

European Cluster Observatory

SUMMARY REPORT

Cluster Internationalisation and Global Mega Trends

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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 Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) of the European Commission 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/growth/smes/cluster/observatory/>

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1. Introduction

1.1 Rationale

This report presents the first results of identified trends in cluster dynamics with particular attention to internationalisation and cross-sectoral linkages. It as well serves as an input for a foresight process regarding the future priorities of developments in emerging industries. The work is conducted within the framework of the European Cluster Observatory – an initiative of the Directorate-General GROWTH of the European Commission.

The focus of this part is - on the basis of the related methodology report¹ - on the identification and analysis of trends as to where and how clusters of selected industries are transforming themselves, and where new specialisation patterns give rise to the renewal or the emergence of new industries. This study shall aim at supporting policy-makers, cluster practitioners and companies to spot transformation trends at an early stage and facilitate further policy efforts in this regard. It can contribute to improve the implementation of regional smart specialisation strategies and will also help European regions identify collaboration areas where industrial trends cut across not only sectors, but geographical borders as well.

The report summarises cluster internationalisation and global mega trends, which are existing and widespread effective, and from which European SMEs can benefit, notably those engaged in clusters. Thus, the report will contribute to provide a global picture and to breakdown the global mega trends exemplarily into fields of competitive advantages and opportunities for Europe's SMEs. The report will show whether clusters act as springboards for SMEs to access global value chains and develop long-term strategic partnerships and if so, at what level of quality.

The report contains the results of the desk research and a survey² amongst European cluster organisations about their priority areas and markets for international cluster collaboration. The key points of this report are the following:

- What are the global mega trends, and how do they influence emerging industries in their industrial transformations?
- Are these influences non-reactive or are there retroactive effects?
- Is there a ranking of impact, and are there noticeable differences or similarities between the ten selected industries?
- Are there noticeable differences between industries, clusters and regions when it comes to international cooperation?
- Are there common patterns of successful strategies in cluster internationalisation, useable as a blue print for further activities?

The analysis focuses on the European Union Member States. Nevertheless, it also takes into account global trends in terms of industrial dynamics, cross-sectoral trends and cluster development in a more global environment, because internationalisation could not be considered only a European issue. It is also necessary to be able to feed the foresight task with a set of input data, as it shall provide a starting point and input for a foresight analysis by highlighting global industrial transformation trends, and those areas where clusters are seen to have the potential to play an important role across borders and across sectors. The report should be regarded as a working document and is designed to be up-dated if new data will be available.

¹ *European Cluster Trends - Methodological Report, European Commission, Brussels, 2014*

² *Assessment of data in the context of benchmarking activities of cluster organisations by the European Secretariat for Cluster Analysis (ESCA, www.cluster-analysis.org)*

2. Mega Trends – Role, Definition, Impact

According to the definition of the European Environment Agency (EEA), Mega Trends³ are those trends visible today that are expected to extend over decades, changing slowly and exerting considerable force that will influence a wide array of areas, including social, technological, economic, environmental and political dimensions. This definition will also have full validity in the future, the effects of mega trends are comprehensive, but above all, they are effective in the economic environment. These are the influences according to which companies must align their strategic decisions to keep their competitiveness also in the future.

Global mega trends can be understood as a sustainable force on a global and macro-economic level, influencing the developments of business, economy, society, cultures and personal lives, on local as well as on a global level. The mega trends therefore need to be considered as a framework in which economies have to function. Thus, the mega trends are also defining the appearance of the future world and its increasing pace of change.

The recent analysis of the European Cluster Observatory (2014) has identified emerging industries as cross-sectoral thematically defined groups of industries in which the growth of dynamic cross-industry linkages is most likely⁴. The following ten emerging industries have been identified and selected for further analysis:

<i>Emerging Industries</i>	<i>Abbreviation</i>
Advanced Packaging	AP
Biopharmaceuticals	BP
Blue Growth Industries	BG
Creative Industries	CI
Digital Industries	DI
Environmental Industries	EnvI
Experience Industries	Expl
Logistical Services	LS
Medical Devices	MD
Mobility Technologies	MT

Figure 1: Emerging Industries – used abbreviations

³ U. Lorenz, H. Haraldsson, *Impact assessment of global megatrends, Two case studies connecting global megatrends to regional topics, Report 6602, February 2014*

⁴ *Methodology and Findings Report for a Cluster Mapping of Related Sectors, European Commission, Brussels 2014, available at: <http://ec.europa.eu/enterprise/initiatives/cluster/observatory/d1.2-cluster-mapping-report.pdf>*

This report explores which of the ten emerging industries are influenced by which mega trends, and which of the emerging industries may possibly empower which mega trends in a reactive manner. The first part of the study follows directly the definition of mega trends and their main effective direction influencing the Emerging Industries (in the following called “downstream”). The second part follows the assumption that the trend may be influenced in its effect by significant developments in certain Emerging Industries (in the following called “upstream”).

As an example for distinguishing these two approaches the following example should be given:

Due to the ability of the “Digital Industries” to provide lots of fast changing generations of mobile end-devices with the impact of the mega trend “Consumerisation, proliferation and ubiquity of IT” on the “Digital Industries”, the diffusion of the initiating trend, last but not least also in other industries and markets, will be accelerated continually.

Due to the availability of lots of user-friendly IT-end -devices the private consumers will more and more be able to bring in their own IT experience in the corporate world. In this way consumerisation of IT will spill-over in the industrial world. Mobile access to business applications becomes independent from the terminal, from the kind of end-device, and also from residence or time. The use of IT-devices and the installed applications will go without sayings and will considered as a basic skill of the majority of employees, because it is accustomed from the daily life. The diffusion of these technologies will be propelled extraordinarily. By consumerisation the role of the driver of IT innovations partly shifts also from large enterprises to private users. This shortens many cycles of innovation of IT products, and also provides increased opportunities and chances for small and new businesses.

This “downstream” and “upstream” relationship of all megatrends and selected Emerging Industries can be visualised as matrices as given later in the document. These will be used for further considerations.

2.1 Impacts of Mega Trends

Mega trends can be seen as the fundamental catalysts for growing markets through their influence on several determining factors, for instance on consumer behaviour as well as on business processes, and so they can be seen as a striking supporter and abundant building block for the introduction of new products and services. Additionally, by influencing price, performance, availability and quality improvements, mega trends will also unlock latent demand and revitalise growth in existing, saturated, mature markets, while unblocking resources to tackle the growth of new market opportunities.

The "modus operandi" of the megatrends when they are influencing the investigated industries are shown in a simplified picture (see Figure 2). The mega trend caused as external stimulus (macro-area) at first an internal change, to respond to the external stimulus and change the internal structure (micro-area) so that correspond to the stimulus (preferably in the most efficient way). In case of a sustainable reaction, these changes will be elaborated as long-term strategies, in order to successfully act also in the future in an external environment (macro-area) under the influences of new or modified stimuli.

Mega trends effectively give a tail wind at the back of emerging industries. These booster-effects accelerate the opportunity and provide the fundamentals to grow at a high rate for a long time. Some of the current mega trends have remarkable direct impact and are affecting the whole ecosystem: consumers, businesses, and entire economies, e.g. logistics, mobility, energy ...).

The increasing use of IT in a business field such as Logistical Services has not only led to the result that logistics companies were able to improve operational efficiency by a continuous implementation of information technologies. They also changed their complete business characteristics, because logis-

tics companies employed information technologies to raise their service capability in the e-commerce age. These changes also influence in parallel the change of the complete eco-system all around or will be influenced by this. This begins with the changes of the customers behaviour with the use the opportunities of the eCommerce: choice, selection, comparison, payment, submission of a complaint, includes the kind of consignment, automatically from the high rack and ends with the kinds of delivery, including the abilities of tracking and tracing of the shipments anywhere and anytime or the after-market services, e.g. maintenances or analysis of customer satisfaction.

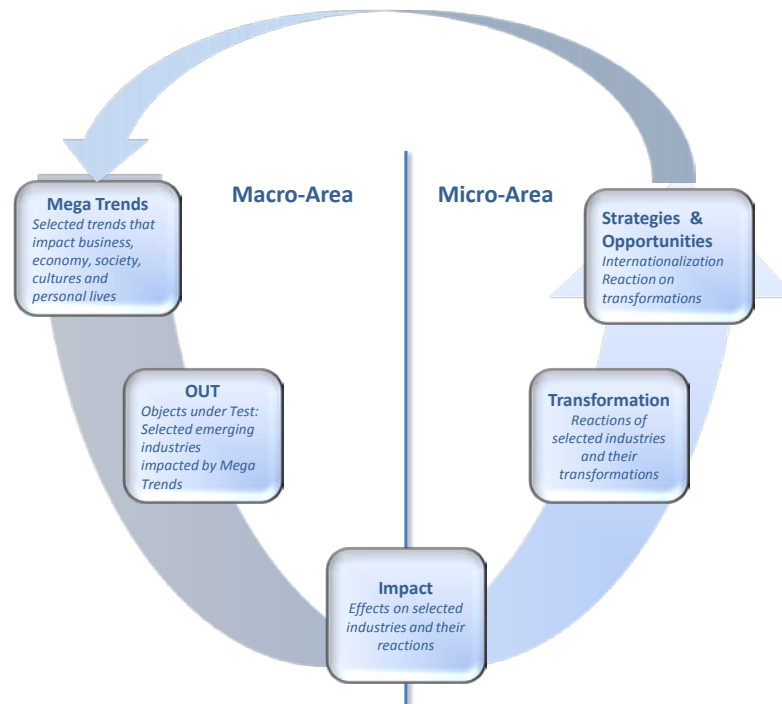


Figure 2: Mega Trends – a “functional chain”

Great growth opportunities are often found where mega trends interlink the growth sectors of the economy, e.g. ICT, health care, renewable energies, environmental industry, or business and consumer services.

A trend such as “Consumerisation, Proliferation and Ubiquity of IT”, which drives and is driven by the Digital Industry, linked with the trend of “Convergence of Products, Device and Services” lead to a massive change in the health sector, in diagnostics as well as in therapies. Telemedicine or personalised medicines are products of these linkages. Together with the influences of the “Big Data” approach new areas of business in the healthcare become reality, e.g. self- or remote diagnosis.⁵

A trend such as the personalisation of Products and Services affected very significantly manufacturing and sales processes. Individualisation, clearly highlighted by the individuality of the product packaging and emphasizing the individuality is a completely new role of an advanced packaging in the whole process and led to an emergence of completely new markets, which have been never seen before.

Value chains are being transformed into value networks as the value chains themselves become more closely linked. In the long term, these dynamics will drive sales, turnover and profits of entire indus-

⁵ For detailed information see also: *European Cluster Trends, Preliminary Report, European Commission, Brussels 2014, p. 5 et seqq.*

tries. As a consequence, companies, which are focused on becoming industry leaders will have best chances to claim the largest share of these rapidly growing markets and to ultimately create tremendous shareholder value.

2.2 Selected Mega Trends

From a large portfolio of long-lasting trends and effects, the following trends have been identified by involving experts from industry and science, cluster managers, scientific studies and desk-top analyses as important and real mega trends to be considered further in this study⁶. Although different sources have been used, there is a common understanding about the upcoming mega trends^{7, 8}.

In the present study, not only currently arising new mega trends were included, because the experience and perceptible impacts of presently developing trends in the combination with emerging industries may be still low. Therefore, also already active, long-lasting trends are included, which themselves undergo certain developments in their existence (drivers and priorities of the trend undergo changes constantly). As an example one can take the changes in "Reduction of Carbon Footprint". This trend resulted initially from a pure shift away from fossil fuels, at the beginning based on individual efforts. A further step of internal development led to more efficient use of energy in equipment and services to reach a reduction of the ecological damages. The next step brought the intensive implementation and usage of all kind of renewable energies. The current stage of internal development is based again on a strong individual environmental consciousness. These are efforts to influence individually the environmental impact by changing the behaviour, for example, by a waiver of energy-intensive products or services (self-restriction).

Cross-linkage of subjects and objects (Internet of Things, etc.)

The use of computers and Internet linkages to manage an increasing spectrum of societal functions, including critical infrastructure, implies a broad range of social, economic, commercial, legal, and security implications. The number of things connected to the Internet now exceeds the total number of humans on the planet, and will be accelerated to as many as 50 billion connected devices by the end of the decade. For manufacturers, the implications of this emerging "Internet of Things" are huge, and ca. 80 to 100 % of all manufacturers will be using relevant applications by then.

The rise of the cross-linkage of subjects and objects has been driven by the convergence of markets and, at the same time, by innovation of enabling technologies. The capabilities of products will be multiplied, will offer new forms of value and will be able to do things far beyond their primary function. This transformation is shifting the sources of value and differentiation to software, and services, and is creating entirely new business models.

Big Data

Big Data is currently not a precise term. But it can be seen as a characterisation of the all-embracing accumulation of all kinds of data, arousing terabytes or petabytes of data sets that are growing exponentially and being too large, too raw, or too unstructured for a traditional approach of analysis with relational database techniques. By applying Big Data to their challenging business issues, companies are reshaping their operations and can upgrade their business results. Big Data will transform every

⁶ KPMG & Mowat Institute, *Centre Future State 2030: The global megatrends shaping governments*, KPMG, Report, 2014 (To view electronic version: www.kpmg.com/government)

⁷ National Intelligence Council, *Global Trends 2030: Alternative Worlds*, Study, NIC, 2012, ISBN 978-1-929667-21-5 (To view electronic version: www.dni.gov/nic/globaltrends)

⁸ Z_punkt gmbH - the Foresight Company, *Megatrends 2020plus, Unternehmerpositionen Nord - Eine Initiative der HSH Nordbank AG*, study, 2014

aspect of the organisation, from strategy and business model design to marketing, product development, recruiting and human resources, operations, and more. Organisations will be developed far more data-driven at all levels. The amount of data in the world is exponentially increasing - large portion of this comes from the interactions via mobile devices being used by people in the industrial countries as well as in the developing world. Researchers and policy-makers are beginning to realize the potential for channelling these torrents of data into actionable information that can be used in a commercial manner. The use of Big Data as a resource will deliver real business value to the enterprises.

Impact of social media

Social media should be seen here as the sum of tools, services, and communication facilitating connection between peers with common interests. They include the online technologies and practices that people use to share content, opinions, insights, experiences, perspectives, and media themselves. Therefore, they can be used as media for social interaction. On the one hand, they facilitate social networks with their enormous reach and easy access to single users or entire user groups to intensively discuss product characteristics and performance.

At the same time, they will also influence noticeable the methods and the result of product selection processes. Interactive information shared among customers is becoming fast and convenient via the internet with the online social networks. On the other side, the whole dynamics of marketing have been changed, and rather than investing in mass channels ads, companies are becoming more consumer-centred through interactions made via social media. They are able to understand the needs of their markets directly from the market itself. This can be executed in a shorter time than with traditional methods of market research and customer survey.

Personalisation of products and services

Here to be understood as the use of systems, combining the low unit cost of mass production processes with the flexibility of individual customisation, aiming to be able to offer customized products and services at standard prices. It has been caused by a change of the customers' behaviour, amongst others characterised by a decreasing brand loyalty. "Personalisation of Products and Services" is a concept with the ability for a company to give its customers the opportunity to choose product specifications.

Responding to these changes of customer orientation, companies often try to react with a variant production, which however often leads to a "trap of the complexity". A solution can be offered by the principle of mass customisation. The target market is not the differentiated market, but the mass market. This will be achieved by the variation of a few features, from the customers' perspective, however, affecting crucial aspects of the product individualisation. Typical modifications individualized design features or fit. Frequently, however, these products are also based on the concept of modularity. That means, the product can be assembled from a variety of building blocks. A special sector of these efforts of individualisation is the field of personalised medicine. Individual medical concepts promise better diagnoses, earlier interventions, more-efficient drug therapies, and customized treatment plans. These concepts are based upon a genomic blueprint and will be able to determine each person's unique disease susceptibility, to define preventive measures and enable tailor-made therapies to promote well-being.

Immediate availability of products and services

The pervasive challenge for emerging industries is the fact to be steadily present in a global market environment. The global market is a buyer's market. The immediate availability of products and services makes efficiency a high priority. Wise, timely, and measurable efforts maintain a business' cutting edge and allow for growth. This can be seen as a concept to satisfy the customers' demand for an immediate availability of products and services, and by this to minimize their costs of carrying excess inventory and minimize business disruptions. As it is not enough to attract customers with low prices

and with great services, the extended opportunities of information and communication do not only accelerate the process of selection. The customers expect also the immediate availability of their choice. This kind of customers' behaviour will distinctly affect the manufacturing processes as well as the logistical infrastructure.

Changes of geo-economical dynamics

New regions came up years ago as a driver of the future of the world. Demographics, territorial scale, low production costs, easy access to commodities – all were signs of impending change in the geo-economic axis. A middle class rises and becomes interesting as customers with growth potential. But the markets are often located in areas with unstable political bases, unpredictable economic conditions and arbitrary political decisions. Emerging economies become important markets, in both views: in size and growth. Emerging markets are more and more changing from low-cost production locations to increasingly large consumer markets. Concepts of future growth may very well depend on the ability to adapt business models to these economies.

But in the past few years, these pro-convergence drivers seem to have changed course. The promising development in the emerging markets has apparently come to an end. Emerging economies have been slowing down. In contrast, the US is recovering and Europe, may be, and is coming out of its recession. This, of course, again has had an impact on the outlook for the direction of capital flows and investment efforts.

Innovation dynamics

Innovation is a central driver of economic growth and development, but its appearance is changing. Fundamental trends can be observed: cloud, mobile, social that is reshaping the technology industry. Companies need to embrace the full spectrum of innovation - from incremental to breakthrough up to radical innovation - in both, their R&D and their business model strategies. With the emergence of disruptive innovation, the introduction of new technologies, products or services is an effort to promote change and to gain advantage over the competition. But also the innovation process itself is changing: the acquisition of required knowledge becomes more and more challenging, because knowledge becomes "liquid", is randomly distributed across several sources or "knowledge carriers" with an enormous regional spread, is highly mobile, and challenging interdisciplinary.

Changes in entrepreneurship culture (crowd funding, etc.)

The role of entrepreneurs, especially in emerging industries remains - beyond any dispute - important for implementation of technology breakthroughs. Several developments, e.g. alternative funding systems for new ventures, have emerged, for instance in the form of crowd funding. Rather than relying on opinions of experts, crowd funding allows millions of individuals to make decisions about which entrepreneurial projects they wish to test and support. Increasing mobility of young people and the ability of linking-up of IT competence with other application fields in an interdisciplinary manner offers new sources for entrepreneurial ideas.

Convergence of products, device and services

The trend represents a merging of corporate and consumer capabilities within IT devices. Customers and companies are using the same technology devices; and they are using them for similar activities, e.g. accessing corporate data to gain better insight into immediate and ongoing relationships (spare parts management, maintenance services, package shipments) - than ever before. This convergence of devices and services will demand new business models and allow opportunities for revenues. Convergence, which is currently increasingly occurring along many different dimensions, will influence the traditional business concepts. Convergence of devices and services allows the users to gain access to the same technology devices for a broad spectrum of different activities – accessing corporate data for a better insight, process data, communication data, measurements results, etc.

Consumerisation, proliferation and ubiquity of IT

The access to a user-friendly experience with mobile devices, tablets, or personal computers is more and more becoming a matter of course. The IT interfaces benefit from the effects of the economy of scales, driven by the consumer sector - performance, reliability, functionality are in a brilliant balance and most of the consumer IT goods are well usable for lots of business processes. This trend seems to be an old one, but it has to be observed as a long-lasting, but very volatile process, every time propelled by the fast-paced development of generations of human interface devices. The influence of this trend is always present, but "the way of doing" is extremely fluctuating.

Customers as well as employees have become accustomed to an unprecedented ease of use in the way they access information online, whether through mobile devices, tablets or personal computers. They expect applications to be as simple, intuitive and task-oriented as online banking, participating in social media or making restaurant reservations. This simpler, task-oriented trend is partially driven by the screen size of mobile devices, but it still perpetuates itself no matter what interface is used at the moment.

Therefore, companies have to develop enterprise applications that are easier to learn, and thus improve productivity. Second, they will need to develop applications that are easier to use on smartphones and other mobile devices. Accommodating both, these trends will require commitments to application development tools that address multiple platforms. It will also require commitments to increased security and privacy to ensure data integrity in every case.

Shortening of product lifetime cycles

The shortening of life cycles means that replacing a product or service more rapidly than before is becoming the normal situation across many industries. Furthermore, if a company is too slow in introducing a product into market, it risks launching goods that have already been superseded by other competitors. This challenging environment means that accurate demand planning and forecasting has never been more imperative, and businesses must take a more co-ordinated approach to their value chain management. Experience-based efforts or processes, e.g. design or pre-aging tests have to be replaced by new, more intelligent solutions.

The collapse of life cycles means that replacing a product or service line every two years is becoming the norm across many industries. A key reaction to this trend is the introduction of technology that enables organisations to quickly and effectively manage operations and gain a greater perspective of the entire value chain.

Technology support is becoming crucial for selecting and executing a value chain inventory programme. Companies have to seek new technologies allowing them to optimise the value chain. A sophistication of value chain management will continue to grow, with organisations increasingly using inventory principles along the entire life cycle of a product, for example to maximise the speed of market launch of a product, a re-brand, or demand variations due to seasonality factors.

Shortening product life cycles makes time-to-market critical, and so businesses must utilise technology to ensure a greater perspective and tighter control of the value chain.

As a product proceeds through its life cycle, the demand characteristics change, and organisations must be committed to adapt the value chain strategy to maintain competitiveness at a moment's notice. This can be achieved through the use of forecasting and planning technology to monitor a product as it proceeds through its life; matching a product to the most appropriate value chain strategy for the next stage of its existence.

Successful organisations will have a strong grasp of shortening product life cycles within their industry and put strategies in place allowing them to adapt quickly to changing markets, enabling new sources of revenue to be generated. Businesses that fail to react will risk falling behind competitors.

Carbon foot-print reduction

The CO₂ footprint can be calculated for people, organisations, countries and events. The knowledge of the CO₂ footprints of several alternatives of action can be taken into account when making decisions. Driven by their customers, businesses are investing in understanding their value chain emissions, verifying the carbon footprint of their products, and communicating with their demanding customers, because they can see the potential for consumers to switch to lower-carbon alternatives and to create a huge value for a product differentiation.

Consumer demand for lower-carbon products and services is growing, despite the tough economic climate. People understand that the manufacture, distribution, sale and disposal of the products they buy come at a high price in terms of carbon emissions across the value chain. They are increasingly prepared to change their shopping habits to help minimise this 'embodied carbon' or 'carbon footprint' associated with their purchases. Leading businesses are responding to these changes by measuring and reducing their impact and developing new businesses on this base.

2.3 Mega Trends and Emerging Industries

The study is based on a twofold approach: Firstly, on the idea that the mega trends influence the examined emerging industries ("**downstream approach**"). Secondly, however, this influence can assumable not be non-reactive and the industries are conversely able to influence the trends as a response in the course of their own development ("**upstream approach**").

For the further analysis⁹, it has been identified, which of the ten emerging industries are strongly influenced by which mega trends – the "downstream" view (see matrix, Figure 3), and also which of the emerging industries conversely strongly empower which mega trends as the "upstream" view (see matrix, Figure 4). There is no doubt that almost all mega trends more or less impact all ten emerging industries, but there is a common sense that in some areas the impact is more significant whereas in others it is much less significant. These two approaches have additionally been merged into one consolidated matrix (see Figure 5) used for further considerations. This Figure 5 represents the fields of the strongest reactions in both directions, "downstream" as well as "upstream", however also, in exceptions, influences in only one direction, but then with an extreme effect. There is no doubt that these downstream and upstream effects have a serious impact on the global value chain within the ten emerging industries and will lead to new cooperation models between involved actors. This provides a huge potential for new SMEs in cluster to enter new value chains and industrial niches within the emerging industries.

⁹ Based on an international expert panel (industry, science, cluster managers), scientific studies and desktop analyses

Mega Trends/ Emerging Industries	Mobility Technology	Medical Devices	Logistical Services	Digital Industries	Experience Industries	Environmental Industries	Creative Industries	Blue Growth Industries	Biopharmaceuticals	Advanced Packaging
Cross-linkage of subjects & objects	●	●	●	●						
Big data	●	●		●		●			●	
Impact of social media					●		●			
Personalisation of products & services		●	●	●			●		●	●
Immediate availability of products & services	●		●	●						
Changes of geo-economical dynamics	●		●	●		●		●	●	
Innovation dynamics				●					●	
Changes in entrepreneurship culture				●	●		●		●	
Convergence of products, devices and services	●			●						●
Consumerisation, proliferation and ubiquity of IT				●						
Shortening of lifetime cycles				●			●			
Carbon foot-print reduction	●			●		●		●		●
● Downstream (Mega trends influence Industries)										

Figure 3: Mega Trends, influencing Emerging Industries – Downstream effects

	Mobility Technology	Medical Devices	Logistical Services	Digital Industries	Experience Industries	Environmental Industries	Creative Industries	Blue Growth Industries	Biopharmaceuticals	Advanced Packaging
Cross-linkage of subjects & objects			●							●
Big data				●						
Impact of social media				●			●			
Personalisation of products & services		●	●		●					●
Immediate availability of products & services							●			
Changes of geo-economical dynamics										
Innovation dynamics										
Changes in entrepreneurship culture										
Convergence of products, devices and services	●									
Consumerisation, proliferation and ubiquity of IT		●		●			●		●	
Shortening of lifetime cycles			●							
Carbon foot-print reduction	●					●		●		
● Upstream (Industries influence mega trends)										

Figure 4: Emerging Industries, influencing Mega Trends – Upstream effects

	Mobility Technologies	Medical Devices	Logistical Services	Digital Industries	Experience Industries	Environmental Industries	Creative Industries	Blue Growth Industries	Biopharmaceuticals	Advanced Packaging
Cross-linkage of subjects & objects			●							
Big data				●						
Impact of social media			●				●			
Personalisation of products & services		●	●							●
Immediate availability of products & services										
Changes of geo-economical dynamics			●							
Innovation dynamics										
Changes in entrepreneurship culture										
Convergence of products, devices and services	●									
Consumerisation, proliferation and ubiquity of IT				●						
Shortening of lifetime cycles										
Carbon foot-print reduction	●					●		●		
● Areas of strong interdependencies										

Figure 5: Mega Trends vs. Emerging Industries – Areas of strong Interdependencies (AOSI's)

The chosen method of analysis considers the effect of mega trends, as outlined in the methodology report, selective with respect to the direction of action.

The used "upstream" and "downstream" approach will ensure a result of the investigations, that contains on one side the influence of the selected trends on the ten emerging industries (the external or "downstream" side), and contains on the other side the level of "individual" positioning or matching of the ten emerging industries with regards to these trends and their "internal propelling effect", the pressure to change of the industries in the direction of these trends (the internal or "upstream" side). It should not play any role for the beginning of analysis whether the "upstream" or "down-stream" approach (or both) will most affect the respective industry. All directions of influences have been evaluated by a panel of experts.

The matrix points that indicate trend effects in a particularly high degree have been identified from Figure 3 and Figure 4 and form the basis for a more detailed further investigation, for instance in the context of the cluster foresight process. Both - intensive, simultaneous "upstream" and "downstream" effects or an intensive one-sided "upstream" or "downstream" effect were considered significant. Thus, Figure 5 as consolidated matrix shows 12 areas of strong mutual interdependencies between global mega trends and emerging industries, to be more in discussed in the following.

The mega trends are not static and often contain of a set of sub-trends with different dynamics. This is also the case for the identified areas of strong interdependencies (AOSI). Figure 6 displays the most the most dynamic underlying sub-trends for the identified Areas of strong interdependencies. These sub-trends define the directions and objectives of the related internal and external development dynamics. Thus, these sub-trends can as well be understood as reactions in the Emerging Industries on the mega trends. These sub-trends in relevant market niches are ideal entry points for clusters, and

here especially for involved SMEs, to enter new and promising value chains. This is because of the resulting upheaval these cases. A radical change in terms of economic development (not merely quantitative development) is produced in a process of creative destruction. Due to this reassignment of factors of production, which prevails successfully, old structures are displaced and eventually destroyed. The destruction is not a system error, it is essential that a reorganisation can take place - with space for new, flexible and innovative player.

Mega trend	Emerging Industry	Sub-trends/Reactions
Cross-linkage of subjects & objects	Logistical Services	<ul style="list-style-type: none"> • Internet Everywhere • Cyber Physical Systems • "TrillionSensor" (sensor networks) • Future Internet • e-Commerce
Impact of social media	Logistical Services	<ul style="list-style-type: none"> • Faster time to deliver (concept to market) • Simplification in conducting business • Faster and informed decision making • Transparency, Tracking and Tracing • Anytime, anywhere access to resources • Emergence of the Prosument • e-Commerce
Impact of social media	Creative Industries	<ul style="list-style-type: none"> • Faster time to deliver (concept to market) • Simplification in conducting business • Increased velocity of processes • Faster and informed decision making • Adaptive to changing business environment • Emergence of the Prosument • Fast advice - price & performance comparisons, blogs and online reviews
Personalisation of products & services	Medical Devices	<ul style="list-style-type: none"> • Digitalisation • Personalised Healthcare • More years, better life • Theranostics • Point-of-Care Healthcare Technologies (POCHT)
Personalisation of products & services	Logistical Services	<ul style="list-style-type: none"> • e-Commerce • Everything immediately • Everything everywhere • Anytime, anywhere access to resources • Emergence of the Prosument • Mass production with batch size one • Transparency, Tracking and Tracing
Personalisation of products & services	Advanced Packaging	<ul style="list-style-type: none"> • Functional Packaging • Combining economy and ecology • Smart packaging for specialty products • Enhancing traceability • Fighting counterfeiting • Labelling & Branding with Packaging
Changes of geo-economical dynamics	Logistical Services	<ul style="list-style-type: none"> • e-Commerce • Emerging markets • Mobility cost volatility • Local content • Extension of the coverage area • Demographic changes

Mega trend	Emerging Industry	Sub-trends/Reactions
Convergence of products, devices and services	Mobility Technologies	<ul style="list-style-type: none"> • Same devices for similar activities • Consumeration of IT • Shared wired/wireless infrastructure • Single device/converged services • Cloud Computing
Consumerisation, proliferation and ubiquity of IT	Digital Industries	<ul style="list-style-type: none"> • Same devices for similar activities • Single device/converged services • Connected people • Anytime, anywhere access
Carbon foot-print reduction	Mobility Technologies	<ul style="list-style-type: none"> • e-Mobility • e-Commerce • Connected vehicle • Altered mobility patterns • Telematics • Mobile does not mean automobile • Networked multimodal urban mobility systems • Cocooning
Carbon foot-print reduction	Environmental Industries	<ul style="list-style-type: none"> • Decoupling economic growth from environmental pollution • Digitalisation • Big Data • Trillion sensors (sensor networks) • Renewable energy • Contamination control • Risk evaluation • Remediation & Recycling economy • Sustainable development • Urban mining
Carbon foot-print reduction	Blue Growth Industries	<ul style="list-style-type: none"> • Shortage of potable water • Protection of coastal areas • Increase of seaborne trade volume • Food & water production • Additional space by land reclamation • Off-shore fossil fuel • Renewable offshore energy • Deep sea mining

Figure 6: Hot-spots of interdependencies of Mega Trends and the Emerging Industries, leading to sub-trends within the Emerging Industries

Example: The **Logistics Industry**¹⁰ is faced by challenges raised from the influence of social media and product personalisation. The example reveals that there can also be interdependencies between individual trends: A fast growing customer potential is combined with an increasing catchment area, where these customers are located - in emerging countries with an increasing demand due to a noticeable increase of purchasing power, caused by the emergence of a middle-class.

Further, supplier and customer are not necessarily different companies. Also intra-firm logistics often are operated by external logistics service providers. So called Third Party Logistics Service Providers (3PL) have taken over logistics activities which were previously performed in-house by manufacturers, wholesalers or retailers themselves. These new activities are not only related to the execution of logistical but include also order fulfilment, inventory management or after-sale customer services.

¹⁰ For further explanation see (Pflanz, 2014)

It can be stated, that two general developments especially are influencing the value chain **Logistics Industry**: specialisation and integration. Specialisation refers to higher expectations of customers to receive high quality customized (and personalised) services. Striving for a higher efficiency and advancements in information technologies result in a deeper integration of logistical processes along the supply and value chains. On the one hand, often such integrated processes are organized by large, globally acting services providers. On the other hand, the logistical services industry has become more interconnected to allow for such integrated chains. These recent trends have transformed logistics into an advanced service industry which will gain further importance in a world with more and more interconnected economies and companies become increasingly part of a networked economy. The increasing importance of e-commerce also for traditional brick-and-mortar commerce leads to new challenges and new business models for logistic service providers. To satisfy the demands of customers for such flexibly logistical solutions logistical service providers on the one hand will have to apply standard logistical processes in a new intelligent way and on the other hand make use of latest and future technological advancements. The choice of services and the assessment service quality as well as an instantaneous, almost undifferentiated communication via social networks.

Customer expectations and government regulations contribute to an increasing demand respective necessity for sustainable logical services at least worldwide. The management of global end-to-end supply in the future, e.g. by fourth party logistics (4PL), also involves production scheduling, supplier planning as well as sourcing and procurement activities. That is logistical service providers vertically extend the logistical value chain by creating and conquering new markets. Ultimately affects this in turn the performance and competitiveness and the further development of entire economies.

Example: The **Advanced Packaging**¹¹ industry will be heavily challenged by the trend of personalisation, because it plays a crucial role, e.g. as an instrument for significant accentuation of brand-defining areas of a product or branding.

The development of the packaging industry is very much linked to the development of consumer preferences, demographic and lifestyle changes and environmental concerns. The most recent trends show more demand for personalised packaging, new design and easy-handling and environmental-friendly solutions. Other trends that influence the requirements from packaging include online shopping that is becoming increasingly popular. For instance packaging should be suitable for the cases where the product should be returned and must be selected that can withstand long transport times, as well as rough handling. Packaging for instance can help to build brand-loyalty, which is why for product manufacturers the right design of packaging is so important.

Cross-overs to other industries support these developments evidently. Digital printing supports the personalisation of goods and products per personalised imprints. The use of smart labels as an element of a sophisticated packaging solution secures extravagant personalised products against counterfeiting.

This is also and particularly true for healthcare packaging. Personalised medicine has to be secured against both, confusion by the customer as well as against counterfeiting by unfair competition with an advanced tailor-made packaging. This should fulfil lots of divergent tasks in parallel: anti-counterfeiting technologies, sterile barrier systems, packaging designs that can enhance user-friendliness (e.g. an important factor in the choice of using a drug) or disposable, prefill-able or dose-able packaging that can be also safely used during home healthcare. These all come together with an eco-friendly packaging, requested by an increasing number of (solvent) customers, because the environmental impact of the packaging industry is relevant and often criticized even if packaging also helps sparing wasting products. The appearance of green consumerism, which can be seen also as a direction of personalisation, has been already pushing companies to adopt modern packaging solutions that provide wast-

¹¹For further explanation see (Izsak, 2014)

age and resource efficiency and is increasingly taking use of environmental services. Many packaging firms are developing biodegradable and recyclable products to reduce waste. New packaging materials are increasingly bio-based and inspired by nature for instance the biodegradable loose-fill packing.

It is obvious that cluster managers can please a huge role for their cluster participants if they guide them into such new market niches. New business support services, created by cluster managements and jointly implemented within cluster initiative, can effectively help SMEs to identify such new value chains and market needs and address them accordingly. Roadmapping, common innovation strategies for fostering open innovations in clusters by using innovation labs etc. are only some promising approach to make SMEs benefiting from these industrial transformation processes. Traditional support services, like networking, matchmaking events etc. are important to increase awareness among the cluster actors, but by far not enough to succeed.

The above identified AOSI's and underlying sub-trends have shown that related markets are moving and changes dramatically, which again, offers a huge potential of clusters and the involved SMEs.

3. Transformations in Value Chains

Value chains¹² define the flow of goods and services from basic raw materials to finished products and solutions for end users. They are key elements of every economy and are responsible for their functioning and their performance. They are a key for the competitiveness, resilience and flexibility of a company, a branch (economic and/or industrial sector) or a national economy.

Value chains are special and are characteristic for each industry. Changes and transformation processes inside an industry can be found reflected in the value chains (and their shifts or transformations). Value chains, however, are themselves rapidly evolving. The change is in part due to their own impact (income and wage convergence) and in part due to external influences, e.g. due to mega trends. As a consequence, value chains can be used as sensorium for the detection of transformations in the respective industries if the self-induced influences of change can be eliminated successfully.

To detect these changes in an industry, which have been caused by the action of external factors, with the utmost security, it is therefore necessary, initially to exclude this influence, which is determined solely by the nature and peculiarity of the single company in concern. This is made possible by the aggregation of value chains' features based on their fundamental, common characteristics.

As already described, in the individual unique value chain of each of the examined emerging industries, very specific alignments and orientations of the ongoing transformation processes can be observed. These features are intrinsically and exclusively applicable for the particular value chain under the specific prevailing conditions.

These transformation processes are categorised within the **Common Characteristics of Value Chains** described in chapter 3.1 and can be universalised, compared, and observed in their trend development on this basis to find a pattern for these processes¹³. Their specificity is described separately and in detail in the ten sectorial "Reports on Cross-sectoral Trends and Geographic Patterns", which are prepared under the service contract of the European Cluster Observatory. In order to elaborate a general and comparable approach, in the following, only common characteristics of value chains have been used, which are applicable for all of the 12 **areas of strong interdependencies** determined earlier, where mega trends significantly impact emerging industries and vice versa.

3.1 Common Characteristics of Value Chains

To characterize the effects of external influences, it is necessary, to define in a comprehensive manner these key areas, that essentially determine the competitive success of value chains. A value chain analysis leads to the following areas of critical importance, common for a wide range of value chains¹⁴ and therefore usable for further investigations:

¹² The study uses the terms *Supply Chain & Value Chain* in the following meaning: The *Supply Chain* includes all enterprise-wide processes that include supply and demand, from purchasing and manufacturing to distribution. The *Value Chain* includes the *Supply Chain* – and all processes and partners outside the company (logistics, raw materials, etc.). With other words: from raw material to processing, including the distribution and retail chain, plus final consumption and disposal or recycling.

¹³ See also: *European Cluster Trends - Preliminary Report*, European Commission, Brussels, 2015.

1. Strategy & Performance

⇒ Agility, strategic orientation, quality of metrics

2. Planning & Execution

⇒ Processes, demand management

3. Talents & Information

⇒ Visibility, learning processes

4. Relationship Management

⇒ Cooperation, customer relationship

On the basis of various differing value chain analyses in different sectors or industries, some overall general development directions can be determined, which will have decisive influence on increasing the competitiveness of any individual value chain. As every industry is characterised by its specific individual value chain, any change here is linked to a change as well in the related industry. In the context of this study, this approach is used for the analyses of the ten Emerging Industries, their individual specific value chains, and the thereof determined general development directions.

The following significant developments described below seem to be particularly effective in terms of improving the performance of value chains. They can therefore be considered as the most effective tuning screws for the further value chain development, because mastering of the value chain is critically dependent on the ability of firms to manage material, money and information flows in a holistic manner. Here, a generally valid approach for characterizing value chains can be found. Basically, this means nothing more than identifying the way or the manner, in which the relations between the main actors of a value chain are managed.

As a large number of factors are influencing the way in which contemporary value chains can be analysed, it is important to keep in mind that the diverse companies and the diverse value chains have their own unique peculiarity in terms of involved products, markets, customers, employees and corporate culture. Each company has its own strategic focus and certainly its own drivers for a consistent further development.

Given the impossibility of keeping the overview, and even more the difficulty of comparing and analysing these different value chains on this widespread, scattered basis, the value chain analysis will be carried out here on the basis of the most critical indicators, valid and significant for many different industries across a wide range of industrial sectors and, therefore, including all the selected emerging industries. To ensure comparability with already available studies and to include the possibility for future updates, a repeatedly tested and well-established method, defined e.g. by Bowersox¹⁵ and M. Christopher¹⁶, was modified and adapted for these investigations.

Using this method, the following directions of investigation seem to be essential in order to make value chains comparable, e.g. market understanding and customer orientation, management ability and flexibility for mastering growing complexity, performance of information processes and systems, specific functional excellence and cross-functional understanding, relationship management and 'win-win' orientation et al.

In order to find these elements for a comparable, but comprehensive characterisation, for further investigation, the following areas should be considered as relevant for their determination:

¹⁵ see also (Bowersox, 2000)

¹⁶ see also (Christopher, 2011)

- The pressure from outside, and internal pressure too, induced by technical and societal mega trends have in recent years led to a development towards a strong focus on the identification and development of core competencies in the companies. This is due to the fact that companies tried to keep control over these changes and the ability to react in a successful manner. Such processes and structures seem to be best suited in order to outperform competitors in this regard.

Because of these vital influences, the companies attempt to identify appropriate strategic responses to current challenges. The corollary of this is that such activities that are deemed to be “non-core” have been outsourced, backward or sideward in the value chain. This process of “disintegration” in the vertical direction has resulted in the development of new architectures of the value chain including much more “virtual elements” than in the past.

In this context, the classical requirement “to own it to be able to control it” has been replaced by a strong orientation towards the management of relationships with key suppliers along the value chain. **The common characteristic of this development in the value chains is its *vertical disintegration*.**

- The demand of more functionality, more reliability and better usability has led to a situation of increasing complexity of products and service offerings. The shortening of product lifecycles, which is a feature in emerging sectors and is related to the rapid speed-up of the technical development, furthermore intensifies this complexity.

Additionally, this is compounded by the growing complexity of the international markets and the business environments in which companies have to operate. These influences have also resulted in the development of more sophisticated and more complex value chains. **The common characteristic of this development in the value chains is its *increasing complexity*.**

- Every business environment is currently, more than ever before, characterised by intense competition between rival firms in most sectors. The situation is perceived as a “hyper-competition”. - But this situation has also created the biggest driver in all aspects of business in recent years - innovation. As a consequence, the need for innovations inside the value chains becomes more evident, including their design, their planning, and last but not least their implementation. **The common characteristic of this development in the value chains is its *resilience in an environment of strongest competition*.**

- Customers have become more challenging and, as a result, markets have become more sophisticated. Customers are demanding more and more in terms of product quality, cost-benefit ratio and service levels at ever more competitive prices.

As a consequence, customers are demanding a “steadily itself improving value for money ratio”. This trend will be additionally accentuated by the economic “frills”, downturn, stagnation or upswing. **The common characteristic of this development in the value chains is its *increasing influence of the customer*.**

- Drastic changes in the past, in politics, trade and international relations have led to structural changes in the global economy. As results, many of the barriers that traditionally existed to the movement of products, services, and the mobility of people, capital and information across international borders have been reduced or eliminated. Hence, a global procurement of products, services, human resources, and in the same way the access to new international markets have become a real opportunity for many firms.

Internationalisation in the past was mostly aimed to promote the export of special products or classes of products or to initiate new, and mostly publicly funded, R&D projects with foreign partners.

It is necessary to consider whether, and if so, what developments occurred under the influence of mega trends and still take place, which will expand the opportunities and use of internationalisation.

Internationalisation is the most important common characteristic, due to its comprehensive approach and its multidimensional implications. Internationalisation will influence and change, as distinct from all the other common characteristics, not only inbuilt elements of the value chain or these of the contiguity. In contrast to the aforementioned characteristics, internationalisation also has an impact with a much broader effect as it will affect basically all other elements of an ecosystem. This in turn can lead to changes in the whole ecosystem. Therefore, in the next chapter, the study will investigate more in detail, what the effects of internationalisation are, which benefits companies, especially SMEs, can earn, and how they are preparing to master these challenges.

3.2 Transitions in Value Chains – Parameters

Certain parameters can be determined to reflect the fundamental paradigm shifts, which are needed by European firms when trying to successfully transform their value chain capabilities to accommodate a transition from an existing, already used, but not expandable to a sustainable concept, driven by societal and/or technology requirements. Thus, using these parameters, the impact of the mega-trends on the value chains of the selected emerging industries can be described. The parameters mirror the substantial changes in the value chains in a comparable and, if necessary, extendable manner, allowing as well the inclusion of other already existing or further planned studies.

The following pragmatic selection of parameters was identified as representative to describe promising directions of a further successful development of the value chains:^{17, 18}

- Customer service orientation
- Business relationships
- Agile implementation strategies
- Business process orientation
- Sustainable competitive advantage orientation
- Information sharing
- Knowledge-based learning orientation
- Virtual integration concepts

In the following, these parameters are explained in detail:

- **Customer service orientation** describes how companies are taking into account the requirement for simple individualisation up to mass customisation. The ability to switch from the traditional “one size fits all approach” to the “different customers have different requirements” view is the measure for describing customer service orientation. It also includes service parameters such as order-to-fulfilment cycle times and delivery reliability as well as the measure for the level of understanding and responding to the evolving demands of customers.
- The change in **business relationships** parameter is based on the recognition that the value chain is only as strong as its weakest link. The achievement of higher levels of value chain

¹⁷ Ernst & Young, *Game-Changing Trends in Supply Chain, First Annual Report 2013*

¹⁸ IBM Business Institute for Value, *Leading through Connections, IBM Global CEO study, 2012, GBE03485-USEN-01*

quality, resilience and performance is dependent upon the development of stronger relationships between customers and suppliers - internally and externally. The change from adversarial relationships to collaborative relationships should lead to a development of a “win-win” relationship with key internal and external customers and suppliers. Such relationships are collaborative in nature, based on principles such as trust and transparency. Both can be used as elements of “strengths sparing” sustainability.

- Because the value chain is the central element of a company and the prime driver of economic profit and shareholder value, firms clearly must have a strategy to have implemented a resilient, but as well flexible value chain at any time, also in times of transition. **Agile implementation strategies** are recognized as a possible concept implying that individual businesses should no longer compete as solely autonomous entities, but rather as networked elements of more complex value chains. To achieve a competitive advantage in the rapidly changing business environment, firms must coordinate operations with suppliers and customers in a way to achieve a higher level of agility beyond that of competitors. Actors along the value chain must be able to rapidly align collective capabilities to respond to changes in demand and supply. The parameter therefore describes the firm’s ability to quickly adjust tactics and operations within its value chain to respond or adapt to changes, opportunities, or threats in its environment.
- **Business process orientation** describes the ability of companies to overcome the traditional functional orientation. The traditional business approach mainly had a strong internal focus and was driven primarily by the need for administrative efficiency. A business approach with a focus on the creation of customer value requires a rather different orientation, which recognises that real value is created by business processes that often cut across traditional functional and/or companies’ boundaries.
- A **sustainable competitive advantage orientation** on relative value for customer relates directly to the financial dimension of the value chain and, in particular, to how financial parameters are measured and will be perceived as important in the company. The traditional focus was laid on parameters as turnover or gross sales. Thus, the ultimate objective of most businesses is profitable growth. In times of transitions, a noticeable focus shift from short-term profit orientation to a long-term sustainable approach has to be performed. If the transformation process shall be sustainable, the attention has to be paid to the development of sustainable competitive advantage rather than to short-term outcomes. By identifying the relative value of different customers, the requirement of the appropriateness of alternative value chain models in meeting the varying requirements of different customers in targeted market segments can be successfully elaborated.
- Rather than hoarding information or simply create generally supportive organisational and inter-organisational structures, collaborating companies along the value chain need to share real-time information. The value of **information sharing** in facilitating value chain integration is evident. Because the technologies are easier to acquire and develop, it has become a necessary criterion for value chain success. An information sharing approach must be developed to support the use of technology. If an information sharing approach has been developed and introduced, collaboration capabilities and benefits are accessible. It seems to be evident that information sharing aspects will influence and propel some other parameters of the value chain transformation processes, e.g. the establishment of fewer adversarial and more collaborative relationships or the implementation of concepts of virtual integration. The efficient and effective management of both, material and financial flows in value chains is in many ways dependent upon the efficient and effective management of associated information flows. The ability to share operational and strategic information is a key characteristic of collaboration. The goal of collaborative acting in a value chain environment is the ability to jointly develop

value chain structures to best serve end-customers. Through a demand management focus, based on collaboration and intensive information sharing, using the opportunities of IT, along the value chain the inefficiencies can be avoided by allowing for optimal planning based on access to system-wide information. The breakthroughs in the use of information technology to capture data on demand directly from the point-of-sale or point-of-use have opened the opportunity to transform the organisation's ability to access the inputs directly from the market and to directly respond directly.

An overall value chain policy that aims to improve the customer service given to the end-consumer supplements this. With an endcast-driven model, companies are getting close to customers and to customers' businesses aiming to achieve reductions in inventory and higher materials turnover and to ensure that specific services and products are available on-time for the organisation's customers. The current status of forecasting their processes and activities of all partners along the value chain results in operational planning which is suboptimal with regard to the quantity of operational throughput, raw materials procured and finished goods inventory holding. To increase the efficiency and effectiveness the aim is that all partners in the chain see what they have to do simultaneously. This kind of supplier and customer collaboration reduces lead time across the chain due to a stronger link among partners and a shifting from the traditional buyer-seller-relationship towards a business partnership approach allowing for a stake in the ultimate product and customers' satisfaction.

- The increasing complexity of value chains and their operating environments as well as their design, planning and execution, requires a high level of knowledge across a range of domains. Knowledge-based learning is becoming a key for a successful further development of value chains. A continued adequate improvement of knowledge is important, because there is a need to develop a finer-grained understanding of the transfer processes involved in coordinating and sharing inter-organisational knowledge between external partners in the value chain. The **knowledge-based learning orientation** describes the ability of companies to use the value chain as a mechanism for inter-firm competency development.
- This trend of a **virtual integration** concept was already introduced several years ago, but companies still have to continue to move to an even more sophisticated virtual integration model with more third party materials and service suppliers. Thus, one of the fundamentals of business is the decision "make or buy", which is more important than ever before. But the outsourcing of processes to a third party service provider requires a well-defined strategy to optimise the leverage effect the third party will provide. Despite of a set of benefits of the vertically integrated business model - e.g. the retention of intellectual property, better control of costs, quality, and delivery or the more effective retaining of institutional knowledge and focus on competencies - the outsourcing trend continues to advance. The reasons are several challenges with vertical integration, e.g. the required considerable capital investment, the highly complex organisational structure, and the lack of an available and dedicated know-how and workforce, which are keys for every emerging industry.

3.3 Transformations in Value Chains of the Emerging Industries

In the next step, the parameters describing the transition (induced by the mega-trends) are matched with the reactions (sub-trends) in the value chains of the selected Emerging Industries. The aim of this exercise is to determine the matching points of highest priority, which build an entry point for innovative SMEs to enter and tackle new value chains. Cluster managers can use this knowledge for further considerations: Status-quo and trend analyses as well as the elaboration of specific targeted support measures.

The “cross-over points” have been marked with two “✓✓”; noticeable transformation activities, however with one “✓” (Figure 7). An empty field does not mean that there are no transformations; it simply means that they are comparably weaker and, even in some single cases, not existing. When having a more detailed look at the cross-over points, it becomes obvious why service innovations are that important¹⁹. Many transformation processes within the cross-over areas are mainly driven by service innovation.

It is important for cluster managers and their cluster firms to get a better understanding of such transformation processes. Business support services based on market intelligence can be considered as ideal base for earning benefits from such ongoing transformation processes²⁰. Internationalisation of clusters gains a new dimension and quality, if the future transnational cooperation is driven by a deep understanding of ongoing transformation processes in respective value chains. It is obvious that such transformation processes may have different dynamics in different regions. Therefore, clusters should focus their international and global partnerships on those regions with the highest dynamic. This is one important pre-condition to successfully conquer related markets or initiate mutual cooperation with sustainable impacts. Support services, concerning internationalisation of clusters, offered by cluster managers, have to take this fact seriously into account. Roadmapping, Transformation-Scanning, Trend-Scouting, Four Lights, etc. are promising business support services to prepare SMEs in clusters for internationalisation and to be able to benefit from such transformation processes in emerging industries. Business intelligence and the understanding of how and why transformation processes happen in dedicated emerging industries will be a key success factor for cluster managers in the future - and for their involved companies as well.

Cluster managers, together with their cluster firms, have to better understand such transformation processes. Business support services, based on market intelligence, can be considered as the ideal base for benefiting from ongoing transformation processes. Internationalisation of clusters gains a new dimension when future transnational cooperation is driven by the understanding of ongoing transformation processes in respective value chains.

Some specific reactions and changes in value chains of the selected Emerging Industries are further discussed in the annexes to the “European Cluster Trends Report” (Cluster_Trend_Report).

¹⁹ *The Smart Guide to Service Innovation, Guidebook Series, European Commission, Brussels, 2012, available at: http://ec.europa.eu/enterprise/policies/sme/regional-sme-policies/documents/no.4_service_innovation_en.pdf*

²⁰ *Cluster Collaboration and Business Support Tools to Facilitate Entrepreneurship, Cross-sectoral Collaboration and Growth, European Commission, Brussels, , 2014 available at: <http://ec.europa.eu/enterprise/initiatives/cluster/observatory/2014-10-10-eco-report-d4.1.pdf>*

	Transformation	Customer service orientation	Business relationships	Agile implementation strategies	Business process orientation	Sustainable competitive advantage orientation	Information sharing	Knowledge-based learning orientation	Virtual integration concepts
	Sub-Trends								
Logistical Services	<i>Internet Everywhere</i>	✓	✓✓		✓	✓	✓✓		✓
	<i>e-Commerce</i>	✓✓		✓	✓	✓✓			
	<i>Cyber Physical Systems</i>		✓	✓				✓	
	<i>Future Internet</i>	✓	✓					✓	
	<i>Trillion Sensor</i>					✓	✓✓		
	<i>Faster time to deliver (concept to market)</i>	✓✓	✓		✓	✓	✓✓		✓
	<i>Simplification in conducting business</i>		✓	✓	✓✓				
	<i>Faster and informed decision making</i>	✓	✓				✓✓		
	<i>Transparency, Tracking and Tracing</i>		✓				✓		✓✓
	<i>Anytime, anywhere access to resources</i>				✓✓	✓	✓✓	✓	
	<i>Emergence of the Prosument</i>	✓✓	✓			✓	✓		
	<i>Everything immediately</i>	✓✓					✓		
	<i>Everything everywhere</i>		✓✓				✓✓		
	<i>Mass production with batch size one</i>	✓✓	✓		✓✓		✓		
	<i>Emerging markets</i>	✓		✓					✓
	<i>Mobility cost volatility</i>		✓✓				✓		✓✓
	<i>Local content</i>	✓	✓✓				✓✓		✓

	Transformation Sub-Trends	Customer service orientation	Business relationships	Agile implementation strategies	Business process orientation	Sustainable competitive advantage orientation	Information sharing	Knowledge-based learning orientation	Virtual integration concepts
	<i>Extension of the coverage area</i>			✓		✓	✓		
	<i>Demographic changes</i>	✓						✓	
Creative Industries	<i>Faster time to deliver (concept to market)</i>			✓		✓			
	<i>Simplification in conducting business</i>			✓	✓				
	<i>Increased velocity of processes</i>				✓✓		✓		
	<i>Faster and informed decision making</i>			✓	✓✓				
	<i>Adaptive to changing business environment</i>			✓✓			✓	✓	
	<i>Emergence of the Prosument</i>	✓		✓			✓		
	<i>Fast advice - price & performance comparisons, blogs and online reviews</i>	✓✓		✓	✓		✓		
Medical Devices	<i>Digitalisation</i>	✓				✓✓	✓✓		
	<i>Personalised Healthcare</i>	✓✓		✓			✓	✓	
	<i>More years, better life</i>	✓✓						✓	
	<i>Theranostics</i>	✓			✓		✓✓		
	<i>Point-of-Care Healthcare Technologies (POCHT)</i>	✓				✓	✓		
Advanced Packaging	<i>Functional Packaging</i>	✓✓		✓		✓			

	Transformation	Customer service orientation	Business relationships	Agile implementation strategies	Business process orientation	Sustainable competitive advantage orientation	Information sharing	Knowledge-based learning orientation	Virtual integration concepts
	Sub-Trends								
	<i>Combining economy and ecology</i>			✓	✓✓				
	<i>Smart packaging for specialty products</i>		✓		✓	✓✓			
	<i>Enhancing traceability</i>	✓					✓✓		
	<i>Fighting counterfeiting</i>		✓✓			✓	✓	✓	✓
	<i>Labelling & Branding with Packaging</i>	✓	✓						✓
Mobility Technology	<i>Same devices for similar activities</i>				✓	✓✓	✓✓		
	<i>Consumeration of IT</i>			✓✓			✓		
	<i>Shared w/wl infrastructure</i>				✓		✓✓		✓
	<i>Single device/converged services</i>								
	<i>Cloud Computing</i>						✓✓		✓
Environmental Industries	<i>Decoupling economic growth from environmental pollution</i>			✓		✓v			
	<i>Digitalisation</i>			✓		✓	✓		
	<i>Big Data</i>			✓			✓✓		
	<i>Trillion Sensors</i>		✓				✓		✓
	<i>Renewable energy</i>					✓✓			
	<i>Contamination control</i>						✓		

	Transformation	Customer service orientation	Business relationships	Agile implementation strategies	Business process orientation	Sustainable competitive advantage orientation	Information sharing	Knowledge-based learning orientation	Virtual integration concepts
	Sub-Trends								
	<i>Risk evaluation</i>				✓		✓	✓	
	<i>Remediation & Recycling economy</i>		✓		✓	✓	✓	✓✓	
	<i>Sustainable development</i>	✓				✓✓			
	<i>Urban mining</i>			✓✓			✓		✓
Blue Growth Industries	<i>Shortage of potable water</i>				✓✓		✓✓		
	<i>Protection of coastal areas</i>			✓			✓		
	<i>Increase of seaborne trade volume</i>						✓✓		✓
	<i>Food & water production</i>	✓✓				✓			
	<i>Additional space by land reclamation</i>	✓				✓			
	<i>Off-shore fossil fuel</i>				✓✓				✓
	<i>Renewable offshore energy</i>			✓		✓	✓	✓	
	<i>Deep sea mining</i>			✓			✓	✓✓	

Figure 7: Transformations in Value Chains of the Emerging Industries – “crossover points” with the most common response (✓✓ = very strong, ✓ = strong)

4. Cluster Internationalisation

4.1 Rationale for Internationalisation

Globalisation is radically reshaping the business environment of most companies. Globalisation tends to benefit primarily larger companies in particular, because these companies are able to exploit new opportunities and increasing their access to new markets, resources, and knowledge. As a consequence, SMEs in the European countries are faced with competition from large companies in their home markets. On the other side, enterprises from emerging economies start to enter these markets based on locational advantages. Additionally, their expanding demand for resources increases prices for commodities, resources, and raw materials.

As a consequence, the global shifts in market dynamics will restrict growth opportunities of SMEs as long as they focus only on their home market. SMEs may respond to these challenges through various ways. One option is to use business opportunities outside their home markets more intensively and more broadly, i.e. to actively participate in the process of globalisation. Another option is to strengthen their innovative capabilities in order to avoid price competition and to differentiate their products from those of the new competitors from abroad. Combining both strategies, internationalisation of innovation activities may be particularly beneficial to SMEs from European countries.

In this study, internationalisation is seen as the process, in which firms start or increase their operations within a global environment. This is done by increasing awareness regarding the direct and indirect influences of international activities and the planning and implementation of various cross-border transactions. In the course of this alignment, internationalisation becomes a process of adapting the companies' operations (in e.g. strategy, structuring, resourcing, etc.) to an international environment.

To analyse the role and importance within the Emerging Industries (in this study), it is necessary to create a clear view on these industries concerning their specifics and comparability. The assumption for the following examination is that industries having the strongest linkages to the global mega trends (as the selected Emerging Industries) and which are undergoing the most rapid transformation processes will also have, at the same time, the strongest needs for internationalisation. This is evident, because internationalisation in a previous chapter (please refer to chapter 3.1) has been determined as the one of the most important common characteristics, due to its comprehensive approach and its multidimensional implications. Whereas several of the common characteristics influence specific parts of the value chains, internationalisation has a broader influence. Therefore, internationalisation is elaborated further in this chapter.

Internationalisation will influence and change, as distinct from all the other common characteristics of the value chain transitions, not only inbuilt elements of the value chain or these of the contiguity. In contrast to the aforementioned characteristics, internationalisation also has an impact with a much broader effect as it will affect basically all other elements of an ecosystem.

Figure 8 shows (for simplicity along the supply chain, here considered as the "inner core" of a value chain) the links and opportunities that arise/can arise from internationalisation, which may affect all elements of the value chain. The example in Figure 8 shows OEMs, suppliers (tier 1 to tier 3) R&D providers and raw material suppliers. A successful internationalisation can manifest itself when the OEM gains access to deals of suppliers from different foreign regions or to R&D offerings from other regions, or (relatively common), when the OEM uses services of raw material providers from abroad. Just as well, a TIER 1 or TIER 2 supplier can be served by several TIER 3 suppliers from elsewhere, despite the currently observed trend to more regionalized supply chains. For other examples, the figure is self-explaining.

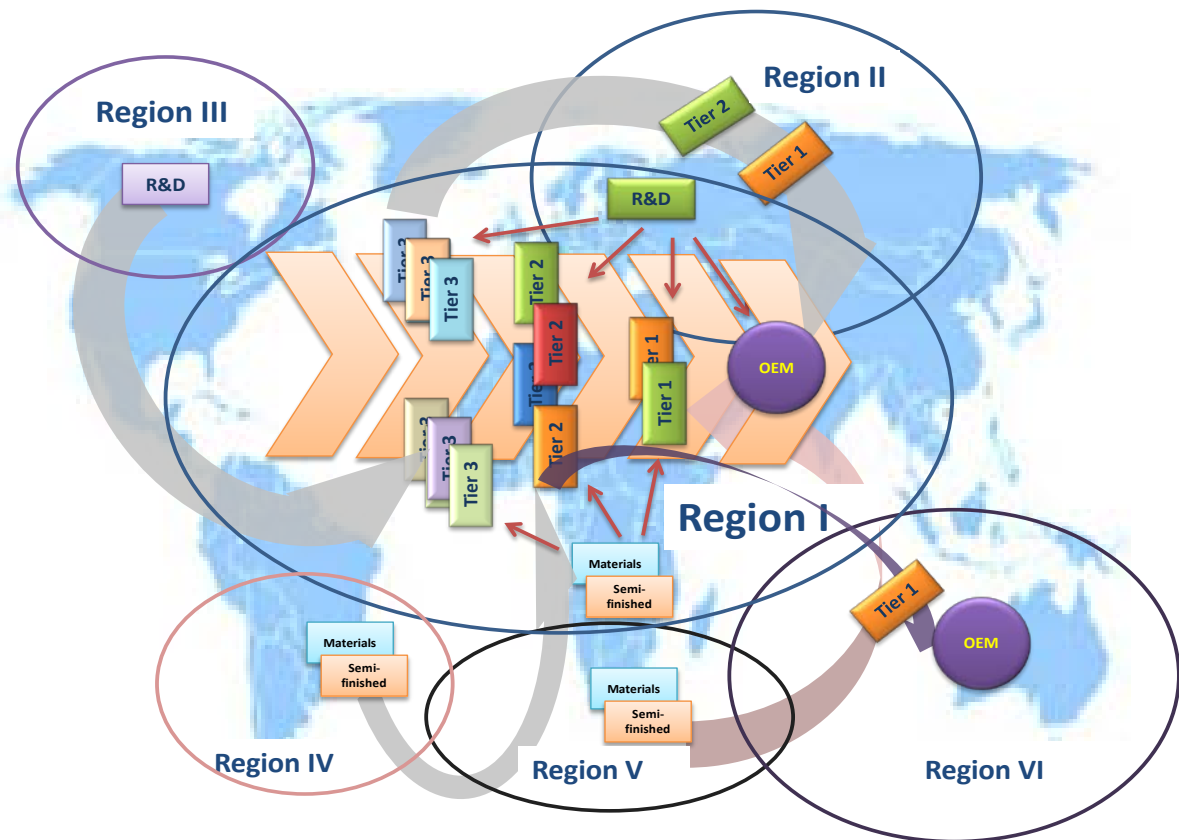


Figure 8: Paths of internationalisation along a value chain (source: VDI/VDE-IT)

4.2 Clusters as a Springboard for Internationalisation of Firms

Clusters act as real "springboards" for firms, especially small and medium enterprises (SMEs) to help them increasing their competitiveness and thus supporting them in getting access to global value chains and new markets²¹. Cluster participants can benefit from specialised business support services of cluster organisations stimulating and organizing these actions. In particular, if firms have to increasingly integrate their activities into global value chains in order to become and remain competitive, being part of a cluster is supportive. This is, especially the case in emerging industries considered in this report.

Clusters in the emerging industries face the needs for internationalisation as shown in the previous chapter. Transformation processes within value chains urge clusters to think global and internationalise accordingly. Internationalisation may no longer be understood as expert promotion or initiating publicly funded R&D projects. Furthermore, the prevailing reason for considering an international scope is to keep their lead in technological development, identify upcoming market needs, properly reacting to transformation processes and to strengthen their own position on markets worldwide. Fur-

²¹ Meier zu Köcker, Müller, Zombori, *European Clusters Go International: Networks and Clusters as Instruments for the Initiation of International Business Cooperation*, 2011, (To view electronic version: http://www.iit-berlin.de/publications/iit_Europe%20Clusters%20go%20International.pdf)

thermore, the expectation to improve the access to identified new niches and target markets, in order to take advantage of the cooperation more easily and efficiently, is a common motive.

Consequently, cluster managers are more and more taking over the responsibility to initiate internationalisation of their cluster members²². The cluster participants and mainly SMEs often lack time, resources, know-how, information or budgets to successfully realise internationalisation processes. There are many other reasons why SMEs are reluctant to go international²³. This is the rationale why cluster organisations can provide customised supporting measures and tools to the cluster participants on their paths towards internationalisation, as they usually have more resources at their disposal and are more experienced in internationalisation matters²⁴. A common understanding within clusters, a sophisticated internationalisation strategy and a consequent implementation of related actions are the prevailing key success factors for internationalisation of clusters²⁵. However, this requires specific cluster manager internationalisation skills for building long-term transnational and cross-sectoral cluster partnerships²⁶.

The transformation processes within emerging industries are impacting market needs and market developments, and they are also having technological impacts - on a regional/national/international level. Firms have to know and react to these trends and have to adopt their (international) business. In many respects, this can be considered as a paradigm chain when it comes to an internationalisation of clusters. The cluster participants alone are no longer the driver for internationalisation (e.g. selecting regions or deciding what kind of internationalisation is needed) rather than the different transformation processes in different emerging industries impact the way how to internationalise. In this case, cluster organisations can support firms by offering tailor-made internationalisation services, taking the industry-specific trends and transformation processes into account. This new international business orientation of clusters, especially if they gain critical mass, will create also further impact on the industrial transformation processes.²⁷

Internationalisation activities demand certain capabilities at the side of SMEs, including financial resources, organisational skills, capabilities to deal with new, unfamiliar business environments, and to absorb external knowledge while also considering the protection of their own knowledge.

Clusters are without any doubts important instruments for the promotion of innovation and competitiveness. They are separated, special "industry eco-systems", providing an ideal ground for experimenting with new business solutions, and they play an important role as catalysts for structural chang-

²² Meier zu Köcker, Buhl: *Internationalisation of Networks – Barriers and Enablers, Study on behalf of the BMWi, Berlin, 2007* (To view electronic version: <http://www.clustercollaboration.eu/documents/271106/0/Internationalisation%20of%20Networks.pdf/79a9be90-a1ba-4093-8bc6-b0deb191372b>),

²³ Zombori, input paper "International Cluster Cooperation for SMEs: Towards an European Approach, EC, 2012 (To view electronic version: <http://www.tci-network.org/news/557>)

²⁴ Greenhalgh (editor), *Cluster internationalisation tactics project – handbook for cluster internationalisation, European Cluster Alliance, on behalf of EC, DG Enterprise and Industry, 2012*, (To view electronic version: https://www.google.de/search?q=Cluster+internationalisation+tactics+project+%E2%80%93+handbook+for+cluster+internationalisation&ie=utf-8&oe=utf-8&gws_rd=cr&ei=L3_UVITUC47PaKOMgpAK)

²⁵ Meier zu Köcker, Müller, Zombori, *Key Success Factors for the Internationalisation of Clusters, Journal of Competitiveness, January 2012, Volume 2, Issue 1, 72ff* (To view electronic version: <http://competitiveness.in/wp-content/uploads/2012/01/JOCS-2012.pdf>)

²⁶ Pattinson, et. al., *Research Paper on Cluster Manager Internationalisation Skills and Key for Success in Managing and Promoting pan-European Strategic Partnerships, INNO-AG, 2014*, (To view electronic version: <http://www.clustercollaboration.eu/documents/2736637/2945973/150120+Final+Research+paper+Final+Report+December+2014.pdf/db5b245e-b77a-400d-9712-5bda649a4fbc?version=1.0>)

²⁷ Meier zu Köcker, Nerger, Lämmer-Gamp, *Cluster Collaboration and Business Support Tools to Facilitate Entrepreneurship, Cross-sectoral Collaboration and Growth, Cluster Observatory, EC, 2014* (To view electronic version: <http://ec.europa.eu/enterprise/initiatives/cluster/observatory/2014-10-10-eco-report-d4.1.pdf>)

es because they contain a high density of "reactants", which are interacting on a high level. Therefore, it can be expected, that the observed relevant changes will run a bit earlier, run also faster and will be better to be studied. Due to these properties, **clusters are excellent test benches** to investigate several changes in industries, eco-systems or economies.

While clusters as a concept have been known for a long time, the importance of cluster organisations as key drivers for industrial change is still a more recent phenomenon. Cluster organisations are important facilitators within clusters as they manage networks of companies, universities and research institutions that develop and sell products and services. Therefore, the investigation of the focus and quality of activities and the strategic approach of the cluster management will lead to an insight of the internationalisation of clusters and about the changes inside their value chains, caused by internationalisation. Whenever the internationalisation process is undertaken by a cluster, it aims to attain several ends, prominent ones being: increased access to knowledge, market, and key infrastructure. Internationalisation also helps to get access to new business partnerships and collaborative research.

Internationalisation will allow them to enlarge their knowledge base by sourcing knowledge, technology and skills from other locations than their traditional environment, and can thus contribute to more ambitious and more efficient product solutions. Approaching new markets often requires products that are adjusted to the specific environment in these markets. Developing or adopting such product solutions at the location of potential customers may be more effective and will lead to an enhanced market positions. The market success of new products does not only depend on a technological advantage, but also on competitiveness in terms of price and performance. Utilising the opportunities of globalisation by an internationalisation concept based on the development of innovative solutions, and upgrading existing production activities abroad through process innovation may noticeably contribute to an improved competitiveness of SMEs in a changing business environment.

Therefore, it can be assumed that developments and reactions (as answers to external impulses), such as e.g. internationalisation as a consequence of transformations inside of value chains, can be observed much earlier, on the basis of the huge self-amplifying effect inside a cluster and due to the strong links between the protagonists with a much stronger effect. Given the obvious, clear technological affiliation, they are much more distinctive, and due to the demarcation of the area under investigation also much clearer as under the conditions of a normal simple economic area without a structure on a high-level.

The internationalisation of clusters is by far not a new topic. The majority of cluster organisations are already active. Thus, it is interesting to see, whether and how clusters do already respond to the previously identified transformation processes. In the following, a closer look is given as to how and to what extent clusters in emerging industries vary in terms of:

- international orientation of the cluster participants by specific emerging industries;
- importance of international cooperation along value chains;
- prevailing framework conditions for internationalisation;
- business support services offered by cluster organisations to support cluster participants to cooperate internationally.

This study makes use of the comprehensive data pool of the European Secretariat for Cluster Analysis (ESCA)²⁸. The here used extracts of the overall cluster benchmarking data consist of data of 154 cluster organisations, only clearly belonging to the selected ten Emerging Industries and being assessed in the period from July 2012 to June 2014. Thus, a large up-to-date data set on internationalisation aspects of various European organisations is available allowing the identification of current trends: from companies, also from SMEs, R&D organisations, and all kinds of education/training providers, all

²⁸ see www.cluster-analysis.org

active in clusters dealing with the selected Emerging Industries. Different types of parameters are considered and analysed in this study:

- "Status of internationalisation of the cluster participants",
- "Importance of internationalisation in the strategy of the cluster",
- "Activities and services regarding internationalisation provided within the cluster" (e.g. initiation and facilitation of trans-national cooperation, initiating international R&D cooperation and projects or opening international business),
- to a limited extent "Degree of positive effects of the activities within the cluster regarding the internationalisation of the cluster participants",
- "Intensity of collaboration with foreign clusters",
- "Target regions for the international collaboration".

In the following two chapters, the cluster-related data is used to illustrate, on one hand, the recent internationalisation aspects of European clusters in each of the Emerging Industries, and on the other hand, the target regions and intensities of international collaborations of clusters in the Emerging Industries distinguished according to their geographic origin.

4.3 International Collaboration of European Clusters in Specific Emerging Industries

Aggregating the existing data (see chapter 4.2) on a very high level allows comparing the strategic orientation of clusters in each of the Emerging Industries with their spectrum and intensity of services available aiming to support internationalisation. Clusters, in this context, are used to represent their industrial sectors as such. Figure 9 demonstrates that strategic importance of internationalisation as well as the spectrum and intensity of services regarding internationalisation offered by cluster organisations vary quite significantly between the different emerging industries.

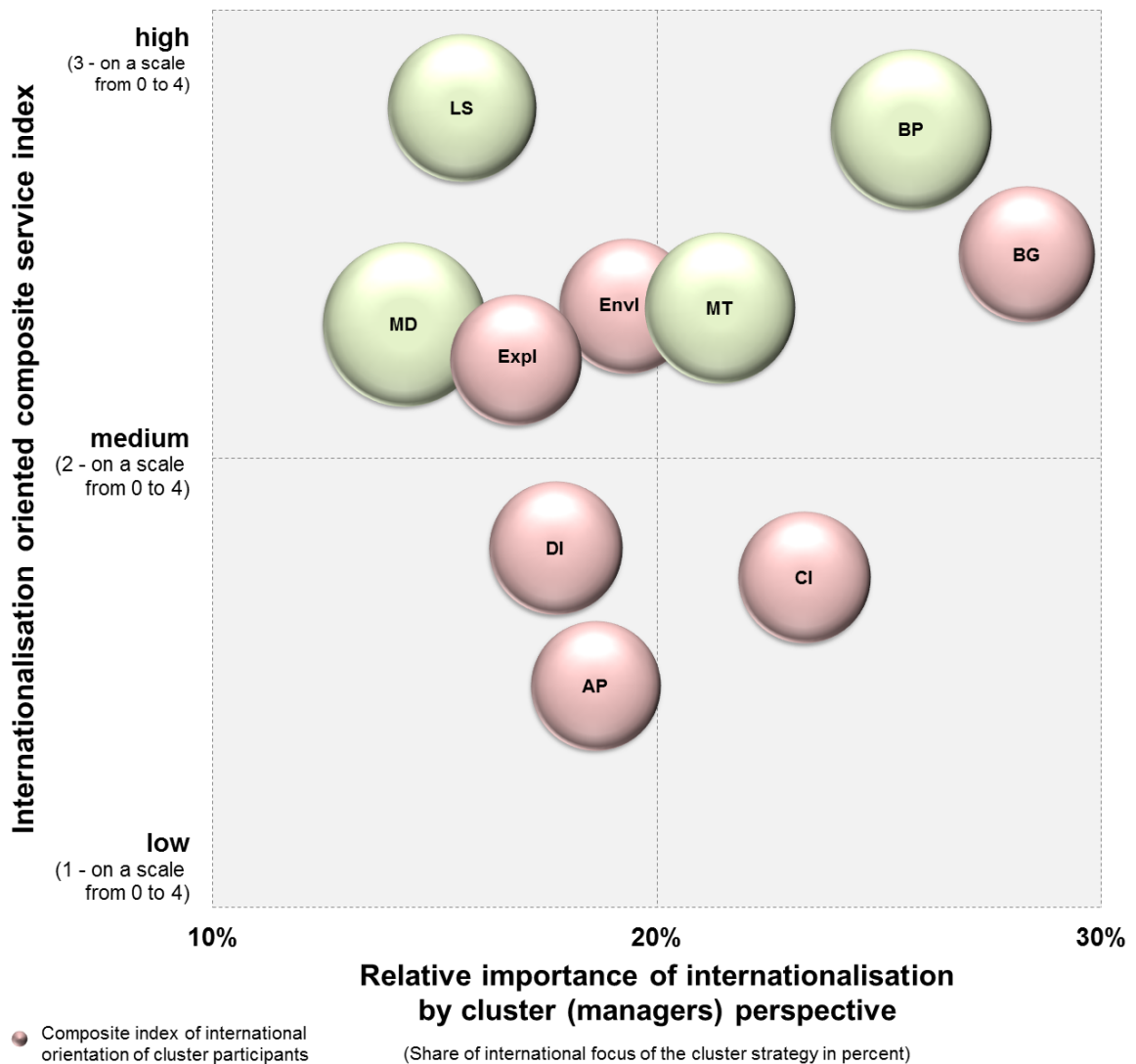


Figure 9: Portfolio analysis of selected internationalisation aspects of European Clusters in the different Emerging Industries²⁹ (source: VDI/VDE-IT)

The allocation of the different industries within this portfolio “strategic importance” versus “related services” furthermore has to be seen in the context of the status or degree of internationalisation of all the stakeholders within this sector. If the status of internationalisation is (very) high, within clusters, the issue of internationalisation does not necessarily need to be specifically addressed, as it is omnipresent. Even though the assessed internationalisation status of cluster participants in all emerging industries was higher than average (compared to all >600 clusters of which data is available in the ESCA database), there are some differences: The size of the “bubble” represents the status of internationalisation, for four of the emerging industries (green colour) a slightly higher status was assessed than for the rest.

Cluster organisations in the field of Blue Growth, Biopharmaceuticals, Environmental and Mobility Industries offer quite an intensity of international support services for their cluster participants, since the importance to act internationally is considered to be high (upper right square). In these cases, the services spectrum is often considered as a dedicated demand due to the high importance. Conse-

²⁹ abbreviations according to Figure 1

quently, less and fewer services are offered in the field of Digital Industries and Advanced Packaging, as the importance for internationalisation is considered to be comparably low.

However, Figure 9 also displays that for cluster participants in the field of Creative Industries, there seems to be a mismatch between strategic importance for internationalisation (which is high) and a comparably low amount of services for internationalisation. But practice has shown that firms being active in this field tend to be reluctant to accept internationalisation support services, even if cluster organisations offer such services in sufficient quality, and even if the cluster firms do know that internationalisation is of high importance³⁰. Since firms in this industry are often very small and do neither have experiences and capacities to go international nor do they have the financial capability, they do often not become internationally active although they should do so. Creative Industries firms, often consist only of some individual artists, which are usually trying to serve their home markets rather than going international³¹. Summarizing the adsorptive capacity of many firms in Creative Industries, the ability to internationalise is limited. Cluster organisations in the field of Logistical Services, whose cluster participants are already quite internationalised (comparably big-sized bubble in Figure 9), still offer a lot of support services (like match-making, strategic partnerships, etc.), although the strategic importance of internationalisation is considered to be decreasing. The respective services offered by cluster organisations have created, according to the explanations of many cluster participants, quite high, positive impacts and helped them to go international. Since these services still have a positive impact on international business, cluster participants appreciate to make further use of them. However, since cluster participants are more and more internationalised, the importance from the cluster participant side is decreasing. Another explanation is that four out of twelve hotspots of strong mutual interdependencies between global mega trends and emerging industries (see Figure 5) can be grouped even to Logistical Services, meaning that cluster participants have to act very globally to follow these hot spots. Thus, it is expected that the importance of internationalisation, following these global transformation trends, might rise in the future.

Cluster participants from industries like Medical Devices or Biopharmaceuticals seem to be more internationalised already than cluster participants from Advanced Packaging or Experience or Creative Industries. Reasons for this might be that Medical Devices or Biopharmaceuticals are quite well established and international R&D and business cooperation are state-of-the-art, whereas Advanced Packaging is a quite young and small sector, not yet much dominated by international R&D or business cooperation. However, it seems to be quite interesting that cluster participants from Digital Industries and Environmental Industries are comparably less internationalised.

However, the result of the analysis presented in Figure 9 can only be considered as a snapshot of the current status quo. For cluster policy-makers and cluster managers it is also important to know the future importance of internationalisation in the different emerging industries. When only considering the axis of abscissae in Figure 9, this compares the order of current degree of internationalisation of cluster participants in the respective ten emerging industries with the strategic importance of internationalisation. It is interesting to see that for Biopharmaceuticals and Mobility Technologies, the status of internationalisation of the cluster participants is high as well as that the future importance of internationalisation within the respective clusters remains high as well - meaning cluster participants are considering internationalisation as still of high strategic importance. When it comes to Medical Devices and Logistical Services, the cluster participants are quite well internationalised, but the importance of internationalisation is decreasing. As already mentioned, the reasons might be that due to the high

³⁰ Meier zu Köcker, Müller, Zombori, *Cluster in Emerging Industries, Working Paper of the Institute for Innovation and Technology (iit), Berlin, 2012, Vol. 9, (To view electronic version: <http://www.iit-berlin.de/de/publikationen/iit-perspektive-9>)*

³¹ Lämmer-Gamp: *Creative Industries – Policy recommendations – promotion of cross-innovation from creative industries, Institute for Innovation and Technology (iit), Berlin, 2014, (To view electronic version: <http://www.iit-berlin.de/de/publikationen/creative-industries/>)*

level of internationalisation of the cluster participants, international cooperation is state of the art, and much further attention is given to this topic. However, it is interesting to see that the three of the four Emerging Industries (Biopharmaceuticals, Medical Devices, Logistical Services as well as Mobility Technologies) of which cluster participants are most internationalised, seven out of twelve AIOS (Areas of strong interdependencies) of strong mutual interdependencies between global mega trends and emerging industries can be grouped (see Figure 5). It is no surprise that especially these AIOS are dedicated targets of global competition and cooperation. The reason for this is not only due to the fact that these industries are per se internationally positioned. This applies both, for their value chains and their markets and customers. If the reactions to external stimuli such as mega trends shall create long-term positive results in these mentioned industries, they must cover the entire "reaction room" of these industries, what means that they would have to be internationally active in every case. Figure 5 indicates that this awareness seems to be already implemented in a comprehensive manner in these emerging industries. Biopharmaceuticals shows the peculiarity that both, the degree of internationalisation and the recognition of the importance of such activities are quite high, which is evident from the portfolio positioning (in the fourth quadrant).

This industry has been faced already longer with the challenges of internationalisation and has already been in the duty to use several options to generate solutions – for example due to its origin story. As a result, the dynamics of regional development in the Biopharmaceuticals sector will be slightly less than in industries that are currently meeting increasing challenges of internationalisation and that have to react accordingly (Medical Devices, Logistical Services as well as Mobility Technologies).³²

Clusters in emerging industries like Blue Growth and Environmental Industries seem to become the future drivers for internationalisation, since the cluster participants are not yet fully internationalised, but there is common sense that internationalisation is gaining strategic importance. Here, cluster managers shall be motivated to increase their efforts to support their cluster participants to internationalise. Since the demand to internationalise is fully understood, there might be a high openness of the cluster participants to support the cluster managements. However, dedicated business services have to be created, taking the specific needs into account. Roadmapping, defining a common internationalisation strategy, identifying strategic partnerships as well as technology and market scouting shall be preparatory actions before taking dedicated actions. The understanding of the transformation process within the both respected Emerging Industries appears to be of high importance. Furthermore, cross-sectoral cooperation, when going international, can be considered as an additional success factor.

4.4 Trans-Regional Collaboration of European Clusters in Emerging Industries

Traditionally, internationalisation by exporting has been considered as a way to increase the growth of firms. Often, cluster organisation focus on activities to promote export possibilities for their cluster participants rather than striving for other aspects of internationalisation. The export of goods still remains significant, but during the studies conducted by the ESCA expert pool over the past, some interesting changes could be identified. Many firms within the investigated clusters have re-directed their focus on business activities of internationalisation besides export and are considering these to be important to achieve sustainable competitive advantages. Cross-border partnerships with foreign companies, foreign investments and cross-border networking have become increasingly important as opportunities to facilitate the exchange of technology and knowledge, which enable also SMEs to formulate international business concepts.

In the following, it is further investigated, in which intensity and in which geographical directions regions tend to cooperate. The expected differences as well as similarities will be shortly explained.

³² *Innovation in Pharmaceutical Biotechnology: Comparing National Innovation Systems at the Sectoral Level*, OECD Publishing, March 2006, p. 115 et seqq., ISBN-92-64-01403-9

Selected examples shall help to illustrate types and peculiarities of cluster cooperations between regions. For the following analyses, geographic regions were defined:

Northern Europe	Northwest Europe	Central Western Europe	Southwest Europe	Southeast Europe	Central Eastern Europe
Denmark Faroe Islands	England	Austria	France	Albania	Czech Republic
Faroe Islands	Ireland	Belgium	Portugal	Balkan	East Europe
Finland	Shetlands	Germany	Southern Europe	Bosnia/Herzegovina	Hungary
Greenland	UK	The Netherlands	Spain	Romania	Poland
Iceland		Switzerland	Italy	Turkey	Slovakia
Nordic Countries ³³				Croatia	Baltic Sea Region
Norway				Greece	Estonia
Sweden				Macedonia	Latvia
				Montenegro	Lithuania
				Cyprus	Belarus
				Slovenia	Moldavia
				Bulgaria	Russia
					Ukraine

North America	South America	Eastern Asia	Africa	Oceania	Arabian Peninsula
Canada	Argentina	China	Africa	Australia	Qatar
Mexico	Brazil	India	Namibia	New Zealand	UAE
North America	Cameron	Japan	Ruanda		Israel
Panama	Chile	Korea	Senegal		
USA	Colombia	Malaysia	Zambia		
	Peru	Singapore	Algeria		
	Uruguay	South East Asia	Libya		
		Taiwan	Morocco		
		Thailand	Tunisia		
		Vietnam			

Figure 10: Defined geographic regions for the investigation of trans-regional Collaboration of European Clusters in Emerging Industries

For each of the investigated Emerging Industries, from a pool of more than 50 representative clusters, those clusters were selected for analysis of their intensity and target regions of international cooperation, which were with their measured parameters inside the range of standard deviation. Thus, statistical outliers could be avoided, and the results give an image of the clusters' behaviour³⁴. In order to get a complete picture, cooperation regarding commercial and business activity was distinguished from cooperation regarding R&D. All figures demonstrating intensity and geographic priorities of the cooperation can be found in the Appendix A: to this report. Some examples are discussed in the following:

³³ This type of subsumption is used, when they were named by the interviewees instead of single countries. To avoid statistical distortions, only those subsumptions have been used which are assignable to the selected partitioning of the regions.

³⁴ Only data of clusters representing values inside the standard deviation were used, in order to give a representative overview and to exclude singularities.

4.4.1 Trans-regional Cooperation with Focus on R&D

Figure 11 shows that the prevailing regions' clusters from "Central Western Europe" cooperate with in the context of any R&D activities. It becomes obvious that clusters from Central Western Europe have intensive cross-border cooperation with Scandinavian and South-Western European peers as well as international cooperation within the own region (meaning other clusters and their participants). All these three regions, Scandinavia, Central as well as South-West Europe are known for their strong innovation capacity³⁵ as well as for the high density of strong R&D institutions. These supportive framework conditions enable such trans-regional cooperation.

From the perspective of Central Western European clusters, Eastern Asia and North America may be accepted as difficult R&D markets, especially by a SME point of view (clusters - to a large extent - represent the SME point of view). Trans-regional cooperation based on clusters is comparably weak (Figure 11). Existing funding schemes, which are always strong enablers for transnational R&D, are not well established between Europe and Eastern Asia/North Africa, which hampers such cooperation. Furthermore, the significant geographic distance and the different R&D culture can also be seen as a barrier³⁶. In these two regions, the industrial demand for services related to R&D may be strong, but is satisfied by strong and competitive domestic R&D providers.

Due to a structurally weak industry and a rather less developed R&D landscape in the other parts of Europe, the framework conditions for international R&D cooperation are less well developed, which results in weaker trans-regional cooperation between clusters from Central Western Europe with other European peer regions. The as weakly recognized cooperative relations of stakeholders in Central Western Europe to Northwest Europe can best be explained with the de-industrialisation of this Northwest Europe region during the past two decades. The existing activities are mainly those between R&D institutions of Northwest Europe, whose reputation is still extremely high, with partners in Central Western Europe.

It is interesting to notice that even due to the financial crises strong R&D-related ties still exist between Southwest and Central as well as Northern Europe. Trans-regional initiatives, like the Vanguard or the "Four Motors for Europe Initiative"³⁷ exactly gather clusters from these regions and support trans-border cooperation.

³⁵ *Regional Innovation Scoreboard 2014*, available at:
http://ec.europa.eu/enterprise/policies/innovation/files/ris/ris-2014_en.pdf

³⁶ Meier zu Köcker, Müller, Zombori, *European Clusters Go International: Networks and Clusters as Instruments for the Initiation of International Business Cooperation*, 2011 (To view electronic version: www.iit-berlin.de/publications/iit_European%20Clusters%20go%20International.pdf)

³⁷ <http://www.4motors.eu>

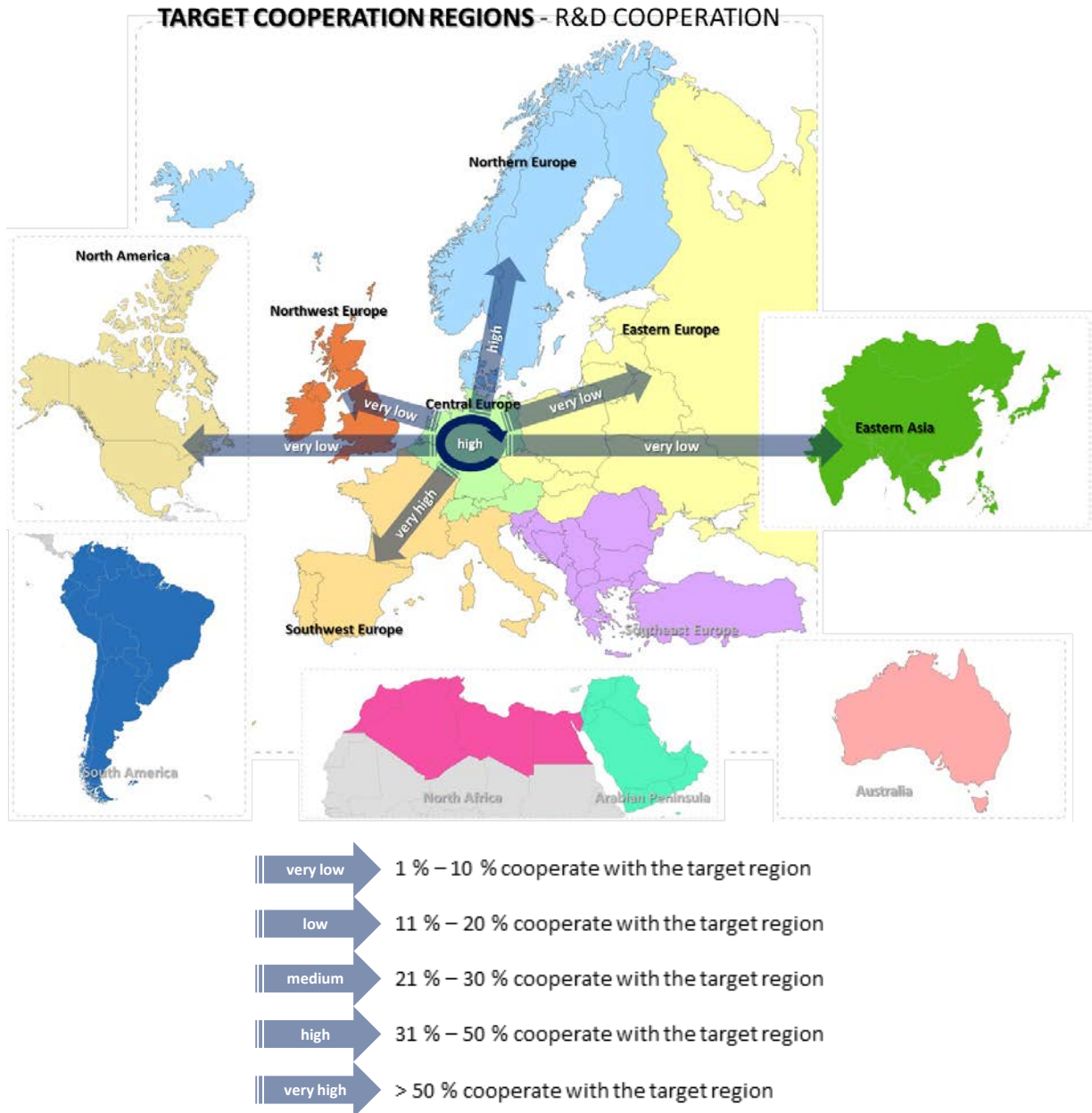


Figure 11: Target Cooperation Regions: R&D cooperation - Central Western Europe

A completely different picture emerges when having a closer look at clusters (cluster participants) from a region that has no sophisticated own R&D infrastructure and less developed framework conditions (see Figure 12 for South-East Europe). Efforts are basically inherently weak compared to all other regions in Europe, even within the own region. The relatively weak connections are clearly directed to Central Eastern Europe. This is due to relationships in the border area of neighbouring countries between partners with similar innovation capabilities. Other, only weak cooperation directed to North West Europe might be based on historical reasons (“alumni effects”). R&D cooperation with clusters (participants) from North America and Eastern Asia has not been observed, with some singular exceptions.

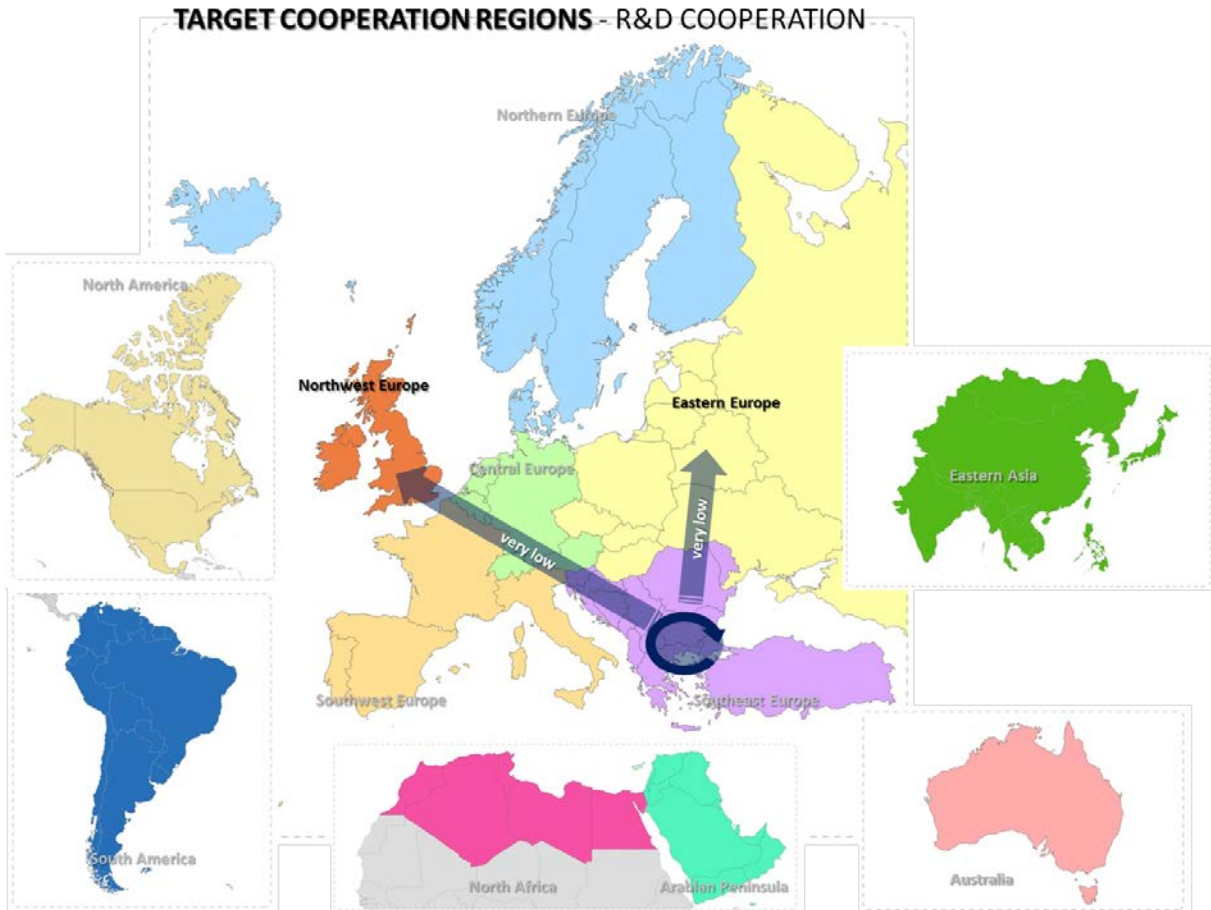


Figure 12: Target Cooperation Regions: R&D cooperation – South-East Europe

Appendix A: demonstrates how clusters from other regions mutually cooperate in the field of R&D and how strong these links are. Figure 13 shows a summary of the cluster-driven trans-regional cooperation with focus on R&D. Strong trans-regional cooperation can be observed between cluster participants from Northern and Central Western Europe as well as Central Western and Southwest Europe. However, significant cooperation can also be found between cluster participants from Northwest and Southwest Europe as well as of Southwest and Central Eastern Europe.

	Northern Europe	Northwest Europe	Central Western Europe	Southwest Europe	Central Eastern Europe	Southeast Europe
Northern Europe		-	+	-	-	-
Northwest Europe	-		-	o	-	-
Central Western Europe	+	-		++	-	-
Southwest Europe	-	o	++		o	-
Central Eastern Europe	-	-	-	o		-
Southeast Europe	-	-	-	-	-	

++ very strong cooperation, + strong cooperation, o medium strong, - weak cooperation

Figure 13: Cluster-driven trans-regional cooperation matrix in the field of emerging industries with focus on R&D cooperation

4.4.2 Trans-regional Cooperation with Focus on Business Cooperation

A much different picture emerges when the degree and direction of international commercial business³⁸ across Europe, initiated among cluster actors, is considered. That means that the satisfaction of the requirements of existing markets or the development of new markets with an internationally competitive product portfolio or the search for strong partners for tasks along the supply chain are the prevailing reasons for cluster participants to seek for trans-regional cooperation with other firms.

Figure 14 shows the typical image of the international orientation of an economically quite strong region like Northern Europe. International business cooperation is state-of-the-art, value chains are developed across these regions. The reasons for this are manifold: The intensity of cooperation is at least medium or even higher with other strong regions within Europe (Northwest Europe, Central Western Europe or Southwest Europe). Weaker cooperation exists with emerging markets (Eastern Asia, but also Central Eastern Europe). Africa, South America, Australia are virtually hidden. Weak industrialised regions therefore induce consequently only a weak response in terms of cooperation or of the ability to cooperate.



Figure 14: Target Cooperation Regions: Business cooperation – Northern Europe

³⁸ Business cooperation among cluster participants from different regions should be understood in a broader sense than just only focusing on export.

Some selected examples will illustrate the types of cooperation, the drivers and the expected directions of development. It can be expected that many ongoing industrial transformation processes will further strengthen this trend. The Scandinavian countries are traditionally strong in the sectors mobility and transportation. Here, a large R&D competence is concentrated, both in the university and in the industrial sector. The region around Gothenburg particularly stands out³⁹. The institutes (e.g. SP Technical Research Institute of Sweden, SWEREA, Chalmers) and industrial research departments (Volvo, Scania, Autoliv, Here (Nokia)) are best known to provide innovative solutions for more competitive environments in application fields such as active and passive driving safety, future traffic concepts, road safety, Heavy Duty Transportation or Telematics and Navigation. Also the manufacturers based in the region, especially in the mentioned areas, achieve outstanding research and development results. Not least, therefore, the chairman of the Working Group R&D of the European Association of Automotive Suppliers (CLEPA) comes from Autoliv, the world's largest automotive safety supplier. Autoliv is a Scandinavian company with sales to all of the leading car manufacturers in the world.

However, the industrial exploitation of these R&D results in the region is based on only a few, though powerful, but very focused OEMs such as Volvo and Scania. The establishment of co-operations for the extension of the application areas, and thus to the conquering of markets, therefore seems be obvious. Because of the concentration of both, as well as powerful suppliers along the entire value chain and also innovative OEMs, the goal for these cooperation activities with Central Western Europe is obvious. German OEMs, which are strong in car manufacturing, significantly extended cooperation with partners in the Skane region (Sweden). The reason is that know-how and capabilities in car communication is still seen as a future key success factor (please refer also to chapter 2.3). One of the centres of competences of mobile communications in Scandinavia is located in the Skane region, where Ericsson once manufactured mobile phones. Central Western European OEMs and suppliers identified these trends in the Mobile Technology sector and initiated respective cooperation with Northern Europe. This is a good example to demonstrate how new value chains have been created and why trans-national cooperation in this field is a must.

Other remarkable examples are: For the development of competitive, road-based freight transport solutions, Volvo leads, together European expertise, in a research centre in Lyon. This centre has grown out of a long-term cooperation with Renault in the truck sector.

The cooperation in the field of intelligent transportation systems (ITS)⁴⁰ brings together excellent Scandinavian navigational expertise, which emerged from the mobile tradition, with the system knowledge of German and French TIER 1 supplier for the development of a European Open Telematics Platform for street and rail traffic (HERE, Valeo, Continental, Bosch, Siemens).

Close research collaboration between the regions of Northern and Central Western Europe join the Scandinavian know-how in the field of heavy goods vehicles and alternative transport solutions together with the system knowledge of leading German system suppliers to develop marketable, eco-friendly and sustainable solutions for the road-based transport of goods. Examples are wired fics⁴¹, ⁴² or Induction Power Transfer solutions for mid- and long ranges (Volvo, Siemens, and Daimler).

Figure 15 shows another, but no less typical picture: Cluster participants from a less strong economy tend to be less able to initiate business cooperation with other cluster participants from other regions.

³⁹ *One of the five strong clusters in West Sweden: Urban future, the marine environment and the maritime sector, transport solutions, green chemistry and bio-based products, and life science.*

⁴⁰ *(Commission, 2010) defines ITS as systems in information and communication technologies which are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport.*

⁴¹ *See also: <http://www.metro.net/projects/i-710-corridor-project/>*

⁴² (Siemens AG, 2014)

Even within the own region, cross-border cooperation is comparably weak. However, there is transnational cooperation between South-eastern European cluster participants and other regions, but only on a low level.

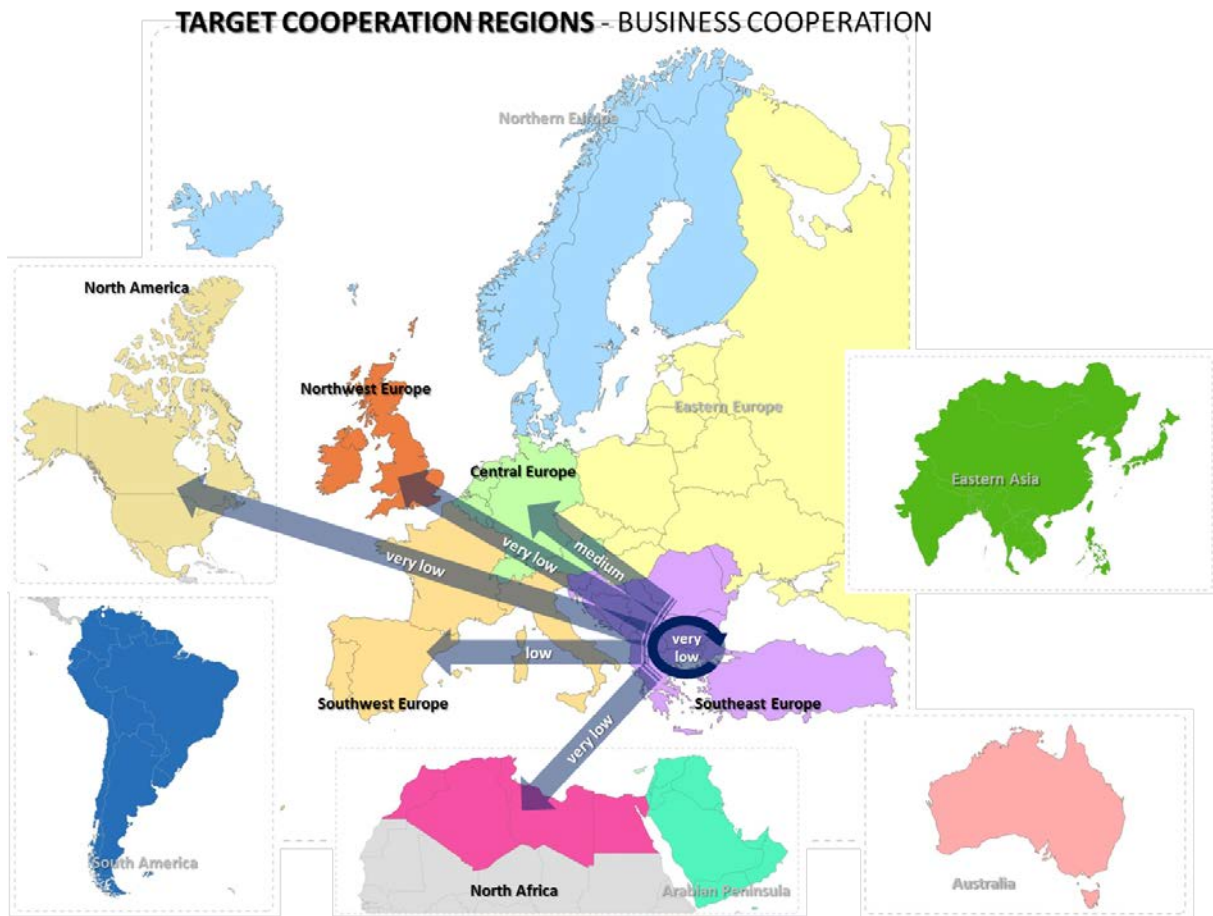


Figure 15: Target Cooperation Regions: Business Cooperation – Southeast Europe

The internationalisation efforts of cluster participants in Southwest Europe have, in contrast to most of the previously studied examples, the peculiarity that both - in the own region as well as with other regions - no strong cooperation but only comparably weak links can be observed (Figure 11). One reason for this may be due to the lack of a larger number of competitive stakeholders in the region who are striving for international excellence (or could do this). Their activities focus on regions where a broader community of suitable partners and related opportunities can most likely be found (cooperation within Southwest Europe and with Central Western Europe). Likewise, there are activities in regions with traditional ties (the Americas).

Appendix A: displays how clusters from other regions mutually cooperate related to business activities and how strong these ties are.

	Northern Europe	Northwest Europe	Central Western Europe	Southwest Europe	Central Eastern Europe	Southeast Europe
Northern Europe		o	++	+	-	-
Northwest Europe	o		o	-	-	-
Central Western Europe	++	o		++	o	o
Southwest Europe	+	-	++		-	-
Central Eastern Europe	-	-	o	-		-
Southeast Europe	-	-	o	-	-	
++ very strong cooperation, + strong cooperation, o medium strong, - weak cooperation						

Figure 16: Cluster-driven trans-regional cooperation matrix in the field of emerging industries with focus on Business Cooperation

Figure 16 shows a summary of the cluster-driven trans-regional cooperation with focus on business cooperation. Compared to Figure 13, trans-regional cooperation among cluster participants within emerging industries tend to be stronger in the field of business cooperation compared to R&D cooperation.

However, when having a closer look to the above mentioned examples, in which cluster participants across regional cooperate and create business along value chains, it was often the case that such cooperation had been initiated by cluster managements. Understanding the needs, the ongoing transformation processes and identifying new ways to enter new value chains is in many cases the pattern of success.

Cluster services, meaning specific, tailor-made services provided by cluster organisations to their cluster participants are important tools for cluster organisations, especially in the field of internationalisation. Practice has shown that cluster organisations can play a decisive role for the development of new industrial value chains and emerging industries, notably through creating a favourable environment. An appropriate strategy, mandate to internationalise and appropriate service spectrum, adapted to the transformation trends and needs of the cluster participants are the key to succeed.

However, the analyses also revealed that there is not a singular service offered by cluster organisations really contributing to the internationalisation success of cluster participants rather than a well-integrated, holistic approach of several complementary activities. Figure 17 demonstrates how it shall work. When deciding to go international to tackle new value chains or emerging industry starts with the observation that there is an opportunity (= “market intelligence services”), then partners are needed to develop ideas on how to take advantage of these opportunities (= “matchmaking services”); once ideas are born, they need to be translated into projects/measures (= “project development services”); new knowledge might be worth to be shared with others and funding is required (= “innovation vouchers”).

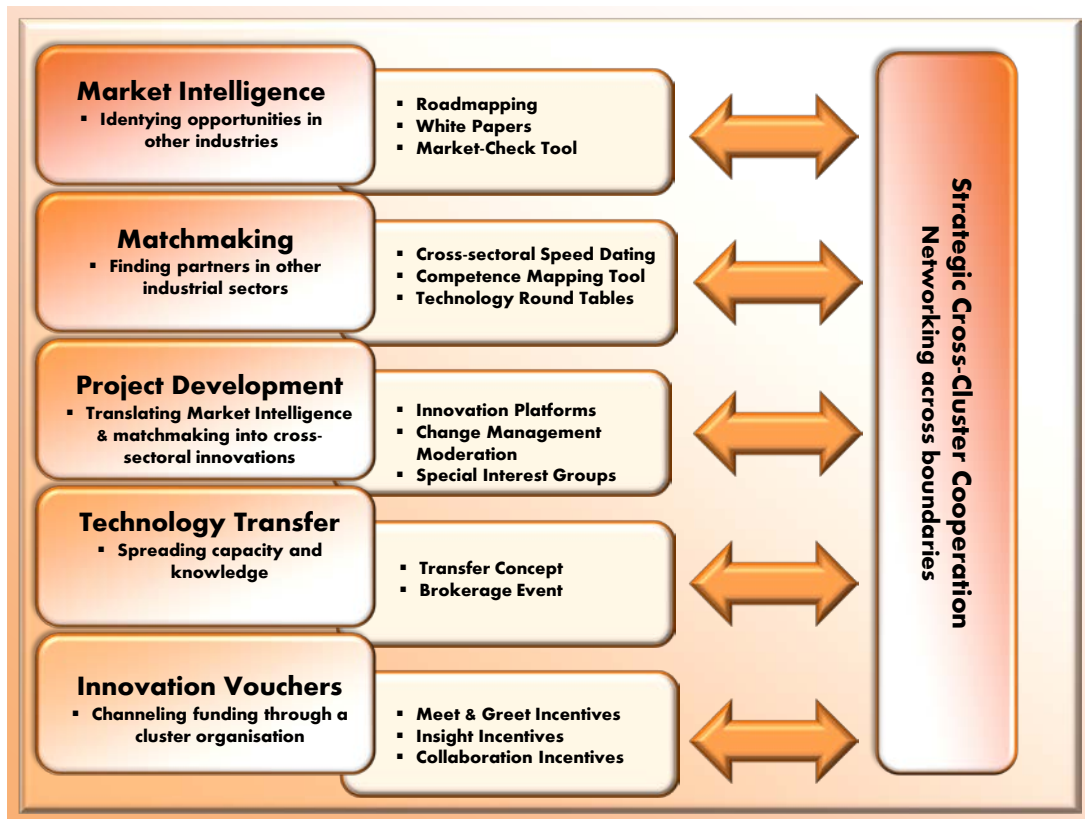


Figure 17: Service spectrum to promote international cross-cluster cooperation⁴³

4.5 Conclusion

The mega trends are considered as a framework in which society and economies have to function. They as well are giving the direction of changes. The mega trends thus influence the changes in all industries. Traditional industries undergo dramatic changes; emerging industries appear. This report discusses the development of dynamics in selected Emerging Industries as a contribution to master the future challenges of economic and societal development. Besides a short discussion of relevant mega trends, the following aspects were analysed:

- How do the mega trends influence emerging industries in their industrial transformations?
- Is there a ranking of impact, and are there noticeable differences or similarities between the industries and their value chains?
- Are there noticeable differences between industries, clusters and regions when it comes to international cooperation and are there common patterns in cluster internationalisation, useable as a blue print for further activities?

It was analysed in which of the emerging industries the most significant changes occur and how these changes come into effect. By this, twelve areas of strong mutual interdependencies between global mega trends and emerging industries were identified; please refer to Figure 5 in chapter 0.

It became evident that within the selected ten Emerging Industries significant transformation processes are ongoing. Mega trends heavily influencing these industries, but also vis-a-versa the emerging

⁴³ Cluster Collaboration and Business Support Tools to Facilitate Entrepreneurship, Cross-sectoral Collaboration and Growth, European Commission, Brussels, , 2014 available at: <http://ec.europa.eu/enterprise/initiatives/cluster/observatory/2014-10-10-eco-report-d4.1.pdf>

industries impact the current mega trends. Logistical Services and Mobility Technologies have revealed the most AOSI, meaning that these industries have the strongest interdependencies with the current mega trends. No surprise that Digital Industries (besides Logistical Services and Mobile Technologies) is seen as the Emerging Industry which is most exposed to current mega trends (Figure 5). With other words, here are the most and strongest transformation processes expected in the future.

And for the further economic and societal development - the identified AOSI could be considered as interesting domains for political and economic action.

Using a set of parameters (common for all specific value chains within the different value chains of the various emerging industries), these AOSI and their underlying industrial value chains were analysed further. By that a spectrum, a direction and a degree of intensity of the transition of these underlying value chains in the selected emerging industries were determined. The following parameters were identified as the most relevant and challenging for inducing transitions in the value chain:

- Collaboration-based intensive **information sharing**, using the opportunities of IT
- **Customer service orientation** described as the ability to switch from the traditional approach "one size fits all approach" to "different customers have different requirements"
- **Business process orientation** describing the ability of companies to overcome the traditional functional-orientation based on efficiency towards customer value
- A **sustainable competitive advantage orientation** characterised by a focus shift from short-term profit orientation to a long-term sustainable approach
- For the further economic and societal development, the identified areas of strong interdependencies could be considered as interesting domains for political and economic action. In addition, regions which focus on the above mentioned Emerging Industries have to be aware of such a high "market and technology" pressure. Thus the implementation of the Regional Smart Specialisation Strategies, built on the cluster approach, have to find proper answers for these transformation processes. But the industrial transformation processes enable and build new value chains across regions. This has to be understood as huge potential for regions and their respective clusters.

The analysed and described transformations within the emerging industries (being made operational in the related value chains) are without any doubts to be considered in a global framework. Thus, internationalisation is mandatory for any further prosperous economic and societal development. Therefore, it is necessary to analyse the status and attempts of the European stakeholders (firms and SMEs in particular) within the emerging industries regarding their international positioning. As clusters are considered as springboards for firms (and SMEs in particular), existing extensive data about cluster organisation already being active in internationalisation matters was analysed regarding the strategic and operational status of internationalisation of clusters and employed for assessing the internationalisation status within the emerging industries.

The importance of internationalisation of clusters varies between the emerging industries. Thus, they have to be considered not as one common block rather than a more diverse, individual element. Clusters of Logistical Services, Mobile Technologies, Biopharmaceuticals as well as Medical Devices are more internationalised than clusters from other the Emerging Industries. The importance for further internationalisation is, on the other side, higher for Blue Growth, Biopharmaceuticals, Creative Industries and Mobile Technologies. Cluster managements have in many cases already reacted to these framework conditions and offer proper support services.

It has also been shown that different regions tend to cooperate closer than others. This is not only due to the economic strength, the framework conditions or the R&D infrastructure rather than due to the fact that new value chains within these emerging industries have already been built across these regions. These streams of cross-regional cooperation have to be understood, especially by those clusters that are currently beginning with their internationalisation and which are new kids on the block.

Taking this into account, there has to be a paradigm change in internationalisation. Transnational co-operation streams have to be identified and understood. Based on this, proper strategies for participation on these streams when going international are the logical consequence.

The report also made evident that there is a strong link between international orientation of cluster participants and business services offered by cluster organisations. As displayed in Figure 17, cluster organisations from regions like Southwest, Central as well as Northern Europe offer highest intensity of internationalisation support services, whereas their firms are already quite internationalised. It can be expected that cluster participants from Central Eastern Europe will catch up soon, since cluster organisations already offer a lot of services as internationalisation is considered as highly important. South Eastern Europe is still lacking, but the high importance might motivate cluster organisations to become more active in the field of internationalisation. A better understanding about the ongoing transformation processes and increasing professionalization will be the key to further succeed.

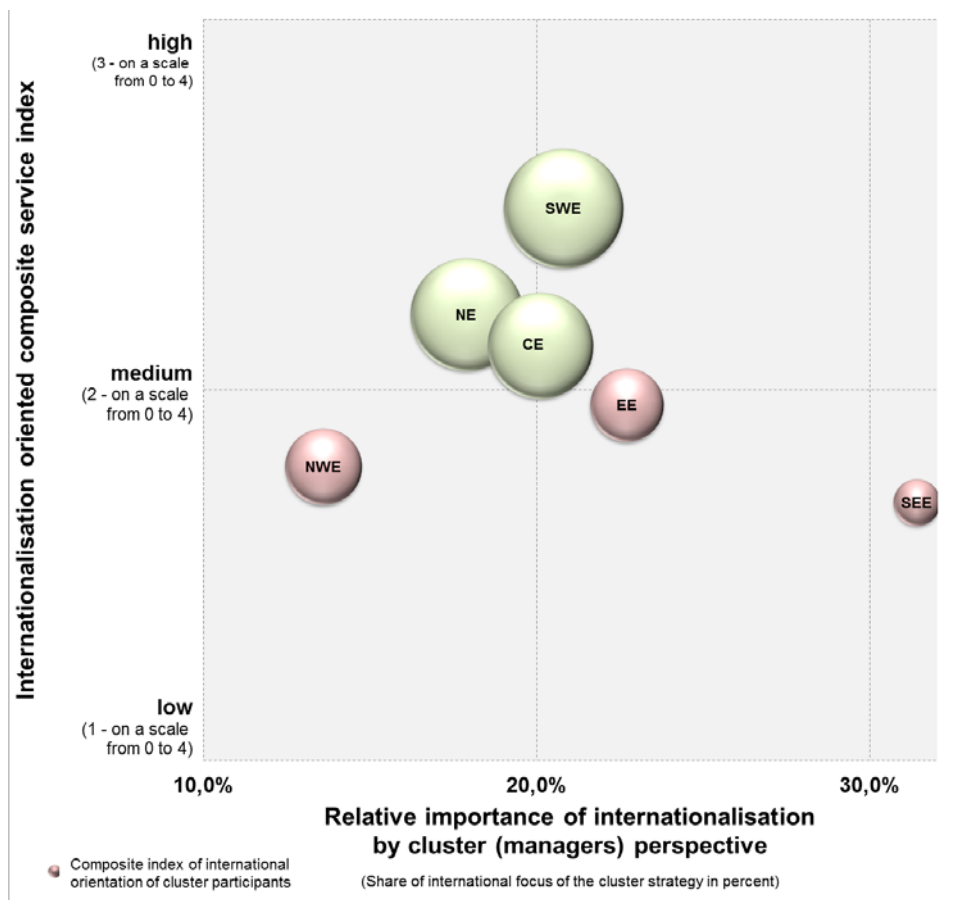


Figure 17: Portfolio analysis of selected internationalisation aspects of European Clusters in the different Emerging Industries (source VDI/VDE-IT)

All these findings lead to a conclusion that future policy and/or support measures for enhancing internationalisation should rather be specifically targeted to different industries in regions rather than to dedicated regions. Especially since the value chains and respective cooperation streams do not fit to political boundaries, the regional approach would not be appropriate. There are already good examples of innovative and international services, which are available and practiced, and which support these kinds of support measures.⁴⁴

⁴⁴ (Christensen, 2012), (Meier zu Köcker, 2011), (Müller, 2012)

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Appendix B: Target Cooperation Regions – the Comprehensive Overview

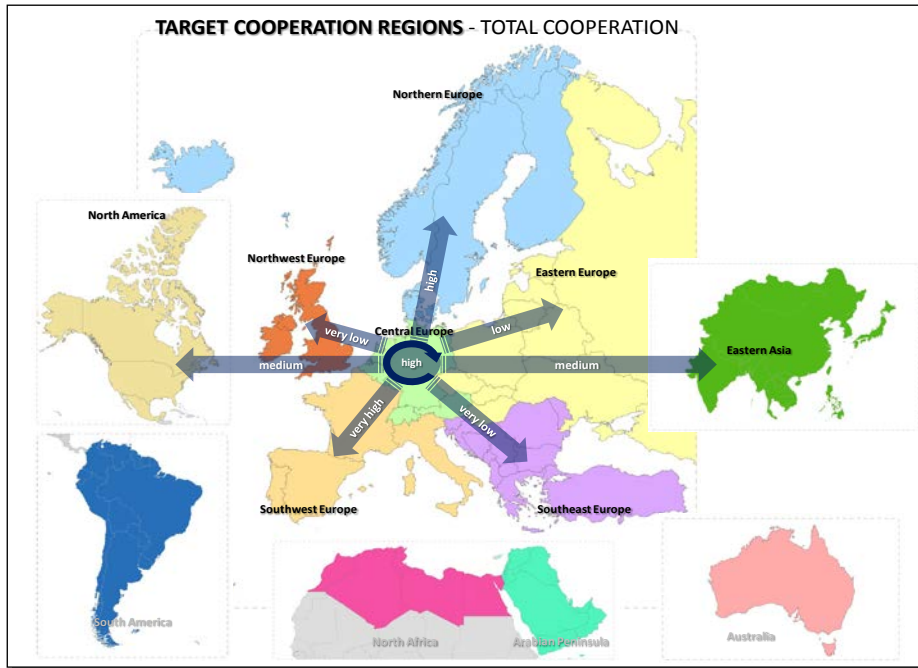


Figure 18: Target Cooperation Regions: Total cooperation – Central Western Europe

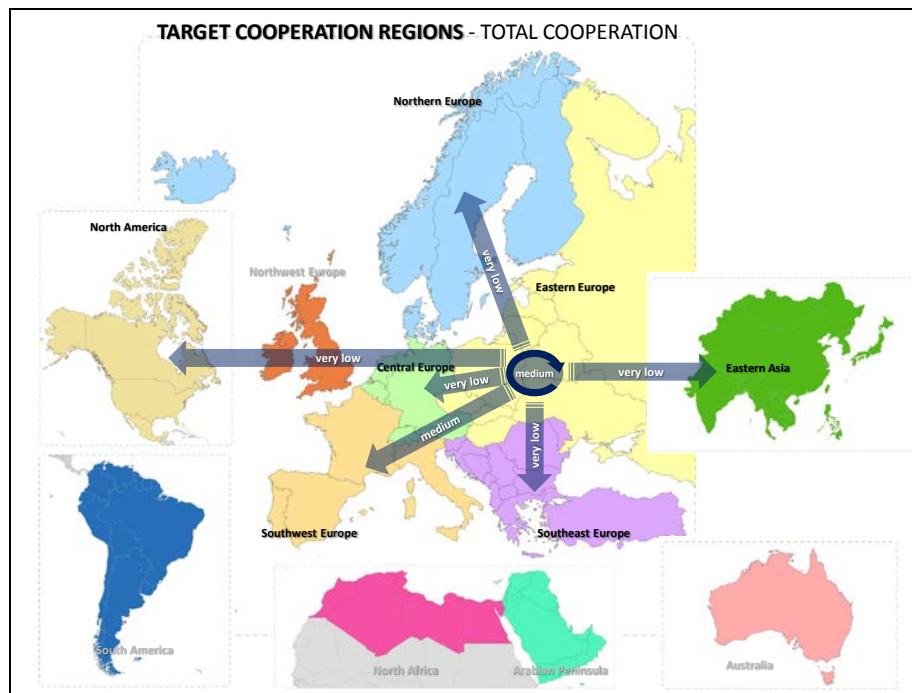


Figure 19: Target Cooperation Regions: Total cooperation – Central Eastern Europe

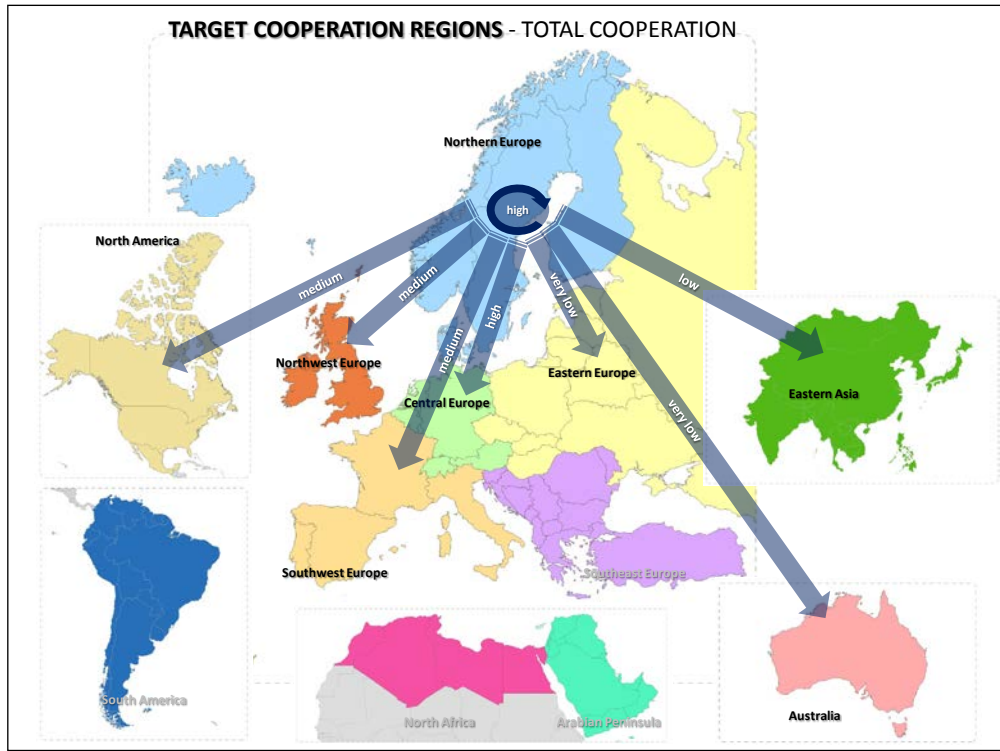


Figure 20: Target Cooperation Regions: Total cooperation – Northern Europe

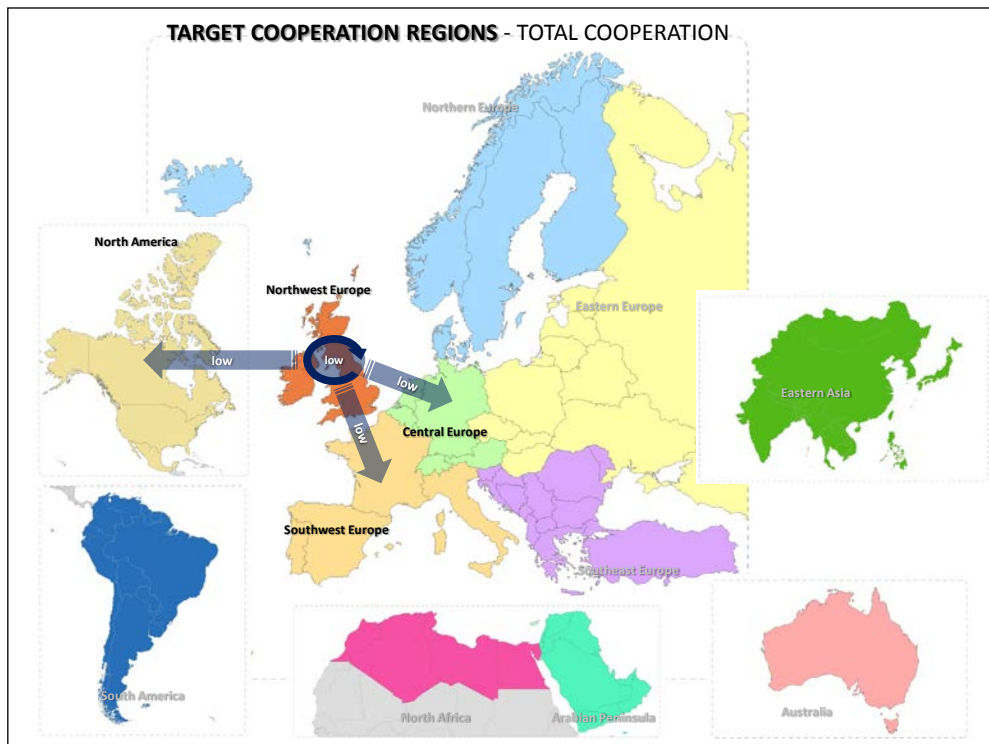


Figure 21: Target Cooperation Regions: Total cooperation – Northwest Europe



Figure 22: Target Cooperation Regions: Total cooperation – Southeast Europe

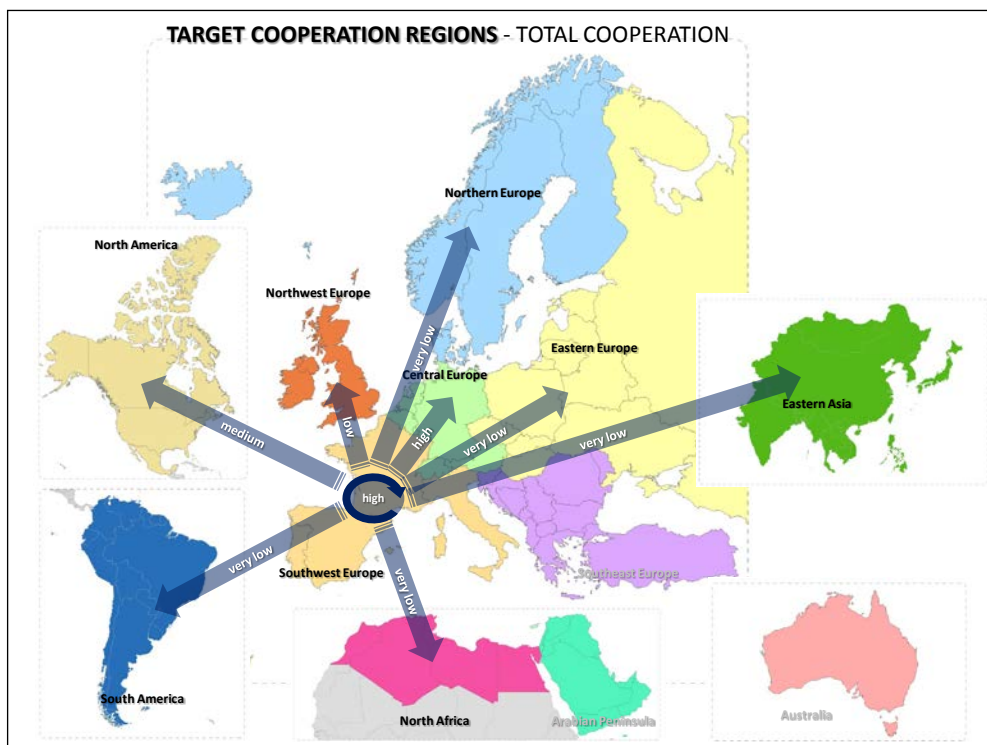


Figure 23: Target Cooperation Regions: Total cooperation – Southwest Europe

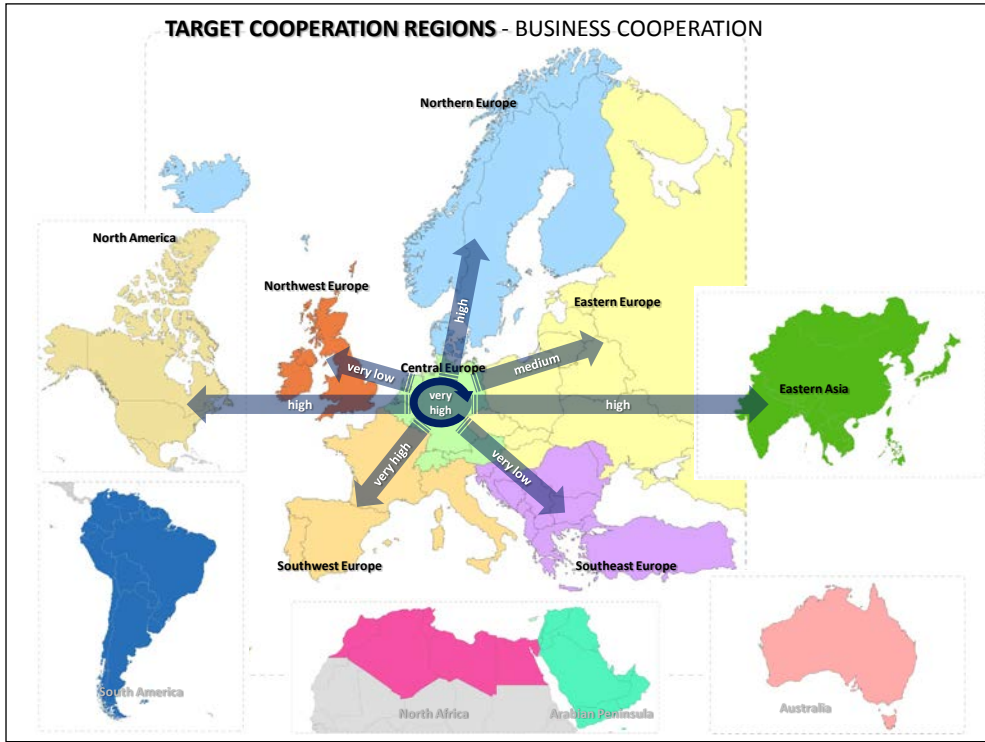


Figure 24: Target Cooperation Regions: Business cooperation – Central Western Europe



Figure 25: Target Cooperation Regions: Business cooperation – Central Eastern Europe



Figure 26: Target Cooperation Regions: Business cooperation – Northern Europe



Figure 27: Target Cooperation Regions: Business cooperation – Northwest Europe

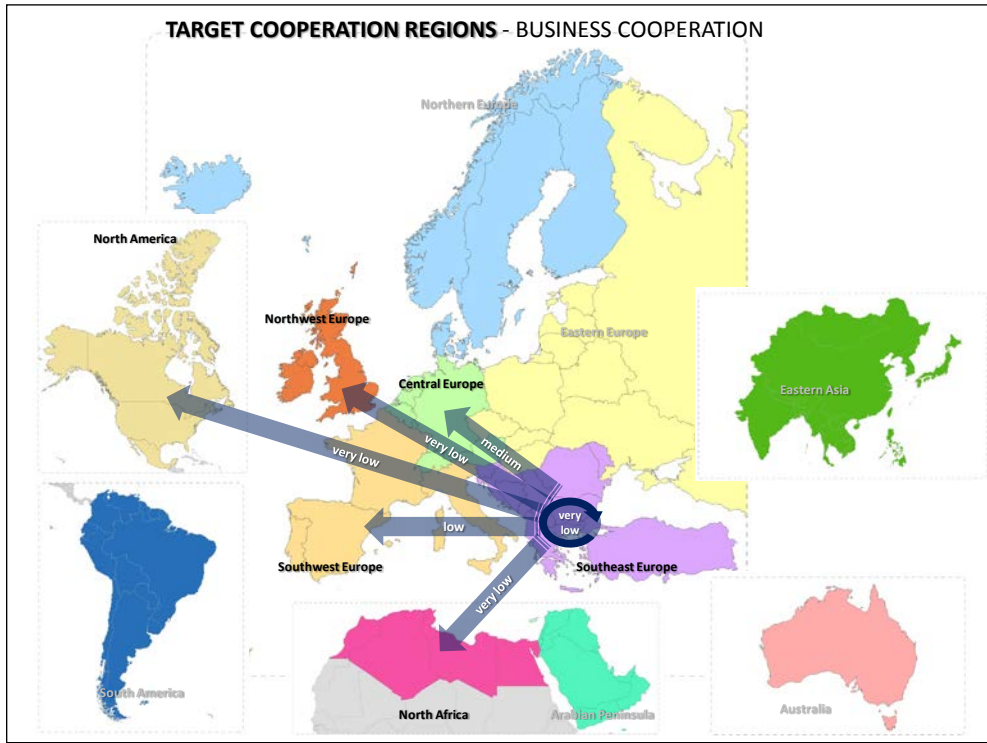


Figure 28: Target Cooperation Regions: Business cooperation – Southeast Europe



Figure 29: Target Cooperation Regions: Business cooperation – Southwest Europe

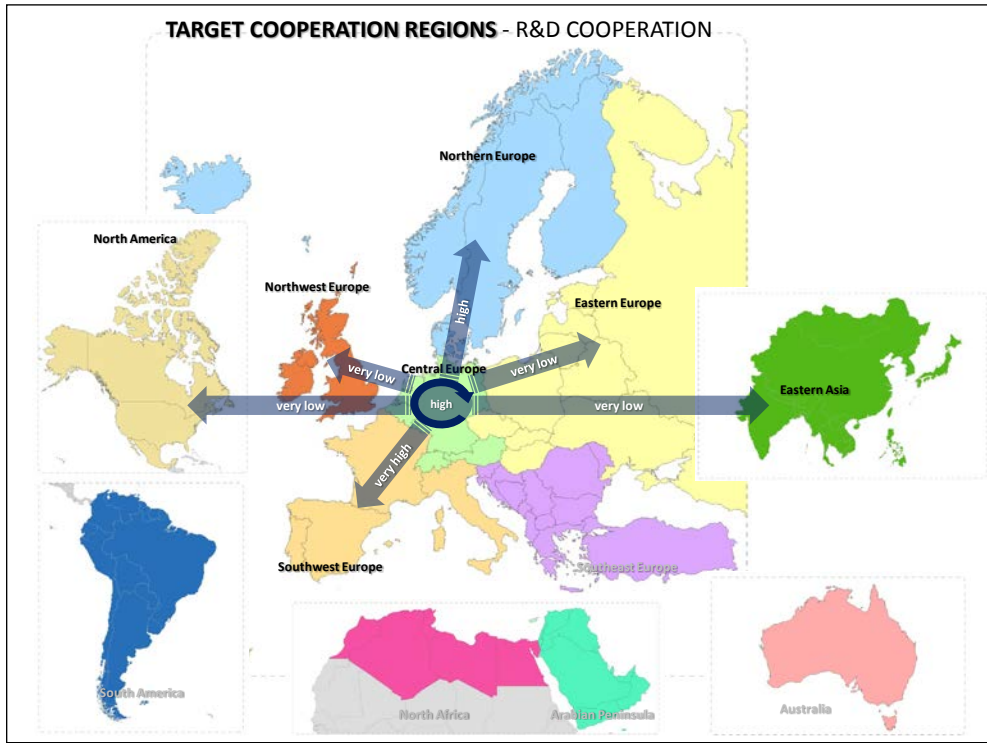


Figure 30: Target Cooperation Regions: R&D cooperation – Central Western Europe

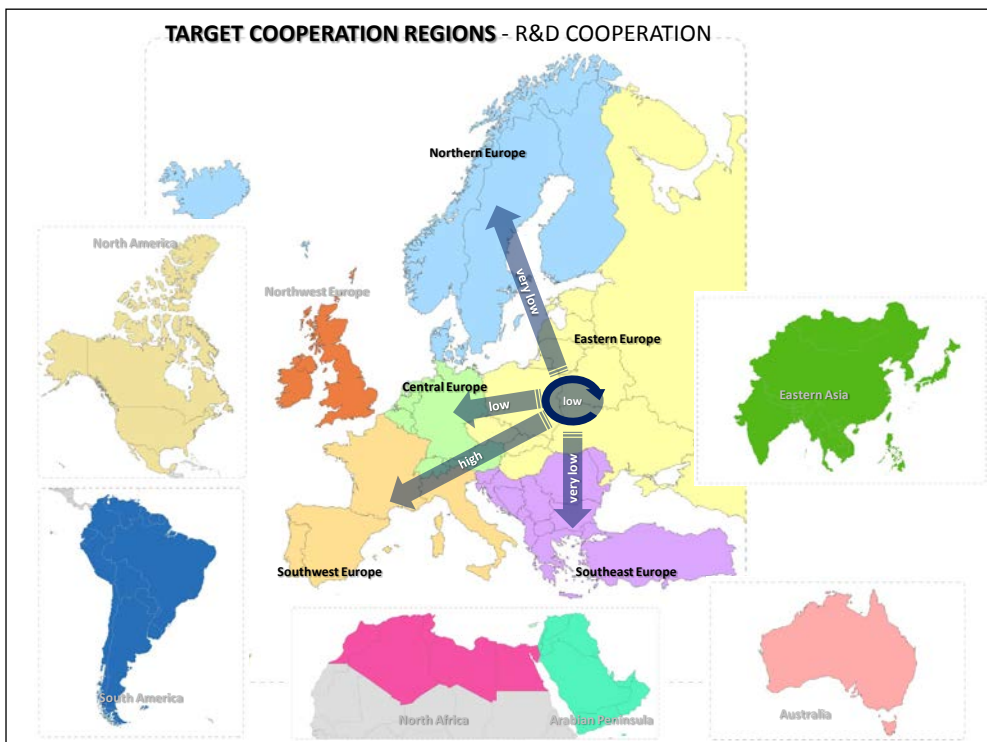


Figure 31: Target Cooperation Regions: R&D cooperation – Central Eastern Europe

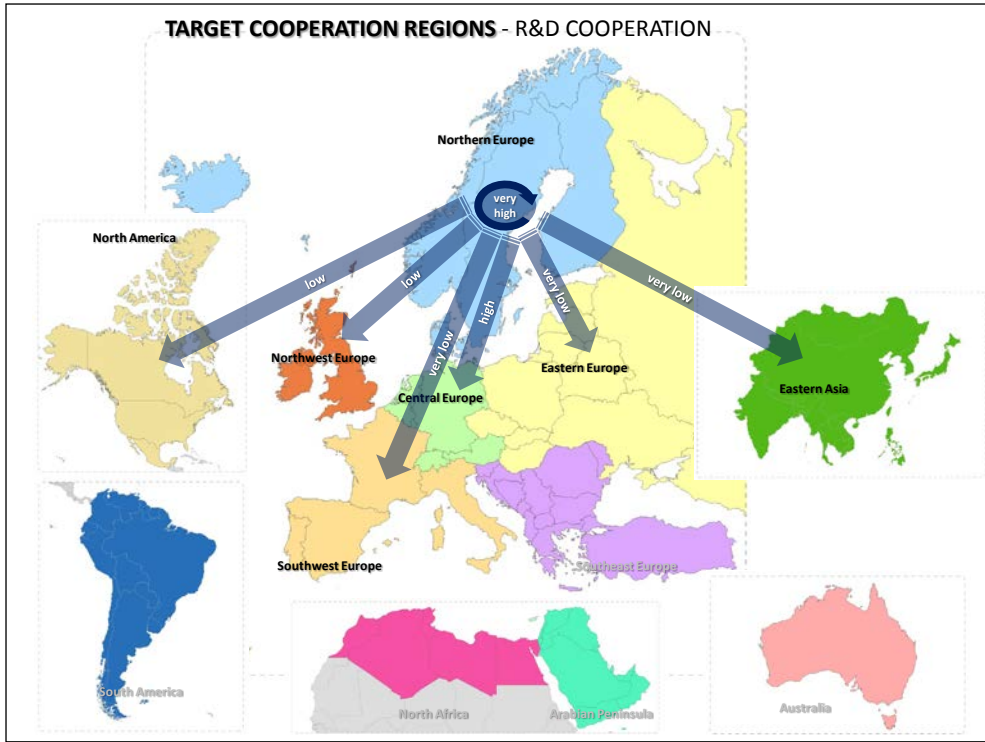


Figure 32: Target Cooperation Regions: R&D cooperation – Northern Europe

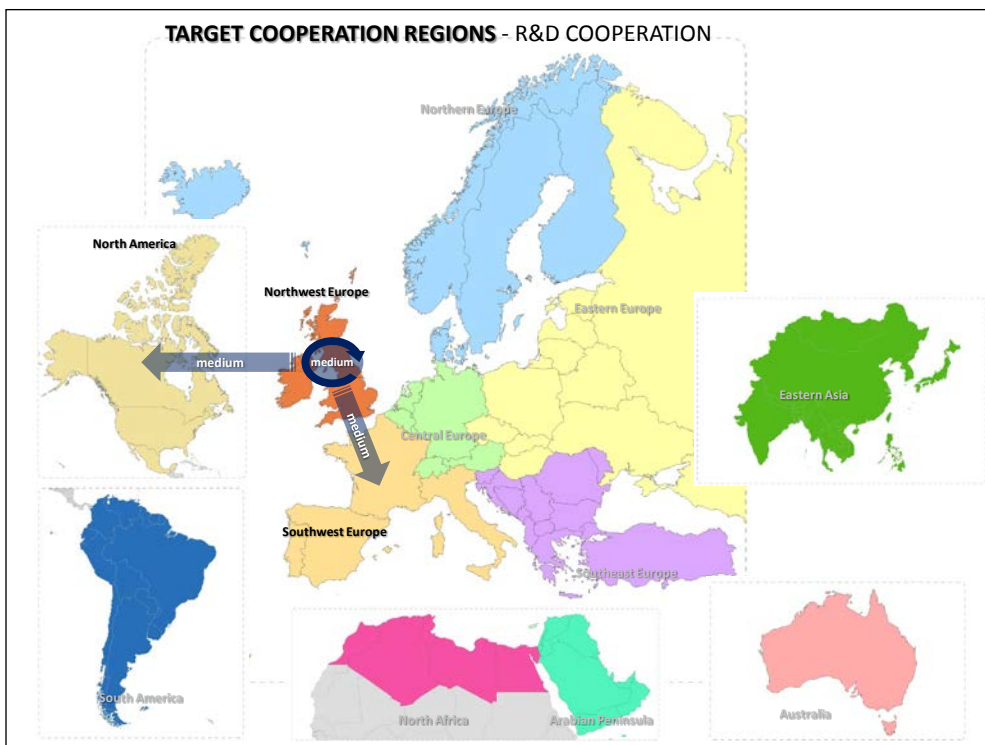


Figure 33: Target Cooperation Regions: R&D cooperation – Northwest Europe



Figure 34: Target Cooperation Regions: R&D cooperation – Southeast Europe



Figure 35: Target Cooperation Regions: R&D cooperation – Southwest Europe

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

<http://ec.europa.eu/growth/smes/cluster/observatory/>



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