



**SUSTAINABLE INNOVATIONS AND  
TREATMENT IN INDUSTRIAL WASTE  
WATER CLUSTERS**

**WP4: Deliverable 4.2  
International overview of the  
cluster policies  
- Final Version-**

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## Executive Summary

Patras Science Park is the leader of **WP4** which studies the policies for the support of Regional Research Driven Clusters and seeks to identify the clusters in the partner regions and assess the state of development in them. Innovation, supporting structures and activities of the research-driven clusters are also to be analyzed.

The main objective of **Task 4.4 & the present Deliverable D4.2** is to study the research driven cluster both inside and outside Europe (USA, Asia and other countries) from the policy point of view, to give examples of successful clusters internationally and provide some factors for clusters' benchmarking.

In the following study we are going to see first of all, which are the characteristics of the research driven clusters, their competitive advantages and the factors that make them successful having as a result the development of the area they activate. In Unit two are described the cluster initiatives. **Cluster Initiatives (CIs)** are recognised efforts to increase growth and competitiveness of clusters within a region, involving cluster firms, government and research community. Cluster Initiatives have become a central feature in improving growth and competitiveness of clusters. They are a new way to organise microeconomic policies, they are not new policies. CIs draw upon many existing policies and their main contribution is to select, adapt and combine policy measures to maximise the impact on clusters competitiveness given the specific conditions a cluster is facing.

Continuing in unit three, there are presented the types of **cluster policies** and approaches which fit more or less clearly into the category of cluster policy. Cluster Policies Whitebook notes that cluster policies can cut across a wide range of existing policy areas: industry policy, science and technology policy, competition policy, education and labour policy and social policy. At the same time, recent studies note that policies to support regional specialization and clustering lie at the intersection of several different policy families, which include regional policy, science and technology policy and industrial/enterprise policy. The programs and instruments employed across this wide range of policy areas that support cluster development are those designed to foster improved linkages among firms and research institutes. In general, policies to support clusters are often targeted at more than one policy objective and these objectives may change over time. Cluster policies do not constitute a new policy area per sector, but rather represent a new approach to synthesizing a range of policy instruments that cut across the fields mentioned above. The purpose of cluster policies is to **use these existing instruments in a more focused and coordinated way and facilitate coordination, dialogue and interaction among the constituent elements – especially firms – that comprise the cluster.**

Into the next three units is described what is happening, regarding the cluster policies and examples, in USA, Asia, Europe and some other countries like Canada and Australia and the

European opening to the North African area. Initially, there are presented the current cluster policies that exist in each area and then some successful cluster examples where these policies have been applicated. It can be observed that there are some cluster policies that are common in clusters, but it is obvious that some cluster policies vary from nation to nation because of the different economic, social, educational, industrial and cultural environment.

Finally, the study ends with some **recommendations from cluster policies** which derive from either the successful examples that have already been presented of by the bibliography. Additionally, there are presented some basic factors which are very usefull from the cluster benchmarking. Benchmarking of cluster organisations reveals different advantages compared to other approaches: reveals the current position compared to others / to the best, shows specific strengths and weaknesses, motivates to learn from the best, provides findings which can be used in the practical work, no good or bad, nor raking or rating, gives interested parties valid information about the competitive position of a cluster compared to others.

## 1. Introduction

Clusters have received widespread attention as an instrument for enabling firms to overcome internal limitations by joining efforts and resources with other firms, R&D institutions and universities, and public sector organisations in pursuit of a common objective or vision. There is now a general interest in, and receptiveness towards, strategies in support of clustering. This has particularly been fuelled by the growing appreciation of innovation in academia as well as in policymaking, and the perception that initiatives in cluster development may be one of the most effective means available for fostering an environment that is conducive to innovation.

Clusters are defined by the co-location of producers, services providers, educational and research institutions, financial institutions and other private and government institutions related through linkages of different types. There is huge diversity among clusters: they differ in terms of their stage of development along the cluster life cycle, some are networks of SMEs, some are organized around key anchor firms, and yet others have developed around universities.

Whichever is their type, it is commonly recognized that transnational cooperation between clusters can further strengthen clusters all over the world, acting as bridge-builders across regions in important ways. Throughout the application of the cluster policies, new business and research contacts can be established, allowing for cross-border learning and innovation. Increased cross-border interaction between clusters enables benchmarking and learning about how to establish and manage clusters, which would otherwise remain unnoticed. Finally, it seems that **cross-border programmes** and **initiatives** can improve the mobility of people, including students, scientists, entrepreneurs and expatriates within larger firms, thus increasing the international aspect of regional and national cluster initiatives.

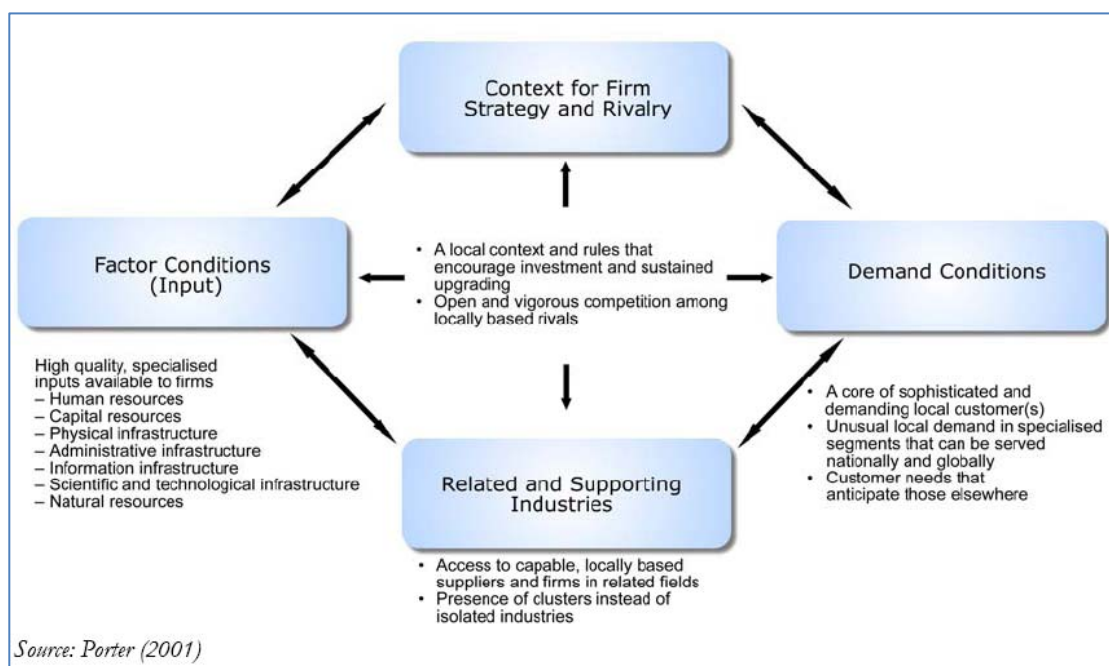
A wide range of government policies affect competitiveness and innovation, with different impacts on clusters. They may be politically supported at different levels and characterised by different degrees of scope and ambition. Some policies affect the general business environment conditions, while others are cluster-specific. **Cluster specific policies aim at mobilising the inherent capabilities of clusters and spurring their upgrading over time.**

When discussing cluster policies, it is important to note that one cannot fully describe a policy measure merely in terms of what the objective is. **Typically, policies in support of cluster development are not explicitly called “cluster policies”** but are part of broader strategies aiming at regional and business development. These are often those having the strongest impact. Similarly, different methods may be used, ranging from hands-on methods, like providing information, contacts, assistance, advice or direct funding to hands-off methods, like lobbying, marketing, monitoring and reporting. This makes it inadvisable to define “cluster policies” in a strict and uniform way, although they could in general be described as policy mixes to support the development of such regional systems.

## 1.1 Competitive advantages of clusters

Clusters are considered powerful engines in the economic structure of national and regional economies. Competitive advantages within clusters enhance the micro-economic environment for businesses, leading to improved opportunities for innovation, enhanced productivity and improved business formation, and thus contribute to regional growth and competitiveness.

A major breakthrough for the cluster concept was Porter's *Competitive Advantage of Nations* which, conversely to the prevailing US local development objective of promoting diversified economies, advocated specialisation according to historical strength by emphasising the power of *industrial clusters*. Porter highlighted that multiple factors beyond the ones internal to the firm may improve its performance. In his "diamond model", illustrated in the figure below, four sets of interrelated forces are brought forward to explain industrial dynamics. These are associated with factor input conditions; sophisticated local demand conditions; related and supported industries; and firm structure, strategy and rivalry.



**Figure 1:** Porter's Diamond

According to Porter, the role of (local) governments in this framework is to foster every single part of the diamond and strengthen the arrows that join them. Because the interactions between the parts of the diamond reinforce each other, an improvement in one box gets magnified through its interactions with the other components of the diamond. **A number of policies are then attached to each part of the diamond.** Porter distinguishes between policies that make a cluster expand (such as "efforts to attract suppliers and service providers from other locations" and various other subsidies to increase the employment size

of the cluster) from policies that make clusters more competitive (e.g., "creation of specialised education programmes", "enhancement of specialised transportation", having local authorities "acting as sophisticated buyer of the cluster's products", and a long list of other policies). Thus the final recommendation consists of many policies, all aimed at "upgrading the cluster". In turn, these interventions are alleged to result in a bigger and more competitive cluster.

## 1.2 Regional Research Driven Clusters (RDC)

RDCs differ from classical clusters by the fact that they have a stronger science/research base and by their ability to generate a greater frequency of innovative enterprises which are able to commercialise and exploit research. In a RDC, higher education institutions and research centres play a key role. An ideal RDC should have the 10 characteristics listed below, even if in practice all RDCs do not possess all of them.

### ✓ **A strong science base**

RDCs have to rely on quality research infrastructure and laboratories as well as on high level talents and skills. Public and private fundings must be available to ensure optimal use of the infrastructure and to motivate or attract talents and skills. In order to be attractive for enterprises, RDCs have to find ways to balance basic and applied research activities.

### ✓ **An above average entrepreneurial culture**

RDCs must help regions or countries to create growth and jobs. This can only be achieved if researchers and people have a strong entrepreneurial and innovation culture. That type of culture needs to find a favourable environment, good framework conditions and a strong public sector support for all types of entrepreneurial activities.

### ✓ **A capacity to generate fast growing start-ups, spin outs/spin offs and to increase the RDTI absorption capacity of SMEs.**

RDCs are able to generate high growth / fast growing enterprises. Some of them can be considered as spin offs / spin outs of universities, some others from existing enterprises. Most of those gazelles such as in Cambridge or in Leuven have been created by serial entrepreneurs. This shows why an entrepreneurial culture is so important for RDCs.

### ✓ **Attractive to talented people and students**

New ideas often flourish in dynamic environments which attract and reward talent. Students are more and more interested in learning and developing their skills in the neighbourhood of talent. This form a virtuous cycle: talent develops new ideas which create an attractive environment to students who contribute to generate new ideas.

### ✓ **A skilled workforce**

To help transform research results into new products and services, RDCs need skilled workforce at each stage of the process, i.e. laboratory tests, prototype, production, etc.

### ✓ **Availability of finance, especially seed and venture capital**

No successful RDC can be developed without a strong financial value chain. This chain needs to be composed of research funding mechanisms, repayable advanced tools to help the development of new ideas, proof of concept schemes, active business angels, seed

capital funds, venture capitalists as well as banks and guarantee providers. Moreover, RDCs have to help entrepreneurs improve their business plan proposal and avoid any misunderstanding due to asymmet RDC information and perception between them and investors. This can be done through business angel networks, investment readiness schemes and venture capital summits.

✓ **Availability of value added business support services**

On top of the classical support services to enterprises such as information on how to create a new business, to write a business plan, how to incorporate it or to get production permits, RDCs have to provide added value support services such as testing facilities, incubation spaces, mentoring, world economic intelligence, IPR protection advice and, as mentioned above, access to a wide range of funding tools.

✓ **A good location for research centres of large corporations**

RDCs are often attractive to the research centres of multinational enterprises because they are able to combine the science based environment with a good quality of life and good transport infrastructures. Science parks are often an asset to attract such enterprises.

✓ **Effective formal and informal networks**

This is of course the essence of any clusters. As already mentioned, RDC's specificity is to allow a lot of interactions and cross-fertilisation of ideas between the players of the triple helix concept, i.e. the public sector, the private sector and the knowledge centres or intermediary organisations. Those networks often create a strong RDC identity among the stakeholders.

✓ **Provision of international co-operation framework**

In today's economy, knowledge and market are global. To help all the stakeholders remain competitive, RDCs have to be part of or to build transnational networks.

### 1.2.1 What makes a Research Driven Cluster successful?

Although clusters are different in many aspects, successful clusters share a number of common features. According to studies that have been conducted in many different countries all over the world where successful clusters are activating, these common features are divided into three groups the above:

#### **Critical Success Factors:**

✓ **Presence of functioning networks and partnerships.**

Strong professional, social and informal networks are fundamental to the effectiveness of a cluster. Such networks may naturally develop within a cluster or be facilitated and promoted by intermediaries such as local associations, technology clubs or governmental agencies. Networks that generate formal and informal flows of knowledge and information throughout a cluster provide the gel that binds success over time. Access to tacit knowledge can support collective learning and more competitive performance. Networks can be the means through which many cluster-development activities are delivered.

*Successful clusters tend to have strongly embedded networks and relationship systems.* Trust and inter-personal relationships are highly developed, providing the cluster with a strong degree of social capital. Developing these relationships takes time. Networks may be supported through strong institutional structures, or through shared cultural values and a common purpose. The value of informal networks, based on social relations and even job-moves, is that it enables a transfer of knowledge around the cluster. Such 'untraded' means of information dissemination such as informal collaboration and extensive contact networks can create a 'knowledge community'.

The sharing of knowledge through networks and partnerships can be achieved through face-to-face contacts or through remote technologies, such as the web. Technology has advanced significantly in this respect and cluster practitioners are using interactive cluster portals to facilitate networking, share information about the cluster as well as using them for actual business to business interactions. The key is that a flow of knowledge occurs and in more sophisticated networks that active collaboration is encouraged.

#### ✓ **Networking and Institutional Development Policies**

Fostering linkages between the members of a cluster is one of the most important elements of any cluster development strategy. In many instances networks are formed naturally by cluster-based firms. This may simply be about bringing firms and others together and allowing an internal dynamic to be established, or it might involve practical actions to foster collaboration and joint working. This can involve developing new institutional structures or formats, which are able to take these roles forward.

Often networks form naturally within clusters in response to needs identified by member firms, or on the initiative of one or two key individuals. What is critical is that all members gain something from their participation. In this respect networks tend to work best when they develop organically and from the bottom up.

Networks and partnerships can support new product development, such as through the **sharing of information** between research institutes, between research bodies and firms or simply between firms. Once a network is established other wider benefits may begin to be realised. Networks provide a mean of **building trust and understanding**, as well as **spreading knowledge and intelligence**. They are facilitative in nature, providing a forum for participants to assess the potential for joint working and collaboration in a given area.

Networking with a purpose Networks should not be encouraged for their own sake. they are a means to an end and not an end in themselves. Unless they fulfil some need they will not survive. It is 'networking with a purpose' that delivers the real benefits in terms of cluster success. This is true whether the networks have sought to deliver common skills or training needs, joint marketing or R&D. In terms of policy intervention care needs to be taken in support of such networks in that there is a clear drive to take them forward. If this isn't present the network will collapse soon after the initial intervention.

The role of networking bodies Institutions such as universities and trade associations can play a key part in nurturing the development of the cluster. In the best cases network organisations can facilitate and animate whole cluster development strategies. Sector bodies can play a key role in terms of networking and have the advantages of being market-led and company focused. However this can mean that other dimensions of cluster development can be neglected and practitioners should consider whether such bodies are providing a service for members or the sector's needs as a whole – these can be two very different things. Be aware also that sector groups can act as a barrier to cluster development as clusters cut across traditional sector definitions – for instance some clusters may be defined by common technologies.

✓ **The presence of a strong skill base**

There is a consensus across the literature that successful clusters are those that been able to access and nurture a strong skills base, both in terms of higher level and management skills and a suitably qualified labour force more generally. This is seen as a key factor in attracting and retaining companies as well as contributing to the successful development of companies within a cluster. The quality and quantity of the available labour force is thus a critical component in the development of successful clusters.

The skills mix and composition is important. Successful clusters require a range of appropriate skills and abilities. The sorts of business skills that are sought within successful clusters included those associated with global businesses such as strategic management skills for business leaders, entrepreneurship for graduates, management and production techniques, leadership skills, mentoring/coaching and personal development skills. Demand and supply side considerations the quality and availability of training can also be a factor contributing to the development of successful clusters. This can apply to the existing workforce as well as to new and potential entrants to the labour market. The capacity of the available training infrastructure to respond to employer needs and provide relevant training is a key factor. The cluster can have an influence on the provider side in terms of encouraging appropriate provision that is flexible and meets with the needs of employers.

When developing activities in this area, practitioners should take every opportunity to draw different companies and groups of employees together through promoting joint provision of training solutions. This will both support the development of networks themselves and contribute to the development of communities of practice or purposeful alliances.

Creating strong links between Higher Education Institutions (HEIs) and businesses is an essential part of improving economic performance, and HEIs have an increasingly important role to play in increasing the competitiveness of regional economies.

✓ **Innovation and R&D capacity**

The evidence shows that product development and well-developed research structures, together with other forms of innovation, are vital for a dynamic cluster. Innovation maintains the cluster at the forefront of the market whilst a strong R&D base can provide the ideas and

products for future development. The promotion of innovation and R&D are two separate activities, although inter-related. Innovation generally refers to product or process development whilst R&D refers to the development of new knowledge. In the best cases successful innovation is the outcome of the R&D process.

Innovation can be incremental, as existing products and processes are gradually built upon, or may be more radical, with the introduction of a wholly new product or approach. Successful clusters are inherently innovative and practitioners can support the innovation process through encouraging networking and the sharing of ideas. Where networks extend outside of the cluster, this can also be beneficial as often innovative ideas are ones that work well in one setting and are being applied for the first time to another area. The benefits of information and intelligence services in this area are often worthwhile exploring.

✓ **Research Institutes including universities, non-profit foundations and for profit R&D** can play an important role as catalysts for research and innovation. They can be the base for developing new ideas and applications but can also play a critical role in nurturing high technology entrepreneurialism. In this respect public and private research facilities can be key drivers within the cluster.

The role of research institutes as drivers of cluster development has been emphasised by the experiences of places like Silicon Valley in the USA and Cambridge in the UK where universities have been important components in the development of the cluster.

✓ **Innovation & Research and Development Policies**  
Support for R&D can take many forms, including the use of R&D tax credits (rarely cluster specific), funding for basic or applied research, technology transfer schemes, the development of specialised research facilities or simply supporting the development of research networks, linking firms, research institutes and other interested parties together. It is important that the role of R&D activity is viewed in the context of the cluster as a whole and that an integrated strategy that includes this element is developed around the cluster. Encouraging multi-firm networks can be crucial elements in this regard.

University research laboratories can provide a fertile source of technology and expertise for industry. Unlocking this potential can be a challenge. As a result many universities have established Industry Liaison Offices which undertake audits of potential commercial applications within their departments and simplify the commercialisation process. In some circumstances, barriers to commercialising research are more fundamental and may need national action. In France, for example, researchers were prevented from establishing businesses whilst they held public research posts. This reduced the number of researchers willing to try to commercialise their ideas. New legislation was introduced in 1999 to overcome this barrier and researchers in fields such as biotechnology now have the right to establish profit making businesses whilst retaining their research posts for up to six years.

✓ **Promoting technology transfer.**

Many networks and intervention systems are designed to encourage technology transfer. Mention has already been made of the dissemination or multi-firm participation requirements of some grant regimes. Institutional structures have also been established to promote technology transfer through formal or informal means.

✓ **Collaboration is the key.**

When supporting innovation and R&D, practitioners should avoid promoting activities within a single company or institution if they are aiming to strengthen the cluster. This is unlikely to provide benefits to the wider cluster or support the development of the cluster itself. Instead practitioners should take every opportunity to promote joint working and the sharing of information, such as through joint research projects, so contributing to the development of networks with a purpose.

✓ **Innovation and cluster Lifecycles.**

New ideas need to permeate throughout the lifecycle. For instance reinvention and innovation policy is a critical part of many declining clusters. Support for product and process improvements would appear to be important for established and mature clusters as well as supporting SMEs to prepare for new markets

## 2. Cluster Initiatives

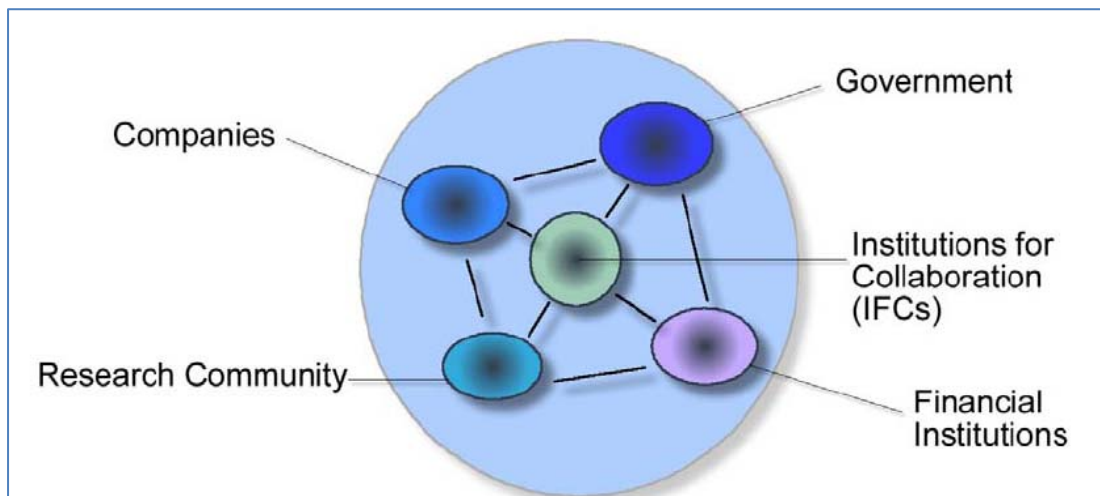
“Cluster initiatives” are viewed as **conscious actions taken by various actors to create or strengthen clusters**. There are multiple relevant actors, and they may relate to each other in different ways. Governments and other public authorities are known to be responsible for most cluster initiatives, although there is a marked geographical variation. For example, in the United States, private initiatives are more common. Yet, even initiatives started or managed by private actors are in many cases dependent on some form of public funding, indicating the significance of “cluster policy” for the outcome of “cluster initiatives”. However, the outcomes of clustering tend to be different depending on whether public or private actors are in charge. Studies of cluster processes have concluded that top-down policies often fail. At the core of cluster processes lies the interaction between the individual firms and organisations.

The *Cluster Initiative Greenbook* argues that four main categories of actors – **companies, governments, the research community and financial institutions** – are vital and normally present in a cluster and active in a cluster initiative, which is illustrated in Figure 2. Of importance for cluster initiatives are also the so-called Institutions for Collaboration (IFCs), defined as formal or informal actors which promote interest in the cluster initiative among the actors involved. The role of an IFC may vary considerably. IFCs may promote cluster initiatives not only internally but also externally and perform a series of cluster actions. It may serve to establish a completely novel set-up and engage numerous organisations, but it may also represent a set of already established actors, such as chambers of commerce, industry

associations, professional associations, trade unions, technology transfer organisations, quality centres, think tanks, university alumni associations, and others

Individual actors are drawn into cluster initiatives by diverse attractions and incentives. Their capabilities and roles may vary according to the national context, and may also evolve over the course of the cluster life cycle. In some countries, for instance, the public sector will be more important than other actors in the early stages of the cluster life cycle. In others, private actors will dominate cluster initiatives from the outset. Such differences may reflect variations in responsibilities and competencies among actors, including between national and local public authorities. In North America, as well as in Germany, China and India among other countries, states, provinces and regions tend to launch significant initiatives.

Meanwhile, in France, the UK, the Nordic countries, and also in most transition economies and developing countries, relevant decision-making tends to be more centralised. In most countries, however, there is **a tendency for regional and local authorities to become more active in clustering initiatives** and to gain importance relative to national governments in this respect. Several authors have stressed the significance of the stance adopted by local and regional authorities, including for the establishment of service-centres.



**Figure 2:** Cluster’s actors

In the United States and Canada, liberal and conservative governments have adopted cluster based strategies. In Europe they have been adopted by governments across the spectrum – from right to left, namely, in all of the Nordic countries, most German and Italian regions, Scotland and Ireland, Spain and Holland. In the Asia Pacific region, national and local governments from Australia and Malaysia, to New Zealand and Singapore have adopted cluster strategies as well.

Ultimately, in both developed and developing countries, cluster initiatives have become a sort of “magic recipe” to meet the challenges of the new economy, to the point that they have now become dangerously fashionable. Many commentators are actually sceptical about the

possibilities of creating from scratch local production systems (clusters) of small firms which compete on the basis of collective efficiency. The evidence, however, indicates that various interventions by public or private institutions can play an important role in helping a cluster, once it has emerged, to attain, maintain and enhance competitiveness. Just to cite a few successful examples:

- ▲ **South Africa**, the government provided funding to assess the competitive advantages of the capital equipment cluster (minerals and metals) and to develop a long-term strategy. The cluster evolved into a private sector-led initiative, and as a result of cluster strategy implementation, exports doubled and revenues tripled in the first year afterwards.
- ▲ **In Scandinavia**, government's early action to support tests with mobile telephony helped to create a strong, globally competitive cluster, having a transformative impact on the economy. The Nordic mobile telephone program was a cooperative effort of the Scandinavian countries to establish mobile telephony, well before anywhere else.
- ▲ **In Japan**, the government policy helped to speed up the growth of the facsimile industry, before it was even known to the rest of the world. For example, early demand for facsimile machines was boosted when the government approved the use of faxed documents for legal purposes.
- ▲ **In India**, the Bangalore Software Cluster is an example of a deliberate public policy to move along the value chain from application software to systems design cluster. In 1991, the government initiated 15 Software Technology Parks, which were instrumental in creating a critical mass of 180 companies with 20,000 skilled professional workers. It exported 85 percent of its software products in 96/97, growing at a 64 percent rate in 2002. While Information Technology Cluster growth worldwide has waned, the Bangalore Cluster continues to grow and still attracts talented expatriates, foreign investment and major corporations, such as Oracle, Microsoft and GE.
- ▲ **In China Taipei**, the Hsinchu Science-Based Industrial Park is an example of government intervention. The government has invested \$1B (USD) since 1980 and provided tax exemptions, generous grants and government laboratories specialising in computer semi-conductors and telecommunications. The Park was established in 1980 and has now over 334 firms, with 98,616 employees generating over \$7,054,000 M (USD) in annual sales. The government reached its break-even point on the project's annual \$40 M (USD) running costs in 1996. The cluster attracts foreign investment and has enticed talented ex-patriot workers back to the region.
- ▲ **In Arizona**, the cluster-based Strategic Planning for Economic Development (ASPED) proved to be a powerful tool to revitalize the economy. In the late 1980's, like most of the United States, Arizona experienced an economic slowdown. Employment growth was mostly concentrated in low-wage and highly cyclical real estate, construction and service sectors. In response to ASPED, Tucson emerged as an international optics 'silicon valley', which grew by 65 percent, between 1994 and 1999. Besides the optics cluster, the aero-space cluster added 60,000 jobs and the tele-services industry cluster grew from 2,000 to 16,000 jobs.

These examples demonstrate that government policies for promoting infrastructure, human resource development, networking and technology diffusion, can play a critical role in creating the conditions that are required for clusters of SMEs to flourish. This applies to both high technology and traditional sectors. In particular, in some areas, public policies not only contribute to cluster strength but governments are in a unique position to enable favourable outcomes. This is particularly the case under circumstances marked by a strong presence of free-rider problems among market actors.

Once clusters are identified, there are at least five kinds of initiatives that policymakers can take to support their growth:

- ⇒ **Establish a solid foundation:** Every cluster has some fundamental needs that are not cluster specific but that affect the ability of clusters to succeed. These include the region's educational assets, physical infrastructure, attractiveness to creative talent, and capacity for aligning the efforts of regional educational, workforce, and economic institutions. Governors are already doing much to promote improvements in these areas, but cluster-strategy development offers additional opportunities to focus the attention of key constituencies on the importance of these building blocks.
- ⇒ **Build relationships:** Inter-firm collaboration facilitates learning and the aggregation of intangible assets, especially the tacit knowledge that resides within company employees and practices. State leaders can help by convening a cluster leadership council and supporting cluster associations.
- ⇒ **Deepen skills and talent:** By nature, clusters attract and enhance talent, but government can reinforce this tendency by creating cluster hubs at community colleges, fostering clusterfocused professional science masters programs at nearby universities, encouraging cluster-training consortia, and encouraging cluster-based career advancement paths.
- ⇒ **Align innovation investments:** States can realize higher returns on their investments in research and development (R&D), centers of excellence, and business innovation by focusing on clusters. In the process, they should keep in mind that innovation is about more than breakthroughs in science and technology; it also is about incremental improvements in products, services, and the processes for producing and marketing them — improvements that are often the result of new product designs and business models
- ⇒ **Accelerate entrepreneurship:** Talent and research are necessary, but it takes entrepreneurship to translate good ideas into successful products and services. Governors can promote entrepreneurship by supporting entrepreneurial networks, creating clusterfocused incubators, organizing small business centers around cluster expertise, and encouraging entrepreneurship education programs at high schools and postsecondary institutions.
- ⇒ **Open global priorities:** Successful clusters extend their networks to distant competitors, vendors, and institutions. Government can help by supporting participation in internationalconferences, trade shows, and study tours; by

providing export assistance; and by establishing cluster-based learning exchanges. Cluster strategies are not silver bullets, but properly designed and applied, they offer a promising way to promote innovation, entrepreneurship, and economic growth.

### 3. Cluster Policies

Many countries use the cluster concept as an instrument for focusing attention on, and to some extent for marketing, specific regions and locations domestically as well as with regard to foreign investors. A range of other countries in all parts of the world, including in developed, developing and transition economies, have implemented certain reforms with reference to cluster processes. Traditional public programmes for the provision of export subsidies and services have commonly been reoriented towards a focus on providing information that can plug into networks of SMEs and cluster structures.

As for more specific observations, the Danish, Dutch, and Finnish **governments belong to the pioneers in brokering programmes with strong SME components**. Austria, Australia, Canada, Finland, France, Germany, New Zealand, Norway, Spain, Portugal the United Kingdom and the United States have **high-calibre public authorities**, most of them with strong programmes addressing **human capital and innovation** issues connected to clustering. China and China Taipei above all pursue broker policies related to science parks and incubators. Thailand explicitly promotes SME cooperation whereas the Philippines have more traditional institutional infrastructure to support SMEs. Japan has downplayed previous R&D-support to SMEs by replacing it with measures to support innovation within clusters on a broader scale.

The cluster concept is further closely studied by a range of countries, e.g. in Central and Eastern Europe, the Middle East, and South Asia in search of lessons for how to promote industrial competitiveness. Promoting clusters is widely seen as an attainable way forward towards enhanced competitiveness also in many situations marked by incomplete markets and rigid institutional conditions. Across a broad range of countries, clusters are attaining growing importance as an instrument for communicating the significance of organisational change and intensified cooperative efforts as building blocks for putting in place a more dynamic, entrepreneurial and innovative society. In this context, the concept is complementary to the attention paid to innovation systems.

Regarding the S&T policies, more generally, include a broad range of measures where cluster considerations often are greatly important. This is the case in the strive for more effective **university-industry linkages, and technology parks and technology incubators** are now flourishing in developed and developing countries alike. In several countries, **changes to patent legislation** and the **distribution of intellectual property rights** between institutions and individuals were made in recent years for the purpose of

strengthening conditions for science-industry links and the commercialisation of research. The extension of patent protection to publicly funded research in the United States has for instance had a significant impact on technology transfer.

Some countries **pursue campaigns** of various sorts to facilitate the valuation and promotion of intangible assets. A few explicitly seek to catalyse experimentation by firms and organisations to upgrade their appreciation and governance of such assets, e.g., through public campaigns or in the context of public procurement. The Danish and British authorities and private firms in Denmark, Finland, Sweden, and the United States belong in that category. Broadly speaking, the interest in collecting and diffusing more sophisticated information on firm-specific assets, and their social ramifications, are on the increase.

Additionally, scientific and technological breakthroughs that emerged from public funded research contributed strongly to the strong US performance in the 1990s as regards high-tech industry, ICT and overall productivity growth. Not only the federal support programmes were important, but so were the support for physical infrastructure, and the fabric developed for public-private partnerships strongly embedded in cluster processes. The advances in ICT, with computer time-sharing, the internet, artificial intelligence and virtual reality, in turn changed the dynamics of networking and clustering itself. With the advance of the internet and electronic commerce, new investments in physical and electronic infrastructure are made by public and private actors alike, based on the understanding that the further evolution of such processes will be greatly important for future competitiveness.

On the other hand, evidence shows that not all clusters are successful. This creates scepticism about cluster policy interventions, especially regarding whether and how such interventions can add value beyond what other economic actors could attain independently. **Cluster policy is expected to initiate comprehensive ways to overcome market, government and systemic failures.** When considering cluster policy, it is important to distinguish cluster-specific interventions from those that are not. For example, a policy to upgrade infrastructure might not be considered a cluster-specific policy, but it could be judged a cluster-specific policy if it is specifically aimed to improve accessibility to a logistics facility necessary for a particular cluster. Cluster policy must contribute in some way to development of clusters.

Cluster policy often **comprises a range of measures and strategies carried out by authorities, which theoretically are public agencies, to generate socio-economic benefits for nations.** Cluster policy can be measures to enable public-private dialogue and collaboration, policies for education and skill training and international strategies for improving basic conditions for clustering and innovation. Such policies are complemented by actions to accelerate cluster development. What is new in cluster policy is the changing mode of intervention and roles of public actors in market economies towards more of a facilitating stance. This implies more participation of the private sector in determining and implementing cluster policies. The focus of cluster policy varies depending on the characteristics of the

participating in the cluster entities. Policies aimed at encouraging newly emergent clusters in high-tech sectors tend to be closely linked with science and technology policies. Moreover, policies in support of newly emerging high-tech clusters are likely to be top-down policies. In contrast, policies to promote natural resource-based or traditional clusters are more bottom-up oriented. Nonetheless, in practice there is no clear-cut line between cluster policy in its various forms.

### 3.1 Types of cluster policies

In theory, cluster policies are pursued by public actors for the purpose of increasing socio-economic benefits through the creation or further development of clusters. Other policies impact on clusters indirectly, e.g., education systems, competition laws, public procurement practices, public funding of research and product development, regulations influencing universities' ability to form holding companies for the commercialisation of new ideas, and so on.

In the continuance, there are addressed five kinds of approaches which fit more or less clearly into the category of cluster policy: *i) Broker policies. ii) Demand side policies. iii) Training policies. iv) Measures for special promotion of international linkages. and v) Framework policies.*

**Broker Policies:** The aim of Broker policies is to enable value-enhancing dialogue and collaboration beyond what would be achieved in the absence of such initiatives. They may be rationalised by the spectrum of market, government and systemic failures. Market forces may under-supply certain interactions or the emergence of supportive services, but there may also be counterproductive activities on the part of public actors and inconsistencies in the interplay between constituents. Different actions can be undertaken:

- Public authorities can support the establishment of linkages between firms through the creation of platforms for dialogue,
- Measures that strengthen science-industry interplay, e.g., by allowing specialisation and local adaptation in university-industry linkages including experimentation with reward systems and other incentive structures so as to promote linkages to local industry.
- Support of knowledge-enhancing organisational linkages through public-private partnership.
- Standard statistics fail to cover many structures and linkages that are crucial for measuring and understanding cluster developments. There is a rationale for specific public efforts to collect and organise relevant statistics.

**Demand Side Policies should aim at increasing openness to new ideas and innovative solutions.** One instrument for that is Public Procurement. If properly used, public procurement has a strong potential for developing and strengthening clusters, especially when pursued consistently over extended periods of time. Although public procurement strategies are now regulated by international trade agreements, and also by other national

and supra-national laws as in the European Union, their potential impact as cluster catalysers remains huge.

**Training:** There is a rationale for policies aimed at upgrading skills and competencies which are essential for effective clustering of SMEs. Apart from catalysing inter-firm networks and university-industry linkages, cluster processes may strengthen the incentives for SME to upgrade their internal competencies, in part because needs and payoffs become more apparent. Special programmes may still be needed to realise and sharpening such efforts. The rationale is a combination of imperfections in information, credit constraints in SMEs coupled with indivisibilities in competence upgrading, and the lack of universities and other public or private training institutions providing educational services tailored to the specific needs of SMEs.

**Promotion of international linkages:** A distinct area of cluster policy is that of promoting international linkages. This is not really a new policy, but it may be seen as an extension of instruments traditionally applied in industrial policy. The elimination of trade barriers and strengthening of transport and communication systems, along with the harmonisation of market regulations have, however, greatly improved conditions of resource flows and enhanced specialisation of value chains across national borders

**Framework Policies,** finally, should put in place an over-riding playing field marked by effective and consistent rules for inter-actor transactions. Broader framework conditions equally influence the success factors for clusters and innovation. Relevant framework conditions include macroeconomic stability, well-functioning product markets (goods and services), factor markets (labour and financial markets), education systems, and physical, institutional and judicial infrastructure, including a governance system that is able to sustain effective and consistent playing rules for innovation, the existence of an appropriate communications and transport infrastructure. Social capital and attitudes that influence trust in transactions may likewise be included. The shaping of such factors naturally goes beyond the domains of cluster processes and cluster policies.

### 3.2 The public policies in clusters

The role of the national government seems to depend on each nation's institutional background. However, regional governments are generally motivated to promote the policy in order to get the subsidies or projects from the national government (or even the higher level like EU) in all cases. On top of that, as a more recent role, regional governments should **coordinate the gaps between top-down policies and bottomup actors' motivations.**

Even in the most decentralized cases, such as Germany, strategic competition between the regional governments for the national level projects, like EXIST or BioRegio as federal government-driven cluster policy has been ever fiercer. Regional governments have been required to **support selected actors like spin-off companies** from universities investing huge amounts of money not only of the region but also of the federal government.

However, especially in the case of less developed regions, regional governments tend to depend on national government's policies or subsidies in all countries. Thus, we can observe that the national government has indirectly or directly initiated the regional policy in such regions. Even in case of some well-developed regions, a lack of effective initiatives by regional governments can often be observed. Each situation depends on its political and historical institution embedded in the region's socio-economic system.

The most difficult task is how to embed the market-oriented approach in the public policy, which is strongly required for different reasons. On one hand the governmental policy should be efficient in increasing productivity. On the other hand, a more holistic efficiency of the policy, which increases economic competitiveness within much more market-driven mechanisms, is also required. In the case of German bioindustrial policy above, selective decisions of such public investments to the private venture business needed the great application of a market-oriented approach.

In the cases of Silicon Valley or the Cambridge Region, private specialists like business consultants, venture capitalists or business angels within their market-driven system have emerged. However, in the case of other regions that do not contain enough actors like these, a governmental body must initiate this role at least until such actors emerge autonomously from the private sector.

Here are defined a few general conditions of the cluster policy. It is assumed that the significant points of the public policy, regardless of who plays each role, are the following:

- Promoting more autonomous development
- Pushing innovative and flexible behavior rather than concentrating on specific fields
- Building up a closer connection among the various policies or plans by competent authorities (In other words, easy accessibility through a one-stop service for the actors)
- Promoting innovative business or technology with market-oriented approach thus stimulating demand factors.

## 4. What is happening in USA?

### 4.1 General

In nations across the globe, the number of cluster initiative programs has grown substantially in recent years in response to the pressures of international competition. Twenty-six of 31 European Union countries have cluster initiative programs in place, as do Japan and Korea. In the US, cluster initiative programs are a component of economic development efforts only in a small number of states, including Maine and also in Connecticut, Oregon, Maine, North Dakota, South Carolina, and Washington.

The US falls behind most developed nation's government initiative to support clusters, as there is no real national-wide effort to encourage and fund cluster development in the US. During the interview with MTI for the Cluster Initiative Program, it was actually noted that when MTI did a major research in order to improve their state's cluster development initiative program, they studied European cluster initiative practices a great deal in order to learn from best practices.

In the United States, regulatory reform and improvement of systems on industry-academia-government collaboration and practical application of public research results were promoted in 1980s as measures for enhancing economic competitiveness. The Bayh-Dole Act in 1980, etc. enabled the research results, i.e. patents, to be attributed to the company or university that carried on the research even if it was federally-funded. Additionally, establishment of technology licensing offices, creation of small business innovation research (SBIR), and easing of regulation on dual employment of university professors activated industry-academia collaboration, which activated joint research between companies and universities, patent licensing activities of universities, and the creation of ventures based on the results of universities.

Under such circumstances, industries using cutting-edge technology such as IT industry and bioindustry grew rapidly in Silicon Valley and other areas. In these areas, universities and research institutes are the base for creating intellectual resources. Human resources, technology and business from there accumulate in surrounding areas to form regional industrial agglomeration and clusters and lead local economy.

In some areas such as North Carolina and Texas, etc., research parks or science parks are developed to attract not only universities, research institutes, and high-tech companies but also R&D projects of national level. Some of them promote cluster formation by combining intrinsic promotion of launching business and extrinsic attraction.

In order to achieve innovation-driven economic growth, the Innovate America report published in December 2004 *suggests i) ensuring human resources for innovation ii) support through investment on the development of Innovation Hot Spots and on the upgrading of*

*R&D investments iii) improving infrastructure such as intellectual property system and manufacturing base.*

## 4.2 Policy Tools for Cluster Development

It is important to recognize that states rarely, if ever, have the ability to create clusters out of whole cloth. However, governors and state policies can play a significant role in facilitating the development of clusters and aiding their sustainability. In particular, governors can do much to aid clusters by exercising their role as convener and using the bully pulpit. Governors also can drive clusters through tax policy, education and training, research investments, regulatory streamlining, and encouraging access to seed and venture capital.

**Convening.** A major element of cluster growth is bringing private sector leaders together with public leaders, including elected officials, education leaders, and even non-governmental entities. **The governor's office is the most effective entity** to ensure that all the key organizations are brought to the table, and it can be instrumental in brokering partnerships and networks. Governors also can appoint special liaisons to work with clusters, thus building the capacity to understand their needs and challenges.

**Using the bully pulpit.** By talking up clusters in public forums locally and when conducting trade and business development visits, governors can play a major role in convincing businesses, investors, and skilled workers that their states are serious about supporting their strategic growth industries. Governors who are knowledgeable about their clusters show investors they care about nurturing these emerging and growing sectors and can help bring capital and talent to the regions. Using the bully pulpit also means aggregating economic information in a way that captures clusters so that the state can track and report on cluster performance.

**Implementing tax policy.** Tax policy can be used to encourage and support cluster activities. For example, R&D tax credits can reward clusters that are R&D intensive. Likewise, tax incentives that reward businesses for providing industry-specific worker training or for creating high-wage jobs also can be effective. Designing tax policy around clusters is important because many clusters may not be able to take advantage of tax incentives that focus only on capital purchases (many clusters involve service industries, require highly skilled talent, and are not capital intensive).

**Funding education and workforce training.** Education and training are among the largest of state expenditures and are perhaps the most powerful tools at the disposal of a governor for shaping industrial policy. The quality of education is one of the most important factors that people and companies evaluate in their location decisions, and the type and quality of higher education is critical in producing and attracting the skilled talent that high-tech businesses

need in the region. Moreover, a flexible and responsive community college system is key to providing the type of workforce training needed for fast-growing clusters.

**Encouraging research investments.** Governors can support clusters by investing in related research in state universities and in the private sector through direct state investments or challenge grants. Governors also can provide matching dollars to federal **research grants** in areas considered important to the states' clusters. Moreover, to demonstrate a long-term commitment to cluster development, many states have created large, multiyear **"innovation" funds** directed at supporting research in targeted areas fundamental to a region's clusters.

**Streamlining regulations.** To support clusters, states can employ a streamlined regulatory policy that is tailored, flexible, and responsive. The use of technology such as on-line filing can simplify the administrative burden of regulations; such streamlining can be particularly helpful to small and start-up firms. Occasionally, regulatory choices can directly spur industry creation. In Delaware, the deregulation of interest rates charged by lenders led to the growth of the financial services (and particularly credit card) sector in Wilmington. In California, strict environmental regulations and incentives have helped catalyze a significant concentration of environmental technology firms.

**Improving access to seed and venture capital.** Most private seed and venture capital is concentrated in just a few areas of the country. To counter this, many states have improved access to such loans by starting their own funds or investing state dollars in a larger fund that serves the area. Although most state programs do not target clusters, venture capital funds can be specialized. For example, 40 percent of all investments in 2005 went to biotechnology or software companies, and two-thirds went to just six high-tech industries.

**Purchasing local goods and services.** The state can choose to support clusters in its role as purchaser. The state typically is the largest purchaser of certain goods and services, and choosing to buy from regional clusters, such as office supplies, alternative energy, and processed foods, rather than from outside the region creates a market and sends a message to others to buy locally where possible. Kentucky and Montana, for example, purchase furnishings from their wood products cluster for their state park systems.

Once a core cluster activity begins to generate economies of scale and demonstrate growth potential, public policies become even more important, priming the pump and easing the nascent cluster along. Rates and trajectories of growth can be influenced by public policies. In almost every cluster success story, public policy played a key role by filling gaps or overcoming weaknesses in critical factors, recruiting new members, and providing incentives for innovation.

California's **investment** in biotechnology research and its community college-based **training programs** for biotechnology technicians have been critical to the growth of that

cluster. Alabama's customized training, technology centers, and sizable tax incentives were primary catalysts for the growth of an automotive cluster. New York's ceramics cluster got a boost from the state's investment in the Center for Advanced Ceramic Technology, its Ceramics Corridor Innovation Centers, and the Appalachian Regional Commission's entrepreneurship programs. Business decisions generate clusters, but the public sector can seed, encourage, and support their growth.

### 4.3 The example of the Pharmaceutical/ Biotechnology Cluster

Many factors that foster innovation are best understood by analyzing clusters. Economic performance and Innovative capacity vary among clusters, even within a region. Some elements of the diamond are more relevant for analyzing economies at the regional level. Other elements are more cluster-specific. Sophistication of demand, context for firm rivalry, and related and supporting Industries are more relevant for understanding clusters than entire regions. It is also of high importance the government policy and cluster-specific institutions for collaboration.

To better understand how these factors lead to innovation, it follows the analysis of the pharmaceutical / biotechnology and communications equipment clusters. These two clusters are both good performers, and hence offer lessons for other clusters and regions.

#### 4.3.1 The Pharmaceutical/ Biotechnology Cluster

Nationally, the pharmaceutical / biotechnology cluster is composed of a number of industries that research, manufacture, test, and market a variety of bioscience products and services. The metropolitan area with the highest share of national cluster employment is Boston, with 5.55% of cluster employment in 1999. Added together, the metro areas of New York and New Jersey would create the largest region. Other Important pharmaceutical / biotechnology centers are present in Los Angeles, Chicago, and Washington. DC.

The pharmaceutical / biotechnology cluster in the Research Triangle<sup>1</sup> is a leading national center of R&D. Approximately 65% of biotechnology companies in North Carolina are located in the Research Triangle Park.

The assessment of the innovative capacity of the Research Triangle cluster shows the **vital importance of having quality factor inputs**, and in particular **human capital**, for

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<sup>1</sup> *Research Triangle Park or Research Triangle is an **epicenter of innovation** in more than a dozen industries. Companies represented in RTP include IBM, GlaxoSmithKline, RTI International, Cisco Systems, NetApp, BASF, Eisai, Cree, Biogen IDEC, United Therapeutics, Bayer CropScience, DuPont, Credit Suisse, Fidelity Investments and Syngenta. In addition, a number of U.S. Federal Agencies have a presence in the Park, including the U.S. Environmental Protection Agency, the National Institute of Environmental Health Sciences, and the U.S. Forestry Service.*

developing a pharmaceutical / biotechnology cluster. Government and private sector efforts attracted a mass of bioscience research institutes, which have produced high-quality research and training. Formal and informal **linkages between these Institutions and local firms** have ensured that technology and human resources are transferred to commercial enterprises. Other factors and elements such as **physical infrastructure, supply of risk capital, local demand**, the context for firm strategy and rivalry, and related **and supporting industries**—have not been sources of competitive advantage for the cluster, but neither have they prevented its successful development.

➤ **Development of the Research Triangle's Pharmaceutical / Biotechnology Cluster**

The Research Triangle's pharmaceutical/ biotechnology cluster came to life in 1959 when Chemstrand purchased 100 acres from (then) Plinlands Co. (now the Research Triangle Park) and started construction of the first major corporate laboratory in the region. The region got its first bioscience research operation in 1965 when Governor Terry Sanford announced that the United States Department of Health, Education and Welfare (later the National Institute of Environmental Health Sciences) decided to build a 370 million facility in the Park. This important center was presented with 509 acres within the Research Triangle Park in 1965 to serve as a site, producing the first major pharmaceutical / biotechnology anchor tenant for the Park and the region.

Currently, the Research Triangle's pharmaceutical / biotechnology cluster is split along two main lines of activities: 70% of the organizations in the area are involved in pharmaceutical, including nine of the ten largest, fully integrated pharmaceutical companies in the country, more than 54% contract research organizations, and 40 other large Pharmaceuticals involved in such highly specialized disciplines as bio-informatics, nanotechnology-based photonics and genomics; while 30% of the organizations in the cluster are involved in agriculture or environmental-related biotechnology activities, including Improved rowcrops, value-added crops, forestry products, toxicological products, and clinical research. Some additional areas of focus for the cluster have been in the areas of bio-informatics.

➤ **Cluster's Innovative capacity**

The analysis indicates a strong innovation environment based on federal government investment in R&D, quality universities and research centers, effective institutions for linking noncommercial research organizations with business, and entrepreneurial research institutions and firms.

**Specialized Educational Institutions and Talent Pool.** The University of North Carolina-Chapell Hill, North Carolina State University, Duke University, local private universities, and the region's community colleges offer a variety of general courses and specialized programs at the undergraduate, graduate, and continuing education levels. Interviewees reported satisfaction with local training and talent as far as quality, but not quantity. Eighty-five percent of biotechnology survey respondents in the Research Triangle region indicated that

advanced educational programs (e.g., vocational schools, colleges and/or universities) provide their businesses with high quality employees, compared to 75% across all regions.

**Specialized Research Centers.** Specialized bioscience research centers are a key strength of the cluster. There are six major research institutes in the Research Triangle. Ninety percent of survey respondents stated that specialized facilities for research are readily available to their firm, and 60% reported that these institutions frequently transfer knowledge. This compares to 76% percent and 53% respectively across all other regions. Duke University ranks among the top centers in peer-reviewed grants and contracts, with the center receiving large portions of its funding from the National Cancer Institute Core Support Grant — nearly \$20 million is expected over a five-year period. The University of North Carolina-Chapel Hill is ranked 13th nationally in cancer research funding to universities, with about \$20 million received annually. The economic impact of each medical center is important to the Triangle. Both are their respective county's top employer.

**Context for Firm Strategy and Rivalry.** The Research Triangle pharmaceutical / biotechnology cluster exhibits relatively little competitive rivalry, high rate of new firm formation, and norms that reward risk-taking. Forty-two percent of survey respondents described competition as "intense," and 42% said there were a large number of local competitors. Both rates were below average across all the regions we surveyed.

**Sophistication of Regional Demand.** The Research Triangle pharmaceutical /biotechnology executives expressed mixed views about the level and sophistication of interaction with their local customer base. Nearly 80% of respondents reported that their regional customers were sophisticated and demanding, but they did not feel that this demand provided them with a competitive advantage.

**Related and Supporting Industries.** There are a number of firms in the Research Triangle that provide lab and testing equipment, and conduct drug testing and small contract manufacturing of trial drugs. Most survey respondents (69.2%) stated that these firms provided *high quality goods and services*. Sixty-four percent reported that specialized suppliers were frequently available in the region, and 35.9% said they frequently had to go outside the region to source materials, components, and services. Forty-two percent stated that ***specialized suppliers frequently helped them in the innovation process***. Each of these ratings was more positive than the average across all regions surveyed.

The Research Triangle has firms in the legal, venture capital, banking, accounting, and real estate services with specialties in technology-related industries. While the quantity and experience of these firms do not match that in Silicon Valley or New York, most of the biotechnology entrepreneurs stated that they could find business services in the region.

**Government.** Government actions have had a positive impact on the cluster through federal R&D funding, state founding and funding of the North Carolina Biotechnology Center and local government's zoning of the Research Triangle Park. Fifty-five percent of the region's

survey respondents indicated that **state and local government support for investment in R&D** (e.g., funding business incubators, creating consortia) was ample, compared to 35% for survey respondents across all regions. Sixty-six percent of the Research Triangle biotechnology respondents indicated that the government's overall responsiveness and **ability** to work with the needs of business were high, compared to 39% across all regions. While these numbers indicate good government involvement in the cluster, several executives cited the need for greater cooperation among the different government jurisdictions, including "the need for one chamber of commerce.

**Institutions for Collaboration.** Like the Research Triangle in general, the business environment of the pharmaceutical / biotechnology cluster was marked by **the presence of large pharmaceutical companies**, but also a lack of start-up business expertise and capital in the 1970s and 1980s. For example, when Sphinx Pharmaceutical was founded, they were unable to rely on local talent or local money. The North Carolina Biotechnology Center and the Council for Entrepreneurial Development changed this. Interviewees consistently cited the North Carolina Biotechnology Center and the Council for Entrepreneurial Development as important to the cluster's success, not only because they link firms to research and talent inside the universities, but also because they give firms access to business knowledge and venture capitalists. Forty-eight percent of survey respondents reported that **institutions for collaboration were helpful to entrepreneurial firms**, but only 26.7% said it was helpful to established firms— a further breakdown of responses is given in Exhibit 63 below. The North Carolina Biotechnology Center and the Council for Entrepreneurial Development have been especially helpful for the pharmaceutical / biotechnology cluster, and any weakening of their effectiveness would disproportionately affect this cluster.

The cluster also faced a complicated regulatory environment and inattentive local government in the 1990s. Interviewees reported that the North Carolina Biotechnology Center and the Council for Entrepreneurial Development have been **effective in helping with regulatory and legislative issues, and community educational outreach**. According to an industry executive, "the Council for Entrepreneurial Development in particular has something for everyone: capital gets access to potential deal-flow, service providers get access to potential clients, companies get mentoring and advice, and scientists get access to industry leaders. The Council for Entrepreneurial Development has also had a number of big successes over the years which give them credibility, they are perceived as being effective, and hence can get the participation that makes them effective. Finally, they have **great leadership**. As for the North Carolina Biotechnology Center, one biotechnology CEO added, "the North Carolina Biotechnology Center is instrumental in helping local biotechnology start-ups. They are usually more useful for start-ups, but they are also very important to the larger players because they help coordinate training programs with the local Community colleges.

Results indicate that **firms partner with other institutions** most often at the idea generation stage, less at the development stage, and least at commercialization. The one exception is interaction with regional customers, with which firms interact most often at the commercialization stage. According to the survey, pharmaceutical / biotechnology executives

are somewhat concerned about insufficient interaction with their local customers; 60% state that improving the quality of transportation is a future threat if not addressed. This was the greatest concern, along with lowering the costs of doing business.

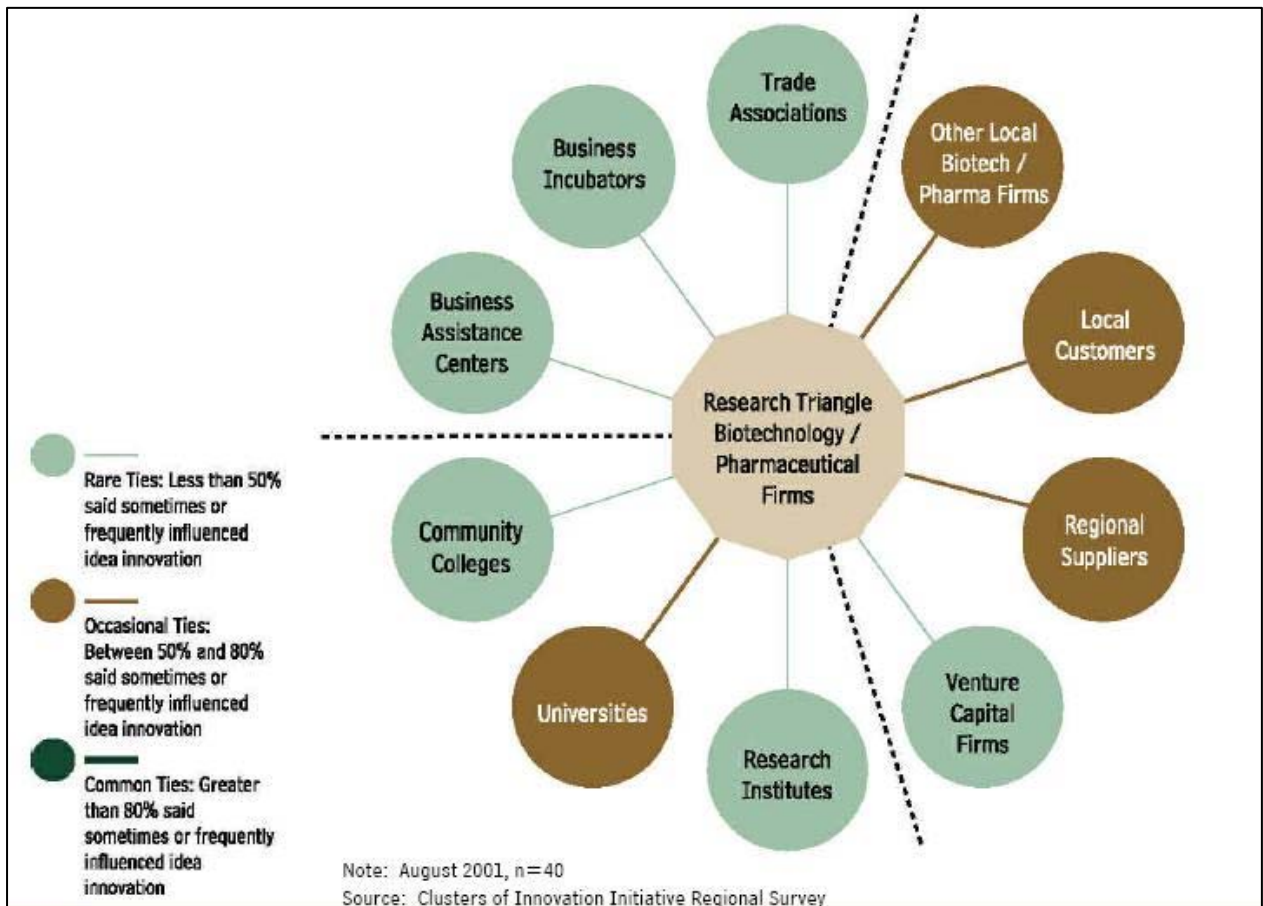


Figure 3: Strengths of linkages, pharmaceutical / biotechnology cluster, Research Triangle

### ➤ What did we learn?

The Research Triangle's pharmaceutical / biotechnology cluster provides a number of useful lessons for other regions seeking to develop their own cluster and substantiates several propositions of the diamond framework. First, **conscious human efforts** were instrumental in launching the cluster, the most important being **the attracting of numerous research institutes, the recruitment of successful scientists** from other regions, and the formation of the Research Triangle Institute and the North Carolina Biotechnology Center to facilitate knowledge transfer and concentrate business know-how. Second, building the cluster required **sustained commitment**, bioscience research centers were established by 1980, but the cluster did not take off until the late 1990s. Third, **high quality specialized inputs—and in particular human assets—** were vital for growing the knowledge-intensive the pharmaceutical/ biotechnology cluster in the Research Triangle. Fourth, **geographic proximity**—in this case clustering on the Research Triangle Park—facilitated the flow of information and ideas. Fifth, **public and private collaboration** were important for building

the cluster, as is demonstrated by the important role of noncommercial research centers, the University of North Carolina-Chapel Hill, Duke University, North Carolina State University, and the institutions for collaboration that help link them to Industry. Sixth, a **diversity of related non-commercial institutions** helped the cluster grow by offering companies a variety of models for collaboration.

## 5. What is happening in Asia?

The cluster approach continues to gain ground as a key strategy for industrial development in today's globalised era. Nevertheless, not every country and cluster achieves the desired competitiveness goal of cluster development. While many cluster studies have examined factors and conditions that influence the success or failure of cluster development, most focus on only one or two aspects. But cluster development is a complex process that involves numerous interdependent actors and institutions. To develop clusters successfully, policymakers must view cluster development as a 'process' and understand their intertwining elements and mechanisms.

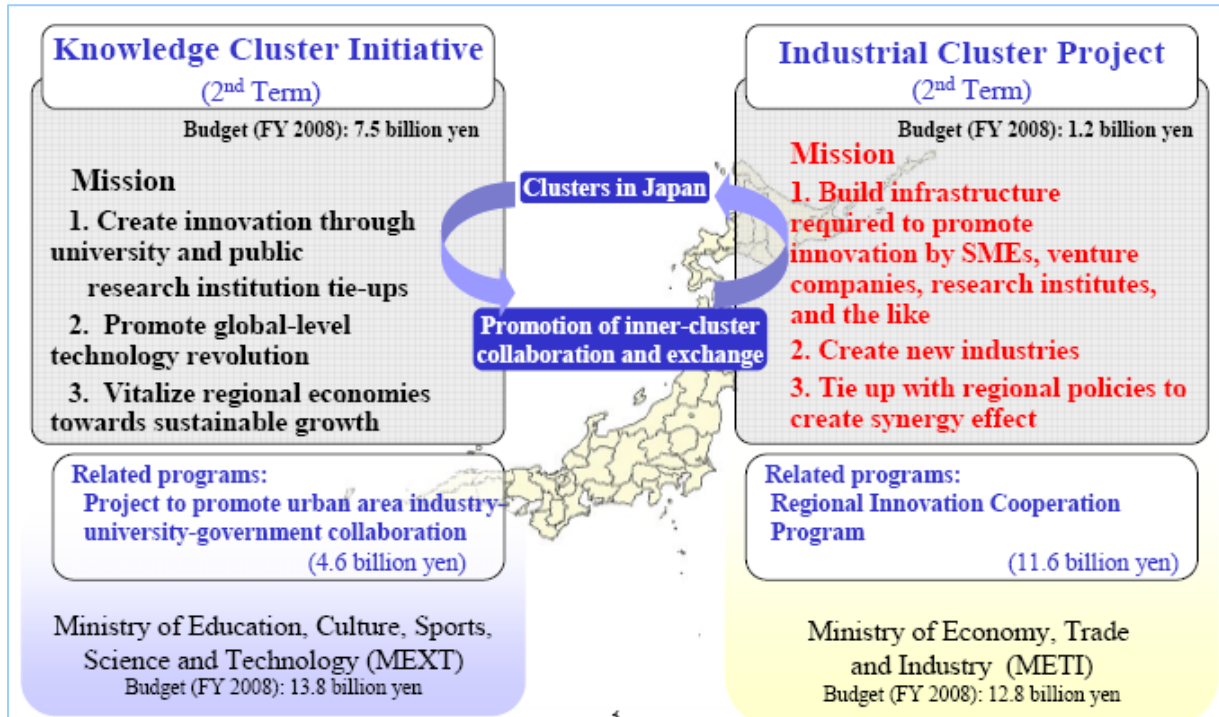
### 5.1 Cluster Policies in Japan

During the last several years major changes and restructuring have been taking place in the Japanese economy. Like other developed countries Japan has been increasingly recognizing the importance of (SMEs), industrial agglomerations (called also districts or clusters) and inter-firm networks. Throughout the last two decades Japan's industrial and SMEs promotion policies have fundamentally changed. However, the policy change seems to be very gradual and slow compared to the actual change surrounding local SMEs. Even though there has always been a general and inevitable gap between the national policy and the SMEs motivations, the question of how to overcome such a gap has emerged only recently as a crucial target of the current industrial policy. Such a tendency could be commonly observed in different countries

The Japanese government has been implementing new policies such as the **Industrial Cluster Plan (METI)** and the **Intellectual Cluster Plan (MEXT)** since 2001. These policies have been promoted as a part of the current decentralization of power. Both plans are being implemented since 2001.

In the background, both METI and MEXT started to use the word "Cluster Plan" at the same time. There had been emphasis on the **importance of networks** within the regional human resources such as **collaborative works of SMEs** or **University-Industry relationships** through the 1990's. However, the term "Cluster" tends to catch up the global fashion trend rather than the actual tendency of the past transition of industrial policy. Applying the word Cluster, the national government and the policy-makers have actively started to propagate

the new industrial policy to the more general public, not only regional actors but also executives and managers of large companies.



**Figure 4:** Depiction of the Cluster Policy in Japan

Main activities of METI

- ✓ *Regional network formation between industry, academia and government*  
Regional bureaus of METI and private promotion organizations collaborate to visit companies, hold study meetings, exchange meetings and seminars, and to support exchange and collaboration of industry-academia-government and industry-industry types led by coordinators.
- ✓ *Support for technical development harnessing regional characteristics*  
Following measures are being developed: “Consortium R&D projects for regional revitalization” that promote industry-academia-government joint R&D utilizing technology seeds and knowledge of each university and “regional new industry creation technical development subsidy project” that promotes high-risk technical development for venture companies to launch business and SMEs’ entry into new fields.
- ✓ *Strengthening incubation functions such as development of facilities for fostering entrepreneurs*

As for hardware, university-collaboration incubator facilities are being developed in several regions per year. Training programs are provided to foster incubation managers. METI budgets about 5.2 billion yen (FY2005) for facility development and training programs.

- ✓ *Support for market cultivation collaborating with trading firms, etc.*

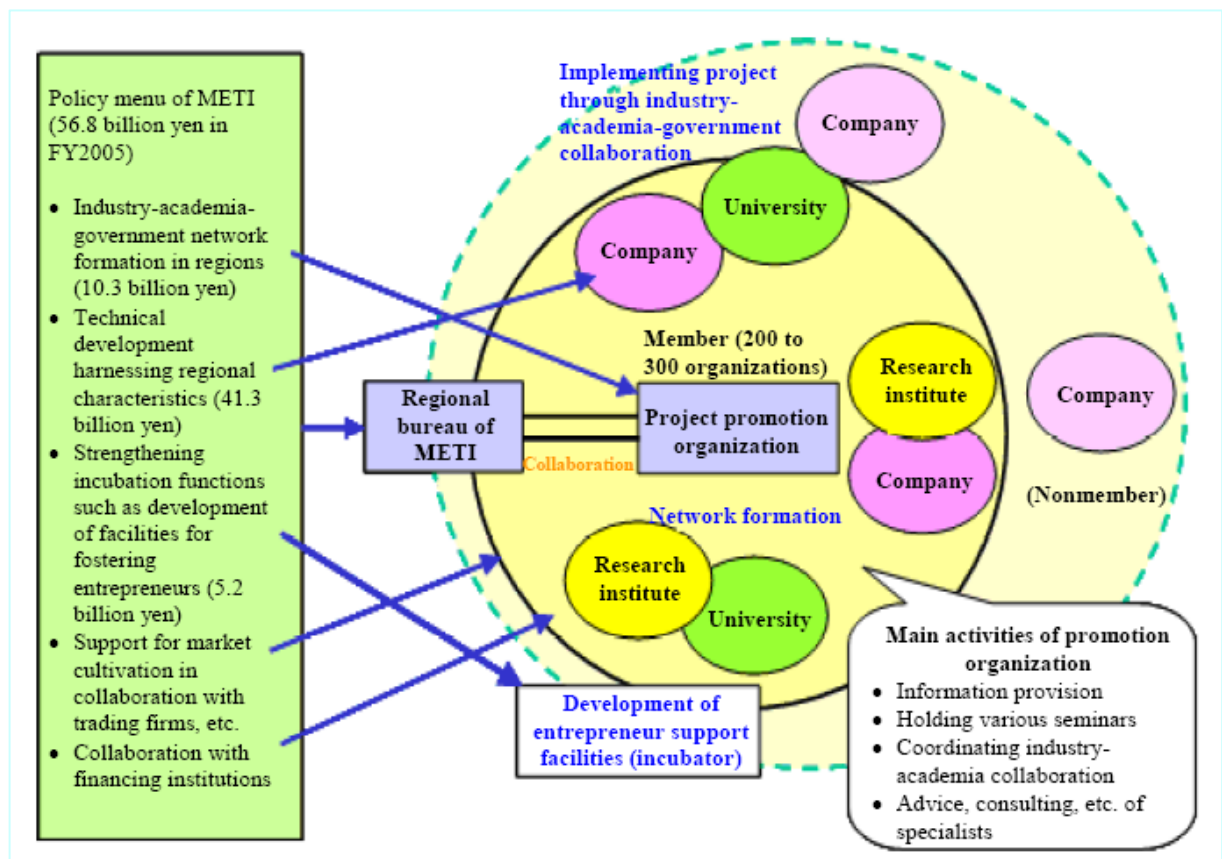
Matching meetings between marketing-savvy trading firms/financial institutions and SMEs are held to support market cultivation.

- ✓ *Financing through collaboration with financial institutions*

Collaboration with the Industrial Cluster Support Finance Conference established in each regional block is being promoted. This led to the establishment of bridge loan system for technical development subsidy, etc. provided by private financial institutions. Some projects have created funds by local venture capital.

- ✓ *Fostering human resources including highly specialized personnel*

Trainings are provided to foster technical personnel. As for financial judging personnel, trainings and business seminars are provided. Two of the characteristics of the Industrial Cluster Plan are that projects are promoted by promotion organizations and that budget of METI for projects is not fixed but flexible.



**Figure 5:** Systems in the Industrial Cluster Plan

**MEXT** supports the formation of regional clusters through the Knowledge Cluster Initiative and the City Area Program. These programs are focused on connecting university R&D functions with regional SMEs and industry. The **Knowledge Cluster Initiative** supports the formation of medium-size clusters to help regions with technological strengths develop “world class innovative clusters” (based on past results), whereas the City Area Program supports small to medium-sized clusters that lever unique regional resources through industry-academia-government collaboration. In both MEXT programs, 80% of funding goes to university R&D activities (for projects conducted together with regional SMEs), and 20% of funding is for coordination activities of the knowledge cluster initiatives. Funding is channelled through “knowledge cluster headquarters” (i.e. cluster organisations) designated by local government. The innovative stage promotes areas not supported by previous knowledge cluster initiatives and focuses on globalising the local knowledge clusters.

## 5.2 Some Japanese Clusters

### Hamamatsu Cluster

The San-En-Nashin Industrial Cluster Hamamatsu branch is an initiative within the METI Industrial Cluster Programme, started in 2002. The cluster has two main objectives: **to foster industry-university- government collaboration** and **to foster creation of new industries** by utilizing research of four research groups: space and airplane technology, medicine-engineering, agriculture-engineering and optical technology. The cluster is coordinated by head of the branch, project manager and vice project manager. The cluster branch organizes activities related to commercialization of products, new product and technology development, training of industrial personnel, improvement of quality and development of technologies. The cluster is quite successful in the development of new products as a result of industry-university collaboration in the Hamamatsu area and due to significant population of product-developing SMEs with absorptive capacity. Two examples of the successful outcome of industry-university collaboration are addressed:

- ✓ The Space Creation Co., Ltd, developed a laser vibration measuring system using self-mixing effect. The product was a result of networking with local universities specialized in photonics, and networking with nation-wide universities and institutes.
- ✓ Another interesting example was addressed was the collaboration of a neurosurgeon, a company specialised in imaging, and a larger enterprise to subsequently “industrialise” and bring a new product to the market.

The Hamamatsu cluster is an interesting demonstration of Public-Private Partnership and the role the local clusters and cluster managers played in this project. It demonstrates that a significant role of the local cluster manager was to facilitate the partnership between a number of enterprises and the hospital as well as providing access to MEXT programs. This particular facilitation is an important part of cluster-practice in Japan that should inspire the cluster internationally.

**University-Business Cooperation Cluster in Sendai**

A new global competition in innovation has begun, to further mankind’s advancement. Known as NBI Converging Technology, the field aims to raise standards of living and improve mankind’s capabilities by combining N (Nanotechnology), B (Biotechnology) and I (Information Technology). Competition in this new area of innovation has already begun, centered in the U.S. In fact, Silicon Valley is looking to NBI Converging Technology to be the drive behind the ‘next generation Silicon Valley,’ to rival other technology centers such as Austin, Boston, Washington and Oxford.

In Japan, the Sendai Cluster can realistically compete on a global scale by **combining the acumen of local businesses with the academic research of Tohoku University**. The university leads the world in material development using nanotechnology, which is viewed as the key to NBI development. Tohoku University has been very active to make university-industry linkages. It established NICHe (The New Industry Creation Hatchery Center) in April 1998 with an aim to vitalize domestic industry by collaborating with outside organizations of industry through the utilization of intellectual resources accumulated at the university. Furthermore, when the Law for Promoting University-Industry Technology Transfer was established in May 1998, the university quickly responded to the law, creating Tohoku Technoarch Co., Ltd., which was approved official TLO under the Law on December of the same year.

**The ‘Silicon Sea-Belt Project’** is a cross-border project for the design and production of semiconductors spanning from Japan (centering on the southern island of Kyushu), to South Korea, Taiwan, China and India. Around 40% of global semiconductor production occurs in this area, and it will continue to play an important role in the future as a base for semiconductor design and production. This area is extremely important because the region is likely to become the biggest market in the world within the next five years, with over 500 million workers earning over five million yen annually. This area will emerge as a far richer market than Europe or even North America. In this area alone, IT products will be able to move in a loop from the formation of technical standards, to design, production and on to consumption. The graphic below depicts the ‘Silicon Sea Belt’ as highlighting the bright future prospects of the Fukuoka semiconductor cluster.



**Figure 6:** *Silicon Seabelt.*

### 5.3 Examples of industrial cluster type and goal setting

Type	Characteristics of measures and goals
<p><b>Industrial cluster of revitalization type in the three metropolitan areas</b></p>	<p>Each of the three metropolitan areas – Kanto, Chubu-Tokai, and Kinki – forms a virtual mega cluster including wide range of fields from <b>automobile, digital appliances, mechatronics to bio and nano industries</b>. In this mega cluster, there are many subclusters such as large company-centered clusters, clusters of SMEs, university-centered clusters, and clusters by local governments, etc.</p> <p>Based on policy needs, in principle, subclusters instead of the whole mega cluster are targeted and cluster formation is supported centering on the revitalization of the existing companies.</p> <p>[Examples of characteristics of goal setting]</p> <ul style="list-style-type: none"> <li>• The revitalization of the existing companies is targeted. Many companies have provided supports that are close to the process of commercialization.</li> <li>• Collaboration with large companies is a prominent feature. Collaboration with municipalities is also common.</li> </ul>
<p><b>Science and technology-centered industrial cluster</b></p>	<p>Regardless of the existing industrial agglomeration, clusters of this type are formed by the industrialization of technology such as the establishment of ventures and technology transfer of research results from science and technology fields including IT, bio, nano, and environment. High-level universities and public research institutes play a central role in carrying on those researches.</p> <p>As a policy, supports for R&amp;D, technology transfer and ventures are given greater importance. Time cost and investment cost before the commercialization level are relatively high because the results of the most-advanced science and technology are treated as seeds.</p> <p>[Examples of characteristics of goal setting]</p> <ul style="list-style-type: none"> <li>• Technology transfer, support for launching of business, and business incubation are focused on.</li> <li>• R&amp;D absorbs a great percentage of support, and there is a big time lag between support and the increase in sales.</li> </ul>
<p><b>Industrial cluster by only one and/or niche</b></p>	<p>There are many regions with certain amount of industrial accumulation not as large as the three metropolitan areas. They have already established “a network where each face is visible.” These regions, by utilizing the regional cohesiveness and community strength, they can foster and develop new products and new business in such fields as only one technology and niche field, which target the three metropolitan areas and global market.</p> <p>As for measures, supports for industrial cluster formation is provided mainly develop new businesses, industry-academia collaboration, cross-industrial collaboration based on the network above mentioned, and the establishment of broad networks.</p> <p>[Examples of characteristics of goal setting]</p> <ul style="list-style-type: none"> <li>• The revitalization of the existing companies is targeted on. Many companies have provided supports that are close to the process of the commercialization.</li> <li>• Niche field is often targeted. Market share is limited.</li> </ul>

<b>network formation between mini clusters</b>	<p>Regions where industrial accumulation is thin and each accumulation base is distant from other bases have only mini clusters; there is no broad-based cluster. As for measures for such areas, broad-based collaboration among mini clusters as well as mini cluster formation in each region is supported to form industrial clusters.</p> <p>Advancement into national market and collaboration with other regions are actively promoted because these regions alone cannot secure sufficient market nor business seeds.</p> <p style="text-align: center;">[Examples of characteristics of goal setting]</p> <ul style="list-style-type: none"> <li>• Each cluster is small-scaled and needs time to develop.</li> <li>• Network formation between clusters also needs long time.</li> <li>• Special attention should be paid to make annual plan and goals.</li> </ul>
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**Table 1:** Cluster, Measures & Goals

## 5.4 Framework of cluster policy

### 1. Policy intent

In order for Japanese industry to survive in increasingly intense international competition and for local economy to develop autonomously, it is important that innovations are created and developed not only in Tokyo but also throughout the country and that new industry and new business are created utilizing industrial resources of each region.

For this purpose, it is vital to **develop business environment to promote innovations** not by vertical and one-sided relationship often seen in subcontract and trade between affiliate companies, but by forming **horizontal networks such as industry-academia, industry-industry and cross-industrial collaborations**.

These efforts to create new industries are being actively developed overseas as industrial cluster formation policy while the Japanese government has started to deal with. It is important to systematize them immediately. Judging from this situation, it is appropriate to define an industrial cluster “not as a mere agglomeration of companies, etc. without interactions but as innovative business environment where new businesses sharing management assets with each other are created one after another through horizontal networks such as industry-academia-government collaboration and collaboration between companies, and the resulting state in which industry with comparative advantage plays a central part in promoting industrial agglomeration.” The intent of the industrial cluster policy can be defined as **“to form industry-academia-government networks and industry-industry networks throughout our country for the purpose of forming industrial clusters, and to create new industries and new businesses by promoting regional innovations”**.

## 2. Policy objectives

In accordance with the policy intent mentioned above, it is important to newly set objectives of industrial cluster policy and the role of the central government as follows.

- Development of business environment to promote innovation. In order to promote innovation by “new fusion” of industry, academia and government, business environment should be developed including **industry-government-academia collaboration system** and support system on launching business, new business development, business collaboration and management innovation.
- **Creation of new businesses** in accordance with national strategies As for the new businesses designated in the Nakagawa Report, etc. as important fields for national strategy, their germinations are to be found and developed in regions. Having new developing industries take root in regions is also needed.
- Synergistic effects with local industry promotion. Collaboration with local industry promotion policy led mainly by the region aiming for independence of local economy by endogenous development is effective for the creation of new business and new industry. It also contributes to local industry promotion and brings about a **greater synergy between the region and the central government**.

## 3. Policy schemes

Policy schemes to achieve the above mentioned objectives of industrial cluster policy are categorized as organizational structure and management structure as follows (Figure).

- Organizational structure: Support for network formation Providing **financial support** and contributing in personnel for large-scale promotion organization leads to the formation of industry-academia-government “network where each face is visible” which is the core of an industrial cluster. **Networking** is also promoted by supporting activities of regional base organizations and core industry support organizations that would contribute to cluster formation.
- Management structure A: **Support for business activities**. Specific businesses based on industrial cluster formation activities are provided business support. Specifically, budget for SMEs, budget for science and technology promotion and other systems are widely and strategically utilized in such business activities as cross-industrial collaboration, management innovation, and support for R&D, market cultivation, launching of business and incubation.
- Management structure B: **Promotion of collaboration** with related organizations in financing, market cultivation, fostering of human resources and other cluster activities, collaboration relationships are promoted with local financial institutions, distributive institutions such as major trading firms and wholesale, and educational institutions such as schools, all of whose cooperation is necessary.

	Support field	Example of support menu
Organizational structure	Network formation (formation of collaboration ground)	<ol style="list-style-type: none"> <li>1) Establishing organization that promotes cluster formation, networking with related organizations (base organization)</li> <li>2) Dispatching coordinators to participating companies and universities</li> <li>3) Information transmission by web site and mail magazine</li> <li>4) Holding industry-academia collaboration exchange, joint meeting for announcing the results, symposium and seminar</li> <li>5) Developing database on companies, researchers and supporters</li> </ol>
Management structure A	Support for R&D (development of collaboration activities)	<ol style="list-style-type: none"> <li>1) Promotion and collaboration of R&amp;D by public fund (projects of regional bureaus of METI, New Energy and Industrial Technology Development Organization, National Institute of Advanced Industrial Science and Technology, and other ministries)</li> <li>2) Promoting utilization of research results (meeting for announcing the results, technology matching, dispatch of specialists, etc.)</li> <li>3) Support for protection and strategic use of intellectual property (establishment of regional intellectual property strategy head quarters, etc.)</li> </ol>
	Strengthening incubation function (support for starting business)	<ol style="list-style-type: none"> <li>1) Developing incubation facilities</li> <li>2) Fostering incubation managers</li> <li>3) Network formation between incubation organizations and incubation managers</li> </ol>
	Support for market cultivating (commercialization of products developed)	<ol style="list-style-type: none"> <li>1) Holding business matching meeting and exhibition of products</li> <li>2) Collaboration with trading firms</li> <li>3) Establishing distribution system</li> <li>4) Market cultivation through coordinator</li> <li>5) Support for cross-industrial collaboration business</li> <li>6) Promoting trade and interchange with overseas markets (local-to-local industrial exchange project, etc.)</li> </ol>
Management structure B	Collaboration with financing institutions (management support)	<ol style="list-style-type: none"> <li>1) Collaboration with local financial institutions (holding of Industrial Cluster Support Finance Conference, bridge loan and low-interest loan by business collaboration, establishment of venture fund)</li> <li>2) Establishing local venture capital</li> <li>3) Holding meetings for announcing business plan</li> </ol>
	Fostering human resources	Fostering highly specialized human resources (manufacturing personnel, technology management specialists, judging personnel, etc.)

**Table 2: Industrial Cluster Policy in Japan**

## 5.5 Evaluations of Japan's Cluster Policy

### Factor-1: Autonomous Developments

Japan's policy has just mentioned its importance and instructed the SMEs and regions to be modeled on the best practices such as Silicon Valley. Not only in Japan but also in many developed countries the best practice-oriented approaches have been implemented because of the difficulty to support the autonomous evolution system of the economy. Due to that problem the governments rather pursue the role of a pilot boat for the industries watching and observing carefully what direction they wish to go or should go. However, we need to discuss if such an objective should be the government's matter or not. In the developed countries it is the industry rather than the government that takes a more proactive attitude. Thus the role of the government has to be restricted and rather regional coordination is required. On the other hand, the government still desires to get the information in different fields in order to justify its new role which aims to enhance clusters both for the regional and for the national advantage. As a result of these tendencies the most crucial point could be

how to reduce the gap between top-down implementation and bottom-up emergence. We shall consider this point from the bottom-up point of view of SMEs later.

*Factor-2: Innovation and Flexibility*

It has been consistently emphasized that both innovation and flexibility need “networks”. This point is deeply related to the first point. Deep analysis and vision how to enhance the networks within clusters seem to be still lacking. However, the most valuable and particular results of the Japanese government (METI) seem to be the organizational change to reform the system of policy implementation. Such a flexible change of the formation must be the proper function of METI. In addition, the implementation of a one-stop coordination system such as the regional platform has succeeded in leaving the best distribution of policies or grants to each region’s discretion. While the results are depending on each region’s ability, we can observe that such an organizational change within a superstructure of industrial policy has directly brought influences on each actor’s organizational behavior. For example, entrepreneurs who were once regarded as outsiders or eccentrics now tend to be regarded as new leaders enhancing the networks within the cluster.

*Factor-3: Closer Connection and Easy Accessibility to Various Policies for the Local Actors*

The gradual but fundamental change throughout the 1990’s could succeed in implementing each region’s one-stop platform. While the level of efficiency is depending on each region’s ability, the basis for such a change was already implemented at least institutionally in all regions. It is needless to say that such a change of regional policy could already be seen in the 1980s in the United States and European countries. In the case of Japan even though a tendency to catch up such a stream with around 15 years delay could be observed, endogenous emergence within its own historical background could also be observed parallelly.

*Factor-4: Market-Oriented Approach*

This last point is probably the most difficult factor for the government. In case of Japan, a more crucial factor of policy measurement seems to be lacking. The appropriate measurement system in implementing the competitive approach is required to judge which region, which university or which company should get the huge subsidies provided with the national cluster policy. **Such a measurement has to include broader knowledge in various disciplines such as corporate finance, marketing, patent, innovation, venture incubation etc.**

## 5.6 A few words about clusters in SE Asia

A brief study in the SE Asian clusters produced five main findings. **First**, clusters in the same sector are likely to have a similar structure due to the influence of the industry-specific context. **Second**, cluster governance is likely to be aligned with the structure of the cluster. **Third**, country-specific context can alter the governance of clusters from the typical form shaped by the industry-specific context. It does this by intervening in the capabilities of local

actors/institutions. **Fourth**, clusters facing a similar challenge and operating under a similar form of governance do not necessarily utilise the same institutional modality to cope with their competitive challenges. Rather, the modality applied depends on the composition of actors in the cluster structure and on the industry-specific context. **Fifth**, differences in the degree of effectiveness of the institutional modality of cluster intervention are attributable to (1) differences in business systems and industrial contexts, (2) characteristics of a core agency for cluster coordination, (3) the type of competitive challenge faced and (4) the presence (or absence) of specific cluster actors.

In addition, the findings reveal three key lessons and policy implications for cluster policymakers and practitioners. *First*, policymakers should consider formulating cluster policy that suits the developmental stage of the cluster. *Second*, to effectively implement cluster policy, the key role of government is to strengthen capabilities of local actors and institutions. *Finally*, in evaluating cluster policy, government should focus more on 'process effectiveness' rather than on only the outputs/outcomes of cluster development policy.

The results of studies regarding clusters in SE Asia unveil three interesting lessons for cluster policymakers and practitioners. *Firstly*, clusters at different stages of development need distinct types of policy support. While generic cluster policy is necessary, it is not sufficient to ensure sustainable development. Cluster strategies have to be tailored to the developmental stage of each cluster. *Secondly*, to develop clusters successfully, a foundation of local capability is crucial. Creating local capability within a nation requires strategies and processes to engage and empower capable people and to develop people's knowledge and organisational and technical skills. *Lastly*, evaluation of the effectiveness of cluster policy or interventions should focus more on process evaluation so as to better see the missing dimensions of cluster policy implementation.

## 6. Other Clusters worldwide

### 6.1 The Australian wine industry cluster: a success story

It is not clear how many potential and active clusters there are in Australia, although more than 70 potential clusters have been identified. Continuing, it is presented a very successful Australian wine cluster.

The Australian wine industry is proof of the positive changes that can be made through collaboration and a focus on quality and export. Victoria's goal should be to replicate the success of the Australian wine cluster throughout the Victorian economy. In the mid-1980s, Australia exported 2% of its production and was a net importer of wine. Exports now total 33% of total production. Australia produces 3.1% of world wine but holds 4.4% of the world's market. Between 1966 and 1996 Australian wine production has tripled from 156 million litres (ML) to 572 ML. In 2002 wine production reached 859 ML.43

The industry comprises 1,465 wineries and over 4,000 growers. It is dominated by a few large companies. The top 9 companies account for 78% of total production. The top three firms (Southcorp, BRL-Hardy and Orlando-Wyndham group) account for 70% of total exports. The top 20 companies own or lease about 22% of all vineyard hectareage, while 22% of the total grape intake is processed at three processing facilities. In addition to core wine growers and producers, there are an estimated 663 firms supplying a wide range of specialised inputs.

**Factors contributing to the success of the wine industry** include the devaluation of the dollar, changing consumer tastes and demand, lifestyle changes, the mechanisation of harvesting and pruning and some natural endowments (land and climate). The structure of the industry has also facilitated growth. **Industry leadership, the strong role of industry associations, the development of support structures and continuous support from Government have all played important roles.**

The main organisations that support the wine industry include the *Winemakers Federation of Australia* (WFA – the industry’s national policy and development body established in 1990 from the previous Commonwealthfunded Industry Advisory Council) and the *Australian Wine and Brandy Corporation* (AWBC – a statutory body established in 1981 to deal with regulatory issues and marketing). Marketing is now promoted via the *Australian Wine Export Council* (1992). The *Grape and Wine Research and Development Corporation* (GWRDC), established in 1991, manages research and development funding.

These main organisations are supported in turn by a number of bodies that deal with research, education, and technology transfer and consumer awareness. These include the *Cooperative Research Centre for Viticulture* (1991 – dealing with research and education policy), the *Wine Industry Information Service* (the first point of contact for inquiries about the wine industry), the *Australian Society of Wine Education* (1990 – providing wine education training to the general public) and the *Australian Wine Foundation* (1988 – dealing with wine and health education).

The *Wine Industry National Education and Training Council* (1995) ensures that future industry skill requirements are met through vocational education and training. The *Australian Winemakers’ Forum* caters mainly for SMEs and was established in 1984. Colleges in Adelaide (*College of Roseworthy*) and Wagga Wagga (*Charles Sturt University*) are specialist agricultural colleges. The *Universities of Adelaide and Flinders*, along with the *CSIRO*, provide research and consulting. Five major journals disseminate information about the wine industry.

**Collaboration among stakeholders is seen as crucial to the growth of the wine industry** and has occurred at many levels, including:

- agreement on export targets set at 200 million in 1993 and \$1 billion by 2000, which led to the AWBC increasing its promotional expenditure

- the 1996 launch of Strategy 2025, a major collaborative effort adopting a holistic approach to growth
- increases in R&D expenditure following the Commonwealth Government's offer to match industry investments in R&D
- technological developments in wine production and grape production.

These collaborative efforts have produced good results:

- Exporting firms grew from 270 in 1994, to 414 in 1998 and 659 in 2002. In all, 45% of firms are exporters.
- Wine exports grew 26% each year on average between 1989–1999. Exports now account for 46.8% of total sales compared to only 3% in 1984. The value of exports has increased from \$13 million in 1981 to \$2 billion in 2001–02.48
- Market capitalisation of wine grew from \$1 billion in 1992 to \$4.2 billion by 1999.
- 68% of Australian winegrowers have adopted one or more innovations, such as improving grape and water quality and better pest and chemical management.

#### **Collaboration of the University of Lancaster with the Australian wine cluster**

If only there were a way to make plants use less water for the same yield. Incredibly, it looks as though there is. The system is called partial root drying (PRD), and it exploits the way that plants' roots signal that water is scarce.

<http://www.foodsecurity.ac.uk/research/current/reducing-water-use.html>

It works like this: when one side of an individual plant's roots are starved of water, signals are sent to the leaves to reduce growth and close leaf pores called stomata, which reduces water use, and loss, respectively. Although the growth rate of the leaves declines, because the other side of the plant is being watered the plant does not wilt and carries on producing fruit bodies, like grapes, tomatoes and so on. Finally, alternating which side of the plant receives water prevents roots from dying in very dry soil.

The overall result can be that the same (or nearly the same) yield is achieved with up to half the amount of water used.

With limited access to water but a thriving wine export economy, ***PRD has been pioneered by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Adelaide, building on science largely conducted by a research team led by Professor Bill Davies at the University of Lancaster.*** When the Lancaster team first tried the system with apple trees, leaf growth declined but the water balance of the leaves remained buoyant; a clue that the signal to reduce leaf growth and close the stomata was coming from the roots – not the leaves – and this can be exploited using different watering strategies to reduce water use in agriculture

The system has been trialled in a number of environments and on different crops. Australian scientists at CSIRO and the University of Adelaide found that water use could be reduced by 40%. An unpredicted bonus was that the reduced leaf growth allowed more sunlight to strike the grapes, raising the sugar concentration which can make for a higher quality product.

**The success of the wine industry has been driven by a partnership between industry and government.** The WFA was the catalyst behind Strategy 2025 and the Commonwealth Government coordinated marketing and R&D through the AWBC and the GWRDC. The Commonwealth Government has played the role of coordinator, facilitator, manager of marketing and research funds, regulator and agent for behavioural change. Governance of the wine industry was facilitated by the collocation of the WFA and other major stakeholders (WGGA, GWRDC and AWBC) in one building at Magill in Adelaide. Overlapping governance – where industry leaders and government representatives are members of more than one industry body – facilitated the development and implementation of the 2025 plan. It also facilitated the alignment of goals and objectives of all stakeholders.

Ian Marsh and Brendan Shaw note that there are many lessons to be learnt from the wine industry. They also place emphasis on:

- ◆ **collaboration** as a way to improve economic performance through which export and innovation opportunities are developed and disseminated
- ◆ **clustering** – which enables firms to access innovation and take advantage of global opportunities
- ◆ **public Policy** – new policies to enable businesses to overcome general transaction costs which are a barrier to economic growth though collaboration and clustering.

### **Some Observations**

The fact that many firms are eager to join networks and clusters demonstrates that firms are willing to work together to achieve common objectives. However, it takes time before firms develop a relationship of trust with other firms. It is too early to say how successful Australian cluster programs have been, although South Australia has achieved positive results in a short time with limited budgets.

The highly **successful Australian wine cluster is proof that where leaders, industry associations, governments and support organisations cooperate to implement a clearly defined vision and plan, Australian clusters can be very successful.** The wine cluster is quite unique, because the Adelaide region fits the definition of a cluster, but contains universities, research centres and statutory bodies that perform a national function, servicing the whole of the Australian wine industry which is concentrated in a number of areas scattered throughout Australia.

### **6.2 Ottawa cluster, Canada**

Ottawa's photonics cluster, the largest such cluster in Canada, has not merely survived the ups and downs of the worldwide telecommunications roller coaster. It has also emerged in recent years as one of the country's most robust and innovative R&D communities.



With around 70 flourishing photonics companies (up from 30 during the worst of the telecom downturn) the Ottawa cluster is home to many start-ups that rely on the expertise of larger community players to realize their research and commercialization goals.

The cluster has diversified substantially since the height of the telecom boom. Today, it comprises many companies developing world-leading solutions in healthcare, energy and sensor applications.

### **Commercialization and technology transfer**

Companies in Ottawa's photonics cluster use the resources of NRC-CPFC as an integrated manufacturing and marketing solution. Among other services, the facility provides world-class engineering and manufacturing assistance, and commercial grade prototyping and pilot-run production facilities.

As a cluster resource, NRC-CPFC helps clients demonstrate the value of their technology and secure venture capital funding. For example, from 2005 to 2009, three Ottawa-based start-up companies who were NRC-CPFC clients raised \$70 million and increased their employee rosters by nearly 100. As well, two US-based firms opened Canadian subsidiaries in 2006-07 to take full advantage of NRC-CPFC's services.

### **Partnerships and collaborations**

**Partnerships** and **collaborations** are keys to the growth of Ottawa's photonics cluster. Membership in the cluster offers companies access to trade missions, guest speaker presentations and world-class networking opportunities. As well, Ottawa's cluster is part of Ontario's Photonics Industry Network (OPIN) and the Canadian Photonics Consortium (CPC), all of which attract investment, employees and business opportunities locally and around the world.

### **International networks and linkages**

The International Photonics Commercialization Alliance (IPCA) is a North American-based network of photonics clusters and is the single largest photonics commercialization cluster linking Canadian and American photonics organizations. NRC-CPFC is a founding member

of IPCA and was a driving force in its creation. IPCA includes recognized photonics clusters from Quebec, Toronto, New York State, Massachusetts, Pennsylvania, Florida, New Jersey, the Carolinas, Colorado, Texas, Arizona, New Mexico, Connecticut and California.

Since 2007, NRC-CPFC has used the Enhanced Representation Initiative/**North American Platform Program** (ERI/NAPP) funds to organize industry missions to the US and to enable cluster members to attend important international workshops and symposia.

### **MaRS, Toronto Canada**

Canada's MaRS is a large scale, mission driven innovation center located in Toronto and networked across Canada. It is focused on building Canada's next generation of cleantech companies. Led by Tom Rand, a veteran entrepreneur, policy advocate, and venture capitalist, the Cleantech Practice at MaRS has quickly established itself as the largest Cleantech deal-flow engine in the country. Founded last year, the Canada MaRS Advisory Services team has already worked with over 250 cleantech companies from across the province. MaRS provides business advice and mentorship, market intelligence, entrepreneurship education, seed capital and access to critical talent, customer and partner networks. MaRS brought five of its cleantech stars to the Cleantech Group's Boston Forum, and will bring five more to this week's San Francisco Forum. MaRS is the largest cleantech deal-flow engine in Canada. Cluster success stories include: Morgan Solar, NIMTec, Hybrid Energy Technologies, and SkyMeter.

## **7. What is happening in Europe?**

### **7.1 Cluster Policies at EU level**

The growing importance of R&D for the economy, employment and well-being was recognised by the Lisbon European Council on March 2000, which sets for the EU a new, very ambitious strategic goal for the decade: to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion.

#### **Critical Parts of the Lisbon Strategy:**

- ◆ Research (ERA, 3% of GDP 2010, FP 7, European Research Council)
- ◆ Intellectual Property (EU Patent)
- ◆ Competition (Internal market)
- ◆ Public-private cooperation (European Technology Platforms)
- ◆ Innovation
- ◆ Supporting SMEs

In order to achieve this goal, a great emphasis was put on education, research and innovation, i.e. the triangle of knowledge. This new policy approach also underlined the importance of so-called triple helix actions, i.e. close interaction between universities, businesses and public authorities. Moreover, the rapprochement of these different stakeholders and their collaboration can be seen as a prerequisite for building up a well-functioning RDC value chain. Alongside with the realisation of the Lisbon strategy, STI (Science, technology & Innovation) activities naturally were positioned as central elements of the development of the European Research Area (ERA).

Regions play a core role in all these efforts: the regions themselves are best placed to initiate focused efforts, for example in the development of regional STI strategies, and with local level partnerships and clusters of related enterprises and researchers.

EU policies could raise the awareness of the importance of research, development and innovation activities and could provide incentives and support investments in research, infrastructures and transfer of technology and knowledge. However, although different EU policy sectors have become more region-conscious and regional measures have become increasingly STI-centred, the way policy sectors approach regions is different. For instance,

- DG (Directorate General) Research is responsible for the research and technological development policy and focuses on excellence in R&D.
- DG Regional Policy is responsible for the regional and cohesion policies and focuses on balanced regional development and on issues related to economic, social and territorial cohesion.
- DG Enterprise and Industry is responsible for the enterprise, industrial and innovation policies and focuses on European competitiveness and innovativeness and more specifically to the development of knowledge-based small- and medium-sized enterprises (SMEs) and business and entrepreneur activities.

On the other hand, despite the obvious differences in their approaches, targets, instruments and funding criteria, the policy sectors also have common denominators, i.e., overlapping objectives and fields of action as well as a common policy base linked to the Lisbon strategy. Since one of the target areas not only of the EU regional policy but also of several other EU policies (e.g. research, industrial, and enterprise and innovation policies) is 'region', there are good reasons for all the aforementioned policy sectors to seek synergies and more efficient joint measures in order to strengthen their complementarities. The most obvious common view between these policy sectors **is the interest in supporting (national and regional) economic and social development with a special emphasis on knowledge, R&D and innovation, including topics such as development of regional research-driven clusters** In this situation, a better division of work and joint co-ordination of actions between the policy sectors and the programmes they develop would be advantageous.

Currently, the EU and its Member States are making conscious efforts to update and enhance their STI policy measures and also to integrate them more efficiently in other policy

sectors, such as the industrial, regional and environmental policies. The EU and Member States have extended their policy instrument toolkit with a view **to support development and innovation activities conducted by business companies, and promote co-operation between companies, universities, and public research institutes**. It should be noted that the implementation of research and innovation policies at EU-level is still comparatively fragmented. Initiatives are too often unconnected. Interdependencies between various measures are not adequately recognised and synergy benefits are not reached. A more systematic and strategic approach should be developed to address these issues through common visions and target-settings.

The EU policy sectors have to deal more proactively with the challenge of building up crosssectored linkages and enhancing the restructuring of current cross-sectored platforms. This is possible since the new major EU funding programmes on promotion of R&D, innovation, business and entrepreneurship all put more emphasis on the **creation of knowledge-based growth and jobs**. The programmes are far more STI-oriented and region-conscious than ever before. Since the programmes have convergent contents, objectives and instruments, there is room for manoeuvre and opportunities for joint actions and increasing synergies.

At the early stage of the current EU programming period (2007–2013), actions could be carried out to explore potential, horizontal joint initiatives and actions particularly with a view to intensify governance and co-ordination. In the beginning, these activities could take place in the form of joint foresight or benchmark project, for instance. Later on during the programming period, platforms, bodies or high level groups could be established with a genuine mandate to design and launch co-financed actions in the areas with clear links and potential synergies between different policy sectors. For instance, at least a small part of resources of each major EU funding programme could be (re-)allocated and made available to these initiatives.

## 7.2 Cluster Policies in Finland, Sweden and Greece

In the Member States, policies towards cluster development are generally issued by national governments with the co-operation of regional or local governments. While, most of the time, national authorities focus on designing and co-ordinating cluster policies, creating the general framework conditions and developing R&D programmes, regional authorities, on the other hand, take on the implementation phase. Regional administrations are indeed better placed to assess and respond to cluster-specific needs.

The main focus of national or regional authorities is currently on fostering innovation and high, and knowledge-based, technology. Very substantial private and public funds are directed to finance **R&D cooperation programmes** and the commercialisation of research applications. The development of a **culture of networking and collaboration** is another important centre of attention. They instigate the creation of platforms to drive exchanges

between cluster firms, education and research centres, financial institutions and governmental and non-governmental organisations.

### Finland

The basic idea of cluster-based policies has been to provide favourable framework conditions to firms, to promote the functioning of markets, and to concentrate on areas where the market fails (R&D, education, infrastructure services). Policies have aimed at upgrading and creating advanced and specialised factors of production and avoiding interventions in the product market. The appropriate roles of policies can be summarised as follows:

- ◆ Establish predictable and stable operational environment for firms.
- ◆ Create a context that encourages innovation.
- ◆ Enhance networking especially in technology policies.
- ◆ Create and communicate a clear economic vision to all actors in the economy.

The emphasis of the policy is on the creating and assuring the prerequisites for innovations. The main focuses for doing this are the securing of the knowledge creation and utilisation processes and structures, paying more attention to R&D and education, creating a more innovation and technology friendly atmosphere and reaching for internationalisation and the more comprehensive understanding of global economic changes.

The strong emphasis on the innovation policy in the Finnish Science and technology policy has its roots in the guidelines set by OECD. The Lisbon Strategy sort of guided European R&D policy to the tracks already directed by Finland. At the time the most important practical issues on the agenda were the aim to grow the national R&D budget to the same level as in other industrial countries and to strengthen regional policies. The Finnish Centre of Expertise Program also kind of crystallized all of these aims.

The newest 'trend' in innovation policy seems to be moving more towards national focus away from strong regional emphasis. The vast number of regional projects seems to include a lot of overlapping and lack of cooperation and knowledge transfer. The new structure of the **Centre of Expertise Programme** is in line with this trend. Intensified use of local resources, stronger centres and well designed cooperation and specialisation between them is wanted.

Innovation and technology policy is mainly implemented in the regional level by the Employment and Economic Development Centres, universities, polytechnics and science parks. There are 15 TE-centres in Finland. They provide several financial and consultancy services for companies and farmers. The services provided are from three different administrative sectors, namely the Ministry of Trade and Industry, the Ministry of Labour, and the Ministry of Agriculture and Forestry. In every TE-Centre there are also representatives of Tekes, who promote the technology and innovation policy in the region.

## **Finnish Environmental Cluster for China**

FECC's (<http://fecc.fi/?action=etusivu&kieli=1>) primary mission is to promote the business of Finnish environmental and energy companies and the visibility of Finnish know-how in China. FECC's specialty area and strongest area of expertise are **environmental matters** and its activities are based on thorough knowledge of the sector and networking.

FECC provides a wide range of services for both conglomerates and individual companies. FECC also supports the networking of companies both with each other and with Chinese companies and, if necessary, also with European companies. Moreover, FECC's operating model is to build concept solutions from companies' products and services, which at client meetings, for example, are tailored to each customer's needs.

FECC is actively involved in the environmental sector strategy discussion between China and Finland, implementation of letters of intent (MoU, Memorandum of Understanding), as well as in technology co-operation.

In the early years, FECC's activities have been concentrated in China's rich coastal region. In future the area of operation will be expanded to the less competed western and northeast provinces, where there is a need for traditional environmental technologies too.

### **Operating model**

FECC, which began its operations in 2006, has built in China a contact network which includes businesses, central government and local authorities, and other environmental sector organisations and research institutions. FECC has also entered into co-operative agreements through which current market information and contacts are obtained and concrete projects are found. Constant contact with this network, but in particular with potential customers, is part of the process of building trust, and extremely important in the Chinese market.

The focus of FECC's activities is on the practical level, close to customers and businesses. FECC focuses particularly on identifying concrete needs and projects and, on the other hand, on putting together and developing an equivalent Finnish offering. Within the FECC framework concept solutions are built which offer Chinese customers a broad-based solution to their problems covering the entire value chain. This kind of cluster model where companies are encouraged to co-operate furthers the possibilities of SMEs to enter the Chinese market too.

Concept solutions are tailored to suit the needs of different customers. Functional concepts are duplicated when new customer contacts are created in the various regions of China.

### **Co-operation network**

The FECC project works in close co-operation with other national environmental projects, such as the environmental technology cluster programme (Clean Tech Cluster, OSKE),

Tekes's water and sustainable community programmes, Sitra's energy programme and the Strategic Centres for Science, Technology and Innovation.

### Co-operation partners in Finland

Tekes, Shanghai and Beijing offices (<http://www.tekes.fi/eng/>)

Finpro (<http://www.finpro.fi/en-US/Finpro/default.htm>)

Ministry of Employment and the Economy, TEM (<http://www.tem.fi/?l=en>)

Ministry of the Environment (<http://www.ymparisto.fi/default.asp?node=4032&lan=en>)

Finnish Environment Institute, SYKE <http://www.ymparisto.fi/default.asp?node=4032&lan=en>)

VTT (<http://www.vtt.fi/?lang=en>)

Greater Helsinki Promotion Oy ([www.helsinkibusinesshub.fi](http://www.helsinkibusinesshub.fi))

Jykes Oy (<http://www.jykes.fi/?action=etusivu&sivusto=&kieli=1>)

Lakes Oy (<http://www.lakes.fi/www/page/english>)

Posek Oy (<http://www.posek.fi>)

Prizztech Oy (<http://www.prizz.fi/sivu.aspx?taso=1&id=112>)

Embassy of Finland, Beijing and Consulates General of Finland, Shanghai, Guangzhou and Hong Kong (<http://www.finland.cn/public/default.aspx?culture=en-US&contentlan=2>)

### Co-operation partners in China

FECC has signed co-operation agreements with Juno Capital Group (JUNO), Shanghai Technology Transfer & Exchange (STTE) and Office of the Mountain-River-Lake Development Committee (MRLDO) of Jiangxi province. Currently underway are negotiations on a number of new co-operation agreements.

FECC also has the opportunity to utilise the offices of the previously mentioned Finnish co-operation partners in China and the network of Finnish companies already established there as well as local businesses.

Successful operation in China requires the participation and approval of public administration (ministries, the provincial government, cities). FECC maintains regular contact with the **ministries** and provincial and city **environmental protection agencies**.

CICETE, Directly under the Ministry of Commerce, The China international Center for Economic and Technical Exchanges is an administratively autonomous agency, which was founded on March 12, 1983 with the approval of the State Council <http://www.cicete.org/en/index.shtml>

### Success stories

Exploiting contacts made through FECC, **Finnish companies have signed deals across China** with both private companies and government agencies. Finland has sold environmental technology equipment, for example, to the coal mining industry, the energy sector and lake restoration projects.

Finnish companies have also signed cooperation agreements with Chinese companies. EcoCity projects are heavily moving forward in China; at the end of June, the Chinese

Ministry of Commerce and the Finnish Ministry of Employment and the Economy signed a letter of intent concerning such projects. China aims at transferring 400 million people from rural areas to cities within the span of a couple of decades. The objective is to develop model cities whose energy consumption and emissions are as low as possible. The Finnish company DigiEcoCity Oy, which is involved in FECC operations, has signed a cooperation agreement regarding the design of such cities in the provinces of Jiangxi and Jiangsu. Both projects involve investments of several billion euros.

### Sweden

Sweden has a long intellectual tradition of looking into the role of collaboration in a specific geographic context as a driver of economic performance and prosperity. The country was part of the initial Porter-study and there has been a constant flow of academic publications on clusters ever since. In parallel, there has been strong interest in the related ideas of innovation systems and triple helix collaboration between companies, academia, and the public sector

What do these few key facts about the use of cluster policies by Swedish government agencies imply for their future use and possible nature of cluster policy? Two observations stick out:

- ◆ Sweden makes good use of cluster policies already. And where cluster policies are used, they are generally well designed. The operational weaknesses that have been identified are not Sweden specific and reflect the more general learning process about how to organize cluster efforts most effectively worldwide. Sweden is part of the efforts to develop new answers for these challenges and is in many aspects at the forefront of these developments. A more strategic approach to internationalization and a more consistent approach to measuring the impact of cluster policies are two priorities for further policy improvements.
  - Funding for internationalization efforts should be conditional on a consistent strategy for creating such partnerships, i.e. the identification of partners that can help a cluster to specific needs like accessing complementary skills and knowledge or entering new markets. Current programs in many countries provide general funding for internationalization but provide little direction on how these efforts should be integrated in an overall cluster strategy.
  - Measuring the impact of cluster initiatives needs to be designed in a way that allows the comparison of cluster-based with crosscluster policies. Current evaluations are focused on improving existing programs which is useful but not sufficient to support policy makers in making choices about whether to shift more resources to cluster-based programs.

- ◆ However, the cluster approach is largely used as an innovative design feature of specific programs by a few government agencies, not as a strategic tool to organize integrated policies across different dimensions of Swedish competitiveness. This limits the overall impact that cluster efforts can have. At the regional level, this leaves cluster efforts operating as individual islands that do not exploit the full potential of a cluster portfolio approach to regional competitiveness. At the national level, it misses the opportunity to make the discussion of cluster policy a trigger for the development of a more broad-based national competitiveness strategy that would integrate cluster policies with cross-cluster policy initiatives. And in the dialogue between the private and the public sector, cluster policy does not provide the visible orientation that would be needed to extend its impact beyond the moderate number of companies actively participating in cluster efforts.

#### Greece

In the past decade Greece has witnessed a significant growth in Research and Development activities, backed by an increase in higher-education orientation towards applied sciences and engineering disciplines. This process has been supported by the Hellenic state placing high priority on the transformation of the country competitive advantage from the obsolete "low-cost labor-force market" towards a "high added-value services"-model that can sustain high-growth in the global arena.

Taking into account that industry clustering is a powerful framework for regional economic development, and recognizing the strengths and opportunities as well as the weakness and threats of the Greek economy, in April 2005 the **Hellenic Ministry of Development** started pushing forwards a framework in order to fuel national growth and competitiveness. This is to be done through a clustering approach on a few strong technology market areas of Greece where there is substantial industry potential in knowledge-intensive and exports-oriented segments that can yield worldclass marketable results.

In this respect the target clusters stand on mature market dynamics already favouring the formation of a cluster, on a sector with existing and emerging key memberplayers, where the members of the sector have taken the first step to form an association, and the candidate sector is competitive at international level, a driver for strong exports, FDI-oriented, knowledge-intensive, helping transform Greece to a value-added services market, strengthening and capitalizing on the already solid base of sciences/engineering and hi-tech academic R&D.

Determined to secure a competitive regional position in an increasingly global European electronics market, Greece has launched a national technology initiative focused on semiconductors, microelectronics and embedded systems. The Hellenic Technology Cluster Initiative, the first of its kind for Greece, was initiated and inspired by the collective vision and bottom-up efforts of a core group of private companies comprising Greece's leading

semiconductor industry entrepreneurs, research institutes and university microelectronics labs.

The clusters formed were financed under the National Initiative of Small & Medium Enterprises (SMEs), according to the specifications set in the tender document. The aim of the Ministry was to promote companies “competitiveness in the fields of manufacturing, marketing and technology transfer”. The participants were mainly small and medium enterprises from diverse business environments and education and research institutes.

### 7.3 Biella Textile Cluster (ITALY)

The Biella Textile Cluster is a long-standing cluster with more than 100 years experience. It currently comprises 1500 spinning mills, clothing companies and machine manufacturers. The Biella CFG was established in 1988. It comprises members from local government, chambers of commerce, business associations and trade unions. The CFG provides strategic direction and conducts promotional activities on behalf of the whole cluster. The CFG’s activities cover the areas of cluster promotion, globalisation, R&D (product and process innovation), environment, telecommunication and quality (total quality management and product certification).

The Biella cluster includes the following support structures:

- Textilia – a training institute promoting inter-firm collaboration, technology transfer and management innovation techniques;
- The Polytechnic of Turin – chemical engineering degrees, with an environmental emphasis National Centre of Research – applied research
- State Technical Industrial Institute – technology transfer • Italian Seat of the International Wool Secretariat –marketing
- Public Institute of the Official Certification of Wool – product standards
- Association of the Environment Protection of the Biella District – environment
- Biella Industrial Union – represents SMEs
- Young Entrepreneurs Association – management and technical training support to new entrepreneurs
- Committee for Small Enterprises – assistance, consultancy services, training and innovation programs for small businesses
- Intraprendere – a meeting point for entrepreneurs to exchange ideas and engage in commercial activities.

#### Achievements include:

- ✓ international recognition as a world centre for high quality garments
- ✓ an unemployment rate of less than 4% and 30% higher income than the national average

- ✓ over 40% of textile and machinery production exported
- ✓ structured international relationships developed by 20% of Biella's companies
- ✓ a capacity to manage change, with strategic changes including:
- ✓

i) an emphasis on niche markets and flexible design in the 1960s

ii) an emphasis on quality in design, products and companies during the 1980s

iii) current restructuring that includes large companies controlling all stages of the supply chains, diversification into complementary products (such as leather goods and other accessories), joint ventures with foreign companies and structured international relationships.

#### 7.4 Waste Cluster Initiative

In the beginning of 2010, the waste cluster initiative was launched with the ambition of involving deiffernebt European Community funded research projects in an exchange of knowledge and experiences, learning from each other's strengths and weaknesses, defining regional strategies and investing in strengths through integral use of national and regional funding. Due to the involvement of partners from the **Mediterranean Partner Countries (MPCs)**, the cluster's main target is knowledge transfer from to directly enhance visibility of the MPCs in the cluster and prepare the grounds for their integration into the **European Research Area (ERA)**

##### Objectives

The objectives of the waste cluster initiative is the **creation of an international balanced network of (regional) waste management-related clusters**, for mutual learning and exchange of knowledge, skills, training opportunities and technologies that will lead to the optimization of waste management-related innovation and competitiveness excellence. More specifically, to:

- Stimulate the innovation and business creation by the expansion and enhancement of a network of regional waste management-oriented clusters, not only circumscribed at a European dimension but also considering Mediterranean Partner Countries MPCs, thus maximizing the usage of knowledge spillovers.
- Concentration of complementary activities with intensive interaction, achieving extraordinary performance and competitiveness, obtaining benefits for industry, society and research.
- Establish a base or platform where clusters can meet each other, detecting new opportunities, new calls, projects, pool practices or build stronger consortiums in order to submit more effective proposals.
- Establish a base or platform where clusters can meet each other, detecting new opportunities, new calls, projects, pool practices or build stronger consortiums in order to submit more effective proposals.

### Cluster's synthesis

- Partners from ongoing projects SOWAEUMED, ST Inno, WASTEKIT and TEMP
- Europe, Associate States as well MPCs
- Integration of actors of the triple helix model (institutions, companies [including SMEs], regional or local authorities or related economic development organisations)

### First results

- Better access of new member states to the community instruments increasing the return on public expenditure.
- Act as catalysts for further development and investments in RTD, innovation, business creation, clustering and international collaboration, with specific regions of third countries.
- Enable leverage for knowledge-based and technology-enabled economic development potentials in the field of waste management and its related sectors.
- Stimulate the actuation of their members to transform research output (knowledge, patents) into new products, new services, new companies and new markets via technology development (new technologies, enabling technologies, and disruptive technologies), relevant skills and transfer & diffusion mechanisms.
- Offer stronger opportunities for more regions into the Regions of Knowledge initiative, into the knowledge economy and the ERA, especially through the mentoring of regions with a less developed research profile providing guidance or solutions and taking positions in the worldwide competitiveness arena to contribute to climate change measures, emission reductions and environmental risk assessment.

### Impacts

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>▪ Infrastructure for solid waste-and wastewater characterization (chemical, biological etc)</li> <li>▪ Know How among the researchers</li> <li>▪ Strong in protecting ground water</li> <li>▪ Openness towards collaboration and initiatives</li> <li>▪ Infrastructures for waste treatment</li> </ul>	<ul style="list-style-type: none"> <li>▪ Lack of knowledge transfer</li> <li>▪ Lack of business development</li> <li>▪ Poor IP Management</li> <li>▪ No representation of business in Universities</li> <li>▪ No research performance indicators</li> </ul>

Opportunities	Treats
<ul style="list-style-type: none"> <li>▪ Available database of projects, results, technology available</li> <li>▪ Awareness in society about waste problems</li> <li>▪ Funding opportunities in EU</li> <li>▪ Availability of valorisation technologies</li> <li>▪ Entrepreneurial potential to do business</li> </ul>	<ul style="list-style-type: none"> <li>▪ No broad strategy for technology transfer and innovation</li> <li>▪ Competition with China</li> <li>▪ Slow reaction of public policy and regulation on research findings</li> <li>▪ Different orientation of business community</li> <li>▪ Political short term thinking</li> </ul>

## 7.5 Food Cluster

In 2007, the Food Cluster has been launched with the ambition of involving different EU funded research projects within an **exchange of knowledge and experiences, learning about each other's strengths and weaknesses**, defining **regional strategies and investing in the strengths through integral use of national and regional funding** (Research Framework Programmes, Structural Funds, Competitiveness and Innovation Framework Programme, etc.) as a basis for establishing EU consortia in food science – in fact building the ERA in Food.

The basic **concept behind the Food-Cluster initiative is to connect the new FP7 food projects with the Food Innovation Network Europe (FINE) to set up a European Food Cluster**. FINE is a network of regional research driven food clusters (comprising interacting science, industry and government components) sharing a vision of connecting to each other. The objectives of the partnering FP7 projects range from setting up new research infrastructures, connecting companies and other research organisations to these, to developing new cluster organisations with the help of other regions as well as entirely new research projects.

The Food Innovation Network Europe (FINE) is an **emerging network of strong food regions** gathered together with the ambition of increased RTD investments through activation of stakeholders and development of regional strategies and the **development of strategic interregional collaborative projects**. **All FINE-regions have common regional characteristics**: a food sector playing an important role in the regional economy; the presence of a strong agricultural sector and other specialized suppliers of the food industry; a high level of food-related knowledge in the region; the presence of public support for the food industry and **local networks linking the different actors together**.

## Objectives of the Food Cluster

### 1. Respond to the growing consumer demand for healthy food by reinforcing the available expertise in functional foods and quality assurance.

The **increasing consumer demand for healthy products** was identified as the most important opportunity. This demand includes two aspects: the demand for products with additional health attributes (e.g. Omega 3) and the demand for products that counteract health problems (obesity, allergies, etc.). It is argued that the EU food industry has available the right skills and knowledge on functional foods to develop new products and the expertise in quality assurance which together create advantages in responding to this demand. However, successful product development might be hampered by a **lack of R&D capabilities in food companies** as a result of low private sector R&D investment and the poor innovation absorptive capacity of many firms.

### 2. Reinforce the high labour productivity and marketing skills available to foster market growth in emerging economies.

The **emerging economies** in other parts of the world are perceived both as a threat and as an opportunity. They pose a serious threat as cheap labour costs generate a competitive disadvantage for the EU food industry. However, the increasing buying power in these economies offers great opportunities for market growth

### 3. Enhance the general RTD capacities of food companies in order to enable them to derive benefit from innovation support and to find innovative solutions to counter present (global) threats.

The Strategic Orientation revealed **two major weaknesses of the EU food industry** which have been associated with several opportunities and threats. The **two weaknesses relate to the R&D capabilities of companies**: large parts of the industry exhibit a poor level of private investment in R&D and in addition their absorptive capacity is poor, (defined as the capacity to detect and absorb external knowledge and apply it to commercial ends). The respondents indicate that these two weaknesses are serious factors which hamper deriving benefit from public innovation support. Furthermore, it is perceived that **inadequate R&D capabilities make the food industry incapable of finding innovative answers** to some of the current global threats, in particular climate change and depletion of fossil energy sources as well as a continued lack of knowledge about the exact health effects of GMO's.

#### Central Macedonia, Greece

Example of SWOT analysis of Food RTD actors in Central Macedonia

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>■ Well equipped and high standard technical research infrastructure.</li> <li>■ Highly skilled RTD personnel</li> <li>■ Experience and well developed</li> </ul>	<ul style="list-style-type: none"> <li>■ Poor functioning links between the industry, the RTD entities and the primary sector (agriculture)</li> <li>■ Not enough start ups and spin- off</li> </ul>

<p>network of partners from long-term of participation in international projects</p> <ul style="list-style-type: none"> <li>Developed structures and initiatives in support of innovation, i.e. Thessaloniki Innovation Zone, Regional Innovation Pole of Central Macedonia, private incubators, technology parks, etc.)</li> <li>Capacity to act as main RTD actor in the Balkan region</li> </ul>	<p>companies due to a risk aversion</p> <ul style="list-style-type: none"> <li>Low visibility of the regional RTD entities and their established capacities</li> <li>Different perspective on research between the RTD entities and the industry complicates joint research projects</li> <li>Low adaptation of the university curricula to cover current research and market needs</li> </ul>
<b>Opportunities</b>	<b>Threats</b>
<ul style="list-style-type: none"> <li>Existing and future European, National and Regional R&amp;D programmes</li> <li>Strong networking between National RTD entities on specific food research themes</li> <li>Increasing demand for new innovative food products and processing technologies</li> <li>Adequate supply of well educated researchers in the scientific area</li> <li>Strong interest of society in the agro food sector as food price and demand increase worldwide</li> </ul>	<ul style="list-style-type: none"> <li>Bureaucracy barriers and administrative burden associated with European and National RTD programmes</li> <li>Lack of strategic vision in national and regional RTD initiatives</li> <li>Brain drain accompanied by failure to attract foreign and Greek highly competitive researchers</li> <li>Limited national financing for R&amp;D for joint research with the industry</li> </ul>

The example of Central Macedonia illustrates some of the conclusions which are similar to all regions participating in the Strategic Orientation.

First of all, most regions express the opinion that the **right quantities of resources for food science are available**: there exist a large number of scientists operating in these fields and there are public initiatives aiming at fostering food research and innovation.

However, nearly all regions consider the **interaction between industry based research and public food research as insufficient or not effective**. Furthermore, despite the efforts made by public initiatives to close this gap, they are rarely successful in this task. Particular threats observed in new member states are the **high bureaucracy and brain drain**.

The industry does not seem to grasp the potential that innovation offers as they are overburdened with everyday challenges and do not dedicate adequate resources to technology and innovation. **Inadequate public and private funding for RTD are also negative factors for innovation**. Most importantly the **lack of strategic vision in national and regional RTD initiatives** hinders their success.

The **SWOT analyses led to a synthetic insight in food science and regional policy in the FOOD-Cluster regions**. This will serve as a frame of reference for the project activities and as a basis for exchange and understanding with other regions within the FOOD-Cluster.

The Food Cluster members' general feeling is that expressing and discussing each other's standpoint indeed contributes to **interaction and mutual learning between EU funded projects**.

Policies that addressed from the study of the Food Cluster:

- ⤴ Reinforce external linkages of the food industry to grasp new consumer trends
- ⤴ Reorienting RTD on food marketing within an enlarged European market
- ⤴ Regional policy action for increasing benefit from EU funding schemes
- ⤴ Strengthen multidisciplinary research in RTD centres to address the industry's need for applied knowledge effectively
- ⤴ Investing in human capital by regional policy makers

Many regions place their hope on EU funding because regional or national instruments are not sufficient, or even fail. However, regional policy is also perceived as a crucial element in bringing these funds closer to the regional actors. This demonstrates that **regional policy initiatives and European funding should go hand in hand**. Regional policy makers should contribute with their understanding of local dynamics and their communication channels. Europe, in turn, contributes with instruments for companies and RTD centres to develop research areas of strategic interest. The downside of this is that where regional policy fails, Europe fails.

The **outcomes from the Food Cluster at a macro level** need to be assessed in the context of these overall policy and strategic objectives of the Commission. So this means that the Food Cluster needs to show effective performance to:

- ✓ Increase R&D capacity
- ✓ Improve performance in R&D and innovation
- ✓ Support technology transfer
- ✓ Connect R&D institutions with the local business community
- ✓ Promote innovation and innovation strategies

## 7.6 The impact of cluster policies

The impact of cluster policies on the development of clusters is difficult to assess, taking into account that regional clusters are the result of many factors that work together over time. Some clusters emerge spontaneously without governmental support, while some cluster initiatives do not or have not yet resulted in statistically significant clusters, as measured for example by the European Cluster Observatory.

European countries and regions have launched a **wide range of cluster initiatives** in recent years. Despite this high level of activity, there is a sense that cluster-specific policies have yet to show their full power. This might be just a temporal issue, as cluster development takes many years and many of the initiatives are still relatively young. But the analysis of available case studies also indicates a number of more **widespread challenges** that may limit the potential impact of these policies.

- ◆ In many countries, cluster efforts have emerged out of SME policies and thus tend to focus on smaller companies and start-ups. Most often, there are no explicit restrictions on domestic owned-companies, but a **low presence of larger companies may limit the economic impact of clusters**. While such efforts have benefits, there is clear evidence that full cluster effects can only develop if all types of companies are actively engaged, independent of size or ownership. Similarly, the participation of companies is often limited to companies that have a direct need for the available government support. While this is natural, successful cluster initiatives also require ‘opportunity-based’ participation where successful companies see additional benefits.
- ◆ In many of the cluster initiatives the **role of the government is limited to the provision of financial incentives**. While this support is useful and often crucial to initiate joint activities, it does not necessarily engage the public sector in addressing the barriers to higher competitiveness and innovation that clusters face. Even worse, some cluster initiatives are designed in a process that bypasses the regional governments which leads to a lack of integration of the cluster and the cluster initiative in an overall regional economic strategy. Without the integration in such a strategy, cluster initiatives are typically less effective. Regional strategies on the other hand should anticipate the international strategies of key actors and stimulate cluster initiatives to position themselves in a European and global context. Without this international alignment, cluster initiatives and the cluster policies that support them are likely to be less effective because of unnecessary duplication and sub-critical mass.
- ◆ At least some of the initiatives focus on **emerging clusters where only a few companies and maybe one research institution are present**. While such efforts can be part of an overall cluster strategy, they should be only one element in a portfolio of activities and are likely to have limited impact and a significant failure rate. The cooperation of regional clusters is often limited to a general exchange of operational practices. While this is useful, it does not fully explore the opportunities of creating networks of regional clusters that play complementary roles along the value chain of their economic sectors.
- ◆ There is often a **bias towards technology-intensive clusters**. It is positive that these areas of the economy are targeted but more potential may lie in service-intensive activities. Service clusters, such as on construction, transportation and logistics, financial services, tourism or entertainment are among the larger cluster categories within Europe but tend to be less supported by specific cluster policies.

Service clusters may also be fundamental for the balanced development of European regions.

- ◆ Relatively few cluster initiatives are targeting the development of internationally competitive clusters. The aspiration level of many cluster policy initiatives may be low. This goes together with an **inflationary** use of the term “cluster”, which is often attributed to all kinds of networking between research and industry.
- ◆ There is **insufficient integration of cluster initiatives at the regional level**. At the regional level, policies often do not exploit existing or potential linkages between clusters within a strong portfolio of clusters at different stages of development. And there is not enough dialogue between cross-cutting policies to strengthen regions and cluster-specific efforts.

These challenges should be properly addressed in order to develop strong clusters in Europe. At the same time, new methodologies could be developed and practically tested **to better measure the practical impact of specific cluster policies**. It is in particular important to assess the impact of regional and national measures (including State Aids and Structural Funds) aiming at cluster expansion, as they could drive the specialisation process in Europe towards more competitive clusters worldwide.

## 8. Opening to the Northern Africa Area

The European Union spans from Eastern Europe to the Mediterranean, and includes neighbouring countries of different cultural, religious, historical backgrounds. Thus the Union has to cope with various political and economic predicaments. This leaves the Community and its 27 member states with a formidable challenge of balancing its engagement with its eastern partners and establishing an active policy of strengthening relations with the southern peripheries, that is North African and Middle Eastern countries. Managing relations with these two distinct geopolitical areas does not only have implications for the external policy of the EU and its global standing, but has direct impact on the internal “balance of power” within the EU.

In November 1995, the European Commission decided, as a strategic response to economic and demographic developments in the Mediterranean region, to upgrade this cooperation, setting in motion what became known as the ‘Barcelona Process’. The innovative alliance, based on the principles of joint ownership, dialogue and cooperation, brought together the Member States of the EU with 12 southern and eastern Mediterranean states.

The **Barcelona Declaration** emphasised the need for the two regions to build an area of peace, security and shared prosperity together. Technology transfer made a first appearance in EU-Africa agreements with the promotion of support mechanisms, outlined as one of four initial priorities for the establishment of the Euro-Mediterranean Free Trade Area (FTA). The

declaration also recognised that **science and technology (S&T) in the Mediterranean have a significant influence on socioeconomic development.**

Key contributors to strengthening S&T alliances between Europe and parts of Africa are two joint Europe- Africa S&T dialogue and promotion platforms at bi-regional level:

- the Mediterranean Innovation and Research Coordination Action (MIRA) programme, covering the African-Mediterranean area of Algeria, Egypt, Libya, Morocco and Tunisia;
- the Network for the Coordination and Advancement of Sub-Saharan Africa-EU Science and Technology Cooperation (CAAST-Net) supporting links between Europe and Sub-Saharan African countries
- these two INCO-Nets will receive some topping up to facilitate the revision and upgrading of ongoing initiatives as well as opening to new partners;
- additional support for the coordination of national policies on S&T cooperation between Europe and Africa will be provided under an ERA-Net (ERAFRICA) currently under negotiation.

### 8.1 African Union Commission and the European Commission partnership

Cooperation between Africa and the EU has rapidly developed to forge a new and stronger partnership that builds on their new identities and changed institutions, capitalises on the lessons of the past and provides a solid framework for long-term, systematic and well integrated cooperation.

Several efforts have been made for partnerships with countries of Northern Africa considering the high education level, strong research workforce (e.g Egypt has a critical mass of research institutions and Universities). For this reason there have been created initiatives which contribute to **EU-African partnership** in all fields.

The Joint Africa-EU Strategy is being implemented through its first Action Plan 2008-2010, and regular and enhanced political dialogue. The Action Plan identifies eight partnerships which entail Peace and security; Democratic governance and human rights; Trade, regional integration and infrastructure; the Millennium Development Goals; **Energy; Climate change;** Migration, **mobility** and **Employment** and **Science, information society** and space. In each of these eight partnerships, African and European experts meet on a regular basis to strengthen Africa-EU cooperation in these fields. Every six months, AU and EU Commission staff, together with representatives from Member States, the Pan-African and European Parliament, civil society, and the private sector, meets to discuss progress and develop new areas of cooperation.

Through regular political dialogue, African and European Member States, as well as the AU and EU Commissions, monitor progress and provide political leadership. Every six months, a ministerial AU-EU Foreign Ministers meeting takes place, while the College of Commissioners of the EU and AU Commissions met in 2008 and 2010 to do so as well. Every three years, an Africa-EU Summit will take place.

The African Union (AU) Commission and the European Commission partnership have the following objectives:

The EU delegation to the AU will:

- help coordinate EU policy and action relating to the AU, and relations between the broader partner group and the AU;
- maintain close contact with the AU Commission and its other institutions, and the representative offices of African sub-regional organisations and AU countries;
- help, advise and support the AU on request, in all areas outlined in the Africa-EU strategy (e.g. development and implementation);
- monitor and report on all relevant AU developments;
- assist the EU's political dialogue and broader relationship with the AU.

## 8.2 ERAfrica

ERAfrica is a new European Union (EU) project aimed at promoting a unified European approach to collaborating with Africa in the field of science and technology research for innovation and sustainable development.

Objectives:

- Establish a **long-term framework for communication, collaboration and coordination** of programme owners/ managers related to S&T co-operation from Europe and Africa .
- **Reinforce EU-Africa S&T collaboration** by promoting joint learning by African and European research programme owners and managers and identifying relevant instruments to address more effectively the global challenges of sustainable development.
- **Develop joint funding schemes and procedures** between European and African programme owners aiming at supporting joint activities.
- **Strengthen African research capacities and improve the impact of research for development in Africa.** Strengthening the impact and the influence of S&T research implies enhancing the transfer of new knowledge to the benefit of the society. It also implies the achievement of greater coherence between research outputs and policies and funding instruments in other areas than research.

Funded by the European Commission for an amount of almost 2 million Euros, ERAfrica unites seven EU countries (France, Germany, Belgium, Spain, Portugal, Finland and Austria), as well as Switzerland and Turkey, with three African partners (South Africa, Kenya and Egypt) in a core consortium built around a mutual recognition of the value of unifying efforts to strengthen intercontinental research collaboration and promotion. In this regard ERAfrica aims to serve as template for interactions between Europe and Africa in the field of science and technology research, and as a model for future cooperative ventures between the two continents.

With ERAfrica research funding scheduled to begin in early 2013, there is still ample opportunity for interested parties to join the consortium or to participate as unaffiliated funders and contribute to the determination of the impact the project is to have on Africa, Europe and the nature of intercontinental collaboration. Already extensive recruitment to this end is planned via a number of briefing sessions to be held in Europe and Africa, addressing international groupings, other funding programmes and potential stakeholders of every stripe.

### **8.3 Future aspects**

The challenge is to be more effective in the different key areas of science and technology (S&T) that address basic needs of sustainable development and to do so in a better informed and coordinated manner. Anchoring these international scientific and technological collaborations in policy-driven demand of African countries themselves is one of the most effective ways of increasing the impact of these efforts.

Ultimately, the appearance of tangible effects on the ground depends not only on high-quality and well-targeted research cooperation but also on the framework conditions in place such as:

- investment in people and institutions
- the policy environment for the creation, organisation and more systematic use of scientifically validated knowledge
- the general communication infrastructure to make sure that ideas, people, products and services can circulate more freely
- implementation of key policies.

The European Commission remains very committed to cooperation with Africa in Science and Technology and firmly believes in the potential of S&T to contribute to the achievement of the Millennium Development Goals and to economic growth and social prosperity in the continent.

## 9. Cluster Policy Recommendations

### 9.1 Recommendations

At present, the supporting organisations for clusters and their member firms devote much energy to fostering cooperation between the actors within the cluster/cluster initiative. Such practise is not sufficient to achieve the level of world-class excellence that is necessary in order to compete in markets that go beyond the region where the clusters are located. Creating stronger linkages between clusters in different locations which offer complementary strengths is the only way that access to the most advanced technologies and best know-how may often be found. Changes in the global economic environment are also making cluster linkages more important. As firms within clusters internationalise their activities in creative ways, it is important that cluster initiatives and organisations (which support them) internationalise too.

Although, as evidence shows, most actors involved in clusters are interested in learning from and developing concrete activities with partners in other geographical locations internationally, there are few examples of systematic strategies and structured activities at the organisation level aimed specifically at fostering international cluster cooperation.

#### Promote International Mobility of Cluster Actors

International exchange of cluster actors would support the **dissemination of international best practices and lead to the development of new knowledge, skills and networks**. Different types of mobility frameworks could target different cluster actors (including companies, academics and managers) with different aims (including increased business to business interactions, strengthened university-industry collaborations, professional development of cluster managers, investment promotion, etc.).

Increased mobility between cluster actors can also have the effect of increasing specialisation and consolidation of clusters. As human capital gets exposed to other cluster contexts and has the choice of moving to the most attractive location, competition between localities will increase. Clusters will become more effective at attracting specialised resources and forming international collaborations, and will become increasingly specialised over time. This would strengthen the level of cluster excellence and help develop trust between cluster actors internationally – creating the conditions necessary for the internationalisation of commercial activities between clusters.

#### Promote Strategic and Commercial Networking of Clusters

Networking among clusters internationally provides an important driver for internationalization of clusters. Strategic networking among clusters aims at building critical mass and strong international linkages between companies and R&D institutions and universities. While

networking is important between cluster stakeholders, there is a strong need to focus on more collaborative and strategic networking processes that aim at creating synergies, transferring knowledge, developing commercial relationships and strengthening innovation and market position in order to stimulate internationalization in clusters.

**The clusters have to reach out and link up to other clusters in order to get access to new markets, research experts and knowledge infrastructure.** By linking companies, centres of research and universities across borders, clusters will be able to make better use of existing infrastructure and take advantage of economies of scale. This in turn can lead to the creation of some of the world's leading innovation hubs in macro regions or zones with a rich ecosystem of actors from various clusters.

#### **Provide Data on the Real Cluster Landscape**

Collaboration between clusters occurs if there is knowledge about potential partners and their complimentary capabilities. Mapping of cluster competencies and readiness to engage in international cooperation is an instrumental fact base for match-making activities. At present, only partial information exists.

#### **Provide information on economies of scale to stakeholders on communication matters (e.g. common participation in conferences)**

The policy is an overall communication strategy with tools dedicated to the promotion of the cluster organisation (internet, collective marketing, branding, etc.). The cluster communication strategy is based on the preparation of a marketing plan. Moreover, communication plans, implementation, organise and run **international sector events** in the region to raise awareness of international opportunities e.g. Meet the Buyer events; seminars focusing on opportunities in emerging markets; international supply chain opportunities; research collaborations. This action should be in line with the internationalisation strategy

#### **Provide Information and Ensure Channels of Dissemination on Emerging Needs and Demand**

Access to new information on industry trends and societal trends can act as a driver for generation of new ideas and new business areas. A challenge is to collect this information and distribute it to cluster stakeholders as there is often no systematic approach in place in cluster organisations. To create a fertile ground where new knowledge on trends is collected and disseminated, it is recommended that information on new trends and foresight studies carried out at European and international level will be aligned to the needs of cluster organisations and that training for cluster managers and cluster organisations is provided in order to build competencies on how to act on new emerging trends.

#### **Suggested Actions**

- Align the information collected, to needs of clusters
- Strengthen the channels to speed up the adoption of new technologies/products/services by clusters
- Improve awareness of environmental, technology and business drivers to better inform judgements about future market opportunities

**Facilitate coherence between strategies and infrastructure that will foster knowledge sharing, innovation conditions and a higher competitiveness**

In the current economic climate, it is important to review the contribution that cluster policy might be able to make in dealing with the imminent crisis. Cluster policy is focused on the long-term supply-side foundations for economic growth and prosperity. The current economic challenges, largely issues of a demand slump originating in U.S. financial market conditions and now spreading out through countries and different sectors of the economy, require largely a demand-focused response.

Cluster policy cannot provide the demand push but it can be an important tool to design and then implement the spending that has been put into the policy pipeline. This way, the spending is more likely to address long-term competitiveness issues beyond the short-term need to prop up demand. And it is standing a higher chance to change the expectations of business and consumers that worry about short term government spending to be paid for by future taxation and might further reduce their own consumption. Cluster policies can thus make a contribution to ensuring that the public spending now under way has a positive impact, in the short- as well as in the long-term.

**Promote Policies for Improving Clusters' specific Framework Conditions**

Framework conditions are important for the emergence, growth, excellence (and decline) of clusters. If clusters are already in place, certain specific activities (such as strengthening cluster management and strategic orientation, ensuring human capital is reinforced and social capital promoted, etc.) can help clusters to grow, internationalise, excel, etc. However, these specific activities or policies for improving cluster-specific framework conditions can only be designed based on a prior assessment of characteristics, functioning and performance of various types of clusters in order to take into account the specific needs of the sector/industry in which a cluster operates. Depending on the identified needs, the cluster-specific mix of policy instruments (e.g. policies to enhance the level of linkages and mutual trust, policies to promote international linkages, demand side policies, training policies, etc.) can be designed.

**Suggested Actions**

- Identify which business environment conditions are of particular importance for specific cluster areas in order to improve policy measures in support of clusters.
- Propose the establishment of working group to develop an analytical tool/framework for identifying the dynamics in the process of social capital formation on the basis of which the

instruments/policy measures for increasing social capital within clusters could be effectively designed.

#### Offer Tools for Enhancing Excellence of Cluster Management

- Develop a methodological framework for benchmarking cluster organizations (based on existing benchmarking methodologies) to be used as a voluntarily tool by clusters to improve their competitiveness.
- Organize a Cluster Summit on a yearly basis (something like Open Days), where different stakeholder groups (e.g. cluster companies, cluster managers, regional authorities, venture capital and other financial institutions, etc.) could meet, and where a Cluster Excellence award could be given

#### Involve existing SME associations to ensure an efficient networking with small companies

### 9.2 Clusters' benchmarking

Benchmarking of clusters describes the process of comparing the cluster structures, processes, developments and methods as well as service with those from other clusters. The comparison within the benchmarking process is not based on a universally valid definite rating scale, but on individual comparison criteria. Thereby, **benchmarking provides a very good orientation on how the own cluster is placed and how it performs compared to similar clusters**. Benchmarking is therefore not only a goal-oriented way to a skills assessment but also an attempt to compare with others, learn from each other ("What is necessary and what is possible?") to optimise one's performing. Thus benchmarking is also an instrument for a steady improvement of one's own work.

For clusters it is important to reflect the defined goals and tasks every so often and to analyse the specific structures and procedures of the cluster that have evolved since its foundation. That is especially important in terms of the continuously changes of the economic and technological conditions. Besides the cluster managements stakeholders often take a reasonable interest in an impartial assessment of the cluster, like

- executive boards,
- policy makers and funding authorities,
- members.

For such analyses of cluster structures, services, added-values for the members and potentials of clusters, benchmarking, namely the comparative analysis with similar clusters, is especially advisable. An extensive evaluation as it's being frequently used as assessment instrument as well as for impact analyses of clusters often doesn't achieve the desired

results, especially for the cluster management as an input for future corrective actions. Compared to that, benchmarking is to be recommended. One of the essential benefits of benchmarking is the limited effort needed for the cluster managements and the fact that the members and partners of the cluster do not need to be involved. Interested members can of course be included in the benchmarking process.

On the following table are presented the main factors that are essential for cluster benchmarking

<b>Factor</b>	<b>Description</b>	<b>Typical Measures/proxies</b>
<b>R&amp;D capacity</b>	Institutes of public or private research in areas related top clusters' products or processes, expert individual researchers that are available or accessible	R&D expenditures from government and private sources that involve cluster members, products or processes
<b>Workforce skills and availability</b>	Degree to which the skills of the labour force are tailored to the needs of the cluster, i.e, technical skills, general knowledge of the industry and entrepreneurial skills	Number of enrolments in relevant programmes. Graduates hired by cluster
<b>Education and training</b>	Education and training for the cluster's major occupations, instructions embedded in context of clusters, instructors with relevant experience, training for technological and organisational changes	Number of credit and non-credit programmes for cluster internships/apprentices employed
<b>Proximity to suppliers</b>	Nearby sources of primary and secondary supplies, materials and services that minimise transaction costs and maximizes interaction	Input/output analysis of supply chains of potential suppliers. Survey of actual suppliers
<b>Capital availability</b>	Local banks that understand the cluster and know the cluster's key players, availability of working and start-up capital, access to seed and venture capital to exploit new opportunities	Value of venture capital, loans made in cluster. Participation of bankers in cluster activities
<b>Specialised services</b>	Public sector services, technology centres, export assistance, or small business centres and private sector services provided by designers, engineering consultants, accountants and lawyers that have special knowledge of the cluster	Number of consultants who specialise in cluster services that employ specialists from cluster and value of local outsources services.
<b>Machine builders and software designers</b>	Access to companies that design and build the machines, tools and software used by the cluster, working relationships between the tool builders and companies to foster collaborative innovations	Number of companies that produce and sell capital equipment to the cluster.
<b>Networks and alliances</b>	Frequency of formal cooperation among cluster members in for example joint ventures, production, marketing, training, or problem solving	Number of joint ventures, skill alliances, marketing consortia, etc.

<b>Social capital</b>	Scale and degree of activity among local business and civic associations in the region, frequency of interaction, informal networks of personal business related contacts	Number of professional, business and trade associations. Membership in each level of activity. Survey of connections
<b>Entrepreneurial climate</b>	Continual formation on new business ventures by workers and managers within the cluster based on new, complementary or competitive products or on core competencies.	Number of new start-ups generated by cluster. Number of attracted to cluster.
<b>Innovation and imitation</b>	New and enhanced technologies and products that are conceived, developed and adopted or brought to market, dispersion of innovations to other local firms	Patents and copyrights, value of investments in new technologies, new product lines started.
<b>Presence of market leaders and innovators</b>	Number of acknowledged market leaders and firms. Marketing and sales of products or services outside the boundaries of the cluster.	Number of headquarter operations, value of exports of cluster products and value of sales outside of region
<b>External connections</b>	Joint ventures, contracts, alliances with firms, contacts/communications with experts in other regions, knowledge of international benchmark practices	Study or benchmarking tours, travel to trade shows. Alliances that include external members
<b>Shared vision and leadership</b>	Firms that think of themselves as a “system”, i.e plan for and share goals, have vision for future, leaders who take responsibility for collective competitiveness.	Collective strategic plan vision statement. Acceptance of cluster name or brand

**Table 3:** *Factors for Cluster’s Benchmarking*

## 10. Conclusions

On the above study was made an effort to present the existing cluster policies in international and European level. Initially, there were presented the competitive advantages of the clusters, the Porter's Diamond, the meaning of the research driven clusters and under which circumstances they can be successful.

In the continuance, followed the **cluster initiatives** that have to be implemented in order to be created and developed a cluster. These initiatives are taken by the private or public sector but always aiming at the strength of the clusters. Clusters and cluster organisations must seek excellence in order to better serve the needs of enterprises and support their competitiveness. This should be the baseline objective of all cluster initiatives. However, today enterprises and clusters face new ways of dealing with innovation and management of knowledge in order to be efficient and successful in a more open-knowledge environment. The initiatives many times vary according to the national context in which activate the clusters but in any case are very useful tools for the clusters' development.

In Unit three are presented the **cluster policies**, which are essential for the viability and development of the clusters. Cluster-based policies have proven effective in improving clusters' ability to compete and, in many instances, have influenced regional and local growth patterns. In the new global economy, clusters continue to confer advantages to their member firms and institutions, and promoting them is still good public policy. To maximize their impact on regional prosperity, however, practitioners and policymakers need to continually assess how the dynamics of clusters are changing and tailor policies to support today's opportunities. Indeed, the increasing competition in innovation and the growing importance of knowledge may transform clusters. All enterprises, even the largest one, may have to collaborate. Therefore it would be important that policy makers, at both national and international levels, consider these changing conditions to encourage enterprises and clusters to efficiently adapt their innovation strategy and successfully access to global networks.

On the other hand policy makers are challenged to implement their research and innovation programmes more effectively with better return on investment and higher valorisation of results. There is a need for a continuous and sound evaluation of national and regional cluster programmes on whether the respective cluster initiatives are delivering the expected results. In this respect, there is a tendency of cluster policies to move from a general to a more selective approach in the support of clusters.

For example, the Danish, Dutch, and Finnish governments belong to the pioneers in brokering programmes with strong SME components. Austria, Australia, Canada, Finland, France, Germany, New Zealand, Norway, Spain, Portugal the United Kingdom and the United States have high-calibre public authorities, most of them with strong programmes addressing human capital and innovation issues connected to clustering. China and China Taipei above all pursue broker policies related to science parks and incubators. Thailand

explicitly promotes SME cooperation whereas the Philippines have more traditional institutional infrastructure to support SMEs. Japan has downplayed previous R&D-support to SMEs by replacing it with measures to support innovation within clusters on a broader scale.

After the cluster policies, followed a presentation of what is happening regarding clusters and cluster policies, in U.S.A., Asia, Europe and other countries. For each area it was presented the current situation concerning the clusters, which are the cluster policies and some indicative examples in order to conceive better the applications of the cluster policies and tools. Moreover, it is mentioned the effort of the European Union and EU organisations to promote collaborations and to expand european research activities to the area of North Africa.

It is obvious from the best practices that the governments have recognised the potential of clusters as a driver in regional and national development. By taking determined action public authorities improve cluster development. This results in strengthening local economies, creating new jobs and attracting new investors. The European Commission has established a number of programmes supporting research and development and started new initiatives to help national and regional governments to create and develop regional clusters. But also, the Asian and American governments and policy makers have establishes programmes and practices that straingthen the development of the clusters a fact that leads to the creation of new enterprises, development of the existing ones and the better collaboration between the research&technological institutes and authorities of the regions'.

Finally, the study is concluded with some **recommendations of clusters policies** that have arised from the best practices that have already been presented. From these cluster examples in Europe, U.S.A., Asia and other countries were obvious some policies that made the clusters successful. These recommendations have been already applicated in the clusters leadinfg them to success and the wider region they activate. Except for the policy reccomendations there are also presented some factors that are esseential for the clusters' benchmarking. The cluster evaluation is used as assessment tool as well as for impact analyses of clusters often doesn't achieve the desired results, especially for the cluster management as an input for future corrective actions.

From all the above we have to keep in mind that clusters are today recognised as an important instrument for promoting industrial development, innovation, competitiveness and growth. Although primarily driven by the efforts made by private companies and individuals, clusters are influenced by various actors, including governments and other public institutions at national and regional levels. The policy dimension in clusters remains controversial, however.

The time has come for policymakers to adopt a *comprehensive* strategy and approach to this field. The systemic approach must not serve as a basis for motivating any kind of measures, but should be adopted in a way that allows policymakers to better identify and address the most critical issues, as well as to act where policy can make the greatest difference in

fostering a better playing field for private sector actors. The mere appreciation and understanding by policymakers of the importance of clusters is important, however, for ensuring that market actors can expect solid and stable policy setups. Further, policies need to be designed both with a view to the acceleration of *existing* clusters and to the importance of providing the basis for the emergence of *new* ones.

## **Abbreviations**

EU: European Union

SME: Small Medium Enterprise

RDC: Research Driven Cluster

R&D: Research & Development

HEIs: Higher Education Institutions

OECD: Organization for Economic Cooperation and Development

STI: Science Technology Innovation

CIP: Competitiveness and Innovation Framework Programme.

RDTI: Research, Development, Technological Innovation

NRC-CPFC: National Research Council Canadian Photonics Fabrication Centre

VC: Venture Capital

CI: Cluster initiatives

ERA: European Research Area

MPCs: Mediterranean Partner Countries

FDI: Foreign Direct Investment

ETP: European Technology Platform

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