

# **Creating Smart Systems**

## **A guide to cluster strategies in less favoured regions**

**European Union-Regional Innovation Strategies**

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**Stuart A. Rosenfeld  
Regional Technology Strategies  
Carrboro, North Carolina, USA  
[www.rtsinc.org](http://www.rtsinc.org)**

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## I. Introduction

Conceptually, industry clusters have become the *sine qua non* of economic development policy in many parts of the world. It is now a universally accepted fact that successful regional economies are, to varying degrees, specialised. Even the most diversified regions are home to industries that, because of historical accident, targeted recruitment, or geographic peculiarities, are found in higher concentrations than in other places. Competitive advantage of place can be best understood in terms of the comparative advantages of specific industries within that place's borders. No nation, and certainly no region, can be outstanding at producing everything. Therefore successful places develop strengths and focus innovative capacities on certain types of industries, or clusters. Clustering provides firms with access to more suppliers and specialised support services, experienced and skilled labour pools and the inevitable knowledge leakage that occurs where people meet and talk about business. The advantages of place draw not only similar but also complementary enterprises and, as a result, clusters become a breeding ground for new clusters.

Why are some regions better able to develop and support innovative and competitive clusters and become more prosperous than others? In the U.S., for example, the state of Mississippi has some outstanding research universities yet its best graduates leave the state, which greatly diminishes the school's contributions to place. The south of Italy has a milieu that attracts tourists but lacks the skilled labour force to attract technology-dependent firms. What potential do cluster-based strategies hold for less favoured regions that have had less success in attracting and keeping good jobs and talented people? Are there ways that these regions can find the assets to rejuvenate existing clusters or build foundations for new ones thus improving their economies?

At first blush, it appears that one can apply a cluster-based framework to weaker economies. The model assumes only that the economy be viewed and assisted systemically. That is, we look for ways that address industry needs collectively and systemically, not individually, in order to achieve and further benefit from externalities. Clusters have been used to design development strategies for less developed places as diverse as Peru and South Africa. Similarly, innovation is just as important and applicable to "Old Economies" as "New Economies." But the conditions in regions with weaker support structures, more mature industries, or fewer people suggest different a different collection of cluster-based actions.

The purpose of this monograph is not to define, explain, or justify clusters in regional economies. That has been done often and well by many experts. This publication focuses instead on *cluster-based actions that are appropriate to less advantaged regions*. It provides a menu of actions appropriate to clusters in less favoured regions that have been used successfully to improve cluster competitiveness. We assume there are three basic categories of less advantaged regions. The first is the older industrialised region dominated by labour intensive industries that have lost cost advantage to newly industrialised nations. The second is the semi-industrialised region that had many small craft industries that operate with very low levels of technology. The last is the peripheral or less populated region that has been dependent on resource-based industries but which must, with rising productivity and out-migration of youth reducing employment, find new clusters with growth opportunities.

Each action proposed here is intended to either “level the playing field” and create an infrastructure that allows the region to compete, overcome market failures, or take advantage of untapped opportunities. But to set the stage, we will very briefly summarise (a) a few assumptions about clusters, (b) the drivers of cluster success (opportunities), (c) the barriers to competitiveness (inequities and market failures), and (d) a few persistent questions.

## II. What Do We Mean by Clusters?

Every region has some distinctive characteristics and one or more concentrations of interdependent firms that are above national average concentrations, even if they do not meet commonly accepted definitions of “clusters”. We do not intend to settle the question of just what constitutes a cluster”, but we will set out some of the assumptions about them that underlie the subsequent suggested actions.

**Clusters are based on systemic relationships** among firms. The relationships can be built on common or complementary products, production processes, core technologies, natural resource requirements, skill requirements, and/or distribution channels.

**Clusters are geographically bound**, defined largely by distances and times that people are willing to travel for employment and that employees and owners of companies consider reasonable for meeting and networking. Range is influenced by transportation systems and traffic but also by cultural identity, personal preferences, and family and social demands.

**Clusters have life cycles**, which progress from an:

- embryonic stage, which can be generated by innovations, inventions, or inward investment, to the
- growth stage, where markets have developed sufficiently to spin off and attract imitators and competitors and to stimulate entrepreneurship, to
- maturity, which is when the processes or services have become routine, more imitators enter the market, and costs become a key competitive advantage, to
- decay, when the products become fully replaceable by lower cost or more effective substitutes.

**Clusters are not defined by organisational membership**, and while an association provides members with many real benefits “free riders” also are parts of the clusters. By virtue of their location and common needs, they may realise the same non-exclusive external economies as members of the cluster associations.

**Clusters produce externalities**, the “hard” externalities that produce a larger pool, greater variety, and lower costs of supplies and components, specialised and customised services, skilled labour, and potential partners, and the soft externalities that produce access to tacit knowledge of technologies, markets, and opportunities to network, and to aggregate interests and needs.

**Clusters are defined by relationships**. Ultimately, they are self-selecting based on how individual employers and institutions in a region define their missions, set their priorities, use their region’s resources, and form relationships.

### III. What makes Clusters Grow?

Why is one cluster more successful than another in less advantaged regions? Even holding market conditions constant, some clusters, for example, fare better because they are able to innovate and develop new comparative advantages or perhaps because they have the foresight to shift their competencies to new markets. Rosabeth Moss Kantor has attributed economic success to three factors: concepts, connections, and competencies.<sup>1</sup>

#### A. Concepts

Innovation, imitation, and entrepreneurship are what propel virtually all competitive clusters. While the success of an individual firm may depend on its ability to protect its own technological advances, new products, or designs, the success of the cluster in which it operates depends on the opposite—widespread diffusion, access to new innovations and information, and spin-offs of new enterprises. The porosity of clusters presses competitors within the cluster to continually improve and innovate in order to maintain their advantages over imitators.

**Innovation.** Innovators generate and commercialise new ideas, find more efficient production processes, or create new markets. Although university and advanced research centre-based R&D attract much of the resources and attention of governments, many of the most valuable innovations are improvements in business and production routines devised by employees, such as in applications of existing technologies, design of production and management systems, marketing of products, and organisation of labour. Customers, suppliers, competitors, and tool builders are important sources of these innovations. The current competitive advantage of Italy's ceramic tile companies, for example, is largely a result of relationships between equipment manufacturers and users.

**Imitation and competition.** Innovation builds a strong company but imitation and the competition that follows generate the scale for a strong cluster. Imitation is as important to a cluster as innovation because it's what circulates new concepts and practices among companies and spurs further innovation. It is the reason that companies look for benchmarks among their peers. Many of the imitators become innovators by improving upon the practices they adopt and this cycle of innovation and imitation drives clusters towards excellence. If a cluster has a collective persona and its markets are global, it views imitation as strengthening the cluster.

**Entrepreneurial energy.** Entrepreneurial capacity is the fuel that drives the expansion of the cluster growth. Recruitment may be a vitamin regimen that fortifies it, but it's the rare location that can recruit a cluster. The genesis of most clusters can be traced to the employees of one or two companies who left to start their own companies. The impetus in some cases was survival when a parent firm downsized, or went out of business, or moved. The hosiery firms in Italy's Castle Goffredo were established by skilled workers of the German-owned company Noemi who, when the firms declined in the 1950s, bought surplus equipment and became entrepreneurs. But a more common stimulus for entrepreneurs has been to exploit a different niche market, become an independent

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<sup>1</sup> Rosabeth Moss Kantor, *World Class*, New York: Simon & Schuster, 1995.

supplier, or develop a new concept—the route taken, for example, in the development of Ireland’s information and communications technology cluster.

## B. Connections

The most successful clusters build mechanisms that can speed the movement of ideas, innovations, and information from firm to firm throughout the economy. The dynamics of clusters, not the individual accomplishments, create the learning region and innovation cluster. The mechanisms and entities for collecting and disseminating knowledge—the gatekeepers, brokers, and intermediaries that encourage and facilitate all forms of associative behaviour—provide the value embodied in social capital that is so important to cluster competitiveness.

**Networking and Networks.** The single most important operating principle of competitive clusters is the ability to network extensively and form networks selectively. Networking is the process that moves and spreads ideas, information, and best practices throughout a cluster and imports them from other places. A “network,” as used here, is the collaborative structure among small and mid-sized enterprises (SMEs). By the late 1980s, networks had become a popular policy tool throughout the industrialised world. These networks were formally structured coalitions of firms that ranged from joint ventures created by legal contracts to business associations formed by nothing more binding than annual membership dues. The former depended heavily on co-operation and trust, the latter on the value of services and networking opportunities. A region that is home to a critical mass of interdependent companies and that has a social infrastructure as well as a set of intermediaries facilitating associative behaviour and specialised support services produces networks with or without government-sponsored network programmes.

**Connections and intermediaries.** The limits or constraints to active participation in a successful cluster are largely a function of lack of “connections,” or deficits in social capital. Some of a region’s stock of social capital resides in its civic and professional associations, and its economic value is deeply embedded in the functions of groups that bring people together to share ideas and knowledge. A variety of entities that work with clusters, including technology centres, NGOs, or skills councils, serve as gateways to information, knowledge, and labour and as linking agents.

## C. Competencies

Although many factors affect the competitive advantages of clusters, none is as important as its competencies they embody. Learning and knowledge transfer represent the lifeblood and skilled labour the gene pool, of clusters.<sup>2</sup>

**Specialised work force.** The skills and knowledge of the work force have soared to the top of the list of businesses’ requirements. As businesses become more technology dependent, they need more highly skilled, educated, and talented employees. While other cluster inputs such as parts, suppliers, and services can today be more easily sourced from afar using the Internet and overnight deliveries, the work force remains a local resource constrained by acceptable commuting patterns. Changing demographics and preferences only reinforce the critical nature of a skilled labour supply. Declining birth

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<sup>2</sup> Jane Jacobs, *The Nature of Economies*, New York: Modern Library, 2000.



rates in industrialised nations along with diminished interest among youth in pursuing industrial careers, have increased the pressures to locate where a labour pool already exists.

**Industry leaders.** Behind every successful cluster is a group of innovative firms led by people, who value learning, are committed to their community and, therefore, are willing to work toward a collective vision for their industry. These leading companies may have a niche or rapidly growing market that is not threatened by competition, or it may face such intense global competition that the benefits of mutual support and learning outweigh concerns about confidentiality. The key to building and sustaining a cluster organisation often rests with the support of these benchmark companies.

**Talent.** Regions are beginning to use incentives to recruit talent as they once recruited branch plants. Universities want faculty who will attract research dollars and bright graduate students, and clusters—especially in knowledge intensive sectors—need bright young people to attract other new firms and young companies. Talent is attracted not just by salaries but by the chance to interact with peers in their field, opportunities for professional development, and membership in local professional associations. Less advantaged and peripheral regions (or even low-income communities in relatively advantaged regions) have trouble keeping their best and their brightest graduates from moving to the “cool” places that can offer recreation activities, high culture, choices of good jobs, and that cater to diversity.

**Tacit knowledge.** Successful regions are home to institutions, individuals, and organisations that serve as storehouses and disseminators of undocumented knowledge. The knowledge resides in research and technology centres and their staff, educational institutions and their faculty, and companies and their employees. It extends well beyond whatever may be recorded. Those that develop and work with new technologies, techniques, and systems know far more about how it works under a variety of circumstances than is ever documented.

#### IV. Barriers Facing Clusters in Less Favoured Regions

Various historic under-investments limit clusters in less favoured regions from gaining new, or holding onto existing, competitive advantages. Most can be traced to a weak infrastructure; lack of access to capital, technology, innovation, and capital; regional insularity and isolation; low educational levels and low skilled work force; absence of talent; and an overly mature or hierarchical industry structure. Social exclusion exists in places with large and isolated underprivileged and undereducated populations; technological exclusion exists in places with poor access to sources of technology and benchmark companies; and economic exclusion is a result of weak links to benchmark regions and markets.

**Deficits in physical infrastructure.** Infrastructure deficits create an uneven playing field for regions that inhibit capital investment. The digital divide has become a rallying cry to bring broadband capabilities to even the most rural areas. But locations where the transportation of goods and people are costly and less frequent pose even more severe handicaps on regions that are difficult to remedy. As time to destination and logistics become more important to customers, poor access to transportation becomes more of a barrier.

**Lack of access to capital.** Clusters live or die with the entrepreneurial and innovative abilities of local employees and companies. The development and commercialisation of new ideas requires resources and capital. But capital markets often prefer New Economy companies to mature and low technology companies and innovation centres over more remote places that are difficult to monitor and assist. The consolidation of banking in many countries has further distanced sources of capital from local communities. Some clusters, especially in smaller communities, have been able to find local sources of capital that understand their business and are willing to invest in building the economy. The rural co-operative bank in Castle Goffredo, Italy underwrote the hosiery technology centre, funded cluster studies, and made loans to firms.

**Weak technology institutional structures.** Clusters depend on regional institutions for a variety of things they cannot do internally or get from other companies. They use regional institutions for information about and help with advances in technologies, economic scans, brokering, and education and training at all levels in their industries. Nearly all regions have an institutional framework for education and training and for some services, but few have an explicit economic development focus. Nor do they have the resources and expertise to target clusters; thus, few have become the centres of excellence that attract talent, resources, and other companies. The technology infrastructure is the mortar for building cluster-based economies, and its absence is a serious handicap in growing clusters.

**Regional insularity and lock-in.** While social capital is the medium that transports information within a cluster, competitiveness is highly dependent on an ability to import new information and ideas from greater distances. The most successful clusters include lead firms that are part of global networks and are exposed to global market opportunities, and that employ people active in international professional associations and networks. These firms regularly benchmark themselves against the best practices anywhere. Because knowledge in general comes from a very diverse set of sources, the wider managers cast the net, the more likely a prize will be caught. Poorer and peripheral regions have limited access to these benchmark practices, innovations, and markets. Without wider access, companies are limited to learning only within their regional borders and have a difficult time achieving any sort of competitive position.

**Lack of skills and opportunities to acquire them.** Companies do not consider locating or expanding in communities where skill levels are low and educational programmes do not match employers' needs. Skills, according to Jane Jacobs, comprise the "gene pool" of successful economies. With formal educational requirements rising in many sectors, those who lack credentials have a decreasing number of options. Even in tight labour markets, firms will try to import workers before they are willing to take a chance on hiring inexperienced and unfamiliar local workers, except to fill the lowest skilled positions. This disconnect becomes mutually reinforcing. With no opportunities to gain experience and skills, the work force remains a liability, not an asset.

**Cluster hierarchies.** In many places that have attracted branch plants or where a few companies dominate a cluster, not all small companies derive the full benefit of clusters. The lower tier suppliers of many large clothing manufacturers, for example, are small, non-unionised, and employ mainly young women at low wages, and invest little in their training. Further, many large producers are paying less attention to proximity and shifting to Internet auctions to find suppliers of parts at lower cost.

## V. Persistent Questions and Common Concerns

Even though industrial districts are an old concept in Europe, the current attention to regional production systems as a model for economic development requires, in most places, a new view of how an economy works and raises legitimate questions. For example, can regions create clusters in less favoured places? Do regional strategies require a strong economic climate? Does the Internet eliminate geographic boundaries? Do all places have clusters? What happens when clusters fail?

**Can regions create clusters?** Most of the world's successful clusters were accidents of circumstances, a serendipitous string of events. Public policies may have been the catalyst but rarely with the intent of starting a cluster. The growth of the largest clusters has been driven by market demand and entrepreneurial spirit. Some began as large companies that originally located in less populated areas to take advantage of low wages and surplus labour markets and that later disintegrated into smaller firms. This scenario describes the origin of furniture manufacturers in Tupelo, Mississippi and in County Monaghan, Ireland. Others were created by transforming a common local craft into a related value-added cluster, such as straw hats into fashion knitwear in Carpi, Italy or plastic combs into more advanced plastic parts in Leominster, Massachusetts. Still other clusters develop because other places don't want them. Prisons, for example, tend to cluster, as in the North Country of New York or the western reaches of Palm Beach County, Florida.

That said, there are examples of regions aiming at transplanting clusters to weak economies via recruitment and incentives, but usually at a very high cost. The most common is the auto industry, where companies agree to bring or use local supply chains in return for a large number of government incentives or where regions design policies to develop and embed supply chains. The auto supplier clusters in central Kentucky or southern Wales and electronics in Ireland were largely inward-investment driven. Table 1 summarises the origins of a sample of clusters.

**Cluster Origins** The mobile telecommunications cluster in northern Denmark grew out of the gradual market decline of SP Radio. It was established in 1948, produced a number of new firms, but then began its decline by the 1960s. Links that developed in the 1980s between the newer companies formed by employees, the University of Aalborg, and a new EU-supported Science Park provided the technological capacity that allowed the cluster to eventually break into the cellular phone market.<sup>3</sup>

The ceramic tile cluster in Sassuolo, Italy traces its roots back two centuries to the Rubbiani firm. The cluster took a major leap forward in 1924 when a new firm, Industria Cermica Veggia, introduced a less expensive and more effective zircon glaze called "Sassuolo white" and a production process that used pouring rather than pressing. But over time, the company's patents and its insularity were its downfall. By protecting its innovations, the company cut itself off from other innovators, lost ground, and declared bankruptcy in the 1960s. Employees with know-how purchased equipment and technology and started their own companies. Regional government support included Regional Laws that funded collaborative activities and the Ceramic Tile Research and Testing centre at the University of Bologna.<sup>4</sup>

<sup>3</sup> Lars Gelsing, "The Case of Mobile Telecommunication Equipment in North Jutland," Unpublished draft paper (Aalborg, Denmark: Aalborg University, 2001).

<sup>4</sup> Margherita Russo, "Complementary Innovations and Generative Relationships in a Small Business production System: The Case of Kervit", Unpublished paper, Industrial Districts and Localized Technological Knowledge, University of Modena, April 1999.

**Table 1**  
**Origins of Clusters**

<b>Place</b>	<b>Cluster</b>	<b>Year</b>	<b>Originator</b>	<b>Attraction</b>	<b>Growth</b>
Aalborg, Denmark	Mobile telecomm.	1948	SP Radio	Marine industry	Spinoffs, technology, university connections
Dalton, GA	Carpets	1918	Craft tufters	Serendipity	Automation, spinoff competitors
Castel Goffredo, Italy	Hosiery	1923	Noemi located plant	Markets	Plant closed, employees buy equipment
Ibi, Spain	Toys	1915	Paya Hermanos S.C.V.L.	Home	Spin-offs of different products
Los Angeles	"Toytown"	1968	Immigrant wholesaler	Distribution hub, low costs	Attract new immigrant entpren., design college
North Central Massachusetts	Plastics	1760s	Noyes, shell comb production	Serendipity	Entrepreneurial apprentices, celluloids, new products
San Diego	Biotech/ pharmaceutical	1950	Scripps, Scripps Institutes, UCSD, Hybritech	Naval base	New product spinoffs, venture capital
Saussoulo, Italy	Ceramic tiles	1600s	Rubbiani	Clays	Innovations, competitors, value added chains
Scotland	Electronics	1940s	British military electronics	Isolation from attack	Inward investment, government R&D
Lahti, Finland	Furniture	1918	Asko Furniture Oy (1918) & Isku Oy (1928)	Birch, skills, craft educ., transport	Specialization, modernisation*
Tupelo, MI	Furniture	1948	Futorian located plant	Labor, lumber	Entrepreneurial employees, Recruitment of suppliers*
Springfield, MA	Metals	1816	Springfield Armory	Water power, ease of logistics	New production methods*

\* Challenged by global competition, employment currently in decline.

**Are clusters only good time or also bad time strategies?** Over the past decade, the labour demand created by the voracious appetite of a rapidly growing economy has led employers to reduce their employment requirements and invest much more in training less or partially qualified applicants. Tight labour markets also give clusters a common problem to address collectively, even if it ultimately means competing for workers. They desperately need a larger labour pool. But in the early 1990s, many of the most successful networks were responses to low demand for products and to labour surpluses, not to the high demand and tight labour markets experienced over the past decade. Adversity has proven to be an effective catalyst for collective action in both good and bad times.

**Does closeness still count or is distance dead?** Even as the world gets smaller and communication anywhere/anytime becomes prevalent, few believe that a telecommunications network can fully replace personal interactions. While proximity accounts for much of the informal learning that occurs within clusters, external connections are just as vital for bringing new information into the cluster and learning about other sources of innovation. There has to be a continual influx of information from leading cluster companies, research institutions, and customers around the world to keep up with the cutting edge ideas. Informal learning, acquisition of know-how, and building trust require the face-to-face contacts that occur through social, professional or trade, and business situations.

**What if there are no clusters in a region?** After an analysis of the industry data and observation of the businesses in a region, there may not be any set of industries that appears to have either the scale or concentration to be a typical cluster. But there may be clusters that are not easily found without expanding the catchment area to include surrounding areas, looking for connections (umbilical cords) to clusters in adjacent areas, considering less obvious commonalities and more generic needs, or considering micro-clusters that lack scale but represent unique local competencies. Re-orienting the central theme of the cluster from some commonality of production process to a commonality related to knowledge, innovation or entrepreneurship may also open up new possibilities for generating externalities and taking collective actions in a region.

**Is there an afterlife for aging clusters?** One of the major criticisms of clusters is that an over-specialised economy is susceptible to global competition and product cycles, and that any significant drop in demand will devastate the region. Clusters, unlike diamonds, are not forever. The first lesson for areas dominated by mature clusters is not to panic but to assess their strengths, determine whether the downturn is temporary or structural, and, if the latter, look for alternative markets and products. The main ways to forestall and even reverse the effects of cluster decline are the following: (a) rejuvenate the cluster with innovation (e.g., new designs, markets, products); (b) take advantage of core competencies to transition into new products; and (c) look for elements of the value chain that can be built into self-sustaining clusters.

For decades, the shoe industry dominated St. Louis and provided thousands of jobs for low and semi-skilled workers. In the 1940s, as the saying went, St. Louis was “first in shoes, first in booze, and last in [baseball’s] the American League.” That industry is now almost non-existent except for some large distributors. But St. Louis had a sufficiently diverse industrial base, a research capacity, and enough foresight to survive, shifting into aerospace and biosciences. South Carolina’s textile cluster successfully recruited a

number of German and Swiss tool machine manufacturers in the 1950s and 60s, which in turn developed into a cluster in its own right that builds machinery for other clusters as textiles declined.

Since clusters have finite life cycles regions must be continually vigilant, scanning market and technological trends. It is important for successful clusters to have contingency plans for changes in consumer tastes and demand and for new technologies that might result in market shifts. The cluster, if well organised and self aware, can become the mechanism that gathers information, predicts shifts, and finds new opportunities.

## **VI. Regional Actions to Support Clusters in Less Favoured Regions**

Knowing and understanding clusters are of value to regions only if that knowledge leads to actions that grow economies and raise standards of living. Unfortunately, there is no single recipe for less favoured regions to follow that will meet the needs of all clusters, which embody many types of systemic relationships and kinds of industries. But there is a menu of actions from which to choose. The choices regions make depend on many factors, including geography, stage of development, resource constraints, special societal needs, cluster priorities, market imperfections, and local preferences. We have organised the menu around ways regions can:

- a) understand and benchmark regional economies
- b) engage employers and institutions
- c) organise and deliver services
- d) build a specialised work force
- e) allocated and attract resources and investments
- f) stimulate innovation and entrepreneurship

The menu that follows focuses only on those actions that are specific to clusters, and particularly useful in less favoured regions. It assumes that there are certain foundation factors that support economic growth in all sectors in all places. All companies and their employees want a sound basic education, good transportation infrastructure, reasonably priced public utilities, a range of housing options, shopping, a safe environment, and cultural and recreational amenities, which, taken together, contribute to the quality of life. These factors are essential to attract and keep the talent that is increasingly mobile and can afford to be discriminating in its choice of place.

Nearly all of the menu items have proven successful in one or more places. A few, however, stretch the limits and suggest best practices from other fields or circumstances that could be even more effective if focused on clusters.

### **Menu of Actions**

#### **A. Actions for understanding and benchmarking regional economies**

- Identify clusters
- Model and map systemic relationships
- Benchmark against competitors

#### **B. Actions for engagement**

- Recognise or, where an unmet need exists, create cluster associations
- Formalise communications channels
- Foster inter-firm collaboration

#### **C. Actions for organising and delivering services**

- Organise and disseminate information by cluster
- Establish one-stop cluster hubs
- Form cross agency cluster teams
- Create cluster branches of government
- Facilitate external connections

#### **D. Actions for building a specialised work force**

- Qualify people for employment
- Use clusters as context for learning
- Establish cluster skill centres
- Form partnerships between educational institutions and clusters
- Support regional skills alliances
- Create inter-regional cluster alliances

#### **E. Actions for stimulating innovation and entrepreneurship**

- Invest in innovation and business start-ups
- Support cluster based incubators
- Encourage entrepreneurs' networks
- Innovation networks
- Establish cluster-based technology hubs

#### **F. Actions for marketing and branding a region**

- Target inward investment
- Promote clusters
- Form export networks
- Look for opportunities to brand regions

#### **G. Actions for allocating resources and investments**

- Give incentives or set aside funds for multi-firm projects only
- Invest in cluster R&D
- Fund critical foundation factors

## A. Actions for understanding and benchmarking regional economies

***Clusters help regions better understand how their economies function as systems and which policy levers are likely to have the greatest impact.***

### Menu

- Identify clusters
- Model and map systemic relationships
- Benchmark against competitors

One of the strongest arguments for focusing on clusters is that it helps governments better understand how their economies really work. By looking at an economy through the lens of various regional production and innovation systems, regions can more accurately identify market imperfections, find pressure points, and detect systemic failures. Only then can they determine which interventions are likely to have the greatest impacts. Most challenges and opportunities are based on circumstances that vary from market to market and product to product.

There are numerous methods for identifying clusters, comparing their relative scales and concentrations, mapping value chains and other systemic relationships, and assessing performance. While the analytical tools are valuable as starting points, the results of even the most rigorous methodologies will be no better than the quality of the input data, which is usually quite soft, and the ways that the clusters are defined. Firms can cluster around common products, common processes, value added chains, core technologies, special skills, natural resource, or distribution hubs. Ultimately, one must apply common sense and depend on on-the-ground observers to identify the roots and, therefore members, of the clusters.

- **Identify clusters.** Most descriptions of regional economies begin with measures collected by government agencies: numbers of establishments and employment by sector; employment, unemployment, and poverty rates; income and wage levels; and average educational attainment of the work force. Concentrations of the clusters in a region are compared to national concentrations to produce a “location quotient” in which 1.0 represents an average concentration. All of these can be in graphs, or in bubble charts, where two variables are chosen for the x and y axis (e.g., location quotients and growth rates), a third variable by the size of a circle around the point on the graph (e.g., number of establishments, and a fourth by the shading in the circle, (e.g., location quotient).

- **Model and map systemic relationships.** The easiest relationships to map are the sector-based supply chains, which are typically available from government agencies. The more difficult relationship to map is the actual supplier and institutional relationships, which require knowledge of the real sales of products and services and the location of specialised support functions. Most maps are very general, showing cluster members as boxes but with little precise knowledge of the strength of the linkages, depicted as arrows connecting them. The most difficult relationships to map—but perhaps the most telling—are the flows of tacit knowledge and innovation, which requires information from individuals about forums for associative behaviour and personal relationships (Table 2).



**Table 2****Sample Questions: Mapping Social Capital among Employers**

*If confidentiality requires protecting names, a general response such as “a partner organisation is a tooling company in the south-western community” can be used. Please give approximate closest location for each connection (i.e., same community, region, or country)*

√ Please list up to five organisations that represent important sources of information or advice (this may be, for example, a technical school, competitor, customer, supplier, or consultant) and number of contacts in the last year.

√ Name up to three individuals or organisations with whom you have collaborated in the recent past (for example, to bid on contracts together, attend trade show together, help fill an order, or share equipment or services), and the type of cooperation.

√ Name up to three organisations that you have recently helped out in some way (such as gave advice, shared information, or loaned equipment) and form of help (advice, production, loan).

√ Name up to three companies in the same general industry as yours that you consider industry leaders and/or innovators.

√ Name up to five businesses or professional organisations/associations to which you belong and attend at least one function of per year and the approximate number of events attended in last 6 months?

√ Name any formal or informal advisory committees or boards for education, training, technology, or economic development organisations on which you actively serve.

√ Name up to three organisations you have used (or your employees have used) for education or training in the past year (and type, e.g., basic skills, IT, management, or vendor) and type of training.

- **Benchmark clusters.** There are a number of characteristics associated with cluster performance that can be used as performance measures, shown in Table 2. This profile can be used to compare clusters to similar clusters in other regions, identify weaknesses, and select appropriate actions

**Table 3**  
**Benchmarking Guide for Clusters**

<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 to cluster's 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, instruction embedded in context of cluster; 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 maximise interaction.	Input/output analysis of supply chains # of potential 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> tier 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, such as technology extension 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.	# of consultants who specialise in cluster Services that employ specialists from cluster \$ value of local outsourced services
<b>Machine builders and software designers</b>	Access to companies that design and build the machines, tools, and software used by 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 co-operation 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 of 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 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 \$ investments in new technologies New product lines started
<b>Presence of market leaders and innovators</b>	Number of acknowledged market leaders and magnet firms Marketing and sales of products or services outside the boundaries of the cluster.	Number of headquarter operations \$ value of exports of cluster products \$ 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 or vision statement Acceptance of cluster name or brand

## B. Actions for engagement

**Clusters offer regional governments new ways to relate to and respond to collective needs of employers.**

### Menu

- Recognise or, where an unmet need exists, create cluster associations
- Formalise communications channels
- Foster inter-firm collaboration

If like companies are concentrated in a region but lack a collective voice, will anyone hear them? A council or association that represents a cluster provides it with a collective identity, a venue for agreeing on and articulating needs, and a mechanism to receive contracts and grants. Efforts to engage and organise the employers that comprise the cluster have become central to most cluster development programmes. The cluster council or association is the anchor for the social infrastructure necessary for networking among members. The risks are that membership organisations become exclusive and restrict membership in order to maximise members' access to its accumulated resources, and that the council becomes confused with the cluster, and that success is defined by membership or council revenues. Michael Enright warned attendees at a Competitiveness Institute conference that failure to distinguish between clusters and cluster organisations lead to the following erroneous and dangerous beliefs:

- “Of course we're part of the cluster, I attend every meeting.”
- “Our industry wanted to be a cluster but the government did not approve us.”
- “Our cluster is very successful; we received 500,000 Euros in government funding last year.”

- **Recognise or, where necessary, create cluster associations.** The first step to understanding how and where relationships are formed and nurtured is to examine existing trade, labour, professional, and civic associations with respect to membership and membership requirements, associational behaviour of members, missions, and services. In clusters already served by a specialised and local business association, that entity can assume additional responsibilities. If no appropriate trade or business organisation exists, interested companies can be assisted in forming one. Gaining recognition from the highest government office, as well as delegating some responsibilities, such as gathering information and planning, are often important parts of launching cluster associations. Most cluster councils begin by identifying members' most pressing needs and acting as point of contact for government agencies and service providers. The director is expected to increase membership, generate income, build recognition, and facilitate networking activities.

**Auto Supplier Cluster: ACStyria:** The Austrian region of Styria, by the 1990s, already had an emerging auto cluster consisting of about 100 companies that employed 10,000 people. It included two large final assembly operations plus suppliers of assemblies and parts to those and other auto manufacturers. In the late 1990s, as a result of a study of the potential of the region's automobile cluster initiated by the Styrian Industrial Association, the region formed ACStyria. It included the auto companies but also colleges, universities, technology centres, the technology park, and development, innovation, and new business agencies. It supports the further growth and ensures the competitiveness of Styria's auto supply chain through research and development, co-operation networks, employment services, communications among members, and marketing. The association. <http://sfg.co.ac/acstyria.com>.

### Cluster Organisation Check List

- √ Inventory of social capital
- √ Cluster identity and government recognition
- √ Corporate status
- √ Business leadership
- √ Open membership
- √ Mission, goals, and plan
- √ Dedicated staff
- √ Interactive web portal
- √ Dues structure or plan for revenue generation
- √ Real services
- √ Collective professional and social activities

- **Formalise communications channels.** While effective clusters communicate frequently, a formal organised mechanism simplifies and structures their search for specific information. The Internet has led clusters to create quite sophisticated communications systems. Since these web sites also can bring new business to a region, governments have reason to support them. North Carolina’s hosiery cluster’s web site, the Legsource Information Network, has a web site that includes a manufacturers’ database about products, capabilities, contacts, a supplier data base, and a clearinghouse for business opportunities, personnel and job postings, and new technologies ([www.legsource.com](http://www.legsource.com)). A sample application is shown in Figure 1.

#### Figure 1: Leg Source Web Site—Sample communications from production planner

Report For Bob @ Top Gun Hosiery



XYZ Mill needs 5000 dozen 84 needle link and link production, email [frank@XYZ.com](mailto:frank@XYZ.com) for details



Big Mill needs 500 dozen \_ cushion cotton women’s 9-11 crew socks immediately, email [sally@bigmill.com](mailto:sally@bigmill.com) today!

[www.legsource.com](http://www.legsource.com)

**Foster inter-firm collaboration.** The model for cluster councils was borrowed from a page in the “users’ guide” for inter-firm collaboration. The roots of many clusters lie in the myriad projects undertaken all over the world in the 1990s to encourage and support inter-firm collaboration (Table 4). They were called business or flexible manufacturing networks. Cluster-based business associations were considered essential to networks. The original success story of inter-firm collaboration in Italy’s Emilia Romagna was carried worldwide by the Confederazione Nazionale Artisans (CNA), the local small firm trade associations that served as that region’s sector, or “cluster councils”, considered integral to inter-firm co-operation. Networks should not be confused with the more process-oriented term, networking. The former is a contractual or otherwise formalised alliance of firms. The latter is a social phenomenon of personal interactions that moves and spreads ideas, information, and best practices throughout a cluster and imports them from other places. *Both the abilities to network extensively and to form networks selectively are vitally important to competitive clusters.*

**Table 4: Elements of Denmark's Network Programmes (1990-1993)**

**Network “brokers”** The Network broker was the key to the programme, serving as external facilitator, or systems integrator for network functions. In some instances, the brokers are consultants but in most cases brokers worked for agencies already serving SMEs. Denmark designed and hosted a broker training and certification programme.

**Multipliers** These are people intimately familiar with the companies and able to detect and assess opportunities for collaboration that can be passed on to brokers. Referred to as “scouts,” they include staff of chambers of commerce, trade associations, banks, accounting firms, law offices, trade centres, technical colleges, and technology extension services.

**Incentives** Denmark offered incentives to compensate small firms for some of the costs of participating in activities with uncertain returns.

**Information campaigns** Denmark widely distributed information through the media, business associations, at shops and bars, and published newsletters on the potential value of networks and funding opportunities. Its well known “mark” was “1 + 1 = 3”.

### C. Actions for organising and delivering services

**Clusters offer an alternative for the delivery of information and services to organise around the complexities and interdependencies of business needs, rather than individual generic functions.**

#### Menu

- Organise and disseminate information by cluster
- Establish one-stop cluster hubs
- Form cross agency cluster teams
- Create cluster branches of government
- Facilitate external connections

The most useful but often least utilised action at the disposal of governments is for reorganising the delivery of services. Most government services are fragmented with related and even overlapping services. Training, education, finance assistance, technical assistance, and marketing assistance are usually run by different agencies. As an organising tool clusters shift government missions from a solution-oriented to problem-oriented approach, from independent to interdependent needs, and from individual to collective interests. Such reorganisations can be accomplished with the least change in policy through brokers, or one-stop-shop service centres for clusters. A more significant change in behaviour would be the formation of cross-agency teams that include cluster expertise. The most fundamental change would be to create new agencies that correspond to key clusters.

- **Collect, organise and disseminate information by clusters.** Most regions organise and publish economic data by sector and economic region or labour market but not by

cluster. It would be helpful to regional and local development agencies, cluster organisations, and service providers to have data aggregated and published for the clusters that the state or industries have identified. Employment and establishment data, growth rates, and market projections would help clusters and agencies plan and design programmes. For a more in-depth and focused analysis, regions ought to conduct periodic cluster benchmark studies and status reports, as some already do.

- **Establish one-stop cluster hubs.** One of the first actions of Italy's new regional government in Emilia Romagna (1970) was the creation of the economic development agency ERVET. The agency, in turn, promptly focused on the industrial districts and established a set of cluster service centres/hubs. By aggregating needs of many small firms, hubs can provide specialised services unaffordable and unavailable to the isolated company. It is essential that staff have direct industry experience and an understanding of the problems the companies face and their technologies, customers, and markets. Each field has its own peculiar language, and those staffing the support organisation have to know that language to gain the confidence of the companies. (Technology Centres, to be described later, can serve this function.)

#### Ideas for Cluster Hubs

- √ Rely on cluster to define services
- √ Include some charge for all services
- √ Employ staff with industry experience
- √ Broker existing services where possible
- √ Look for ways to work with firms collectively
- √ Know the companies and gain their trust
- √ Establish formal link to cluster organisation

- **Form cross-agency cluster teams.** Some less favoured regions already use cross-disciplinary teams to meet, greet, and woo branch plants being recruited. They might include someone from technical colleges, economic development agencies, technology assistance agencies, and marketing divisions. Such cross-agency and cross-disciplinary teams are low-cost means for regions to address clusters' need systemically, but the teams must include individuals who either know or will invest in learning about the cluster.

- **Create cluster branches of government.** This most drastic action may appear to be unrealisable, however most nations already have separated their agricultural branches. It may be equally useful to distinguish among certain classes of clusters with different needs in order to improve services to them. General categories might be, for example, clusters of mature production industries, of information and knowledge-based industries, or those that involve chemical processing.

- **Facilitate external connections.** Clusters that focus exclusively on internal linkages cut themselves off from sources of new knowledge and technology. The Swiss watch industry is an example of a world-renowned cluster in fine watch manufacture that refused to connect to the Japanese chip industry, held fast to its own mechanical technologies, and missed the shift to digital watches. Without access to benchmark practices and markets—often the case in less favoured regions—clusters are limited to learning only within their borders and have a difficult time achieving competitive positions. The Internet overcomes some of their isolation, but a very real divide is a limiting factor, and even

Internet access does not match the value of direct experience and broader personal relationships.

**Learning through study tours.** In 1996, a dozen Hosiery company owners and managers, Carolina Hosiery Association officials, college technology centre staff, the Governor's economic advisor, and the director of the state technology agency travelled to Castle Goffredo and Carpi in northern Italy to meet with and benchmark their European counterparts and visit their technology and research centres, trade associations, and tool builders. Following their return from that eye-opening trip, the companies, through their association, revamped their technology centre at the college adding research and training for dying and marketing and product testing capabilities; formed an R&D network with North Carolina State University in which 20 members contributed matching funds to develop a key technology; established links to the main machine builders in Brescia; and organised export networks. [www.legsource.com](http://www.legsource.com)

## D. Actions for building a specialised work force

**Institutions that teach in a cluster context produce workers that are more productive, informed about labour markets, and better connected to employers.**

### Menu

- Qualify people for employment
- Use clusters as context for learning
- Establish cluster skill centres
- Form partnerships between educational institutions and clusters
- Support regional skills alliances
- Work with NGOs to reach low income populations

Nothing is more important to clusters in less favoured regions than the development of their human resources. In no resource are the clusters more dependent on the government, which is the biggest investor in education and training. Companies value access to a labour pool that is familiar with the operations of their businesses and able to apply their skills in the particular work environment of the cluster. To be sure, “commodity skills” that are easily transferable are wanted by all employers. But the “leveraged skills”<sup>5</sup> that are industry specific are scarcer. Even more specialised, firm-specific “proprietary skills” are learned on the job and enable companies to build internal intelligence; such skills also foster knowledge spillover as people change jobs.

- **Qualify people for employment.** The first major hurdle for low- and middle-income people lacking relevant work experience is a record of basic educational and/or skill attainment that qualifies them to even be considered for employment in jobs with a future. Raising educational levels is considered fundamental to the achievement of both the social and economic goals of any region. Cluster connections have the potential to strengthen entry-level programmes by introducing reality and context into the education and aligning programmes with real workplace needs. Even the most basic programmes, such as vocational English, can be taught more effectively if the vocabulary is related to that used in the cluster.

<sup>5</sup> Thomas A. Stewart. *Intellectual Capital: The New Wealth of Organizations*, (New York: Doubleday, 1998).



**Ideas**

- √ Create career paths and ladders
- √ Use cluster context for literacy education
- √ Reward incremental accomplishments
- √ Encourage continuing education

• **Use clusters as context for learning.** The context in which learning occurs matters. Educators classify their programmes by occupation but the skills used are defined by the context in which they are applied, and vary across industry. The network administrator working in a division of a large multi-national corporation, a government agency, and a small service company have different skill requirements and must operate in a different business culture. By designing curricula around the workplace and business of firms in a local cluster, learners can come to appreciate the value of the cluster, understand more about their regional environment, and perhaps be more inclined to follow career paths in the cluster.

• **Establish cluster skill centres.** Rather than expecting every technical and business college to meet the specific needs of all firms, regions could designate centres of excellence around clusters. Cluster skill centres, associated with an existing institution, could become the lead entities for surveying industry needs, developing new curricula, staying in touch with cluster councils, updating skill standards, benchmarking practices in other places, and generally collecting information about cluster occupations and programmes. This would not be bricks and mortar but a virtual centre that might organise teams from various colleges to work on particular problems, conduct R&D, or develop curricula—and all products and information would be readily available throughout the region and nation (Table 5). Skills centres can serve as gateways, for example, to help firms bombarded with more information than they can sift and sort through determine which training programmes have the most relevant staff experience, technologies, best track record, and are most familiar record with the industry. They can provide on-site outreach and access to socially excluded populations. The United Kingdom announced steps in this direction on February 2002 when it listed awards to specialised Centres of Vocational Excellence that match needs of local economies at 70 of its Further Education Colleges (Table 6).

**Table 5**  
**Characteristics of Cluster Skills Centres**

- Cluster, not technology, based
- Emphasis on industry-specific knowledge, not job-specific skills
- Critical links to industry associations
- Uses business, not machine, as context
- Functions as information repository and information portal
- Budget stresses staff and curricula, not bricks and mortar
- Share curricula and information statewide, and train faculty from other places
- Lead responsibility for cluster needs assessments, skill standards
- Provides outreach to socially excluded populations

**Table 6**  
**Examples of Centres of Vocational Excellence in the United Kingdom**

Programme	FE College	Learning & Skills Council
Digital Imaging	South Nottinghamshire	Nottinghamshire
Fashion & clothing	London Institute	London Central
Rail Industry Engineering	Newham College	London East
Mechatronics	North Tyneside College	Tyne & Wear
Retail & distributive trades	Preston College	Lancashire
Hospitality & catering	Thanet College	Kent & Medway
High Tech engineering	Plymouth College	Devon & Cornwall
Print media & graphics	Matthew Bolton College	Birmingham & Solihull

Source: “70 Colleges progress to next phase of centres of vocational excellence programme”, Issue Paper #45, 11 February 2002, Learning and Skills Council, United Kingdom.

- **Form partnerships between educational institutions and clusters.** Educational institutions need to partner with the cluster organisation, and the cluster needs to be actively involved in educational programme design and development. At present, many technical education and training programmes work with industry. But industry partners are often large employers and are rarely positioned or empowered to speak on behalf of a specific industry. Cluster organisations represent a collective voice for the private sector to influence education and training policies.

#### **Cluster roles in education policy**

- √ Coordinate cluster needs assessments
- √ Develop state skill standards
- √ Curricula design and development
- √ Projections of future skill and employment needs
- √ Establish workplace learning opportunities
- √ Help access latest technologies

- **Support regional skills alliances.** Regional skill alliances (RSAs) are a form of inter-firm collaboration, or network, that associates to acquire (or reduce costs of) training programmes. Broad-based RSAs also include the public sector, education and training organisations, and frequently organised labour, as intended by the United Kingdom’s Learning and Skills Councils. The most common problem cited for RSA failure is poor choice of training vendors. Clearly, the vendor must have the capacity to provide the training—the required expertise and familiarity with the industry. For example, a technical college must be flexible enough to offer non-degree courses, provide training on site, and offer weekend and evening classes.
- **Create cluster alliances among educational institutions in different regions.** Any region’s efforts to build workforce programmes, skill standards, or curricula can benefit from the ideas and experiences of others. Innovation and learning are collective and interactive activities and opportunities for staff and faculty to exchange ideas leads to programme improvement. Support for such alliances, in terms of acknowledging the value

of learning, providing release time, and allowing travel, also creates potential learning and benchmarking opportunities in the cluster.

## E. Actions for stimulating innovation and entrepreneurship

**Cluster growth is generated by new ideas and new enterprises.**

### Menu

- Invest in innovations and business start-ups
- Support cluster based incubators
- Facilitate entrepreneurs' support networks
- Innovation networks
- Build technology cluster hubs

Innovation and entrepreneurship are the engines of cluster development growth. Most clusters have been formed by entrepreneurial employees of existing employers in pursuit of expanding supply chains or new market potential or in response to a corporate downsizing/closure. Although both innovation and entrepreneurship are influenced heavily by a region's educational process and cultural norms, they can be enhanced by deliberate supporting policies.

- **Invest in innovations, expansions, and business start-ups.** New ideas and new business formation may be the most important yet least developed cluster-based strategies. Entrepreneurship has often been a major part of national and state technology development and innovation strategies, and the commercialisation of research and development has been widely supported but rarely with an explicit cluster orientation. In mature clusters, entrepreneurship has not been given the priority it deserves. Embryonic clusters include many new and potential entrepreneurs while mature clusters are composed of older firms that may resent start-ups as competitors for their limited markets, workers, and capital. The investments range from seed capital and product development funds, to venture capital for entrepreneurs, to working capital for mature and expanding firms.

- **Establish cluster based incubators.** Incubators are now widely used strategies for supporting new and small business enterprises. The basic concept is a low-cost shared space and services, combined with technical assistance. Limiting tenants to certain types of similar or complementary firms justifies more highly specialised services and assistance, produces intra-incubator business activity, and encourages learning and technology transfer among firms.

- **Facilitate entrepreneurial support and learning networks.** Entrepreneurs and young firms have a greater need for networking than existing companies because they have less experience and no established routines. They thrive on information, advice, and knowledge. The most effective networks are based on some sort of existing relationships among entrepreneurs, such as incubators, economic development programmes, common sources of capital, or associations.

Innovative companies can benefit from networks. The innovation networks (called knowledge networks), in Norway and Denmark in the 1970s was a model for the

subsequent harder business networks in the 1990s. In some parts of the U.S., these are called continuous improvement user groups, forming around common problems or specific technologies. The critical success factors are a competent facilitator and pressing need.

- **Establish cluster-specific technology centres.** In the 1980s and 1990s, many regions invested in technology centres as regional economic development policies. In the U.S., the state of Ohio created Edison Centres for various industries across the state and Pennsylvania established similar Ben Franklin Centres. In Baden-Wurttemberg, the Steinbeis Foundation created a host of specialised technology transfer centres, Ireland a programme of Technology Centres, and the Valencia region of Spain a set of cluster-based Technology Institutes (Table 7). Many are associated with educational institutions but some are independent. An evaluation of Ireland's 17 Centres found some successes but a common problem of underutilisation, often due to weak marketing and links to industry. Tighter links between cluster associations and the Centres might expand utilisation of the services of the centres.

**Table 7**  
**Examples of Cluster-Based Technology Centres**

Food Product Development	Dublin Institute of Technology	Ireland
Nautical Enterprise Centre	Cork Institute of Technology	Ireland
Tool Industry Res, & Advisory Centre	Sligo Institute of Technology	Ireland
Toy Technology Institute	Ibi	Spain
Plastics Technology Institute	Valencia	Spain
Ceramics Technology Institute	Castellon	Spain

#### **Typical Functions of Technology Centres**

- √ Applied research & development
- √ Testing and quality standards
- √ Technical advice
- √ Network brokering
- √ Technician and management training
- √ Conduct technical studies

## **F. Actions for marketing and branding a region**

**Clusters increase the success rates of marketing efforts.**

#### **Menu**

- Target inward investment
- Promote clusters
- Form export networks
- Look for opportunities for regional branding

The most successful clusters result in a brand that identifies a place with quality, establishes customer loyalty, and becomes a prime destination of retail and wholesale

buyers. Brands have been common in agriculture, with French champagne, Scotch whiskey, Belgian chocolates, Vermont maple syrup, Modena balsamic, and Parma's cheese and ham—all globally recognised brands associated with clusters. In other fields, Finland has become internationally known for cell phones, southern California for movies, Germany for machine tools, Denmark for modern furniture, New York for publishing, Waterford for crystal, Venice for glass, Orlando for theme parks, and Boston for education.

- **Focus inward investment.** Industrial recruitment is one of the most convincing rationales for cluster strategies. Targeting certain kinds of companies helps regions boosts chances of success in the competition for plant locations. It represents a relatively easy transition for economic developers already loaded with recruitment tools. An even more ambitious goal is to use recruitment to create clusters. Despite the fact that most clusters developed as accidents of history or local conditions, it is not uncommon for regions to aspire to create a cluster out of whole cloth, particularly in the hottest high tech sectors, by luring companies.
- **Promote a region's clusters.** Regions around the world have used clusters to promote themselves as a desirable place to visit and do business. Few have taken it so far the Austrian region of Upper Austria, which proudly calls itself "Clusterland" in its regular marketing publication called *Business Focus*. Each issue traces its latest cluster initiatives. Scotland, New Zealand, Canada, and Spain have all effectively used clusters to market regions to investors and customers.

***Business Focus: Upper Austria: Excerpts from Issue 3, 2001***

"The annual conference of the Plastics Cluster focused on the topic of "Know-how management and co-operation. Innovation demands constant learning, in order that new knowledge is created."

"The annual conference of the Automotive Cluster was predominated by questions related to the demands made by international customers on their suppliers."

"The thematic debate at the annual conference of the Diesel Technology Cluster centered on the formation of modules in the engine sector...[and the effects of the] increasing trend towards modularization in the engine sub-supply industry."

- **Form cluster-based export networks.** Individual small and mid-sized firms lack the resources and knowledge of other countries to effectively exploit global market opportunities. Existing export assistance programmes reach very few SMEs. Marketing, and especially exporting, has been one of the most widely accepted multi-firm activities. In New Zealand, where exports are a way of life, Joint Action Groups were formed around clusters with similar or common markets. Supported by the government, they became the models for the subsequent business network programme. In Canada's British Columbia, the government supported the formation of similar cluster-based export associations. In each case, the catalyst was expanding export opportunities but the product was a forum for associative behaviour that stretched well beyond exporting.

**Ideas**

- √ Multi-firm participation in trade shows
- √ Cluster trade missions
- √ Shared international sales offices
- √ Export cluster alliances
- √ Export networks

- **Support regional branding.** The cluster can also be a means to brand a product to distinguish it from competitors. Branding is especially important in an economy where consumers and customers are overwhelmed with choices and often fall back on name recognition. Regions can support branding through their marketing efforts and state publications. Many regions take pride in connecting their wines to place, whether it be Spain, California, South Australia, or New Zealand. Branding is more common in clusters that comprise locally owned firms that sell to consumer markets but can also serve technology companies, especially if they are connected to world-class research centres or universities. Another way to establish a brand is to selectively host cluster conventions and trade shows. Sassuolo, Italy holds the largest ceramic tile show in the world and High Point, North Carolina and Copenhagen hold some of the largest furniture shows in the world. Conventions attract customers, suppliers, and potential investors from all over the world. A cluster must already be established to use this strategy, but it can help to further secure a region's advantage.

**Arizona Optics Industry.** “In 1992, the optics cluster companies (approximately 145 firms) incorporated as the Arizona Optics Industry Association (AOIA). Soon after, the AOIA landed a cover story in *Business Week* that dubbed Tucson “Optics Valley.” In addition, over a 3-year period, cluster companies bid together and successfully won a large contract (which they could not even have bid on individually), worked jointly with the University of Arizona to create two centres of excellence in optical manufacturing technology, put assistants in eight local schools to promote careers in science, and developed specialised curricula for community colleges. More recently, the cluster, in partnership with the state’s major international service providers, has focused on building long-term export capacity for its member firms. The results already are significant—\$5 million in immediate sales, establishment of an annual industry show in Arizona that draws more than 700 domestic and international firms, and a joint Arizona-Mexico university research agreement....a number of optics-related firms have chosen to relocate to Arizona as a result of growing recognition of this industry in the state”<sup>6</sup>

## G. Actions for allocating resources and investments

**Clusters provide a rationale for allocating resources to maximise impacts on the economy.**

### Menu

- Give incentives or set aside funds for multi-firm projects only
- Invest in cluster R&D
- Support applications for national and EU funding in less favoured regions
- Fund critical foundation factors

Major investments in an important element of a cluster—often research and development or large industrial parks—are common ways to build a cluster’s reputation and attract additional firms. Some regions have attempted to purchase clusters with sufficient investment but with mixed success. The ways that state agencies allocate resources to clusters is particularly sensitive to the degree of maturity of the cluster. Embryonic clusters have very different needs than mature clusters.

<sup>6</sup> Mary Jo Waits, *Economic Development Quarterly*, February 2000, p. 45.

- **Create incentives in competitive funding programmes for collective applications.**

One of the easiest ways to encourage collaboration among firms and achieve greater economies of scale without incurring additional costs is to re-direct funds to multi-firm proposals. It was law in northern Italian region of Emilia-Romagna in the mid-1980s. The laws (a) supported concentrations or associations of businesses, (b) awarded grants to consortia of companies for technical and managerial services for training of *associate* companies (individual firms only qualified if they were experimenting with a new process), (c) provided capital to consortia of small companies to develop or improve sites, (d) funded groups of five or more small service urban companies.

- **Invest in cluster-based R&D.** Much of the leading edge research takes place at public universities. Historically, it has been funded through a competitive process reviewed by peers in a field but not necessarily linked to regional economies. Rewards have been based on publications, not commercialisation, though in some places that is beginning to change. In some instances, a major breakthrough has given birth to clusters in or around the parent universities. Further, while many less favoured regions lack flagship research universities, most have postsecondary institutions that also are beginning to assume more responsibility for industry R&D. Research at these institutions is more likely to be driven by needs of the local economy and less by the global interests of international faculty, and investments can have more immediate payoffs. Clusters can be supported by (a) adding relevance to regional economy and commercial potential to the review criteria and (b) shifting more research funds to institutions in less favoured regions.

- **Support opportunities for EU and national funding for cluster initiatives.** Few cluster organisations can support themselves only through membership fees, and nearly all continually search for sources of funds to support cluster activities. National or regional support, and sometimes cost share, is crucial to many of these agencies. By helping to identify and secure multi-year funding, states can give cluster organisations the boost they need to firmly establish themselves within the cluster.

- **Support foundation factors.** It goes almost without saying that all governments must commit the resources to support the basic foundations for economic growth that are required by any cluster. These include a universal basic education from early childhood through secondary; the infrastructure of roads, ports, public transportation, utilities, water, waste disposal and sanitation; health care and a healthy environment; and adequate housing. Less favoured regions are often stuck in a cycle of economic distress because they lack the tax base and resources to pay for the basic conditions for growth and the economic wealth that would give them the resources.





## VII. Partial List of Resources

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## VIII. Sample Cluster Information Web Sites & Newsletters

Biomed Clusters Worldwide

<http://www.zurichmednet.org/clustersworld.html>

Industry and Regional Clusters: Concepts and Comparative Applications

[www.rri.wvu.edu/WebBook/Bergman-Feser](http://www.rri.wvu.edu/WebBook/Bergman-Feser)

Cluster Alliance Newsletter, Australia

Contact [apd@orac.net.au](mailto:apd@orac.net.au)

Cluster Navigators, New Zealand

[www.clusternavigators.com](http://www.clusternavigators.com)

Cluster Mapping project, Harvard Business School

<http://www.isc.hbs.edu/econ-clusters.htm>

Competitiveness Institute, Barcelona

<http://www.competitiveness.org/home.htm>

Industrial District Club of Italy

<http://www.clubdistretti.it>

Institute for Competitiveness of Inner Cities, US

<http://www.icic.org/home.html>

National Commission on Entrepreneurship, U.S.

<http://www.ncoe.org>

National Network of Sector Practitioners, U.S.

<http://www.nedlc.org/nnspp>

Regional Innovation Strategies, European Union

<http://www.innovating-regions.org>

Regional Technology Strategies, Inc.

<http://www.rtsinc.org>

Organization for Economic Cooperation and Development LEED programme, Paris

<http://www.oecd.org/tds/LLEDonline/1.htm>

University of North Carolina Cluster Course

<http://www.unc.edu/depts/dcrpweb/courses/261/leveen>

U.S. Council on Competitiveness

<http://www.compete.org>

The World Bank

<http://www.worldbank.org/urban/led/cluster.html>



Clustering is an unsupervised machine learning algorithm. It helps in clustering data points to groups. Validating the clustering algorithm is bit tricky compared to supervised machine learning. Before evaluating the clustering performance, making sure that data set we are working has clustering tendency and does not contain uniformly distributed points is very important. If the data does not contain clustering tendency, then clusters identified by any state of the art clustering algorithms may be irrelevant. Non-uniform distribution of points in data set becomes important in clustering. To solve this, Hopkins test, a statistical test for spatial randomness of a variable, can be used to measure the probability of data points generated by uniform data distribution. Clustering and transnational corporations offer substantial advantages, and participating in global value chains and interacting with foreign buyers and companies may enhance local firms' capabilities to produce goods. However, what matters most markedly is the form of governance of value chains and clusters, which affects the upgrading process of territorial systems. Competitive factors that influence innovative models of regional economic development and lead to successful country and regional scientific and technological policies are investigated. The emergence of new fields, including Creating Smart Systems A guide to cluster strategies in less favoured. regions. European Union-Regional Innovation Strategies. April 2002. Stuart A. Rosenfeld Regional Technology Strategies Carrboro, North Carolina, USA. [www.rtsinc.org](http://www.rtsinc.org). What potential do cluster-based strategies hold for less favoured regions that have had less success in attracting and keeping good jobs and talented people? Are there ways that these regions can find the assets to rejuvenate existing clusters or build foundations for new ones thus improving their economies? Rosenfeld S.A. Creating Smart Systems: A guide to cluster strategies in less favored regions. European Union-Regional Innovation Strategies. Regional Technology Strategies. Carrboro, North Carolina, USA, 2002. Available at: [http://rtsinc.org/publications/pdf/less\\_favoured.pdf](http://rtsinc.org/publications/pdf/less_favoured.pdf) (accessed 27 May 2016). Kutsenko E. Pilot Innovative Territorial Clusters in Russia: A Sustainable Development Model. Foresight-Russia, vol. 9, no. 1, pp. 32-55. DOI: 10.17323/1995-459x.2015.1.32.55 Available at: <https://foresight-journal.hse.ru/data/2015/04/07/1096415210/3-Kutsenko-32-55.pdf> (accessed 27 May 2016). A guide to cluster strategies in less favoured. regions. European Union-Regional Innovation Strategies. April 2002. Stuart A. Rosenfeld. Regional Technology Strategies. Carrboro, North Carolina, USA. [www.rtsinc.org](http://www.rtsinc.org). What potential do cluster-based strategies hold for less favoured regions. that have had less success in attracting and keeping good jobs and talented people? Are. there ways that these regions can find the assets to rejuvenate existing clusters or build. foundations for new ones thus improving their economies? At first blush, it appears that one can apply a cluster-based framework to weaker.

Smart specialisation strategies are key elements of a new, more result-oriented Cohesion Policy focusing on growth through innovation, which is now being implemented. It helps regions at different stages of development to focus on their strengths, to position themselves in global value chains and to team up to build strategic partnerships across Europe with other regions that have complementary strength in similar priority areas. The aim of this Smart Guide to Cluster Policy is to highlight the benefits of an integrated approach to cluster policies and smart specialisation and to discuss the opportunities and challenges for cluster policies in this context. It offers practical examples and a toolbox with new ideas for the transition towards modern cluster policies. Another strategy to facilitate cluster innovation is to foster the links between universities and firms. A number of internationally renowned clusters have developed around institutions of higher education and technical training. In addition to facilitating access to research, proximity to universities and training institutions can be important in recruiting highly qualified graduates, creating prestige and accessing information.

Rosenfeld S. (2002), "A guide to cluster strategies in less favoured regions", *Creating Smart System, European Union-Regional Technology Strategies*. 7. A guide to cluster munitions. GENEVA INTERNATIONAL CENTRE FOR HUMANITARIAN DEMINING (GICHD) The GICHD is an expert organisation working to reduce the impact of mines, cluster munitions and other explosive hazards, in close partnership with mine action organisations and other human security organisations.

This new edition of *A Guide to Cluster Munitions* features updated information on the Convention's key obligations such as stockpile destruction and cluster munitions clearance. It features comprehensive descriptions and illustrations of the types of cluster munitions in contaminated areas. That impact is felt directly and indirectly. In some countries and regions, submunitions are a major cause of deaths and injuries to civilians.

*Creating Smart Systems A guide to cluster strategies in less favoured. regions. European Union-Regional Innovation Strategies*. April 2002. Stuart A. Rosenfeld Regional Technology Strategies Carrboro, North Carolina, USA. [www.rtsinc.org](http://www.rtsinc.org)

What potential do cluster-based strategies hold for less favoured regions that have had less success in attracting and keeping good jobs and talented people? Are there ways that these regions can find the assets to rejuvenate existing clusters or build foundations for new ones thus improving their economies?

2. Types of Clustering. Broadly speaking, clustering can be divided into two subgroups : Hard Clustering: In hard clustering, each data point either belongs to a cluster completely or not. For example, in the above example each customer is put into one group out of the 10 groups. Soft Clustering: In soft clustering, instead of putting each data point into a separate cluster, a probability or likelihood of that data point to be in those clusters is assigned. For example, from the above scenario each customer is assigned a probability to be in either of 10 clusters of the retail store.

3. Types of clustering algorithms. Since the task of clustering is subjective, the means that can be used for achieving this goal are plenty. Creating Smart Systems A guide to cluster strategies in less favoured. regions. European Union-Regional Innovation Strategies. April 2002. Stuart A. Rosenfeld Regional Technology Strategies Carrboro, North Carolina, USA. [www.rtsinc.org](http://www.rtsinc.org). What potential do cluster-based strategies hold for less favoured regions that have had less success in attracting and keeping good jobs and talented people? Are there ways that these regions can find the assets to rejuvenate existing clusters or build foundations for new ones thus improving their economies? PDF | On Jan 1, 2002, Stuart A. Rosenfeld published Creating Smart Systems A guide to cluster strategies in less favoured regions | Find, read and cite all the research you need on ResearchGate. provides a menu of actions appropriate to clusters in less favoured regions that have been. used successfully to improve cluster competitiveness. We assume there are three basic. categories of less advantaged regions. The first is the older industrialised region. dominated by labour intensive industries that have lost cost advantage to newly. [12] Rosenfeld S. A. Creating smart systems " a guide to cluster strategies in less favoured regions. European Union-Regional Innovation Strategies, Regional Technology Strategies Inc., Carrboro, North Carolina, April 2002, <http://led.co.za/sites/default/files/documents/154.pdf>, last accessed 2018/01/05. [13] Schmiedeberg C. Evaluation of cluster policy: a methodological overview. Evaluation, 16(4), 389-412 (2010).