Special Issue: Clusters, System of Innovation and Intangible for fostering growth: finding the keys for SMEs in transitional and developing economies

How to catch mutual effects in clusters: medium-sized enterprises study

Abstract:

In recent years links between spatial proximity, formal and informal firm's contacts have become a sufficient subject for research in the field of innovation, competitiveness and sustainable economic growth.

We introduce the model for quantitative evaluation of relationship between cluster participation and innovation activity as well company's value growth. The paper focuses on mutual effects for medium-sized companies from transitional economies.

We use the sample of 284 traded European companies between 2005 and 2009 which were carefully applied and subjected to panel data analysis techniques. Our empirical findings show the positive impact of clustering on innovation activity measured be patents and intangible assets and company's economic value added. Moreover, we identify factors enhancing mutual effects such as industry level of public R&D expenses, country innovation infrastructure development and location in megalopolis.

Keywords: cluster identification, mutual effects, interfirm cooperation, spatial proximity, innovative medium-sized enterprises

Paper type: Research paper

1. Introduction

There are a lot of outstanding facts that several firms within and across different industries, sizes and nations, are more successful in their overall network activity than others. One of the most familiar theoretical frameworks in this field is cluster concept.

According to Hagedoorn (1999) in order to receive benefits from innovations, successfully adapt to the rapidly changing environment and win the competition, most of the companies rely increasingly on external partners for overcoming competence limitations or leveraging capabilities. As Porter (1996) insightfully stated that cooperative capabilities can be viewed as a rare, valuable and difficult to imitate resource. This is of particular significant especially to emerging markets and transitional economies as well as small and medium sized companies. As a consequence, the number of different forms of companies' relationships as well as the percentage of revenues that comes from network participants has increased significantly in recent years (OECD, 2006, 2008).

There is empirical evidence that institutional and informal relationships between the firm and other actors influence on company's performance (Carlucci and Schiuma, 2007; Subramaniam and Youndt, 2005; Reed et al., 2006; Youndt et al., 2004). In such works, as Arndt and Sternberg (2000); Audretsch and Feldman (1996); Bekele (2007); Conte and Vivarelli (2006); Newlands (2003); Maggioni (2002); Porter (2002) found out and analyzed positive spillovers for the companies located in clusters.

However, researches and practitioners have different explained theories about cluster effects and obtain contradictory empirical results (Park and Ungson, 2001).

The present study tries to provide by the help of econometric-based analysis a new insight into thorough understanding of cluster benefits for companies and government. This paper is primarily focused on clusters as a specific systemic approach to stimulate firm innovation activity and value growth as well as regional development. Such approach helps us to overcome the gap between the theoretical thinking of clusterisation processes and its implementation by practitioners (Kong, 2008). This gap is extremely important for emerging markets due to the general lack of available information, unstable links between companies and developing national and regional institutional systems. In addition, the present paper attempts to add some empirical evidence about the factors which facilitate or obstruct the mutual effects.

In order to test our hypotheses, we examine 284 European different industries and sized companies from 2005–2009 using panel-data analysis. We discern innovative leaders from catching-up countries as well as cluster participants and others based upon European United Scoreboard and Cluster Mapping project results, respectively.

We hope that quantitative model developed in our paper might be valuable both for researches and practitioners. It extends the methodology of cluster effects analysis and can assist future research in this field. Moreover, it gives some practical guide for government regulation concerning cluster development.

The paper is structured as follows. First, we offer a deeper explanation of cluster concept and define the key directions considered in the study. Secondly, we present the research design proposed in the study including hypotheses to be tested. After that, we explain the measurement of variables; give sample description followed to carry out our empirical analysis. Then, we present the empirical findings. We conclude with a discussion of the results and their implications, and further research directions.

2. Plural concepts of clusters: theoretical background

Over the last decade, clusters have been widely recognized as one of the ways of overcoming the size limitations of companies and as an important instrument for improving their productivity, innovativeness, and, overall, competitiveness. While such issues have long been discussed (Grant, 1996), more recently Hoffe and Chen (2006), Porter's (2002) or Sunley (2003) works have focused their attention on the ways in which localized knowledge and technology spillovers may promote innovation and lead to company's success. In particular, they are argued that face-to-face contacts between local firms and organizations enhance knowledge exchanges, which in turn are assumed to facilitate innovation (Ahuja, 2000). Audretsch and Feldman show that innovative activity is substantially more concentrated than overall production (Audretsch and Feldman, 2003). According to McKendrick (2001), competitive firms look for to cooperate. Moreover, this cooperative competition (or "co-opetition", see Sunley, 2003) allows to exclude "weak" participants and stimulates others to innovations.

We argue that cluster's concept is one of the most familiar among cooperation theories like strategic alliances or social networks, combining elements of them. Despite the fact that numerous studies have been conducted in various countries, a common understanding of the cluster concept has not to be achieved yet. We could not see enough papers which confirm a positively impact cooperation indicators to firm results and its innovation absorption capacity (Immarino, 2006). Moreover, if for developed markets cooperation has already explored more or less in depth, for emerging markets and transitional economies it has been underdeveloped in the literature (Ketels et al., 2006). In particular, the cluster definitions, research methods, cluster effects evaluation procedures are needed in improvement (Cipolla, 2006; Torbett, 2001). In this sense, in order to deepen cluster concept, a comprehensive literature review was carried out.

In our paper we divide most comprehensive theories about clusters into three groups. All of them consider cluster theory mostly focus on one aspect of cluster activity:

- Agglomeration Theory (spatial proximity).
- Porter's cluster theory (competition and institutional system).
- Relational Capital Concept (strong and frequently ties, both formal and informal).

The first direction tries to answer the following question: Do companies grow faster if they are concentrated? This is one of the most fundamental questions for the economists posed by the economic geographers from A. Marshall (1890). This research has established that companies, due to the geographic proximity of clients, suppliers, competitors, universities and other institutions, provide localized knowledge externalities or spillovers that give positive economic value. As a result, companies in these locations enjoy higher productivity, experience greater innovation and growth, and pay higher wages. Fujita and Thisse (2002) find that "growth and agglomeration go hand-in-hand". The review paper by Baldwin and Martin (2004) stresses the result that, given localized spillovers, "spatial agglomeration is conducive to growth." Their research generally supports the view that spatial proximity is good for economic growth; although the research papers with reverse conclusions exist as well (see, for example, Bekele, 2007; Sunley, 2003).

The second approach also incorporates a more detailed conduct of the impact of the institutional environment in evaluating the relationship among competition, innovation, and realized productivity growth. Porter's (2002) framework suggests that an environment in clusters will be an essential determinant of the rate of innovation in the private sector. This stimulates innovation by raising the bar for product and processes and depends on innovation incentives such as intellectual property protection but also constant pressure from intense local rivalry and openness to international competition.

The third line of the studies considered networks as one of the most promising areas within the resource-based view (Acedo et al., 2006) as well as has the great interest acquired by relationships in achieving innovation (Chang, 2003; Zheng, 2010). Accordingly, relational capital can be defined as the set of knowledge obtained by the firm derived from relationships with other agents of its environment which brings the necessary knowledge base to carry out its activity more efficiently (Brooking, 1996; Sveiby, 2001; Youndt et al., 2004). According to recent research we can conclude that analyze of clusters as "open innovation practices" is rapidly gaining popularity direction in this field (Audretsch and Feldman, 1996; Chesbrough, 2006; Immarino and McCann, 2006; OECD, 2006). According to this evidence, we can consider that firms, in order to increase their capacity to develop innovations, should create new networks with customers, suppliers, allies and other partners. Thus, Nieto and Santamaría (2007) pointed out that the networks have a positive influence on the probability of developing radical product innovation.

In line with previous authors, in our research we try to combine different directions and define “cluster**”** in terms of intersection of described theories. The definition is given by OECD experts in European Innobarometer (2006) and using then in Cluster Mapping Project can take into account all benefits from theories which are described above. According to this research **cluster** is a *group of different-sized competitive companies, operating in one industry mostly, with:*

- *Spatial proximity (concentrating in one region);*

and

- *Strong local ties with industry partners (including competitors) and/or different non-market actors like universities, venture funds, government, business-associations and etc.*

This approach allows us to determine the motives of the interaction among companies and external sources of knowledge, ***to evaluate the impact of clustering on innovation and outcomes or “catch” mutual effects***. Among its advantages is the possibility of explaining the dynamics of clusters, centered on one or several large companies of traditional industries, supported by many small companies and institutions.

Thus, according to modern research, agglomeration and relationship effects are typical characteristics of cluster concept which is much more popular than others in economy and policy today. In spite of this fact many researches all over the world consider, that cluster concept requirements in upgrading and unification for application.

As described below, in the absence of an all-encompassing theoretical approach, choosing the appropriate method of cluster effects evaluation is far from trivial. There are a number of relevant papers, which together present a quite coherent body of evidence. Akundi (2003), for instance, surveyed in greater detail 25 state-level cluster studies and found that 16 studies relied at least partly on the use of quantitative methodologies, of which 9 studies exclusively relied on location quotients and shift-share techniques. Doeringer and Terkla (1995) and Rosenfeld (1997) already have emphasized that these methods are by no means sufficient, either alone or in combination, to actually identify industrial clusters, suggesting some confusion and misunderstanding with respect to methodological approaches of indicators reflecting the mutual effects (OECD, 2006).

In the next section we carefully review relationship between cluster participation and innovations production and company’s value growth, and try to take on the main differences between emerging and developed markets in terms of cluster forming.

3. Clusters, innovation and value growth: Enhancer or Obstacle?

In whole, there are several potential sources of innovation capacity and, as the consequence, company's performance for firms operating in clusters (Baptista and Swann, 1998):

- Localized external economies-MAR externalities access to specialized labour:
  - access to specialized network of suppliers and customers minimizing search costs;
  - localized knowledge spillovers;
  - effective learning, innovation and technological development.
- Reduction in transaction costs.
- Systemic properties embedded within the local systems:
  - advantages from the initial territorial specialization;
  - advantages to being customer driven organizations.
- Reduces the general uncertainty in the specialization and division of labour:
  - affects the coordination costs;
  - affects the innovation process by shaping the amount and diversity of knowledge achievable by the actor.

Clustering and networking can be valuable to SMEs in countries that are industrially and infra-structurally developing. It is also clear that structures and forms of organization associated with clustering are in a state of continuously change. That might be the reason of contradictions in previous studies (table 1).

Table 1

Results of several previous empirical research

Author	Sample	Results
Bengston et al. (2004)	144 different Swedish industry firms	Positive interaction between customer-supplier networks within cluster and participants' innovation activity
Cappelo and Faggian (2005)	Sample of 217 firms in the Veneto region, Italy	Importance of cluster participation on innovation activity
Cooke et al. (2005)	Innovative SMEs in 12 UK regions	Firms tend to collaborate and information exchange, and be involved in higher trust relationships
Hauser et al. (2007)	Sample of European regions	Social capital does have considerable impact on production of knowledge
Hollenstein (2003)	Panel of Sweden 9 plant-level data (2731 objects numbers)	A positive impact for knowledge capital intensity on several collaboration factors
Ketels et al. (2006)	713 companies, 100 represented developing	The findings suggest that there are considerable differences between

	economies and 76 transition economies	developing and transition economies on different aspects of cluster activity
Laursen et al. (2007)	2,464 Italian manufacturing firms	High levels of social interaction lead to a higher propensity to innovate
Maggioni and Riggi (2006)	Panel data for 2949 Italian companies	Innovation cluster participation for SMEs has a positive correlation with external knowledge sources network, which implies a positive impact on productivity
Sivadas and Dwyer (2000)	718 companies from semiconductor industry with more than 20 employees	Cooperation positively influences on the innovation processes and firm's outcomes
Steiner and Hartmann (2006)	Study five clusters (149 firms) in an Austrian province	Social networks seem to be rather unimportant for firms learning process

The report written by Ketels et al. (2006), mentioned in the table 1, is the most comprehensive research in the field of cluster analysis. It concludes that developed economies keep overall better results than transition in promoting cooperation and increasing the economic importance, market reach, and widening the range of related and supporting industries in the cluster. They determine the following differences between transitional and developed countries:

- Less trust between actors than in developed economies.
- Operating in rapidly challenging innovation environment.
- Focus on increasing value added and exports not on innovation and business environment improvement.
- Focus on "basic industries" or mix between industry types.
- Weaker competitive position and less innovation capacity of clusters.
- Decrease of government influence on over time while business becomes (business-associations and personal network) more important in clusters creation.
- Positive influence on the number of firms in the cluster.
- Related and supporting industries are present to a lower degree, and there are sometimes fewer levels of the value chain present.

In the figure 1 there is an illustration of the differences which were recognized by authors of the report:

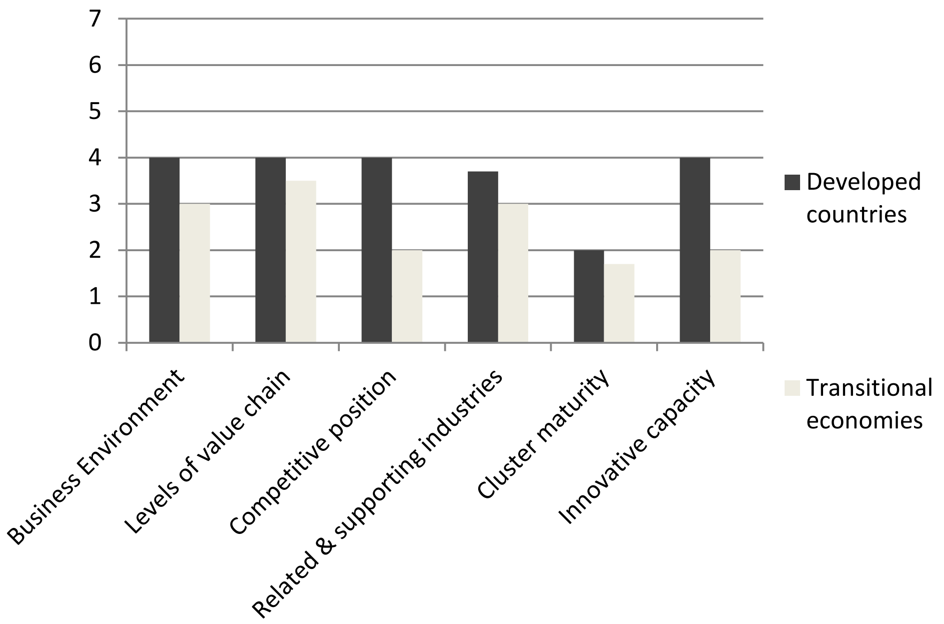

Figure 1 Cluster Strength in different type of countries (Ketels et. al., 2006)

Based on this analysis it can be assumed that roughly 38% of all European employees are the part of the cluster sector. In some regions, this share goes up to over 50% while in others it drops to 25%. About one fifth (21%) of these employees are engaged in regions that are more than twice as specialised in a particular cluster category as the average region (Innovation Clusters in Europe, 2006). Moreover, on average, every fourth company in Europe works in a cluster-like environment characterised by close cooperation with other local businesses and strong ties to local business infrastructure (Innobarometer, 2006).

Therefore, with several exclusions, empirical evidence points out that research connect with cluster participation concentrate on developed countries; focus on cluster identification and based on regional data. It is difficult to capture the link between clusters, innovation activity and firm's results as well as find clusters success factors, in spite of the interfirm relationship analysis papers increasing.

4. Research Design

As we mentioned above, any study under cluster subject is unlikely to be simple. This paper provides an empirical analysis of cluster or mutual effects exploration focusing on transitional economies and medium sized firms. In order to extend collect practical implications it is needed to have a "benchmark". For this purpose all investigations will be done for companies are situated both in developed and transitional economies.

Supporting Ketels (2011), we propose that agglomeration; R&D expenses; and environment are essential in enhancing cluster activity and ensure the existence of mutual effects. More importantly, we propose innovation is an intermediate output of a firm's outcome and include patents for testifying the link between cluster and company's value growth as well as environment, internal, industry and cooperation factors. Finally, we outline some suggestions for an empirical investigation of the topic in depth.

With regard to these assumptions and literature background we use the following research framework:

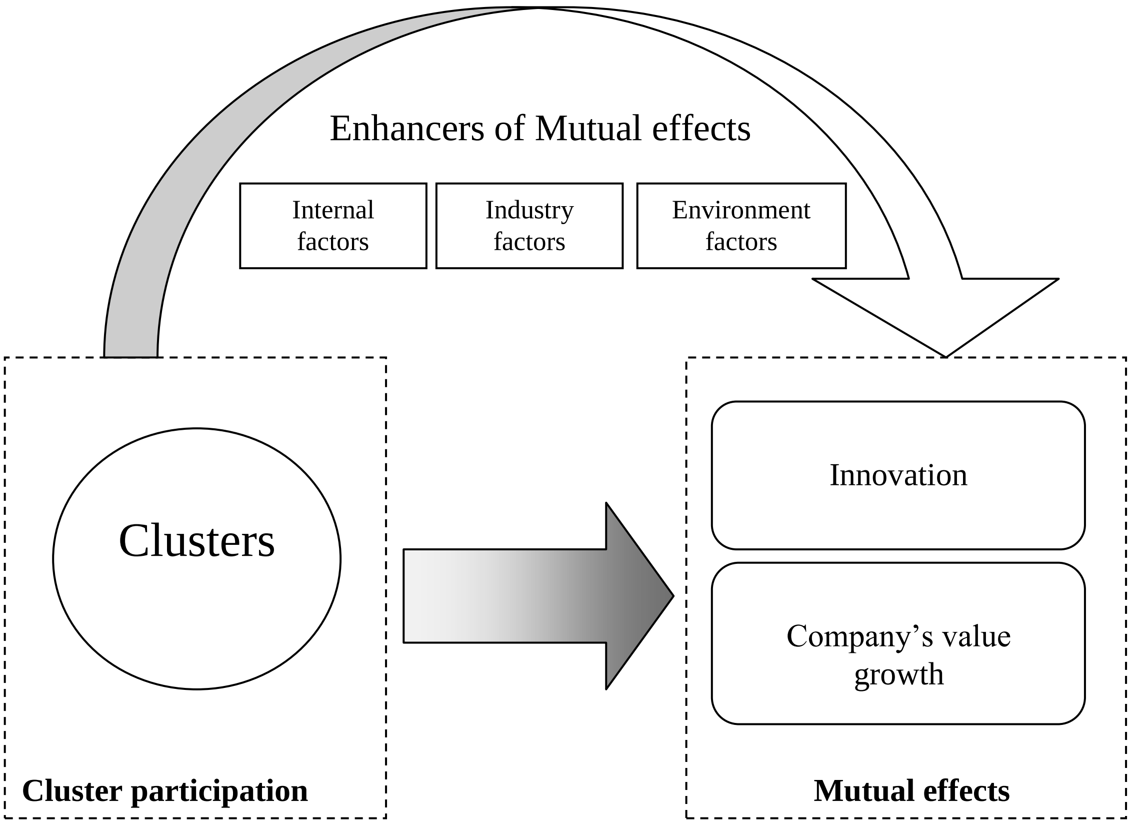

Figure 2. Research framework

It can be argued that collaboration with more than one agent has a positive effect on the probability of carrying out an innovation. In other words, much greater variety of external knowledge derived from different relationships with various stakeholders, like research networks, public research institutions or universities, the better position to achieve a greater number of innovations (Baba and Walsh, 2010; Landry et al., 2002). Therefore, based on the arguments above, we suggest the following hypothesis:

Hypothesis 1: Cluster participation has a positive influence on innovation. Effects are much stronger for developed countries and important for SMEs.

The argumentation is provided by Simon et al. (2007) for which the relationships with universities, government laboratories and external research institutions play a complementary role enriching firm's internal resources, sharing the risk and facilitating the company success. This, in turn, enhances the incentives and resources available for entrepreneurship, innovation, and firm growth (Audretsch and Feldman, 1996; Delgado, Porter and Stern, 2011). Our main hypothesis concerns the role of clusters in company's performance:

Hypothesis 2: With controlling for the country's type and company's size, the company's performance will be increasing in the strength of cluster.

These hypotheses hold for any measure of company's innovations and output, such as based on number of patents, R&D expenses, intangible assets, market value added, Q-Tobin coefficient, economic value added and etc. In our empirical work, we also examine several external factors of the cluster environment including specialization of other regional clusters or firm-university links, which constitute the cluster and support its growth. The results of empirical estimation will be present in the next section.

5. Mutual effects in cluster: the empirical investigation

Main research questions aim at evaluating clusters in terms of finding statistical significant relationship between cooperation, innovation and company's outcomes.

Our sample consists of 284 traded companies in different sectors or industries from 2005 to 2009. We selected countries according to their rank in United Innovation Scoreboard (2010) with high and low level of innovation development – “innovative leaders” and “catching-up countries”. The first group consists of the developed countries (according to Global Cluster Initiative Survey (2006) discern) (Germany, Finland, Great Britain, and Denmark); the second one includes firms from developing and transitional economies (Serbia, Ukraine, and Turkey). Transition economies are defined as those within the scope of the European Bank for Reconstruction and Development (EBRD). We have selected countries with high and low levels of innovation, in order to illustrate how clusters’ participation, mutual effects and the underlying environment relate to company’s value growth. We have used the data by EuropaINNO® for picking up industries with cluster activity. Data on clusters is derived from the European Cluster Observatory and their project “Cluster Mapping” (http://www.clusterobservatory.eu/index.html), which provides performance and evaluation measures of regional clusters all over the world. The dataset in this study derives from the detailed longitudinal database “Amadeus” provided by Bureau Van Dijk which is based on the companies’ annual statistical and financial reports. The next step, firm selection was carried out through a “one step stratified sample design”. Regarding the European (United) Innovation Scoreboard (www.europainno.eu) and from Global Competitiveness Index (www.weforum.org), we obtained the regional cluster or innovation data. In order to test hypotheses linear ad logit regression analyses were carried out.

The validity of country and industry choice test (ANOVA) shows that we can use the data for further analysis with some restrictions (non-normal distribution). The sample in each stratum was selected with equal probability and without remission.

According the definition we classify a company as a cluster participant if it is situated in the city (or town or agglomeration) with “strong” or “3rd stars clusters” in appropriate industry. This data were obtained from European Cluster Observatory (Cluster Mapping Project by Cluster Excellence). It means that such firm satisfies for **all** cluster features from definition: spatial proximity, competition, partners for networking, and concentration.

From a wide review of the literature and based on the framework, we considered variables for our research divided into several groups:

Table 2

Indicators and information sources of variables

Name	Description	Source
Internal factors		
Age	Year of foundation	Company’s Annual Report

Belonging to medium-sized company	If company belongs has no more than 1000 people – 1 point, otherwise – 0 points	Company's Annual Report
Belonging to catching-up countries	If company belongs to this type of countries – 1 point, otherwise – 0 points	Discern based on results of ranking by European Innovation Scoreboard (lowest innovation level)
Location in megalopolis	If the number of inhabitants is more than 1 million people – 1 point, otherwise – 0 points	Search on company's location on their website
Industry Factors		
Public R&D expenses in industry	R&D expenditures in particular country and industry are made by government as % of GDP	Eurostat Database http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
Business R&D expenses in industry	R&D expenditures in particular country and industry are made by private organisations as % of GDP	Eurostat Database http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
Cluster Environment		
Global Competitiveness Index	Comprehensive index for measuring national competitiveness	The Global Competitiveness Report 2009-2010, World Economic Forum
Efficiency Drivers	The efficiency enhancers subindex of GCI includes pillars: Higher education and training; Goods, labor and financial market efficiency; Technological readiness; Market size	The Global Competitiveness Report 2009-2010, World Economic Forum
Innovation and Sophistication Factors	Innovation and sophistication factors subindex of GCI includes the business development and innovation pillars	The Global Competitiveness Report 2009-2010, World Economic Forum
Innovative SMEs collaborating with others	If respondents in relevant country reported about collaboration more than average in EU in % – 1 point, otherwise – 0 points	Innobarometer on cluster's role in facilitating innovation in Europe, 2006
Subsidiaries presence	Initial links with partners If company has subsidiaries – 1 point, otherwise – 0 points	Company's Annual Report
Frequently dialogue with partners	If respondents in relevant country reported about dialogue in % more than average in EU – 1 point, otherwise – 0 points	Innobarometer on cluster's role in facilitating innovation in Europe, 2006
Brand	Company recognition by society If company has a rank – 1 point,	Search on company's name on the website:

	otherwise – 0 points	http://www.justmeans.com/top-global-1000-companies
Innovation		
Patents	Output of company's innovations, number of patents	Search on company's name and number of patents on the website QPAT: http://library.hse.ru/e-resources/e-resources.htm
Intangible Assets	Indictor of innovation activity, th.euro	Company's Annual Report
Company's outcomes		
EVA	Economic value added, th. euro $EVA_t=IC_{t-1}*(ROIC_t-WACC_t)$	Estimated using Company's Annual Report

Table 3 helps us to characterize the samples that were analysed in our research. It presents several descriptive statistics, where the mean, median and the standard deviation of the variables are detailed in terms of subsamples (cluster participant or not).

Table 3.

Subsamples descriptive statistics

Subsamples	**Objects observation numbers**	**Min**	**Max**	**Mean**	**Median**	**St. deviation**
Patents, number						
1*	460	0	452	21	0	73
0 **	960	0	1331	27	0	124
Intangible assets, th. euro						
1	460	0	6627.11	217.97	15.10	674.86
0	960	0	5892.97	143.22	12.18	397.81
Economic value added, th. euro						
1	317	-87,91	2062,62	-11.62	-1.06	607.86
0	811	-693.02	1762.43	-20.93	-8.34	116,18
Age, years						
1	427	0	130	35	18	34
0	931	0	145	36	19	33
Number of employees, number						
1	460	36	20059	3834	2204	4418
0	960	118	18768	4457	2944	4460

* 1 – cluster participants; ** 0 – other companies

The next step is designing the regression models. We paid attention to the normality of dependent variable, obtaining satisfactory results using Q-Q graphs and Kolmogorov-Smirnov test, and to the possible multicollinearity through correlations matrix. The correlation coefficients between explanatory variables are not high. They range from a low of 0.008 to a high of 0.41. Consequently, we can presume the absence of any multicollinearity problems. Our results show that the differences between countries and industries are statistically significant, and the distribution is non-normal.

With respect to the first hypothesis, we will consider three indicators to evaluate innovations: patents and intangible assets. We control for country type and company size effects and in all specifications. We take into account factors which can enhance mutual effects between cluster participation and innovation. Our specification, estimated with robust OLS, is the following:

$$Innovation = \alpha + (\beta_1,.... B_n)IntF_{it} + (\delta_1,.... \delta_n)IndF_{it} + (\varphi_1,....\varphi_n)EnvF_{it} + \varepsilon_{it}$$

where IntF is a vector of factors, reflecting companies behaviour;
IndF is a vector of factors, indicating industry's features;
EnF is a vector of factors, representing environment in which company's operates;
E is a vector of errors; T is a time period;
β_i, δ_i, φ_i, – regression coefficients.

Table 4 exhibits the results of the regressions. Panel A presents the results for intangible assets while Panel B presents the results for patents, respectively.

Table 4.

Results of Regression Analysis for Hypothesis 1 Testifying

Independent variables	**Dependent variables and specifications**	
	Intangibles (Panel A)	**Patents (Panel B)**
Location in Cluster	95.18** (3.01)	12.74** (2.28)
Internal factors		
Age	-1.12** (-2.38)	-0.06 (-0.73)
Belonging to catching-up countries	1266.56*** (3.75)	-124.12** (-2.08)
Location in megalopolis	73.60** (2.12)	6.28 (1.02)
Belonging to medium sized companies	0.041*** (12.70)	0.002*** (3.28)

Industry factors		
Public R&D expenses in industry	12607.64*** (6.28)	848.33** (2.37)
Business R&D expenses in industry	-1970.33*** (-5.38)	-188.94** (-2.92)
Environment factors		
Efficiency Drivers	1915.63*** (6.37)	146.40** (2.75)
Innovation and Sophistication Factors	1104.80*** (7.53)	55.52** (2.14)
Constant	-10227.94 (-6.20)	210.94 (0.72)
Adjusted R-squared	0.21	0.07
F-statistic	33.83	10.68
Prob (F-statistic)	0.000000	0.000000
Number of observations	1130	1130

According to multiple linear regression rules, Durbin-Watson's values statistics, we can conclude that residuals are independent. The adjusted R2 equals from 0.07 to 0.21 for different specifications. These numbers indicate that the regression is able to explain about 14 per cent on average of the variance in the dependent variable for the sample. All equations are statistically significant in terms of F-statistic meaning.

As it can be seen in the table, cluster participation has a positive and significant statistical influence on innovation, supporting our hypothesis about mutual effects presence. Moreover, they are consistent across specifications. We posit that the results seem to be robust because all coefficients have the expected sign, high significance ($p < 0.1$ or better) and remain unchanged as well as the findings correspond with previous studies.

Findings show that there are several factors among different groups of indicators enhancing the mutual effects. In particular, the company size has positive ad significant link with innovation. At the same time, unexpected finding implies that age does not appreciate the importance of the innovation activity is measured by patents. Probably, this link has probably non-liner effect and differs for firms with one and twenty foundation years. Moreover, some coefficients have positive signs with intangibles and negative with patents, and are strongly significant ($p < 0.001$) meanwhile. Regarding the industry factors, we received the positive relation for public R&D and negative for business R&D. Last item can be explained by advantage of cluster – sharing the costs. Turning to cluster environment factors, we conclude that business climate is strongly and positively associated with innovation in co-location conditions: companies with a higher innovation activity tend to concentrate in the regions with sufficient numbers of partners and well-developed infrastructure.

With respect to the second hypothesis, we will consider specification, estimated with robust OLS:

$$Performance = \alpha + (\beta_1, \ldots B_n)IntF_{it} + (\delta_1, \ldots \delta_n)IndF_{it} + (\varphi_1, \ldots \varphi_n)EnvF_{it} + +(\lambda_1, \ldots \lambda_n)CoF_{it} + \varepsilon_{it}$$

where IntF is a vector of factors, reflecting companies behaviour
IndF is a vector of factors, indicating industry's features
EnF is a vector of factors, representing environment in which company's operates;
CoF is a vector of factors, demonstrating different types of company's cooperation activity;
E is a vector of errors; T is a time period;
β_i, δ_i, φ_i, λ_i – regression coefficients.

In comparing with regression 1, we add the cooperation factors to the model due to the fact that different types of company's links influence on not only innovation but all types of company's activity as well value growth.

Regarding to confirmation of Hypothesis 2, the variable, reflecting cluster membership, should be statistical significant and have the positive sign. Table 5 reports the results of the estimation of the relationship between clustering and value's growth, considering the economic value added as a dependent variable (EVA).

Table 5.

Regression Analysis for Hypothesis 2 Testifying

Independent variable	**Economic Value Added (EVA)**	
	β-coefficient	**t-statistic**
Location in Cluster	41.74***	(3.68)
Internal factors		
Age	0.03	(0.20)
Location in megalopolis	31.19**	(2.41)
Belonging to catching-up countries	-246.20	(0.34)
Belonging to medium-sized companies	-0.005***	(-3.84)
Patents	-0.06	(-0.89)
Industry factors		
Public R&D expenses in industry	2072.98	(0.83)

Business R&D expenses in industry	-531.59	(-0.95)
Environment factors		
Innovative SMEs collaborating with others	7.45**	(2.11)
Subsidiaries presence	-0.19***	(-3.40)
Frequently dialogue with partners	157.98	(1.12)
Brand	29.90	(1.59)
Global Competitiveness Index	8.16	(0.24)
Constant	-891.44	(-0.98)
Adjusted R-squared	0.067	
F-statistic	5.80	
Prob (F-statistic)	0.000000	
Number of observations	975	

Table 5 demonstrates that we have developed statistically significant model (p-value (F-statistic) =0,000). The R^2 equals about 7% for the robust estimations. These numbers indicate that the regression is able to explain on average about 7 per cent of the variance in the dependent variable for the sample. Moreover, we can conclude that residuals are independent because the Durbin-Watson's values statistics is more than 1.5.

Our study found the positive and significant relationship between cluster participation and company's value growth which prove our second hypothesis. It is allow obtaining an accurate picture of the mutual effects: the higher activity of the company in clustering the higher innovation activity it has, and, consequence, lead to higher company's outcome.

Among enhancers of mutual effects we revealed company‘s and environment factors only. In confirming to our expectations location in agglomeration has positive and significant sign. We interpret this as evidence that leading firms learn more from their partners and receive benefits from the partners and infrastructure concentrating in one city. At the same time, size, i.e. belonging to medium-sized companies, has a negative relationship with EVA. Contrary to our expectations, country's differences have not an effect on value's growth.

For environment factors we gained explainable results. The company is better at value's growth in frame of cluster concept if it has fewer subsidiaries and if it has more innovative SMEs collaborating with firms in the relevant industry and country.

Finally, results on industry level of R&D expenditures are not confirmed: public and private expenses do not stimulate cluster effects.

In whole, empirical investigation justify the mutual effects in clusters or positive link between clustering and innovation and value's growth exist for companies from European transitional and developed countries. These effects are much stronger for subsample of innovative leaders which is proved by previous research in this field (for example, Ketels et al., 2006). The attractive issue is also related to companies' financial policies: the greater its financial leverage, the more efficient are a company's investments in intangibles.

Conclusion

Our findings extend the knowledge about the impact of clustering on innovation and company value creation. According to regression analysis mutual effects are recognized with positive link to the patenting and the intangibles disclosure. Moreover we found out the complementary factors to this relationship. These factors appeared to be in three different levels: company, industry and environmental.

First of all, medium size companies are better off in the gaining from cluster participation. Others individual company characteristics were unsustainable in tested models that complicate unambiguous conclusions. Unsuspected results were obtained concerning the belonging to catching-up countries. The clustering effects are stronger for the innovative leaders in the case of patenting while the innovation activity measured by intangible assets is higher in catching-up countries. We consider that this contradictory results need to be further investigated.

Industry level showed sustainable outcomes in both models. Public research and development expenses in particular industry support the impact of clustering on innovation activity. In the contrary the clustering is accompanied by opposite link between average level of industry business expenses and patenting, intangibles. We can explain this phenomenon due to join R&D activities in cluster that decrease the R&D expenses of each company.

We should emphasis that the environmental factors play a pivotal role in enhancing mutual effects expressed in innovation activity. This empirically tested conclusion could be a useful argument in government policy.

We validated that participation in cluster allows the company to be better off in value creation; and this fact is stronger for medium-sized companies. Location in megalopolis facilitates this positive effect. Encouraging results are obtained concerning the collaborative practices among the innovative SMEs. The evidence is represented that this art of activity supports cluster benefits. The last but not least finding is that the clustering declines the role of company subsidiaries.

We realize the shortcomings of our research expressed in restricted part of catching–up countries in the investigated sample. For future research the representation of catching-up countries could be increased. The further exploration of mutual effects could be improved through identification strong and long term ties between the companies located in cluster.

The clustering is complexity and ambiguous process as we have seen once more in our study. The most exiting question that can be derived from this research concerns the role of individual characteristics of company and external factors in leveraging cluster participation.

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