Innovation, Absorptive Capacity, Environmental Complexity, Trust and Cooperation within Clusters

Review of Integrative Business & Economics Research

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ABSTRACT

Purpose – Innovation within clusters is a crucial aspect in regional development. In the last decades, in the literature the role of absorptive capacity, environment, trust and cooperation in leveraging both explorative and exploitive innovation has been highlighted. In this paper we assess the contributions of these factors on the basis of a comparative analysis between about 250 firms belonging to twelve cluster of six European countries.

Design/methodology/approach – Knowledge acquisition, assimilation and transformation; environmental dynamism and competitiveness; trust in region and cooperation within cluster are defined and argued as driver of explorative and exploitative innovation. Each variable was defined by aggregating items measured through a seven-point Likert scale (reliability of each construct was verified by performing factor analysis and Cronbach alpha). Scatter plots and ANOVA test are applied to evaluate the statistically significant difference between clusters.

Findings - The results confirm the role of absorptive capacities and environmental dynamism as key drivers in innovation. Trust positively contributes to exploitative innovation more than explorative one. Cluster management subsidizes the lack of trust.

Practical implications – The paper provides a comparative methodology to make the difference between cluster evident. Significant implications in regional policies could be defined to enhance innovation capacity of less innovative cluster.

Keywords
Innovative cluster, absorptive capacity, environment, trust, cluster management

1. INTRODUCTION

Recent scholarship points out dynamic capabilities as key factor for the competitiveness of firms in fast-moving business environments open to global competition and characterized by dispersion in the geographical and organizational sources of innovation and manufacturing (Teece 2007). Within this framework, large attention has been devoted to absorptive capacity (Cohen & Levinthal 1990) as a key dynamic capability pertaining the creation and utilization of knowledge (Zahra & George 2002). Absorptive capacities are defined as a set of organizational routines by which firms acquire, assimilate, transform and exploit knowledge to produce dynamic capabilities. These four capabilities are expected to play different but complementary roles in explain how absorptive capacity can contribute to the competitive advantage of firms.

Even if absorptive capacities are expected to be affected by the competitive environment firms are embedded in, little is still known about how different contextual conditions reflects into a different combination of these capabilities. Jansen et. al. (Jansen et al. 2006) focus on the environmental dynamism and environmental competitiveness. They found that environmental dynamism positively moderates the relationship between explorative innovation and performance and negatively moderate the relationship between exploitative innovation and performance. Environmental competitiveness, on the contrary, negatively moderates the relationship between explorative innovation and performance and positively moderate the relationship between exploitative innovation and performance. However, there are other environmental factors that may affect absorptive capacity in firms. For instance, social integration and cooperation mechanisms are crucial of explorative innovation process. When firms are embedded in trustful environment, knowledge externalities give rise to the development of a collective capacity to innovate. Similarly, a high degree of collaboration and systemic coordination increase the chance to exploit the network advantages and externalities.

In this research paper, we do not focus on competitive environment in general. We focus on cluster as peculiar context in which competition between firms takes place and is embedded in. As argued by Porter (Porter 2000), “clusters suggest that a good deal of competitive advantage lies outside companies and even outside their industries, residing instead in the locations at which their business units are based”. There is a vast literature addressing how spatial agglomeration may contribute to enhance the competitiveness of firms. However, most of this literature focus on macro- and meso-level factors (Makell, 2001). Little is known about how these factors affect the development firms’ absorptive capacities. Thus, the focus is on the innovative competitiveness of cluster as spatial agglomeration of firms rather than on the competitiveness of its single firms. Our contribution is the study of the role of clustering and environment in enhancing firms’ absorptive capacity.

The structure of the paper is the following. The first section is devoted to review the literature on the features of explorative and exploitative innovation processes. The following section focus on social and environmental drivers of innovation capacity. Our main objective is to understand how dynamic and competitive environment, on a hand, and trust and cooperation within cluster, on the other one, may affect the development of firms’ absorptive and innovation capacity. In the third section, sample, data collection and variables are described and explained. Then a comparative analysis is applied at cluster level and discussion of the findings is presented. A final section concludes the paper.

2. EXPLORATIVE AND EXPLOITATIVE INNOVATION PROCESS

There is a vast literature addressing spatial agglomeration as source of competiveness in firms and local systems. Several theoretical constructs - such as industrial districts (Becattini 1990; Brusco 1990; Belussi & Pilotti 2002; Rullani 2003), cluster (Porter 1990; Porter 2000), innovative milieu (Camagni 1991), regional innovation systems (Cooke 2001), learning regions (Asheim 2001) - have been proposed for this purpose. The strategic significance of clusters is tied to enhancing the regional competitiveness by reinforcing innovation processes, not just supporting the internal innovation capacity of firms, but facilitating the cooperation and the sharing of knowledge into the local network. In this context, the role of knowledge externalities in giving shape and feeding the development of a model of innovation that is spatially distributed and geographically clustered is crucial (Asheim et al. 2011). The lack of appropriability, in general, is expected to negatively affect the incentives for firms to invest in innovation (Jansen et al. 2006). Furthermore, it should lead firms to focus on exploitation rather than on the exploration of their environment. However, if firms are embedded in an institutional context of shared norms and values and share common and/or related competencies, knowledge externalities give rise to the development of a collective capacity, that is of a community and not of a single firms, to innovate.

In the last decades, large attention has been devoted to external sources and competencies as complementary sources of innovation (e.g. Cohen & Levinthal 1990; Chesbrough 2003). An important part of the innovation process, especially when SMEs are regarded, comes from the systematic capacity to acquire external knowledge and exploit it internally. This requires firms interacting and cooperating with other companies in the region and the capacity to size evolutionary opportunities made available by continuous changes in the market, even accessing sectors and technological fields not directly related with own business. The partnership and cooperation agreements with other firms, both internal and external to the business industry, provide a larger access to information, resources, skills, markets and new or complementary technologies (Cohen & Levinthal 1990; Grant & Baden Fuller 2003), activate specific learning processes, share the costs and reduce the time and risk associated with innovation (Cassiman & Veugelers 2005).

Firms' ability to innovate in networks, clusters, districts and local production systems is the result of an evolutionary process which integrates, on the one hand, a process of increasing specialization, and on the other one, a high degree of collaboration and systemic coordination, which enable them to exploit network advantages and externalities.

In other words, the innovation potential rate of a region depends on the ability of enterprises to develop both, explorative and exploitative innovative processes.

Exploratory innovations are likely related to radical innovations and are designed to meet the needs of emerging customers or markets (Benner & Tushman 2003; Jansen et al. 2006). Explorative innovation depends on relationships and ties with other territorial actors. The higher is the divergence in cognitive bases of cluster's firms, the higher is the chance to favor radical innovations or exaptation processes.

The role of cognitive proximity (Nooteboom 2000; Nooteboom et al. 2007) such as the appropriate trade-off between homogeneity and heterogeneity is still debated (Asheim et al. 2011). The homogeneity leads to the development of a common knowledge base and a specific shared language, reduces the cognitive distance, speeds up the process of

knowledge creation, decreases time and marginal costs of innovation (Boschma 2005). The continuous reiteration leads to the development of high levels of commitment and trustful environment which facilitate and simplify the relationship between firms, reducing the risk of opportunistic behaviors (Capaldo 2007). Moreover, some degree of cognitive proximity is required to ensure effective communication and interactive learning (Nooteboom 2000).
However, recent contributions highlight the role of heterogeneity in triggering new ideas, inducing knowledge spillover and providing valuable resources for innovation (Frenken 2007; Boschma & Iammarino 2009). The homogeneity, in fact, allows an accelerated development of common knowledge, enhancing trust and cooperation, and supporting an incremental innovative process, but in the long run, it can excessively reduce cognitive distance and overlaying an effective innovative development process. As opposed, the heterogeneity allows to broaden the firm's cognitive base, to enjoy a greater variety of knowledge, to benefit from new opportunities for development and from debate within other network actors and finally to stimulate the creativity, the creation of new knowledge and radical innovation (Burt 2005). Thus heterogeneity may be an important driver of explorative innovation. The higher the degree of related local variety, the number of actors with different competencies and related in a local context, the higher the potential for learning (Asheim et al. 2011) and the expected development of potential absorptive capacity (Zahra & George 2002).

3. DRIVER OF INNOVATION WITHIN CLUSTER

Several studies have focused in the last decades on drivers of innovation. Innovation process can be influenced by internal and external factors. Internal innovation capacity depends mainly on firm's availability of resources and on organizational and dynamic capabilities. External innovation capacity depends on the dynamics and competitiveness of the environment where firm is active and on the interaction and cooperation dynamics with other enterprises belonging to the firm's network.
In this research study we consider the firms' innovation capacity within the clusters, focusing on both exploitive and explorative innovation. In particular, based on recent literature framework, some internal and external factors are analyzed as drivers of innovation. The aim of the research is to assess how these factors impact on innovation by using a comparative analysis between twelve European clusters.

Absorptive capacity

The concept of absorptive capacity have been originally proposed by Cohen and Levinthal (1990). This is defined as the ability of a firm to recognize the value of new external information, assimilate it, and apply it to commercial. Absorptive capacity are largely dependent on the firm's level of prior related knowledge. More recently, Zahra and George (2002), in an attempt to clarify it, proposes, based on an extensive literature review, a reconceptualization of this construct. They define absorptive capacity as a set of organizational routines and processes by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability. The latter are defined as the capabilities being concerned with change (Winter 2003; Collis 2006). For instance, product development, as practiced in many firms, is a prototypical example of first order dynamic capabilities. Thus, according to this view, absorptive capacities are second order dynamic capabilities concerning with the acquisition, assimilation, transformation, and

exploitation of the knowledge necessary to foster organizational change and build other organizational capabilities (e.g. marketing, distribution, and production).
Absorptive capacities can be broken down into two complementary components: potential absorptive capacities and realized absorptive capacities (Zahra & George 2002). Potential absorptive capacity is defined as the capacity of a firm to acquire and assimilate external knowledge. Realized absorptive capacity is function of the capacity of a firm to transform and exploit the commercial value of assimilated knowledge. The ration between potential absorptive capacities and realized absorptive capacities is defined as the efficiency factor. Thus, it defines the efficiency of a firm in transforming the potential of the acquirable knowledge into new knowledge, innovation and value for the firm itself.

Environmental dynamics and competitiveness

Jansen et. al. (2006) focus on two major environmental factors: environmental dynamism and environmental competitiveness. Environmental dynamism is defined as the rate of change and the degree of instability of the environment. Firms competing in an environment characterized by a high degree of dynamism are required to develop their potential absorptive capacity in order to minimize the risk of obsolescence. Thus, a high degree of environmental dynamism should positively moderate the relationship between explorative innovation and firms' financial performance.
Environmental competitiveness is defined as the extent to which external environments are characterized by intense competition. Competition in a competitive environment is positively associated with intense pressure for higher efficiency and lower price. Thus, investment in explorative innovation are discouraged. On the one hand, this kind of innovation is both costly and intrinsically risky. Furthermore, its outcomes are difficult to appropriate. Thus, competitive environments should encourage the development of realized absorptive capacity and indeed positively moderate the relationship between explorative innovations and firms' performance.

Trust and cooperation within the cluster

The efficiency of firms in transforming potential absorptive capacities into realized absorptive capacity depends on social integration and cooperation mechanisms (Zahra & George 2002; Tsai 2009). This, in a cluster setting, means that high level of trust and cooperation between firms should leverage the collective innovative capacity of firms in the cluster (Ottati 2005). These mechanisms can facilitate the sharing and eventual exploitation of knowledge between firms in the cluster (Nahapiet & Ghoshal 1998). They can be either informal (social networks) or formal (e.g. use of coordinators). The advantage of informal mechanisms of social integration is that they promote the spontaneous sharing of ideas and the development of unforeseeable associations between them. The use of formal mechanisms of coordination, on the other hand, makes information sharing and interpretation gathering more systematic in firms. A crucial role in leveraging collaboration and cooperation can be played by cluster management. A high level of cooperation between local firms within cluster management can lead to more effective forms of coordination and control, which may help local firms to take advantage of radical change and emerging path of technological development.
In this context, much attention has been devoted to the issue of trust as the major diver of the cooperation in the local process of knowledge creation. There are two major aspects that have been highlighted. First, the role of trust in reducing transaction costs within cluster (Ottati 2005). This enable firms to specialize on specific cognitive activities and

relay to other local partners to get access to complementary source of knowledge and know-how. Second, the role of trust have been highlighted as critical for leveraging the capacity of local firms to share and combine knowledge (Inkpen & Tsang 2005). The tacit nature of trust (Ganzaroli 2002), which is based on shared norms and values and mutual identification as member of the same community, has been addressed also as possible source of cognitive lock-in, due to the incapacity of firms to deal with parties located outside the local system.

4. METHODOLOGY

4.1 Sample description

The research project focuses on a benchmark analysis of twelve clusters belonging to six European countries. The project originally involved the interview of about 25 companies per cluster. At the end of survey, 252 usable questionnaires were collected. Data aggregated per cluster, such as country, number, average age and size of analyzed firms, are reported in *Table 1*.

Even if clusters are sufficiently homogeneously sampled (the percentage range of firms per cluster is between 5% and 9%), some structural heterogeneities are inevitable. Therefore, there are clusters composed by several young firms (less than 20 years old), and others which register an average age value over 30, such as the Czech Cabinet Makers Cluster or Italian Footwear Cluster. Similarly, the average firms' size of each cluster is very floating; there are clusters composed mainly by small enterprises and some others by larger firms.

Cluster name	*Country*	*N. firms*	*% firms*	*Average firms' age*	*Average firms' size*
Mechatronics	Austria	21	8.33	26.29	372.15
Styrian Automation Technology Platform	Austria	24	9.52	18.29	169.67
Network Security Monitoring	Czech Republic	13	5.16	11.54	39.92
Cabinet Makers	Czech Republic	13	5.16	35.62	235.54
Steel and Metalworkingr	Germany	21	8.33	21.76	73.57
Optic alliance	Germany	22	8.73	16.55	19.45
Pannon Textile	Hungary	16	6.35	19.00	46.19
Pannon Thermal	Hungary	25	9.92	12.84	105.38
Val d'Enza Packaging	Italy	24	9.52	32.96	19.00
Emilia Romagna Footwear	Italy	25	9.92	23.56	44.84
Polish Wood	Poland	24	9.52	13.83	74.04
Energy-saving and Passive House	Poland	24	9.52	14.67	40.21
12 Clusters	6 Countries	252	100	20.29	98.94

Table n.1 – descriptive statistics of sample

4.2 Survey structure and variables explanation

A structured questionnaire was used as research instrument; according to previous studies conducted with analogues purposes, it consisted of different sections:

- Environmental dynamics and competitiveness
- Trust and cooperation in region and cluster management
- Firms acquire, assimilate, transform and exploit knowledge capacity
- Firms exploitative and explorative innovation

Each section was composed by several items measured through a seven-point Likert scale (ranging from "fully disagree" and "fully agree").

The underlying latent variables of each section were operationalized by using several items.

Exploitative innovation process is an incremental innovative process which is developed to satisfy the needs of existing customers and markets. Exploitative innovations are based on existing knowledge, developed internally to business organization, which allow to analyze existing products and services, to implement small adaptations, to improve products design and to expand services for existing customers.

Explorative innovation process is mainly related to radical innovations. It represents the organizational R&D capacity to invent, experiment and commercialize products and services which are completely new to firm, exploiting new market opportunities or new distribution channels.

Knowledge acquire and assimilate capacity, even defined potential absorptive capacity by Zhara and George (2002), refers to firm's ability to search, identify, evaluate alternative sources of knowledge and assimilate it. It is measured trough the organizational capacity to collect information from customers, suppliers and third parties such as R&D institutions, management or technical consultants.

Knowledge transform and exploit capacity, even defined realized absorptive capacity by Zhara and George (2002), corresponds to firm's ability to transform assimilated knowledge into organization skills and routines, and secondly to transform and exploit this knowledge into new products and services. It is measured assessing the organizational capacity to store newly acquired knowledge, to internalize it into organizational strategies, operative activities and common language in order to better exploit external knowledge.

Environmental dynamism regards the rate of change and the degree of instability of firm's environment. It depends on the continuity of changes in firm's industry and market, on one hand, and on the speed which makes existing products and services obsolete for the needs of customers, on the other hand.

Environmental competitiveness refers to the intensity of competition. A very competitive environment makes the firm's innovation process necessary to keep a sustainable competitive advantage in the long run. It depends on the intensity of competition, the strength of competitors and the aggressiveness of their market strategies.

Trust in region is based on shared norms and values and mutual identification as member of the same community. The expectation on reliability of other local firms leverages their capacity to share and combine knowledge. At contrary, the risk of opportunistic behaviors reduce the trust effect on innovation propensity.

Cooperation within cluster management refers to the active business involvement in using the services, participating in events organized by the cluster and cooperating with the cluster to identify new customers, suppliers and partners for future developments.

In order to achieve the unidimensionality and reliability of constructs, factorial and Cronbach alpha analyses were tested and some items were deleted. The results are reported in *Table 2*.

						correlation matrix							
	n.	*alpha*	*G.l.6*	*mean*	*sd*	*X1*	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*	*X8*
Explorative Innovation	6	0.81	0.80	4.13	1.41	1							
Exploitative Innovation	6	0.85	0.83	4.91	1.38	0.608	1						
Acquire and assimilate capacity	9	0.79	0.81	4.70	1.12	0.650	0.662	1					
Transform and exploit capacity	10	0.89	0.90	5.14	1.21	0.483	0.745	0.686	1				
Environment dynamism	4	0.80	0.78	4.96	1.41	0.573	0.587	0.498	0.489	1			
Environment competitivness	3	0.80	0.74	4.93	1.57	0.112	0.445	0.251	0.558	0.284	1		
Trust in region	4	0.82	0.79	4.30	1.35	0.096	0.318	0.196	0.210	0.211	-0.04	1	
Cluster management	4	0.84	0.82	3.89	2.13	0.383	0.338	0.485	0.352	0.301	0.178	0.137	1

Table n.2 – Variables description (n. items, Cronbach alpha and Guttman Lambda 6, mean, st. deviation and correlation matrix)

Cluster (field of activity)	*Country*	*Explorative Innovation*	*Exploitative Innovation*	*Knowledge acquire capacity*	*Knowledge transform capacity*	*Environmental dynamism*	*Environmental competi-tiveness*	*Trust in region*	*Cluster management*
Mechatronics [(1)]	AT	0.418*	0.383*	0.383*	0.186	0.254	-0.197	0.681***	0.288
Automation Technology	AT	-0.428	-0.108	-0.228	-0.136	+0.393	+0.066	-0.137	-0.448
Information Technology	CZ	+0.11	-0.011	+0.007	+0.457	+0.387	+0.773**	-1.576***	-0.081
Cabinet Makers	CZ	-0.284	-0.021	-0.395	-0.018	-0.059	+0.514	-1.207***	-0.109
Steel and Metalworking	DE	-0.59*	-0.22	-0.014	+0.036	-0.224	+0.47*	-0.283	+0.205
Optics	DE	+0.076	+0.315	+0.601*	+0.621**	+0.296	+0.475*	-0.002	+0.432
Textile	HU	-0.663*	-0.579*	-0.266	+0.24	-0.436	+0.322	-0.821**	+0.188
Thermal	HU	-0.322	-0.123	-0.437	+0.173	-0.378	+0.518*	-0.742**	-0.311
Food Packaging	IT	-0.53*	-0.24	-0.962***	-0.435*	-0.486	+0.379	-0.775**	-0.844**
Footwear	IT	-1.067***	-0.671**	-0.999***	-0.5*	-0.311	+0.387	-0.718**	-0.806**
Wood	PL	-0.409	-0.49*	-0.336	+0.099	-0.476	+0.283	-1.183***	-0.083
Energy	PL	-0.672*	-2.011***	-1.253***	-2.244***	-1.338***	-1.333***	-1.238***	-0.699*

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

[(1)] *AT-Mechatronics* is the reference level and the values on this row represents the standardized mean for each variable, other clusters are smaller or larger on average (it depends on the sign). Asterisks indicate whether a statistical significant difference is with respect to reference cluster.

Table n.3 – Anova Statistics, difference in mean per cluster.

4.3 Analysis and results

The scatter plot in *Figure 1*, generated on the basis of the Pearson's correlation coefficients, shows what factors influence the innovative capacities of the firms and, consequently, of the cluster. Four major issues are highlighted.

- It confirms the existence of a strong correlation between exploration and exploitation capacities, on the one hand, and explorative and exploitive innovations, on the other hand.
- Acquire and assimilate capacity is more related to explorative innovation than exploitative one; on the contrary, exploitive and transformation capacity is more linked to exploitative innovation.
- The different role played by the environment in the development of firms. Dynamicity, on the one hand, positively affect innovation as whole and independently form the type of innovation. Competitiveness, differently, impact on internal process, which are more structured and formalized. This means that while competitiveness force firms to optimize the use of existing competencies and resources, dynamicity contribute to enact a virtuous cycle of collective process of growth enabling firms to enlarge their cognitive-base and their opportunities for networking and collaboration.
- There is a lack of evidences supporting the thesis according to which trust and cluster management should leverage firms' innovative capacity.

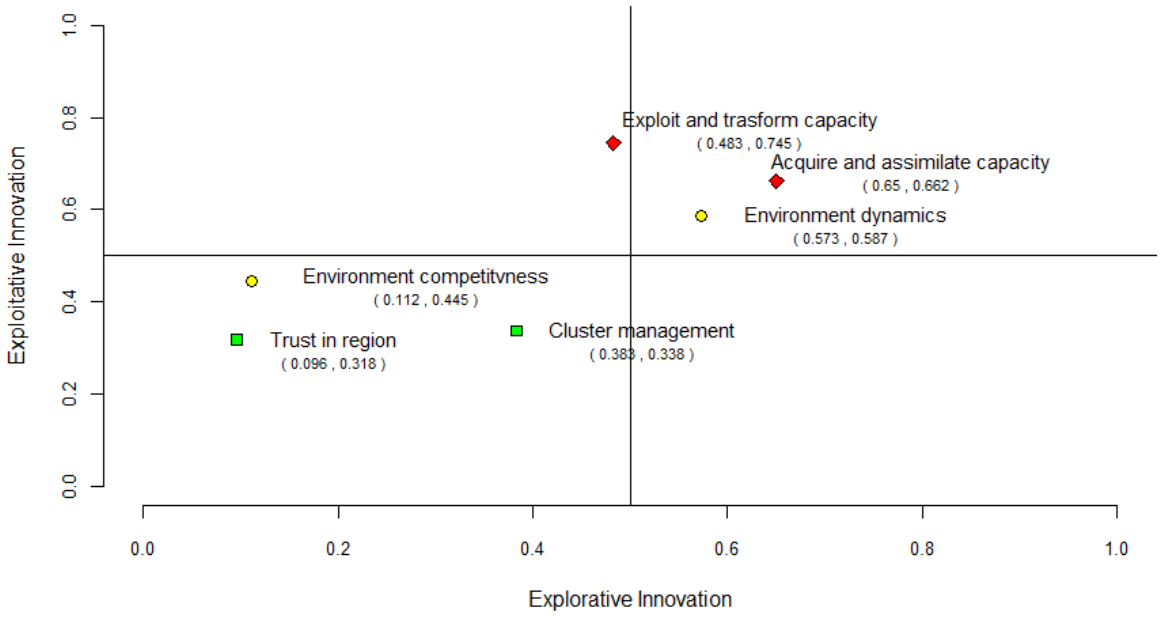

Figure n.1 – factors related to innovation capacity (by using Pearson correlation coefficients)

The following section is a comparative analysis which points to evidence strengthens and weaknesses of each cluster with respect to innovation capacities, knowledge management competences (absorptive capacity), environment, trust and cooperation. Each area is composed by two dimensions. Clusters are plotted by using standardized average values so that it is easier to identify clusters above and below the mean (of total sample).

Exploitative and Explorative Innovation

This comparative analysis focuses on two dimensions of innovation, distinguishing between "*exploitative innovation*", which is an innovation process developed incrementally based on

the continuous improvement of firm's internal resources, and "*explorative innovation*", an innovation process which exploits the collaboration, the trust and the exchange of knowledge within and outside of firm's local network. On this basis it is possible to identify clusters more and less innovative.

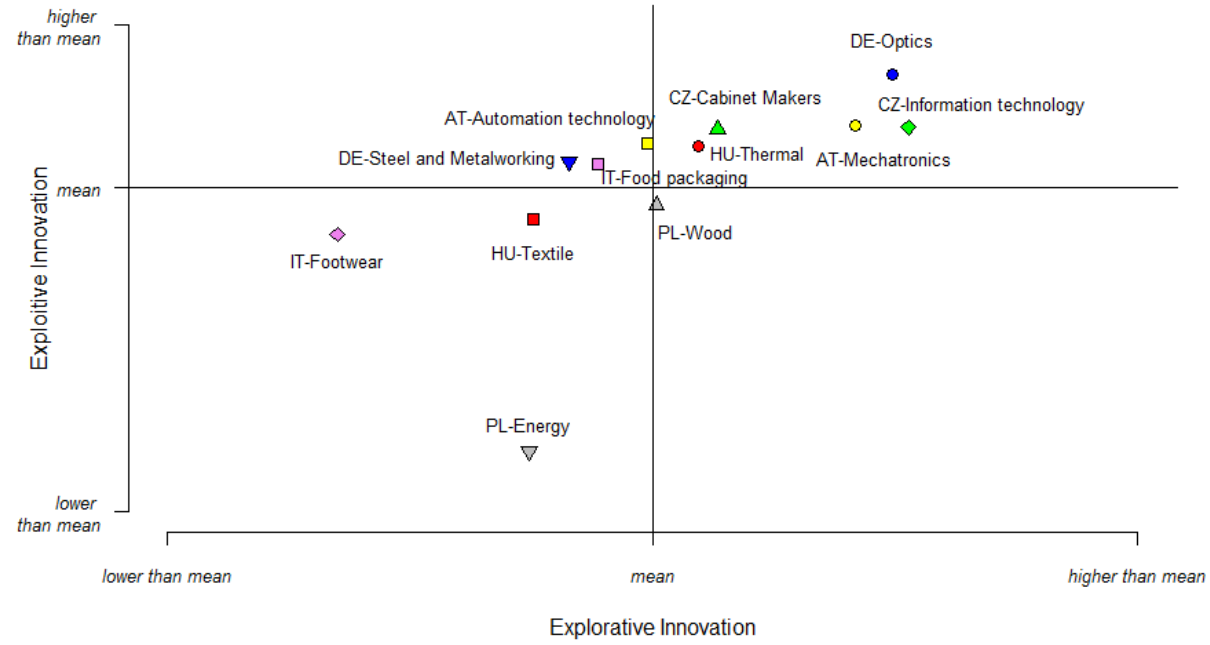

Figure n.2 – Clusters and innovation capacity dimensions (by using standardized average values)

From the scatter plot in *Figure 2*, some considerations are possible:

- there are clusters with high innovation capacity, on both dimensions, such as *De-Optics*, the two Czech Republic clusters, *AT- Mechatronics* and *HU-Thermal*;
- some clusters tend to develop innovative products and processes based on the knowledge within the organization more than exploiting the network externalities that arise from a continuous interaction with the other enterprises in the region (*AT-Automation Technology*, *IT-Food Packaging* and *DE-Steel and Metalworking*);
- the cluster PL-Wood has innovation aptitude which does not differ from the average values of the benchmark;
- three of the twelve cluster analysis are not very creative and result unable to make effective use of both innovation dimensions (*IT-Footwear*, *HU-Textile* and *PL-Energy*).

Firms acquire, assimilate, transform and exploit knowledge capacity

Multiple theories have argued the processes of knowledge acquisition, transfer and transformation are the main drivers of innovation. Referring to these cognitive processes, Cohen & Levinthal (1990) have defined the concept of absorptive capacity; Zhara & George (2002) and Zhou & Wu (2009) have, more recently, distinguished among "potential" and "realized" absorptive capacity. According the last one, the absorptive capacity is firstly the firm's ability to search, identify, evaluate and assimilate knowledge from different sources; secondly the firm's ability to transform and exploit internal and externally assimilated knowledge in new knowledge, new products and innovation.
The data analyzed in this research study confirms the predominant role on innovation of both, exploration and exploitation processes (*Figure 1*). The scatter plot in *Figure 3* shows the average capacity of each cluster in terms of exploration and exploitation.

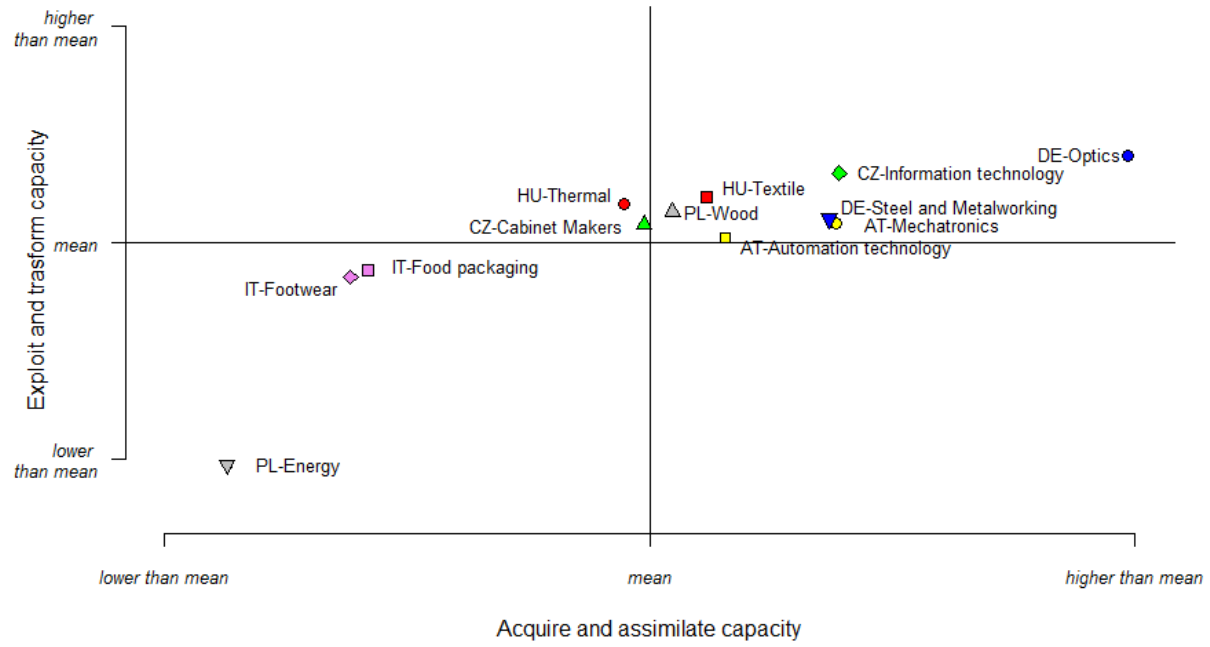

Figure n.3 – Clusters and absorptive capacity dimensions (by using standardized average values)

The distribution of most of the clusters in the right upper quadrant shows the awareness of enterprises for the collection and exploitation of knowledge, both internal and external to the organization, as driver of innovation. Deviate from this group, at least in terms of explorative capacity, are cluster *CZ- Cabinet Makers* and *HU-Thermal*. Slightly below the benchmark mean, on both dimensions, there are also the two Italian clusters. Finally, we point out the large negative deviation from benchmark of *PL-Energy* cluster; it is evident the lack of local enterprises to capture, manage and transform internal and external knowledge into new knowledge is directly related to the innovation reluctance of the cluster.

Environmental dynamics and competitiveness

The competitiveness and dynamism of the environment, as mentioned before, play a very different role in influencing the innovative capacity of firms and the cluster. The dynamism of the sector, in the previous analysis, proved to be a crucial element in stimulating the innovation process of firms, much more than the environmental competitiveness.
In the scatter plot (*Figure 4*), we observe that the environmental aspects seem strongly related to the country rather than the single cluster (with the exception of Poland).
Some evidence can easily detected:

- German and Czech Republic clusters perceive a highly dynamic and competitive environment;
- Austrian clusters fit in a less competitive but with high level of dynamism that encourages innovation;
- Italian and Hungarian clusters tend to greater static and although they belong in intensely competitive industries they are unable to generate the conditions for a constant and creative process of innovation.
- Poland, finally, is represented in this analysis by two clusters: the first within the woodworking industry that it is very similar to the Italian and Hungarian clusters for the environmental features, the second belonging to the energy sector shows a apparently static and non-competitive industrial context. These environmental

features explain, likely, a significant percentage of the low innovative capacity of this cluster.

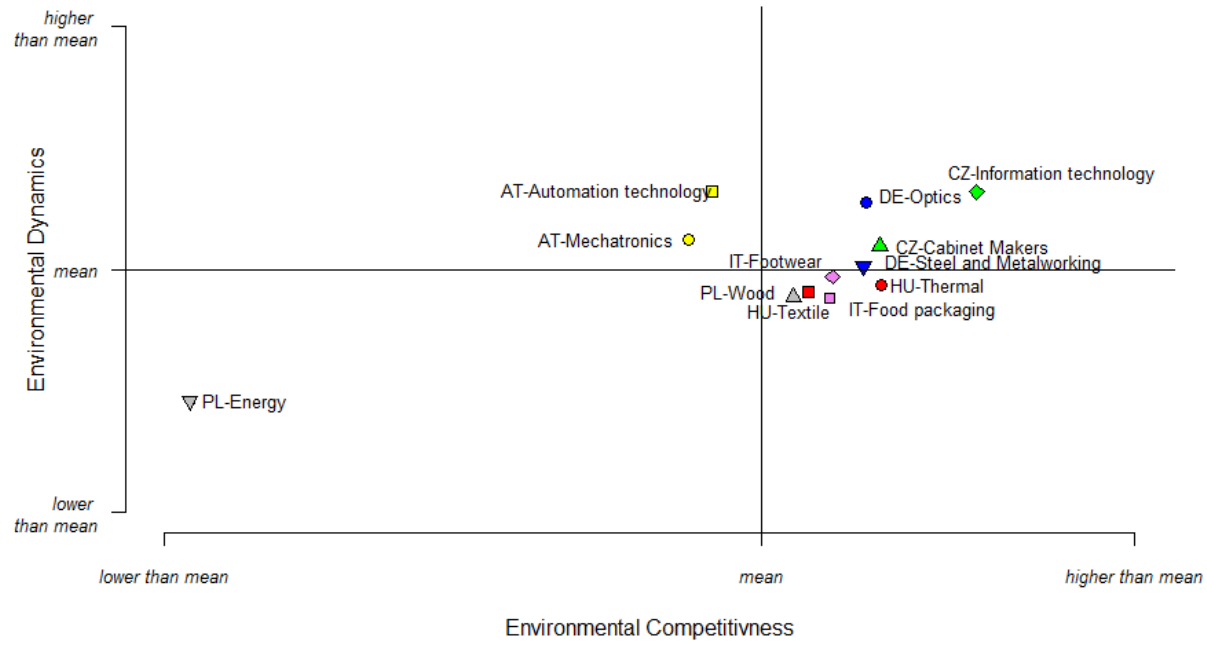

Figure n.4 – Clusters and environmental dimensions (by using standardized average values)

Trust and cooperation in region and cluster management

The literature on industrial districts often refers to the importance of relationships, the existence of strong ties and weak ties, the cooperation in the network coordination and the effect that these aspects produce, on the one hand, in terms of trust and control and, on the other, in terms of the variety of knowledge, creativity and innovation. Trust in local business and the level of cooperation within the cluster management are, at least theoretically, two crucial factors of the innovation capacity of a cluster. At contrary, in this research study, data in *Figure 1* show a low perceived effect on the dimensions of innovation. It is likely due to a lack or failure in policies and management of territory and cluster to effectively manage the trade-off between trust and control and to create and foster conditions, in micro and macro level, for a process of shared innovation and a context of expanded cooperation.

In *Figure 5*, the enterprises belonging to the German and Austrian clusters have levels of trust in other local firms much higher than the other clusters and countries considered. Italian and Hungarian clusters don't excessively deviate from average values of the whole sample. The enterprises of Polish and Czech Republic clusters are the most unconfident.

In terms of cooperation instead there is less variability between clusters. Italian cluster are below the mean, they do not excel either for trust levels or for participation and cooperation. The same is for *PL- Automation Technology* and *AT-Energy* clusters. In the first case, the lack of trust and of control/coordination does evidently affect the innovativeness of the cluster. In the case of *AT-Automation Technology*, the lacks in the cluster management are likely to be offset by trustful ties with other local companies. In contrast, firms in the *CZ-Cabinet Makers* and *CZ-Information Technology* clusters, though they show the lowest levels of trust in the region, are more aware of the strategic role played by the cluster management in facilitating relationships and knowledge flows. In other words, the strong cooperation within cluster management is realized with the ability of the latter to mediate the lack of trust with a good coordination and control capacity.

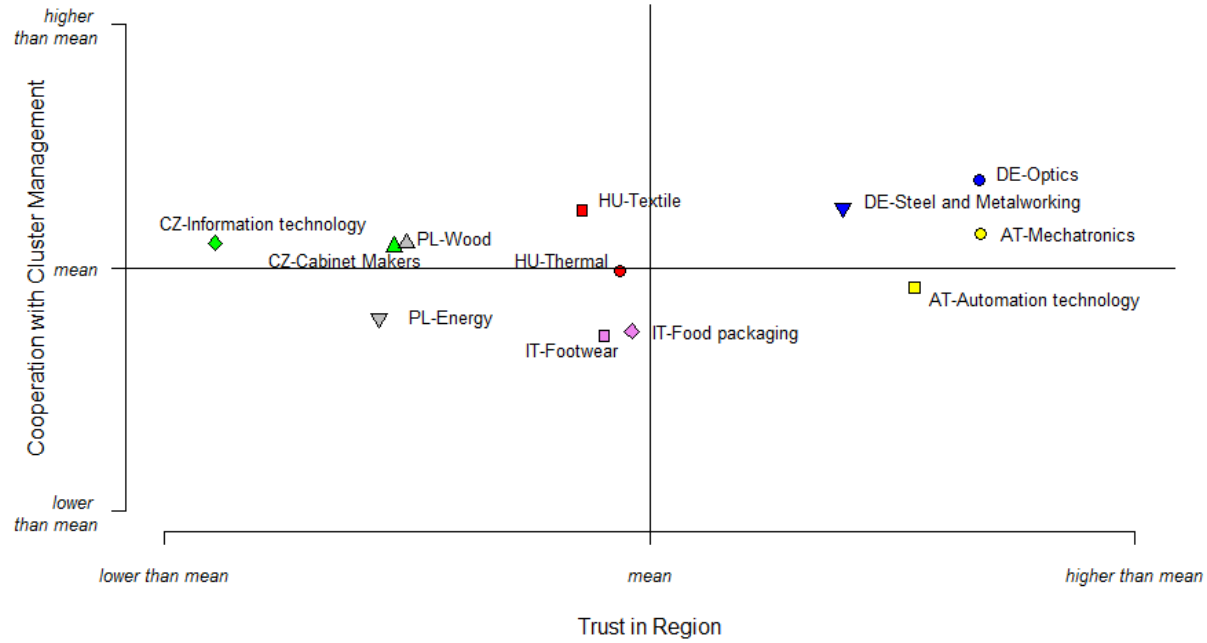

Figure n.5 – Trust and Cooperation within the clusters (by using standardized average values)

5. CONCLUSION

In this paper we develop a comparative analysis between the innovative capacity of twelve European clusters. We focus on three major drivers of the innovative process in cluster: firms' absorptive capacity; environmental dynamism and competitiveness; trust and cluster management. Our analysis produced the following main results.

Firstly, it confirms the existence of a strong correlation between firms' absorptive capacity and the outcome of innovation in term of both exploitive and explorative innovations. Secondly, it confirms that the competitive environment play a role in influencing the firms' innovative performance. Furthermore, it also shows that dynamism is more related to explorative innovation, while competition is more related to exploitative innovation. Thirdly, despite the literature suggests a positive relation between trust/social capital and knowledge combination, we do not have large evidence for it. Both trust in region and cooperation within cluster management moderately affect firms' innovative performance in clusters. Both these factors, in fact, are expected to play a major role in leveraging collective absorptive capacity in clusters. Moreover, trust seems to lowly influence exploitative innovation than more explorative one. It is likely due to the role of trust as mechanism of control in order to better support incremental innovations than radical innovation processes.

Finally, there are significant differences between firms' innovative performances between clusters. Clusters differ mainly for firms' potential absorptive capacity, which is firms' capacity to scan their environment and assimilate the potential value of complementary sources of knowledge and innovation. In this perspective, the technological level of the industry in which clusters are specializing on seems to play a role. Firms in high-tech clusters are specializing more on explorative innovation rather than on exploitive one. This is probably due to the greater opportunities for innovation available in such industries and the greater variety of the knowledge resources mobilized in the process of innovating.

Clusters differ largely in terms level of perceived environmental competitiveness, too. However, there are significant differences also in terms perceived dynamicity. The cluster that rank higher in terms of environmental dynamicity and competitiveness are also those ranking higher in terms of exploratory and exploitive capacities. This confirm the relevance of the environment in shaping the development of absorptive capacity in firms.

At last, analyzed clusters differ for the trust placed on the partners in the region, too. Trust seems to be matter of national membership. Firms in German clusters are more willing to trust their counterparts in the region. At the contrary, firms in East-European clusters have no trust in their

counterparts in regions. Italian clusters then evidence a low level of cooperation within cluster management.

ACKNOWLEDGEMENT

They gratefully acknowledge financial assistance from the "Agreement for human capital development within Lombard university system" D.D.U.O. n. 10842/2009, POR of Lombardy Ob. 2 FSE 2007-2013, Asse IV – Human Capital Development

REFERENCES

[1] Asheim, B.T., 2001. Learning regions as development coalitions: Partnership as governance in European workfare states? *Concepts and Transformation*, 6(1), pagg.73–101.

[2] Asheim, B.T., Boschma, R. & Cooke, P., 2011. Constructing regional advantage: platform policies based on related variety and differentiated knowledge bases. *Regional Studies*, 45(7), pagg.893–904.

[3] Becattini, G., 1990. The Marshallian industrial district as a socio-economic notion. *Industrial districts and inter-firm co-operation in Italy*, pagg.37–51.

[4] Belussi, F. & Pilotti, L., 2002. Knowledge creation, learning and innovation in Italian industrial districts. *Geografiska Annaler: Series B, Human Geography*, 84(2), pagg.125–139.

[5] Benner, M.J. & Tushman, M.L., 2003. Exploitation, exploration, and process management: The productivity dilemma revisited. *The Academy of Management Review*, pagg.238–256.

[6] Boschma, R., 2005. Proximity and innovation: a critical assessment. *Regional studies*, 39(1), pagg.61–74.

[7] Boschma, R. & Iammarino, S., 2009. Related variety, trade linkages, and regional growth in Italy. *Economic Geography*, 85(3), pagg.289–311.

[8] Brusco, S., 1990. The idea of the industrial district: its genesis. *Industrial districts and inter-firm co-operation in Italy. Genf*.

[9] Burt, R.S., 2005. Brokerage and closure: An introduction to social capital.

[10] Camagni, R., 1991. *Innovation networks*, John Wiley & Sons, Inc.

[11] Capaldo, A., 2007. Network structure and innovation: The leveraging of a dual network as a distinctive relational capability. *Strategic Management Journal*, 28(6), pagg.585–608.

[12] Cassiman, B. & Veugelers, R., 2005. R&D cooperation and spillovers: some empirical evidence.

[13] Chesbrough, H.W., 2003. *Open innovation: The new imperative for creating and profiting from technology*, Harvard Business Press.

[14] Cohen, W.M. & Levinthal, D.A., 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative science quarterly*, 35(1).

[15] Collis, D.J., 2006. Research note: how valuable are organizational capabilities? *Strategic Management Journal*, 15(S1), pagg.143–152.

[16] Cooke, P., 2001. Regional innovation systems, clusters, and the knowledge economy. *Industrial and corporate change*, 10(4), pagg.945–974.

[17] Frenken, K., 2007. *Applied evolutionary economics and economic geography*, Edward Elgar Pub.

[18] Ganzaroli, A., 2002. *Creating trust between local and global systems*, Erasmus University Rotterdam.

[19] Grant, R.M. & Baden-Fuller, C., 2003. A knowledge accessing theory of strategic alliances. *Journal of Management Studies*, 41(1), pagg.61–84.

[20] Inkpen, A.C. & Tsang, E.W.K., 2005. Social capital, networks, and knowledge transfer. *Academy of management review*, 30(1), pagg.146–165.

[21] Jansen, J.J.P., Van Den Bosch, F.A.J. & Volberda, H.W., 2006. Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management science*, 52(11), pagg.1661–1674.

[22] Nahapiet, J. & Ghoshal, S., 1998. Social capital, intellectual capital, and the organizational advantage. *Academy of management review*, pagg.242–266.

[23] Nooteboom, B., 2000. *Learning and innovation in organizations and economies*, Oxford University Press, USA.

[24] Nooteboom, B. et al., 2007. Optimal cognitive distance and absorptive capacity. *Research Policy*, 36(7), pagg.1016–1034.

[25] Ottati, G.D., 2005. Trust, interlinking transactions and credit in the industrial district. *Cambridge Journal of Economics*, 18(6), pagg.529–46.

[26] Porter, M.E., 2000. Location, competition, and economic development: Local clusters in a global economy. *Economic development quarterly*, 14(1), pagg.15–34.

[27] Porter, M.E., 1990. *The competitive advantage of nations/Michael E. Porter*, London: New York: Macmillan.

[28] Rullani, E., 2003. The Industrial District (ID) as a cognitive system. *The technological evolution of industrial districts*, pagg.63–87.

[29] Teece, D.J., 2007. Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic management journal*, 28(13), pagg.1319–1350.

[30] Tsai, K.H., 2009. Collaborative networks and product innovation performance: Toward a contingency perspective. *Research Policy*, 38(5), pagg.765–778.

[31] Winter, S.G., 2003. Understanding dynamic capabilities. *Strategic Management Journal*, 24(10), pagg.991–995.

[32] Zahra, S.A. & George, G., 2002. Absorptive capacity: A review, reconceptualization, and extension. *Academy of management review*, pagg.185–203.

[33] Zhou, K.Z. & Wu, F., 2009. Technological capability, strategic flexibility, and product innovation. *Strategic Management Journal*, 31(5), pagg.547–561.