leipzig, Lyons and Vienna. We found that the level of new firm creation depends on the type of cluster, the degree and level of starter support and the general attitude towards entrepreneurship. In the medical clusters (in Vienna and Lyons), to set up a new firm—for instance, in biotechnology and medical technology—is very difficult because of strict regulations, the strong vested interests of existing (multinational) companies and a lack of incentives. In Vienna, for instance, hospital staff have no incentive to develop new products, as any patent benefits accrue to the city—the owner of the hospitals—and not to the inventor. In Lyons, more than in other clusters, we found that the huge cultural and mental gap between the universities and the business world seriously hampers the development of spin-off companies from the university. In the field of media (particularly new media), it is much easier to start new business, because of less regulation, fewer requirements in terms of scale, technology and capital, and a less mature market.

We found several types of support policy

for start-ups. A very integral approach was found in the starter facilities in Munich and in Helsinki, that offer not only office space and all kinds of support, but also offer starters' access to networks of established firms in the region. The concept of 'twinning' new firms with existing ones is also developed in Eindhoven, where large firms contribute to a starters' facility, not only financially but also by sharing their knowledge and networks. In other clusters as well—for instance, in Vienna—large firms indicated that they benefit from the proximity of young, dynamic complementary firms, and are willing to invest in them with several resources. In Rotterdam, Vienna, Leipzig, Lyons, Manchester and Amsterdam, we found no cluster-specific support structures.

We conclude that effective support for starting firms should not remain restricted to financial support and space provision, but should become more integral and more targeted. This implies that a starter-up policy should not be a matter of public agencies only: precisely the knowledge, experience and networks of existing firms can make a starter policy successful and should be used to the full.

5.3 Organising Capacity

The final element that we presented in the analytical framework as one of the factors contributing to the development of clusters is the degree of 'organising capacity' regarding the cluster. Previous research (van den Berg, Braun and van der Meer, 1997) has identified several factors that contribute to organising capacity in cities. In this investigation we have investigated: whether the urban management has a vision and whether there is a strategy regarding the development of the cluster; the extent to which cluster actors are involved in the making of cluster policies; and, the extent to which there is political/societal support. Table 3 shows the scores of each of the city(cluster) cases. These scores should be treated with care: they are not based on hard data analysis, but form an indication on the basis of an evaluation of the policy documents of the cities and expert interviews in both the public and private sectors.

Presence of an integral cluster strategy. Do the cities have an integral target cluster strategy, and to what extent does having a strategy contribute to cluster development? Amsterdam, Munich and Eindhoven have the most integrative strategies. The city of Amsterdam has a clear vision of and strategy for the tourist cluster, broadly supported by key actors in the cluster itself. Eindhoven has made the promotion of networking and partnerships in the region a leading principle in the region's economic policy. This is particularly important for the mechatronics cluster in which the combination of different technological disciplines is essential. In the case of media in Munich, it was the Freestate of Bavaria that developed a policy favouring the media cluster. Ten years ago, the city of Munich was not very supportive of the cluster, but that attitude is changing with positive initiatives such as the Munich Technology Centre as a sign of the new strategy in the city. The approach to the cultural industries in Manchester is also changing. Culture and cultural enterprises have been given a place in the region-wide regeneration strategy, with Manchester City Council now working on a policy scheme for tailor-made support to cultural business in the fields of design, media, multimedia and popular music. Lyons has developed an integrated vision of the health cluster with five concentration poles; however, there is no clarity on the development direction of these focal poles. In the other cities, a clear, fully balanced vision of and strategy for the development of the cluster as a whole is yet to be developed or is in progress (Vienna, Rotterdam, Leipzig and Helsinki). The experiences of the cities illustrate that some successful clusters are supported by an integral vision of the development of the cluster in the context of the local and regional economy. Particularly from the Helsinki case, it may be concluded that the absence of a regional vision or strategy does not hamper favourable cluster de-

Table 3. Indicative scores of the case clusters on organising capacity

City (cluster)	Amsterdam (tourism)	Eindhoven (mechatronics)	Helsinki (tele-communications)	Manchester (cultural industries)	Leipzig (media)	Munich (media)	Rotterdam (media)	Lyons (medical)	Vienna (medical)
Presence of vision/strategy	+	+ +	—	0	0	0	—	+ +	—
Involvement of cluster actors in policy-making	+	+ +	0	0	0	+	—	0	—
Political/societal support	0	+	0	0/+	+ +	+	+	+	0

+ + very strong; + strong; 0 moderate; — weak.

velopment. However, to use fully the growth potential in the longer run might call for a specific cluster strategy. There is certainly a case for public leadership in cluster development, to establish missing links in the clusters, to promote new technology or to create incentives for co-operation.

Involvement of cluster actors in cluster policy making. To what extent are cluster actors involved in policy-making regarding the cluster under consideration, and to what extent do they contribute to the quality and effectiveness of policies? We found high levels of private involvement in Eindhoven, Munich and Amsterdam; and low levels in Rotterdam and Vienna. The other cities hold an intermediate position. In Rotterdam, lack of strategic interaction between the city departments and the business community has resulted in ineffective *ad hoc* policies: several large real-estate projects in the field of media have been developed by the city without having consultation with private businesses. In Manchester, the strategic contacts between the city and the cultural industries could be improved as well. The city's cultural industries are an economic factor as well as a source of creativity that the city government could use in the marketing of Manchester. Lyons serves as an example of good co-operation: a medical cluster strategy was drawn up under the leadership of the Chamber of Commerce, but in very close co-operation with the central hospital organisation, the medical faculty of the universities, the pharmaceutical industry and local and regional government. In Helsinki, the establishment of structural consultation between key figures in the Helsinki club (a club of leaders in the metropolitan area, for the public and the private sectors) might lead to efforts to overcome the lack of a metropolitan vision with regard to the telecommunications cluster. The strategic interaction in the mechatronics cluster in Eindhoven has been strongly encouraged by the Stimulus Programme leading to public and private investment in the Twinning Centre, whose aim is to accommodate young entrepreneurs and twin them with the expertise of senior business people.

It can be concluded that public–private co-operation is a prerequisite for the development of effective and efficient cluster policies. 'Interactive policy-making' is needed in the marketing of the cluster, in attracting new firms, in helping start-ups and in all other aspects of cluster policies, to make optimum use of the knowledge and resources of the existing actors in the cluster. This also implies that civil servants involved in cluster policies need to be well educated and have sufficient 'feeling' with the cluster.

Political and societal support. How important are political and societal support for cluster development? We found that clusters with growth potential are helped by well-developed political and societal support, and that lack of support can be a threat to growth possibilities for the cluster. One of the clearest examples is the case of tourism in Amsterdam, where tourism causes inconvenience to inhabitants, in particular for those in the city centre. There is still enough political and societal support, but the challenge for policy-makers is to sustain support as the cluster continues to grow. In Leipzig, the promotion of the media sector is supported wholeheartedly in political circles and can count on support from the population as well, since unemployment is still a major problem for the city in transition. In Vienna, the negative attitude of the general public towards gene manipulation hampers (public) investment in starter facilities in biotechnology, one of the most dynamic parts of the health cluster.

6. Final Remarks

Large urban regions throughout Europe are seeking to capitalise on new growth opportunities. In this paper, we have tried to analyse and compare the development of different kinds of growth clusters—localised networks of specialised organisations—in urban regions. The cluster perspective, with its focus

on local interaction and innovation, proves useful as, increasingly, economic activities cross the boundaries of traditional economic sectors and innovations are generated in interorganisational settings. We found strong evidence that, despite the emergence of global networks, many networks have a strong local dimension, due to the importance of 'cultural proximity' in strategic relations, even though the actors in the clusters seem to thrive in the global economy as well.

The investigation shows that, for any type of economic activity, the generation of new value added and employment growth should be seen in the urban context: the potential of individual cities to benefit from growth sectors depends not only on the 'autonomous' growth of that particular sector, but also on the initial strength of that city in that sector, and on the quality of urban policies. Other factors include the quality of life that a city can offer—to attract appropriate staff—and its accessibility. This limits the capacity of ambitious cities to 'build' growth sectors from scratch and asks for policies that are resource-based—i.e. based on a thorough evaluation of the cities' strengths.

Increasing urban competition in Europe urges cities to make optimum use of their resources. In this light, the stimulation of networking and clustering can be an effective means the better to use resources that are dispersed among many actors. This can be done by supporting cluster institutions, investing in cluster-specific infrastructure or supporting informal networking. In addition, cluster-oriented policies are a means of tying increasingly mobile firms to the region by embedding them strongly in regional networks.

Note

1. Eurocities is the association of European metropolitan cities. It currently represents 90 large and medium-sized cities in 26 European countries. One of the aims of the network is to promote the exchange of experience and best practice between city governments.

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