European Cluster Observatory

REPORT

Methodology and Findings Report for Correlation Analysis between Cluster Strength and Competitiveness Indicators

Prepared by:

Susana Franco (Orkestra)

Asier Murciego (Orkestra)

James Wilson (Orkestra)

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Enterprise and Industry

European Cluster Observatory in Brief

The European Cluster Observatory is a single access point for statistical information, analysis and mapping of clusters and cluster policy in Europe that is foremost aimed at European, national, regional and local policy-makers as well as cluster managers and representatives of SME intermediaries. It is an initiative of the "SMEs: Clusters and Emerging Industries" unit of the European Commission's Enterprise and Industry Directorate-General that aims at promoting the development of more world-class clusters in Europe, notably with a view to fostering competitiveness and entrepreneurship in emerging industries and facilitating SMEs' access to clusters and internationalisation activities through clusters.

The ultimate objective is to help Member States and regions in designing smart specialisation and cluster strategies to assist companies in developing new, globally competitive advantages in emerging industries through clusters, and in this way strengthen the role of cluster policies for the rejuvenation of Europe's industry as part of the Europe 2020 Strategy.

To support evidence-based policy-making and partnering, the European Cluster Observatory provides an EU-wide comparative cluster mapping with sectoral and cross-sectoral statistical analysis of the geographical concentration of economic activities and performance. The European Cluster Observatory provides the following services:

- **a bi-annual "European Cluster Panorama"(cluster mapping)** providing an update and enrichment of the statistical mapping of clusters in Europe, including for ten related sectors (i.e. cross-sectoral) and a correlation analysis with key competitiveness indicators;

- **a "European Cluster Trends" report** analysing cross-sectoral clustering trends, cluster internationalisation and global mega trends of industrial transformations; identifying common interaction spaces; and providing a foresight analysis of industrial and cluster opportunities;

- **a "Regional Eco-system Scoreboard"** setting out strengths and weaknesses of regional and national eco-systems for clusters, and identifying cluster-specific framework conditions for three cross-sectoral collaboration areas;

- **a "European Stress Test for Cluster Policy",** including a self-assessment tool accompanied by policy guidance for developing cluster policies in support of emerging industries;

- **showcase modern cluster policy practice through advisory support services to six selected model demonstrator regions**, including expert analysis, regional survey & benchmarking report, peer-review meeting, and policy briefings in support of emerging industries. The policy advice builds also upon the policy lessons from related initiatives in the area of emerging industries;

- bring together **Europe's cluster policy-makers and stakeholders at the European Cluster Conferences** 2014 and 2016 for a high-level cluster policy dialogue and policy learning, and facilitate exchange of information through these webpages, newsletters, videos, etc.

More information about the European Cluster Observatory is available at the EU Cluster Portal at: http://ec.europa.eu/enterprise/initiatives/cluster/observatory/.

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Introduction

Much of the rationale for cluster policies lies on the idea that, where clusters are present, regions and companies generate better economic outcomes. This is something that has been widely examined in the economics and business literatures. Thus, companies in clusters have been found to grow and innovate more, while regions with clusters seem to attract more start-ups (Audretsch and Feldman, 1996; Baptista, 2000; Baptista and Swann, 1998; Delgado et al., 2010, 2012; Klepper, 2007; Swann et al., 1998). At territorial level, clusters have been linked to positive impacts on economic outcomes, particularly measured through GDP per capita (Porter, 2003; Sölvell et al., 2009; Spencer et al., 2010) but also combined with other elements such as disposable income per capita, productivity and long term unemployment (Ketels and Protsiv, 2013). However, these positive impacts do not seem to extend to prosperity understood in a wider sense to incorporate social and environment concerns (Franco and Wilson, 2012; Ketels and Protsiv, 2013).

This report tackles the issue of exploring the relationship between clusters and prosperity. Deeper insight into the impacts of clusters is achieved by empirically testing the relationship between indicators of cluster strength and different outcome indicators of competitiveness at regional level using correlation analysis. The rationale behind this analysis is to explore whether the overall strength of the regional cluster portfolio is linked with positive outcomes in the territory. The data and the results from the empirical analysis developed in this report will be integrated into the European Cluster Observatory.

Additionally, in this report we also explore whether the presence of emerging industries is linked to regional competitiveness. The presence of a strong cluster in a region has been found to also enhance growth opportunities in other related industries and to give rise to the emergence of new regional industries (Delgado et al., 2012). Clusters are therefore not analysed in a narrow sectoral sense but as regional business environments for groups of closely related and complementary sectors and industries in view of capturing their potential positive spill-overs that they may have across complementary economic activities.

Recent analysis of the European Cluster Observatory (2014) has identified ten emerging industries as cross-sectoral thematically defined groups of industries in which the growth of dynamic cross-industry linkages is most likely. Even if positive effects exist, cluster presence is evidently not the only factor driving such positive outcomes, and there are questions about the causal role and quantitative importance of clusters. Other elements in the European Cluster Observatory, such as the Regional Ecosystem Scoreboard will at a later stage contribute to a better understanding of the factors that foster or hinder cluster presence in the regions and their territorial impact.

1. Methodological Approach

This chapter starts by explaining the choice of indicators to measure regional competitiveness, on one hand, and cluster strength on the other, as both remain elusive concepts that are difficult to quantify. It then moves to describe the methodology used to analyse the relationship between them through the use of correlation coefficients.

1.1   Indicators of Competitive Outcomes

Even at national level, there is not a unique way to understand and measure competitiveness. Several initiatives exist to measure the microeconomic, macroeconomic and institutional factors that influence national competitiveness. Some concentrate on the detailed account of specific elements, such as the ease of doing business (World Bank, 2013), the quality of governance (Kaufmann et al., 2010) or innovation capabilities and outcomes (Dutta et al., 2014). Others seek to capture the broad set of elements that describe national competitiveness. Most notably among them stand the *Global Competitiveness Report* (World Economic Forum, 2014) and the *World Competitiveness Yearbook* (International Institute for Management Development, 2014).

At regional level the task becomes even more complicated due to the lack of availability of regionally disaggregated data. Even so, in Europe we can find several initiatives that have adapted efforts made at national level to the regional context. Similarly to their national counterparts, some measure particular elements that affect competitiveness, such as the *Regional Innovation Scoreboard* (Hollanders et al., 2014) or the *Quality of Government Index* (Charron et al., 2012), while the *Regional Competitiveness Index* encompasses the more comprehensive picture (Annoni and Dijkstra, 2013).

Both national and regional indexes tend to incorporate different dimensions of competitiveness that mix input and output elements that are difficult to disentangle. In order to focus only on outcomes, our selection of indicators makes use of the conceptual framework for regional competitiveness designed and applied during the first phase of the European Cluster Observatory, which is illustrated in Figure 1.

Figure 1: Regional competitiveness framework
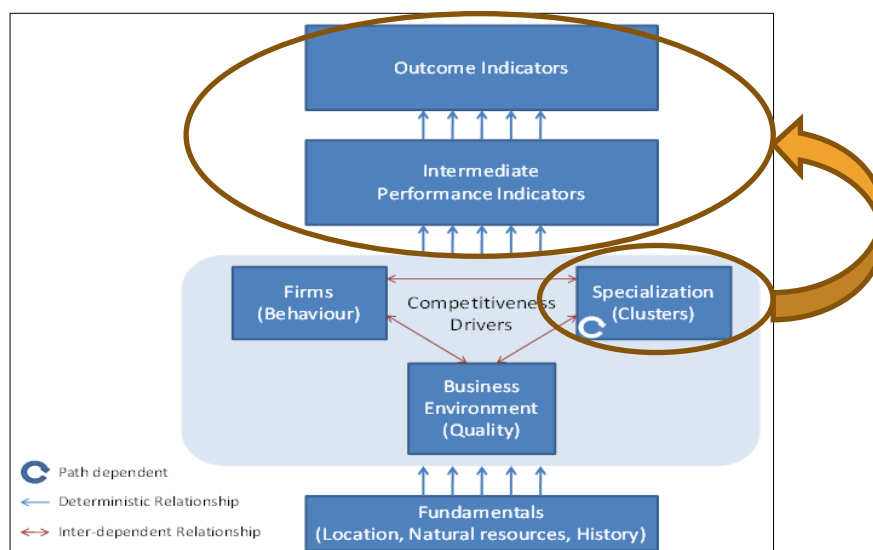
This framework organizes competitiveness indicators in several layers differentiated by their relation to the ultimate objective of economic policy, and by the degree to which they can be directly affected by economic policy.

At the bottom of the framework we find a group of "fundamentals" that affect competitiveness but can be considered fixed or difficult to change in the medium term. These include characteristics such as geographical location, endowment of natural resources, size of the economy, etc. Above them stand the competitiveness drivers, arranged in three inter-related groups of indicators, which contain the elements that are more likely to be affected by economic policy:

■ "Firms" gather indicators that reflect the choices that companies in a region make in terms of investments, R&D expenditure, etc. that are likely to have an impact on their productivity and competitiveness. Government policy can seek to influence these choices.

■ "Specialisation" captures the industrial structure of the territory. The indicators of cluster strength (that will be described in the next sub-chapter) are contained here, and again government policy towards clusters can have an impact here.

■ "Business environment" captures the quality of the environment in which the firms of a region must operate. They include relevant elements for territorial competitiveness that would fall under the 'factors', 'demand', and 'context for strategy and rivalry' corners of Porter's (1990) diamond model. They are also key areas where government policy aims to influence.

While the interaction between business environment and clusters will be analysed as part of the Regional Eco-system Scoreboard of the current phase of the European Cluster Observatory, the top two layers are the important reference points for this report. They encompass final competitiveness outcomes and intermediate performance indicators that are most likely to be affected by the presence of strong clusters in the region. Intermediate performance indicators (such as innovation outputs, productivity or exports) are the direct outputs of the interactions taken place among the competitiveness drivers, that is, the results of the behaviour of firms in the region that are either clustered or not and which will be conditioned by their business environment. Even if these intermediate performance indicators might be considered policy targets, they mostly do not constitute the ultimate goals of the policies. These belong in the top layer of the framework and are generally defined as the standard of living that citizens in the territory enjoy, which is typically measured by GDP per capita, but is also expanded to include social and environmental concerns, which are considerably more difficult to measure.

For the purpose of the current analysis, the top two layers have been merged, with the indicators being divided in four categories: economic, innovation, social and environmental. A thorough search of available indicators to fall into these four categories has been conducted, but several gaps still remain, particularly on indicators that capture social and environmental elements. The sources explored include Eurostat, various OECD regional databases, the Community Innovation Survey (and the estimates based on this survey in the Regional Innovation Scoreboard), the European Social Survey and various national statistical offices.

The analysis is to be carried out for EU28 regions at NUTS2 regions, but for some indicators data is only available at NUTS1 in some countries. In these cases, the original combination of NUTS1 and NUTS2 has been kept because the NUTS2 regionalisation of the data would have introduced distortions in these indicators that would have reduced the accuracy of correlation coefficients. Table 1 summarizes the list of indicators, sources and regional availability.

Table 1: Regional competitiveness outcomes

Category	Variable	Source	Regional Availability
Economic	GDP per capita (PPP)	Eurostat	NUTS2
	Disposable income per capita	Eurostat	NUTS2
	Labour force participation rate	Eurostat	NUTS2
	Youth labour force participation rate	Eurostat	NUTS2
	Labour cost per employee	Eurostat	NUTS2
	Labour cost in manufactures per employee	Eurostat	NUTS2
	Apparent labour productivity (GDP (PPP) per employee)	Eurostat	NUTS2
	Employment growth	Eurostat	NUTS2
	Exports over GDP[1]	National Statistical offices	▪ NUTS1 in BE, DE, NL, UK ▪ NUTS2 in AT, CY, ES, FR, IT, LT, LU, LV, MT, PT, UK
Innovation	PCT Patents filed per million inhabitants	OECD Regpat	NUTS2
	PCT Patents filed per million employed persons	OECD Regpat	NUTS2
	PCT Patents filed per million people in Science&Technology CORE Sector	OECD Regpat	NUTS2
	SMEs introducing product or process innovations	CIS[2]	▪ NUTS1 in AT, BE, BG, DE, EL, FR, UK ▪ NUTS2 in CZ, DK, ES, FI, HR, HU, IE, IT, NL, NO, PL, PT, RO, SE, SI, SK
	SMEs introducing market or organisational innovations	CIS[2]	▪ NUTS1 in AT, BE, BG, DE, EL, FR, UK ▪ NUTS2 in CZ, DK, ES, FI, HR, HU, IE, IT, NL, NO, PL, PT, RO, SE, SI, SK
	Sale of new to market and new to firm innovations	CIS[2]	▪ NUTS1 in AT, BE, BG, DE, EL, FR, UK ▪ NUTS2 in CZ, DK, ES, FI, HR, HU, IE, IT, NL, NO, PL, PT, RO, SE, SI, SK
Social	At-risk-of-poverty rate	Eurostat	NUTS2
	Long term unemployment rate	Eurostat	NUTS2
	Unemployment rate	Eurostat	NUTS2
	Youth unemployment rate	Eurostat	NUTS2
	Life Satisfaction Rate	ESS	NUTS2
Environmental	Land use with heavy environmental impact	Eurostat	NUTS2

Notes: (1) Only 10 out of EU28 countries report regionally disaggregated exports through their statistical offices. There are 5 additional countries for which export data is available because they only have one NUTS2 region; (2) Normalized values obtained from the Regional Innovation Scoreboard 2014. These values have been calculated from Community Innovation Survey data provided by national statistical offices.

Economic indicators include several measures of economic prosperity (GDP per capita and disposable income), ability to mobilize human resources (general and youth labour force participation rates) and creating jobs (employment growth), efficiency in the production process (apparent labour productivity) at low cost (general and manufacturing labour costs), and sales abroad (exports over GDP).

Innovation outputs are included to assess whether clusters contribute to foster regional innovation that will translate into economic progress. They are measured in terms of patents relative to inhabitants, employees, and Science and Technology employees. SMEs innovation performance is appraised through their ability to introduce product or process innovations on one hand and market or organizational innovations on the other. The economic value that innovations produce is incorporated through sales of new to market and new to firm innovations.

Social indicators include several societal aims, such as low levels of poverty and unemployment rates as well as a subjective measure of welfare: the average reported rate of life satisfaction, on a scale from 0 to 10.

Environmental indicators are the hardest to find at regional level and the only one that had enough coverage was the proportion of total land with heavy environmental impact use.

1.2 Indicators of Cluster Strength

In the previous phase of the European Cluster Observatory, the strength of a regional cluster in an industrial category was appraised through a "three-star" methodology that covered the following three criteria:

- Size: The top 10% of all clusters in Europe within the same cluster category in terms of the number of employees received one 'star'.

- Specialization: A cluster with a specialization quotient (LQ)[1] of 2 or more received a 'star'.

- Focus: The top 10% of clusters which account for the largest proportion of their region's total employment received a 'star'.

While this provided a straightforward method to assess the strength of any given cluster (the greater the number of stars, the stronger the cluster was), it did not provide an easy measure of overall cluster strength in the region. The first edition of the Regional Competitiveness Index (Annoni and Kozovska, 2010) included the median number of stars per region as a measure of cluster strength, but this indicator has been substituted in the subsequent edition.

Following Delgado et al. (2012) and Ketels and Protsiv (2013), strong clusters are defined here as clusters that are among the top 20% of clusters in terms of their LQ within each cluster category. Additionally, they have to be within the top 80% of all clusters in a category ranked by employment (in order not to include very small clusters that have spuriously high specialisation). The set of cluster categories employed in the analysis is the 51 categories forming the core of the cluster mapping, since their properties of full coverage of traded industries and non-intersecting definitions are preferable for

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[1] *The location quotient (LQ) is calculated as the industrial category's share of total employment in a specific region to the industrial category's share of total European employment in all regions. Hence, a LQ equal to 1 means that the given region is not specialized in the given industrial category. A LQ equal to 2 means that the given industry is represented by a 100% bigger share of employment in the given region than the industry's share of employment on the level of all regions. The larger the LQ the more specialized the region is in that cluster.*

assessment of the overall regional cluster strength. Based on this definition of strong clusters two indicators of cluster strength at regional level are computed:

- ■ Employment share in strong clusters: the share of regional traded employment in strong clusters. It measures the strength purely in employment terms.

- ■ Payroll share in strong clusters: the share of regional payroll in strong clusters in overall regional payroll in traded industries. Combining employment and wages, this second measure attempts to capture value creation and productivity.[2]

Additionally, the identification of emerging industries constitutes a central part of the current analysis that is being conducted as part of the European Cluster Observatory. Using the methodology described in its methodology and findings report for the cluster mapping of related sectors (2014), ten such emerging industries have been identified: Advanced Packaging, Biopharmaceuticals, Blue Growth Industries, Creative Industries, Digital Industries, Environmental Industries, Experience Industries, Logistical Services, Medical Devices and Mobility Technologies. Even if the impact of these industries is expected to occur in the medium and long term, we can already assess whether the competitiveness outcomes of regions (as defined in the previous sub-chapter) are correlated with the presence of these industries. Hence, the LQ in each of these industries is also considered as a measure of cluster strength in each region.

The European Cluster Observatory has also introduced a new four-star methodology to assess cluster strength. In addition to the above-mentioned size and specialization criteria, two additional criteria are considered. The first one captures the dynamism of the cluster by providing stars on the basis of annual growth rates. The second additional criterion assesses cluster's productivity using wages per employee. The overall strength of emerging industries in the region is measured by the sum of stars the ten emerging industries accumulate.

1.3   Methodology for Correlation Analysis

In order to assess the relationship among them, each of the competitiveness indicators has been correlated with each of the two overall measures of cluster strength and the ten emerging industries' LQ. Two types of correlation coefficients have been computed: Pearson and Spearman. While the former is more commonly used, the latter might be more appropriate in this case because Pearson's coefficient measures the linear relationship between two variables. We are assuming that a relationship exists between cluster strength and competitiveness outcomes, but this relationship might not be linear. Spearman's coefficient measures the rank order of the points, that is, it would assess whether the regions with stronger clusters tend to also have better competitive outcomes. Another advantage of Spearman's coefficient is that it is less affected by the presence of outliers (regions that extremely outperform or underperform in some of the indicators).

The value of both Pearson and Spearman lie between minus one (total negative correlation) and one (total positive correlation). Positive correlation implies that when one variable increases the other increases too. Negative correlation occurs when increments in one variable are associated with de-

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[2] *This indicator is based on the gross wages and salaries received by employees and does not include social security costs. In most countries this data was available on the same disaggregation level as employment data. In the countries where this was not the case (Albania, Czech Republic, Germany, Greece, Israel, Italy, Liechtenstein, Netherlands, Serbia, and United Kingdom) average wage was estimated using Eurostat Structural Business Statistics national 4-digit and regional 2-digit data, and then combined with employment figures to arrive at the total payroll.*

creases in the other. A value of zero indicates that the two variables are not related at all. All statistical estimations have errors. It is therefore necessary to test whether the estimated coefficients are indeed significantly different from zero.[3]

The relationship between cluster strength and competitiveness indicators might be affected by time lags. Hence, the correlation tests have been implemented not only for the same year in each variable, but also with one and two year lags. In order to include those lags, we have chosen 2010 as the reference year to measure cluster strength. The indicators of cluster strength in 2010 have been correlated with the indicators of competitive performance in the year 2010 and, when the data was available, one and two years later. Before moving to the chapter that describes the results of the analysis, it should be stressed that correlation coefficients do not assume causal relationships. That is, if a high correlation is found between one of the measures of cluster strength and one of outcome measures, such as GDP per capita, it might be because more prosperous regions have managed to invest more on clusters, have a more educated labour force that is employed in these clusters, or many other factors. Such analysis will be part of further developments in the European Cluster Observatory.

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[3] *This is achieved by performing a standard t-test.*

2. Discussion of Results

The complete results of the correlation analysis are presented in the Appendix. In order to ease the interpretation, we only report here Spearman correlation coefficients that are significantly different from zero.[4] In some cases a positive coefficient was expected (for instance between cluster strength and GDP per capita), while in other cases it was expected to be negative (for example between cluster strength and at-risk-of-poverty rates). When the coefficients are significant but have the opposite effect to what was to be expected, the background of the cells is darkened.

Table 2: Spearman correlation coefficients (Economic)

	Employment share	Payroll share	Adv. Packaging LQ	Biopharma LQ	Blue Growth LQ	Creative Industries LQ	Digital Industries LQ	Environmental LQ	Experience LQ	Logistical LQ	Medical Devices LQ	Mobility Tech. LQ
GDP per capita												
2010		0.16	-0.12	0.28	0.23	0.58	0.60	0.15	0.30	0.12	0.21	
2011		0.15		0.29	0.21	0.56	0.62	0.18	0.26	0.11	0.25	
Disposable income												
2010				0.27		0.45	0.49	0.21	0.22		0.30	0.15
2011				0.27		0.44	0.51	0.24	0.19		0.33	0.19
Labour Force Participation												
2010	0.18	0.16	-0.16	0.16	0.16	0.45	0.47		0.32			-0.11
2011	0.18	0.18	-0.12	0.16	0.16	0.46	0.50		0.29	0.12		
2012	0.18	0.20	-0.12	0.16	0.15	0.44	0.50		0.27	0.11		
Youth Labour Force Particip_ticip												
2010					0.21	0.45	0.44		0.35	0.11		
2011					0.21	0.44	0.44		0.30	0.14		
2012					0.18	0.44	0.44		0.30	0.13		
Labour cost												
2010				0.23	0.22	0.54	0.53	0.10	0.27		0.14	
2011			0.12	0.15		0.40	0.63	0.11			0.40	0.28
Labour cost manufacture												
2010				0.27		0.54	0.53		0.25	-0.14	0.16	
2011				0.24		0.57	0.56		0.28		0.20	
Productivity												
2010			-0.15	0.28	0.28	0.51	0.46	0.12	0.28	0.21		
2011			-0.12	0.28	0.27	0.49	0.47	0.15	0.24	0.21	0.12	
Employment growth												
2010				0.14		0.12	0.23	0.17			0.21	0.20
2011		0.11	0.25	0.17		0.21	0.43	0.24			0.41	0.33
2012						0.25	0.39			-0.23	0.17	0.11
Exports over GDP												
2010			0.45				0.31	0.40	-0.41		0.44	0.49
2011			0.45			-0.20	0.29	0.41	-0.43		0.45	0.49

[4] *A 5 percent significance level has been considered.*

The results in Table 2 show that the presence of strong clusters (as measured through the two indicators of overall cluster strength) is positively correlated with economic prosperity as traditionally measured (in terms of GDP per capita[5]), with higher rates of general participation in the labour market and with employment growth. The relationship with labour force participation rates seems to slightly increase when we include time lags, indicating that positive effects continue in subsequent years. However, no significant relationship is found with youth labour force participation, labour productivity, labour costs or exports. While these results do not support the clear positive relationship between cluster strength and these important aspects of performance that we might expect, it should be noted that this does not necessary imply that there is no impact of clusters in these areas. That the results are insignificant simply means that it cannot be argued with any certainty that each performance variable on its own is correlated with the measures of cluster strength. In practice there is likely to be considerable interaction between the effects of clusters on a wide range of performance variables which may influence the existence of a direct correlation between any two individual variables. As later suggested in the conclusions further research is needed to untangle these effects.

Table 3: Spearman correlation coefficients (Innovation)

	Employment share	Payroll share	Adv. Packaging LQ	Biopharma LQ	Blue Growth LQ	Creative Industries LQ	Digital Industries LQ	Environmental LQ	Experience LQ	Logistical LQ	Medical Devices LQ	Mobility Tech. LQ
Patents per inhabitant												
2010			0.15	0.30		0.49	0.71	0.31			0.47	0.30
2011			0.15	0.30	0.11	0.49	0.69	0.29			0.44	0.29
2012			0.11	0.29	0.12	0.49	0.69	0.27	0.11		0.43	0.25
Patents per employee												
2010	-0.11		0.16	0.31	0.11	0.48	0.70	0.32			0.46	0.31
2011	-0.12		0.15	0.31	0.12	0.48	0.67	0.29			0.42	0.29
2012		0.38		0.54			0.65	0.37				
Patents per emp. in S&T												
2010	-0.14		0.22	0.25		0.42	0.66	0.32		-0.11	0.51	0.37
2011	-0.16		0.23	0.24		0.41	0.62	0.30			0.48	0.36
2012	-0.12		0.18	0.23		0.41	0.62	0.28			0.47	0.31
Sale of new to market and new to firm innovations												
2010				0.21	0.18	0.30	0.20		0.19			-0.22
SMEs market organization innovations												
2010				0.34	0.32	0.35	0.33	0.32	0.21	0.20		
SMEs product or process innovations												
2010				0.32	0.39	0.37	0.43	0.28	0.21	0.23		

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[5] *As can be seen in the Appendix, Pearson's correlation coefficient also rendered a significantly positive relationship between GDP per capita and employment share in strong clusters.*

The results are more promising when specialization in the emerging industries in considered. Most of these industries are associated with positive economic outcomes. Two of them in particular (digital industries and medical devices) stand out, as all the correlations are significant and have the expected sign. Specialization in advanced packing, on the other hand, seems to be linked to lower GDP per capita, labour force participation and productivity. Not surprisingly, the specialization in creative and experience industries are negatively associated with large exports, because the products and service these industries produce are mainly consumed locally. Their relationship with the other economic outcomes, however, remains positive.

With regard to the relationship between overall cluster strength and innovation outcomes (in Table 3), the results are surprising, because the relationship is either insignificant or contrary to what was expected. Thus, stronger clusters are associated with lower patenting output in the regions.

Once again, we observed stronger results when we consider specialization in the emerging industries. Some of them (biopharmaceuticals, blue growth, creative, digital and environmental industries) show a positive relationship with innovation outcomes both in terms of patenting activity, innovating SMEs and sales. Others are only correlated with patenting outcomes (advanced packaging, medical devices and mobility technologies) or innovating SMEs and sales (experience industries and logistical services).

Table 4: Spearman correlation coefficients (Social and Environmental)

	Employment share	Payroll share	Adv. Packaging LQ	Biopharma LQ	Blue Growth LQ	Creative Industries LQ	Digital Industries LQ	Environmental LQ	Experience LQ	Logistical LQ	Medical Devices LQ	Mobility Tech. LQ
At risk of poverty rate												
2010	0.23		-0.28	-0.16			-0.42	-0.21	0.15	-0.10	-0.44	-0.36
2011	0.18		-0.25	-0.18			-0.46	-0.22	0.12		-0.44	-0.34
2012	0.19		-0.26	-0.18			-0.47	-0.19	0.15		-0.44	-0.34
Long term unemployment												
2010		-0.10				-0.12	-0.27	-0.45		-0.15		-0.19	
2011			-0.10			-0.29	-0.53	-0.13	-0.10		-0.29	-0.19
2012			-0.15			-0.29	-0.57	-0.17			-0.35	-0.25
Youth unemployment												
2010			-0.14	-0.14		-0.22	-0.54	-0.28			-0.39	-0.25
2011			-0.17	-0.17		-0.24	-0.58	-0.31			-0.43	-0.29
2012			-0.16	-0.15		-0.25	-0.58	-0.30			-0.41	-0.28
Unemployment rate												
2010						-0.23	-0.43	-0.13	-0.12		-0.22	-0.14
2011			-0.12			-0.23	-0.49	-0.18			-0.31	-0.23
2012			-0.13			-0.25	-0.52	-0.21		0.10	-0.33	-0.24
Life satisfaction rate												
2010						0.26	0.40	0.36	0.19	0.14		
2012		0.13				0.26	0.39	0.40	0.30			
Heavy environmental land use												
2010[1]			-0.12	0.29		0.38	0.51		0.14		0.13	

Note: (1) The indicator for the share of land use with heavy environmental impact was only available for 2009. It has been assumed that the indicator remains unchanged in 2010.

As mentioned in the previous chapter social and, particularly, environmental outcome indicators are difficult to find at regional levels. Correlation analysis between existing indicators and the proposed measures of overall regional cluster strength (in Table 4) indicates that the relationship is, in most cases, insignificant. Perhaps worryingly, the presence of strong clusters is associated with larger rates of at-risk-of-poverty rates.

Similarly to what has been observed in other categories, specialization in emerging industries is generally associated with positive social outcomes: lower poverty and unemployment rates and higher life satisfaction rates. The only two exceptions are specialization in experience industries (which is linked to higher poverty) and logistical industries (which is positively correlated with future unemployment rates).

The picture is quite different when we consider environmental outcomes: specialization in emerging industries is generally associated with a more intensive use of land with heavy environmental impact. While we need other environmental indicators to become available to deepen the analysis, these results point to the fact that the positive economic and social outcomes that emerging industries might produce may be achieved with a cost in terms of environmental sustainability.

Table 5: Regional Competitiveness Outcomes and Emerging Industry Portfolio Strength

	Indicator	Median					
		Star rating range					Overall
		0-4	5-9	10-14	15-19	20+	
Economic	GDP per capita	20 150	22 200	26 850	27 500	35 400	**22 600**
	Disposable income	13 600	14 600	16 600	17 800	18 900	**14 900**
	Labour Force Participation	0.55	0.58	0.58	0.61	0.62	**0.58**
	Youth Labour Force Particip.	0.36	0.42	0.48	0.50	0.52	**0.41**
	Labour cost	30 670	31 345	35 070	41 040	44 945	**33 560**
	Labour cost manufacture	31 330	34 610	43 170	49 500	53 080	**38 930**
	Productivity	49 290	53 800	56 877	59 336	71 605	**54 513**
	Employment growth	-1.19	-0.30	-0.55	0.82	-0.65	**-0.48**
	Exports over GDP	0.17	0.28	0.28	0.23	0.12	**0.20**
Innovation	Patents per inhabitant	23	53	104	149	223	**54**
	Patents per employee	57	118	219	321	460	**125**
	Patents per emp. in S&T	357	643	1 342	1 223	1 998	**686**
	Sale of new to market and new to firm innovations	0.49	0.50	0.50	0.40	0.54	**0.50**
	SMEs market or organisation innovations	0.22	0.35	0.40	0.42	0.39	**0.34**
	SMEs product or process innovations	0.25	0.38	0.54	0.59	0.66	**0.37**
Social	At risk of poverty rate	18.78	15.40	14.15	13.10	11.60	**15.50**
	Long term unemployment	3.40	3.10	2.45	1.90	1.50	**3.00**
	Youth unemployment	24.46	21.15	14.55	16.65	10.48	**21.03**
	Unemployment rate	9.22	9.79	7.14	6.36	5.78	**8.41**
	Life satisfaction rate	6.55	6.62	7.12	7.64	7.75	**6.81**
Env	Heavy environmental land use	3.05	3.91	4.50	5.99	6.43	**3.83**

Note: Shaded cells indicate that smaller medians imply good performance.

In addition to the correlation analysis, the impact of emerging industries has also been assessed by classifying regions according to the number of stars they accumulate and profiling them according to the median values for each of the outcome indicators. The results of such analysis, presented in Table 5, confirm that regions with stronger presence of emerging industries tend to perform better in economic, innovation and social terms, but present a negative environmental performance.

■ Regarding *economic outcomes*, it can be observed that the larger the number of stars, the higher the levels of GDP per capita and disposable income are. Labour force participation (both overall and among young people) also increases with the number of stars. Regions with more stars also exhibit larger productivity levels, which are likely to be associated with higher wages. This is likely to contribute to larger labour costs, both generally in the economy and in the manufacturing sectors. Employment levels decreased in the period considered due to the crisis and the detailed profile of the star-classified regions show that the behaviour was uneven: while regions with 0-4 stars present the highest average rate of employment destruction and regions with 15-19 stars managed on average to create employment, regions in the top category (20+ stars) could not avoid employment reductions. Export behaviour was also uneven, with exports peaking in the regions with 5-14 stars.

■ The presence of emerging industries is also associated with positive *innovation outcomes*. This is particularly the case when these outcomes are measured in terms of patenting, either scaled by population, employment or employment in science and technology. It also holds true when the results are measured on the basis of SMEs innovating behaviour, more markedly regarding product or process innovations than market or organisation innovations. What is not clear, on the basis of these results, is whether more innovations translate into more sales, because there is no distinctive behaviour associated with the star classification of regions.

■ Specialisation in emerging industries is generally associated with positive *social outcomes* such as lower poverty and unemployment rates and higher life satisfaction rates.

■ The picture is quite different in terms of *environmental outcomes* as specialisation in emerging industries is generally associated with a more intensive use of land with heavy environmental impact. This is likely driven by the nature of these regions; they are heavily urbanized and have high levels of population density.

3. Conclusions

This report has empirically tested the relationship between the presence of strong clusters in European regions and different dimensions of regional competitiveness. Using the framework developed in the previous phase of the European Cluster Observatory as the basis for measures of regional competiveness, and extending this though extensive searches for further available indicators at regional level, a set of twenty one variables have been identified to capture competitiveness outcomes in four categories: economic, innovation, social and environmental. These indicators have been correlated with measures of overall cluster strength and specialization in ten emerging industries, and regions have been profiled for these outcomes according to their emerging industry star-rating.

Divergent results arise from this analysis. On the one hand the relationships between overall cluster strength measures and regional competitiveness outcomes tend to be insignificant or even negative. On the other hand, the presences of the selected ten emerging industries overall appear to be associated with strong economic, innovation and social performance, and with negative environmental performance, although there is some variation in the direction of correlations in a handful of the emerging industry categories. This is confirmed by the regional star analysis: regions with stronger presence of emerging industries tend to perform better in economic, innovation and social terms, but present a negative environmental performance.

The above results spark two main reflections. The first has to do with the measures of overall regional cluster strength and whether the poor results of the correlation analysis really imply that strong clusters do not impact on regional competitiveness outcomes. We suggest that this result, in part at least, reflects limitations in our capacity to measure overall cluster strength at regional level. The strength of clusters is extremely heterogeneous, with regions likely to house a mix of strong and weak clusters in practice. The two chosen measures attempt to aggregate that effect, but are anchored on a fairly narrow interpretation of cluster strength that is based on their relative specialization (with regard to the European average) in terms of employment. Even if the second measure incorporates wages in order to calculate payroll and thus capture variations in value creation and productivity, the question remains as to whether these two measures really reflect the presence of strong clusters in the region. The search for alternative indicators is hindered by the lack of disaggregated data at cluster level that might be aggregated regionally. Still, further research should go in this direction in order to complement the analysis carried out so far.

The second main set of reflections has to do with the presence of emerging industries. Here, the results reinforce the idea that support for these emerging industries may produce positive outcomes at regional level in the future, although we should be aware that questions of causality in this relationship have not been answered in this analysis. Nevertheless the scope of significant correlations across most indicators and most industries is a promising sign. What is more, the variation in strength and sign of correlation across different emerging industries can help to reflect on their different territorial impact.

Finally, it is important to bear in mind that the study presented herein has made use solely of correlation coefficients. Additional analysis is required to explore causation. Moreover, the lower layers of the regional competitiveness framework should be explored in order to investigate other factors that interact with cluster presence to shape regional competitiveness. In particular, the results from the Regional Eco-system Scoreboard that will be developed as part of the current phase on the European Cluster Observatory will shed some light on the interaction between business environment and the presence of clusters and, in doing so, it will help to better understand the role of cluster in improving regional competitiveness.

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Appendix: Detailed Results of the Correlation Analysis

Table A.1 Spearman correlation coefficients (p values in brackets)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
GDP per capita												
2010	0.0504 (0.4140)	0.1566 (0.0107)	-0.1239 (0.0439)	0.2798 (0.0000)	0.2265 (0.0002)	0.5800 (0.0000)	0.5976 (0.0000)	0.1470 (0.0166)	0.3046 (0.0000)	0.1229 (0.0455)	0.2088 (0.0006)	0.0112 (0.8557)
2011	0.0278 (0.6525)	0.1470 (0.0166)	-0.0805 (0.1916)	0.2865 (0.0000)	0.2137 (0.0005)	0.5599 (0.0000)	0.6167 (0.0000)	0.1831 (0.0028)	0.2587 (0.0000)	0.1115 (0.0699)	0.2500 (0.0000)	0.0593 (0.3367)
Disposable in-come												
2010	-0.0795 (0.2004)	0.0292 (0.6387)	-0.0122 (0.8448)	0.2659 (0.0000)	0.0986 (0.1122)	0.4455 (0.0000)	0.4873 (0.0000)	0.2139 (0.0005)	0.2218 (0.0003)	0.0220 (0.7239)	0.3000 (0.0000)	0.1516 (0.0142)
2011	-0.0957 (0.1230)	0.0218 (0.7263)	0.0258 (0.6779)	0.2745 (0.0000)	0.0994 (0.1090)	0.4388 (0.0000)	0.5095 (0.0000)	0.2421 (0.0000)	0.1877 (0.0023)	0.0202 (0.7453)	0.3331 (0.0000)	0.1899 (0.0021)
Labour Force Participation												
2010	0.1829 (0.0028)	0.1553 (0.0114)	-0.1566 (0.0107)	0.1649 (0.0072)	0.1585 (0.0097)	0.4529 (0.0000)	0.4732 (0.0000)	-0.0515 (0.4035)	0.3163 (0.0000)	0.0742 (0.2289)	0.0731 (0.2357)	-0.1055 (0.0864)
2011	0.1838 (0.0026)	0.1816 (0.0029)	-0.1245 (0.0429)	0.1605 (0.0090)	0.1584 (0.0098)	0.4575 (0.0000)	0.5012 (0.0000)	-0.0218 (0.7242)	0.2930 (0.0000)	0.0812 (0.1875)	0.1206 (0.0499)	-0.0779 (0.2056)
2012	0.1809 (0.0031)	0.1956 (0.0013)	-0.1180 (0.0549)	0.1628 (0.0080)	0.1544 (0.0118)	0.4413 (0.0000)	0.5033 (0.0000)	-0.0041 (0.9457)	0.2702 (0.0000)	0.0664 (0.2812)	0.1099 (0.0738)	-0.0757 (0.2188)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Youth Labour Force Particip												
2010	0.0425	-0.0107	-0.0815	0.0921	0.2106	0.4521	0.4392	0.0769	0.3453	-0.0072	0.1078	-0.0249
	(0.4902)	(0.8611)	(0.1858)	(0.1353)	(0.0005)	(0.0000)	(0.0000)	(0.2120)	(0.0000)	(0.9064)	(0.0797)	(0.6861)
2011	0.0422	0.0005	-0.0516	0.0936	0.2086	0.4437	0.4449	0.0967	0.3025	0.0021	0.1403	0.0053
	(0.4936)	(0.9933)	(0.4023)	(0.1292)	(0.0006)	(0.0000)	(0.0000)	(0.1162)	(0.0000)	(0.9724)	(0.0222)	(0.9306)
2012	0.0510	0.0111	-0.0507	0.0679	0.1818	0.4421	0.4395	0.0852	0.3041	-0.0130	0.1295	0.0000
	(0.4077)	(0.8565)	(0.4106)	(0.2714)	(0.0029)	(0.0000)	(0.0000)	(0.1662)	(0.0000)	(0.8328)	(0.0350)	(0.9996)
Labour cost												
2010	-0.0781	-0.0239	-0.0988	0.2282	0.2228	0.5386	0.5256	0.1029	0.2695	0.0911	0.1421	0.0489
	(0.2116)	(0.7021)	(0.1138)	(0.0002)	(0.0003)	(0.0000)	(0.0000)	(0.0997)	(0.0000)	(0.1452)	(0.0226)	(0.4344)
2011	-0.0728	0.0180	0.1195	0.1484	-0.0068	0.4030	0.6319	0.1111	0.1013	-0.0247	0.3973	0.2827
	(0.2799)	(0.7893)	(0.0754)	(0.0273)	(0.9190)	(0.0000)	(0.0000)	(0.0985)	(0.1322)	(0.7139)	(0.0000)	(0.0000)
Labour cost manufacture												
2010	0.0430	0.0822	-0.0552	0.2742	0.0944	0.5396	0.5308	0.1315	0.2493	-0.1388	0.1562	0.0695
	(0.5258)	(0.2255)	(0.4155)	(0.0000)	(0.1638)	(0.0000)	(0.0000)	(0.0519)	(0.0001)	(0.0400)	(0.0206)	(0.3053)
2011	0.0401	0.0249	0.0046	0.2412	0.0191	0.5688	0.5570	-0.0442	0.2788	-0.0816	0.1999	0.1477
	(0.5999)	(0.7449)	(0.9512)	(0.0014)	(0.8020)	(0.0000)	(0.0000)	(0.5627)	(0.0002)	(0.2853)	(0.0083)	(0.0523)
Productivity												
2010	-0.0376	0.0603	-0.1512	0.2800	0.2769	0.5145	0.4610	0.1227	0.2781	0.2136	0.0920	-0.0215
	(0.5429)	(0.3286)	(0.0139)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0463)	(0.0000)	(0.0004)	(0.1357)	(0.7269)
2011	-0.0419	0.0671	-0.1197	0.2842	0.2697	0.4940	0.4746	0.1511	0.2390	0.2069	0.1242	0.0098
	(0.4974)	(0.2768)	(0.0519)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0139)	(0.0001)	(0.0007)	(0.0436)	(0.8732)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Employment growth												
2010	-0.0970	-0.0534	0.07593	0.1399	-0.0718	0.1197	0.2298	0.1722	0.0098	-0.0659	0.2059	0.2038
	(0.1150)	(0.3864)	(0.2179)	(0.0229)	(0.2439)	(0.0514)	(0.0002)	(0.0049)	(0.8730)	(0.2846)	(0.0007)	(0.0008)
2011	-0.0389	0.1089	0.2547	0.1697	-0.0327	0.2069	0.4252	0.2420	-0.0984	-0.0836	0.4145	0.3327
	(0.5280)	(0.0765)	(0.0000)	(0.0057)	(0.5954)	(0.0007)	(0.0000)	(0.0000)	(0.1097)	(0.1743)	(0.0000)	(0.0000)
2012	0.0147	0.0925	0.0437	0.0980	-0.0811	0.2534	0.3912	0.0490	0.0498	-0.2301	0.1707	0.1092
	(0.8106)	(0.0132)	(0.4785)	(0.1121)	(0.1879)	(0.0000)	(0.0000)	(0.4267)	(0.4190)	(0.0002)	(0.0053)	(0.0758)
Exports over GDP												
2010	-0.1485	-0.0940	0.4535	0.1368	0.0974	-0.1703	0.3136	0.3989	-0.4094	-0.0325	0.4413	0.4901
	(0.1164)	(0.3223)	(0.0000)	(0.1486)	(0.3049)	(0.0713)	(0.0007)	(0.0000)	(0.0000)	(0.7325)	(0.0000)	(0.0000)
2011	-0.1524	-0.1003	0.4532	0.1480	0.1262	-0.2025	0.2856	0.4121	-0.4322	0.0092	0.4532	0.4862
	(0.1070)	(0.2906)	(0.0000)	(0.1178)	(0.1830)	(0.0315)	(0.0022)	(0.0000)	(0.0000)	(0.9227)	(0.0000)	(0.0000)
Patents per in-habitant												
2010	-0.0798	0.0352	0.1501	0.3010	0.0996	0.4923	0.7094	0.3079	0.0850	-0.0861	0.4663	0.3006
	(0.1949)	(0.5682)	(0.0143)	(0.0000)	(0.1056)	(0.0000)	(0.0000)	(0.0000)	(0.1676)	(0.1622)	(0.0000)	(0.0000)
2011	-0.0828	0.0358	0.1459	0.3033	0.1067	0.4919	0.6946	0.2943	0.0852	-0.0849	0.4394	0.2897
	(0.1785)	(0.5611)	(0.0174)	(0.0000)	(0.0828)	(0.0000)	(0.0000)	(0.0000)	(0.1666)	(0.1679)	(0.0000)	(0.0000)
2012	-0.0541	0.0476	0.1105	0.2881	0.1217	0.4916	0.6907	0.2730	0.1071	-0.0685	0.4316	0.2521
	(0.3795)	(0.4403)	(0.0723)	(0.0000)	(0.0477)	(0.0000)	(0.0000)	(0.0000)	(0.0816)	(0.2662)	(0.0000)	(0.0000)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Patents per em-ployee												
2010	-0.1115 (0.0704)	0.0037 (0.9519)	0.1608 (0.0089)	0.3121 (0.0000)	0.1149 (0.0623)	0.4789 (0.0000)	0.6993 (0.0000)	0.3155 (0.0000)	0.0697 (0.2593)	-0.0860 (0.1637)	0.4578 (0.0000)	0.3062 (0.0000)
2011	-0.1164 (0.0589)	0.0004 (0.9953)	0.1514 (0.0138)	0.3098 (0.0000)	0.1232 (0.0456)	0.4763 (0.0000)	0.6723 (0.0000)	0.2929 (0.0000)	0.0765 (0.2156)	-0.0851 (0.1682)	0.4189 (0.0000)	0.2893 (0.0000)
2012	0.3248 (0.1403)	0.3762 (0.0845)	-0.0712 (0.7530)	0.5360 (0.0101)	0.0198 (0.9304)	0.1220 (0.5886)	0.6501 (0.0011)	0.3705 (0.0896)	-0.0006 (0.9980)	-0.2237 (0.3170)	0.2231 (0.3183)	0.1830 (0.4150)
Patents per emp. in S&T												
2010	-0.1350 (0.0279)	-0.0186 (0.7630)	0.2244 (0.0002)	0.2479 (0.0000)	0.0448 (0.4675)	0.4235 (0.0000)	0.6606 (0.0000)	0.3205 (0.0000)	0.0473 (0.4435)	-0.1087 (0.0773)	0.5102 (0.0000)	0.3706 (0.0000)
2011	-0.1556 (0.0112)	-0.0283 (0.6461)	0.2287 (0.0002)	0.2431 (0.0001)	0.0653 (0.2899)	0.4085 (0.0000)	0.6227 (0.0000)	0.3007 (0.0000)	0.0378 (0.5406)	-0.0843 (0.1710)	0.4789 (0.0000)	0.3639 (0.0000)
2012	-0.1200 (0.0511)	-0.0092 (0.8816)	0.1795 (0.0034)	0.2322 (0.0001)	0.0891 (0.1482)	0.4121 (0.0000)	0.6243 (0.0000)	0.2800 (0.0000)	0.0682 (0.2690)	-0.0596 (0.3338)	0.4662 (0.0000)	0.3127 (0.0000)
Sale of new to market and new to firm innov.												
2010	-0.2188 (0.0043)	-0.1429 (0.0638)	-0.0092 (0.9054)	0.2131 (0.0056)	0.1804 (0.0189)	0.2980 (0.0001)	0.2041 (0.0078)	0.0655 (0.3979)	0.1872 (0.0148)	0.1391 (0.0713)	0.0532 (0.4924)	0.0576 (0.4573)
SMEs market organization innov												
2010	-0.0942 (0.2232)	-0.0666 (0.3896)	-0.0252 (0.7451)	0.3421 (0.0000)	0.3218 (0.0000)	0.3544 (0.0000)	0.3276 (0.0000)	0.3201 (0.0000)	0.2054 (0.0074)	0.2048 (0.0076)	0.2894 (0.0001)	0.0649 (0.4022)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
SMEs product or process innov												
2010	-0.1173 (0.1289)	-0.0738 (0.3405)	0.0047 (0.9514)	0.3150 (0.0000)	0.3916 (0.0000)	0.3750 (0.0000)	0.4334 (0.0000)	0.2794 (0.0002)	0.2092 (0.0063)	0.2271 (0.0030)	0.2946 (0.0001)	0.0622 (0.4218)
At risk of pov-erty rate												
2010	0.2303 (0.0002)	0.0884 (0.1512)	-0.2810 (0.0000)	-0.1571 (0.0106)	-0.0698 (0.2572)	-0.0313 (0.6122)	-0.4203 (0.0000)	-0.2121 (0.0005)	0.1536 (0.0123)	-0.1028 (0.0950)	-0.4412 (0.0000)	-0.3600 (0.0000)
2011	0.1824 (0.0029)	0.0497 (0.4207)	-0.2540 (0.0000)	-0.1837 (0.0027)	-0.0735 (0.2332)	-0.0748 (0.2247)	-0.4564 (0.0000)	-0.2229 (0.0003)	0.1238 (0.0441)	-0.0702 (0.2545)	-0.4434 (0.0000)	-0.3438 (0.0000)
2012	0.1914 (0.0017)	0.0696 (0.2586)	-0.2632 (0.0000)	-0.1842 (0.0027)	-0.0582 (0.3451)	-0.0661 (0.2834)	-0.4652 (0.0000)	-0.1892 (0.0020)	0.1456 (0.0177)	-0.0510 (0.4083)	-0.4445 (0.0000)	-0.3368 (0.0000)
Long term un-employment												
2010	-0.0622 (0.3131)	-0.1037 (0.0921)	-0.0286 (0.6434)	-0.0188 (0.7612)	-0.1185 (0.0540)	-0.2749 (0.0000)	-0.4471 (0.0000)	-0.0711 (0.2488)	-0.1470 (0.0166)	0.0021 (0.9726)	-0.1862 (0.0023)	-0.0970 (0.1152)
2011	-0.0246 (0.6898)	-0.0942 (0.1263)	-0.1035 (0.0926)	-0.0606 (0.3268)	-0.0792 (0.1988)	-0.2879 (0.0000)	-0.5305 (0.0000)	-0.1330 (0.0304)	-0.1039 (0.0914)	0.0335 (0.5875)	-0.2908 (0.0000)	-0.1947 (0.0014)
2012	0.0036 (0.9532)	-0.0820 (0.1831)	-0.1510 (0.0139)	-0.0762 (0.2172)	-0.0517 (0.4015)	-0.2868 (0.0000)	-0.5681 (0.0000)	-0.1738 (0.0045)	-0.0506 (0.4116)	0.0685 (0.2668)	-0.3466 (0.0000)	-0.2486 (0.0000)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Youth unem-ployment												
2010	0.0631 (0.3063)	-0.0300 (0.6263)	-0.1410 (0.0217)	-0.1447 (0.0187)	-0.0420 (0.4958)	-0.2185 (0.0003)	-0.5394 (0.0000)	-0.2773 (0.0000)	-0.0053 (0.9319)	0.0881 (0.1529)	-0.3950 (0.0000)	-0.2458 (0.0001)
2011	0.0849 (0.1681)	-0.0258 (0.6754)	-0.1697 (0.0056)	-0.1655 (0.0070)	-0.0556 (0.3676)	-0.2385 (0.0001)	-0.5835 (0.0000)	-0.3050 (0.0000)	0.0079 (0.8980)	0.0813 (0.1869)	-0.4308 (0.0000)	-0.2923 (0.0000)
2012	0.0582 (0.3454)	-0.0638 (0.3006)	-0.1603 (0.0089)	-0.1454 (0.0181)	-0.0648 (0.2932)	-0.2468 (0.0000)	-0.5775 (0.0000)	-0.2981 (0.0000)	0.0025 (0.9672)	0.0956 (0.1206)	-0.4102 (0.0000)	-0.2752 (0.0000)
Unemployment rate												
2010	0.0342 (0.5790)	-0.0297 (0.6302)	-0.0429 (0.4869)	-0.0586 (0.3429)	-0.0392 (0.5249)	-0.2304 (0.0002)	-0.4330 (0.0000)	-0.1267 (0.0393)	-0.1183 (0.0543)	0.0215 (0.7273)	-0.2194 (0.0003)	-0.1395 (0.0231)
2011	0.0607 (0.3253)	-0.0417 (0.4996)	-0.1208 (0.0495)	-0.0850 (0.1688)	-0.0184 (0.7654)	-0.2288 (0.0002)	-0.4918 (0.0000)	-0.1830 (0.0028)	-0.0528 (0.3924)	0.0684 (0.2669)	-0.3092 (0.0000)	-0.2266 (0.0002)
2012	0.0489 (0.4275)	-0.0627 (0.3090)	-0.1317 (0.0321)	-0.0978 (0.1128)	-0.0205 (0.7397)	-0.2497 (0.0000)	-0.5249 (0.0000)	-0.2061 (0.0007)	-0.0370 (0.5491)	0.1036 (0.0923)	-0.3301 (0.0000)	-0.2391 (0.0001)
Life satisfaction rate												
2010	0.0213 (0.7862)	0.0473 (0.5464)	-0.0014 (0.9861)	-0.0146 (0.8523)	0.2561 (0.0009)	0.3951 (0.0000)	0.3582 (0.0000)	0.0424 (0.5883)	0.1857 (0.0170)	0.1390 (0.0749)	0.0176 (0.8226)	0.0402 (0.6078)
2012	0.1000 (0.1944)	0.1341 (0.0813)	-0.0284 (0.7132)	0.0063 (0.9350)	0.2552 (0.0008)	0.3914 (0.0000)	0.3988 (0.0000)	0.0752 (0.3296)	0.3030 (0.0001)	0.0953 (0.2164)	0.0346 (0.6543)	-0.0101 (0.8963)
Heavy environmental land use												
2010[1]	0.0186 (0.7810)	0.0821 (0.2191)	-0.1223 (0.0664)	0.2893 (0.0000)	0.0694 (0.2992)	0.3757 (0.0000)	0.5059 (0.0000)	0.0528 (0.4294)	0.1371 (0.0395)	0.1015 (0.1283)	0.1344 (0.0436)	0.0097 (0.8851)

Note: (1) The indicator for the share of land use with heavy environmental impact was only available for 2009. It has been assumed that the indicator remains unchanged in 2010.

Table A.2 Pearson correlation coefficients (p values in brackets)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
GDP per capita												
2010	0.1508 (0.0140)	0.2409 (0.0001)	-0.1709 (0.0053)	0.2392 (0.0001)	0.2282 (0.0002)	0.6680 (0.0000)	0.5558 (0.0000)	0.0961 (0.1186)	0.2423 (0.0001)	0.1103 (0.0730)	0.1016 (0.0989)	-0.0501 (0.4162)
2011	0.1372 (0.0255)	0.2376 (0.0001)	-0.1307 (0.0334)	0.2270 (0.0002)	0.2169 (0.0004)	0.6487 (0.0000)	0.5753 (0.0000)	0.1202 (0.0506)	0.2052 (0.0008)	0.1014 (0.0996)	0.1409 (0.0218)	-0.0060 (0.9231)
Disposable income												
2010	-0.0633 (0.3079)	0.0241 (0.6981)	-0.0432 (0.4875)	0.2330 (0.0002)	0.1689 (0.0062)	0.5000 (0.0000)	0.4803 (0.0000)	0.1854 (0.0026)	0.2490 (0.0000)	0.0682 (0.2723)	0.2373 (0.0001)	0.1134 (0.0673)
2011	-0.0811 (0.1915)	0.0189 (0.7610)	0.0059 (0.9247)	0.2419 (0.0001)	0.1582 (0.0105)	0.4834 (0.0000)	0.5144 (0.0000)	0.2138 (0.0005)	0.2014 (0.0011)	0.0512 (0.4105)	0.2876 (0.0000)	0.1671 (0.0068)
Labour Force Participation												
2010	0.1585 (0.0097)	0.1469 (0.0167)	-0.0981 (0.1110)	0.1287 (0.0366)	0.2165 (0.0004)	0.4378 (0.0000)	0.4794 (0.0000)	0.0212 (0.7318)	0.2227 (0.0003)	0.0802 (0.1930)	0.1022 (0.0970)	-0.0501 (0.4167)
2011	0.1579 (0.0101)	0.1640 (0.0075)	-0.0569 (0.3562)	0.1328 (0.0310)	0.2004 (0.0010)	0.4447 (0.0000)	0.5018 (0.0000)	0.0453 (0.4625)	0.1905 (0.0018)	0.0721 (0.2418)	0.1509 (0.0139)	-0.0115 (0.8527)
2012	0.1539 (0.0121)	0.1728 (0.0048)	-0.0528 (0.3923)	0.1317 (0.0325)	0.2202 (0.0003)	0.4408 (0.0000)	0.5031 (0.0000)	0.0716 (0.2455)	0.1627 (0.0080)	0.0582 (0.3449)	0.1405 (0.0222)	-0.0069 (0.9116)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Youth Labour Force Particip												
2010	0.0502 (0.4156)	0.0070 (0.9095)	-0.0755 (0.2207)	0.0002 (0.9977)	0.2315 (0.0001)	0.3987 (0.0000)	0.4385 (0.0000)	0.1312 (0.0327)	0.2805 (0.0000)	-0.0180 (0.7709)	0.1298 (0.0347)	-0.0128 (0.8358)
2011	0.0560 (0.3635)	0.0251 (0.6838)	-0.0398 (0.5193)	-0.0070 (0.9096)	0.2294 (0.0002)	0.3939 (0.0000)	0.4485 (0.0000)	0.1545 (0.0118)	0.2334 (0.0001)	-0.0079 (0.8983)	0.1641 (0.0074)	0.0218 (0.7239)
2012	0.0613 (0.3200)	0.0312 (0.6128)	-0.0475 (0.4410)	-0.0249 (0.6870)	0.2312 (0.0001)	0.3935 (0.0000)	0.4458 (0.0000)	0.1491 (0.0151)	0.2391 (0.0001)	-0.0234 (0.7044)	0.1435 (0.0194)	0.0124 (0.8410)
Labour cost												
2010	-0.0153 (0.8074)	0.0162 (0.7958)	-0.1809 (0.0036)	0.2246 (0.0003)	0.1888 (0.0024)	0.6020 (0.0000)	0.4815 (0.0000)	0.0327 (0.6022)	0.2524 (0.0000)	0.0450 (0.4730)	0.0224 (0.7206)	-0.0620 (0.3218)
2011	-0.0441 (0.5130)	-0.0193 (0.7748)	0.1400 (0.0371)	0.0478 (0.4796)	-0.0711 (0.2917)	0.1371 (0.0413)	0.3913 (0.0000)	0.0029 (0.9658)	-0.0485 (0.4723)	-0.0733 (0.2769)	0.2801 (0.0000)	0.1988 (0.0029)
Labour cost manufacture												
2010	0.0394 (0.5620)	0.0790 (0.2446)	-0.0783 (0.2488)	0.2901 (0.0000)	0.0728 (0.2834)	0.5420 (0.0000)	0.5002 (0.0000)	0.1101 (0.1041)	0.2117 (0.0016)	-0.1517 (0.0247)	0.1058 (0.1186)	0.0253 (0.7100)
2011	0.0362 (0.6359)	0.0380 (0.6199)	-0.0572 (0.4551)	0.2960 (0.0001)	0.0255 (0.7389)	0.5518 (0.0000)	0.5392 (0.0000)	-0.0364 (0.6349)	0.2182 (0.0039)	-0.0980 (0.1996)	0.0975 (0.2020)	0.0503 (0.5113)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Productivity												
2010	0.0625 (0.3120)	0.1286 (0.0367)	-0.1823 (0.0029)	0.2452 (0.0001)	0.1921 (0.0017)	0.5968 (0.0000)	0.4687 (0.0000)	0.0442 (0.4748)	0.2298 (0.0002)	0.1136 (0.0653)	0.0025 (0.9673)	-0.0916 (0.1378)
2011	0.0539 (0.3828)	0.1275 (0.0384)	-0.1543 (0.0121)	0.2270 (0.0002)	0.1888 (0.0021)	0.5777 (0.0000)	0.4783 (0.0000)	0.0659 (0.2861)	0.1979 (0.0012)	0.1078 (0.0803)	0.0292 (0.6372)	-0.0614 (0.3206)
Employment growth												
2010	-0.0956 (0.1206)	-0.0646 (0.2945)	0.0499 (0.4181)	0.1206 (0.0503)	0.0256 (0.6778)	0.1079 (0.0794)	0.1766 (0.0039)	0.1192 (0.0525)	0.0764 (0.2152)	0.0388 (0.5294)	0.1359 (0.0269)	0.1505 (0.0142)
2011	-0.0308 (0.6174)	0.0940 (0.1270)	0.2692 (0.0000)	0.1339 (0.0297)	-0.0079 (0.8981)	0.2363 (0.0001)	0.4554 (0.0000)	0.1527 (0.0128)	-0.1050 (0.0882)	-0.1293 (0.0353)	0.3717 (0.0000)	0.3284 (0.0000)
2012	-0.0425 (0.4909)	0.0544 (0.3781)	0.1232 (0.0450)	0.0873 (0.1570)	0.0437 (0.4789)	0.2404 (0.0001)	0.4213 (0.0000)	0.1068 (0.0827)	-0.0154 (0.8030)	-0.2212 (0.0003)	0.2045 (0.0008)	0.1989 (0.0011)
Exports over GDP												
2010	-0.0526 (0.5803)	0.0128 (0.8929)	0.2892 (0.0019)	0.0928 (0.3280)	0.2066 (0.0281)	-0.1058 (0.2649)	0.2815 (0.0025)	0.3309 (0.0003)	-0.3092 (0.0009)	0.0100 (0.9164)	0.2645 (0.0046)	0.3616 (0.0001)
2011	-0.0581 (0.5413)	0.0037 (0.9691)	0.3002 (0.0012)	0.1010 (0.2871)	0.2147 (0.0224)	-0.1340 (0.1570)	0.2641 (0.0047)	0.3400 (0.0002)	-0.3265 (0.0004)	0.0288 (0.7624)	0.2717 (0.0036)	0.3631 (0.0001)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Patents per inhabitant												
2010	0.0325	0.1755	0.1731	0.2654	0.0650	0.3601	0.6595	0.3626	-0.0605	-0.1361	0.5028	0.3376
	(0.5987)	(0.0042)	(0.0047)	(0.0000)	(0.2921)	(0.0000)	(0.0000)	(0.0000)	(0.3265)	(0.0267)	(0.0000)	(0.0000)
2011	0.0264	0.1621	0.1630	0.2831	0.0934	0.3576	0.6539	0.3048	-0.0594	-0.1246	0.4751	0.3134
	(0.6684)	(0.0082)	(0.0079)	(0.0000)	(0.1295)	(0.0000)	(0.0000)	(0.0000)	(0.3354)	(0.0426)	(0.0000)	(0.0000)
2012	0.0559	0.1841	0.1418	0.2421	0.1084	0.3630	0.6422	0.2938	-0.0477	-0.1035	0.4557	0.2888
	(0.3645)	(0.0026)	(0.0209)	(0.0001)	(0.0782)	(0.0000)	(0.0000)	(0.0000)	(0.4390)	(0.0926)	(0.0000)	(0.0000)
Patents per employee												
2010	-0.0128	0.1283	0.1858	0.3015	0.0644	0.3471	0.6579	0.3556	-0.0759	-0.1374	0.4927	0.3440
	(0.8360)	(0.0372)	(0.0024)	(0.0000)	(0.2975)	(0.0000)	(0.0000)	(0.0000)	(0.2189)	(0.0256)	(0.0000)	(0.0000)
2011	-0.0243	0.1071	0.1711	0.3193	0.0859	0.3435	0.6423	0.2948	-0.0736	-0.1225	0.4523	0.3124
	(0.6941)	(0.0823)	(0.0053)	(0.0000)	(0.1642)	(0.0000)	(0.0000)	(0.0000)	(0.2333)	(0.0468)	(0.0000)	(0.0000)
2012	0.2769	0.3259	-0.1151	0.4947	0.0113	0.4320	0.7840	0.3450	-0.1124	-0.2950	0.4174	0.1291
	(0.2123)	(0.1388)	(0.6099)	(0.0193)	(0.9600)	(0.0447)	(0.0000)	(0.1159)	(0.6185)	(0.1826)	(0.0532)	(0.5670)
Patents per emp. in S&T												
2010	-0.0544	0.0835	0.2818	0.1521	-0.0133	0.2045	0.5576	0.3614	-0.0873	-0.1507	0.5385	0.4357
	(0.3778)	(0.1753)	(0.0000)	(0.0134)	(0.8298)	(0.0008)	(0.0000)	(0.0000)	(0.1566)	(0.0141)	(0.0000)	(0.0000)
2011	-0.0855	0.0476	0.2606	0.1612	0.0403	0.2012	0.5141	0.2851	-0.0919	-0.1122	0.4726	0.4004
	(0.1653)	(0.4400)	(0.0000)	(0.0087)	(0.5133)	(0.0010)	(0.0000)	(0.0000)	(0.1357)	(0.0683)	(0.0000)	(0.0000)
2012	-0.0478	0.0793	0.2316	0.1549	0.0755	0.2316	0.5523	0.2985	-0.0736	-0.0886	0.4850	0.3690
	(0.4380)	(0.1982)	(0.0001)	(0.0117)	(0.2205)	(0.0001)	(0.0000)	(0.0000)	(0.2328)	(0.1502)	(0.0000)	(0.0000)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Sale of new to market and new to firm innov.												
2010	-0.2049 (0.0075)	-0.1454 (0.0592)	-0.0923 (0.2326)	0.1834 (0.0174)	0.1376 (0.0743)	0.2873 (0.0002)	0.1595 (0.0384)	0.0657 (0.3959)	0.0789 (0.3079)	0.0647 (0.4035)	0.0161 (0.8351)	0.0174 (0.8228)
SMEs market organization innov												
2010	-0.0678 (0.3813)	-0.0441 (0.5692)	-0.0349 (0.6526)	0.3116 (0.0000)	0.2291 (0.0027)	0.2863 (0.0002)	0.2958 (0.0001)	0.3703 (0.0000)	0.0980 (0.2050)	0.1671 (0.0299)	0.3074 (0.0000)	0.0918 (0.2353)
SMEs product or process innov												
2010	-0.0976 (0.2070)	-0.0569 (0.4621)	0.0260 (0.7368)	0.3124 (0.0000)	0.2480 (0.0012)	0.3017 (0.0001)	0.4046 (0.0000)	0.3565 (0.0000)	0.0539 (0.4861)	0.1432 (0.0632)	0.3416 (0.0000)	0.1209 (0.1173)
At risk of pov-erty rate												
2010	0.2232 (0.0003)	0.1214 (0.0483)	-0.2911 (0.0000)	-0.1475 (0.0164)	-0.1193 (0.0524)	-0.0391 (0.5257)	-0.4036 (0.0000)	-0.1767 (0.0039)	0.1649 (0.0071)	-0.0412 (0.5045)	-0.3780 (0.0000)	-0.3504 (0.0000)
2011	0.1710 (0.0053)	0.0873 (0.1565)	-0.2650 (0.0000)	-0.1657 (0.0070)	-0.1055 (0.0864)	-0.0868 (0.1590)	-0.4467 (0.0000)	-0.1745 (0.0044)	0.1335 (0.0298)	-0.0180 (0.7712)	-0.3780 (0.0000)	-0.3362 (0.0000)
2012	0.1891 (0.0020)	0.1121 (0.0683)	-0.2677 (0.0000)	-0.1626 (0.0081)	-0.0828 (0.1787)	-0.0855 (0.1651)	-0.4597 (0.0000)	-0.1608 (0.0088)	0.1468 (0.0168)	-0.0101 (0.8698)	-0.3819 (0.0000)	-0.3272 (0.0000)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Long term unemploy-ment												
2010	0.0023	-0.0386	-0.0595	-0.0298	-0.1447	-0.2198	-0.3938	-0.0678	-0.0805	0.0478	-0.1614	-0.1188
	(0.9708)	(0.5312)	(0.3343)	(0.6296)	(0.0185)	(0.0003)	(0.0000)	(0.2717)	(0.1912)	(0.4388)	(0.0085)	(0.0535)
2011	0.0434	-0.0222	-0.1504	-0.0882	-0.1097	-0.2395	-0.4845	-0.1184	-0.0438	0.0908	-0.2695	-0.2335
	(0.4820)	(0.7188)	(0.0143)	(0.1531)	(0.0747)	(0.0001)	(0.0000)	(0.0542)	(0.4778)	(0.1405)	(0.0000)	(0.0001)
2012	0.0717	-0.0129	-0.2117	-0.1123	-0.0658	-0.2295	-0.5293	-0.1405	0.0199	0.1397	-0.3339	-0.3060
	(0.2446)	(0.8350)	(0.0005)	(0.0685)	(0.2860)	(0.0002)	(0.0000)	(0.0221)	(0.7475)	(0.0229)	(0.0000)	(0.0000)
Youth unem-ployment												
2010	0.0768	-0.0125	-0.1727	-0.0844	-0.0920	-0.1790	-0.5097	-0.3016	0.0648	0.0903	-0.4091	-0.2809
	(0.2130)	(0.8399)	(0.0048)	(0.1716)	(0.1351)	(0.0035)	(0.0000)	(0.0000)	(0.2930)	(0.1426)	(0.0000)	(0.0000)
2011	0.1028	-0.0035	-0.2200	-0.1281	-0.0811	-0.2014	-0.5612	-0.2956	0.0553	0.1128	-0.4417	-0.3376
	(0.0948)	(0.9542)	(0.0003)	(0.0376)	(0.1880)	(0.0010)	(0.0000)	(0.0000)	(0.3702)	(0.0667)	(0.0000)	(0.0000)
2012	0.0946	-0.0164	-0.2204	-0.1204	-0.0754	-0.2009	-0.5567	-0.2776	0.0560	0.1497	-0.4232	-0.3350
	(0.1244)	(0.7900)	(0.0003)	(0.0506)	(0.2215)	(0.0010)	(0.0000)	(0.0000)	(0.3637)	(0.0147)	(0.0000)	(0.0000)
Unemploy-ment rate												
2010	0.0695	0.0075	-0.1101	-0.0683	-0.1254	-0.1811	-0.3917	-0.1955	0.0141	0.0522	-0.2480	-0.1998
	(0.2595)	(0.9031)	(0.0736)	(0.2690)	(0.0413)	(0.0031)	(0.0000)	(0.0014)	(0.8187)	(0.3978)	(0.0000)	(0.0011)
2011	0.0967	0.0025	-0.1908	-0.1018	-0.1055	-0.1931	-0.4705	-0.2280	0.0483	0.1150	-0.3296	-0.2939
	(0.1165)	(0.9673)	(0.0018)	(0.0989)	(0.0864)	(0.0016)	(0.0000)	(0.0002)	(0.4339)	(0.0615)	(0.0000)	(0.0000)
2012	0.0952	-0.0109	-0.2185	-0.1086	-0.0867	-0.1976	-0.5004	-0.2277	0.0626	0.1620	-0.3538	-0.3233
	(0.1223)	(0.8592)	(0.0003)	(0.0780)	(0.1593)	(0.0012)	(0.0000)	(0.0002)	(0.3100)	(0.0082)	(0.0000)	(0.0000)

	Employ-ment share	Payroll share	Adv Pack LQ	Bioph LQ	Blue Growth LQ	Creative LQ	Digital LQ	Environ-mental LQ	Experi-ence LQ	Logis-tical LQ	Medical Devices LQ	Mobility Tech LQ
Life satisfac-tion rate												
2010	-0.0035 (0.9644)	0.0254 (0.7458)	0.0208 (0.7911)	0.0499 (0.5243)	0.2503 (0.0012)	0.3614 (0.0000)	0.3915 (0.0000)	0.0751 (0.3379)	0.0652 (0.4054)	0.1395 (0.0739)	-0.0178 (0.8206)	0.0568 (0.4687)
2012	0.0679 (0.3789)	0.1185 (0.1236)	-0.0253 (0.7429)	0.0736 (0.3419)	0.2355 (0.0020)	0.3901 (0.0000)	0.4046 (0.0000)	0.0609 (0.4299)	0.1946 (0.0110)	0.1040 (0.1773)	-0.0404 (0.6007)	0.0104 (0.8929)
Heavy environmental land use												
2010[1]	0.1603 (0.0159)	0.1873 (0.0047)	-0.2064 (0.0018)	0.2661 (0.0001)	0.1216 (0.0680)	0.4173 (0.0000)	0.3679 (0.0000)	0.0282 (0.6727)	0.0578 (0.3869)	0.1641 (0.0135)	-0.0012 (0.9855)	-0.1077 (0.1065)

Note: (1) The indicator for the share of land use with heavy environmental impact was only available for 2009. It has been assumed that the indicator remains unchanged in 2010.

For further information, please consult the European Cluster Observatory Website:

http://ec.europa.eu/enterprise/initiatives/cluster/observatory/

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