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Driving factors for cluster development - Which kind of spatial rootedness and change?

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Abstract

Driving factors and mechanisms for cluster development have often been investigated based on the standard cluster approach as conceptualised e.g. by Michael Porter. These studies have revealed certain insights regarding the role of local entrepreneurship, factor conditions, demand, and related industries in supporting clusters. However, such factors were analysed often from a static competitiveness perspective, and they were often seen as rooted in a region or part of an overly schematic local-global pattern. We suggest instead that driving factors of cluster development coexist at several spatial scales such as regional, national, European and global levels. We also argue that specific factors change in their importance for firms and for clusters over time, and that these changes are industry- and knowledge base specific. Relying on insights from cluster life cycle-, evolutionary- and knowledge base approaches among others we investigate changes in driving factors for cluster development and their relationship to different geographical scales. We provide some answers to these questions by comparing the environmental technology sector of Upper Austria and the New Media sector of Vienna, industries that differ in their knowledge bases and their spatial rootedness.

1) Introduction

Clusters have been a prominent topic in research on regional development and competitiveness for the past two decades. They are defined as interconnected firms and institutions in a specific field which are also geographically concentrated (Porter 2008). Studies undertaken have explored cluster competitiveness and performance, networks, innovation and knowledge relations (Baptista and Swann 1998, Bröcker et al. 2003, Braunerhelm and Feldman 2006, Karlsson 2008, Asheim et al. 2011, Tödtling et al. 2013). More recently their long term development and transformation has raised attention with life cycle- and evolutionary models as conceptual backgrounds (Swann et al. 1998, Bergman 2008, Sölvell 2008, Menzel and Fornahl 2009). However, there are still considerable knowledge gaps as to the driving forces and factors for cluster development and to the relevant spatial scales in this context. Dominant theories have been stressing supply and demand factors, related industries and networks, among others. However, factors were analysed often from a static competitiveness perspective, and the geographical focus has been strongly placed on the respective local area or region or analysed from an overly schematic local-global perspective (Bathelt et al. 2004). We suggest instead that driving factors of cluster development are nowadays often the result of interdependencies at several spatial scales including regional, national, European and global scales. We, furthermore, argue that the specific pattern changes over time from early to later stages of cluster evolution (Martin and Sunley 2006, Bergman 2008, Menzel and Fornahl 2009) and that it depends on the type industry and knowledge base (Asheim et al. 2011). Based on cluster life cycle- and evolutionary theories, we are going to investigate, therefore, to what extent factors for cluster development change in their importance over time, and to what extent they have been shifting between geographical scales during cluster evolution. By "scales" we refer to different geographical levels and institutional contexts relevant for cluster development such as region, country, European and global levels. In the paper we investigate and compare the Environmental Technology sector of Upper Austria (ET) and the New Media sector of Vienna (NM) in this regard. We have selected these cases since they represent different knowledge bases (predominantly synthetic and symbolic knowledge bases respectively) and region types (industrial and metropolitan). In addition, both sectors are growing industries that have emerged from existing ones. For these reasons they appear to represent good cases for studying cluster development from a multi-scalar perspective. Environmental Technologies in Upper Austria have emerged in the 1970s from traditional manufacturing industries in the region such as materials, machinery and engineering, and the sector has been growing strongly since the 1990s in response to rising environmental problems and -demands. The cluster focusses on technology areas such as energy, waste and pollution and is driven by regulations at national and European levels. New Media firms in Vienna are to a large extent small and micro firms that emerged and grew since the Mid 1990s. Creativity and symbolic knowledge play an important role in these service sectors, making companies more reliant on the local cultural milieu and networks. At the same time, however, there is a strong need and pressure to tap into global knowledge bases and networks, and to adapt such knowledge for local applications and markets. By comparing the two cases we want to find out to what extent driving factors for cluster development and their changes are industry- or region-specific, or of a more general nature.

In the following section 2 we start with a review of conceptual literature to the development and evolution of clusters. In section 3 we give some background to the investigated industries and cases. And in section 4 we present empirical findings from the company interviews in the two industries

and regions. Section 5, finally, draws some conclusions and will relate findings back to theories used.

2) Conceptual approaches to the evolution of clusters and driving factors

The purpose of this section is to deal with key theories for understanding cluster development and to identify factors that are relevant for their emergence, growth and evolution. One of the most popular approaches to the **development and of clusters** has been provided by **Michael Porter** (1990, 2008). He has focused on the factors that help to explain why firms in clusters are more competitive than those in non-clustered locations, or why some clusters perform better than others. The factors Porter refers to in his well-known Diamond-model are factor conditions (ie the quality of inputs such as qualified labour, R&D, risk capital), demand conditions (sophisticated customers), related firms and support organizations, and the context for firm strategy and rivalry. Although there is a role for policy in upgrading the cluster diamond and also for cooperation among actors, he clearly puts the emphasis on the propelling force of competition among cluster firms. Porter's approach is illustrative and useful for our frame, however, it lacks a more systematic dynamic view of cluster emergence, growth and transformation over time.

Menzel and Fornahl (2009), Swann et al. (1998) and Bergman (2008) provide such a dynamic view in a **cluster life cycle approach** (CLC). Clusters are said to move through a set of stages (emergence, growth, sustaining, decline, rejuvenation) that show differences in local technological heterogeneity, and in localized learning and innovation capabilities of firms. Key elements and drivers are actors, networks and institutions that may be inside or outside the cluster, the industry or the region. Among the actors we find firms, support organisations and policy actors. Networks relate to the density and quality of interactions. Institutions include the regulatory setting, and the formal and informal rules that are shaping the behaviour of actors. Driving factors vary by stage, i.e. the factors relevant in the emergence stage differ from those in the growth and maturity stage. The exact beginning of clusters is often hard to identify because they may have various historical roots. The authors hypothesise that "clusters are established in those regions where the knowledge bases of companies converge around technological focal points" (Menzel and Fornahl, 2009:231). The emergence stage is characterized by start-ups and spin-offs, few and technologically diverse companies, and a supportive science and skills base. In the second stage we observe firm growth, an increasing number of new firms and a specialization of the cluster. But there is also a shake-out of companies, and a decreasing heterogeneity of knowledge. A more focused development leads to the emergence of a dominant design, and the cluster demonstrates a clear structure, getting close to the technological frontier. There is a growing density of companies and institutions, and the cluster offers possibilities for customer-supplier relations and innovation networks. The third stage - sustainment - is characterized by a relatively stable state and dense networks. External connections, however, may bring in new knowledge and keep networks open. Thematic boundaries are shifting incrementally and the cluster is shaping increasingly its regional environment. In the fourth stage of the cluster – decline – we find a decrease in the number of firms and employment, firm failures, lay-offs and closures. Too rigid networks and knowledge relationships might result in a "lock-in" (Grabher 1993, Hassink 2007). The region then 'lags behind' other global regions in the same industrial fields. Under certain conditions clusters might be able to transform and renew themselves as their companies integrate and apply new knowledge and technologies, and they may enter new growth phases (Tödtling and Trippl 2004, Trippl and Tödtling 2008). Such stage characteristics might

be difficult to identify in this ideal-typical form, however, and indeed there might be few clusters in reality that exhibit all of them (Martin and Sunley 2006, 2010). The movement of a cluster through a life cycle is the result of internal cluster elements and activities as well as of external factors. Of key importance is the heterogeneity of knowledge and the way this is exploited.

The **Evolutionary Economic Geography approach** (EEG) also helps to understand the emergence and evolution of clusters in particular regions. Industries are said to emerge from and follow certain paths that are rooted in pre-existing industrial and institutional structures of regions (Martin and Sunley 2006, 2010). In the centre are evolutionary processes of firm variation and -creation that are related to already existing industrial trajectories. There is a co-evolution of firms, technologies and supporting institutions that leads to a certain fit among them. External shocks (e.g. market- or technology shifts) can change such paths and lead to restructuring or rejuvenation. Frenken and Boschma (2007) and Boschma and Frenken (2011) have suggested that often those industries emerge and grow that are in their knowledge base related to other existing sectors in the region. Competences can be transferred from old to new sectors e.g. through the branching of firms, spin-offs, and the mobility of entrepreneurs or of qualified labour. Such situations of "related variety" are regarded as more favourable for industry performance than specialization or unrelated diversity. Factors shaping cluster development according to the EEG approach, thus, are pre-existing sectorial and firm structures, technological competencies, and institutional settings including rules, habits and routines leading to specific development paths. These may be interrupted or changed through external shocks such as radical new technologies, or global market shifts among others.

The **knowledge base approach** helps to understand how specific types of industries innovate, which kind of knowledge they predominantly use and where they are drawing their knowledge from (Asheim and Gertler 2005, Asheim et al 2011, Tödtling et al. 2013). It argues that knowledge and innovation are of key importance for cluster performance and development, and that knowledge bases and innovation processes differ between sectors (SAS: Synthetic, Analytic and Symbolic Knowledge Base). Although there are usually mixes and combinations of knowledge bases in industries (Strambach and Klement 2012), we find often a predominating one. Sectors based on analytical knowledge rely more on scientific knowledge, frequently of codified nature, interacting with universities and research organisations. Sectors based on synthetic knowledge (such as Environmental Technologies) usually recombine existing knowledge, using both codified and tacit forms thereof and they interact more with other firms from the value chain. Sectors based on symbolic knowledge (such as New Media) use symbols and artefacts in their innovation process, drawing on both local and global sources and networks. Factors shaping cluster development according to this approach, thus, are sector-specific knowledge bases, multi-scalar knowledge networks, and conditions for innovation within the region and beyond.

With regard to the latter aspect, the **innovation systems approach (RIS and NIS)** offers additional insights. It focusses on the conditions for innovation in a region or country, emphasising the role of knowledge organizations, universities, schools, and intermediaries, as well as interrelation of clusters and industries in such territories. There is a strong role of formal and informal institutions as well as of government bodies (Cooke et al. 2000, 2004, 2007; Doloreux 2002; Lundvall and Borràs 2005; Tödtling and Trippl 2005,). By including the broader set of industries and knowledge organizations of a region the approach helps to understand also horizontal or cross industry effects such as the branching of industries or clusters, diversification or the emergence of new industries or technology paths (Tödtling and Trippl, 2012).

Which geographical scale of driving factors?

The "scale"-dimension of driving factors for cluster development has often remained at an implicit level and used in an unclear or flexible way in the presented approaches. Porter, e.g. refers to clusters as being a localised phenomenon that benefits from various advantages of collocation. This includes local advantages regarding factor inputs, sophisticated demand, supporting industries, and knowledge flows and innovation. However, he is less clear about the more specific geographical scale of business environments and what „local" actually means. In his and related cluster literature relevant spatial levels reach from local labour markets and metropolitan areas to regions, provinces and states depending on the cluster dimension of interest. Similarly, Menzel and Fornahl (2009) speak of factors that are internal or external to the cluster (as a localised industrial setting) or the region (a specific territory). There is not much distinction of the "external world", but some indication that the relevance of internal and external environments changes during the cluster life cycle. Boschma and Frenken (2011) in the related variety approach refer to a regional level that in the respective empirical work often relates to administrative (macro)-regions such ad provinces Boschma and Iammarino (2009).

As for the knowledge base approach, Moodysson et al. (2008) have emphasized local-global patterns of knowledge interactions in industrial clusters along the lines of the local buzz and global pipelines concept of Bathelt et al. (2004). The argument is that the different knowledge bases (SAS) have particular geographies of knowledge relationships. Companies that rely on a predominantly analytical knowledge base exchange more often codified knowledge and are found to be more globally oriented, whereas companies relying on a symbolic and synthetic knowledge base are more often using and exchanging tacit knowledge, and are more tied to the local cultural context in comparison. Subsequent empirical studies have been using this approach in a multi-scalar and comparative perspective for analysing knowledge relations in different types of clusters (e.g. CRA project: Asheim et al. 2011, Tödtling et al. 2013). These have shown that knowledge sources of firms are in fact distributed at several spatial scales, including regional, national, European and global and confirmed that the patterns are shaped by the respective knowledge base. However, these studies also have demonstrated that knowledge interdependencies are often less clear-cut than expected. E.g. for the synthetic knowledge base Moodysson et al. (2008) as well as Gertler and Wolfe (2006) see a high role for local learning and informal (tacit) knowledge exchange with local suppliers and clients, whereas Tödtling et al. (2012) have found that knowledge exchange in such sectors often takes place within the value chain on higher (national and international) spatial scales.

In the innovation systems literature we find a focus on territories that are characterised by certain institutional configurations and governance aspects. Much of this work has addressed either national innovation systems (NIS) or regional innovation systems (RIS) in an unconnected way (Bunnel and Coe 2001). A few studies relate these two levels and include also the international or European one, pointing out interconnections and complementarities (Cooke et al. 2000, Fromhold-Eisebith 2007). In such a „multi-level-approach" distinct institutional roles and policy competencies of regions, countries, and the European level for industrial development and innovation have been emphasised. Studies on regional innovation systems (RIS) (Cooke et al. 2000, 2004, Doloreux, 2002) focus on the particularities of regional industrial and institutional structures including dominant clusters and emphasise the interplay and often trust-based networking of regional firms with universities, research, education and knowledge transfer among others. The literature on national innovation systems (NIS: OECD 1997, Lundvall 2008) stresses the role of innovation-relevant regulations and

institutions that are specific to countries including public research organisations, RTD policies, innovation finance and -support, the national education system, and sector specific regulations, among others. At the European level the role of European programs and policies (e.g. the Framework programs), and of research networks has been pointed out (Edqvist 1997, Lundvall 2008).

Based on these considerations we argue that geographies of driving factors for cluster development can reach from local to global scales. Often they are not rooted in particular predefined levels or territories, but along a continuum from local to global interactions, such as relations to markets, suppliers and clients, or knowledge- and innovation networks of firms (Bunnel and Coe 2001). However, predefined territorial levels *do* matter, since the institutional and the policy dimension is usually tied to territories such as regions (provinces), countries (national states) and the European level. In the empirical section below we will use these territorial levels, therefore, for analysing the spatial dimension and respective shifts of driving factors for cluster development.

From these conceptual approaches we derive the following **conclusions for a framework** of factors relevant for cluster development:

- Cluster development can be understood as an evolutionary process that is indicated by start-ups, firm-growth, and the growth of employment and sales in a local cluster. 'Evolutionary' in this context implies that cluster emergence and growth are related to pre-existing industrial structures and institutional settings (Boschma and Frenken 2011), and that clusters evolve along particular paths that may show growth but also stagnation, decline or rejuvenation in certain phases (Martin and Sunley 2006).
- Driving factors are expected to change in their importance during cluster evolution as both the cluster life cycle model and evolutionary approaches have pointed out (Bergman 2008, Menzel and Fornahl 2010). In the emergence phase companies are said to rely partly on knowledge from related industries or from research organisations for developing new business models and products, and they often use their personal and social networks in order to overcome problems and barriers for the start-up process and for company development. The region is expected to be an important interaction space during this phase, since start-ups and spin offs are often geographically close to originating sectors, firms and organisations (Frenken and Boschma 2007).
- During the growth phase Porter´s diamond model (2008) seems to get more relevance, i e. the conditions for acquiring key inputs such as qualified labour, (risk-)capital and necessary infrastructure, the access to markets and sophisticated customers, and the availability of related firms and services. For some of these factors such as local infrastructure, a qualified workforce and tacit knowledge exchange the region has a high importance, for others such as markets, related firms (suppliers, clients) and formal innovation relationships higher spatial scales (national, European and global) increasingly matter. Although there is a certain tendency for the cluster space and driving factors to expand towards higher spatial scales in the course of cluster growth, this is not a "linear" movement. Factors that still tie the cluster to the region have to do with the qualified workforce and skills, and with the exchange of tacit knowledge and informal networking. For these latter aspects also sectorial and institutional contexts matter.
- Regarding the sectorial context, we expect the importance and spatial scale of factors to differ between types of industries and knowledge bases (Asheim and Gertler 2005, Asheim et

al. 2011). Whereas firms in industries with synthetic knowledge base are expected to rely to a large extent on suppliers, clients, and service firms as knowledge sources for innovation at various spatial scales, companies in "symbolic industries" such as New Media are expected to rely more on local skills, qualifications and informal networks in their activities and innovations. However, due to their reliance on modern ICTs and the internet also global communities and relationships matter to an increasing extent.

- Finally, cluster development and innovation are shaped also by institutional settings in certain territories as in particular innovation systems approaches have pointed out (Cooke et al. 2001, 2004; Lundvall 2008). Relevant factors are the proximity to organisations for research, education and knowledge transfer, the existence of relevant policies and programs, as well as regulations that affect the respective sectors. As we have pointed out above, such institutional settings matter on several spatial scales, the regional level (RIS), the national level (NIS), and increasingly also at an international (European and global) scale.

We will try to evaluate the spatial rootedness of driving factors and their changes by investigating different kinds of data. (1) We will study the emergence, evolution and growth of the two clusters by using available documents, materials and a number of qualitative interviews with experts and policy actors in the following section three. Then in section four, based on semi-standardised interviews with companies we analyse (2) types of innovation processes and external knowledge sources, (3) factors for companies to locate and stay in the region, and (4) multi-scale factors for company- and cluster development in different points in time.

3) Cluster emergence and background to the cases

This section focusses on the factors that have supported the emergence of the investigated clusters and gives an overview and background to their development. It is based on a review of literature and of documents as well as on 10 qualitative interviews with industry- and policy experts in these two fields.

3.1 Environmental Technologies in Upper Austria

Environmental Technologies can be traced back to the early 1970s when pollution problems from basic industries spurred the creation of end-of-pipe products for their abatement (OECD, 1999; Weber 2005). During these initial years firms were selling to domestic markets to solve such problems, as in North-Rhine Westphalia in Germany (Hilbert et al., 2004). In the 1980s and 1990s the use of information technologies (IT) allowed environmental technology industries to shift towards more integrated, and process-oriented clean technologies and products. In the 2000s an integration of diverse technology areas such as IT, biotechnology, nanotechnology, and materials science into process-based environmental technologies could be observed, aiming at resource- and energy-efficiency and pollution abatement within the production process itself. These have been called 'sustainable' technologies (Weber, 2005; Frondel et al., 2007). At the regional level these processes were reflected in a convergence of environmental and high-tech industries, and the emergence of 'cleantech' clusters notably in Germany and in the US (Cooke, 2008). Societal challenges such as environmental pollution, unsustainable resource use and emerging resource scarcities, thus, played an essential role for the development of this sector. To an increasing extent regulations concerning

environmental standards were introduced, penalizing firms for not meeting them (Porter and van der Linde, 1995; Jaffe et al., 2002).

Some factors of growth in this industry are specific to the region. The roots of the Upper Austrian Environmental Technology firms are predominantly in engineering, machinery and instruments sectors and firms, based on their technical competencies, have been branching into these areas. These firms have applied and further developed existing capabilities to the production of environmental technology products. Relying predominantly on a synthetic knowledge base (i.e. innovating by recombining existing knowledge: Asheim et al. 2011) and a DUI mode of innovation (i.e. innovating by "doing, using and interacting": Johnson et al. 2002) firms have integrated environmental solutions into their product range, trying to gain competitive advantages through such innovations (De Marchi, 2012). The strongest areas in Upper Austria are renewable energy, energy efficiency, water and waste. Similar to the Ruhrgebiet in Germany (Hilbert et al., 2004), emergence and growth of these technologies has been triggered by pollution problems caused by manufacturing industries in the 1960s and 1970s. Contamination of air, water and soil by heavy industries prompted local activism for its reduction and control. VOEST, a leading global steel producer located in the region, has been one of the key polluters during the years of high growth in the 60s and 70s. Local protests pushed the firm and the industry towards the reduction of emissions and wastewater. Regulations and policies for pollution control in manufacturing were further factors gaining momentum during this period (Pirgmaier, 2011). Such regulations were implemented often at national and EU levels setting incentives for searching new solutions to reduce pollution. This created further demand for environmental technology products that firms in Upper Austria had the capabilities to produce. E.g. gas furnaces with reduced emissions were both manufactured and applied in local industries. Existing technological capabilities, supply chains and sophisticated local buyers (such as steel and engineering firms), stressed e.g. by Porter (1990, 2008), were, thus, essential factors for the emergence and growth of these new products and technology areas such as air purification and energy efficiency.

A key factor for the development of the Upper Austrian Environmental Technology sector, furthermore, has been also a well performing regional innovation system (Tödtling et al., 2011). The economy is based on manufacturing, with strengths in steel production, machinery, mechanical engineering, vehicles and chemicals, among others. Its regional innovation system (RIS) comprises universities, colleges and research organizations in different fields, although the number and quality of these knowledge organizations is clearly lower compared to Vienna. The region exhibits relatively high private (business) but low public R&D activities. However, there are intensive links between business and academia and the RIS appears to be well networked (Tödtling et al., 2011). This is partly due to support organizations such as the Upper Austrian Business Agency (TMG Group) as well as a number of cluster organizations. Highly qualified employees and a good skills base enhance the absorptive capacity and innovation capabilities of firms as stressed by Cohen and Levinthal (1990) and Zahra and George (2002) among others. With regards to knowledge generating organizations, the Environmental Technology Institute and the Energy Institute at the Johannes Kepler University in Linz, as well as the environmental technology institute at the technical college in Wels play an important role as knowledge providers for local firms. Nevertheless, the region is characterized by rather weak knowledge infrastructure compared to leading regions such as Vienna or Styria. This finding has been confirmed by qualitative interview partners, some of them even working in respective organizations. Furthermore, Upper Austria has two related cluster initiatives that are

offering a number of services to their member firms. The membership in both cluster organizations is open to outside firms and organizations as well, as complementary knowledge and competence from external partners are considered important for cluster development and innovation (Mytelka, 2000; Wolfe and Gertler, 2004; Gertler and Wolfe, 2006). These cluster organisations are key focal points for fostering horizontal platform-type linkages between relevant knowledge organizations and firms and for enhancing cluster 'openness' and branching into related industries (Cooke 2008, 2011).

3.2 Creative industries and New Media in Vienna

New Media is part of the wider group of creative industries that have been studied internationally for at least two decades not least because of their increasing role for growth and competitiveness in advanced economies (see e.g. Lazzeretti 2012, for Austria ZEW 2008, and for Vienna Ratzenböck et al. 2004). As regards the definition of this industry we follow Lazzeretti et al. (2008) differentiating between "traditional creative industries" (for example, printing and reproduction of recorded media, motion picture, video, television, architectural and engineering activities, creative arts, entertainment and museums) and "non-traditional creative industries" (such as software and computer services, scientific research and development, and advertising and market research) the latter including New Media products and services (Sinozic and Tödtling 2014).

Creative industries including New Media tend to develop and sell products and services by organising in temporary projects (DeFillippi and Arthur, 1998; Lorenzen and Frederiksen, 2008). Uncertain markets and demand make more stable structures expensive and risk. Interactions between skills (human capital) and work relationships (social capital) are important for participating in projects. At the local level, project-based work connects communities (Grabher, 2001:354). Projects are oriented towards client needs, and these influence the work organisation and interactions among creative firms. An important driver of inter-organisational interactions is technological diversity within projects. For example in advertising, client needs may not only refer to advertising but also to marketing and communication strategies. Because knowledge needs to be constructed through cooperation it depends upon social relations of the individual (Brown and Duguid, 1991:48). Work is done in communities that cross organisational boundaries. Projects in creative industries tend to be based upon, and over time create, stable communities and networks between individuals and organisations in the region and beyond (Sydow and Staber, 2002). These are tools to pass on learning experiences over time.

New Media are a relatively small segment of Vienna's creative industries which have a rich history, as Resch (2008) has demonstrated using Austrian national census statistics from 1910, 1951 and 2001. In 1910, the creative industries in Vienna (composed at the time of traditional creative industries, such as architecture, audio-visuals, arts, print and publishing, music, museums and libraries) employed around 200,500 persons. Between 1910 and 1951 Vienna lost its imperil role and political position in Europe, causing a decline in sectors such as graphics, fashion, design, museums and libraries. During the same period, spurred on by new technology and growing demand, the audio-visuals and music sectors grew. In the period from 1951 to 2001 some creative sectors went through dramatic growth phases (especially architecture, museums, libraries, advertising, architecture and audio-visuals, whereas graphics, fashion, design, print, publishing and music declined during this period. These never really recovered to the full size they enjoyed when Vienna was the centre of the Austro-Hungarian Empire. Most importantly, for the purposes of our study, this was also the period of the emergence of the global ICTs industry, and the start of New Media. Indeed, between 2000 and

2010, the sectors that have converged to form the New Media cluster in Vienna (including film and video, advertising, software applications, gaming and computer services) have grown by approximately by 40%, the most dramatic growth of all Creative Industries during that period. These sectors have also been the major focus of government subsidies in Vienna during this period (such as the programs “Departure”, and “Impulse”).

4) Factors of cluster development and innovation – a firm perspective

4.1 Methodology

This section compares cluster development and innovation for the two industries and regions and it investigates relevant factors from the perspective of firms. Empirically it is based on 55 semi-standardised company interviews and other sources. An interview guideline was designed based on the conceptual framework of the project[1], and a combination of theoretical and statistical sampling was used to select the firms. Only companies having operative functions in production or services were selected, those involved only in sales or distribution, were excluded.

The environmental technology cluster in Upper Austria was chosen because it represents one of the leading and dynamic clusters in Austria in this sector. A sample of 30 companies was drawn from the populations of two cluster initiatives in the region in this field, the eco-energy cluster (164 firms and organisations as members) and the environmental technology cluster (136). The New Media cluster in Vienna, a sub-sector of creative industries, was selected because it is a dynamic cluster that is at the interface of different technology areas and that seems to be both locally and globally connected. It was difficult to statistically define the New Media sector because it is rapidly changing and NACE codes are not always up to date. We relied therefore on previous studies to this topic such as Lazzeretti et al (2008), and included the following NACE categories: advertising (7311), film and video production (5911), selected ICTs (7311; 6209), publishing (1812). Based on these criteria, the New Media cluster in Vienna had a total of 480 firms in 2013, from which we interviewed 25 firms. Firm interviews were carried out face-to-face with general managers, and lasted between one and two hours.

In the following, we characterise the sample firms in terms of age, cluster stage, clients and geography of markets (4.2). This should help us to better understand the companies and clusters investigated in terms of history and present state. In 4.3 their innovation activities and –relationships are analysed. This helps us to evaluate knowledge sources and the geographical reach of innovation interactions. Factors affecting cluster evolution are addressed more explicitly in the subsequent sections. In 4.4 we investigate factors indicated by the companies as important for locating and for staying in the region. In 4.5 we focus on the factors considered as relevant for company- and cluster development.

[1] The framework and interview guidelines were developed within a cooperative European research project („Cluster Life Cycles“) supported by the European Science Foundation and the Austrian Science Fund (FWF: see Acknowledgements).

4.2 Characteristics of sample firms

Comparing the two samples in terms of company age and -size, firm- and cluster stage, and markets we find some differences that also matter for the spatial rootedness of the two clusters. As regards the **age of firms,** Figure A1 in the Annex demonstrates that both sectors are rather young with most of the interviewed companies starting after 1990, but the Environmental Technology sector in Upper Austria has older roots as was pointed out in section 3. **Cluster stages were** explored both for the firm- and cluster levels (see table A1 in the Annex). For the Environmental Technology cluster we find a dominance of the growth phase (stronger even at the cluster level), but there are also about 1/3 of companies that indicate to be already in the sustainment phase. For the New Media sector Vienna we can observe a segmented structure. On the one hand we find a high share of firms considering themselves or the cluster to be in the growth phase. On the other hand there is an even higher share that indicates to be in the transformation phase. This pattern might be explained by a high speed of technological and/or organisational change, and as a consequence relatively short product life cycles in this sector. As regards the **size of companies**, we find that companies in the Environmental Technology sample are larger with 37% of them having more than 50 employees (table A2 in the Annex). The fact that we find also many micro-firms in the ET sector indicates a vital start-up process, as in fact is shown also in figure A1. The New Media firms are to a high extent micro-firms and small firms. This is due to the low capital intensities and lower entrance barriers in this sector in comparison to Environmental Technologies. In addition, New Media firms often work in project based network, so small size is not necessarily a disadvantage for doing business.

The **structure of clients,** overall, is quite similar in the two sectors (table A3 in the Annex). 77-78 % of the sales go to the business sector. The main difference is that in particular medium and larger Environmental Technology firms are also oriented to the public sector as client (up to 23 % of sales), whereas more than 80% of sales in New Media firms (except the Micro firms) are going to other firms as clients. This underlines the role of New Media firms as business services with a lower importance of consumers and the public sector as clients. For the **spatial scale of markets** (table A4 in the Annex) we can observe that new media firms in Vienna are more oriented to the regional market (1/3 of the sales), whereas Environmental Technology firms in Upper Austria address relatively more the Austrian market (46% of sales). The global market is in both sectors still relatively unimportant.[2] There are also some differences in this regard between size classes: Smaller New Media firms tend to do business regionally and nationally whereas their Environmental Technology counterparts seem to concentrate on the national market. Interestingly, large Environmental Technology firms are still very active on their regional market (serving industrial firms and the public sector) compared to large New Media firms which expand their business to European clients.

[2] For the Environmental Technology sector Upper Austria this contradicts to some extent the findings of our previous study on this cluster that was based on WIFO data (Tödtling et al. 2014). There we found a stronger and growing importance of markets outside Europe since the 2000s.

4.3 Innovation and knowledge exchange

We expect the spatial rootedness of clusters to be strongly related to their types of knowledge- and innovation processes as it has been argued by the knowledge base concept (see section 2). Therefore we investigate how firms innovate, on which competencies they rely on, and with whom they exchange knowledge in the innovation process. The two sectors rely on quite different knowledge bases: Environmental Technologies are dominated by a synthetic knowledge base where existing engineering-, materials- and other competencies are combined for bringing forward innovations (Asheim and Gertler 2005, Cooke 2012). There may also be analytical inputs necessary for developing new materials, products or processes as will be shown below. New Media industries are strongly relying on symbolic knowledge (design, advertising) as well as on synthetic knowledge as e.g. in software and IT areas (Halkier et al. 2010, Lazzereti et al. 2008). Furthermore, in Environmental Technology the innovation process is propelled by new demands from industry and the public sector, stimulated by environmental challenges and public regulations. In New Media innovation is mostly customer driven where firms develop new designs and solutions for respective needs (Sinozic and Tödtling 2014). For this purpose firms team up with other firms and skilled professionals, often in the form of temporary projects (Grabher 2001). From table 1 we can see that in both sectors incremental improvements of products and services is the most frequent type of innovation with 77% of companies in Environmental Technologies and even 88% in New Media. This is rather typical for industries based on both synthetic (Environmental Technologies) and symbolic knowledge (New Media). As distinct patterns we find a higher frequency of products new to the market in Environmental Technologies (73%), whereas in New Media we observe more often changes of processes, strategies or organisations. Obviously, Environmental Technology has more "tangible" new products as outcomes, whereas New Media firms in contrast focus on new ways of organising and delivering their services to the clients. This is to some extent reflected in the core competencies of companies: For both sectors highly qualified employees are pointed out as key assets for innovation and competition by the companies. But Environmental Technology firms require first of all technical know-how, whereas New Media firms in addition rely on creativity, and design- and marketing competencies in order to achieve competitive advantages.

Tab 1) Types of innovation in Environmental Technologies Upper Austria (ET) and New Media Vienna (NM) (Environmental Technology: n=30; New Media: n=25)

Types of innovation	ET companies (% of sample firms)	NM companies (% of sample firms)
Introduction or improvement on products and services	77	88
Introduction of new product to the market	73	60
Use of new or improved process, component or material	73	76
Use of new or improved strategy	50	64
Use of new or improved organisational structure	20	56
Introduction of a new or improved marketing concept	40	40

These innovation patterns are to some extent reflected in the types of organisations for exchanging knowledge in the innovation process that the firms use at different spatial levels (table 3). There are some interesting distinctions between the two clusters. Overall, Environmental Technology firms in Upper Austria indicate relatively more external knowledge sources and partners (4.4 per firm on average compared to 3.5 for New Media in Vienna). This may as well have to do with the larger firm sizes in this sector. Larger firms tend to have more complex innovation activities and also more knowledge sources and partners (Tödtling et al. 2006). As regards the type of such organisations, Environmental Technology firms interact much more with public agencies (32% of relations) as well as with universities (25%). There is a broad spectrum of relevant public agencies in the region and in Austria, such as regulatory bodies, transfer and support agencies, etc. Whereas universities offer knowledge and competencies for developing Environmental Technology products and services, public agencies act as key customers, regulators and intermediaries on regional and national levels. New Media firms, in comparison, are clearly much more oriented to the firms in the same sector (45% of relations) or to clients (16%). This indicates strong interactions among New Media firms and a vital community that shares concepts and ideas in order to find solution for respective problems. Environmental Technology firms, in contrast, regard firms of the same sector with suspicion and rather prefer to be innovative by sharing ideas with their suppliers and clients. For New Media firms universities also play a certain role (20% of companies). This is true in particular for IT and software competencies and their role as suppliers of highly qualified graduates.

As regards the spatial scale of knowledge relations (table 2), we find for Environmental Technologies a vast majority of them at the national level (43%) and at the regional level (40%), i.e. there is a strong orientation of the firms to the regional (RIS) and national innovation systems (NIS). For the New Media we observe rather a local - global pattern, i.e. 40% of knowledge relations within the region and 30% at a global scale. The latter pattern might be due to the stronger use of ICT and the internet by New Media firms that allows them to take part in global networks and communities.

Tab. 2) Knowledge exchange in the Innovation process
Environmental Technologies Upper Austria (n=30)

	Regional.	National	EU	Global	Total	% of total
Suppliers	8	5	6	2	21	15,9
Clients	5	9	3	3	20	15,2
Firms of same sector	1	5	-	2	8	6,1
Firms of different sector	6	-	1	-	7	5,3
Universities	15	17	1	1	34	25,8
Public agencies	18	21	1	2	42	31,8
Total	53	57	12	10	132	100
% of Total	40,2	43,2	9,1	7,6	-	-

New Media Vienna (n=25)

Type of partner	Regional	National	EU	Global	Total	% of Total
Suppliers	0	0	0	3	3	3,5
Clients/customers	3	2	7	2	14	16,3
Firms in same sector	11	6	3	19	39	45,3
Firms in different sector	2	0	0	0	2	2,3
Universities	11	4	2	0	17	19,8
Government agencies	7	2	0	2	11	12,8
Total	34	14	12	26	86	100
% of Total	39,5	16,3	14	30,2	-	-

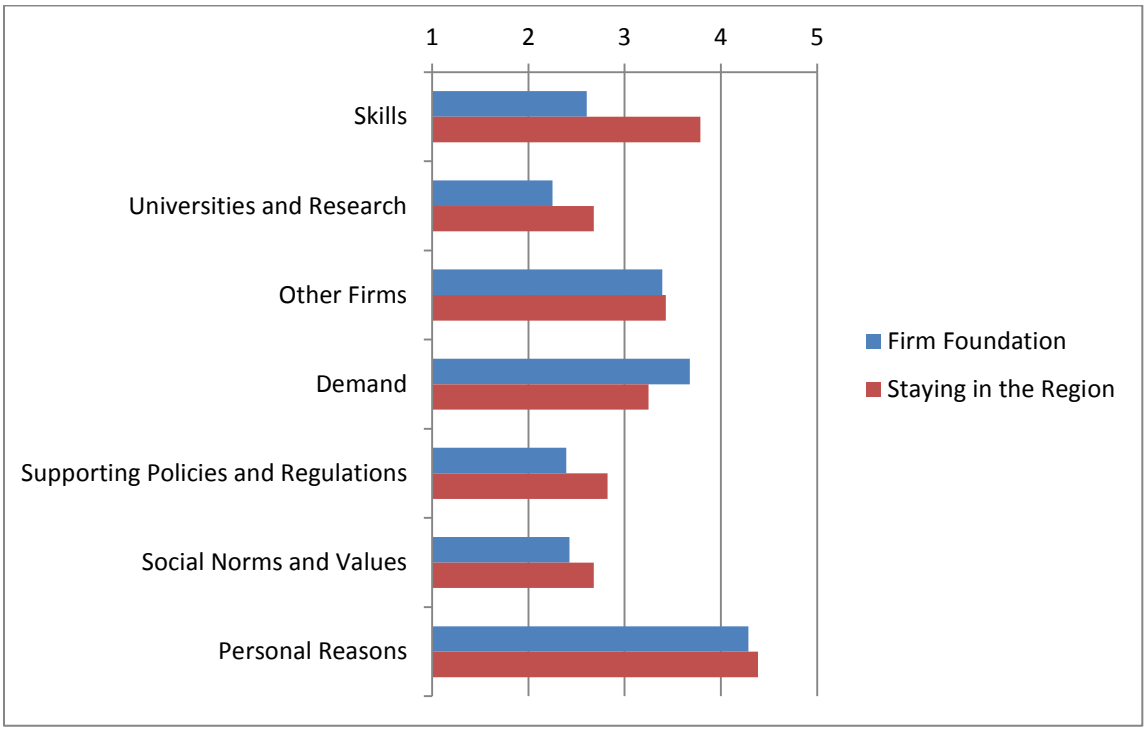
4.4 Factors relevant for locating and for staying in the region

Since we were interested in factors for cluster development from a life cycle and evolutionary perspective we were investigating factors for locating and for staying in the region, asking companies about their importance by using a 1-5 Lickert scale. From figure 1 we can see that the *location of companies in the region* has been dominated by personal factors in both sectors. This is basically in line with other studies on firm establishment that have shown similar results (Sternberg 2007, Tödtling et al. 2009). Also, regional demand and the existence of other firms in the sector as potential business partners in the region were considered as relevant by firms in both cases. This finding indicates a supportive role of an emerging cluster (i.e. vertically linked firms) for the foundation of firms. Demand was even more relevant for Environmental Technology firms, showing a strong regional market focus in the initial years. For New Media, in addition, skills are highly important for locating in Vienna. Unsurprisingly, New Media firms rely more on human capital and skills than on physical capital or material inputs than other sectors. The other factors listed were considered as rather unimportant by the investigated firms. This is in particular true for supporting policies and regulations (these might not have existed yet) and for the role of universities and research. Obviously, in the foundation stage companies were focussing on their core activities, i.e. producing / delivering the respective product or service with the help of their suppliers and on the market. Innovation factors were considered as less relevant.

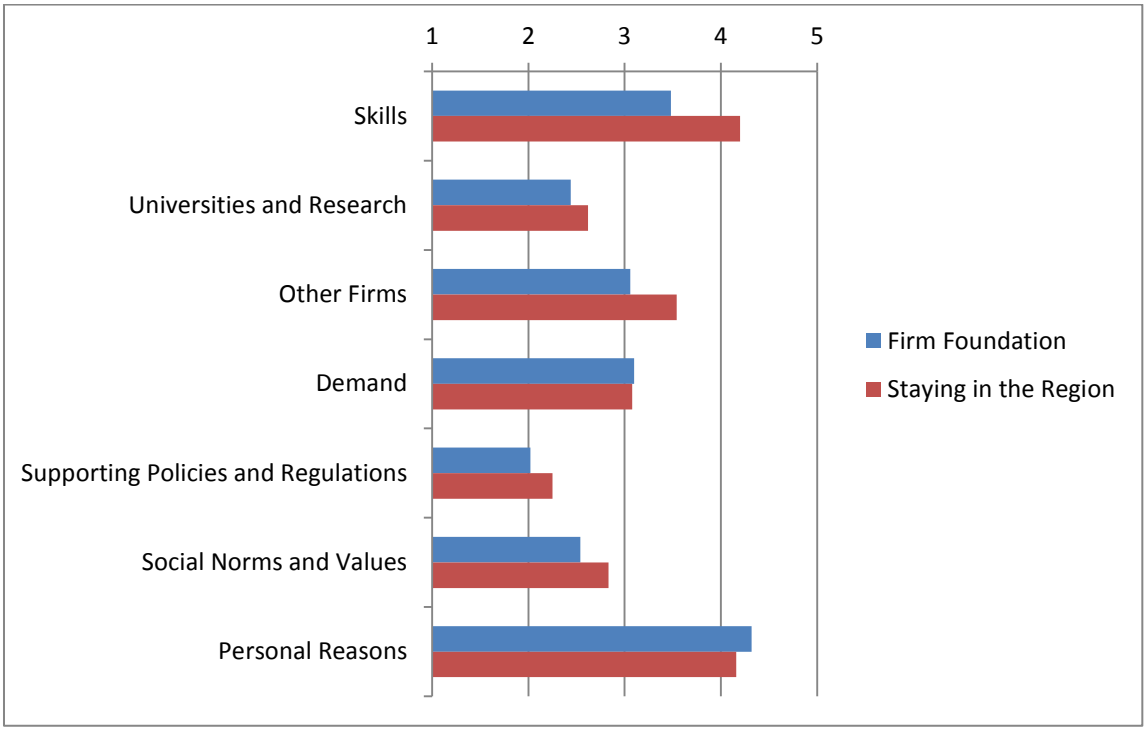
Factors for staying in the region have in general more importance in both clusters investigated compared to the factors for location. This indicates that firms have become more embedded into the region in many respects such as recruiting skills, links to university, supporting policies, and reliance on social norms. The exception here is “demand” that obviously relies less on the region but on markets at higher spatial scales as was shown above. In both clusters the strongest increase in importance can be observed for skills in comparison to the factors for location. This finding might be due to a growing sophistication of production and business processes, i.e. a growth of activities and functions such as marketing, management, innovation and R&D. This is reflected also in a higher relevance of universities and research, and of supporting policies and regulations. In particular, for New Media we can observe a growing importance of “other firms” along the value chain, i.e. suppliers and clients, indicating a process of cluster formation.

Fig. 1: Factors relevant for locating and for staying in the region
(1= low importance, 5= high importance)

Environmental Technologies Upper Austria (n=30)



New Media Vienna (n=25)



4.5 Multi-scale factors for company- and cluster development

In addition to the factors for locating and staying in the region we were focussing on the factors that were regarded as important for the further development of respective companies and of the overall cluster. We differentiated by spatial scale (regional, national and international) and were investigating these factors both for the past (i.e. 3-5 years ago) and for the present time by using 1-5 Lickert-scales again. As regards **factors for the development of companies** (figures 2 and 3) we can identify "skills" (i.e. qualified personnel) as most important for both cases. As to be expected these skills are highly localized, i.e. firms rely on the respective regional labour market, and they recruit skills form the Austrian labour market. The New Media firms in Vienna also draw talent from abroad, i.e. at an international scale.

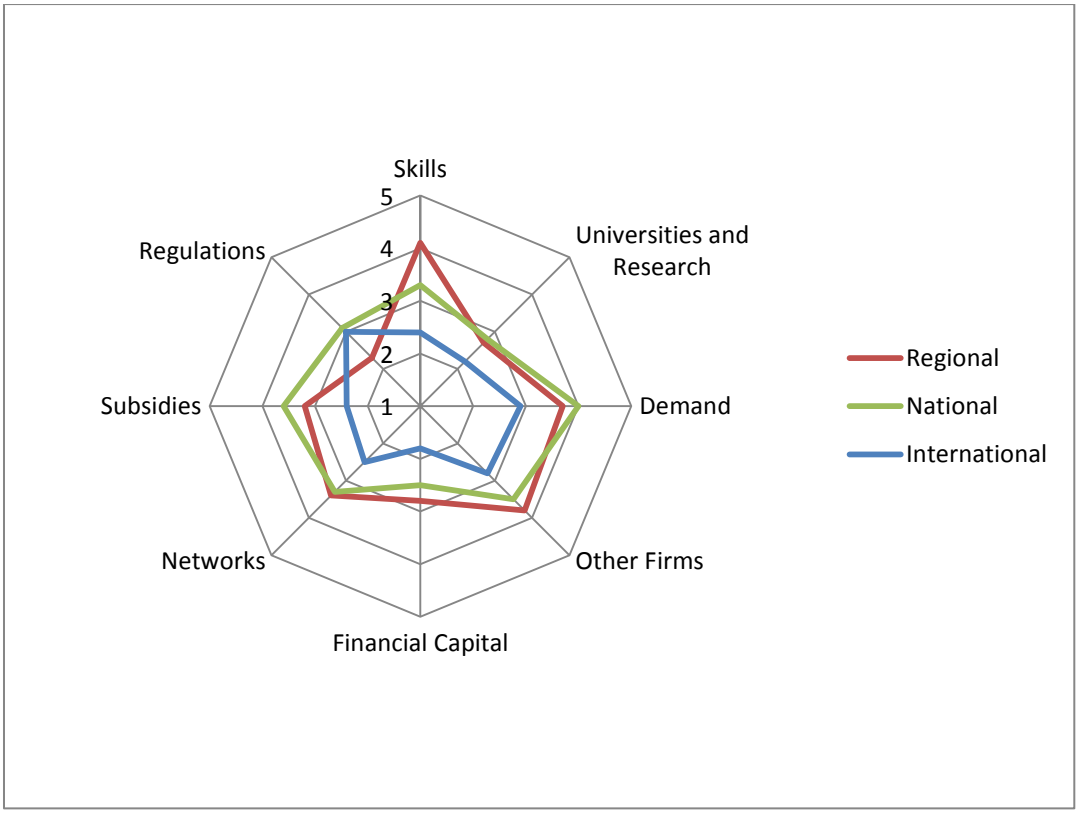
Other factors rated as important for the development of the companies are other firms from the sector or cluster indicating a supportive role of e.g. suppliers and services in the region and in Austria. Other firms on regional level are more important for the New Media sector than for the Environmental Technology sector. This finding might be due to frequent knowledge exchange with other cluster firms in Vienna as was reported above (section 4.3). In the time perspective we see for New Media in Vienna a higher importance of other firms at present than in the past and for both sectors a higher importance of other firms in the region and in Austria. Obviously, for firms in both sectors geographical proximity to potential business partners is supportive for their development. For New Media firms this factor has become even more important over time.

The same is true for "networks" (i.e. more durable relations to other firms and organisations) where we also can observe a higher importance of proximate links (regional, national) and an increasing importance over time. Obviously it takes some time to build up relationships and trust and we see rather more than less embedding into the region and the country in the course of firm- and cluster development. Network-links to international partners have become more important presently, so we see an extension towards multi-scalar networks in particular in New Media, but also in the Environmental Technology sector.

The factor "demand" seems to be more important for Environmental Technology firms than for New Media companies. For Environmental Technology firms we see a continuing strong importance of the national market, but also a shift from the regional to the international level. This is in line with findings from our earlier study based on the broader data set that also showed a clear shift towards international markets for Upper Austria Environmental Technology firms (Tödtling et al. 2014). Also in the case of New Media the factor demand that has shifted in importance from national to the international scale.

Subsidies are more relevant for firms in the Environmental Technology sector where previously regional and national ones have played a role and presently all three levels are relevant. This is due to the relatively high priority this sector receives within regional, national and EU promotion schemes. Regulations and directives were reported as having no relevance for the New Media sector (both at company and cluster level). They clearly had a higher and increasing importance for the Environmental Technology sector (both for the firms and the cluster), and they were more important at the international and then the national level. At the level of the region regulations play obviously only a minor role for the development of the firms and the cluster.

Fig. 2) Factors relevant for company development in Environmental Technologies Upper Austria
Factors *previously* relevant (n=30)



Factors *presently* relevant

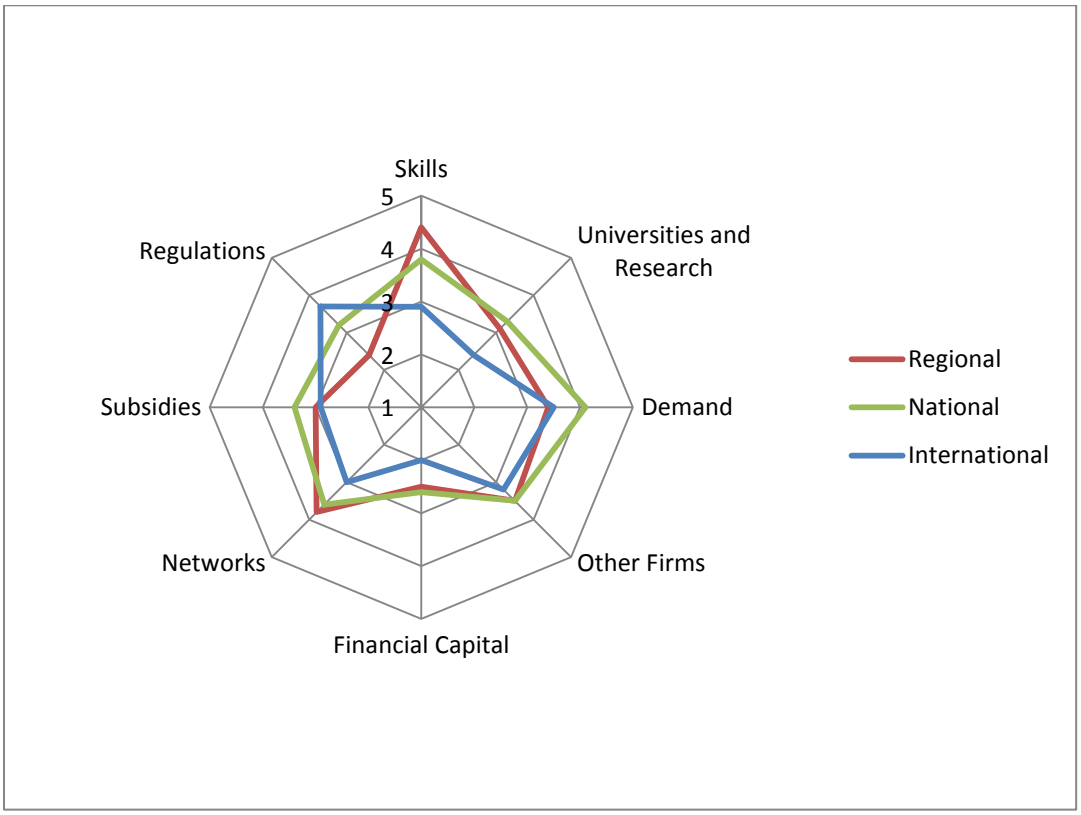
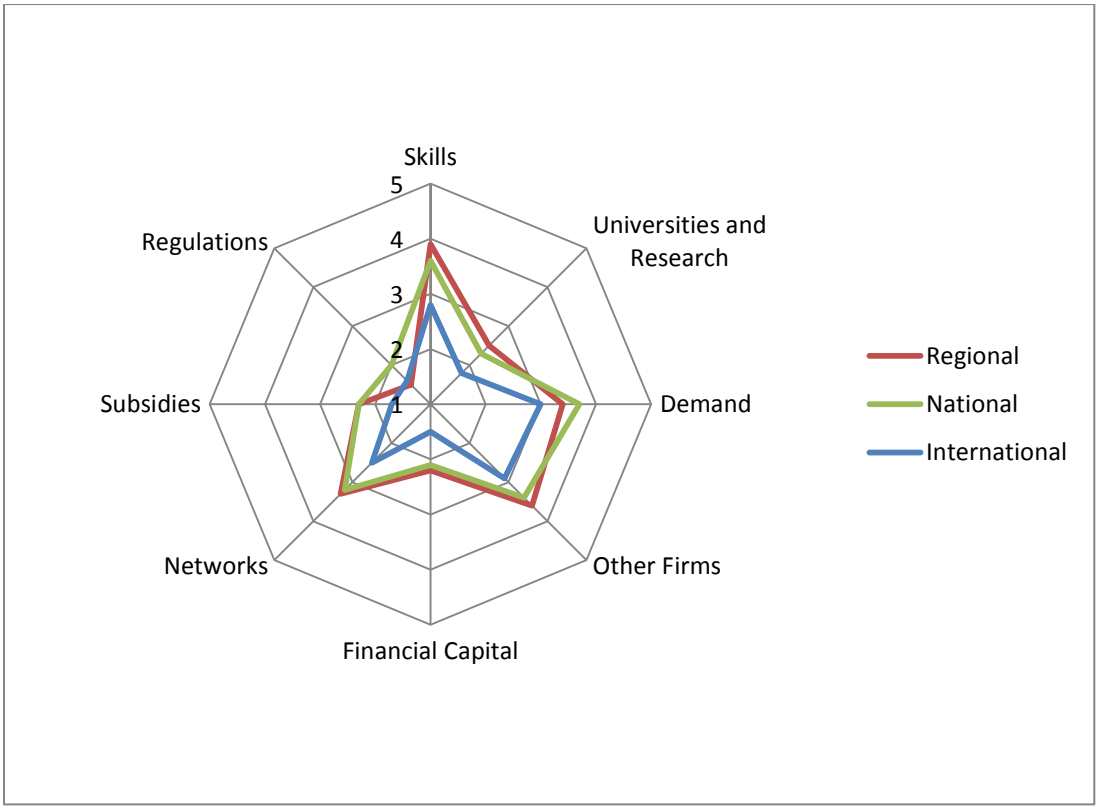
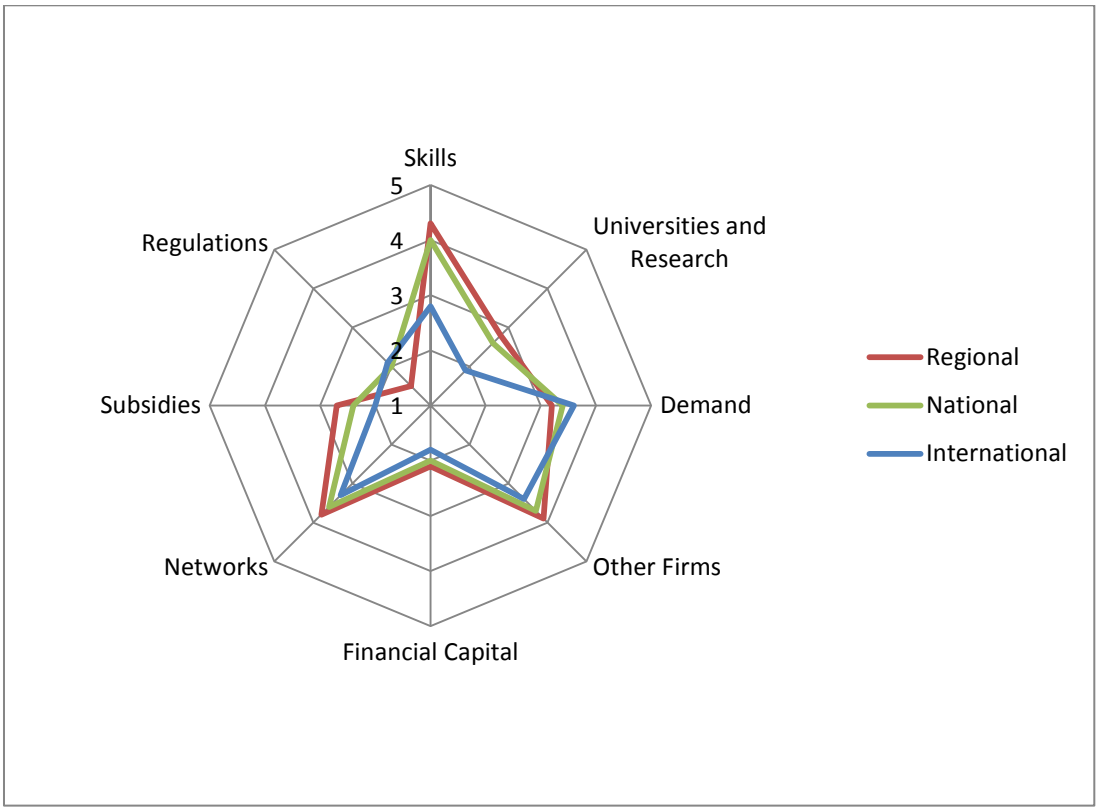


Figure 3) Factors relevant for company development in New Media Vienna (n=25)

Factors *previously* relevant



Factors *presently* relevant



Looking at **factors relevant for development of the overall cluster** we can observe some interesting differences to the company level. Overall, we find that firms evaluate factors for the cluster generally as more important than for their own company (see table A6 in the Annex). This is particularly the case for some of the less relevant factors at the company level such as universities & research organisations and for finance. Obviously, interviewed companies see a role of these factors at the overall cluster level that is beyond their own company. In the case of universities & research this indicates that there are knowledge spill-overs at the cluster level, and a role of analytical knowledge for innovation even in these predominantly synthetic (ET) and symbolic (NM) sectors. This is in line with more recent approaches and studies to combinatorial knowledge bases as pointed out e.g. in Halkier et al. (2010), and Strambach (2012).

Some further analyses have shown, in addition, that **factors for company development differ by age group of firms**, were we distinguished between three cohorts: firms founded before 1990, those between 1990 and 2000, and those after the year 2000. For the **Environmental Technology firms** in Upper Austria we find that older firms that were established before 1990 stress skills from the region, other firms from the region and regional and national demand as factors that were previously important for company development. These are, in fact, the classical Marshallian localization advantages and cluster factors that were often stressed in the literature. The "middle age group" (founded between 1990 and 2000) has been stressing also some additional factors such as subsidies and networks. This can be explained by the fact that public support and cluster initiatives have been started only since the 1990s and 2000s. Furthermore, we find that the national and EU levels have got more relevance for this age group, indicating a more extended cluster space for this cohort. In the **New Media sector** the older firms (those established before 1990) have been stressing relations to other sector firms in Vienna and Austria as well as networks, whereas younger firms (+1990) in addition indicate a high importance of skills that are drawn from all levels. For the young New Media firms (2000+) international demand is most important, implying that this young cohort tends to sell their products and services already more on international markets. This could be due to the use of ICT and the internet. At the same time the youngest cohort of New Media firms also relies strongly on networks at all spatial scales, a finding that could be due to the collaboration in distributed project-networks at an early company stage.

5) Conclusions

The aim of this paper was to investigate to what extent driving factors for cluster development differ in their spatial rootedness between industries and how these patterns change over time in the course of cluster evolution. For this purpose we have compared Environmental Technologies in Upper Austria and the New Media in Vienna in this regard. Driving factors for cluster development were investigated mainly from a firm perspective by interviewing two samples of companies in the two sectors and regions on their evaluation of the relevance, spatial scale and shifts of specific factors.

We found that there are indeed distinctions between the two cases in this respect. Whereas companies in the Environmental Technologies sector in Upper Austria are generally more dependent on public clients and demand as well as on the regulatory setting and subsidies at the Austrian level, the New Media sector of Vienna relies more on the demand from other businesses located in the region and in Austria. Other key factors for company- and cluster development in the New Media

sector are the qualifications and skills available on the regional and Austrian labour markets, the possibility to interact with other sector- or cluster firms in Vienna and in Austria and to engage in respective networks. Partly, the spatial rootedness of driving factors is related to differences in the innovation process as the knowledge base approach argues. Environmental Technologies firms in Upper Austria are more often introducing new products on the market, relying on internal technical competencies as well as on external knowledge from universities, colleges and transfer agencies leading to a strong rootedness both in the RIS and NIS. New Media firms in Vienna on the other hand are mainly interacting with other sector firms in a local-global pattern. Due to the nature of the sector and the importance of temporary projects (Grabher 2001) these companies rely both on personal interaction in the region and the country, and on internet based cooperation and virtual communities at a global level.

The second key interest in this paper was the question to what extent factors relevant for company- and cluster development change over time from the early stages to the later ones, as the CLC concept and evolutionary approaches suggest. Indeed, we have observed such shifts that are partly similar and partly different in the two sectors. In both cases we find a strong role of personal and social relationships within the region in the initial years of company foundation. Also, in both sectors demand from the region and the country, as well as qualifications and skills on the labour market matter most strongly in the early stages. This is basically in line with studies on company location that usually stress the role of personal factors as well as with the view that Marshallian labour market externalities matter in the early years. Different from other cluster studies we find that relationships to other firms in the region (supporting firms, services) as well as networks do not seem to be of the highest importance initially, but become more relevant later on. Obviously, it takes some time as well as a certain concentration of firms and organisations to build up such relationships in a cluster and to engage in networks.

In recent years, companies have clearly reached beyond the region and the country in several dimensions. For companies in both cases international (often European) markets and clients get more relevance, as well as relationships to other firms from the sector and along the value chain. Also, networks of knowledge sourcing and innovation become extended in geographical space and include increasingly European and global partners. However, despite much talk on “globalisation” in the literature, we do not find a replacement or hollowing out of the region or the country as interaction spaces since these territories both keep their importance in various respects. Instead, we observe is a shift towards multi-scalar factors and –interactions in several dimensions. There are two marked differences between the two sectors in this process of spatial extension. For Environmental Technologies firms in Upper Austria we observe that International (mainly European) regulations have become a key factor recently, whereas for New Media firms in Vienna it is demand on an international scale as well as networks that matter strongly in recent years.

Overall, our findings reject on the one hand the Porterian view, that cluster competitiveness and growth is mainly local and regional factors. We find that clusters to some extent always depend also on national and international factors, although the regional setting indeed matters in the early stages. On the other hand, our findings also reject a globalisation perspective that suggests that industries and clusters predominantly depend on global markets and technologies, accompanied by an erosion of local, regional and national business environments as interaction spaces. Also the view that industries are moving to a schematic local - global paradigm where firms and clusters are rooted socially and informally in their region, and compete, trade and collaborate mainly at a global scale

does not seem to be adequate. From our study it appears that, indeed, international factors *do* matter to an increasing extent, but "international" in our cases is more often "European" than truly global and both regional and the national business environments keep their relevance regarding specific factors for company- and cluster development. What we observe is a shift towards multi-scalar factors of cluster development that depend on type of industry and knowledge base in their more specific configuration among others.

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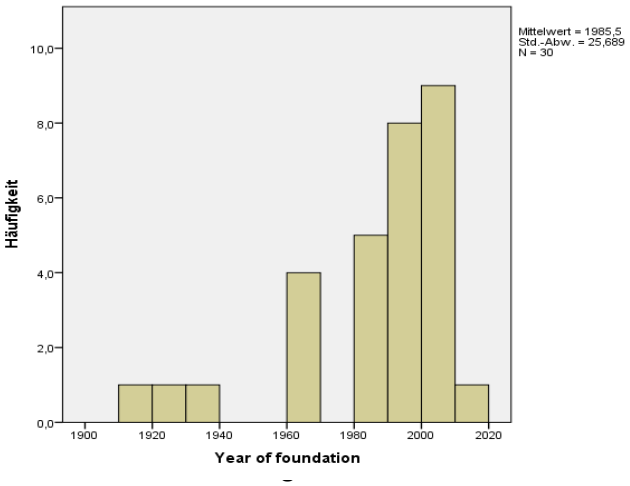
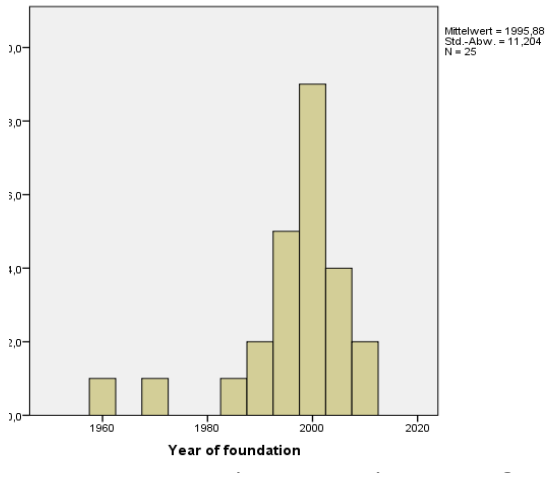
Annex

Fig. A1) **Year of foundation for Environmental Technologies Upper Austria and New Media**

Environmental Technologies (n=30)



New Media (n=25)



Tab. A1) **Cluster stages for Environmental Technologies Upper Austria and New Media Vienna** (Environmental Technology: n=30; New Media: n=25)

	ET Companies (%)	ET Cluster (%)	NM Companies (%)	NM Cluster (%)
Emergence Phase	10	0	4	0
Growth Phase	33	48	40	32
Sustainment Phase	30	31	8	20
Transformation Phase	32	21	48	48
Total	100	97	100	100

Tab. A2) **Company Sizes for Environmental Technologies Upper Austria and New Media** (Environmental Technology: n=30; New Media: n=25)

Size category (number of employees)	% of ET firms (2010)	% of ET firms (2013)	% of NM firms (2010)	% of NM firms (2013)
Micro firms (0-9)	40	30	44	36
Small firms (10-19)	7	10	28	20
Medium firms (20-49)	17	23	20	32
Large firms (50+)	37	37	8	12

Tab. A3) **Sales by client groups**

Environmental Technologies Upper Austria (n=30)

Company Size Categories	Revenue from Firms (%)	Revenue from Consumers (%)	Revenue from Public Sector (%)	Revenue from Others (%)
Micro Firms (n = 9)	84	11	2	2
Small Firms (n = 3)	90	0	10	0
Medium Firms (n = 7)	76	0	22	1
Large Firms (n = 11)	66	10	20	4
Total (n = 30)	76	7	14	2

New Media Vienna (n=25)

Company Size Categories	Revenue from Firms (%)	Revenue from Consumers (%)	Revenue from Public Sector (%)	Revenue from Others (%)
Micro Firms (n = 9)	65	13	8	14
Small Firms (n = 5)	80	0	16	4
Medium Firms (n = 8)	83	1	15	0,4
Large Firms (n = 3)	100	0	0	0
Total (n = 25)	78	5	11	6

Tab. A4) **Geography of sales**

Environmental Technologies Upper Austria (n=30)

Company Size Categories	Regional level (%)	National level (%)	EU level (%)	Global level (%)
Micro Firms (n = 8)	27	69	4	0
Small Firms (n = 3)	10	52	32	7
Medium Firms (n = 7)	14	49	29	9
Large Firms (n = 11)	37	27	31	5
Total (n = 29)	26	46	23	5

New Media Vienna (n=25)

Company Size Categories	Regional level (%)	National level (%)	EU level (%)	Global Level (%)
Micro Firms (n = 9)	38	51	10	2
Small Firms (n = 5)	56	35	9	0
Medium Firms (n = 8)	25	25	39	9
Large Firms (n = 3)	0	57	43	0
Total (n = 25)	33	40	23	3

Tab. A5) **Factors for development on *company* level** for Environmental Technologies Upper Austria and New Media Vienna (mean values of importance 5=high importance to 1=low importance)

		Mean Value			
		Company ET		Company NM	
		Previously	Presently	Previously	Presently
Skills	Regional	4,1	4,4	3,9	4,3
	National	3,3	3,8	3,6	4,0
	International	2,4	2,9	2,8	3,3
Universities and Research	Regional	2,7	3,1	2,5	2,8
	National	2,8	3,3	2,3	2,6
	International	2,2	2,4	1,8	1,9
Demand	Regional	3,7	3,4	3,4	3,2
	National	4,0	4,1	3,7	3,4
	International	2,9	3,5	3,0	3,6
Other Firms	Regional	3,8	3,5	3,6	3,9
	National	3,5	3,5	3,4	3,7
	International	2,8	3,2	2,9	3,4
Financial Capital	Regional	2,8	2,5	2,2	2,1
	National	2,5	2,6	2,1	2,0
	International	1,8	2,0	1,5	1,8
Networks	Regional	3,4	3,8	3,3	3,8
	National	3,3	3,6	3,2	3,6
	International	2,5	3,0	2,5	3,3
Subsidies	Regional	3,2	3,0	2,3	2,7
	National	3,6	3,4	2,3	2,4
	International	2,4	2,9	1,7	2,0
Regulations	Regional	2,3	2,4	1,5	1,5
	National	3,1	3,2	2,0	2,0
	International	3,0	3,7	1,6	2,1
Directives	Regional	2,3	2,4	1,4	1,4
	National	3,0	3,1	1,8	1,9
	International	3,0	3,6	1,5	2,0

X (highly important factors), X (important factors)

Tab.A6) **Factors for development on overall *cluster* level** for Environmental Technologies Upper Austria and New Media Vienna (mean values of importance 5=high importance to 1=low importance)

		Mean Value			
		Cluster ET		Cluster NM	
		Previously	Presently	Previously	Presently
Skills	Regional	4,4	4,7	4,6	4,8
	National	3,8	4,4	4,4	4,5
	International	3,3	3,8	3,7	4,2
Universities and Research	Regional	3,8	3,8	3,5	3,5
	National	3,6	3,9	3,3	3,6
	International	2,8	3,4	2,7	3,1
Demand	Regional	3,7	3,6	3,3	3,5
	National	4,2	4,1	3,7	3,5
	International	3,5	4,1	3,3	3,9
Other Firms	Regional	3,8	3,7	3,8	4,1
	National	3,6	3,6	3,5	3,9
	International	3,2	3,7	3,5	4,0
Financial Capital	Regional	3,5	3,5	2,8	2,9
	National	3,3	3,4	2,9	3,0
	International	2,8	3,3	2,7	3,3
Networks	Regional	3,8	4,2	3,9	4,2
	National	3,5	3,9	3,6	3,9
	International	3,1	3,8	3,4	4,0
Subsidies	Regional	4,0	3,8	3,3	3,5
	National	4,2	3,9	3,7	3,9
	International	3,4	3,7	3,0	3,5
Regulations	Regional	3,2	3,1	1,9	2,1
	National	3,7	3,6	2,6	2,0
	International	3,4	3,9	2,0	2,8
Directives	Regional	3,0	3,0	1,7	1,9
	National	3,7	3,6	2,0	2,3
	International	3,3	3,8	2,0	2,4

X (highly important factors), X (important factors)

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