New Cluster Concepts for central Europe

Joint Strategy developed in the Frame of the Project CluStrat

Work Package 5 – Strategy development for new cluster concepts
Output 5.2.1 – Validated Joint Strategy

CENTRAL EUROPE COOPERATING FOR SUCCESS.

EUROPEAN UNION EUROPEAN REGIONAL DEVELOPMENT FUND

INDEX

1. THE BASIC ELEMENTS OF THE CLUSTRAT PROJECT

The first section of this document – setting out the validated joint strategy of the CluStrat project – the CluStrat's founding concepts and their interconnections are presented. The founding concepts are:

- clusters,

- emerging industries, and

- cross-cutting issues.

The connections between the three concepts have been clearly outlined in the CluStrat's earlier documents, as summarized in Figure 1. Clusters, whether traditional-sector clusters or high-technology clusters, do not constitute a pre-condition for the development of the industries identified by CluStrat as "emerging", that are:

- active ageing,

- green economy, and

- sustainable mobility.

Rather, these emerging industries offer the clusters with an opportunity for future development and competitive evolution. In other words, the clusters can actively participate in the emergence of these new industries, which in turn "are a reaction to challenges of society" (p. 3)[1] and cannot therefore prescind from considering the demand side and the social dimension. Using the specific advantages of clusters to exploit the opportunities of the emerging industries represented the main objective of CluStrat, and the cross-cutting issues were strategic leverages for the achievement of this goal. They are:

- knowledge transfer and knowledge co-production,

- internationalisation, and

- gender and innovation including diversity.

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[1] Püchner P. (2011), Discussion Paper on Emerging Industries, 2nd Draft, Steinbeis-Europa-Zentrum.

Figure 1 – The basic elements of CluStrat's strategic framework
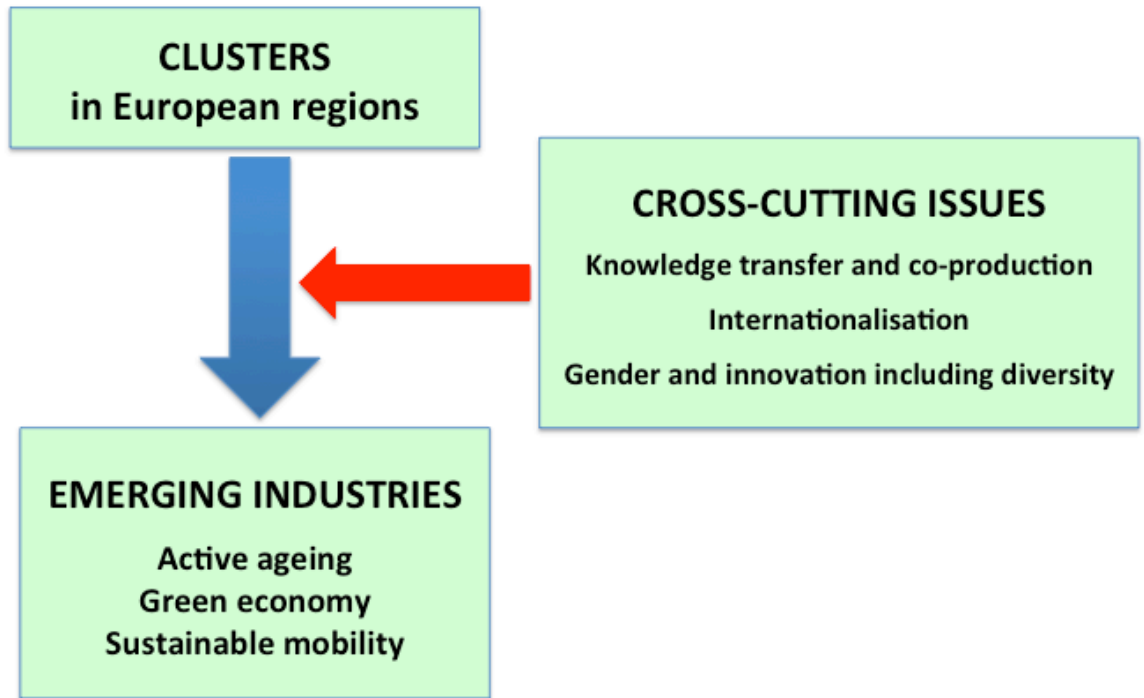
1.1 DEFINITION OF CLUSTERS

Several definitions of (geographical) clusters have been developed, but the most diffused and wide-spread accepted by scholars and policy makers is the one formulated by Michael Porter, who defines them as "geographic concentrations of interconnected companies and institutions in a particular field" (p. 78).[2] The author adds that "clusters encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services, and providers of specialized infrastructure. Clusters also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies, or common inputs. Finally, many clusters include governmental and other institutions – such as universities, standard-setting agencies, think tanks, vocational training providers, and trade associations – that provide specialized training, education, information, research, and

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[2] Porter M.E. (1998), Clusters and the new economics of competition, *Harvard Business Review*, 76(6): 77-90.

technical support" (p. 78). Following this definition, the main elements that characterise a cluster are three:

1. the concentration in a regional or subregional area;

2. the existence of a number firms and institutions being interconnected;

3. the presence of firms specialised in the production of different intermediary or final goods, services or technologies, but all related to one category of products ("a particular field" to put it in Porter's words).

It is important to notice that the definition of cluster used in the CluStrat context prescinds from the presence of a cluster management organisation (CMO), but considers the existence of a recognised set of actors, mostly firms but also institutional actors, operating in that industry, or in those related industries[3]. Also, the understanding of clusters used in CluStrat project does not include just clusters specialised in traditional manufacturing industries, such as clothing, eyewear, furniture, but includes geographical concentrations of firms and institutions specialised in the production of high-tech products and service. Actually very often firms specialized in services (e.g., service providers, logistics, designers) or advances technologies (e.g., nanotechnologies, ICT,…) co-exists within clusters specialized in the production of 'traditional' products, such as furniture, and vice versa. Moreover, firms that were initially mainly manufacturing ones develop over time into service firms, such as in the case of a shoemaker that became a designer or a distributors of shoes manufactured by others.

Even tough this definition does not give specific criteria and yardsticks to identify what is a cluster and what is not, it is clear that not all regional specializations are clusters, but that there is a need for a 'critical mass', which anyway may differ from region to region, from industry to industry. Actually, the CluStrat partners, in agreement with the advisory board experts, decided to refrain from a jointly agreed cluster definition that goes beyond the very general characteristics of a cluster as outlined above. Regional innovation policies in the Central Europe Region differ according to the regional specific challenges and industrial history and culture, in which Italian regions speak about industrial districts or where Baden-Württemberg has a joint dedicated research target as a mandatory asset for a cluster.

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[3] This statement has not to be understood as in opposition with what proposed in the CluStrat framework in par. 2.2, i.e., the importance of an entrepreneurial CMO. In fact, even though existing clusters without a CMO may exist, its presence is needed to develop successfully toward emerging industries and take on societal challenges.

1.2 CLUSTERS, EMERGING INDUSTRIES AND CROSS-CLUSTER COOPERATION

Active ageing, green economy and sustainable mobility are emerging industries entailing a high growth potential. However, none of these can be defined as an industry in the strict sense of the word, or even as a specific technology, even tough it is industries (in the strict sense) or technologies the normal references for the definition of clusters. In this paragraph we explain the link between the concept of cluster with that of emerging industries within the context of CluStrat.

Both scholars and policy makers have acknowledged the importance, in the case of clusters, of providing the economies of many European countries with a competitive advantage, at least until recently. And European Union documents and programmes have always acknowledged the importance of clusters. Similarly, CluStrat supports that "clusters are known to enhance innovation in businesses and are thus an accepted part of the innovation framework", as reported in the project's application form.

Notwithstanding, the clusters we refer to are not able to face the challenges of even a single emerging industry alone. None of them, even the most advanced in terms of technology, business relations and research infrastructures, are able to do this. In fact, the emerging industries such as active ageing or sustainable mobility cannot be served without combining a variety of technologies, services and traditional sectors. After all, clusters in Europe represent important tesserae to build each of the emerging industries' mosaic, aiding the combination of complementary specialisations in accord with the emerging industries themselves. Similarly, emerging industries offers to clusters the necessary perspective to revamp their competitiveness in the global economy.

In this way, CluStrat has offered an important context to experiment one of the key concepts of the Europe 2020 policy framework, i.e. that of smart specialisation[4]. This concept was developed by a group of academicians in 2008 and had very quickly a significant impact on the EU policy audience. Indeed, the European Commission announced in 2010 the setting up of a platform (S^3Platform) in order to assist Regions and States in developing, implementing and reviewing regional smart specialisations strategies. Accordingly to the smart specialisation concept, regions have to focus on their peculiar strengths. Such strengths may be defined as activities and industries well diffused in a region, which hold a competitive advantage at the global level and for which it seems appropriate to develop innovation policies aimed at support their competitiveness. A smart specialisation strategy shall therefore begin with an analysis of

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[4] Council Conclusions on Innovation Union for Europe, 3049th Competitiveness Council Meeting, Brussels, 26 November 2010.

potential partners in other regions to avoid unnecessary duplication. In this sense, regional smart specialisation and trans-regional (trans-national) cooperation are two sides of the same coin, as we will better discussed in paragraph 2.3.

Obviously, clusters represent a fundamental resource to design and implement smart specialisation strategies. This is explicitly recognized by the "EU Guide to Research and Innovation Strategies for Smart Specialization".[5] More precisely, to ensure that this resource can be effectively used in the prospect of smart specialisation, the policy makers have to bring three types of action onto the field:

- using cluster mapping to identify regional competences and assets;

- support clusters to meet the objectives of smart specialisation;

- strengthen local and international cluster cooperation, in particular for addressing emerging industries with the aim of making use of complementarities between regions.

CluStrat has moved along the lines of these policy recommendations as other EU strategic projects, e.g. the INNO-Net project TACTICS (within the PRO INNO Europe), acronym for Transnational Alliance of Clusters Towards Improved Cooperation Support. Similarly to CluStrat, TACTICS involved initiatives of cross-cluster cooperation oriented to addressing emerging industries.[6]

The strategic links between (smart) specialized clusters and emerging industries are thus obtained through cross-cluster cooperation, involving clusters that may be located in other regions or countries (Figure 2). Given the intrinsically complex nature of the emerging industries, where key enabling technologies (KET) such as nanotechnology or advanced materials support new methods of producing and consuming goods and services, this cooperation must also involve clusters specialised in advanced technologies and traditional clusters. Such cooperation is to be intended as a cross-fertilizing process, a mean to introduce KET into traditional industries and to identify new and profitable applications for KET. The interaction of high-tech or KET clusters and traditional clusters with the intent to establish strategic and object-oriented partnership has therefore represented the central aim of each pilot project of CluStrat. The result of such cross-fertilization/cross-cooperation is the generation of new products or services that answer societal challenges and, thus, boost innovation and economic growth.

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[5] European Commission, Guide to Research and Innovation Strategies for Smart Specialization (RIS 3), May 2012.

[6] TACTICS, Using Clusters to Address Emerging Industries and Services. Working Paper, October 2012.

Figure 2 – The relationships among the basic elements of the CluStrat project
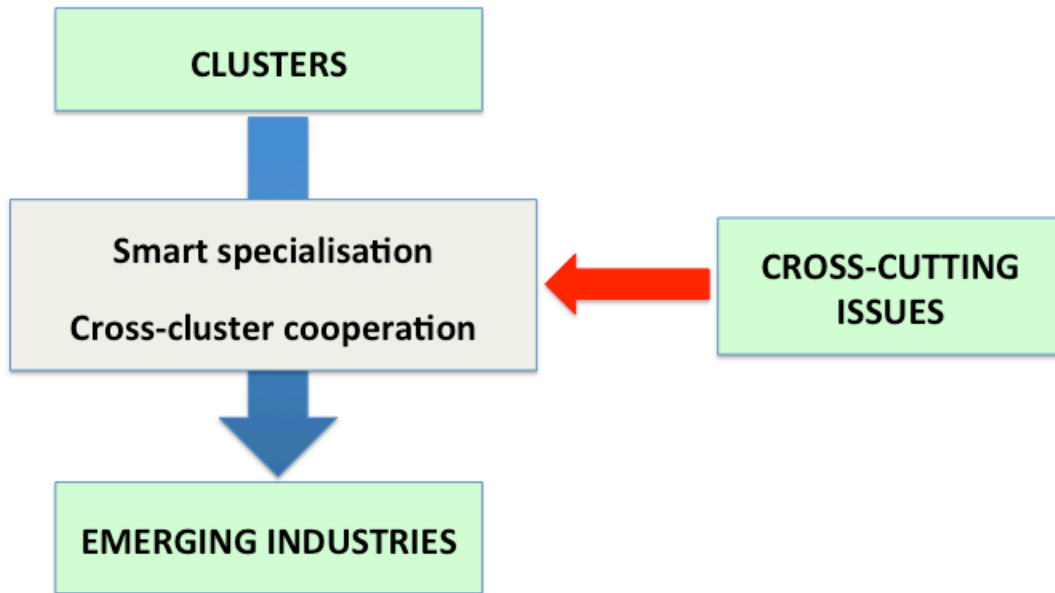
Cross-cutting issues support the development of the smart specialisation and cross-cluster cooperation and, more generally, of the elements of the strategic framework which will be discussed in section 2. Section 3 will discuss more in detail the role of cross-cutting issues for the strategic framework. It is useful to provide already at this point, however, a definition of the cross-cutting issue on knowledge. What the project started, in fact, it was defined as "knowledge and technology transfer", but we then modify it in "knowledge transfer and co-production". Indeed when looking at the strategies for smart specialisation of clusters and cooperation between clusters from a cognitive perspective, the cross-cutting issue that really counts is much more far-reaching than simple transfer – from one, more advanced region, firm or institution to a more backward one – assuming rather a form of knowledge co-production, considering for the break-through level of innovativeness represented by emerging industries.

1.3 THE VARIETY OF CLUSTERS

Within the regions participating to the CluStrat project and more generally European regions, clusters are very diversified as far as their structural characteristics and competitive capacity is concerned. Such evidence attracted a large attention in the CluStrat project and will be developed in this and in the next paragraph. Porter's definition itself is a rather broad one; consequently, the category of clusters is somewhat heterogeneous. The literature studying clusters suggest that the most important variables along which to classify such diversity are:

- the geographical extension – existing very large and very small clusters;

- how they were formed – spontaneously vs. thanks to the determined effort of policy makers;

- the role of policies to develop them, once formed – being very strong or rather marginal;

- the specialisation – high-tech vs. low-tech;

- the size of firms – being mostly small firms or having also an important share of medium or large firms;

- the presence or absence of a cluster management organization (CMO) and of a cluster strategy;

- the presence or absence in the cluster of knowledge institutions such as universities and technology transfer centres;

- the type of prevalent inter-organizational relationships – e.g., quasi-hierarchical vs. relational ones;

- the stage of the cluster development – e.g., mature vs. developing-ones;

- the existence of common cluster services and cluster projects.

In the literature, several models of cluster have been proposed, representing an attempt to reduce the complexity emerging from these axes into a small number of general instances. Among the models proposed, those for which a adequate number of empirical cases have been observed are:

- Marshallian industrial district;

- High-tech cluster;

- Hub-and-spoke cluster.

The first model is the so-called Marshallian industrial district, first studied by Alfred Marshall in the latter half of the 19th century and then discovered again by Giacomo Beccatini in Italy a century later[7]. Such a model, however, has been observed also in other European countries, such as Spain, France and Germany.

Marshallian districts differ from other clusters for two peculiarities (Figure 3): first, they occupy a geographically circumscribed, naturally and historically bounded area (being therefore concentrated in a narrower area); second, within them there is a strong interpenetration between the production domain and the social domain. This overlap between production activities and daily life reduces frictions (transaction costs) in the relationships between the firms located within the cluster, and facilitates the circulation of knowledge (especially tacit knowledge) at the local level.

Figure 3 – The peculiarities of the Marshallian variant vs. generic clusters

Clusters

A territory

A specific business area

A population of
firms and institutions

Division of labor and
inter-organizational
relationships

**Marshallian
industrial
districts**

A limited territory

Interpenetration
between production
and social structures

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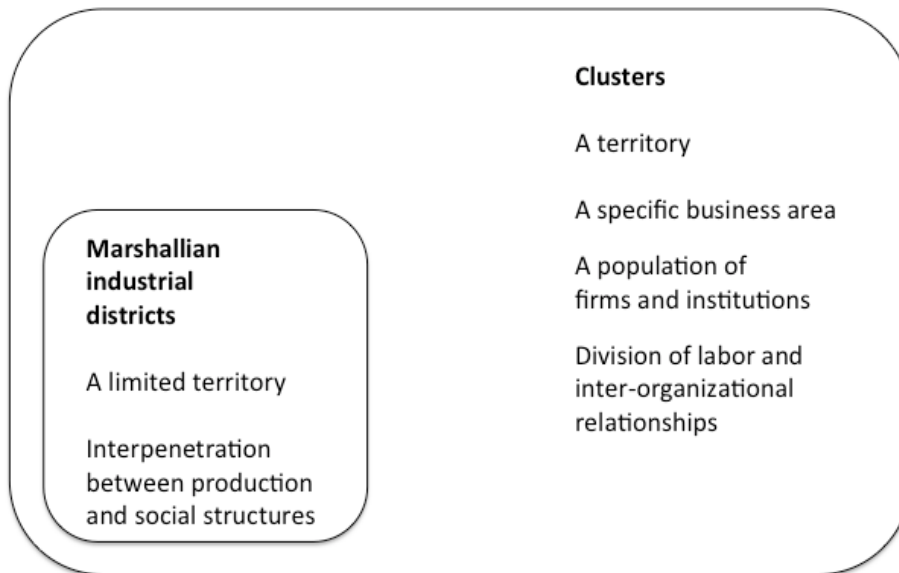
[7] Pyke F., Becattini G. and Sengerberger W. (eds.) (1990), Industrial Districts and Inter-firm Cooperation in Italy, Geneva, International Institute of Labour Studies.

According to the literature, a second type of cluster is the high-tech one, specialized in high-tech sectors and characterized by a significant interaction between firms and research centres, classic examples being the Rhône-Alpes medical technology cluster[8], and the clusters in Baden-Württemberg, the region that inspired the model of the regional innovation system and that of the triple helix[9]. The average size of firms in this second type of cluster is much larger than in the Marshallian districts, and so is the geographical extension of the cluster. Moreover, the role of policies is by far more relevant and knowledge codification process is more intense.

A third model, less studied in the literature but well-spread in Europe, especially in the South and East regions, is what Markusen named hub-and-spoke[10] and other scholars defined hierarchical or also captive cluster, since the governance of the cluster is mainly driven by one large firms or a handful of key firms, which may be located within or outside the cluster, so that the other firms are mostly working as sub-suppliers for them. Figure 4 draws the three clusters model described.

It is important to notice at this point that this list of models is not a prescriptive but rather descriptive: each model has its own evolutionary path, advantages and disadvantages, also considering for different geographical areas and no one-best-way is available for regions. Similarly, it is not to be considered complete but rather indicative of the variety of clusters (more specific models may describe the variety of clusters characteristics the EU context). Moreover, beyond such a static variety, i.e., focused at a point in time, it is worth mentioning the existence of a dynamic variety, i.e., the presence of a plurality of evolutionary trajectories of cluster that could once be ascribed to the same model. Such trajectories include the "concentric diversification" – the progressive enlargement of the cluster business specialisation, such as in the case of the Medical Technology Cluster in Tuttlingen (Baden-Württemberg, Germany) that passed from the production of surgery instrument to a much larger variety of applications

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[8]Andersson S., Evers N. and Griot C. (2013), Local and international networks in small firm internationalization: Cases from the Rhône-Alpes medical technology regional cluster, Entrepreneurship & Regional Development, 25(9–10): 867-888.

[9] Cooke P. and Morgan K. (1994), The regional innovation system in Baden-Württemberg, International Journal of Technology Management, 9(3-4): 394-429.

[10] Markusen A. (1996), Sticky places in slippery space: A typology of industrial districts, Economic Geography, 72(3): 293-313.

for medical engineering[11] – and the "glocal cluster", moving from a prevalence of cluster-contained inter-organizational relationships to a local-global configuration.

Figure 4 – Models of clusters in the European landscape

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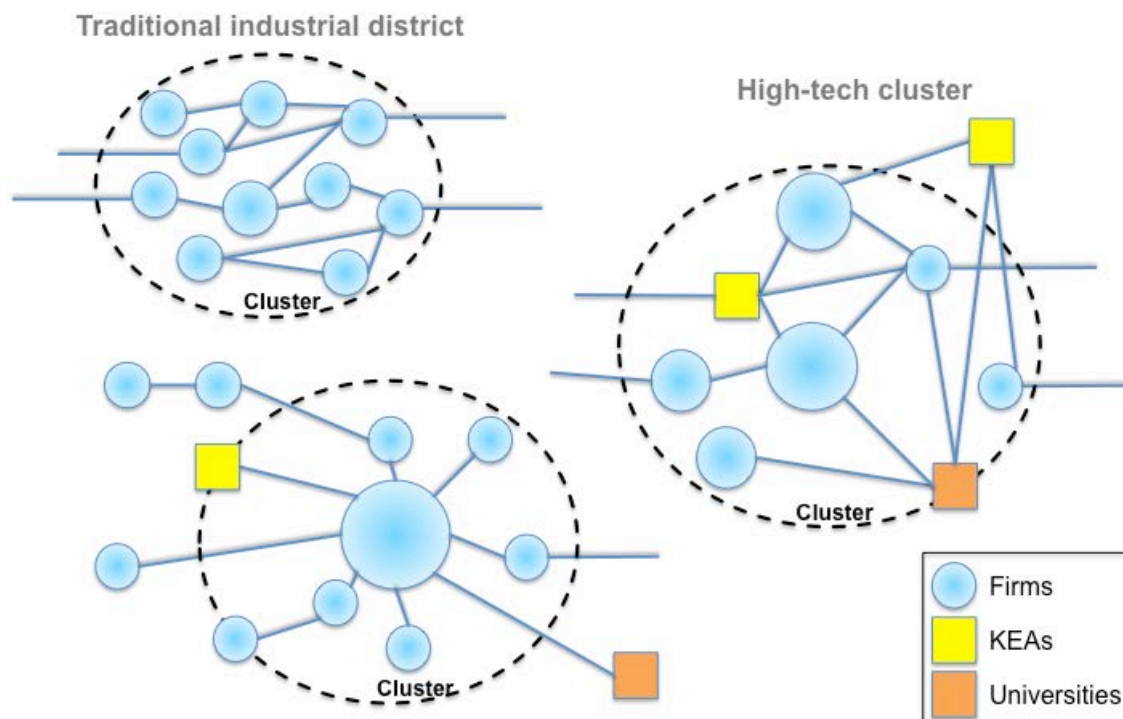
[11] Halder G. (2004), Local upgrading strategies in response to global challenges: The surgical instrument cluster of Tuttlingen, in Schmitz H. (ed.), Local Enterprises in the Global Economy: Issues of Governance and Upgrading, Cheltenham, Edward Elgar, pp. 200-232.

1.4 FROM A CROWDED TO A SUSTAINABLE CLUSTER LANDSCAPE

As suggested by a number of policy documents produced at the regional, national and European level so as by the reports on regional or national potential written by CluStrat partners, Europe is filled with clusters. Considering for such a rich cluster landscape and if we believe in the theory of the competitive advantage of clusters, we should expect European regions to have higher competitive performance, on average, than what data show[12]. Likewise, the concerns of several observers on the loss of competitiveness of Europe to the advantage of BRIC countries and other emerging economies such as Mexico and South Korea should not take place. In reality, it is reasonable to think that a not negligible part of the number of clusters identified in Europe that have been institutionalized are not "competitive clusters", meaning systems that are able to guarantee a competitive advantage to the firms that belong to them.

Following the literature on clusters, competitive clusters are those that achieve these five requisites:

1. the existence of a web of local business relationships that keep alive because cluster firms consider them advantageous with respect to relationships with external firms;

2. the presence of entrepreneurial firms that have the ability to seek, identify and exploit new business opportunities[13], pioneers in the development of innovations that then get spread into the cluster;

3. the presence of institutional actors that are able to create a favourable context for cluster inter-firm relationships;

4. the connection to research and innovation drivers;

5. the ability of the cluster to operate as an open local cluster, or a "glocal" cluster.

The last characteristic suggests that clusters, so as firms, are embedded in a global competitive landscape and should therefore be able to defend against its threats and take advantage of its opportunities, avoiding lock-in risks. Competitive clusters can thus be seen as "glocal", that is local (regional or subregional) concentrations of organizations and inter-organizational relationships (local networks)

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[12] At this regard, see the brand new draft report on regional competitiveness, which is one of the preparatory studies for the sixth report (2013-14) on economic and social cohesion: Annoni, P. and Kozovska, K. (2013), EU Regional Competitiveness Index 2013.

[13] Shane S. and Venkataraman S. (2000), The promise of entrepreneurship as a field of research, Academy of Management Review, 25(1): 217-226.

extensively interconnected by means of inter-organizational relations with other external actors (global networks) [14]. In these clusters, entrepreneurial players are relatively numerous and varied, including leading manufacturing companies and providers of knowledge-intensive business services, and they maintain relations (albeit selectively) within their cluster. They can thus act as knowledge gatekeepers between the cluster and the global circuits where much of the knowledge relevant to the sector in which the cluster specialises is generated, circulated and used [15]. Of course, each of the clusters that fits this bill, fulfilling the requisites of the competitive cluster, has its own particular features, depending partly on the sector, partly on the district's history, and partly on the more recent strategic choices made by single enterprises and institutional actors within it.

In the light of what discussed, we can think of two policy implications that – as the others that will follow – can be applied at the European, national and regional level. Even if not naming them explicitly, this policy implication is to be understood in the light of emerging industries. In fact, in order for clusters to take opportunities on the most advanced frontiers – the emerging industries indeed – it is necessary for the cluster to have good foundations.

Policy implication 1a - Cluster policy should be selective, not supporting all the existing clusters but aiming at favouring the development or the formation of production systems that have the characteristics of – or the potential for – a competitive cluster, i.e. advantageous inter-firm relationships, entrepreneurial firms, effective local institutions, connection to innovation drivers and global links.

Policy implication 1b - Cluster policy should be cluster-specific, meaning to provide different support and tools to clusters considering for their peculiarities in terms of specialisation, size, presence of key enabling and other relevant actors, model and the like.

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[14] De Marchi V. and Grandinetti R. (2014), Industrial districts and the collapse of the Marshallian model: Looking at the Italian experience, Competition & Change, 18(1): 70-87.

[15] Morrison A. (2008), Gatekeepers of knowledge within industrial districts: Who they are, how they interact, Regional Studies, 42(6): 817-835.

It is important to highlight that the first policy implication is applicable to three, distinctive situations, being:

a. clusters obeying the above-mentioned competitiveness requisites, so that policy should be oriented toward their consolidation;

b. clusters which do not obey to all such requisites but have an important potential, so that policies should consider to fill in such gaps without diminishing the strengths of the cluster;

c. regions that have not full clusters yet[16], for which the above-mentioned requisites represent a useful benchmark to develop policies aimed at supporting the emersion of local clusters and the cooperation with existing clusters outside the region.

CLUSTRAT

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[16] A useful case in point, within the CluStrat project, is represented by the Karlovy Vary region.

2. DEVELOPING NEW CLUSTER CONCEPTS: THE CLUSTRAT FRAMEWORK

As mentioned in paragraph 1.4, the presence of entrepreneurial firms – that have the ability to seek, identify and exploit new business opportunities – is a fundamental requisite to support the competitiveness of clusters. A new entrepreneurial idea can be either developed by an existing firm or introduced by a new venture, as in the case of entrepreneurial spin-offs, where an ex-employee pursues a business opportunity that his/her parent firm is unable to recognise or unwilling, or slow to pursue. Entrepreneurial processes always create new economic activities. The degree of newness to the market of these activities may vary considerably, from breakthrough to incremental innovations.

Entrepreneurial firms represent the drivers of the competitive evolution of clusters, to which they belong to, thanks to the relations they establish with other cluster firms and other forms of knowledge transfer and spillover. However, in the present scenario, being very competitive and complex, cluster success depends also upon a series of conditions that overcome the firms, i.e., upon the design and implementation of good cluster policies.

Leveraging on the documents developed within the CluStrat project, the discussions held at the regional, national and transnational policy dialogues and the experiences learnt through the project pilots, this document aims at setting some considerations useful for developing the policy recommendations that will be fully developed in subsequent documents considering for the results of the pilots. In particular, the main aim of this document is that to provide a comprehensive framework to understand all the main elements that are to be considered for the development of policies for new cluster concepts (NCCs), as emerged from the project. Figure 5 provide a summary of the main elements of the CluStrat's strategic framework that will be discussed in detail in the following paragraphs. Each element need to be considered to develop NCCs but is not to be understood in isolation: rather each of them is emphasizing a different aspect of a common framework. They are instrumental to develop NCCs and complementary to better describe how to achieve them.

Figure 5 – Developing new cluster concepts: the CluStrat's strategic framework
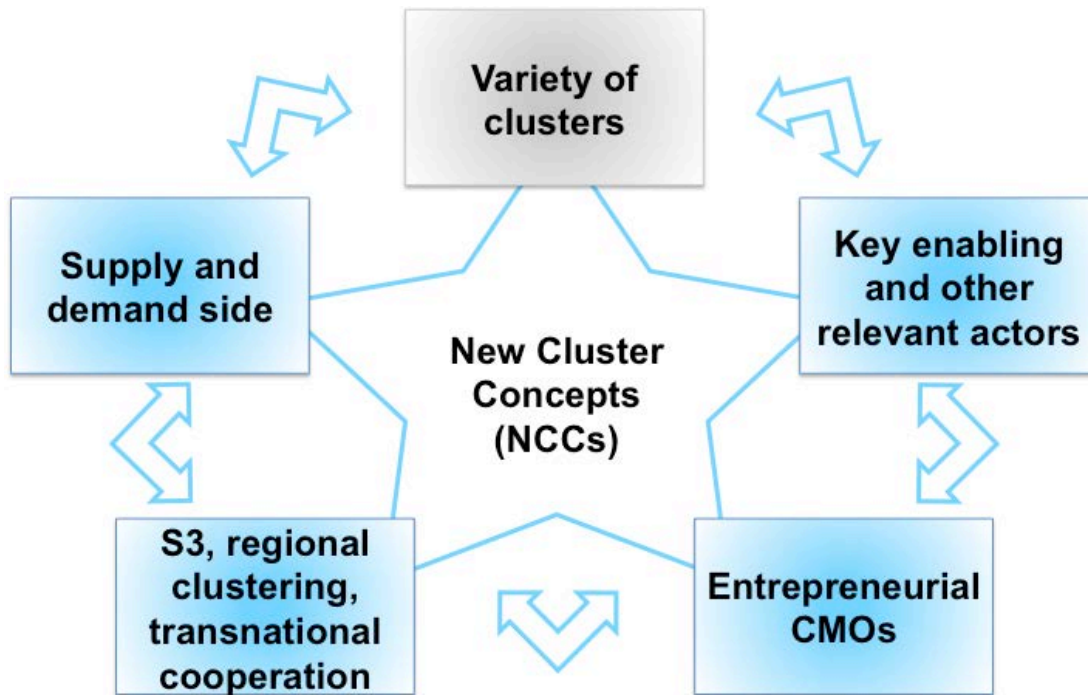
Key enabling and other relevant actors - The first element of the proposed framework discusses about the actors that need to be involved into clusters to effectively achieve a specialisation in one or more of the emerging industries. Other than (small, medium and large-sized) firms and universities, traditionally considered by policy makers, the effective development of new specialisations within the emerging industries trajectories requires the involvement of key enabling actors (KEA), specialized in key enabling technologies (KET) and (institutional) knowledge-intensive business services (KIBS), which support the transfer of knowledge among the cluster's actors and their innovation processes.

Entrepreneurial Cluster Management Organizations - The second element of the framework highlights the importance of the Cluster Management Organizations (CMOs) in supporting the evolution of clusters toward emerging industries, highlighting that, in order to face the challenges posed by emerging industries and, more generally, by competitive markets, CMOs need to take on an entrepreneurial character, opening up opportunities of transnational collaboration for firms.

Smart Specialisation Strategies (S3), regional clustering and transnational cooperation - The third element of the framework regards how to achieve S3 objects proposing different cross-cluster cooperation alternatives including the regional clustering – i.e. developing "new clusters" combining existing clusters and/or actors present in the region having complementary specialisation toward emerging industries – and transnational cooperation, i.e., extending cooperation with actors based in other European regions.

Considering the demand of emerging industries - The fourth element of the framework suggests the importance to consider the demand side other than the supply one, creating contexts in which they can interact, so to identify new market niches and researching and developing innovation in the emerging industries field.

The variety of clusters - All of the elements presented, are to be considered in light of the variety of clusters discussed in the paragraph 1.3, which suggest the need for the NCCs to be adapted to the local specificities and for variations across clusters in terms of the actors involved, the way in which the supply and demand side are interacting, the integration with the regional S3 and the role of CMOs.

The general aim of the topics addressed and the related policy indications, taken together, is the very essence of the CluStrat project: to improve the competitive ability of European regions on the emerging industries by creating better conditions for the development of cross-cluster and transnational projects of cooperation on innovation.

2.1 KEY ENABLING AND OTHER RELEVANT ACTORS

As suggested in the initial paragraphs, a defining element of clusters is the existence of a number of interconnected firms and institutions. Considering the complexity and inter-sectorial character of emerging industries, however, it is clear that clusters willing to develop in such directions will not have already all the relevant knowledge within their boundaries. In this sense, clusters may find complementary competences to introduce innovations outside their boundaries.

As suggested by the regional innovation system (RIS) model together with the "twin" model of the triple helix [17] (declined at the regional level), which had a great influence on European policies on innovation, innovation – be it technological or non-technological, radical or incremental – has to be seen to be taking place within a system, involving a number of actors and their interactions. The whole point in the RIS literature is that the presence and actions of these actors, and the complex relations between them create a favourable setting for the development of knowledge and innovation, which can then be capitalized by firms through the development of new products or processes. In this sense, regions act as knowledge accumulators, favouring interactive learning among the actors in the region that are directly or indirectly embedded in the production processes [18]. Autio clarified this concept by emphasizing that RIS are systems consisting of two interacting subsystems: the first (knowledge application and exploitation) includes the region's firms with their co-localized clients, suppliers, partners and competitors; the second comprises the various organizations and institutions (starting with the universities) that engage in the production and circulation of knowledge and skills [19]. Therefore, the highly innovative performance of a regional system of innovation depends to a significant degree on two factors: an effective institutional subsystem that produces and circulates knowledge and competences, and intensive interactive relationships within and between this subsystem and the subsystem of firms. In this context, the role of policies institutions is key to create and support forms of interaction among the different actors involved.

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[17] Etzkowitz, H. and Leydesdorff, L. (2000), The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations, Research Policy, 29 (2): 109-123.

[18] Cooke, P., Gomez Uranga, M. and Etxebarria, G. (1997), Regional innovation systems: institutional and organisational dimensions, Research Policy, 26 (4-5): 475-491.

[19] Autio, E. (1998), Evaluation of RTD in regional systems of innovation, European Planning Studies, 6 (2): 131-140.

As far as the firms are concerned, the presence of both small and medium sized enterprises (SMEs) so as of large firms, being both local or multinational, is very important, with the first group being the most numerous and the second being even absent in some clusters. It is also important to remember, at this point, that such firms are not specialized just in manufacturing activities but also in (business) service ones. As a matter of fact, service activities are getting increasingly relevant and may play a particular role in the pursuing of emerging industries. A case in point is the sustainable mobility where the most interesting solutions are those realized through the development of services (e.g., car-sharing services) rather than through innovative technological manufacturing solutions (e.g., new engines).

As far as the other institutions are concerned, we propose that there are two important categories of actors to be included in order to pursue effectively cluster specialisations in emerging industries, i.e., key enabling actors (KEA) and institutional knowledge-intensive business services (KIBS).

Key enabling actors (KEA)

Key enabling actors (KEA) are research centres specialised in one of the key enabling technologies (KET) associated with the emerging industries. The KET identified by CluStrat are the same ones that the European Commission selected in its 2009 Communication "Preparing for Our Future: Developing a Common Strategy for Key Enabling Technologies in the EU" including:

- nanotechnology,

- micro-nanoelectronics,

- advanced materials,

- photonics,

- industrial biotechnology, and

- advanced manufacturing systems.

In addition to these KET, also cross-cutting services should be considered, e.g., ICT and creative industry applications, in that they represent enabling technologies with high potential for many traditional industry sectors (e.g. the application of ICT for home automation in the building industry). Such actors are recognized at the European level for holding frontier competences on such knowledge, being of a basic type, and may be university department, public research centres and the like.

Figure 6 – Clusters, key enabling technologies and cross-cutting issues[20]

Traditional Clusters

Key enabling technologies	Automotive	Food	Manufact. industries	Materials	Furniture	…
Nanotechnology						
Photonics						
Industrial Biotechnologies						
….						

Cross-cutting

Knowledge transfer and co-production

Internationalisation

Gender and innovation including diversity
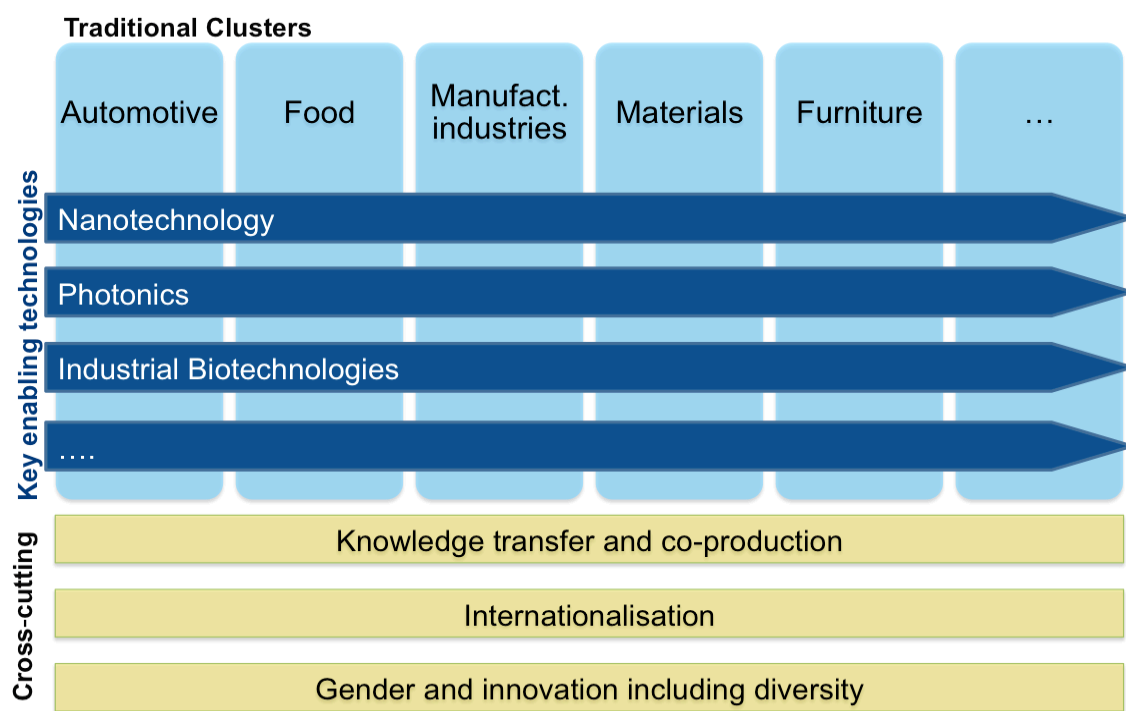
(Institutional) knowledge-intensive business services (KIBS)

We propose that, additionally to KEA, also institutional knowledge-intensive business services (which from now on we will name KIBS) are key component of clusters willing to effectively develop in emerging industries. KIBS differ from KEA in that they include knowledge institutions in a more specialized field, e.g., a specific category of materials or of products. They are service organizations having highly qualified human capital that transfer to and co-produce knowledge with their clients, playing therefore a crucial role in supporting the innovation processes taking place in the territories where they work. Despite KIBS may be both private firms or public or institutional organizations, in this context we focus just on institutional ones, being those entailing the higher innovation potential for emerging industries. Institutional KIBS are often founded to address the demands of firms part of a local or regional

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[20] The source of the figure is: Dott. Petra Püchner – "Expected impact of new cluster strategies for Central Europe and the Danube region".

cluster: the more they act as knowledge gatekeepers between the cluster and the external competitive environment[21], the more effective in addressing them. Several institutional KIBS developed the capability to work on transnational projects on innovation: they are for sure among the most interesting actors to involve, in the perspective to develop emerging industries at the European level. If KEA are well recognized at the EU level, KIBS are usually less visible, meaning that there may be the need to support firms in identifying which may be the best fit for their needs.

These institutional KIBS are present in all sectors, being particularly numerous in some of them in Europe. Among such KIBS-intensive sectors is, for example, the home-furniture industry, where InnovaWood is active – a network of KIBS to support innovation in the forest, wood-based and furniture activities[22]. InnovaWood members are active in the areas of research, education and training, technology transfer and business services. They are located in 25 European countries; some of them are part of universities and other not, but still have a public or institutional character, such as the Thünen Institute for Wood Research (Germany), the Wood K-plus (Competence Centre for Wood Composites and Wood Chemistry, Austria) and the Instytut Technologii Drewna (Poland).

The role of KEA and KIBS

To understand the role of KEA and KIBS in supporting the development of emerging industries in clusters is particularly important to consider that innovation involves several steps, including: the initial generation of ideas, the selection of the most promising and feasible ones, the development of the selected projects to transform them into new products, services or business models and finally the development and the diffusion of the innovation on the market. At this regard, the concept of Technology Readiness Levels (TRL), used also by the European Commission[23] in the effort to set the EU strategy for KET and developed to assess the maturity of evolving technologies, is helpful to understand the different steps part of the innovation value chain in the context of technological innovations. According to the TRL scheme

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[21] A model of institutional KIBS acting as knowledge gatekeeper is that discussed in Grandinetti, R. (2011), Local/global interfaces within industrial districts: an Italian case study, The Learning Organization, 18 (4): 301-312.

[22] More precisely, InnovaWood is an umbrella organisation that integrates four European networks (Eurifi, Eurofortech, Euroligna, Eurowood).

[23] European Commission, A European Strategy for Key Enabling Technologies – A bridge to growth and jobs, 26.6.2012, COM(2012) 341 final.

(Figure 7), fundamental research is the first step; technological research steps follow (including the formulation of technology concept; the experimental proof of the concept, and the validation of the technology in laboratories). Before the successful implementation on the market, other four phases of product demonstration are considered, i.e. the technological validation in relevant environment; the demonstration in relevant environment; the demonstration in operational environment and finally the completion and qualification of the system. Of course, not all the phases are applicable for all the innovations introduced (e.g., incremental innovation or business model innovation). What is relevant here, however, is the recognition that each of those phases needs different competences (e.g., in the first steps knowledge in basic and applied research is mostly important, whereas in the last ones management competences are rather the most relevant). The cooperation with KEA and KIBS is relevant especially for the first steps of such a chain, to allow firms identify and develop fruitful ideas, which they will then transform in products to be sold on the market leveraging on their private knowledge.

Figure 7 – The TRL scheme for R&D&I funding under EU policies and laws
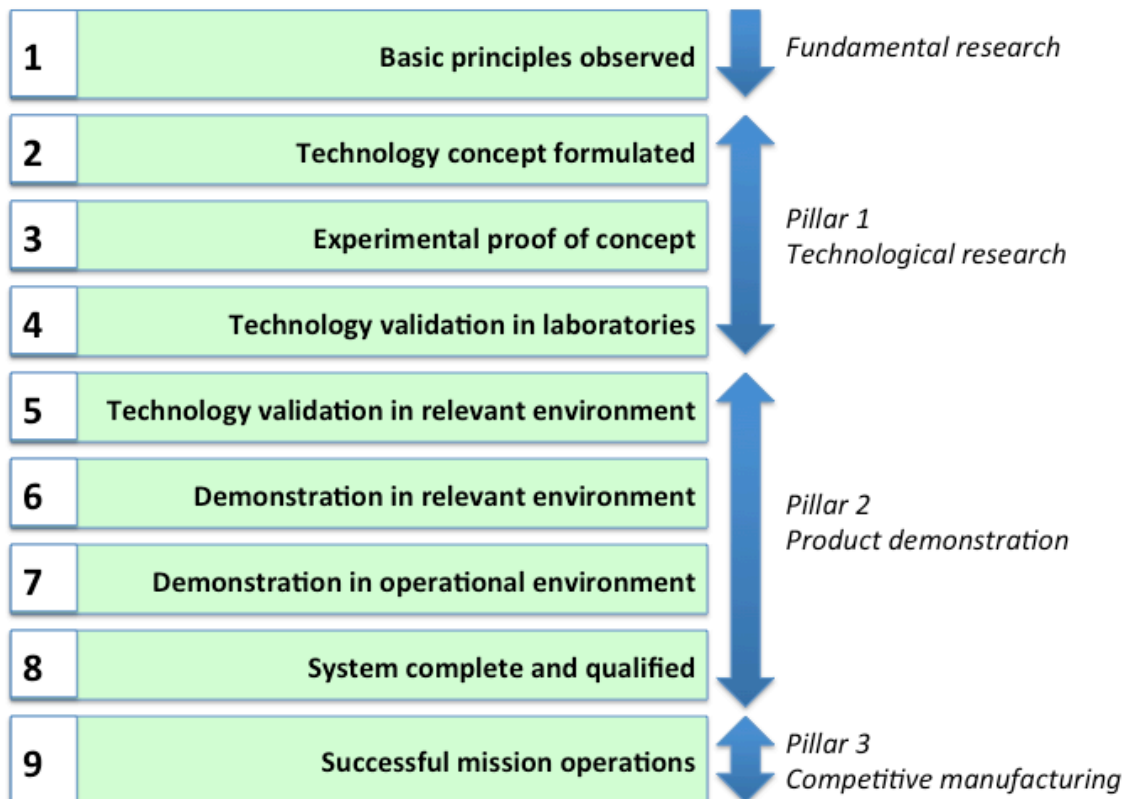
It is important to highlight, at this point, that KEA and KIBS are not necessarily to be located within a cluster: the more specialist and cutting edge the needed knowledge, the more likely that just few actors held it, therefore the lower the possibilities that they are co-located with the firm which is looking for their knowledge. This is the case for both KEA and KIBS, but the relevance of this evidence for policy making is even higher in the case of KIBS, considering that they are less "visible" in the EU context. Being more specialized in sub-fields and usually of smaller dimensions and more numerous, it is important to support a system that allows firms and clusters to recognize who held which knowledge, so to allow for the highest innovation potential. Of course, the fact that they are located far away from cluster firms increase potential difficulties for reciprocal knowledge and interaction: in this sense, it is even more relevant the role of an 'entrepreneurial' CMO, who can support the creation and development of such interaction (see par 2.2).

The KET unit within DG Enterprise, understanding the need especially for SMEs to receive supporting services for bringing innovations to market, especially in TRL 5 – 8, has started a new initiative to identify KET platforms that offer services to SMEs in those TRL on a European scale. This initiative thus follows the same understanding for the need of KIBS, especially SMEs, which are the core target for policy makers in regard to cluster policy[24].

The importance of knowledge institutions to the development of innovations in challenging areas, suggest the subsequent policy implications.

> ***Policy implication 2a -*** *In order to increase the ability of European regions to compete in emerging industries, innovation projects developed by firms and clusters – in particular the projects implying trans-national cooperation – have to be supported by an appropriate knowledge institutions (sub)system. Such system shall include both key enabling technology actors (KEA) and institutional knowledge-intensive business services (KIBS). They should have reached the excellence in their field, work at the global level and thus be a valuable partner in projects of transnational cooperation on emerging industries.*
>
> ***Policy implication 2b -*** *In order to ensure to involve just knowledge institutions being particular knowledgeable, a form of accreditation of both KEA and KIBS at the European level could be helpful.*

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[24] Steinbeis-Europa-Zentrum, coordinator of CluStrat, is the main contractor to DG Enterprise supporting the implementation of this initiative. First publicly available results are expected for December 2014.

2.2 ENTREPRENEURIAL CLUSTER MANAGEMENT ORGANIZATIONS

As discussed in the initial paragraphs, not all the clusters have a cluster management organization (CMO) that leads and coordinates joint activities. In principle, the presence of a CMO is not a requisite of the competitiveness of the cluster (as suggested by the Silicon Valley example),[25] which is the reason why it was not included in the list of requisites presented in paragraph 1.4. However, considering the challenges connected with the specialisation in the emerging industries, such as active ageing or sustainable mobility, which require a great deal of collaboration with firms and institutions being located both within and outside the cluster and having a different knowledge base, the role of the CMO became crucial, and should therefore be recognized, also even in the form of participation fees, by cluster partners.

Not all CMOs, however, have the ability to play this role, but just those that we define "entrepreneurial CMOs". In the literature, entrepreneurship is defined as the ability to seek, identify and exploit new business opportunities[26]. Even if this term normally refers to firms, we consider appropriate to extend it also to CMOs and suggest that they should take on the task of search, recognition and pre-exploitation, even if they are non-profit organizations and are public or publicly funded institutions. Entrepreneurial CMO should also support entrepreneurship at cluster firms and the development of the needed competences, facilitating the emergence of strategic initiatives responding to the strategic challenges of the clusters.

Different are the activities that CMOs should perform in order to be "entrepreneurial" and therefore being actively supporting the development of the cluster partners toward emerging industries.

Intra-cluster collaboration

First of all, entrepreneurial CMOs should favour collaboration between firms part of the cluster. Considering that the majority of firms part of the cluster are too small, as it is typically observed in many European clusters, the CMO should favour their aggregation in the form of consortium or other collective

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[25] Saxenian A. (1994), Regional Advantage: Culture and Competition in Silicon Valley and Route 128, Cambridge, Harvard University Press.

[26] Stevenson, H.H. and Jarillo, J.C. (1990), A paradigm of entrepreneurship: entrepreneurial management, Strategic Management Journal, 11 (Special Issue): 17-27; Shane, S. and Venkataraman, S. (2000), The promise of entrepreneurship as a field of research, Academy of Management Review, 25 (1): 217-226.

configurations, so that they can better dialogue with (external) partners and be better able to recognize and take advantage of new business opportunities, so as entering foreign markets. In order to do so, CMO should look for all the possible opportunities, being fund raising or the development of contracts suitable to support cooperation and innovation. A useful case in point is represented by the "business network contract" developed in Italy through the Italian Law 9 April 2009, n. 33 art. 3, co. 4-ter, part of the "small business act for Europe", and which is now being proposed for enlargement at the European level too[27]. Such contract allows two or more enterprises, on a purely contractual basis, to jointly perform one or more economic activities in order to increase their potentials for innovation and competitiveness. Among the lawful goals of the contract there is the capacity to approach relationships otherwise precluded to the single business: funding, facilitation, public contracts (public call for bids) and in general all kind of businesses and strategic activities where an "organisation trigger" is necessary to reach more ambitious and dimensional targets. The interest in such tool, suited for small and medium enterprises (SMEs), relies on the fact that it is focused on specific (innovation-oriented) goals and that establishes a common body for governance, that support cooperation and the interaction with external (potentially international) commercial and innovation partners.

Intra-cluster collaboration also includes the involvement of research organisations, who are permanent players in the cluster eco-system of many European clusters. In Germany, a focus on research collaborations involving industry and high-level research organisations is a key issue to form a cluster and receive funding. This research driven cluster approach is especially useful for SMEs that are members of the cluster, as they get access to knowledge and at the same time the services to apply this knowledge for their own competitiveness.

Cross-cluster, trans-national collaboration

In a demanding and increasingly competitive global market environment, CMOs are challenged to take up a more complex role than in the past, and to focus not only on the *inside* of the cluster but also on how to link it to the *outside*. Adopting the perspective of emerging industries, CMOs should, in fact, help cluster firms to recognize opportunities that they would have a hard time to identify, being focused just on their cluster (industry) specialisation. Entrepreneurial CMOs should support cluster firms collaboration toward emerging industries involving actors part of different industries and different clusters, especially at the

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[27] More information are available at the website: http://www.retedimpresa.com/?page_id=188

international level, which hold competences and production specialisations complementary to the cluster firms, in order to jointly take advantage of emerging opportunities. A useful solution in this sense is the support of trans-regional cooperation, also in the form of meta-clusters, which will developed more thoroughly in paragraph 2.3.

Support to new ventures

Other than supporting the cooperation among existing firms within and beyond the cluster, entrepreneurial CMOs should work also as a sort of "smart" business incubators, supporting the creation and development of new firms, especially when established specifically to target a need or specialisation related to one or more emerging industry. This could be the case especially when new services/products – which cannot be covered by the involved capacities/actors or which are not interesting to the firms because of the small size of the market – are generated as a result of the process. Despite the small size and impact on the local economy, new ventures may be an essential tool to drive the cluster toward the development of a specialisation in emerging industries, since they are usually capable of break-through innovation and may develop to satisfy specific market niches, complementary to the specialisation in the existing cluster.

Leveraging on this discussion on the role of entrepreneurial CMOs we propose the following policy implication.

> *Policy implication 3: In the context of selective policies to favour clusters, a crucial aim is that of the evolution of CMOs toward an entrepreneurial approach, so that they get capable of identifying and proposing to cluster firms (or their combinations) business opportunities in emerging industries and to offer occasions of trans-regional cooperation.*

2.3   SMART   SPECIALISATION,   REGIONAL   CLUSTERING   AND   TRANSREGIONAL COOPERATION

Smart specialisation and the triple helix model

"Smart specialisation must not be associated with a strategy of the simple industrial specialisation of a particular region in tourism or fisheries (to take two fairly low tech sectors as an example). Instead, smart specialisation is about R&D and innovation and it might suggest that such a region should specialise in R&D and innovation related to the sector of tourism or fisheries. This means that smart specialisation is a process addressing the missing or weak relations between R&D and innovation resources and activities, on the one hand, and the industrial structure of the economy, on the other. A key point is that smart specialisation is not just for the 'best' regions and technology leaders. On the contrary, this concept provides strategies and roles for any region" (p. 5)[28]. And, this enables every region and every area of competence to recognize its specific strengths, evaluate them/their relevance in the regional economic context, and deploy them.

Following such considerations, developed by the inventors of the smart specialisation concept, innovation and regional development policies in Europe have changed, recognizing that each region should define its specific path leveraging on the existing regional strengths and assets. Moreover, considering that "no region is an island", the specialisation of a region raises its competitive value if it connects and cooperates with a complementary specialisation of another region.

Following the triple helix approach, a S3 comprises three types of actors:

1.   firms, being manufacturing or service;

2.   knowledge institutions[29];

3.   policy makers, first of all the regional ones.

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[28] Foray D., David P.A. and Hall B.H. (2011), Smart specialization: From academic idea to political instrument, the surprising career of a concept and the difficulties involved in its implementation, MTEI Working Paper, November 2011.

[29] The triple-helix model originally included as knowledge institutions just universities and public research centres, whereas more recently also technology transfer centres, corporate research centres and public or private KIBS have been included.

In order for the selected specialisation to be truly smart, such three subsystems need to interact in an effective and efficient manner, such is suggested in the triple helix model. In several European regions and countries the interaction between the first and the second actors is particularly weak. For this reason, the identification of the smart specialisation should pave the way to policies that favour such interaction so the transfer of the result from the research to firms (see Figure 8). Regions should therefore favour the knowledge institutions that are specialized in the S3 fields so that they became excellence centres and promote their cooperation with other, EU research centres having complementary specialisations. In this sense, the S3 should be accompanied by the mutual learning of clusters and policy makers within EU regions.

Taken together, the S3 and the triple helix concepts arrange an appropriate framework to develop a strategy on European clusters.

Figure 8 – Smart specialisation and the triple helix
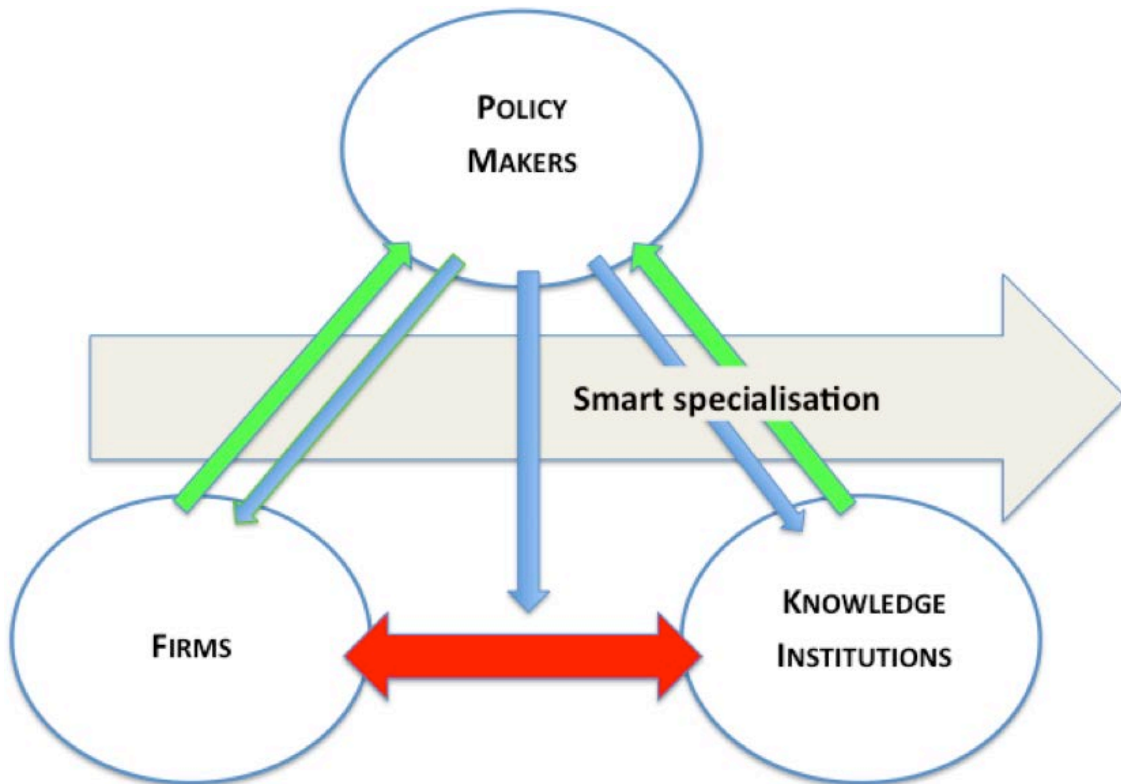
Regional clustering and transregional cooperation

As mentioned in paragraph 1.2, the Guide to Research and Innovation Strategies for Smart Specialisation, drawn up by a group of experts for the European Commission, assigns an important role to clusters. In particular, this document states: "the use of clusters for smart specialisation may imply important political decisions regarding the development of new cluster initiatives or the use of existing ones. New cluster initiatives can be launched, provided that they are crucial for implementing the regional governments' visions and that will therefore be strongly supported in the future. Otherwise, new cluster initiatives should be avoided. Fragmentation and proliferation of cluster initiatives often leads to dispersion of forces and financial resources as well as to less cooperation and fewer synergies between them" (p. 67).

With the aim of adhering to these guidelines, CluStrat has provided the stimulus not so much for the creation in a given region of brand new clusters, but rather the development of regional cooperation projects stemming from existing sub-regional (industry-based) clusters and potentially from businesses and institutions which, even if not part of a cluster, still possess competences that are relevant for cross-cluster cooperation. Such cooperation initiatives at the regional level are normally temporary and very targeted, being thematically-driven and flexible in their composition[30], but can even constitute the starting point for the formation of a new and permanent regional cluster. These regional clustering projects have an important strategic meaning for CluStrat, as the regions involved increase their capacity to actively participate in cross-cluster (transregional and transnational) cooperation initiatives, in view of the emerging industries selected by CluStrat.

The pilot project developed by the Veneto Region – in collaboration with other CluStrat Regions (Friuli-Venezia Giulia, Piemonte, Baden-Württemberg) – is a good example of this strategy of regional clustering. The aim of the pilot has been to develop the basic conditions so to form a regional cluster in the field of the sustainable living and housing, which address the sustainable economy and active ageing emerging industries. The region, in fact, hosts several "pieces" that are useful to the purpose of creating such a regional cluster: industrial districts (subregional clusters) and single medium or large firms with good internal R&D capabilities specialized on home-furnishing, electronic appliances, ICT and other related sectors; a wide and widespread construction sector; knowledge-intensive business services; national and internationally recognized universities (Padua, Venice and Verona) having departments

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[30] Such non-permanent targeted innovation networks or clusters are already described as example for Finland´s cluster policy in the TACTICS publication: 'Where the cluster winds are blowing - Better cluster policies and tools for implementation', by Emily Wise and Cecilia Johansson, Vinnova in October 2012.

specialised in chemicals, engineering and the like. A relevant part of these businesses are devoting a great deal of attention and efforts to improving the environmental sustainability of their processes and products, or of those of their clients; several institutional actors are yet engaged in innovation projects dealing with topics on sustainable living. All such actors have interests, knowledge and competences, products and services that can be organized in various ways to develop new projects linked with sustainable living and housing, and also to participate in initiatives for transnational cooperation in this field. Such a choice is even more interesting considering that the Veneto Region has contextually introduced a regional law (L.R. 13/2014) that encourages the formation of regional innovation clusters such as that described above, and that it identified "sustainable living" as one of its smart specialisations.

The approach to regional clustering by Baden-Württemberg was different. Given the existence of highly competitive clusters in KET both for health care and the building sector, a cross-clustering between those targeted on the topic of smart home and living was achieved through a dedicated coordinating platform, in which cluster managers as well as other key actors from research and industry take the lead for developing targeted intra-cluster cooperation. Without policy intervention, this topic would not have been taken up as an intra-cluster target, but would have remained in the ICT and housing ecosystem, neglecting the chances and opportunities of all the other competences.

The option of regional clustering is meaningful if it allows to put together existing actors (including firms, knowledge institutions, sub-regional clusters) specialised in different fields that are complementary, so that the system as a whole will have better chances than its single parts. In other words, the idea of regional clustering is based on two conditions:

1. the elements part of the regional clustering are adequate in terms of their number and quality;

2. the result of such process is to improve the chances of the region to reach a competitive position in one of the emerging industries.

So, regional clustering in the context of an emerging industry is not necessarily a realistic aim for every region. Indeed, it is just one among the several possible cooperation forms among actors willing to work in the context of emerging industries and cross-cutting issues, which is the interest of the CluStrat project. When the regional clustering strategy is feasible, such regional clusters will have larger capabilities to produce services and products and to develop innovation in one emerging industry, and it will get a credible interlocutor for trans-regional and trans-national cooperation projects. If a region knows its strengths, it is capable to get engaged into the implementation of KET in a much more targeted way. The precondition for this is to know one's assets and the relevance of different KET for the industries and

product portfolios of the region. This is why smart specialization processes in the regions can represent a good starting point for implementation of KET through cluster initiatives.

Towards European clusters or meta-clusters?

The experiences of cross-cluster and transnational cooperation activated in CluStrat pilots may also constitute the embryo for the formation of clusters on a European scale, or of meta-clusters, to use a concept introduced in another project of the European Regional Development Fund, i.e. Alps4Eu[31], where a meta-cluster is defined as "a trans-regional network of cluster initiatives, which focus on the same or complementary specific technological field or sector. A meta-cluster consists of at least three cluster initiatives in three different regions". The practice of this and similar initiatives shows that meta-clusters are often formed among clusters of the same topic. Photonic clusters of different regions from one bigger unit to exchange among photonic active industries and research.

In the case of CluStrat, the factor that would hold together the clusters of a meta-cluster is an emerging industry or a narrower segment of an emerging industry. This implies that in active aging, for example, food clusters, health clusters, ICT and photonic clusters etc. join forces on a meta level, supporting their members to develop ideas and projects, products and services which use the variety of competences to answer the needs of the market. Such meta-cluster not necessarily has to be durable and institutionalized, but may consist also of dynamic and flexible cross-regional cooperation networks and projects. This might in fact differ between different industries/technological fields: for instance, as for the experience of the Baden-Württemberg's pilot, for the field of "smart home", the creation of a platform at meta-level was necessary; at the same time, for the field of green technology, rather a temporary cooperation appears feasible.

Smart specialisation and diverse modes of cross-cluster cooperation

In this section we discussed several cross-cluster cooperation options coherently with the smart specialisation, being summarized in Figure 9. The first one is regional clustering, where one or more sub-regional clusters and other actors (A) such as lead firms, a university department or a KIBS develop

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[31] Alps4Eu has been co-financed by European Territorial Cooperation Programme Alpine Space 2007-2013 and coordinated by the Piedmont Region - Directorate of Industry and Productive Activities.

cooperation initiatives in the context of an emerging industry. The second one is a transregional (or even transnational) cooperation where each region participates with own clusters; the third is a transregional (or even transnational) cooperation where some regions participate not with a cluster but with a key enabling technology actor (KEA).

CLUSTRAT

Figure 9 – Strategies of cross-cluster cooperation
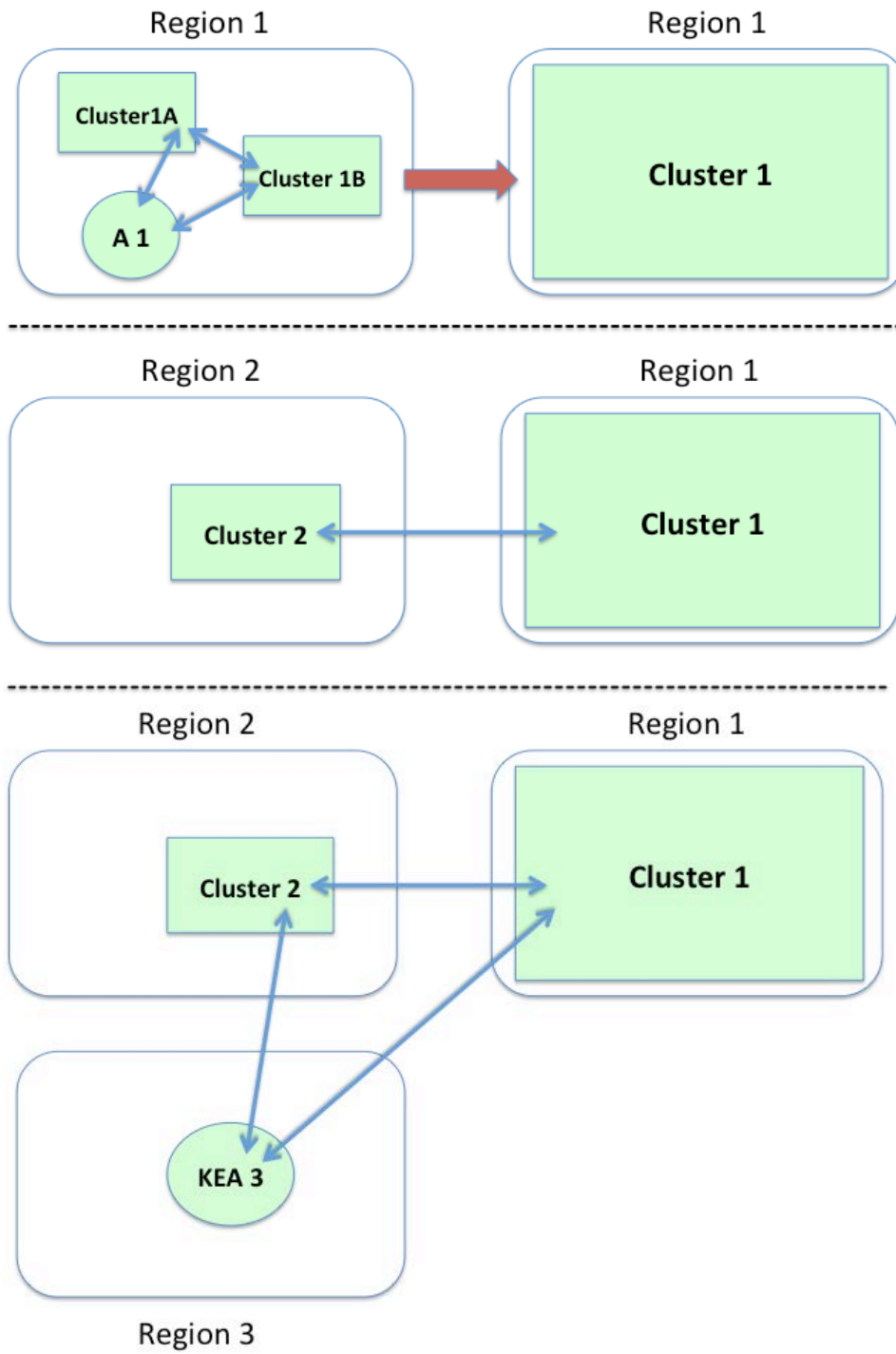
Following the route indicated, three levels are clearly identified in the definition of the strategies focusing on cross-cluster cooperation, and of the public policies, in particular:

- the European Union level (or a smaller interregional and macro-regional level, like the Central Europe), where the measures aimed at boosting transnational cross-cluster cooperation and the formation of smart meta-clusters (transnational clustering) are to be adopted;

- the national level, where the national government bodies should make use of the existing tools (if any) or prepare new ones to boost transregional cross-cluster cooperation;

- the regional level, where the regional government bodies should make use of the existing tools (if any) or prepare new ones to boost smart specialisation of existing clusters, intraregional cross-cluster cooperation and the formation of smart regional clusters (regional clustering).

The considerations written above have the following policy implications, holding at the European, national and regional level:

Policy implication 4a - *Cluster policy should favour the creation of regional clusters in cases in which the regional scale allows to take opportunities linked with the emerging industries, which a smaller scale will not allow to catch. A similar approach should favour the development of other suitable forms of collaboration and networking having the same aim.*

Policy implication 4b - *In accordance with the smart specialisation framework, which stresses the potential of the combination of regions having different strengths and competences, a forward-looking cluster policy identifies and exploits – on a transregional and transnational scale – opportunities for cross-cluster cooperation being useful to improve competitive chances of clusters and regions in emerging industries.*

2.4 CONSIDERING THE DEMAND SIDE OF EMERGING INDUSTRIES

The quadruple helix model

The Guide to Research and Innovation Strategies for Smart Specialisation states that "the perhaps most common, tripartite governance model based on the involvement of industry, education and research institutions, and government (the so-called Triple Helix model), is no longer enough in the context of smart specialisation. Innovation users or groups representing demand-side perspectives and consumers, relevant non-profit organisations representing citizens and workers should all be taken on board of the design process of RIS3" (p. 22). The Quadruple Helix is the approach through which the involvement of the demand side is modelled; the adding helix is composed by a set of demand actors, starting from the products and services users[32].

As suggested in Figure 10, the four helixes are different and represent an autonomous system within the overall framework. Similarly, also the interfaces that connect such systems are different. Indeed the possibility that the sub-systems interact and co-evolve is dependent on the effectiveness of the interfaces, which add to the complexity of the system. The inclusion of the demand sub-system adds particularly to the complexity of the framework, since it is much more fragmented than the others, which opens up the problem of how to organize it in order to interact with the other sub-systems (e.g., through non-profit organizations, consumers associations, virtual community of users). Moreover, the cognitive distance between users and the other actors is very high, which requires the setting up of specific contexts to favour the interaction.

The quadruple helix model is particularly important for CluStrat, in that the involvement of the demand is considered the *sine qua non* condition to successfully explore open and complex issues such as those connected to emerging industries, as these are closely related to the grand societal challenges.

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[32] Arnkil R., Jäervensivu A., Koski P. and Piirainen T. (2010), Exploring quadruple helix: Outlining user-oriented innovation models, University of Tampere, Work Research Center, Working Paper No. 85 (Final Report on Quadruple Helix Research for the CLIQ project, INTERREG IVC Programme).

Figure 10 – Smart specialisation and the quadruple helix

Interaction context
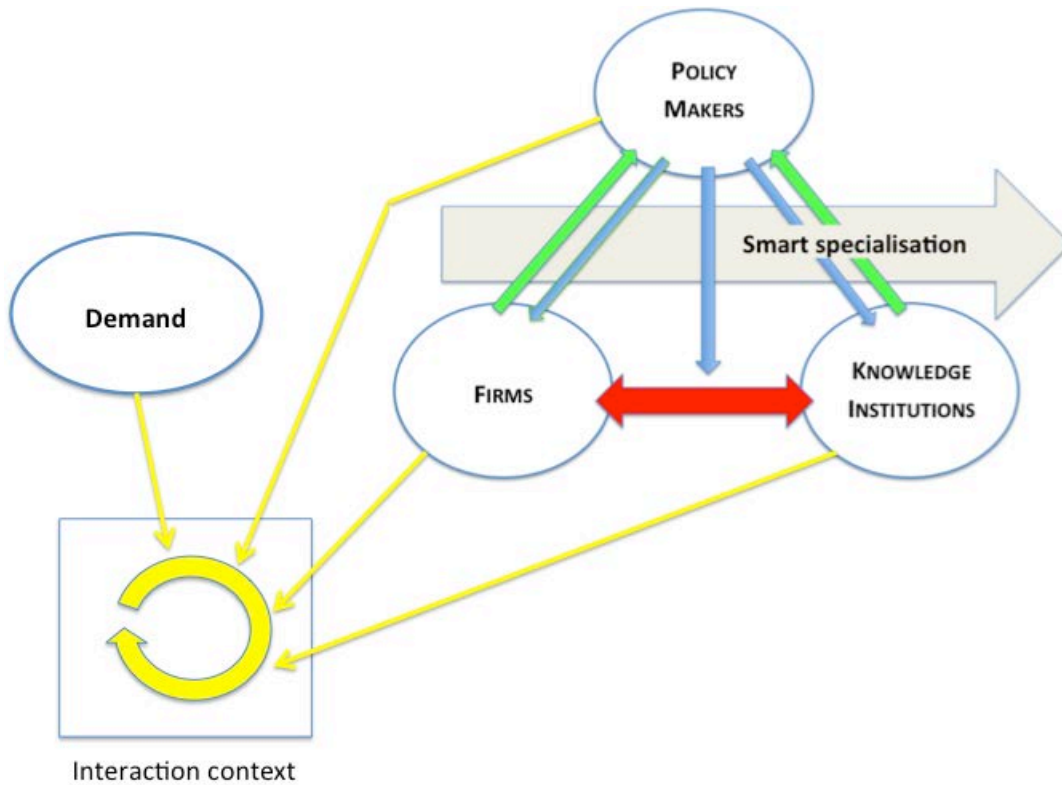
Creating contexts where the supply side and the demand side of emerging industries can interact

In CluStrat emerging industries are defined as those sectors "which are most likely to come in the near future or are even already seen to develop. Those emerging sectors or industries are a reaction to challenges of society. The trend in society is visible, but the industrial and service sectors have not yet exploited it. Thus, it needs to emerge to exploit the market opportunities already visible. This means there is a clear potential seen for new products and services, and policy looks for instruments to actively strengthen the existing potential to play a major part in those emerging industries" (p. 3) [33]. This definition leads to the acknowledgement that the emerging industries are frontiers of innovation, featuring high levels of complexity due to the range of problems and needs to be dealt with. Within this scenario and also bearing in mind the specific nature of the emerging industries of CluStrat – i.e. active ageing, green

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[33] Püchner P. (2011), Discussion Paper on Emerging Industries, 2nd Draft, Steinbeis-Europa-Zentrum.

economy and sustainable mobility – an important factor is the set-up of contexts (territories) for experimentation and experience in which the innovative competences of producers of goods, services and technologies, the "voice" and the behaviour of users and consumers, and the functions of the policy makers in those territories may converge and cooperate.

Integrating the perspective of the supply side with that of the demand side constitutes a highly qualifying element of CluStrat. In concrete, this meant conceiving the pilot projects so that the two perspectives co-exist and may interact with one another. In particular, the demand side has been considered in the initial stage of the project, in the form of an initial assessment of the demand needs or new demand trends and the involvement of stakeholders representing the demand, but also in the final stage, in order to communicate the outcome of the project to the potential customers. Pilot results confirm the importance to integrate the demand helix in order to develop valuable innovations in the emerging industries realm.

The cognitive interaction between supply and demand is a key aspect in the context of emerging industries, where several of the innovations to be introduced are breakthrough (disruptive), rather than consisting in the optimization of existing products. Actually, it is a matter of thinking to problems and needs of people and to develop new ways to satisfy them, rather than looking for incremental improvements to the existing products (or services). For instance, to tackle the problem of the reduced mobility of elderly people in their homes, it is necessary to observe them and dialogue with them in order to understand the obstacles and difficulties they face, prescinding from which are the technologies now available to face these issues. On the other hand, this approach may allow also to find ways to develop the potential demand, in the cases in which technologies have already been developed but have not been successful on the market.

In the realm of marketing studies, several **techniques to analyse the demand** have been developed, that are useful to support the process of new product development – from idea generation to market test before the launch of the new product – and that may be very useful in the case of complex innovations such as those targeted by CluStrat.

Considering for the high fragmentation of the fourth helix, a further important mode to include the demand in the innovation process consist in favouring the **aggregation of potential users into groups** (like in the case of ethical purchasing groups). This may be the case, for example, of products improved for their environmental character, developed by firms in an agri-food cluster. Potential consumers of an organised group might get informed about the specific issue of sustainability considered and buy the

products and services generated by firms part of the cluster with a better deal, guaranteed by the collective demand and its management.

To the same general perspective (supply-demand interaction), it could be useful to develop **laboratories where the demand and supply sides can meet, for the purpose of researching and developing innovations**. More specifically, in such labs researchers and developers can observe the behaviours of users in experimenting new technologies and services and cognitive interaction between users and producers are developed. A case in point is that of he FZI Living Lab Ambient Assisted Living (AAL) in Karlruhe (Baden-Württemberg), a best practice in active ageing. This lab consists of a series of rooms that offer a realistic living environment for elderly people acting as a design, implementation and evaluation context for a broad range of existing technologies, research prototypes and related services. The lab is composed by a network of researchers, companies (both technology and service providers), and end user organizations working together in end-user oriented research on ambient assisted living[34]. A further interesting example is LAK (Living for All Kitchen) in Friuli Venezia Giulia. LAK is a project promoted by a group of small and medium-sized firms and regional research centres leaded by Snaidero Rino Spa (one of the largest producers in Europe of fitted kitchens), whose objective is experimenting and integrating new home automation technologies (home automation) in the kitchen-environment, to make it more liveable, especially for elderly or people with slight mental disability.

If the study of consumer behaviours nowadays is well supported by information and communication technologies that allow to design sophisticated virtual consumer environments, we must not overlook the observation in real environments. As supported by an influential study on ambient intelligence in assisted living of elderly people, "test and evaluation of technology and prototypes should be done in controlled environment simulating real-life, such as the Assisted Living Laboratory" (p. 111). A similar approach is useful also to arrange suitable activities in terms of information and training, which are necessary "to make the elderly people aware of the ambient and unobtrusive assistance in their home environment" (p. 111)[35]. It is important to add that user can be useful included in the research and development process not

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[34] http://aal.fzi.de

[35] Kleinberger, T. Becker, M., Ras, E., Holzinger, A. and Müller, P. (2007), Ambient intelligence in assisted living: Enable elderly people to handle future interfaces, in Stephanidis, C. (ed), *Universal Access in Human-Computer Interaction: Ambient Interaction, Part II*, Berlin-Heidelberg, Springer-Verlag.

only as the subject under scrutiny, but also as a subject that can actively contribute to the definition and development of innovations[36].

Another context in which the quadruple helix model can be applied is the **societal pilots**, i.e., projects in which the introduction of new products and services into a real-life environment is intended to result in societal innovation. In Europe, there are already a number of experiences of this kind[37].

Similarly to what has been discussed in paragraph 2.3 as far as transregional cooperation was considered, the interaction context could be located in a different region than those where clusters and key enabling actors are located, being a suitable territory under the profile of demand, i.e. a context in which clusters' producers (from other regions), local users and local policy makers can interact and work together on the innovative frontier of an emerging industry (Figure 11).

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[36] The role of customers, being them consumers or organizations, as knowledge co-creators in the development of new products has been analysed in a number of theoretical and empirical studies. See, among others: Nambisan, S. (2002), Designing virtual customer environments for new product development: Toward a theory, *Academy of Management Review*, 27 (3): 392-413.

[37] Ballon P., Pierson J. and Delaere S. (2005), Test and experimentation platforms for broadband innovation: Examining European practice, Conference Proceedings of ITS 16th European Regional Conference (International Telecommunications Society), Porto, Portugal, 4–6 September 2005.

Figure 11 – Broadening the framework of cross-cluster cooperation
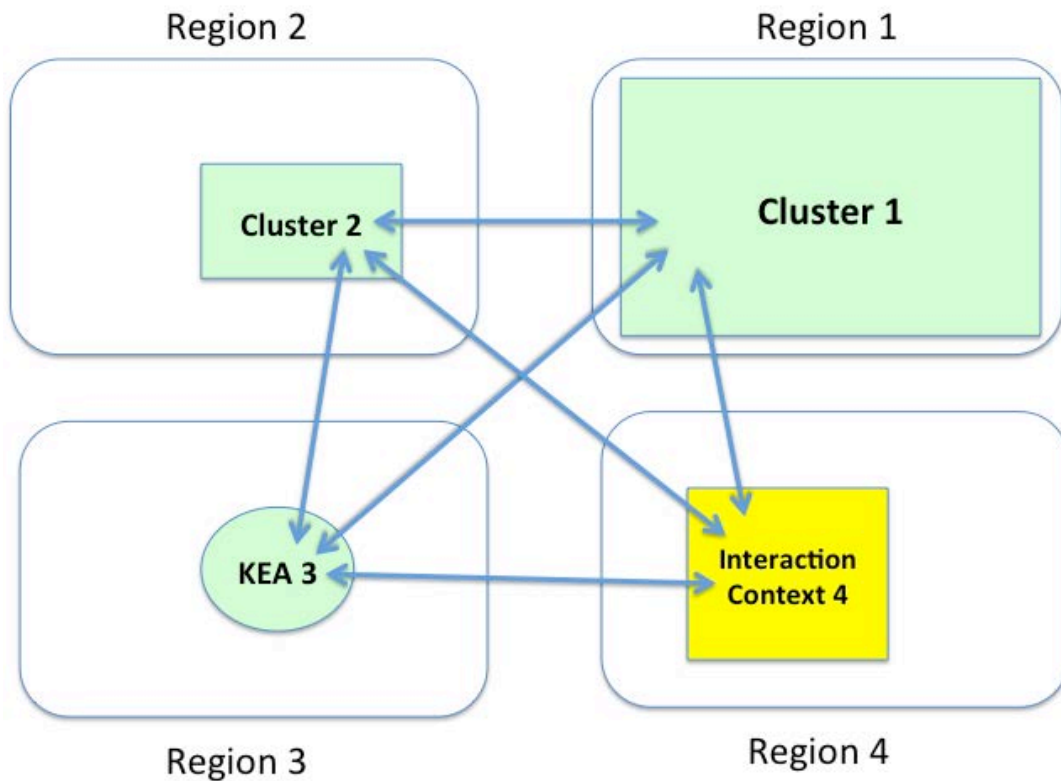
The transregional and transnational cooperation to improve the supply and demand interaction might be particularly useful in the context of very complex and expensive experimentations, being the way to make them economically sustainable. This is especially true in the case of very complex "products", having different and interdependent components (goods, services, technologies, organizational routines), for instance a project to improve the usability of historical centres by people with disabilities. Costs of such solutions may be spread across more cities co-operating in its development or may be better overcame if it is then sold to other cities at a later stage.

A set of important policy implications follows this discussion on the importance to make supply and demand interact.

Policy implication 5a - *The presence of laboratories where demand and supply can meet and interact represents a cognitive resource entailing a high value to the development of innovation projects in emerging industries. The formation of new contexts of this type and the strengthening of the existing ones represent a qualified object of cluster policy aimed to seek and exploit new opportunities in the emerging industries.*

Policy implication 5b - *Considering that demand is much more fragmented than the other sub-systems, another qualified object of cluster policy in the emerging industries is supporting its organization.*

Policy implication 5c - *Complex and expensive experimentations between demand and supply in the context of emerging industries may be developed thanks to transnational cooperation.*

Policy implication 5d - *Acceptance of new products and services by the market may be an issue to look at by supported and targeted early dialogue processes among clusters and user groups.*

CLUSTRAT

3. THE CROSS-CUTTING ISSUES AND THE NEW CLUSTER CONCEPTS

Aim of the CluStrat project was to assess systematically the cluster potential in relation to three emerging industries, considering for cross-cutting issues that can be understood as "strategic leverages" for the advancement of the emerging industries. The emerging framework has clear implications for the three cross-cutting issues considered in the project: knowledge transfer and co-production, internationalisation, and gender and diversity for innovation.

3.1 KNOWLEDGE TRANSFER AND CO-PRODUCTION

When the project started, this cross-cutting issue was defined as "knowledge and technology transfer", but we later modify it in "knowledge transfer and co-production". Indeed, considering for the break-through level of innovativeness represented by emerging industries the cross-cutting issue that really counts is much more far-reaching than simple transfer – from one, more advanced region, firm or institution to a more backward one – assuming also a form of knowledge co-production.

All the elements discussed in the framework have a potential clear incidence to the cross-cutting issue considered. First of all, this is the case for the **smart specialisation, regional clustering and transnational cooperation**, where cross-cluster collaboration to the strengthening of the regional potential is envisioned, and the **entrepreneurial CMOs**, who support the development of the clusters and the individuation of new opportunities. In fact, according to the literature, an important aspect determining the success of industrial districts and, more generally, of clusters, is the fact that they function as learning systems, where information and knowledge circulate and combine to generate new knowledge, to identify new opportunities and to activate new business relationships[38]. Similarly, the clusters should be able to develop existing technologies that have not found a market yet but that may find suitable applications in the context of emerging industries. This cognitive capability of clusters depends on their (industry) specialisation, which is challenged by emerging industries that are, by definition, complex and intersectoral. For actors willing to work on such frontiers of innovation and production – the emerging industries identified by the CluStrat project – it is therefore crucial to equip with an appropriate cognitive infrastructure, or better, to have multiple occasions and contexts to exchange information, experiences and knowledge, which shall be proposed by the entrepreneurial CMO.

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[38] Asheim, B.T. (1996), Industrial districts as "learning regions": a condition for prosperity, *European Planning Studies*, 4 (4): 379-400.

An example of how such infrastructure can be created or developed is the experience of the Knowledge and Innovation Communities (KICs) – established under the European Institute of Research and Innovation[39] – which however has not the territorial approach that is suggested in CluStrat and is focused mostly on education and training. In addition, it is possible to think about other forms of exchange of information, experiences and knowledge. An interesting example emerging from the CluStrat project is that developed within the pilot leaded by the Austrian partner, consisting in the creation of a space for matchmaking among firms during the world's leading trade fairs for water, sewage, waste and raw materials management. Moreover, in order to ensure the flow of knowledge from best practice, study visits abroad and a virtual platform to exchange ideas have been organized for the firms participating, which supported knowledge transfer.

Also the involvement of **key enabling and other relevant actors,** another element of the framework, favouring the synergic cooperation across knowledge institutions (intra-region and across-region) is a key aspect in order to support the cluster to work as a "learning system". Finally, also the **integrated demand/supply perspective** has interesting implications with regard to the knowledge issue: the insertion of demand subjects expands the knowledge community to be created and empowers the cognitive processes developed within. This is particular important, as it allows firms and clusters to capture and develop market knowledge, which they would otherwise miss, and which is often the one missing in traditional cluster, not allowing firms to capitalize on existing technologies and competences.

Following this discussion, we propose a final policy implication.

> *Policy implication 6 -* *To arrange occasions and contexts to exchange information, experiences and knowledge represent a key infrastructure to develop cooperation and innovation projects in the emerging industries*

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[39] http://eit.europa.eu/kics

3.2 INTERNATIONALISATION AND TRANSNATIONAL COOPERATION

The cross-cutting theme internationalisation and transnational cooperation is well embedded in all the factors considered in the emerging framework, even tough the experience of the pilots suggests that it may be very difficult to be achieved.

Internationalisation and especially transnational cooperation has been at the core of the proposal of **smart specialisation, regional clustering and transnational cooperation**. The prospect of meta-clusters, proposed in the paragraph 2.3 leads us to consider the cross-cutting issue of internationalisation in all its potential. Thanks to the cooperation within meta-clusters, each of the actors involved internationalize, being a very advanced form to strengthen the competitive position of Europe and its regions in the emerging industries on a global scale

The involvement of **KEA and institutional KIBS** located in different EU regions is necessary to develop competences in the emerging industries. Such institutions hold competences and specialisations that are very advanced and key to transform the clusters' existing specialisations, like furniture or building, into emerging industries, like the sustainable living. As discussed above, they are not necessarily located within the region where the cluster is located: the more specialized the knowledge needed by the cluster firms, the higher the probability that to find it they will have to look for KEA or KIBS located in other EU regions. The collaboration with KEA and KIBS will became therefore another occasion for cluster firms to get international.

The experience of the CluStrat project is that both the collaboration with foreign KEA and KIBS or clusters is not easy to be achieved. The main role of the **entrepreneurial CMOs** should indeed be to promote internationalisation and transnational cooperation, overcoming potential barriers. A first problem preventing firms to connect with institutions and companies located in other regions and countries is that there is not the awareness about their existence and their specialisation, and therefore about how relevant such an interaction could be to develop toward emerging industries. Against this situation, the CMOs has a key role to be played, by identifying clusters, firms, KEA and KIBS being potentially fit for cluster's firms, creating occasions for firms and institutions to learn about each others and supporting the development of joint projects, and supporting sensitization and awareness-raising processes together with cluster policy in order to facilitate the later acceptance of the new solutions.

Also the integration between the **demand and the supply** has a particular relevance for the internationalisation issue, as the relevant market for firms and cluster is no more the region they are embedded it. Considering that each market has its own specificities, such integration may provide a key

avenue for firms to understand how to insert into global markets in the emerging industries context. Moreover, as suggested in the paragraph 2.4, the context where demand and supply can meet may well be located in a different region than where the firms are located, and even in another countries, being an additional avenue for companies to increase their cooperation at the international level.

Such an impact of the CluStrat strategic framework on the cross-cutting issue internationalisation is even larger if we consider that the concept of cluster proposed in this framework exceeds the region even as far as the supply is concerned, and advocates the integration of firms, clusters, KIBS or KEA specialized in traditional industries with other mastering KET and advanced knowledge being located in other EU regions.

The policy implication 7 follows such a reasoning.

> *Policy Implication 7: The new cluster concepts developed have to aim at supporting the internationalisation and transnational cooperation of firms through clusters, so to support the specialisation of EU regions and increasing the competitiveness at the international level.*

3.3 GENDER AND DIVERSITY

Diversity (in a wide sense, even beyond the – still important – gender issue) is a strategic leverage for CluStrat to the extent that its potential value is recognised and used especially as far as innovation is considered, and thus enhancing both business performance (considering the level of single firms) and economic development (considering the cluster and region level). Gender and diversity are mandatory factors for innovation environments like clusters, especially as the business case for gender diversity in technology and innovation has been extensively made. The participation of female researchers and entrepreneurs in all the stages of the innovation value chain has a great potential in terms of innovation success. The more diverse the workforce, the larger the diversity in the knowledge base and the probability the firm will innovate successfully[40]. Gender, and more generally diversity, supports creativity and therefore the identification of new needs and the definition of new products, which is particularly

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[40] Vinnova (2011), *Innovation & Gender*, Västra Aros AB: Västerås, Sweden.

important in the context of emerging industries, since it allows to mix different perspective and capabilities and to identify products tapping gender-specific markets. This issue is not solved by simply adding women to the team, but implies a new thinking and permitting that traditionally-used methodologies in research and innovation are on the test and implications of research on different types of societal groups are on the radar. In this sense, innovation policy in clusters cannot prescind from thinking about gender issues in workforce, considering labour market related policies and education related policies[41].

The element of integration of **supply and demand side** makes it particularly evident how gender and diversity might contribute to the competitiveness of clusters specialized in emerging industries. On the one hand, knowledge of diversity of consumers and users and their involvement stimulate the design of innovative solutions in every emerging industry and increase the probability that these solutions are achieved successfully (demand side). For example, women and men have different ways to use products, leave different ecological footprints and are affected by global warming to different extent. Understanding diversity and such differences means exploring new, profitable opportunities in the realm of emerging industries. On the other hand, diversity of people is a resource for both the enterprises and institutions that are involved in the various emerging industries (supply side), a resource that is widely neglected.

Diversity per se has been an issue in one pilot action, and can certainly be found as a cross-cutting issue in quite a few of the others. The newly started social innovation cluster in CZ develops mainly around the topic of diversity in the workforce and in manufacturing in regard to social inclusion of handicapped people. Quite certain, this cluster will further develop into other diversity issues in regard to social innovation, depending on the cluster member´s interests.

The emerging industry "active aging" is certainly one, where you would consider that diversity – in terms of gender as well as topics like seniors/juniors, less educated and highly educated, etc. – play a role. Interestingly, the smart home and living industry is mainly male driven, as ICT and the building sector are major player until now. Including female perspectives as from the health&care sector brings very fruitful additional aspects into the topic, as could be showcased in the international cluster forum in Stuttgart on active aging, where a female health-care professor identified the weaknesses of today´s approach in a few clear-cut sentences, convincing the technology driven audience in a minute that change is needed.

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[41] Püchner P. (2011), Cross-cutting issues for boosting innovation through new cluster policies. Innovation and Gender. 1st Draft, Steinbeis-Europa-Zentrum, October.

Clusters in Northern Europe are giving us good examples of how diversity and gender bring additional value to technology driven environments. Certainly, there is no one key that fits all approach. One cluster may start with activities to attract a more diverse workforce, including measures to strengthen for example their small female workforce. Another cluster starts to understand that the market is not only male but also female. Asking potential female users of their products for ideas new concepts and innovation is generated for the product range and at the same time a new market opened.

If gender and diversity is a general issue for firms, it entails an even larger meaning when it comes to clusters. The high concentration of firms and institutions (and therefore human resources) that defines a cluster, on the one hand, makes the gender issues better visible, on the other hand, provides a context to tackle it better, especially considering for the fact that are constituted mainly by SMEs. Differently from large firms, in fact, small firms lack resources to create the condition for gender issue to be tackled e.g., through the formation of specific educational programmes to support the entrance of female workers in male-dominated industries, or by the provision of a nursery within the firm buildings to facilitate working mothers. If such services are beyond SMEs' means, considered as single firms, they are not if considering them as a group: a cluster. Clusters could therefore become the perfect context where experimenting new forms of services to support female presence at all the organizational level, e.g., by developing cluster nurseries, cluster-related trainings and other services.

Considering for the difficulties in transforming all such potentials into reality, it is clear that there is the need for a central actors to spur the development of such joint projects and disclose to clusters' partners the importance for them to be fulfilled. In this sense, **entrepreneurial CMOs** should support diversity both in entrepreneurship (ethnic entrepreneurship, woman entrepreneurship, youth entrepreneurship) and human resource management as source of creativity and innovation for firms and institutions involved.

Policy Implication 8: A key object of European cluster policies should be to create forms to release the innovation and creativity potential linked to favouring diversity at all the organizational levels. Clusters represent especially suitable context where to develop gender and diversity inclusion forms suitable also for small and medium-sized enterprises.

4. CONCLUSIONS

The CluStrat project has been developed around three founding concepts, i.e. clusters, emerging industries and cross-cutting issues. Clusters – a geographical concentration of interconnected businesses and institutions in a specific field – were the backbone of the European economy, being challenged by international competition. The three emerging industries identified in the project – active ageing, green economy and sustainable mobility – offer clusters an opportunity for future development and competitive evolution. Involving the clusters in emerging industries represents the main objective of CluStrat, and the cross-cutting issues are strategic leverages for the achievement of this goal.

The project proposed the definition of new cluster concepts, being summarized in the CluStrat Strategic Framework, which are all interconnected among them. In other words, they have to be considered as different sides of the same coin. The new cluster concepts identified to support the development of emerging industries are four:

- *Smart Specialisation Strategies (S3), regional clustering and transnational cooperation* – suggesting the importance to connect existing cluster or actors in new inter-sectoral ways at the regional level and supporting transnational cooperation as a mean to achieve the regional S3, so that the S3 highlight the strength of regional clusters and regional clustering is done to fulfil S3 objectives;

- *Key enabling and other relevant actors* – suggesting that other than firms (small, medium and large-sized) and universities, also KEA and KIBS have to be involved in clusters specializing in emerging industries;

- *The demand side of emerging industries* – supporting that the supply need to be integrated with the demand one, with the creation of contexts where they can interact so that new markets needs and innovation potentials are discovered and exploited;

- *Entrepreneurial Cluster Management Organization (CMOs)* – proposing that CMOs should increasingly perform more complex activities, identifying and proposing to cluster partners opportunities of intra-cluster, cross-cluster and trans-national collaboration in the field of emerging industries so as supporting new ventures.

Those interwoven elements have to be understood in the light on an additional one – the *variety of clusters* – which states that the existing differences across clusters, in terms of specialisation, size, actors involved, history, have to be considered in order to develop adequate cluster policies. Moreover, each of

them have clear and specific implications for the three cross-cutting issue considered in the project, being knowledge transfer and co-production, internationalisation, and gender and innovation including diversity.

Such an analysis drove the identification of 8 policy implications, one for each of the elements identified by the framework plus those relating to the cross-cutting issues, which are reported in the following.

Policy implication 1a - Cluster policy should be selective, not supporting all the existing clusters but aiming at favouring the development or the formation of production systems that have the characteristics of – or the potential for – a competitive cluster, i.e. advantageous inter-firm relationships, entrepreneurial firms, effective local institutions, connection to innovation drivers and global links.

Policy implication 1b - Cluster policy should be cluster-specific, meaning to provide different support and tools to clusters considering for their peculiarities in terms of specialisation, size, presence of key enabling and other relevant actors, model and the like.

Policy implication 2a - In order to increase the ability of European regions to compete in emerging industries, innovation projects developed by firms and clusters – in particular the projects implying trans-national cooperation – have to be supported by an appropriate knowledge institutions (sub)system. Such system shall include both key enabling technology actors (KEA) and institutional knowledge-intensive business services (KIBS). They should have reached the excellence in their field, work at the global level and thus be a valuable partner in projects of transnational cooperation on emerging industries.

Policy implication 2b - In order to ensure to involve just knowledge institutions being particular knowledgeable, a form of accreditation of both KEA and KIBS at the European level could be helpful.

Policy implication 3: In the context of selective policies to favour clusters, a crucial aim is that of the evolution of CMOs toward an entrepreneurial approach, so that they get capable of identifying and proposing to cluster firms (or their combinations) business opportunities in emerging industries and to offer occasions of trans-regional cooperation.

Policy implication 4a - Cluster policy should favour the creation of regional clusters in cases in which the regional scale allows to take opportunities linked with the emerging industries, which a smaller scale will not allow to catch. A similar approach should favour the development of other suitable forms of collaboration and networking having the same aim.

Policy implication 4b - In accordance with the smart specialisation framework, which stresses the potential of the combination of regions having different strengths and competences, a forward-looking cluster policy identifies and exploits – on a transregional and transnational scale – opportunities for cross-cluster cooperation being useful to improve competitive chances of clusters and regions in emerging industries.

Policy implication 5a - The presence of laboratories where demand and supply can meet and interact represents a cognitive resource entailing a high value to the development of innovation projects in emerging industries. The formation of new contexts of this type and the strengthening of the existing ones represent a qualified object of cluster policy aimed to seek and exploit new opportunities in the emerging industries.

Policy implication 5b - Considering that demand is much more fragmented than the other sub-systems, another qualified object of cluster policy in the emerging industries is supporting its organization.

Policy implication 5c - Complex and expensive experimentations between demand and supply in the context of emerging industries may be developed thanks to transnational cooperation.

Policy implication 5d - *Acceptance of new products and services by the market may be an issue to look at by supported and targeted early dialogue processes among clusters and user groups.*

Policy Implication 6: *To arrange occasions and contexts to exchange information, experiences and knowledge represent a key infrastructure to develop cooperation and innovation projects in the emerging industries.*

Policy Implication 7: *The new cluster concepts developed have to aim at supporting the internationalisation and transnational cooperation of firms through clusters, so to support the specialisation of EU regions and increasing the competitiveness at the international level.*

Policy Implication 8: *A key object of European cluster policies should be to create forms to release the innovation and creativity potential linked to favouring diversity at all the organizational levels. Clusters represent especially suitable contexts where to develop gender and diversity inclusion forms suitable also for small and medium-sized enterprises.*

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