

European Cluster Observatory

REPORT

# Methodology and Findings Report for a Cluster Mapping of Related Sectors

Prepared by:

Christian Ketels and Sergiy Protsiv

Center for Strategy and Competitiveness

Stockholm School of Economics

October 2014

## 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**

Europe is looking for new sources of growth. Among the places to look, there is a growing interest in situations where industries, technologies, and value chains link up in new ways. Understanding where and how these new linkages emerge is critical for effective policy support to this process. Clusters as regional concentrations of economic activities in related industries provide a natural starting point for tracking these cross-industry linkages.

To capture these linkages, the analysis of clusters must thus go beyond a narrow sectoral focus. The statistical cluster categories used as the definitional building blocks of cluster mapping reflect those linkages that over time have proven to be strong enough to shape the economic geography across regions as we see it today. The ambition of the present analysis of the European Cluster Observatory is to build upon the previous analysis and on the latest available cluster categories and then move beyond them to take a look into the future by capturing weaker signals about emerging new linkages across industries and clusters. The first new cluster mapping picture that emerges from this analysis has formed the basis of the European Cluster Panorama presented at the European Cluster Conference in October 2014.

A two-stage process is followed for this purpose. First, the latest advances in defining cluster categories based on the methodological development in the US Cluster Mapping Project<sup>1</sup> are incorporated. The new set of cluster categories relies on a combination of several novel datasets and rigorous analysis, which are briefly described in the following chapter, as well as the process of adapting the new codes to European industry classification. These updated European cluster definitions are the foundation for the core cluster mapping data set of the European Cluster Observatory, capturing the clusters currently present across Europe. The detailed methodological process of arriving at the updated cluster definitions is described in Chapter 2.

Second, ten industries have been selected that each group a set of sectors for which the data suggests the presence of different types of linkages. At the core of these industries are cluster categories that capture those linkages that are already so strong that they are visible in many regions. Then, further industries and clusters are added to create broader sectors with somewhat weaker but still measurable linkages to each other. The emerging industries capture subsets of the economy in which the emergence and growth of new cross-industry linkages seems most likely; these new combinations of industries are expected to occur in specific niches of a sector and not cover their entire space. The detailed methodological process of arriving at the ten emerging industries is described in Chapter 3.

The remainder of this paper is organized as follows: A short initial section defines key concepts of the European Cluster Observatory methodological framework. Chapters 2 and 3 then describe the core steps taken in the updating of the clusters definitions (Chapter 2) and the generation and selection of then ten industries (Chapter 3). The conclusion section provides a brief discussion of how the cluster and industry definitions will be used in the further activities of this project. The appendices provide details on the relation between the old and the updated cluster definitions and on the industry composition of the updated clusters and emerging industries.

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<sup>1</sup> [www.clustermapping.us](http://www.clustermapping.us)

## **1. Core Concepts**

A cluster is a regional concentration of economic activities in related industries, connected through multiple types of linkages. It includes companies of different types, including suppliers, service providers, and producers of final products and services, as well as other innovation actors, such as research and educational institutions, specialised government agencies, financial actors and many other organisations that provide relevant services or in different ways connect the different elements of the clusters. Clusters are a reflection of cross-industry linkages (sometimes also referred to as 'related diversification'), not just of economies of scales through narrow specialisation.

Cluster definitions group narrow industries into cluster categories to systematically track and measure the presence of clusters across locations in a comparable way. Cluster mapping is the process of generating such definitions and applying them to a specific economy. The result of cluster mapping is a data set of cluster-specific indicators like employment, establishments, and wages across locations.

## 2. Updating the Definition of Cluster Categories

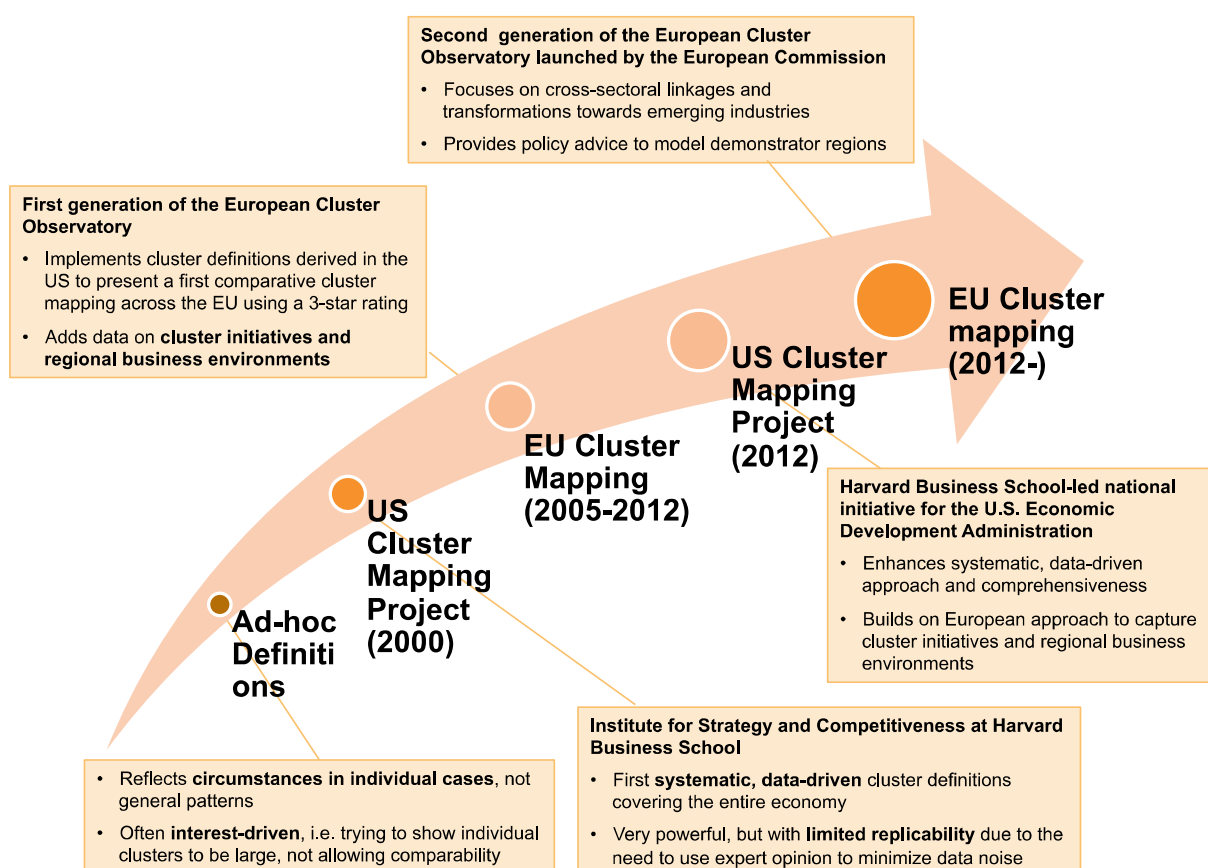
Cluster mapping is a key ingredient of assessing clusters as it provides rich fact-based analysis of local competitiveness. It is generally based on statistical data for several key indicators and combines regional and sectoral dimensions.

### 2.1 The Evolution of Cluster Mapping

The first cluster mapping exercise was conducted by Michael Porter and his team in the United States in 2000 (Figure 1). The mapping consisted of two fundamental parts:

- the development of industry groupings which best identify and measure industrial agglomerations within regions;
- the development of performance indicators which can measure the competitiveness and dynamism of clusters.

Figure 1: The evolution of the cluster mapping methodology



For the first task, calculations were made to identify co-location patterns of industries across the U.S. Such industry agglomerations reflect “revealed” patterns of externalities (i.e. spill-overs). If two or more industries tend to co-locate, it indicates that these industries have common interests or linkages, such as the sharing of labour skills, technological co-operation and the like. A set of 41 so-called traded cluster codes was defined, accounting for roughly one third of the total U.S. employment.

In 2003-2005, the U.S. model was brought to Europe by the Center for Strategy and Competitiveness at Stockholm School of Economics. The first European cluster mapping exercises were done for Sweden, the new EU-10 members, and finally for all of Europe in 2007 as part of the first phase of the European Cluster Observatory. This phase of cluster mapping made one of the most significant contributions by translating the cluster codes from the US SIC classification of economic activities to the NACE classification employed in Europe, overcoming many incompatibilities.

The latest cluster definitions, made available in early 2014, have been the result of research done by a team from Harvard Business School, Massachusetts Institute of Technology, and Temple University in the United States (Delgado et al., 2014). The point of departure for their work were the cluster definitions originally developed in the US (Porter, 2003) and then later translated into the European classification system as part of the first phase of the European Cluster Observatory.

## 2.2 The New Cluster Category Definitions

The new definitions benefit from a number of improvements that were not available when the old definitions were created:

- **New methodology** to generate the cluster definitions: The new approach combines data on several indicators of linkages, including co-location, skill use, and input-output relationships. This broadens the perspective to capture a wider range of the linkages discussed in the academic literature. The new approach also reduces the number of expert choices by combining a few core choices (like the overall number of cluster categories) with a data-driven algorithm. This significantly increases the transparency and replicability of the definitions.
- **New industrial classification** system in the US: The US government has implemented a new version of the North American Industrial Classification System (NAICS) in its reporting of core economic data in the county business pattern dataset, the core source of information for the cluster mapping. This new version provides more granularity on industries that have been growing in economic importance in recent years and decades, including industries related to IT and different aspects of services.
- **New data:** There is now almost a decade more data available for the analysis. This increases the robustness of measures and provides a better representation of the current linkages across industries rather than those reflected in economic geography patterns a decade ago.

The new generation of the European Cluster Observatory first looked into emerging industries with its “Emerging Industries” report in 2012, which looked at industrial transformations based on cross-sectoral financial investments and data from Merger & Acquisitions. The updated cluster mapping presented in the 2014 European Cluster Panorama by the European Cluster Observatory incorporates the revised U.S. cluster category. The consideration of these new cluster category definitions applied by the U.S. cluster mapping project<sup>2</sup> allows for benchmarking through comparable cluster datasets.

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<sup>2</sup> [www.clustermapping.us](http://www.clustermapping.us)

The U.S. based cluster category definitions continue to be based on the economic geography patterns in the US, just like the definitions currently used in Europe. There are a number of reasons why these definitions are useful also in the European context:

First, the US provides more granular data across all of its regions than what is available at the moment in Europe. An application of the same methodology in Europe would thus lack the same level of precision that can be achieved in the US; the resulting cluster definitions would suffer from this lower quality of data.

Second, the US has been a fully integrated economy for much longer than the European Union; arguably the US economy still is much more integrated than the EU economy. This implies that the patterns of economic geography in the US are more strongly driven by the productivity effect of local externalities than in Europe (where market access is likely to still be a more powerful driver). US-based definitions thus will provide a more unbiased view of how cluster categories 'should' look like to generate the strongest productivity impact, a motivation that is as relevant in Europe as in the US.

However, the US-based cluster definitions work only well in those areas where the US economy has a significant position. Given the size of the US economy, this is true in most but not all areas of economic activity. Already in the 2003 version of definitions adjustments were made in areas like pulp & paper and ship building, where Europe has a rich set of economic activities in the US, and in motor homes, where the opposite is true. The European Cluster Observatory suggests continuing making such targeted adjustments to better reflect the European economic landscape in the cluster definitions. This will be a particularly reviewed prior to the 2016 update of the European Cluster Panorama.

The new cluster definitions propose 51 traded cluster categories while treating the rest of the economy as local. Traded clusters capture those industries that are serving markets beyond their own location and that are fully exposed to competition from other locations. Traded clusters concentrate across regions; their high wages and high levels of innovative activity make them the key engines of regional economies. Local clusters combine those industries that operate only locally, and that are present in similar density across all regions; their high employment numbers make them an important channel for creating shared prosperity in regions.

In the traded cluster categories, the new definitions propose to include natural-resource driven industries. These industries were previously separated, because they have to locate where the necessary natural conditions are present. Other traded industries can locate anywhere they find it most beneficial.

Apart from this change, the new definitions apply the new methodology, new industry classifications, and new data as discussed above. This leads to some older cluster categories to be split, some to be merged, and some individual industries to be re-allocated. Overall, about 80 % of all employment stays in the comparable cluster category after moving from the old to the new definitions. The remainder tends to be in industries that have relatively similar linkages to several cluster categories, and where the new information available has led to a different choice than in 2003 (compare Appendix A).



## **2.3 Comparing the Old and the New Definitions**

The definitions prepared as part of the first phase of the European Cluster Observatory project comprised 38 traded cluster categories covering 302 4-digit NACE 2.0 industries out of 615. The new definitions include several categories that were previously considered 'natural resource driven' or 'local' and thus cover 406 industries. The total share of employment in traded industries is close to 40% consistent with earlier classifications and the situation in US.

There are 51 cluster categories in the new definitions. These are rather compatible with the previous ones: about 70 % of industries and 80 % of employment are part of equivalent clusters in the two definitions. The primary reason for the discrepancy is that some industries in strongly related categories (such as Apparel versus Textile and Distribution versus Logistics) were reclassified based on new data and more recent patterns.

There are two main sources of the increase in the number of cluster categories. One is that some of the clusters previously considered 'natural resource based' are now treated as traded, which resulted in new categories such as Forestry, Coal Mining, Metal Mining, as well as Non-metal Mining replacing Stone Quarries. The other reason is that some industries previously treated as one were split into constituent parts to reflect diverging patterns within them: Chemicals and Metal Manufacturing were both split into upstream and downstream clusters, while Entertainment became separate Music, Movies, and Performing Arts clusters.

### **3. Defining Industries of Related Sectors**

Cluster categories capture by design the strongest existing linkages among industries, however much economic dynamism is perceived to occur at the intersection of sectors. But the nature of these linkages is continuously shifting, driven by new technologies, value chains, and business models. Effective economic development needs to respond to these trends as it aims to move a location into more advanced activities. Some of these activities will be in cluster categories that are new to a region, but not to the economy at large. Others will reflect genuinely new cluster categories, emerging from growing or entirely new linkages across previously less related industries and the appearance of entirely new industries.

One of the main objectives of the European Cluster Observatory is to identify ten cross-sectoral thematically defined groups of industries in which the growth of dynamic cross-industry linkages is most likely. A data-driven process is used to define these industries, and then profile their economic performance and geographical footprint. This chapter describes in detail the underlying methodological choices we have made for this process, the implementation of this process to generate a long-list of industries, and evaluation of this long-list to arrive at the ten industries viewed as having the highest potential of creating new cross-industry groupings that can drive growth.

#### **3.1 Overall Approach for Defining the Industries**

There are different ways to try capturing the emergence and growth of new cross-industry linkages. The European Cluster Observatory has chosen to use an approach that is data-driven, focuses on patterns that are meaningful from a European perspective, and results in the identification of broader industries in which more narrow niches with high dynamism seem most likely to emerge. The key alternative would be a more case-driven approach that captures interesting developments in a few individual regions, and identifies the narrow mix of industries that has created dynamic outcomes in those specific cases.

This more top-down approach was chosen because the data it generates are seen as better suited to support policy makers across Europe in capturing broader trends and then guiding individual locations to find the hotspots of potential dynamism most relevant for them. While specific examples of such hotspots in other locations are always intriguing, it is hard to draw more than general motivation from them. They are by their very nature context-specific and there is no evidence that would allow another region to assess whether it is feasible or even profitable to try and follow such an example.

There is also no robust way that would allow policy makers at the European level to generate more aggregate indicators of the relevance and broader economic role of these cases across Europe. The European Cluster Observatory approach does generate such European data, and is robust and firmly grounded in cross-regional data. But it is also true that it only sets out broad categories in which dynamism is most likely, it does not identify the specific niches that actually will emerge. Chapter 3.2 discusses how other work of the European Cluster Observatory will drill down deeper into these niches.

This broader choice on the conceptual approach has a number of operational implications that are important to note:

- First, the industries need to be defined by economic activity codes to be able to describe them through standard economic data.
- Second, the industries need to be systematically related to the 'traditional' cluster categories. These cluster categories already capture the strongest existing cross-industry linkages and spill-overs as revealed by different empirical measures. The connection to the cluster categories is also valuable to keep consistent relationship with the reporting on clusters by the European Cluster Observatory so far. The industries can move beyond the cluster categories by capturing weaker signals, emerging new trends, and the fact that industries have relations to many cluster categories.
- Third, the data used to define these industries should indicate that the linkages among its narrower industries are meaningful across a broader set of regions, not just in one place. The alternative discussed above is to look for any industries that might be connected in some way in some region; this approach is going to generate a lot of 'false positives' in a cross-regional perspective, i.e. it doesn't distinguish between the (potentially many) regions where these industries exist but have no linkage from the few where they do.

## 3.2 Generating Industries

The first step in the process is to generate a long-list of broader categories that move beyond these traditional definitions. This step is almost entirely data-driven, though we did eliminate several obvious cases of spurious correlation between industries<sup>3</sup>. We use three complimentary methods to capture the emerging linkages among industries, all of them with 'traditional' cluster categories at the core:

- Merge existing cluster categories
- Add individual industries to existing cluster categories
- Match cluster categories with the emerging industries proposed by the earlier analysis of the European Cluster Observatory that was supported by the European Forum for Clusters in Emerging Industries<sup>4</sup>

These methods lead to partially overlapping results; i.e. an individual industry might be part of a number of different broad categories within an individual method as well as across the three different methods applied.

### a. Related Clusters

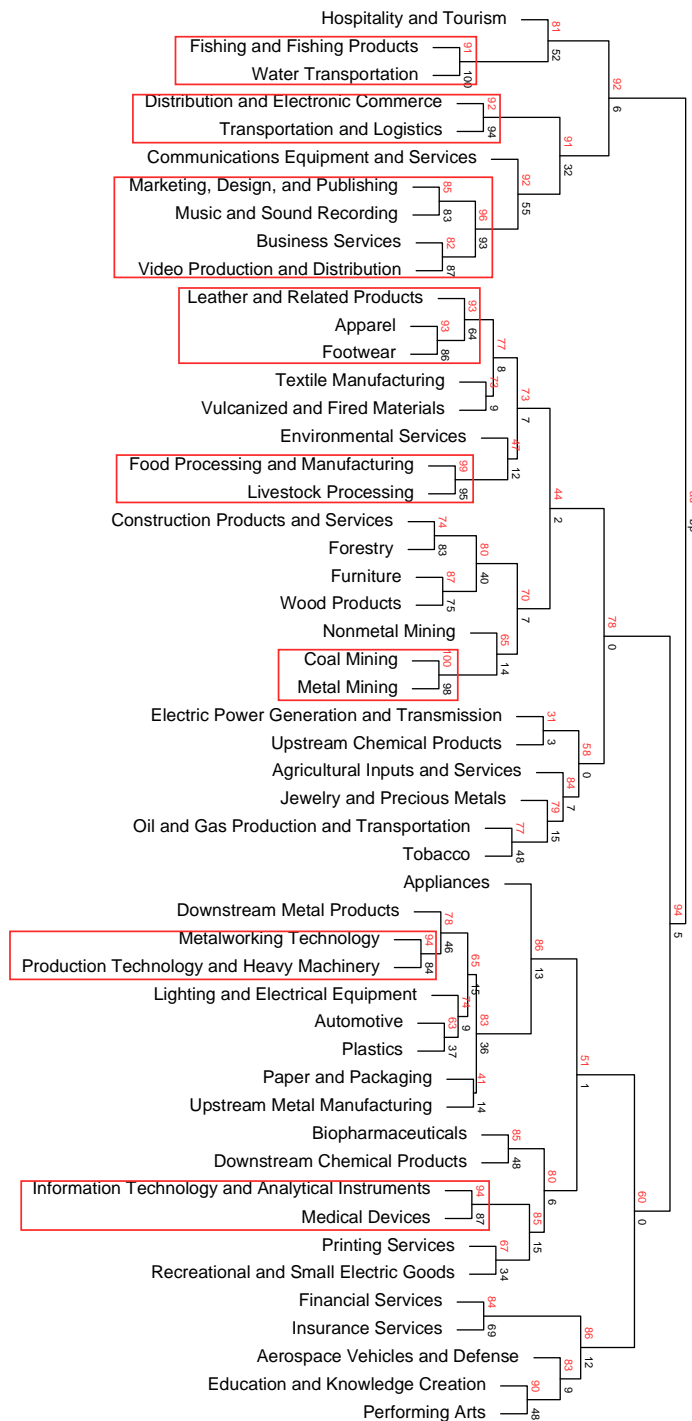
By design, current linkages between industries are stronger within cluster categories than across cluster categories. But there is still evidence on weaker and potentially emerging linkages that do cut across the boundaries of current cluster categories.

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<sup>3</sup> The spurious connections were usually due to extremely small sizes of certain industries, such as Space Travel.

<sup>4</sup> For more information, see [www.emergingindustries.eu](http://www.emergingindustries.eu)

Figure 2: Cluster relatedness tree



The first approach explores emerging linkages between entire cluster categories. It identifies situations where cluster categories are so strongly related that merging them into a combined category is reasonable for tracking emerging cross-industry linkages.

**Data source:** The European Cluster Observatory dataset on employment on the cluster level in NUTS 2 regions in EU+EEA.

**Method:** The share of each cluster category in each European region's economy has been computed to measure the structure of the regional economy. This data is then used to create the locational correlation matrix between each pair of clusters measuring the similarity of their distribution across regions (cluster category pairs found in the same regions more often get a higher co-location score). The corresponding matrix is then used as an input to the statistical analysis that suggests the most coherent groupings of cluster categories and provides an indicator of the significance of this grouping. Figure 2 presents the hierarchical tree of cluster category relatedness that this statistical procedure generates: the closer the merger of cluster categories is to the bottom of the diagram, the more related they are in terms of co-location. The approximate significance of each grouping is displayed in red next to each branch<sup>5</sup>.

**Result:** There were eight groups of merged cluster categories that showed the most consistent relationships, identified by red rectangles in the figure. Seven of these eight groups included two traditional cluster categories; one includes four traditional cluster categories. There is no overlap across these merged cluster categories.

## b. Clusters plus Related Industries

The second approach takes a similar approach as the previous one, but differs in two important respects. First, it looks at the linkages between cluster categories have to individual industries outside of their scope (rather than to entire cluster categories). And second, it draws on data that covers a broader set of more granular linkages. This approach leads to 'clouds' of related industries around existing cluster categories, creating broader new categories.

**Source:** The European co-location data on both the cluster and industry level as well as Swedish data on skills at the industry and cluster level and co-occurrence of industries at the company level.

**Method:** This is a composite method that captures three different dimensions of industry relatedness. First, account is taken for co-location by computing (as in the previous step) the locational similarity between each cluster category and each industry not belonging to it. Second, the similarity of skills used is analysed in different industries by comparing the distribution of the occupations of the employees. Finally, we explore the within-company co-occurrence to reveal the relatedness of the industries by analysing which industries are commonly found in multi-plant firms (with the argument that these combinations of industries have proven to be sustainable as the firms have survived).

Based on each of the three measures, a 'cloud' around each of the 'traditional' cluster categories is constructed that contains the most related industries according to either measure.<sup>6</sup> Most of the industries are only related by one measure, but there are 12 % of connections based on two indicators and a further 1 % (8 industries) that are related on all three. Note that for the latter two indicators (where we use Swedish data) results are only shown in sectors where Sweden has at least a proportional representation of jobs compared to the European average.<sup>7</sup>

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<sup>5</sup> The values represent the approximately unbiased significance of each grouping based on 10 000 simulations. E.g. the value of 95 can be interpreted as the probability of 95% that the grouping is not based on a random fluctuation in the data, but rather represents an actual relationship. The criteria for coherence are: approximate significance > 90 and preferring small clusters to large ones.

<sup>6</sup> The definitions for 'the most related' are top 5 % similarity by co-location and skills, and top-10 % by co-occurrence (due to data availability).

<sup>7</sup> More specifically, Sweden needs to have either both a specialisation with a location quotient (LQ)>1 and >1 000 employees, or >5 000 employees for data in a cluster category to be considered reliable.

**Result:** This approach leads to 50 ‘clouds’ or cluster categories plus related industries, one for each of the existing cluster categories (aside from Tobacco, which was not related to any category). The new, broader categories are by design overlapping – each newly added related industry is also already part of an existing cluster category. And they are overlapping with the merged cluster categories generated through the prior approach for those industries and clusters captured in the eight merged clusters.

### c. Previous Emerging Industries Categories

The European Cluster Observatory has developed in a previous analysis by PwC a number of candidates for clusters in emerging industries.<sup>8</sup> This process led to a selection of seven groups or categories of industries that meet the criteria for emerging industries set out in the project. These groups are created from a bottom-up perspective; i.e. they cover all industries that in some location appear to be connected with the underlying group.

Table 1: Core cluster categories per previously identified emerging industries industry

Emerging Industries Category	Core Cluster Category
<b>Creative</b>	Communications Equipment and Services Marketing, Design, and Publishing Music and Sound Recording Performing Arts Printing Services Video Production and Distribution
<b>Eco</b>	Electric Power Generation and Transmission Environmental Services
<b>Experience</b>	Hospitality and Tourism Performing Arts
<b>Maritime</b>	Electric Power Generation and Transmission Fishing and Fishing Products Water Transportation
<b>Mobile Services</b>	Communications Equipment and Services Plastics
<b>Mobility</b>	Aerospace Vehicles and Defence Automotive Communications Equipment and Services Electric Power Generation and Transmission Information Technology and Analytical Instruments Transportation and Logistics
<b>Personalized Medicine</b>	Biopharmaceuticals Insurance Services Medical Devices

They are, however, not necessarily connected in a systematic way across all regions, which would have been picked up in the cluster methodologies discussed above. These emerging industries categories previously identified thus tend to be broader but represent significantly weaker linkages than the existing cluster categories. These approaches are aligned by pairing each of these previous emerging industries categories with the core cluster categories they are the closest match to, but also keep all other industries suggested in the previous emerging industries definitions that fall outside those core cluster categories.

<sup>8</sup> See “Emerging Industries: Report on the methodology for their classification and on the most active, significant and relevant new emerging industrial sectors”, July 2012. Available at [www.emergingindustries.eu](http://www.emergingindustries.eu).

**Source:** The set of definitions for seven emerging industry groups proposed by the previous work of the European Cluster Observatory by PwC informed by data on: firm capital raising, sector investment, firm patenting intensity, and sector growth potential.

**Method:** The first step of this analysis is to match the definitions compiled by the earlier analysis of the European Cluster Observatory with the cluster categories. For each cluster category we compute the share of employment per cluster category that has accounted for by the industries in each of the previous emerging industries categories. If a category includes industries with more than 80 % of all employment in a cluster category, this cluster category is considered to be a 'core category' (see Table 1) for the respective emerging industries category.

The definitions for the new sectors are then constructed by taking the combination of the core categories for each of the previous emerging industries and complimenting it with the remaining codes from that industry.

**Result:** This approach leads to seven categories of groups of cluster categories plus related industries, one for each of the seven identified emerging industries categories. These new, broader categories related to the earlier analysis are partially overlapping both with the merged cluster categories and the cluster clouds generated through the prior approaches.

### 3.3 Selecting ten Emerging Industries

The methods above generate a list of 65 broad, mutually overlapping categories. In the selection of the most relevant emerging industries we have looked mainly at employment growth, overall size, and within-sector heterogeneity. The breadth of linkages and the perceived market potential are also considered.

Employment growth between 2005 and 2011 has been used as a key indicator of 'emergence' or economic dynamism. Both overall employment growth across the entire category and the share of employees in industries that have reached more than 1 % employment growth<sup>9</sup> are considered. The latter was added to pick-up potential 'islands' of high growth within larger categories. Employment growth is considered here as the best available indicator for 'emergence'. Within the core set of available data, an alternative would have been to look at changes in the different measures of linkages across clusters and industries that are applied. However, the European Cluster Observatory data set does not allow to identify such trends in any statistically robust way. Beyond the used core set of the data, there are, however, other additional indicators that can be looked at.

Size is a relevant indicator of overall relevance to the European economy. But size can go hand-in-hand with large within-group heterogeneity and spurious linkages inside the respective group of industries. This analysis has aimed to balance these two factors, generally opting for larger categories as long as there was sufficient support from the data that they had meaningful internal linkages. More concretely, the previously identified emerging industries-based groups were used that tend to have weaker internal linkages only when the alternatives were much smaller and did not capture a growing part of the broad group.

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<sup>9</sup> Growth was computed on a subset of countries not including Cyprus, Estonia, Greece, Poland, Spain, and United Kingdom, due to data availability.

**Table 2: Ten selected emerging industries**

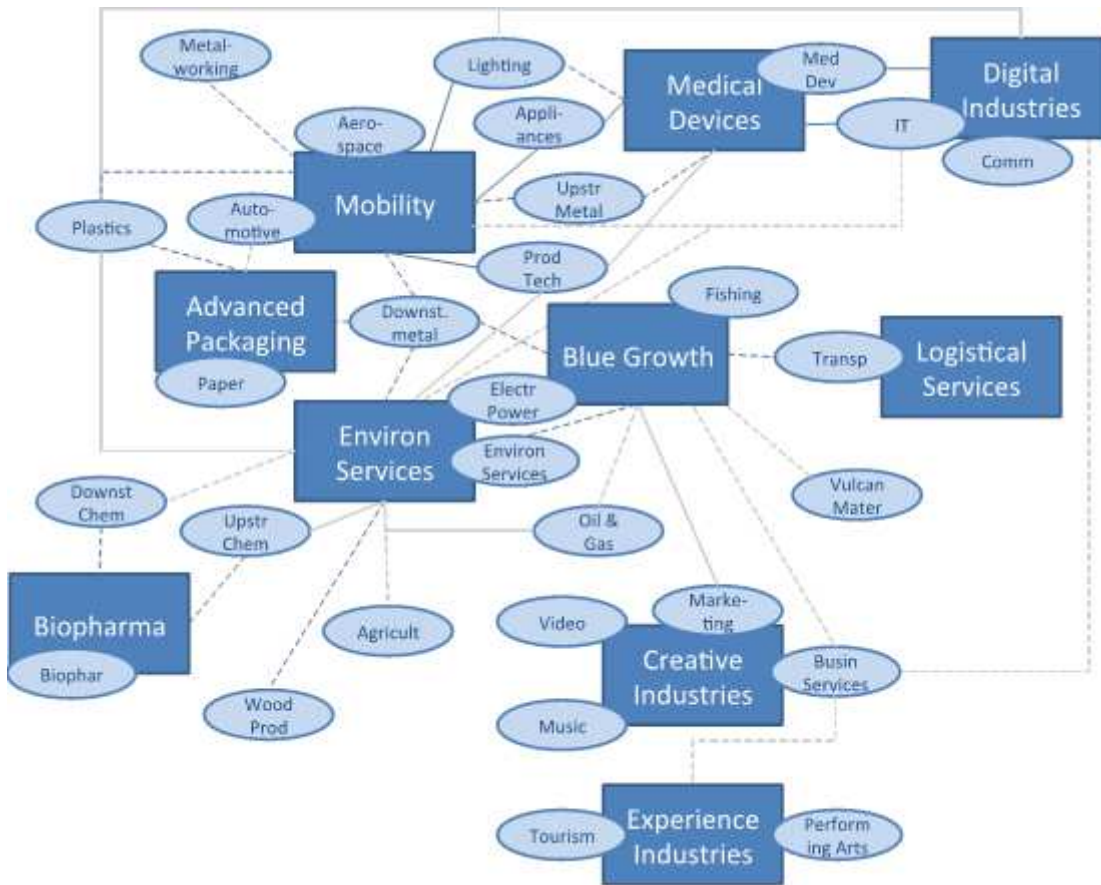
<b>Industry</b>	<b>Employment 2012</b>	<b>Annual Growth 2007-12</b>	<b>Average Wage 2012</b>
Advanced Packaging	4 353 336	0.08%	26 302
Biopharmaceuticals	2 507 906	-0.08%	41 003
Blue Growth Industries	11 825 652	0.31%	27 098
Creative Industries	12 175 055	1.61%	31 789
Digital Industries	8 775 778	1.07%	36 532
Environmental Industries	8 597 431	-0.05%	31 803
Experience Industries	10 043 510	0.50%	26 045
Logistical Services	6 344 855	0.42%	22 390
Medical Devices	4 373 575	0.16%	33 606
Mobility Technologies	10 658 541	-0.59%	30 907
<b>Total Emerging Industries*</b>	<b>45 685 106</b>	<b>0.27%</b>	<b>29 654</b>
<b>Total Traded Clusters</b>	<b>68 758 784</b>	<b>-0.21%</b>	<b>27 101</b>
<b>Total All Industries</b>	<b>172 887 399</b>	<b>0.22%</b>	<b>22 671</b>

\* Total Emerging Industries are computed as the sum of all narrow industries belonging to at least one emerging industry to avoid double counting industries that are part of several sectors.

The long-list of industries includes by design many overlaps; Appendix B presents the core categories across these groups. This analysis used this overlap matrix to first identify which grouping from the set of related alternatives seemed to best fit the criteria above. The highest performing ones were then selected from the remaining list.



Figure 3: Linkages between Clusters and Emerging Industries



**Legend**

Box: Emerging industry

Oval: Cluster category

Overlap cluster – industry = cluster is 100% part of industry

Blue line = 100% > overlap >80%

Blue dotted line = 80% > overlap > 50%

Grey line = 50% > overlap > 30%

Grey dotted line = 30% > overlap > 20%

The distances on the graph are approximate

As a result, the European Cluster Observatory identified ten categories as primary choice. Table 2 above lists them with some key statistics and the core clusters around which they are anchored. The list includes a range of activities:

- *Creative Industries and Logistical Services* are all key service sectors in modern economy. They have significant size and rank among the absolute leaders in terms of job creation over the past few years.
- *Digital Technologies* resulting from a merger of IT Hardware and Communications plus are key parts of the ICT economy. They have solid size and high growth compared to many other parts of the economy.
- *Biopharmaceuticals and Medical Devices* are both part of the Life Sciences industry. Their growth has been subdued but the global market potential is perceived as high; they are also connected to large and growing employment in local health care services.
- *Advanced Packaging* is perceived as an increasingly important input to many other activities, from food processing to automotive supply chains, and has meaningful size. But with its low growth dynamics it is probably the most marginal among the ten top categories.
- *Mobility Technologies* are a core part of the manufacturing industry. They have suffered during the recent crisis, but are large area of traditional European strength and a clear focus for Europe’s strategy to re-industrialize.

- *Blue Growth Industries, Environmental Industries, and Experience Industries* are three large groups based on emerging industries proposed by the previous analysis. They have relatively limited growth but represent areas in which interesting new ‘islands’ of activity might emerge.

**Table 3: Relationships between cluster categories and emerging industries**

	Advanced Packaging	Biopharmaceuticals	Blue Growth Industries	Creative Industries	Digital Industries	Environmental Industries	Experience Industries	Logistical Services	Medical Devices	Mobility Technologies
Aerospace										100%
Agricultural						24%				
Appliances									80%	80%
Automotive	39%								5%	100%
Biopharmaceuticals		100%								
Business Services			21%	100%	25%	17%	26%	4%	1%	
Communications					100%			3%		
Construction	9%		5%			7%				3%
Distribution	1%	7%	12%		19%	3%	16%		7%	9%
Downstream Chemical		64%				23%				
Downstream Metal	53%		53%			53%			7%	53%
Education		19%	17%			19%				
Electric Power			100%			100%				
Environmental Services			61%			100%				
Fishing			100%							
Food Processing		2%								
Furniture	18%									
Hospitality and Tourism			7%				100%			
Information Technology					100%	29%	11%		81%	26%
Lighting and Electrical					42%				59%	82%
Marketing			33%	100%	20%		6%			
Medical Devices					87%				100%	
Metalworking	19%				19%				10%	57%
Music				100%						
Oil and Gas			27%			42%				
Paper and Packaging	100%	10%				10%				
Performing Arts							100%			
Plastics	70%				37%	47%				57%
Production Technology	12%		16%		25%	32%			38%	85%
Recreational Goods										8%
Transportation			73%			19%	14%	100%		
Upstream Chemical		77%				47%				
Upstream Metal						33%				53%
Video				100%						
Vulcanized Materials			24%			1%			6%	
Water Transportation			97%			20%	24%			
Wood Products						22%				

The numbers specify the share of each cluster category’s employment involved in a given industry.

One way to better illustrate the relationships among the emerging industries is to explore the composition of each in terms of core cluster categories. Table 3 displays the shares of each cluster category's employment in each of the emerging industries. One can see that some emerging industries are quite focused and cover a few distinct clusters (e.g. Creative Industries and Logistical Services), while others are more cross-cutting (such as Blue Growth and Environmental Industries).

When it comes to inter-relatedness of the industries, rather than merely their composition, Figure 3 provides a detailed map of the overlap between emerging industries and cluster categories based on the same numbers as Table 3. The closer the two industries are to each other, the more they overlap and rely on the same underlying technologies. The ten newly identified emerging industries are rather distinct and cover much of the economy's sectoral scope.

One can see that Mobility Technologies, Advanced Packaging, Environmental Industries, and Blue Growth Industries are inter-related and all include substantial parts of Production Technology and Downstream Metal Products clusters. Other cluster categories, such as Information Technology and Business Services, are present in most emerging industries. Similarly Environmental Industries is the emerging industry with the broadest coverage: it includes parts of more than half of all cluster categories suggesting that nearly every industry has an environment-related component.

## **4. Conclusion**

The methodology outlined in this report defines ten emerging industries that meet our criteria in terms of process (e.g., data-driven, transparency) and content (e.g., likelihood of cross-industry linkages, economic dynamism, relevance across Europe). They generate the starting point for further work to identify and track developments in these broad industries of related sectors and the specific niches where new linkages are reaching critical mass. Within the context of the current project, the European Cluster Observatory will use the industries in a number of ways.

First, the European Cluster Panorama will track the performance and geographical footprint of those industries that given their size and growth indicate the highest potential for Europe. The report will focus on tracking Europe's performance in these industries over time and exhibiting the regions with high potential to be the new hotspots. Exactly where it will happen and which industries will be involved remains to be seen, but the ten emerging industries will help policy makers to look for them where they are most likely to occur.

Second, the ten emerging industries are input for the foundation for the analysis of cross-sectoral clustering trends that are leading to the identification of three cross-sectoral collaboration spaces that cut across sectors and value chains. The European Cluster Observatory will complement the existing analysis with data on knowledge, financial and entrepreneurial spill-overs that can cut through traditional industry boundaries and highlight the areas of potential industrial collaboration.

Finally, as the identified emerging industries are affected by the global mega trends and are undergoing rapid transformation processes, they have the strongest needs for internationalisation. The European Cluster Observatory will identify cluster organisations representing the emerging industries among those that participated in a cluster benchmarking by the European Secretariat for Cluster Analysis (ESCA, [www.cluster-analysis.org](http://www.cluster-analysis.org)). An in-depth analysis of their internationalisation patterns will be followed by expert interview of the organisations that received the ESCA label GOLD (Proven for Cluster Management Excellence). The resulting internationalisation patterns together with cross-sectoral collaboration spaces will form the core of the European Cluster Trends report presented in 2015.

## Appendix A: New Cluster Definitions

Cluster	NACE	Industry Name	
Aerospace Vehicles and Defence	30.30	Manufacture of air and spacecraft and related machinery	
Agricultural Inputs and Services	01.61	Support activities for crop production	
	01.62	Support activities for animal production	
	01.63	Post-harvest crop activities	
	01.64	Seed processing for propagation	
	20.15	Manufacture of fertilisers and nitrogen compounds	
Apparel	14.11	Manufacture of leather clothes	
	14.12	Manufacture of workwear	
	14.13	Manufacture of other outerwear	
	14.14	Manufacture of underwear	
	14.19	Manufacture of other wearing apparel and accessories	
	14.20	Manufacture of articles of fur	
	27.51	Manufacture of electric domestic appliances	
Appliances	27.52	Manufacture of non-electric domestic appliances	
Automotive	24.53	Casting of light metals	
	24.54	Casting of other non-ferrous metals	
	28.13	Manufacture of other pumps and compressors	
	29.10	Manufacture of motor vehicles	
	29.20	Manufacture of bodies (coachwork) for motor vehicles manufacture of trailers and semi-trailers	
	29.31	Manufacture of electrical and electronic equipment for motor vehicles	
	29.32	Manufacture of other parts and accessories for motor vehicles	
	30.40	Manufacture of military fighting vehicles	
	Biopharmaceuticals	21.10	Manufacture of basic pharmaceutical products
		21.20	Manufacture of pharmaceutical preparations
Business Services	49.32	Taxi operation	
	62.01	Computer programming activities	
	62.02	Computer consultancy activities	
	62.03	Computer facilities management activities	
	62.09	Other information technology and computer service activities	
	63.11	Data processing, hosting and related activities	
	64.20	Activities of holding companies	
	70.10	Activities of head offices	
	70.22	Business and other management consultancy activities	
	71.11	Architectural activities	
	71.12	Engineering activities and related technical consultancy	
	71.20	Technical testing and analysis	
	74.30	Translation and interpretation activities	

Cluster	NACE	Industry Name
	74.90	Other professional, scientific and technical activities n.e.c.
	77.12	Renting and leasing of trucks
	77.40	Leasing of intellectual property and similar products, except copyrighted works
	78.10	Activities of employment placement agencies
	78.30	Other human resources provision
	81.10	Combined facilities support activities
	82.20	Activities of call centres
	82.30	Organisation of conventions and trade shows
Coal Mining	05.10	Mining of hard coal
	05.20	Mining of lignite
	09.90	Support activities for other mining and quarrying
Communications Equipment and Services	26.30	Manufacture of communication equipment
	61.20	Wireless telecommunications activities
	61.30	Satellite telecommunications activities
	61.90	Other telecommunications activities
Construction Products and Services	23.14	Manufacture of glass fibres
	23.51	Manufacture of cement
	23.52	Manufacture of lime and plaster
	23.61	Manufacture of concrete products for construction purposes
	23.62	Manufacture of plaster products for construction purposes
	23.64	Manufacture of mortars
	23.65	Manufacture of fibre cement
	23.70	Cutting, shaping and finishing of stone
	23.99	Manufacture of other non-metallic mineral products n.e.c.
	24.20	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel
	25.30	Manufacture of steam generators, except central heating hot water boilers
	35.30	Steam and air conditioning supply
	42.12	Construction of railways and underground railways
	42.22	Construction of utility projects for electricity and telecommunications
	42.91	Construction of water projects
Distribution and Electronic Commerce	46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods
	46.12	Agents involved in the sale of fuels, ores, metals and industrial chemicals
	46.13	Agents involved in the sale of timber and building materials
	46.14	Agents involved in the sale of machinery, industrial equipment, ships and aircraft
	46.15	Agents involved in the sale of furniture, household goods, hardware and ironmongery
	46.16	Agents involved in the sale of textiles, clothing, fur, footwear and leather goods
	46.17	Agents involved in the sale of food, beverages and tobacco

Cluster	NACE	Industry Name
		co
	46.18	Agents specialised in the sale of other particular products
	46.19	Agents involved in the sale of a variety of goods
	46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds
	46.22	Wholesale of flowers and plants
	46.23	Wholesale of live animals
	46.24	Wholesale of hides, skins and leather
	46.31	Wholesale of fruit and vegetables
	46.32	Wholesale of meat and meat products
	46.34	Wholesale of beverages
	46.35	Wholesale of tobacco products
	46.38	Wholesale of other food, including fish, crustaceans and molluscs
	46.41	Wholesale of textiles
	46.42	Wholesale of clothing and footwear
	46.43	Wholesale of electrical household appliances
	46.44	Wholesale of china and glassware and cleaning materials
	46.45	Wholesale of perfume and cosmetics
	46.46	Wholesale of pharmaceutical goods
	46.47	Wholesale of furniture, carpets and lighting equipment
	46.48	Wholesale of watches and jewellery
	46.49	Wholesale of other household goods
	46.51	Wholesale of computers, computer peripheral equipment and software
	46.52	Wholesale of electronic and telecommunications equipment and parts
	46.61	Wholesale of agricultural machinery, equipment and supplies
	46.62	Wholesale of machine tools
	46.63	Wholesale of mining, construction and civil engineering machinery
	46.64	Wholesale of machinery for the textile industry and of sewing and knitting machines
	46.65	Wholesale of office furniture
	46.66	Wholesale of other office machinery and equipment
	46.69	Wholesale of other machinery and equipment
	46.71	Wholesale of solid, liquid and gaseous fuels and related products
	46.72	Wholesale of metals and metal ores
	46.76	Wholesale of other intermediate products
	47.91	Retail sale via mail order houses or via Internet
	52.10	Warehousing and storage
	77.31	Renting and leasing of agricultural machinery and equipment
	77.32	Renting and leasing of construction and civil engineering machinery and equipment
	77.33	Renting and leasing of office machinery and equipment (including computers)

Cluster	NACE	Industry Name
	77.34	Renting and leasing of water transport equipment
	77.35	Renting and leasing of air transport equipment
	77.39	Renting and leasing of other machinery, equipment and tangible goods n.e.c.
	82.92	Packaging activities
Downstream Chemical Products	20.12	Manufacture of dyes and pigments
	20.30	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
	20.41	Manufacture of soap and detergents, cleaning and polishing preparations
	20.42	Manufacture of perfumes and toilet preparations
	20.51	Manufacture of explosives
	20.52	Manufacture of glues
	20.53	Manufacture of essential oils
	20.59	Manufacture of other chemical products n.e.c.
Downstream Metal Products	25.29	Manufacture of other tanks, reservoirs and containers of metal
	25.40	Manufacture of weapons and ammunition
	25.71	Manufacture of cutlery
	25.72	Manufacture of locks and hinges
	25.91	Manufacture of steel drums and similar containers
	25.92	Manufacture of light metal packaging
	25.99	Manufacture of other fabricated metal products n.e.c.
Education and Knowledge Creation	72.11	Research and experimental development on biotechnology
	72.19	Other research and experimental development on natural sciences and engineering
	72.20	Research and experimental development on social sciences and humanities
	85.41	Post-secondary non-tertiary education
	85.42	Tertiary education
	85.52	Cultural education
	85.59	Other education n.e.c.
	85.60	Educational support activities
	94.12	Activities of professional membership organisations
Electric Power Generation and Transmission	35.11	Production of electricity
	35.12	Transmission of electricity
Environmental Services	36.00	Water collection, treatment and supply
	38.12	Collection of hazardous waste
	38.22	Treatment and disposal of hazardous waste
	38.32	Recovery of sorted materials
Financial Services	64.11	Central banking
	64.30	Trusts, funds and similar financial entities
	64.91	Financial leasing
	64.92	Other credit granting
	64.99	Other financial service activities, except insurance and pension funding n.e.c.
	66.11	Administration of financial markets
	66.12	Security and commodity contracts brokerage



<b>Cluster</b>	<b>NACE</b>	<b>Industry Name</b>
	66.19	Other activities auxiliary to financial services, except insurance and pension funding
	66.30	Fund management activities
Fishing and Fishing Products	03.11	Marine fishing
	03.12	Freshwater fishing
	10.20	Processing and preserving of fish, crustaceans and molluscs
Food Processing and Manufacturing	10.31	Processing and preserving of potatoes
	10.32	Manufacture of fruit and vegetable juice
	10.39	Other processing and preserving of fruit and vegetables
	10.41	Manufacture of oils and fats
	10.42	Manufacture of margarine and similar edible fats
	10.51	Operation of dairies and cheese making
	10.52	Manufacture of ice cream
	10.61	Manufacture of grain mill products
	10.62	Manufacture of starches and starch products
	10.72	Manufacture of rusks and biscuits manufacture of preserved pastry goods and cakes
	10.73	Manufacture of macaroni, noodles, couscous and similar farinaceous products
	10.81	Manufacture of sugar
	10.82	Manufacture of cocoa, chocolate and sugar confectionery
	10.83	Processing of tea and coffee
	10.84	Manufacture of condiments and seasonings
	10.85	Manufacture of prepared meals and dishes
	10.86	Manufacture of homogenised food preparations and dietetic food
	10.89	Manufacture of other food products n.e.c.
	10.91	Manufacture of prepared feeds for farm animals
	10.92	Manufacture of prepared pet foods
	11.01	Distilling, rectifying and blending of spirits
	11.02	Manufacture of wine from grape
	11.03	Manufacture of cider and other fruit wines
	11.04	Manufacture of other non-distilled fermented beverages
	11.05	Manufacture of beer
	11.06	Manufacture of malt
	11.07	Manufacture of soft drinks production of mineral waters and other bottled waters
Footwear	15.11	Tanning and dressing of leather dressing and dyeing of fur
	15.20	Manufacture of footwear
Forestry	02.10	Silviculture and other forestry activities
	02.20	Logging
	02.30	Gathering of wild growing non-wood products
	02.40	Support services to forestry
Furniture	31.01	Manufacture of office and shop furniture

Cluster	NACE	Industry Name
	31.02	Manufacture of kitchen furniture
	31.03	Manufacture of mattresses
	31.09	Manufacture of other furniture
Hospitality and Tourism	01.70	Hunting, trapping and related service activities
	55.10	Hotels and similar accommodation
	55.20	Holiday and other short-stay accommodation
	55.30	Camping grounds, recreational vehicle parks and trailer parks
	55.90	Other accommodation
	77.21	Renting and leasing of recreational and sports goods
	79.11	Travel agency activities
	79.12	Tour operator activities
	79.90	Other reservation service and related activities
	91.02	Museums activities
	91.03	Operation of historical sites and buildings and similar visitor attractions
	91.04	Botanical and zoological gardens and nature reserves activities
	92.00	Gambling and betting activities
	93.11	Operation of sports facilities
	93.12	Activities of sport clubs
	93.19	Other sports activities
	93.21	Activities of amusement parks and theme parks
	93.29	Other amusement and recreation activities
Information Technology and Analytical Instruments	26.11	Manufacture of electronic components
	26.12	Manufacture of loaded electronic boards
	26.20	Manufacture of computers and peripheral equipment
	26.40	Manufacture of consumer electronics
	26.51	Manufacture of instruments and appliances for measuring, testing and navigation
	26.52	Manufacture of watches and clocks
	26.70	Manufacture of optical instruments and photographic equipment
	26.80	Manufacture of magnetic and optical media
	58.21	Publishing of computer games
	58.29	Other software publishing
Insurance Services	65.11	Life insurance
	65.12	Non-life insurance
	65.20	Reinsurance
	66.21	Risk and damage evaluation
	66.29	Other activities auxiliary to insurance and pension funding
Jewellery and Precious Metals	32.11	Striking of coins
	32.12	Manufacture of jewellery and related articles
	32.13	Manufacture of imitation jewellery and related articles
Leather and Related Products	15.12	Manufacture of luggage, handbags and the like, saddlery

Cluster	NACE	Industry Name
		and harness
Lighting and Electrical Equipment	27.11	Manufacture of electric motors, generators and transformers
	27.12	Manufacture of electricity distribution and control apparatus
	27.20	Manufacture of batteries and accumulators
	27.31	Manufacture of fibre optic cables
	27.32	Manufacture of other electronic and electric wires and cables
	27.33	Manufacture of wiring devices
	27.40	Manufacture of electric lighting equipment
	27.90	Manufacture of other electrical equipment
Livestock Processing	10.11	Processing and preserving of meat
	10.12	Processing and preserving of poultry meat
	10.13	Production of meat and poultry meat products
Marketing, Design, and Publishing	58.11	Book publishing
	58.12	Publishing of directories and mailing lists
	58.14	Publishing of journals and periodicals
	58.19	Other publishing activities
	63.12	Web portals
	63.91	News agency activities
	63.99	Other information service activities n.e.c.
	70.21	Public relations and communication activities
	73.11	Advertising agencies
	73.12	Media representation
	73.20	Market research and public opinion polling
	74.10	Specialised design activities
	91.01	Library and archives activities
Medical Devices	26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment
	32.50	Manufacture of medical and dental instruments and supplies
Metal Mining	07.10	Mining of iron ores
	07.21	Mining of uranium and thorium ores
	07.29	Mining of other non-ferrous metal ores
Metalworking Technology	23.91	Production of abrasive products
	25.11	Manufacture of metal structures and parts of structures
	25.12	Manufacture of doors and windows of metal
	25.61	Treatment and coating of metals
	25.62	Machining
	25.73	Manufacture of tools
	25.94	Manufacture of fasteners and screw machine products
	28.41	Manufacture of metal forming machinery
28.91	Manufacture of machinery for metallurgy	
Music and Sound Recording	59.20	Sound recording and music publishing activities
Non-metal Mining	08.11	Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate

Cluster	NACE	Industry Name
Oil and Gas Production and Transportation	08.12	Operation of gravel and sand pits mining of clays and kaolin
	08.91	Mining of chemical and fertiliser minerals
	08.92	Extraction of peat
	08.93	Extraction of salt
	08.99	Other mining and quarrying n.e.c.
	06.10	Extraction of crude petroleum
	06.20	Extraction of natural gas
	09.10	Support activities for petroleum and natural gas extraction
	19.10	Manufacture of coke oven products
	19.20	Manufacture of refined petroleum products
Paper and Packaging	49.50	Transport via pipeline
	17.11	Manufacture of pulp
	17.12	Manufacture of paper and paperboard
	17.21	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
	17.22	Manufacture of household and sanitary goods and of toilet requisites
	17.23	Manufacture of paper stationery
	17.24	Manufacture of wallpaper
Performing Arts	17.29	Manufacture of other articles of paper and paperboard
	90.01	Performing arts
	90.02	Support activities to performing arts
	90.03	Artistic creation
Plastics	90.04	Operation of arts facilities
	20.16	Manufacture of plastics in primary forms
	22.21	Manufacture of plastic plates, sheets, tubes and profiles
	22.22	Manufacture of plastic packing goods
	22.23	Manufacture of builders' ware of plastic
	22.29	Manufacture of other plastic products
Printing Services	28.96	Manufacture of plastics and rubber machinery
	18.11	Printing of newspapers
	18.12	Other printing
	18.13	Pre-press and pre-media services
Production Technology and Heavy Machinery	18.14	Binding and related services
	25.21	Manufacture of central heating radiators and boilers
	28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
	28.12	Manufacture of fluid power equipment
	28.14	Manufacture of other taps and valves
	28.15	Manufacture of bearings, gears, gearing and driving elements
	28.21	Manufacture of ovens, furnaces and furnace burners
	28.22	Manufacture of lifting and handling equipment
	28.24	Manufacture of power-driven hand tools
28.25	Manufacture of non-domestic cooling and ventilation equipment	

Cluster	NACE	Industry Name
	28.29	Manufacture of other general-purpose machinery n.e.c.
	28.30	Manufacture of agricultural and forestry machinery
	28.49	Manufacture of other machine tools
	28.92	Manufacture of machinery for mining, quarrying and construction
	28.93	Manufacture of machinery for food, beverage and tobacco processing
	28.94	Manufacture of machinery for textile, apparel and leather production
	28.95	Manufacture of machinery for paper and paperboard production
	28.99	Manufacture of other special-purpose machinery n.e.c.
	30.20	Manufacture of railway locomotives and rolling stock
	30.99	Manufacture of other transport equipment n.e.c.
Recreational and Small Electric Goods	28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)
	30.91	Manufacture of motorcycles
	30.92	Manufacture of bicycles and invalid carriages
	32.20	Manufacture of musical instruments
	32.30	Manufacture of sports goods
	32.40	Manufacture of games and toys
	32.91	Manufacture of brooms and brushes
	32.99	Other manufacturing n.e.c.
Textile Manufacturing	13.10	Preparation and spinning of textile fibres
	13.20	Weaving of textiles
	13.30	Finishing of textiles
	13.91	Manufacture of knitted and crocheted fabrics
	13.92	Manufacture of made-up textile articles, except apparel
	13.93	Manufacture of carpets and rugs
	13.94	Manufacture of cordage, rope, twine and netting
	13.95	Manufacture of non-wovens and articles made from non-wovens, except apparel
	13.96	Manufacture of other technical and industrial textiles
	13.99	Manufacture of other textiles n.e.c.
	14.31	Manufacture of knitted and crocheted hosiery
	14.39	Manufacture of other knitted and crocheted apparel
	20.60	Manufacture of man-made fibres
Tobacco	12.00	Manufacture of tobacco products
Transportation and Logistics	33.16	Repair and maintenance of aircraft and spacecraft
	49.39	Other passenger land transport n.e.c.
	49.41	Freight transport by road
	51.10	Passenger air transport
	51.21	Freight air transport
	51.22	Space transport
	52.21	Service activities incidental to land transportation
	52.23	Service activities incidental to air transportation
	52.24	Cargo handling

Cluster	NACE	Industry Name
Upstream Chemical Products	52.29	Other transportation support activities
	20.11	Manufacture of industrial gases
	20.13	Manufacture of other inorganic basic chemicals
	20.14	Manufacture of other organic basic chemicals
	20.17	Manufacture of synthetic rubber in primary forms
Upstream Metal Manufacturing	20.20	Manufacture of pesticides and other agrochemical products
	24.10	Manufacture of basic iron and steel and of ferro-alloys
	24.31	Cold drawing of bars
	24.32	Cold rolling of narrow strip
	24.33	Cold forming or folding
	24.34	Cold drawing of wire
	24.41	Precious metals production
	24.42	Aluminium production
	24.43	Lead, zinc and tin production
	24.44	Copper production
	24.45	Other non-ferrous metal production
	24.46	Processing of nuclear fuel
	24.51	Casting of iron
	24.52	Casting of steel
	25.50	Forging, pressing, stamping and roll-forming of metal powder metallurgy
Video Production and Distribution	25.93	Manufacture of wire products, chain and springs
	18.20	Reproduction of recorded media
	59.11	Motion picture, video and television programme production activities
	59.12	Motion picture, video and television programme post-production activities
	59.13	Motion picture, video and television programme distribution activities
Vulcanized and Fired Materials	22.11	Manufacture of rubber tyres and tubes retreading and rebuilding of rubber tyres
	22.19	Manufacture of other rubber products
	23.11	Manufacture of flat glass
	23.12	Shaping and processing of flat glass
	23.13	Manufacture of hollow glass
	23.19	Manufacture and processing of other glass, including technical glassware
	23.20	Manufacture of refractory products
	23.31	Manufacture of ceramic tiles and flags
	23.32	Manufacture of bricks, tiles and construction products, in baked clay
	23.41	Manufacture of ceramic household and ornamental articles
	23.43	Manufacture of ceramic insulators and insulating fittings
Water Transportation	23.44	Manufacture of other technical ceramic products
	23.49	Manufacture of other ceramic products
	30.11	Building of ships and floating structures
	30.12	Building of pleasure and sporting boats

<b>Cluster</b>	<b>NACE</b>	<b>Industry Name</b>
	33.15	Repair and maintenance of ships and boats
	38.31	Dismantling of wrecks
	50.10	Sea and coastal passenger water transport
	50.20	Sea and coastal freight water transport
	50.30	Inland passenger water transport
	50.40	Inland freight water transport
	52.22	Service activities incidental to water transportation
Wood Products	16.10	Sawmilling and planing of wood
	16.21	Manufacture of veneer sheets and wood-based panels
	16.22	Manufacture of assembled parquet floors
	16.23	Manufacture of other builders' carpentry and joinery
	16.24	Manufacture of wooden containers
	16.29	Manufacture of other products of wood manufacture of articles of cork, straw and plaiting materials

## Appendix B: Broad Categories and Their Core Cluster Categories

ID	Broad Category	Core Cluster Categories
M1	Coal + Metal	Coal Mining; Metal Mining
M2	Fishing + Water Transportation	Fishing and Fishing Products; Water Transportation
M3	Distribution + Transportation	Distribution and Electronic Commerce; Transportation and Logistics
M4	Business Services + Marketing + Music + Video	Business Services; Marketing, Design, and Publishing; Music and Sound Recording; Video Production and Distribution
M5	Apparel + Leather + Footwear	Apparel; Footwear; Leather and Related Products
M6	Food + Livestock Processing	Food Processing and Manufacturing; Livestock Processing
M7	Production Technology + Metalworking	Metalworking Technology; Production Technology and Heavy Machinery
M8	IT + Medical Devices	Information Technology and Analytical Instruments; Medical Devices
C01	Aerospace Vehicles and Defence cloud	Aerospace Vehicles and Defence
C02	Agricultural Inputs and Services cloud	Agricultural Inputs and Services
C03	Apparel cloud	Apparel; Footwear
C04	Automotive cloud	Aerospace Vehicles and Defence; Automotive
C05	Biopharmaceuticals cloud	Biopharmaceuticals
C06	Business Services cloud	Business Services; Music and Sound Recording
C07	Coal Mining cloud	Coal Mining
C08	Communications Equipment and Services cloud	Communications Equipment and Services
C09	Construction Products and Services cloud	Construction Products and Services
C10	Distribution and Electronic Commerce cloud	Distribution and Electronic Commerce; Tobacco
C11	Downstream Chemical Products cloud	Biopharmaceuticals; Downstream Chemical Products
C12	Downstream Metal Products cloud	Downstream Metal Products
C13	Education and Knowledge Creation cloud	Education and Knowledge Creation
C14	Electric Power Generation and Transmission cloud	Electric Power Generation and Transmission
C15	Environmental Services cloud	Environmental Services
C16	Financial Services cloud	Financial Services
C17	Fishing and Fishing Products cloud	Fishing and Fishing Products
C18	Food Processing and Manufacturing cloud	Food Processing and Manufacturing
C19	Footwear cloud	Footwear; Leather and Related Products
C20	Forestry cloud	Footwear; Forestry
C21	Furniture cloud	Footwear; Furniture
C22	Hospitality and Tourism cloud	Hospitality and Tourism
C23	Information Technology and Analytical Instruments cloud	Information Technology and Analytical Instruments
C24	Insurance Services cloud	Insurance Services



<b>ID</b>	<b>Broad Category</b>	<b>Core Cluster Categories</b>
C25	Jewellery and Precious Metals cloud	Jewellery and Precious Metals
C26	Leather and Related Products cloud	Footwear; Leather and Related Products
C27	Lighting and Electrical Equipment cloud	Lighting and Electrical Equipment
C28	Livestock Processing cloud	Livestock Processing
C29	Marketing, Design, and Publishing cloud	Marketing, Design, and Publishing; Music and Sound Recording
C30	Medical Devices cloud	Medical Devices
C31	Metal Mining cloud	Metal Mining
C32	Metalworking Technology cloud	Metalworking Technology
C33	Music and Sound Recording cloud	Music and Sound Recording; Performing Arts
C34	Non-metal Mining cloud	Non-metal Mining
C35	Oil and Gas Production and Transportation cloud	Oil and Gas Production and Transportation
C36	Paper and Packaging cloud	Paper and Packaging
C37	Performing Arts cloud	Music and Sound Recording; Performing Arts
C38	Plastics cloud	Plastics
C39	Printing Services cloud	Music and Sound Recording; Printing Services
C40	Production Technology and Heavy Machinery cloud	Production Technology and Heavy Machinery
C41	Recreational and Small Electric Goods cloud	Recreational and Small Electric Goods
C42	Textile Manufacturing cloud	Footwear; Textile Manufacturing
C44	Appliances cloud	Appliances
C45	Transportation and Logistics cloud	Transportation and Logistics
C46	Upstream Chemical Products cloud	Biopharmaceuticals; Upstream Chemical Products
C47	Upstream Metal Manufacturing cloud	Aerospace Vehicles and Defence; Upstream Metal Manufacturing
C48	Video Production and Distribution cloud	Music and Sound Recording; Video Production and Distribution
C49	Vulcanized and Fired Materials cloud	Vulcanized and Fired Materials
C50	Water Transportation cloud	Water Transportation
C51	Wood Products cloud	Wood Products
P1	Emerging Creative	Communications Equipment and Services; Marketing, Design, and Publishing; Music and Sound Recording; Performing Arts; Printing Services; Video Production and Distribution
P2	Emerging Eco	Electric Power Generation and Transmission; Environmental Services
P3	Emerging Experience	Hospitality and Tourism; Performing Arts
P4	Emerging Maritime	Electric Power Generation and Transmission; Fishing and Fishing Products; Water Transportation
P5	Emerging Mobile Services	Communications Equipment and Services; Plastics
P6	Emerging Mobility	Aerospace Vehicles and Defence; Automotive; Communications Equipment and Services; Electric Power Generation and Transmission; Information Technology and Analytical Instruments; Transportation and Logistics
P7	Emerging Personalized Medicine	Biopharmaceuticals; Insurance Services; Metal Mining

## Appendix C: Emerging Industries' Definitions

Emerging Industry	NACE	NACE Name
Advanced Packaging	17.11	Manufacture of pulp
	17.12	Manufacture of paper and paperboard
	17.21	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
	17.22	Manufacture of household and sanitary goods and of toilet requisites
	17.23	Manufacture of paper stationery
	17.24	Manufacture of wallpaper
	17.29	Manufacture of other articles of paper and paperboard
	22.21	Manufacture of plastic plates, sheets, tubes and profiles
	22.22	Manufacture of plastic packing goods
	22.29	Manufacture of other plastic products
	24.20	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel
	25.61	Treatment and coating of metals
	25.73	Manufacture of tools
	25.99	Manufacture of other fabricated metal products n.e.c.
	28.99	Manufacture of other special-purpose machinery n.e.c.
	29.32	Manufacture of other parts and accessories for motor vehicles
	31.01	Manufacture of office and shop furniture
	46.76	Wholesale of other intermediate products
Biopharmaceuticals	11.01	Distilling, rectifying and blending of spirits
	17.22	Manufacture of household and sanitary goods and of toilet requisites
	20.13	Manufacture of other inorganic basic chemicals
	20.14	Manufacture of other organic basic chemicals
	20.30	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
	20.41	Manufacture of soap and detergents, cleaning and polishing preparations
	20.59	Manufacture of other chemical products n.e.c.
	21.10	Manufacture of basic pharmaceutical products
	21.20	Manufacture of pharmaceutical preparations
	46.46	Wholesale of pharmaceutical goods
	72.11	Research and experimental development on biotechnology
72.19	Other research and experimental development on natural sciences and engineering	
Blue Growth Industries	03.11	Marine fishing
	03.12	Freshwater fishing
	09.10	Support activities for petroleum and natural gas extraction
	10.20	Processing and preserving of fish, crustaceans and molluscs
	22.19	Manufacture of other rubber products
	25.99	Manufacture of other fabricated metal products n.e.c.
	28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
	28.22	Manufacture of lifting and handling equipment

<b>Emerging Industry</b>	<b>NACE</b>	<b>NACE Name</b>
	30.11	Building of ships and floating structures
	30.12	Building of pleasure and sporting boats
	33.15	Repair and maintenance of ships and boats
	35.11	Production of electricity
	35.12	Transmission of electricity
	36.00	Water collection, treatment and supply
	42.91	Construction of water projects
	46.14	Agents involved in the sale of machinery, industrial equipment, ships and aircraft
	49.41	Freight transport by road
	50.10	Sea and coastal passenger water transport
	50.20	Sea and coastal freight water transport
	50.30	Inland passenger water transport
	50.40	Inland freight water transport
	52.10	Warehousing and storage
	52.22	Service activities incidental to water transportation
	52.23	Service activities incidental to air transportation
	52.24	Cargo handling
	52.29	Other transportation support activities
	71.12	Engineering activities and related technical consultancy
	71.20	Technical testing and analysis
	72.19	Other research and experimental development on natural sciences and engineering
	73.11	Advertising agencies
	77.32	Renting and leasing of construction and civil engineering machinery and equipment
	77.34	Renting and leasing of water transport equipment
	79.11	Travel agency activities
Creative Industries	18.20	Reproduction of recorded media
	49.32	Taxi operation
	58.11	Book publishing
	58.12	Publishing of directories and mailing lists
	58.14	Publishing of journals and periodicals
	58.19	Other publishing activities
	59.11	Motion picture, video and television programme production activities
	59.12	Motion picture, video and television programme post-production activities
	59.13	Motion picture, video and television programme distribution activities
	59.20	Sound recording and music publishing activities
	62.01	Computer programming activities
	62.02	Computer consultancy activities
	62.03	Computer facilities management activities
	62.09	Other information technology and computer service activities
	63.11	Data processing, hosting and related activities
	63.12	Web portals

<b>Emerging Industry</b>	<b>NACE</b>	<b>NACE Name</b>
	63.91	News agency activities
	63.99	Other information service activities n.e.c.
	64.20	Activities of holding companies
	70.10	Activities of head offices
	70.21	Public relations and communication activities
	70.22	Business and other management consultancy activities
	71.11	Architectural activities
	71.12	Engineering activities and related technical consultancy
	71.20	Technical testing and analysis
	73.11	Advertising agencies
	73.12	Media representation
	73.20	Market research and public opinion polling
	74.10	Specialised design activities
	74.30	Translation and interpretation activities
	74.90	Other professional, scientific and technical activities n.e.c.
	77.12	Renting and leasing of trucks
	77.40	Leasing of intellectual property and similar products, except copy-righted works
	78.10	Activities of employment placement agencies
	78.30	Other human resources provision
	81.10	Combined facilities support activities
	82.20	Activities of call centres
	82.30	Organisation of conventions and trade shows
	91.01	Library and archives activities
Digital Industries	22.29	Manufacture of other plastic products
	25.61	Treatment and coating of metals
	25.73	Manufacture of tools
	26.11	Manufacture of electronic components
	26.12	Manufacture of loaded electronic boards
	26.20	Manufacture of computers and peripheral equipment
	26.30	Manufacture of communication equipment
	26.40	Manufacture of consumer electronics
	26.51	Manufacture of instruments and appliances for measuring, testing and navigation
	26.52	Manufacture of watches and clocks
	26.70	Manufacture of optical instruments and photographic equipment
	26.80	Manufacture of magnetic and optical media
	27.12	Manufacture of electricity distribution and control apparatus
	27.90	Manufacture of other electrical equipment
	28.24	Manufacture of power-driven hand tools
	28.29	Manufacture of other general-purpose machinery n.e.c.
	28.99	Manufacture of other special-purpose machinery n.e.c.
	32.50	Manufacture of medical and dental instruments and supplies
	46.43	Wholesale of electrical household appliances
	46.51	Wholesale of computers, computer peripheral equipment and software
	46.52	Wholesale of electronic and telecommunications equipment and

Emerging Industry	NACE	NACE Name
		parts
	46.66	Wholesale of other office machinery and equipment
	46.69	Wholesale of other machinery and equipment
	58.11	Book publishing
	58.21	Publishing of computer games
	58.29	Other software publishing
	61.20	Wireless telecommunications activities
	61.30	Satellite telecommunications activities
	61.90	Other telecommunications activities
	62.01	Computer programming activities
	62.02	Computer consultancy activities
	62.09	Other information technology and computer service activities
	70.21	Public relations and communication activities
	73.20	Market research and public opinion polling
Environmental Industries	06.20	Extraction of natural gas
	09.10	Support activities for petroleum and natural gas extraction
	16.21	Manufacture of veneer sheets and wood-based panels
	16.29	Manufacture of other products of wood manufacture of articles of cork, straw and plaiting materials
	17.22	Manufacture of household and sanitary goods and of toilet requisites
	20.14	Manufacture of other organic basic chemicals
	20.15	Manufacture of fertilisers and nitrogen compounds
	20.16	Manufacture of plastics in primary forms
	20.59	Manufacture of other chemical products n.e.c.
	22.29	Manufacture of other plastic products
	23.49	Manufacture of other ceramic products
	23.51	Manufacture of cement
	24.10	Manufacture of basic iron and steel and of ferro-alloys
	25.21	Manufacture of central heating radiators and boilers
	25.30	Manufacture of steam generators, except central heating hot water boilers
	25.99	Manufacture of other fabricated metal products n.e.c.
	26.51	Manufacture of instruments and appliances for measuring, testing and navigation
	28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
	28.29	Manufacture of other general-purpose machinery n.e.c.
	28.99	Manufacture of other special-purpose machinery n.e.c.
	35.11	Production of electricity
	35.12	Transmission of electricity
	36.00	Water collection, treatment and supply
	38.12	Collection of hazardous waste
	38.22	Treatment and disposal of hazardous waste
	38.31	Dismantling of wrecks
	38.32	Recovery of sorted materials

<b>Emerging Industry</b>	<b>NACE</b>	<b>NACE Name</b>	
	46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	
	46.22	Wholesale of flowers and plants	
	49.50	Transport via pipeline	
	52.22	Service activities incidental to water transportation	
	52.29	Other transportation support activities	
	71.12	Engineering activities and related technical consultancy	
	72.11	Research and experimental development on biotechnology	
	72.19	Other research and experimental development on natural sciences and engineering	
	Experience Industries	01.70	Hunting, trapping and related service activities
		46.18	Agents specialised in the sale of other particular products
		46.42	Wholesale of clothing and footwear
		46.49	Wholesale of other household goods
		47.91	Retail sale via mail order houses or via Internet
		49.39	Other passenger land transport n.e.c.
		50.30	Inland passenger water transport
		50.40	Inland freight water transport
		52.22	Service activities incidental to water transportation
		52.23	Service activities incidental to air transportation
		55.10	Hotels and similar accommodation
55.20		Holiday and other short-stay accommodation	
55.30		Camping grounds, recreational vehicle parks and trailer parks	
55.90		Other accommodation	
58.29		Other software publishing	
62.01		Computer programming activities	
62.09		Other information technology and computer service activities	
63.12		Web portals	
70.21		Public relations and communication activities	
70.22		Business and other management consultancy activities	
77.21		Renting and leasing of recreational and sports goods	
79.11		Travel agency activities	
79.12		Tour operator activities	
79.90		Other reservation service and related activities	
82.30		Organisation of conventions and trade shows	
90.01		Performing arts	
90.02		Support activities to performing arts	
90.03		Artistic creation	
90.04		Operation of arts facilities	
91.02		Museums activities	
91.03		Operation of historical sites and buildings and similar visitor attractions	
91.04		Botanical and zoological gardens and nature reserves activities	
92.00		Gambling and betting activities	
93.11	Operation of sports facilities		
93.12	Activities of sport clubs		
93.19	Other sports activities		

<b>Emerging Industry</b>	<b>NACE</b>	<b>NACE Name</b>
	93.21	Activities of amusement parks and theme parks
	93.29	Other amusement and recreation activities
Logistical Services	33.16	Repair and maintenance of aircraft and spacecraft
	49.32	Taxi operation
	49.39	Other passenger land transport n.e.c.
	49.41	Freight transport by road
	51.10	Passenger air transport
	51.21	Freight air transport
	51.22	Space transport
	52.21	Service activities incidental to land transportation
	52.23	Service activities incidental to air transportation
	52.24	Cargo handling
	52.29	Other transportation support activities
	61.30	Satellite telecommunications activities
Medical Devices	23.32	Manufacture of bricks, tiles and construction products, in baked clay
	25.40	Manufacture of weapons and ammunition
	25.73	Manufacture of tools
	26.11	Manufacture of electronic components
	26.12	Manufacture of loaded electronic boards
	26.40	Manufacture of consumer electronics
	26.51	Manufacture of instruments and appliances for measuring, testing and navigation
	26.52	Manufacture of watches and clocks
	26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment
	26.70	Manufacture of optical instruments and photographic equipment
	27.12	Manufacture of electricity distribution and control apparatus
	27.31	Manufacture of fibre optic cables
	27.32	Manufacture of other electronic and electric wires and cables
	27.33	Manufacture of wiring devices
	27.51	Manufacture of electric domestic appliances
	27.90	Manufacture of other electrical equipment
	28.12	Manufacture of fluid power equipment
	28.13	Manufacture of other pumps and compressors
	28.25	Manufacture of non-domestic cooling and ventilation equipment
	28.29	Manufacture of other general-purpose machinery n.e.c.
	28.95	Manufacture of machinery for paper and paperboard production
	28.99	Manufacture of other special-purpose machinery n.e.c.
	32.50	Manufacture of medical and dental instruments and supplies
	46.46	Wholesale of pharmaceutical goods
	62.03	Computer facilities management activities
Mobility	22.21	Manufacture of plastic plates, sheets, tubes and profiles
Technologies	22.29	Manufacture of other plastic products
	24.10	Manufacture of basic iron and steel and of ferro-alloys

<b>Emerging Industry</b>	<b>NACE</b>	<b>NACE Name</b>
	24.53	Casting of light metals
	24.54	Casting of other non-ferrous metals
	25.30	Manufacture of steam generators, except central heating hot water boilers
	25.50	Forging, pressing, stamping and roll-forming of metal powder metallurgy
	25.61	Treatment and coating of metals
	25.62	Machining
	25.73	Manufacture of tools
	25.94	Manufacture of fasteners and screw machine products
	25.99	Manufacture of other fabricated metal products n.e.c.
	26.11	Manufacture of electronic components
	27.11	Manufacture of electric motors, generators and transformers
	27.12	Manufacture of electricity distribution and control apparatus
	27.32	Manufacture of other electronic and electric wires and cables
	27.33	Manufacture of wiring devices
	27.51	Manufacture of electric domestic appliances
	27.90	Manufacture of other electrical equipment
	28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
	28.12	Manufacture of fluid power equipment
	28.13	Manufacture of other pumps and compressors
	28.15	Manufacture of bearings, gears, gearing and driving elements
	28.22	Manufacture of lifting and handling equipment
	28.24	Manufacture of power-driven hand tools
	28.25	Manufacture of non-domestic cooling and ventilation equipment
	28.29	Manufacture of other general-purpose machinery n.e.c.
	28.30	Manufacture of agricultural and forestry machinery
	28.41	Manufacture of metal forming machinery
	28.49	Manufacture of other machine tools
	28.92	Manufacture of machinery for mining, quarrying and construction
	28.94	Manufacture of machinery for textile, apparel and leather production
	28.95	Manufacture of machinery for paper and paperboard production
	28.96	Manufacture of plastics and rubber machinery
	28.99	Manufacture of other special-purpose machinery n.e.c.
	29.10	Manufacture of motor vehicles
	29.20	Manufacture of bodies (coachwork) for motor vehicles manufacture of trailers and semi-trailers
	29.31	Manufacture of electrical and electronic equipment for motor vehicles
	29.32	Manufacture of other parts and accessories for motor vehicles
	30.20	Manufacture of railway locomotives and rolling stock
	30.30	Manufacture of air and spacecraft and related machinery
	30.40	Manufacture of military fighting vehicles
	30.92	Manufacture of bicycles and invalid carriages
	46.69	Wholesale of other machinery and equipment



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

**<http://ec.europa.eu/enterprise/initiatives/cluster/observatory/>**



*This work is part of a service contract for the Enterprise and Industry Directorate-General of the European Commission. It is financed under the Competitiveness and Innovation Framework programme (CIP) which aims to encourage the competitiveness of European enterprises. The views expressed in this document, as well as the information included in it, do not necessarily reflect the opinion or position of the European Commission.*