

CLUSTERS

Balancing Evolutionary and Constructive Forces

ÖRJAN SÖLVELL



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CONSTRUCTIVE FORCES

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Clusters – Balancing Evolutionary and Constructive Forces

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IVORY TOWER

to Ingela, Frida & Christian

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Preface

This book is the outcome of many years of research around clusters, statistical cluster mapping, cluster initiatives, and cluster policy. The idea is to give the reader an overview of the field, and to show how clusters can be used as a constructive tool, not only for scholars but also for cluster practitioners, for industry, academic, and political leaders, and for civil servants working with clusters, regional development and innovation.

The two main arguments of this book are: first, that clusters do matter, especially as environments for innovation; and second, that clusters evolve from both evolutionary and constructive forces. Both forces are bound by history and geography, and therefore every cluster has its own unique characteristics. Drawing upon our research, we want to offer some insights about cluster evolution and construction that can guide and inspire leaders and cluster practitioners around the world.

The book is divided into two parts; the evolution of clusters (part I) and the construction and reconstruction of clusters (part II). The first part emphasizes the reasons why economic activity tends to agglomerate, causing clusters to take off, grow and ultimately decline. The second part analyzes policymaking and cluster initiatives, where social, political, and business leaders come together in a conscious effort to promote clusters and the regional business environment. We wish to draw a rather sharp distinction between the evolutionary forces of industry agglomeration and clustering, and the planning and active execution of cluster construction. Both of these phenomena are, of course, two sides of the same coin, but they tend to play out differently in distinct geographies and time periods.

The basis for this book is found in a number of earlier works I have published alone or jointly with Christian Ketels and Göran Lindqvist. Examples of joint publications include *The Cluster Initiative Greenbook* (2003) and *Cluster Initiatives in Developing and Transition Economies* (2006), known informally as the “blue book”. It also draws upon data and analysis carried out together with my colleagues working for the European Cluster Observatory (www.clusterobservatory.eu). Göran Lindqvist and Sergiy Protsiv have been helpful with data collection, model construction and analysis at various stages of the research. Both are work-

ing on their doctorates at the Stockholm School of Economics (SSE), and both promise to make significant contributions in the fields that intersect International Business, Strategy and Economic Geography.

This book represents the work of many people to whom I am indebted. Chapter 3 is based on a case that I have used for teaching cluster evolution, as well as the interplay between the diamond model, social capital and entrepreneurship. The case version was co-authored with Karin Larson and Marcus Lindén, both of whom were students at SEE.

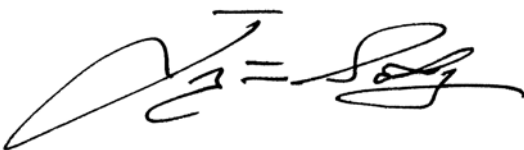
Chapter 5 is based partly on work that was carried out in cooperation with Harald Furre at Oxford Research in Norway. Chapter 6, which addresses cluster evaluation, was co-authored with Evert Vedung, Professor Emeritus at Uppsala University, and Agnetha Nilsson of Region Värmland. Madeline Smith wrote the section on Scottish Enterprise, while Robin Teigland and Per Lundequist wrote the section on Uppsala Bio. The Värmland case in Chapter 7 was written by Hemming Lindell, Gullers Group Information Counselors, Anders Thorén, Thorén & Stenberg Kommunikation, and Staffan Bjurulf, Region Värmland and SLIM. I would also like to thank Werner Pamminger, Clusterland Upper Austria, Anne T. Ballantyne, NRC Canada, David Pawera, the Regional Development Agency Ostrava, and Knut Senneseth of Innovation Norway for sharing their experiences and views on cluster program evaluation.

I am indebted to Henrik Glimstedt at SSE, with whom I have had many constructive discussions over the years on how constructive forces shape society. This study would not have been completed without extraordinary support from Marie Tsujita Stephenson, Administrator for the Center for Strategy and Competitiveness (CSC) at SSE.

Finally, I would like to thank my family – Ingela, Frida and Christian – to whom this book is dedicated – for all support I have received when not working on the book.

I am thankful for financial support from the Stockholm School of Economics Center for Strategy and Competitiveness, the European Commission – DG Enterprise and Industry, and Region Värmland, one of the new constructive actors on the cluster scene.

Stockholm, January 2009

A handwritten signature in black ink, appearing to be 'J. S. Johansson', written in a cursive style.

Introduction

It all began as an academic exercise. In the mid-1980s, Professor Michael Porter at the Harvard Business School was contemplating why some firms – especially those based in particular nations, regions or business environments – were able to achieve globally leading positions, while firms in other environments developed less sophisticated and innovative strategies. Even for firms based in regions with similar levels of prosperity, the differences in success, in terms of industries and market segments, were striking. If firms differed in their ability to innovate and upgrade, the differences between regions were similarly as striking.

Some world-renowned clusters are obvious and widely recognized: film in Hollywood and Bollywood, wine in the Barossa Valley, IT and the Internet in the Silicon Valley, biotech in Boston, optical equipment and cars in Kanto and Kansai, Japan, financial services in Manhattan's Wall Street and inner London, automotive production in southern Germany, watches in Switzerland, and mobile communication in Stockholm. But, as Professor Porter and other scholars, particularly those within the field of Economic Geography, had shown earlier, the phenomena of clustering, industrial concentration and regional specialization were readily identifiable across the globe. Furthermore, clusters could be identified across industries: in high-tech fields and more traditional industries, in handicraft industries, in manufacturing as well as services, and in small- and large-firm dominated clusters. In short, local clusters with a global reach were easily identifiable throughout a range of industries.

Professor Porter had decided to spend his sabbatical in 1986 travelling the world in order to better understand who the winners were in global competition. After being appointed to the President's Commission on Industrial Competitiveness by President Reagan in the mid-1980s, Porter began paying closer attention to competitiveness, the impact global competition exerted on the U.S. economy, and the role of government. His travels took him to Japan, Singapore, Italy, Sweden, Denmark, Germany and other far-flung destinations. Porter was accompanied by one of his graduate students, Michael Enright, who would later become a leading scholar on clusters and competitiveness.

Eventually, a team of more than 30 researchers from ten nations were assembled, and in August 1987 Professor Porter invited the group to HBS for a “Seminar on the Competitiveness of Nations”. A draft version of the “Diamond” model was taking shape. Three years later, the “big black book” – *The Competitive Advantage of Nations* – was published. Porter also used the book as the basis for a popular video set on competitiveness that covered a number of cases from around the world. A series of nationally focused books was later released, with topics including Sweden, Denmark, New Zealand, Canada and Japan.

Throughout the course of the project, Porter had tried to capture and explain the microeconomic fundamentals that drive firms in particular locations to innovate and develop more sophisticated strategies. The phenomena he had observed stood in sharp contrast to the models portrayed in the classical competitiveness literature, in which competitiveness was regarded as a result of cost advantages such as low labor costs and aided by recurrent devaluations in many nations. Porter also turned away from other popular explanations of national success in particular industries, including aggressive industrial policy and cultural characteristics of management systems, such as “Japanese management”. Instead, he devised the diamond model, which identified four core drivers of competitive advantage. In this approach, competitiveness is seen as a function of specialized and advanced factors of production, sophisticated demand, intense rivalry and varied strategies among firms, and finally, the existence of supplying and related industries, i.e. clusters. In addition, Porter contended that external exigencies (war, natural catastrophes, and disruptive technological shifts) and government policy also played a role in the diamond model of competitiveness, impacting each of the four corners of the model in various, and often unforeseeable, ways.

The title of the book implied that the unit of analysis was the nation. However, this turned out to be misleading. In fact, the whole point of the book was to show that no single nation is or can be competitive in everything. Instead, every nation has a range of competitive and uncompetitive industries, in line with what classical trade theory would predict. With the Japanese onslaught that was prevalent at the time, it was important to show that Japanese competitiveness was geared towards certain industries, or clusters, around consumer electronics, automobiles, computers, cameras, and the like, whereas Japan was uncompetitive in chemicals, aerospace, processed food, software and most services. But Porter pointed out not only differences in success in particular industries, but also the fact that competitiveness emanated from particular localities within nations. The power of the diamond model was enhanced by geographical proximity, and thus, in addition to firms, clusters were thrust onto center stage.

As we understand clusters today, they can be described along four key dimensions: type of agglomeration, level of dynamism, stage in the life cycle, and level of political involvement. Let us now consider these four dimensions in greater detail.

Four Perspectives on Clusters

Interestingly enough, the diamond model as such did not make a big imprint on the research community, or the policy community for that matter. However, the concept of clusters did. In addition to the focus on local rivalry, the cluster box of the model was the real novelty, or rather, a rejuvenation of old knowledge that had first been enunciated by the renowned economist Alfred Marshall in the late 19th century. The cluster was composed of private firms, constituting the value system of buyers and suppliers, and also included firms in related technologies that shared certain factor or product markets. As the cluster model took hold, it was enlarged and expanded upon by different scholars to include other agents, such as universities, public agencies and public-private organizations. These variables would later come to be termed Institutions for Collaboration (IFCs) by Professor Porter and Professor Willis Emmons. Over time, as the cluster model gained more prevalence, it began to overlap with the diamond model, involving the qualities of the factor side, the demand side and firm strategies.

Clusters – One of Four Agglomerations

As noted above, economic activity tends to agglomerate in certain places at certain times. In order to separate out different types of agglomeration economies, one can make a simple classification scheme delineating efficiency advantages (largely economies of scale) versus innovation advantages of clusters on the one hand, and agglomeration in general versus agglomeration of technologically related actors on the other. This division leads to four main types of agglomerations (see Figure 1, taken from Malmberg, Sölvell, & Zander, 1996).

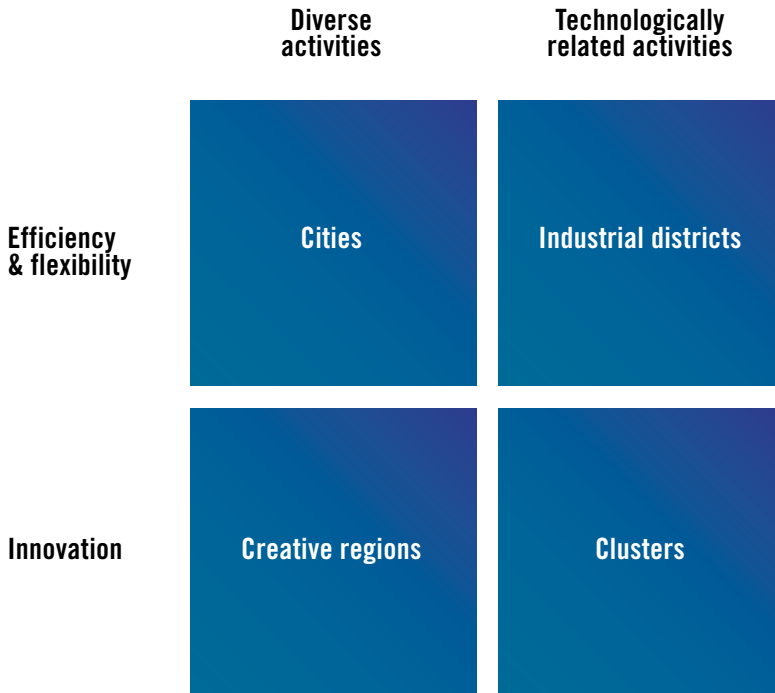


Figure 1. Four Types of Agglomerations

The first type of agglomeration relates to general economies of regional and urban concentration that apply to all firms and industries in a single location (so-called urbanization economies), emanating from lowered transportation costs and the efficiency of large-scale operations of the agglomeration as a whole. These are the forces that lead to the emergence of larger manufacturing belts and metropolitan regions. City agglomerations attract a wide range of economic activity. More important cities, particularly capital cities, represent political power and markets for public projects, and are therefore attractive targets for headquarter functions of large corporations.

A second agglomeration type involves economies that relate to firms engaged in similar or linked business activities, leading to the emergence of industrial districts. Such districts constitute a base for flexible production systems that can meet the demands of volatile markets (Piore & Sabel, 1984). In both cases, agglomeration economies have their roots in processes whereby linkages among firms, institutions and infrastructures within a geographic area give rise to economies of scale and scope; the development of general labor markets and pools of specialized skills;

enhanced interaction between local suppliers and customers; shared infrastructure; and other localized externalities. Agglomeration economies are believed to arise when such links either lower the costs or increase the revenues (or both) of the firms taking part in the local exchange. Presence in an agglomeration is, in other words, believed to improve performance by reducing the costs of transactions for both tangibles and intangibles. In Scott's view (Scott, 1983, 1988), the formation of agglomerations will be particularly intense where linkages and flows tend to be small-scale, unstable and unpredictable, and hence subject to high transaction costs. On the other hand, large-scale and more predictable and standardized flows, such as raw materials, components, products, or blueprints, are perfectly handled by global markets.

In addition to these two types of agglomerations, which can be explained mostly by efficiency gains and flexibility, one can distinguish two other types of agglomerations that can be explained as centers of knowledge creation and innovation. In the academic literature, there is a debate about whether specialized regions with clusters (as modeled by Marshall, Arrow, Romer and Porter) perform better, or whether diverse city-regions, offering a multitude of skills, technologies, political and academic institutions, cultural inspiration and so forth (as modeled by Jacobs) are more conducive to innovation and upgrading. We hold that these models are not mutually exclusive, but rather are complementary to one another (Lindqvist, Protsiv and Sölvell, 2008).

The first type we refer to as clusters, where sustained competitiveness is based on capabilities that are linked to a particular location (Porter, 1990; 1998). Clusters are not seen as fixed flows of goods and services, but rather as dynamic arrangements based on knowledge creation, increasing returns (Krugman, 1991) and innovation in a broad sense. In line with this view, more recent research approaches have come to focus on the importance of innovation as a means of trying to explain the emergence and sustainability of agglomerations. Thus, clusters are made up not only of physical flows of inputs and outputs, but also include the intense exchange of business information, know-how, and technological expertise, both in traded and un-traded forms. Such technological spillovers were actually at the core of Marshall's analysis in the early 20th century, but had been mostly forgotten until Paul Krugman and Michael Porter brought them back to central stage in the early 1990s. Several studies have confirmed knowledge externalities in clusters (Audretsch & Feldman, 1996, Jaffe, Trajtenberg, & Henderson, 1993). Many types of firms and organizations constitute the set of actors on the "cluster stage". Here we have identified six main types: firms, financial actors, public actors, universities, organizations for collaboration and media (see Figure 2).

The last type of agglomeration relates to knowledge creation and creativity in a region without any sectoral boundaries. While Porter’s main concern has been the existence and reproduction of clusters of technologically related firms, there are corresponding attempts to analyze the learning abilities and creativity of regional and urban agglomerations of the general type. Instead of specialization and spatial clustering of related industries, emphasis is placed upon the presence of a regional variety of skills and competencies, where the often-unplanned interaction among different actors can lead to new and sometimes unexpected ideas and creative designs, products, services and business concepts (Florida, 2002; Johannisson, 1987; Andersson, 1985).

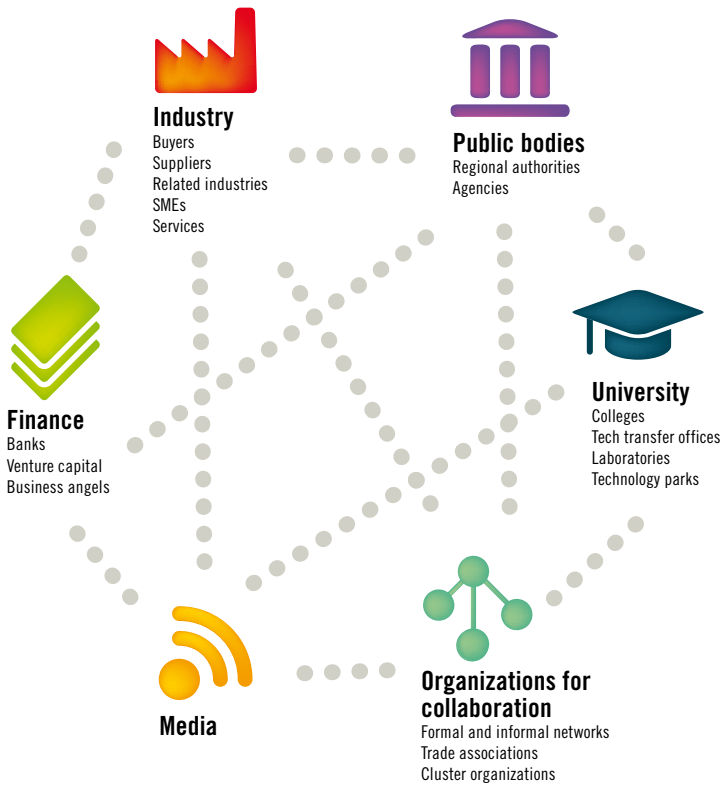


Figure 2. Actors on the Cluster Stage

THE ACTORS ON THE CLUSTER STAGE

- 1 Upstream and downstream firms involving both large firms and SMEs. Private industry includes competitors, suppliers of goods (e.g. machinery and input components) and services (e.g. consulting, legal and business services), buyers, and firms in related technologies sharing common factors, such as labor skills or technologies.
- 2 Financial institutions, involving traditional banks, commercial banks, venture capital, private equity and angel networks.
- 3 Public actors including:
 - National ministries and agencies involved in: industry and economic development policy (SME, entrepreneurship, networking, cluster, and investment attraction), regional policy (e.g. readjustment funds, infrastructure, and cluster programs), science and technology policy (innovation, incubator, university-industry cooperation and technology transfer, and technology cluster).
 - Regional agencies and regional units of national bodies (e.g. county administrative boards), and regional public bodies based on federative initiatives from local communities.
 - Local communities.
- 4 Academic actors including universities and colleges, research institutes, technology transfer offices and science parks.
- 5 Private and public-private organizations for collaboration (NGOs, chambers of commerce, formal networks, cluster organizations, etc.).
- 6 Media of different kinds creating “stories” around the cluster and building a regional brand.

Looking out over the economic landscape, we find firms and organizations being located in, or relocated to, places that are characterized by everything from large agglomerations, such as Silicon Valley, to almost total isolation. Some clusters are part of larger urban agglomerations, whereas others are more rural. A firm to the left on the scale in Figure 3 is isolated in a cluster sense, lacking close rivals or firms in technologically related industries, including suppliers and buyers in the vicinity. However, the firm can still be located in an urban location, surrounded by other diverse actors.

The left-hand side is in line with the Soviet-style planning model built on highly fragmented value chains, or the Swedish model of “bruk”, i.e. one-company towns in traditional industries such as paper and steel. These firms were often large and efficient in terms of economies of scale at the plant level. On the other hand, they

were not surrounded by a multitude of related firms and industries, and entrepreneurship and new firm formation were unknown phenomena in these towns.

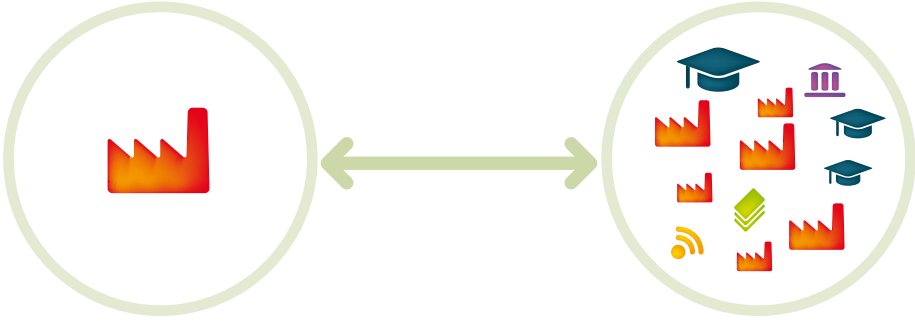


Figure 3. Degree of Cluster Agglomeration

Cluster Dynamics and Competitiveness

The second dimension of clusters involves the level of dynamism and amount and quality of linkages between cluster actors, and external linkages to international markets. Some agglomerations are more on the static side, i.e., the “Silicon Glens” as opposed to the “Silicon Valleys”. Variables such as level of networking, factor mobility and general dynamism differ enormously across clusters. Similarly, the level of sophistication differs between clusters, with some being focused on the production of low-cost goods (such as the automotive cluster in Dogu Marmara, Turkey), while others offer highly differentiated products (such as the automotive clusters in southern Germany), including R&D, design, branding and other strategic functions. If the quality of resources differs within a region, so too does the flexibility with which the pieces can be assembled and reassembled. As with a Chinese puzzle, the shape of each blue component plays a role, but it is also important to pay attention to the ways in which the pieces fit together, and how they can be constantly rearranged to improve the productivity of available resources.



Figure 4. Clusters Facilitate Reshuffling of Resources

Dynamic clusters create the foundation for sophisticated strategies and act as a driving force behind upgrading and innovation among incumbent firms. In summary:

- Firms in dynamic clusters develop strategies and routines across the value chain, engendering new capabilities in a process of prestigious backyard *rivalry*.
- Firms in clusters tend to share many activities through *cooperation*, e.g., swapping technology, components or products. Clusters facilitate both horizontal and vertical (buyer-supplier) cooperation within a setting of a “common language”, trust and high social capital.
- Firms in rich clusters can operate more *efficiently*, drawing on specialized assets, suppliers, and buyers with short lead times. Critical resources and capabilities often do not exist within the firm but are accessible through networks inside the cluster.
- Firms in clusters can achieve higher levels of *knowledge creation* and *innovation*. Knowledge *spillovers* and close day-to-day interaction between buyers, suppliers and organizations lead to incremental improvements, which are in turn the foundation of both technical (product and process improvements) and non-technical (business model improvements) Innovations. Furthermore, both types of innovations tend to diffuse quickly within clusters.
- Clusters offer an environment where different resources (individuals, technologies, capital, etc.) can quickly be reshuffled and *restructured* (spin-offs, labor mobility transferring skills across organizations, etc.), allowing for new and better economic combinations of skills, capital and technology. The need for changing the strategy or “recipe” of the firm can quickly be accommodated within a cluster.

- The rate of new *business formation* tends to be higher in dynamic clusters. Start-ups are reliant on close interaction with suppliers and buyers. The cost of failure is typically lower within a cluster where many alternative opportunities exist.
- Clusters in many cases offer *lead markets* where sophisticated buyers encourage and cultivate technology development and innovation in close interaction with suppliers.

The outcomes of firms, as manifested in the output of goods and services, will vary from cluster to cluster. To be certain, cars from Japan will compete in the global marketplace with cars from Germany or the U.S., and increasingly, Japanese-built cars in the U.S. will compete with U.S. cars built in Mexico. But global markets are one thing and local clusters quite another. Cars from one cluster will “taste” and “smell” differently than cars that hail from another. They will cater to different consumer tastes; they will exhibit differences in cost levels, quality, features, energy efficiency and so on. Let us consider a historic example. The most sophisticated products of the East German automotive cluster were the Trabant and the somewhat larger Wartburg car, whereas West Germany turned out VWs, Audis, BMWs, Mercedes, Porsches and other cars. Interestingly enough, before the country was divided by war, Audi and Trabant were one company, Auto-union, that was the result of a 1930s merger of four German brands. In the course of fewer than five decades, one company divided into two, could, just as two twins brought up in different neighborhoods, develop into two vastly different car manufacturers. The differences in the microeconomic business environments and cluster dynamics were staggering, and as such, so were the products that they produced.

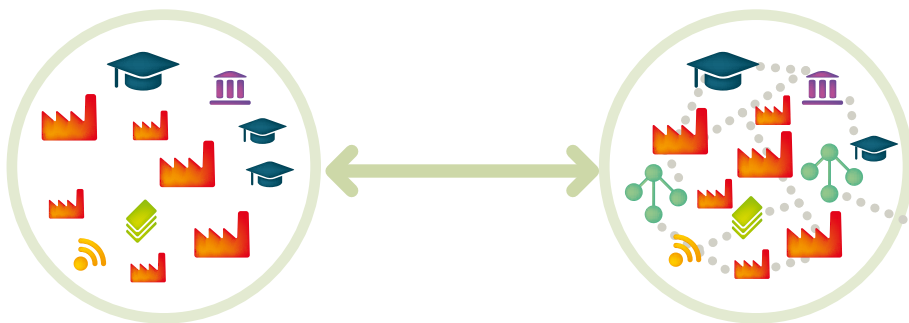


Figure 5. Degree of Cluster Dynamics

Clusters tend to oscillate on the scale in Figure 5. Some clusters continue as static agglomerations for long periods, whereas others increase in dynamism. Again, other clusters have experienced the conditions represented on the right side of the scale, but have lost touch due to external shocks or lock-in effects. Internal constraints that can kill cluster dynamics include (adopted from Hannan and Freeman, 1984):

- Investments in plants, equipment and specialized labor and infrastructure that reduces flexibility.
- Limitations on information received by decision makers and increased ethnocentrism (and the NIH syndrome), leading eventually to a dead end.
- History and culture leading to political constraints.
- Evolution of rigid institutions (legal barriers and self-restraint based on norms) hindering a change in technology or strategy.
- Legitimacy considerations reducing room for action and unconventional strategies.

External constraints typically emerge from technological shifts emanating outside the cluster, or from actions of war or other exogenous shocks. In the next section, we will discuss the ups and downs in the life cycles of clusters.

Cluster Life Cycles

The third dimension of clusters involves the maturity of the cluster. Clusters follow life cycles. Typical seeds of clusters include natural advantages (such as ore deposits, transportation routes, climate, etc.), or some particular demand or skill within the region (Porter, 1998). Hollywood grew up around sunny beaches that were perfect for shooting silent movies; the wine industry in Bordeaux, France was based on a particular *terroir*, the silk industry in western Japan depended on a consistent and moist climate, and the Swedish paper industry in Värmland was predicated upon its ready access to timber, energy and efficient transportation on rivers. Another typical cluster seed is an entrepreneur who starts a particular industrial activity in a particular location. If the new venture is successful, with factor advantages supporting the business idea, a cluster can begin to grow and prosper. In Chapter 3, we present such a case of an emerging cluster, combining factor advantages with early entrepreneurship.

Some emerging clusters will ultimately take off and grow, whereas others will remain small or disappear. Growing clusters will enter into a process of international competition in both factor markets (attractiveness on new companies, people and capital) and final goods markets. The more successful clusters are built on a

combination of superior internal dynamics, including rivalry and intensive new-firm formation, and superior attraction on resources from the outside. Over time, the cluster will move through different phases. The early period is often identified with one or a few people, termed the “heroes” of the cluster. If the entrepreneur is successful, others will soon follow suit and enter the business. With a growing business, there is room for the subsequent entry of both upstream and downstream industries. Soon, an identifiable cluster begins to emerge. As the cluster matures, certain strategies will tend to dominate, and economies of scale will play an increasing role (in line with product life cycles and dominant designs; see Utterback, 1974 on this point). Ultimately, some clusters go into decline, finally reaching the “museum” stage; alternately, they jump onto a new cycle and experience a renaissance based on new technologies and new firms (see Figure 6). For a deeper discussion of cluster life cycles, please refer to Chapter 4.

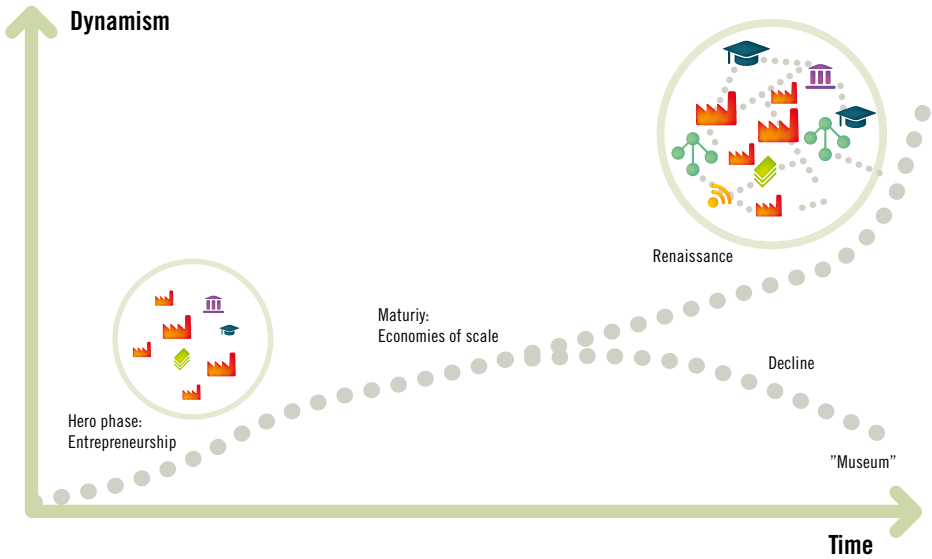


Figure 6. The Cluster Life Cycle

Clusters and the Visible Hand

The fourth dimension of clusters involves the level of planning and policy involvement. Many leading clusters were not “planned” in the way we typically interpret the word. In other cases, there has been more of a clear “game-plan” deliberately

created by national or regional governments. In Dubai, Saudi Arabia, Korea, China, and other parts of the Middle East and Asia we can witness very visible government hands at work in cluster development, whereas in the Anglo-Saxon world it tends to be more invisible, at least as a direct cluster policy or program. However, in recent years, Europe has adopted a more direct approach to the planning and execution of cluster programs and initiatives. A study in early 2008 reported that almost all EU nations had at least one cluster program in place (Furre, 2008). Even in the U.S., cluster programs have begun to emerge as part of local and regional economic development policies. Although cluster policy is not yet a part of U.S. federal policy, some states are now heavily involved in cluster building. Examples include programs and initiatives in Texas, Maine and Connecticut, all of which have relied heavily on the works of Michael Porter.

As Professor Porter’s cluster model began to be “adopted” by policymakers and civil servants all around the world, it typically shifted from a focus on competition to one of cooperation. It also shifted from a model that sought to understand how market forces lead to clusters, to one of planning and constructing clusters. As we shall discuss in this report, there are valid reasons to combine these views. Clusters are “constructed” in one sense, even if there is not one central “manager” guiding the process. Policies impact firms and regions in many ways. Industrial policy, innovation policy, science policy, regional policy, and now even cluster policy are all crucial parts of the business environments that impact firms all around the world. Some policies help by fostering a more innovation-driven business environment, while other policies and regulations serve to hinder innovation and upgrading. Policies do play important roles, but not necessarily constructive ones (see Part II of the book).

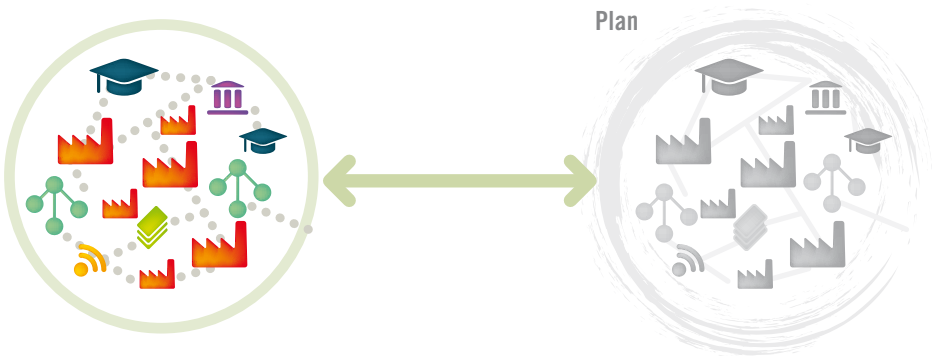


Figure 7. Degree of Cluster Construction

Many cluster initiatives emanate top-down from national governments, such as the Vinnväxt program in Sweden and the “pôles de compétitivité” in France. The Swedish program invited competitive bids from the local level (private-public-academic partnerships), while the French program, which also invited competition, was based more upon political choice by the government. We also see bottom-up cases where firms, academic institutions and public actors at the local scale come together to form cluster initiatives without direct governmental support. Over time, surviving cluster initiatives tend to move from a project status to highly organized ventures, including several areas of activity.

CLUSTER INITIATIVES

Cluster initiatives (CI) are organized efforts to enhance the competitiveness of a cluster, involving private industry, public authorities and/or academic institutions (Sölvell, Lindqvist and Ketels, 2003). A cluster initiative (CI) involves:

1. different *member* firms and organizations (three main types of actors: private, public and academic)
2. often a cluster *organization* (CO) with an office, cluster facilitator/manager, website etc.
3. *governance* of the initiative (e.g., constellation of CO board)
4. *financing* of the initiative (international/national/regional/local public funding, member fees, consulting, etc.)

Clusters – Evolutionary and Constructive Forces

Clusters function as part of the microeconomic business environment of a region. Clusters are shaped by certain, almost deterministic forces (see blue arrow in Figure 8) related to the overall history and culture of a region, the geographical circumstances (access to waterways, how affluent neighbors are, etc.), general institutions and regulations, and the overall macroeconomic environment. All clusters within a nation are affected by things such as the exchange rate, political bent of the government, and historical and geographical circumstances of the nation or region.

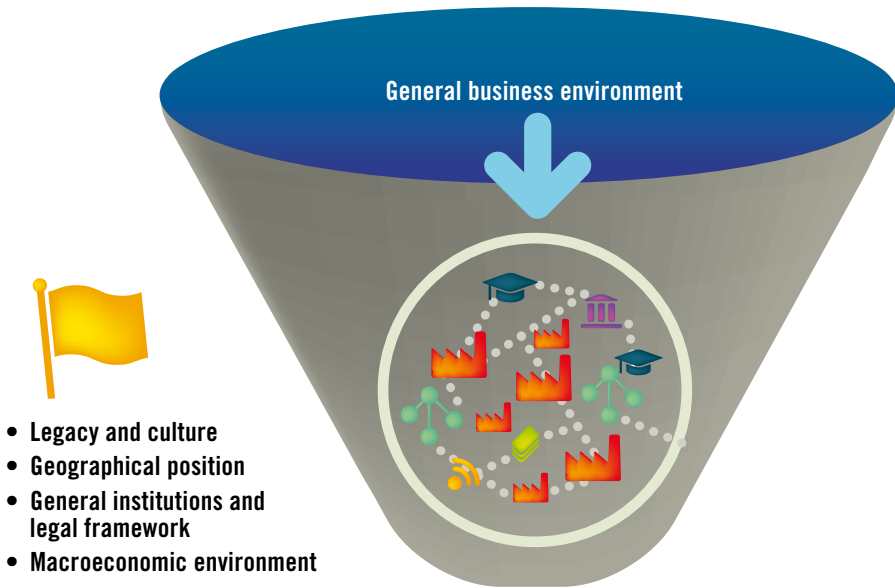


Figure 8. The Funnel Model – The General Business Environment in a Nation

If we take the analysis of the funnel one step further, one must distinguish between different clusters within a nation or region. Thus, within the same national or regional context, we have a scale of clusters ranging from highly dynamic and competitive to static and uncompetitive. In line with this, we expect to see more competitive firms on the right-hand side and less competitive firms on the left-hand side of the scale in Figure 9.

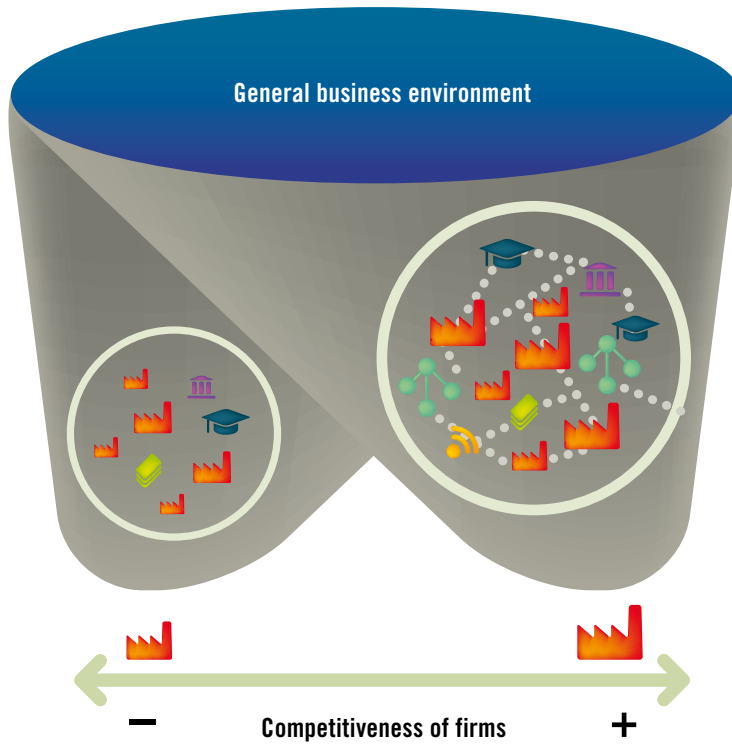


Figure 9. The Funnel Model: Cluster Dynamism and Firm Competitiveness

Clusters are also shaped bottom-up by forces such as entrepreneurial action and firms that are implementing new strategies and business models. Such activities are not coordinated, but function as part of the normal market mechanism – the invisible hand at work. However, as a result of these actions, the larger cluster environment will either develop or decline. Decisions to invest and enhance innovation build the cluster, whereas decisions to leave the region will push the cluster towards decline, causing resources to flow to other areas of the economy or to become idle. Through entrepreneurship and innovative strategies clusters will be shaped over the longer term (see blue arrow in Figure 10).

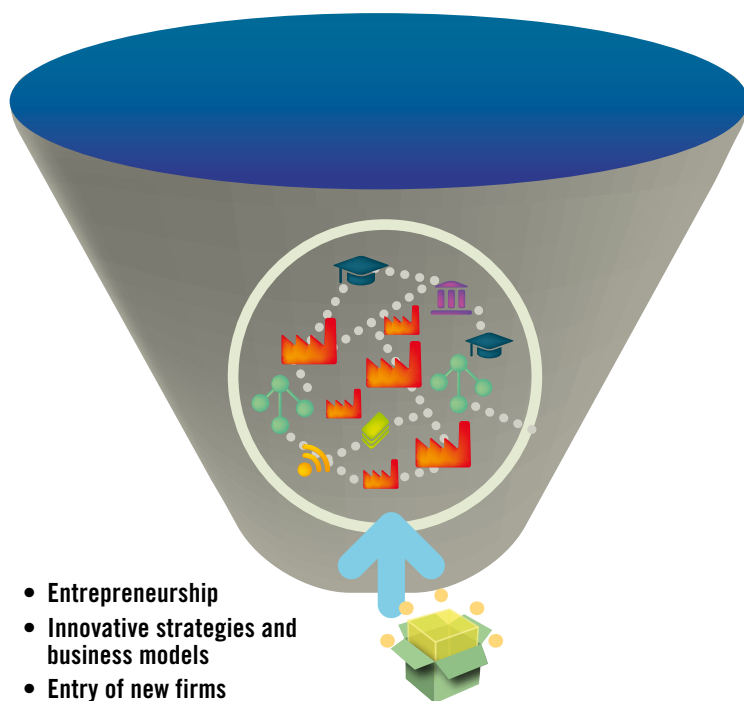


Figure 10. The Funnel Model: Entrepreneurship and New Strategies

Thus, the evolution of clusters emanates from both deterministic forces (top blue arrow) and voluntaristic forces (bottom blue arrow). In addition to this, we have the constructive forces that will impact the development and competitiveness of the cluster positively or negatively. One type of constructive forces emanates from policies that are geared towards improving the microeconomic business environment of a region. This category includes both general policies for clusters and targeted cluster policies. Other constructive forces emanate from initiatives by actors within the cluster, including leaders from private industry, organizations and academia (see Figure 11). Local leaders that develop and implement cluster initiatives take on a constructive role to improve the workings of the cluster or the larger regional environment. Typical objectives of such initiatives include upgrading human resources, the expansion of the cluster, stimulating new firm formation and attracting new firms to the cluster, business development, and commercial collaboration such as joint export initiatives or coordinated purchasing to increase purchasing power. Other objectives include upgrading of technology and improving the overall business environment by initiating dialogue on new regulations and upgrading the infrastructure.

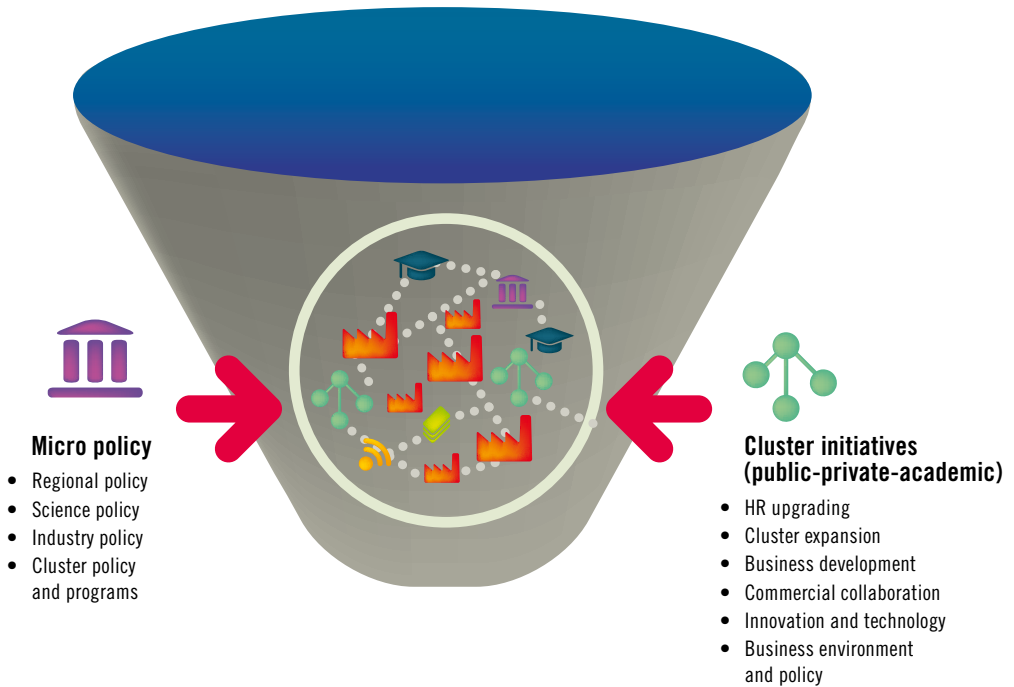


Figure 11. The Funnel Model: Constructive Forces Shaping the Cluster

Combining these two sets of forces, both evolutionary and constructive, we can gain a better understanding of how clusters develop, as well as understanding whether clusters will increase in dynamism and size, or if they will go into decline (see Figure 12).

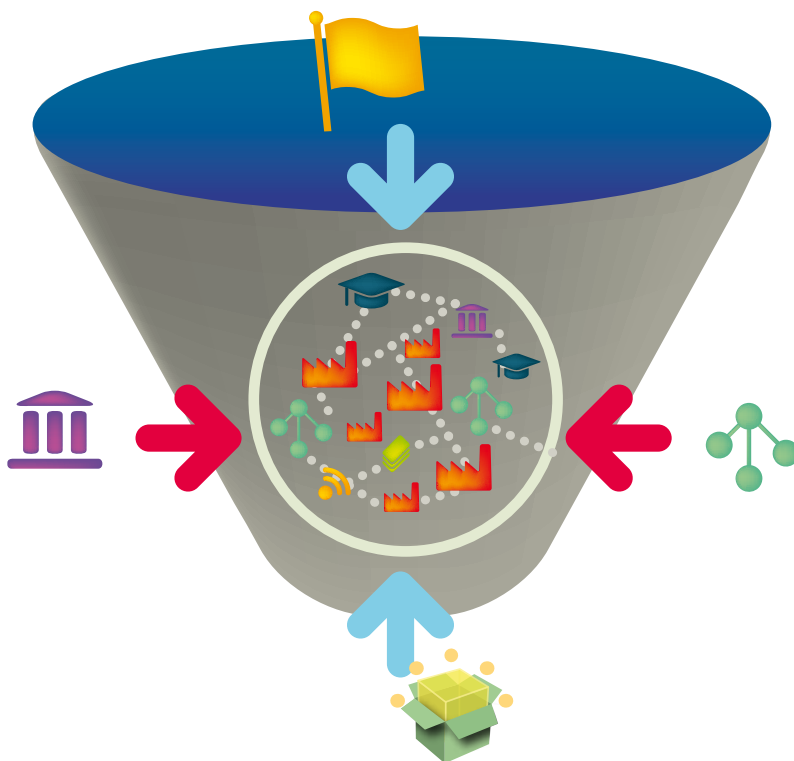


Figure 12. Clusters – Where Evolutionary and Constructive Forces Meet

We know from our research that cluster dynamics is a highly complex process, and is best understood as a combination of evolutionary and constructive forces. However, constructors must be aware that the evolutionary forces are strong, and political vision can easily remain mired in the conceptual stage. As constructors roll up their sleeves, it is important to adopt an outlook of clear-eyed humility.

Part I of the book covers the evolutionary forces and presents a case of an emerging cluster over three decades, focusing on winter car testing in North Sweden (Chapter 3). The cluster life cycle is presented in more detail in Chapter 4. Part II of the book covers the constructive and reconstructive side, including chapters on cluster policy, programs and initiatives (Chapter 5), cluster evaluation (Chapter 6), and a case of cluster reconstruction in Värmland, North-mid Sweden (Chapter 7). The last chapter ends the discussion with some concluding thoughts on the future agenda for cluster practitioners and policymakers who are seeking to construct and reconstruct clusters.

Part I

EVOLUTION

In this first part of the book, we turn to the overarching question of why clusters matter, delineating the evolutionary forces that impact clusters and the stages in the cluster life cycle. To add dimension to the story, we also present a case from Sweden that shows how one cluster evolved without much policy or planning. A combination of factor advantages, basic infrastructure, and entrepreneurship created the foundation for an emerging cluster. Ultimately, it would take about three decades for the winter car testing cluster in North Sweden to emerge and become firmly established. Beginning with one entrepreneur who planed the ice on a frozen lake outside the small town of Arjeplog, the cluster today involves several competing test providers, specialized skills and infrastructure, and local establishments of leading international component and car manufacturers.

Why Clusters Matter

The fact that economic activity tends to cluster in particular locations is driven by efficiency advantages (lowered costs, including transaction costs), flexibility advantages (high mobility of labor and other resources) and innovation advantages (knowledge spillovers and cooperation). The role of clusters in explaining regional economic performance has been confirmed in several studies (Porter, 2003). From our own European data, we can show that economic prosperity among the regions of Europe is related to the degree of cluster strength (the X-axis representing the share of employees in clusters with a location quotient larger than 2); see Figure 13 for an illustration of this point.



Figure 13. Cluster Strength and Prosperity in Europe

Today, there is substantial evidence that suggests that innovation and economic growth is heavily geographically concentrated. Clusters provide an environment that is conducive to innovation and knowledge creation. Regions with strong cluster portfolios are innovative leaders, while regions with no clusters or isolated research facilities fall behind. Globalization has increased the benefits of strong clusters and raised the costs for regions which fail to develop some level of clustering. Strong clusters emerge in open markets where intense rivalry and cooperation within and between clusters coexist. Clusters emerge where competition across regions enables companies, entrepreneurs and financial actors to choose a location based on the attractiveness of regions, rather than in response to artificial barriers. Globalization has increased the need to combine strong internal dynamics within clusters with solid linkages to clusters and markets located elsewhere.

Regional specialization also brings risks, rendering regions more vulnerable to cluster-specific demand shocks or fundamental technological shifts. The emerging evidence suggests, however, that a cluster-based regional economy still generates better outcomes. First, the economic costs of lower productivity due to lack of specialization have dramatically increased with globally integrated markets. Second, dynamic clusters that are open to outside trends are better equipped to deal with external shocks, for example, by transferring existing skills into new market areas. And third, our research indicates that the most successful regions tend to have a portfolio of clusters that are related through linkages and overlaps and that ease the trade-offs between specialization and diversification.

Clusters and Innovation

Innovation performance tends to be highly skewed across regions, both within and across nations. A large number of empirical studies on regions and innovative performance have been published in the last decade (see Crescenzi, Rodríguez-Pose, & Storper, 2007, for an excellent overview). Using data from the European Cluster Observatory (www.clusterobservatory.eu), we can conclude that there is an important relationship between regional specialization (degree of clustering) and innovative performance (measured as patenting levels). Regions in Europe without clusters (i.e., with employment evenly spread out across sectors) are all performing poorly (as represented by dots to the left in Figure 14). On the other hand, regions in Europe with many ranked clusters are all top performers (to the right in Figure 14). In the group of regions that have a few ranked clusters each, some are performing well and other less well. Again, this finding underlines that the economic performance of a region is explained not only by the degree of cluster strength, but also by other aspects of the broader

business environment, such as labor quality, research and education, as well as access to venture capital and advanced infrastructure, i.e., the microeconomic framework conditions.

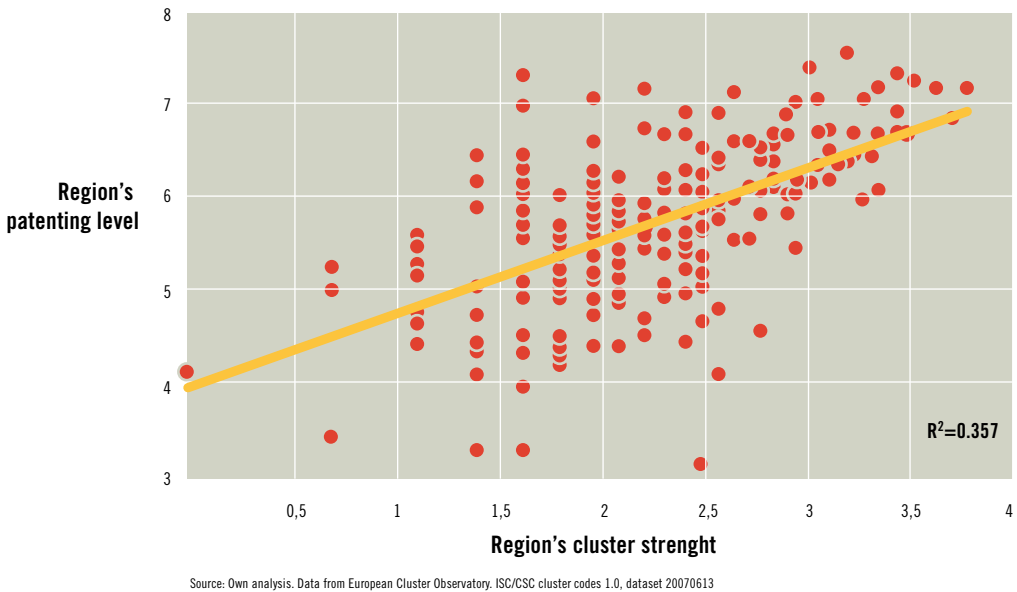


Figure 14. Cluster Strength and Patenting Performance in European Regions

Regions with clusters also perform better in terms of innovation performance. A competing, but more often complementary, explanation to regional success is the degree of urbanization, as metropolises offer diverse and creative environments, as well as proximity to a greater number of academic institutions. Our research on European data shows that both urbanization and regional specialization, i.e. clustering, bring economic prosperity to regions, but in different ways. Urbanization has a direct effect on regional performance, whereas clusters work through the process of engendering more innovative environments, which in turn leads to greater economic prosperity (Lindqvist, Protsiv and Sölvell, 2008). A second main conclusion from our research is that urbanization is positively associated with economic performance as expected, but unlike with clusters, it has no direct effect on innovative output (as measured by patenting). In Europe, it seems as if urbanization has an effect on innovation mainly indirectly, through the ability of university R&D to promote

business R&D. On the other hand, more public R&D does not in itself lead to increased patenting activity. Again, the role of clusters and business R&D is significant (see Figure 15).

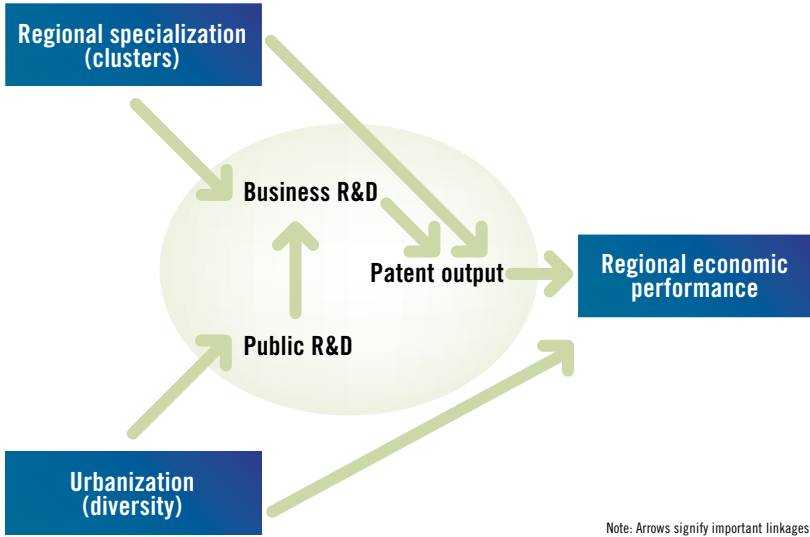


Figure 15. Model Explaining Regional Economic Performance

So what are the mechanisms behind this? Why do we see a greater degree of innovation emerging inside clusters? As we know from the writings of Rosenberg (1976; 1992), the economic effects of technological breakthroughs are not really about the sophistication of a technology itself, but instead are connected to the degree to which the technology is commercialized and diffused into society. In instances that involve an actual technological invention, incremental innovation and the adjustment of the business model and financial construction often become more important than the invention itself. This is precisely where clusters enter into the picture. Clusters offer an advantageous atmosphere in which frequent, day-to-day and face-to-face interactions can transpire, and where ideas, concepts and beta versions are tried over and over again, within a particular institutional setting, amongst personal networks and on a foundation of shared trust that has been built up over time (Malmberg, Sölvell, & Zander, 1996).

Localized innovation and knowledge creation is built on the interaction of several technologically related actors on the cluster scene (buyer-supplier, industry-university, etc.). We can identify four main interrelated characteristics, all of which are particularly important for understanding innovation processes within clusters.

- Innovation is based on a process of incremental reduction of technical and economic uncertainty (Freeman, 1982; 1991), where new technologies typically undergo a number of modifications and business models are adjusted accordingly. New particular knowledge and skills develop over time. This often takes place in a process of Rosenbergian learning (Rosenberg, 1982), where unplanned problems are solved in unplanned meetings, using technology in unplanned ways. Proximity favors such a complex and evolutionary process. Tacit knowledge cannot reside in blueprints and formulae, but rather, is based on personal skills and operational procedures that do not lend themselves to be presented and defined in either language or writing and therefore adds to “stickiness.”
- Innovation is based on a process of continuous interaction across organizations, building thick ties, specialized language, and social capital within the region. This process of exchange and creation of new knowledge is enhanced by face-to-face contacts. Frequent interaction between buyers and suppliers and the role of users has been emphasized by von Hippel (1998) and Lundvall (1992). These exchanges frequently involve sensitive information, and therefore require a high level of trust between the parties.
- Certain innovations are partly the outcome of a process of transferring technology and tacit skills through university education, apprenticeship training, specialized technology transfer offices and incubators, and regional public-private organizations that focus on networking and commercializing new discoveries. Important linkages between the scientific community and firms engaged in innovation have been illustrated in several studies (Freeman, 1982). Again, proximity favors such transfers and co-learning, as research, technology and innovation are all involved simultaneously, rather than sequentially.
- Innovation is enhanced in environments where different resources can constantly be rearranged at low cost, through mobility of skilled personnel, IPOs and other financial restructuring by VC firms, private equity and angels, licensing and the like. Various forms of product and technology sharing or sourcing also facilitate reshuffling of critical resources. Many inventions and

innovations do not find use where they first emerge, but only after migration will they find the right soil, a process that is highly influenced by information distance and density of networks. Clusters favor mobility of “small streams”, with high transaction costs, while “large flows” of standardized information, materials, components and products are traded globally (Scott, 1998).

All of this can potentially take place at a global scale, but for reasons of efficiency, flexibility and openness, built on trust and social capital, these innovation processes seem overwhelmingly productive within proximate and networked environments (social capital), surrounded by a common set of institutions and particular historical and cultural norms. Linkages across organizational boundaries can, for example, include joint R&D projects, joint product development, or the sharing of technology through licensing (involving fees, patent transfers and so on). These ties can develop between similar types of organizations (firm-firm), or between different types of cluster actors (public research organization-firm, VC-firm, and so on). For example, the Boston-Cambridge biotech cluster is built on two quite separate networks of thick ties, one centered around Harvard-Brigham & Women’s Hospital-Genzyme, and the other centered around MIT-Mass General Hospital-Biogen (Powell, Owen-Smith, & Colyvas, 2007).

Face-to-face contacts appear to be of particular value for exchanging tacit knowledge, or when the exchange of knowledge involves the direct observation of products or production processes in use. Some studies indicate that informal and oral information sources provide most key communications about the market opportunities and technological possibilities that lead to innovation. According to Utterback (1974), the unanticipated, or unplanned, personal encounters often turn out to be most valuable. It is in this context that the cluster offers substantial advantages over dispersed configurations. The costs and time associated with repeated exchange of knowledge and information in the development work will be lowered if taking place in the local context.

Chapter 3

Cluster Evolution: Winter Car Testing in North Sweden

Imagine a small, isolated town in the north-western part of Sweden, where winters are freezing cold and most of the population of a few thousand people work for the sawmill, the local mine, or local public services agencies. This was Arjeplog three decades ago, a small town situated in Upper Norrland, the northernmost region in Sweden, and one of the most sparsely populated areas in Europe, with about 3 inhabitants per km². Today, Arjeplog is the global “hot spot” for winter car testing, where automotive manufacturers and component suppliers from all corners of the world meet to test new technologies and innovations under harsh climate conditions. Starting out as a peripheral business three decades ago, it is now the dominant cluster in the region.

During winter seasons, ridges of high pressure travel over northern Sweden from Russia. This has a greater effect on the temperature in the region than the Gulf Stream that moves along Norway’s coast to the west. The consequence is typically cold weather that lasts in the region for long periods of the year. Furthermore, the Polar Circle intersects Upper Norrland, making the seasonal shifts very distinct with cold, dark winters and summers with midnight sun. Yet another factor influencing the cold climate that defines Arjeplog is the area’s unique terrain. The valleys have microclimates of constant temperatures that are quite specific to the region. The coldest temperatures occur from December to March and can dip as low as minus 40 degrees Celsius.

A local entrepreneur named David Sundström ran a small transport business, using a hydroplane to shuttle tourists into the mountainous wilderness that covers the border between Sweden and Norway. During winter, Mr Sundström would carefully plane the ice on one of the local lakes in order to create his own landing strip. One winter day in the early 1970s, a couple of engineers from a German firm drove along the frozen lake and stopped to talk to David. They presented themselves and asked if they could borrow the landing strip to perform brake tests. Over the course of the next few weeks, the tests were performed and Mr Sundström earned the equivalent

of 1,500 euros. The next winter, the engineers from Germany returned. In due time, Arjeplog became established as the preferred site for winter car testing.

The infrastructure in the area was reasonably well developed. There were several airports in northern Sweden, with Arvidsjaur being the closest to Arjeplog. In the counties of Norrbotten and Västerbotten, there were more than 25,000 kilometers of public roads. All major roads were asphalted and in fairly good condition, and all of the main roads were ploughed and cleared on a regular basis during the wintertime. Arjeplog also boasts the largest area of water among all the municipalities of Sweden – 1,790 square kilometers distributed among some 8,000 lakes. The most longstanding occupations in the area were connected to reindeer herding, and industry had largely been limited to mining and forestry. For upper secondary education or university schooling, students had to move to the larger coastal cities along the Gulf of Bothnia.

The local community was tied together through a web of voluntary organizations such as educational associations, local associations of households, athletic associations and sewing circles. Historically, hunts were a common way of socializing, and there were several hunting parties based in Arjeplog. In total, there were about 80 non-profit associations that operated in the community.

During the 1980s and 1990s, Arjeplog was struggling. The town had experienced the shutdown of both the local sawmill and later, the mine. The population was declining as young people moved to the southern parts of Sweden in droves. However, by the end of the 1990s, a new industry based around winter car testing had begun to emerge. David Sundström had decided to set up a company to better serve his growing client base. Others soon followed suit, attending to other German car manufacturers. By 2000, Bosch, headquartered in Germany and one of Europe's largest and most important automotive component manufacturers, was considering expanding its business in the region and building its own winter testing facility.

Car Testing

Car manufacturers invest heavily in new models and product features in order to achieve and maintain competitive advantage. To ensure that every part of a new car model is working perfectly, extensive testing has to be performed. These tests can be conducted through simulations, but it is also often necessary to perform some tests under varying climatic conditions. To test under different conditions, car manufacturers typically managed a number of different testing facilities, some of which were located close to their plants, whereas others were located in remote regions typified by harsh climatic conditions. The tests were often performed in cooperation with local service providers. Typically, the local entrepreneurs owned

the garages, test facilities, etc., but by the 1990s, an increasing number of car and component manufacturers were investing in their own facilities. Some of the service providers offered individual services to their customers, whereas others focused on providing overall solutions, including accommodations, leisure activities, food, special requirements, rental cars, etc.

Many manufacturers ran two programs for summer and winter testing. The summer testing could be performed almost everywhere and was usually conducted in the home country of the car manufacturer, close to R&D centers. There were also special facilities located in places such as Nardo, Italy, where high-speed tests were performed. Barcelona, Spain, had also emerged as a preferred center for special summer testing. For winter testing, there were only a few sites in the world where it was possible to conduct sufficiently rigorous assessments: Sweden, Finland, Canada, Japan and New Zealand. American manufacturers typically tested in Canada, while European manufacturers preferred Finland and Sweden, and Asian manufacturers grouped in Japan. New Zealand was slightly different from the other locations, as its location in the Southern hemisphere meant that it experienced winter when the other countries were in the midst of their summer season.

The conditions in Sweden meant that it was possible to perform tests nearly 100 percent of the days that fell within the testing season. Car testing was centered in Arjeplog and Arvidsjaur in Norrbotten. The division of space on the lakes, where most of the actual testing was performed, was allocated in a series of agreements that were hammered out among the local service providers. Tests were scheduled carefully, so that they were not being performed at the same time. Since much of the testing was done on prototypes, secrecy was a key factor. Discretion was an important selling point in the region, and it was made known that paparazzi photographers were not welcome. A system had been developed in Arjeplog to deal with the problem; suspicious behavior was reported to the service providers, as well as to staff reporters at the *Arjeplog Times*.

The Hero Phase

The two friends David Sundström and Per-Axel Andersson ran various businesses in the Arjeplog area, ranging from shoe production, scooter production and the construction of apartment houses, to the management of a fishing and camping site and a hydroplane shuttle business. Sundström, the innovator of the two who was often described as a man who had a knack for recognizing opportunities, was driven by a constant urge to test new ground and push the envelope, as it were. At the outset of the 1970s, three engineers had been sent from Germany's Teldix (later Bosch) with the mission of finding a location for winter testing of new car

models and components. At the time, the three men were working together on a prototype for an anti-lock brake system. They had been to Kiruna, Jokkmokk and other locations in Upper Norrland before coming to Arjeplog. As mentioned earlier, Sundström and Andersson were then using the ice on Lake Hornavan as a landing strip. The Teldix engineers, Sundström and Andersson quickly established rapport and got along well, and soon it was agreed that the Germans could use the pair's runway to test the performance of their cars and components. The three engineers went out on the ice – each equipped with a broom – to clear the runway by hand, and so began Arjeplog's winter car testing industry. In the early years, Sundström and Andersson had their hands full with the hydroplane business and tourism, but they found time to assist the Germans with their expertise in ice planing and creating smooth, even testing strips on the ice when necessary.

With time, however, Sundström and Andersson began to realize the full potential of the business opportunities around the car testing industry. Soon afterwards, the two men changed their focus from merely being helpful and hospitable hosts to the engineers to providing a full suite of professional services. The two friends started a service providing company, Andersson & Sundström, which was later renamed Icemakers.

People in the community would sublet rooms in their own homes, and also provided private garage space for the engineers. The three engineers from Teldix later ended up at three different companies within the German automotive cluster: Opel, Bosch and BMW. Word spread quickly in Germany, France and across Europe about a new testing facility in the north of Sweden. The area had everything needed for winter test operations: a reliably cold climate, plentiful snow, and numerous frozen lakes. Furthermore, the infrastructure was sufficient to provide the potential for increasing the scale and scope of testing activities in the area. The first car manufacturers to arrive in Arjeplog were Porsche, Mercedes, and BMW. With the assistance of Andersson & Sundström, the component manufacturer Alfred Teves was soon established in adjacent Arvidsjaur, collaborating with a new service provider founded by some the friends of Sundström.

New Firm Formation and Transformation of Social Capital

During the 1980s, the automotive engineers asked for better garages and storage facilities, and their need for various complementary services increased. In order to meet this increased demand, Andersson & Sundström invested in machines to clear the ice of snow and learned how to scratch the ice, water the ice and take care of other requests from their customers. In this way, their testing business was taken to a new level, with more customized services delivered at higher standards

and with the use of new technologies. The service business developed from the rudimentary level of merely offering customized roads on the lakes, to later offering asphalted road-strips and artificial ice-roads on land. Bosch, which at the time was cooperating with Icemakers, invested in a parcel of new land tracks.

The demand for services grew so rapidly that Icemakers had trouble satisfying all their customers. Lars-Gunnar Gyllenberg recognized the business opportunity and joined forces with his friend Harald Fjellström. Fjellström owned land and Gyllenberg had good business connections in the area, as well as a broad network of international relationships from his earlier business experience. On top of that, he maintained strong local connections from his years as the mayor of Arjeplog. Gyllenberg and Fjellström started a company called Colmis in 1985. Gyllenberg discovered that, up to that point, British component producer Lucas Gerling (later merged into TRW, one of the world's largest component manufacturers) had been using local families' garages and was looking for a more permanent garage facility. Colmis offered Lucas a garage on Fjellström's property just outside the center of Arjeplog. In 1986, the first garage was built, and Colmis later expanded its offerings to include the provision of tracks.

Jörgen Stenberg was originally a journalist, and had travelled around the world, writing books and producing TV programs about the art of fishing. Stenberg realized that winter car testing was "the new thing" in Arjeplog and that there was money to be made in this emerging business. Jörgen Stenberg and three others founded the winter car-testing provider Tjintokk in 1986 and, later, Norrlands Marknadsidéer (the NMI Group). Cartest was yet another service provider established in Arjeplog during the late 1980s. Åse Sundström, daughter of Alf Sundström (one of the founders of Cartest), described the birth of the company as "a coincidence, because Alf just happened to sit next to the international manager of Knorr-Bremse at the restaurant in Kraja." Alf Sundström offered to build a testing facility for them in Arjeplog. "I will make some calculations," Alf Sundström said to the manager of the German component manufacturer. The deal was later closed, and in 1988, Alf Sundström founded Cartest with two of his friends. In addition to test services, Cartest arranged various kinds of social activities for the international test drivers, such as sports activities and scooter safaris. In general, the atmosphere in the town was friendly and dinner parties were held regularly at the homes of community members.

Some people in the community were skeptical about the new business ventures, expressing concern that they did not fit with local traditions and norms. The antagonists' concerns included the possible pollution of Lake Hornavan, among other things. According to Mayor Bengt-Urban Fransson:

“Initially, they [the international car testers] were quite few, but they set the tone right from the start. In the early days there were heated conflicts between the international testers and some locals. The community could at this time be characterized as being very ‘macho’, and with a strong hunting culture. When the international testers appeared, many of them naturally met local women, resulting in many divorces.”

Colmis later lost their first customer in a bidding contest. The British firm Lucas moved to another service provider after it was acquired by the American company Kelsey-Hayes (later TRW), which already had their testing facilities in Arvidsjaur. However, Lars-Gunnar Gyllenberg maintains that “Colmis came out as the winner of this process, because Lucas’ move to Arvidsjaur resulted in the attraction of Fiat to Colmis’ facilities. Fiat, having originally used the same service provider as Kelsey-Hayes, felt it was too crowded in Arvidsjaur.”

With the increased activity, more customers were drawn to the region, first from Europe and gradually from other parts of the world. In some instances, cultural clashes arose. Alf Sundström had an interesting first meeting with a manager in a high position at a Korean car company. Just before the meeting, Sundström discovered that there was a problem with one of the bathrooms in the office building. Sundström, who was not afraid of getting his hands dirty, dealt with the problem. While he was fixing the toilet, one of his customers, Delphi, had welcomed a large OEM from Korea and was taking them on a tour of Cartest’s facilities. At the end of the tour, the Koreans asked who owned and ran the facility and found out that it was Sundström, the man they had walked past when he was busy fixing the toilet. Ever since, Alf Sundström accepted that he needed to put on a business suit more often and adhere to a higher standard of professional decorum.

Sometimes, technical mishaps occurred because the car and component manufacturers were not used to the climate; for example, a staff person once made the mistake of flushing water over instruments in the middle of the winter in order to clean the equipment. Garage doors were left open overnight, resulting in unpleasant discoveries the following morning – with temperatures plunging as low as minus 40 degrees Celsius. There were also stories about the car companies renting cars, disassembling them in the workshops, copying the parts and then reassembling the vehicles and returning them. The community made a valiant effort to avoid cultural clashes between the Swedish and Asian cultures by offering seminars concentrating on Asian culture and how to engage it with sensitivity, not only in a business context, but also personally. A Japanese company requested that a Japanese chef be present to even consider testing in the area.

The Full Diamond at Work

The wheels of the automotive industry were spinning faster and faster. The service providers in the Arjeplog area had to keep up with the ever-faster cycles of developing new prototypes and the dwindling life cycles of cars. New testing facilities were usually built with little advance planning in order to meet the urgent requirements of the customers. Most service providers' core products still consisted of the provision of services to the car testing business. However, the services improved during the 1980s to include tracks on land and ice, workshops, modern garages, cold chambers, gas stations and administrative buildings. The workshops were located close to the tracks to save on travel time. Garages were used to store and hide cars. The cold chambers were used to test functionality in a cold climate, with the advantage of providing stable testing conditions compared to withstanding the outdoor weather.

At this time, Colmis began working on a new business concept where they performed less complex testing procedures on their own. The car manufacturer sent a number of cars and a test protocol to Arjeplog. Colmis performed the tests as described in the protocol and then reported the results back to the R&D departments of the car manufacturers. This would allow the car manufacturers to focus on more complex testing when they made site visits to Arjeplog. However, although there were several advantages with the new system, some of the German, Italian, and French test drivers were critical.

The demand for personnel covered a broad spectrum ranging from cleaners to mechanical engineers, and from basic activities to more advanced services demanding education and training. Human resources posed a problem for the service providers, as it was only possible to employ people for about six months of each year. The seasonal aspect of the business made it difficult to attract and retain skilled workers. It was common for skilled workers in the area to have two to three different employers during the course of a single year. After the test season concluded each April, many people were unemployed or moved on to other seasonal jobs, such as construction or tourism in the region, while others had to leave Arjeplog.

In the early days, there had been very little dialogue between the new businesses and the municipality. The entrepreneurs ran their businesses without any assistance from local agencies or authorities. In a meeting, Bengt-Urban Fransson said: "In the 1970s and the 1980s, no one really realized that the winter car testing business would turn out to be such lucrative industry." During the 1990s, however, the involvement of the municipality increased. Local officials met with representatives

of the international companies doing business in Arjeplog on a regular basis at least one to two times a year, depending on what was on the agenda. In specific projects, the involvement of the municipality might become more active, for example, necessitating the negotiation of contracts for the procurement of land and general infrastructure.

The increased involvement of the municipality eventually led to the formation of Argentis, a non-profit business development agency that was 78 percent owned by the service providers and 22 percent owned by the municipality of Arjeplog. It was founded in 1996 with the mission to strengthen business in Arjeplog and to function as an intermediary between the service providers and the municipality, but also to attend to the needs of the international customers coming to the region. Every Friday, “fika” (the Swedish term for getting together over a cup of coffee and a cookie or cake) was arranged by Företagarna in Arjeplog (the federation of private enterprises), and all businesses in Arjeplog were welcome to attend. Representatives from the municipalities were also present at fika, which created a forum for sharing ideas and discussing common issues.

The creation of the organization known as the Swedish Proving Ground Association (SPGA) took place during this period. SPGA was a non-profit association of Swedish service providers that specialized in providing automotive testing services. SPGA was founded in 2000 as a result of an investigation of the car testing region performed by the Ministry of Industry, Employment and Communication. SPGA had 12 member companies and their combined turnover amounted to 250 million SEK. SPGA members operated in the municipalities of Arjeplog, Arvidsjaur, Jokkmokk and Älvsbyn. The primary mission of SPGA was to help member companies in their operations. Through SPGA, member companies cooperated to develop industry guidelines and practices through both formal and informal discussions. The association also functioned as an intermediary to help avoid and reduce long-standing grudges. Lars Sundström, CEO of Icemakers, argued that: “several of the entrepreneurs have been like enemies and did not talk to each other at all. Now, with these meetings, there are things we share, common interests that may solve old issues.”

The entire community developed into more of an international municipality. Some of the tangible adaptations made for the international workers in Arjeplog included increasing the number of restaurants with international menus. In Arvidsjaur, you could order your choice of international beers or wines with your hot dog or hamburger at the local outlet down on the corner. Six gas stations were established in the center of Arjeplog, and arrangements were made to hold Catholic mass every two weeks. Reflecting on the international atmosphere, Bengt-Urban

Fransson said: “During the winter test season, you will often find yourself being the only person speaking Swedish to the check-out assistant when buying food at Konsum [the local grocery store].”

Most of the established customers in Arjeplog had been in the region for quite some time and had gradually adapted to the community. Test drivers and other specialists often returned year after year. Markus Hofbauer, from Stuttgart, Germany, said: “Arjeplog is the best test area I have been to because the people are so friendly and warm. We are welcomed as friends here and not as guests. I feel like part of the community.” Marco Carmagnola from Turin, Italy, said he liked “the peace here in Arjeplog and the wonderful landscape.” Cédric Van Essen from Paris, France, added that a positive thing in Arjeplog was that “everyone speaks English.” The community clearly tried to make the international test drivers feel welcome and to facilitate their stay as much as possible.

Global Reach

In 2001, Arjeplog Test Management, ATM, was founded by the people behind the service provider Tjintokk with the sole purpose of serving Bosch. Bosch had decided to join ATM and invested 40 MSEK, followed by an additional 160 MSEK in 2003 for the building of a new testing facility. In late 2003, the new facility was opened by H.M. King Carl XVI Gustaf of Sweden. Although the investment itself was large and important for the region, the signal it sent was perhaps even more significant. Bosch was one of the key players in the testing business, since most of the car manufacturers collaborated with them and used their equipment. This trend of local entrepreneurs becoming partners with multinational car manufacturers was increasingly common in Arjeplog. Service providers were also cooperating with supporting industries. ATM, for example, cooperated with a plough manufacturer. ATM used the snow ploughs not only for their regular work, but also for demonstrations for both their existing customers and other potential buyers.

In 2003, General Motors (GM), a giant in the automotive industry, placed its winter testing of all brands at Colmis’ facilities. Harald Fjellström, co-founder of Colmis, confirmed that Colmis invested 37 MSEK in its facility as a direct consequence of GM’s presence. Soon afterwards, all of the testing sites throughout the entire testing region received broadband access. SPGA was one of the active, lobbying forces behind this development. In 2004, the German car manufacturer Volkswagen relocated its long-range testing from Rovaniemi, Finland, to Sorsele, a municipality adjacent to Arjeplog. The test facility employed approximately 40 people. The municipality of Sorsele supported the venture by purchasing the land where the test facility was built.

Airport traffic had nearly doubled between the mid-1990s and the early 2000s. In the autumn of 2004, the airport authority started an expansion of its runway and the addition of a new aircraft taxiway. The Swedish government, the Norrbotten government and the municipality of Arvidsjaur invested a total of 37 MSEK in the airport. Bilsystemteknik (“Car System Technology”), an upper secondary school program located in Arjeplog, started in 2004. The motive was not only to offer specialized education for car testing or engineering professions, but also to attract younger people to Arjeplog. Before Bilsystemteknik was founded, the closest alternatives for upper secondary school education were in Piteå or Luleå along the Gulf of Bothnia.

In 2005, Icemakers’ business grew substantially. One of its customers, BMW, decided to invest 150 million SEK together with Icemakers in a new testing facility, which was built in 2005-2006. With this new investment, BMW tripled its business in Arjeplog. Between 1987 and 1990, Toyota had conducted its winter testing in Sweden, but for a number of reasons, Toyota chose ultimately to move its testing to a competing region in Finland. However, after 14 years in Finland, Toyota Europe conducted an extensive “Winter Test Facility Investigation”, and decided in 2005 to return to Sweden and Arjeplog. Hyundai, a Korean car manufacturer, decided to invest in a new testing facility together with Cartest. The investment amounted to some 15 MSEK. The total turnover in Arjeplog’s car testing business in 2005 amounted to around 500 MSEK. About 300 local citizens were employed in the business, along with an additional 1,500 visiting car testers and other specialists who found work every winter. The car testing industry was now the second largest employer in the region after the municipality’s public agencies.

In 2007, ATM established an office in Yakeshi in Inner Mongolia and began to offer testing services to Chinese auto manufacturers Geely, Chery and Great Wall. The leap forward in strategy was supported by Germany’s Bosch, which was a major supplier to the automotive industry in China.

Summary of Case

So what can we learn from this case? First, Arjeplog is not an obvious place for a new and vibrant cluster to emerge. The region had been through troubled times with the downsizing of traditional employment; both the local mine and sawmill had closed down. The population density was low and the climate harsh. Furthermore, the education level in the region was generally low. Many residents, especially among the younger population, were looking for education and job opportunities elsewhere. However, having said that, there were also a number of obvious advantages connected with the unique geography and history of Arjeplog.

Guided by the diamond model, we can easily identify the initial natural factor advantages, including a perfect arctic climate, plenty of frozen lakes during wintertime, a sparsely populated area, fairly good road and airport infrastructure, and some basic knowledge about ice planing (see Figure 16).

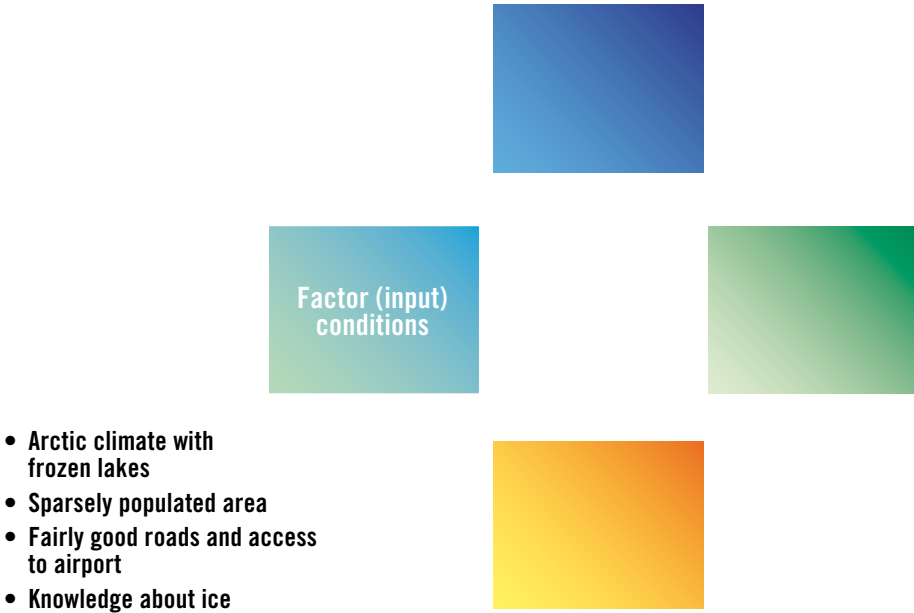


Figure 16. The Initial Diamond Conditions

In addition to these factor advantages, the presence of a few entrepreneurs in the area made the difference. At the time, there were many areas around the world with frozen lakes, but a car testing industry took off in only a select few spots. Without the early entrepreneurship, the frozen lakes in the area would probably remain idle resources, perhaps used solely for winter fishing.

During the 1980s and 1990s, other parts of the diamond came into play, and the existing social capital was transformed. Entry of new service providers added rivalry and new strategies, and sophisticated demand conditions started to play out. Several new organizations for collaboration emerged. Some of the larger customers began to invest in facilities in the area, adding a degree of commitment to the region (see Figure 17).

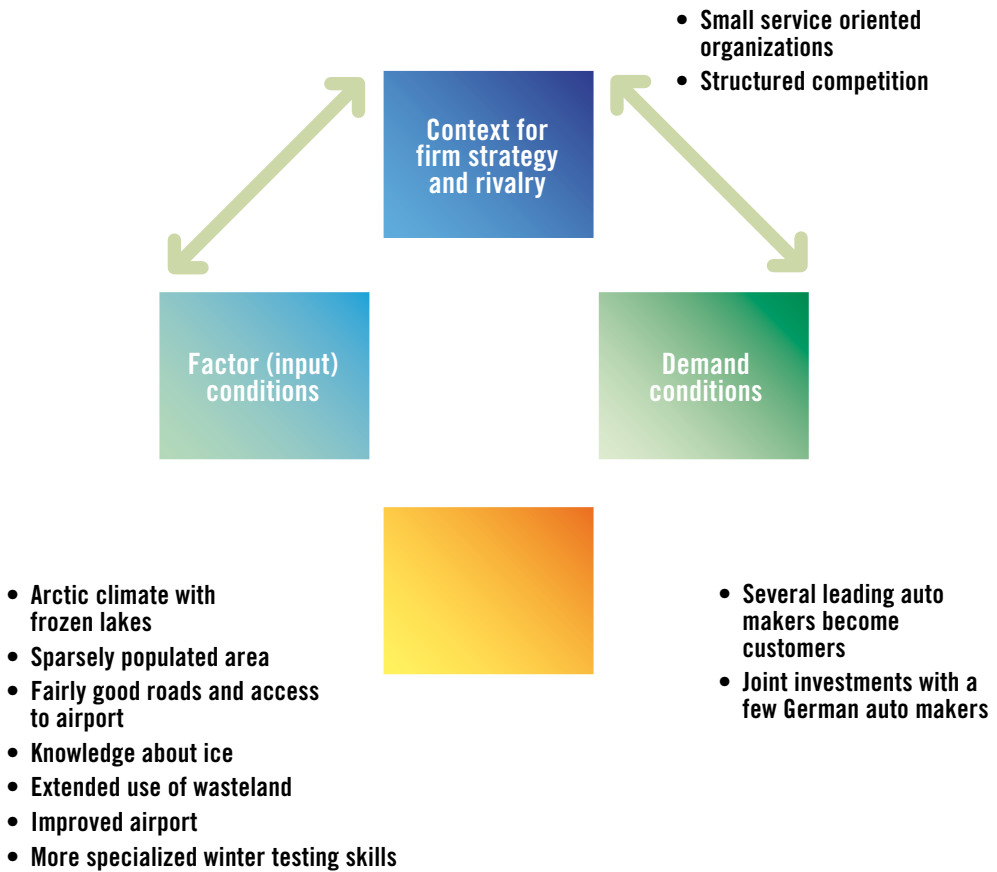


Figure 17. More Parts of the Diamond Coming into Play

By the 1990s, a full blown cluster had emerged (see Figure 18). Skills and infrastructure were becoming more advanced and more specialized. Over time, media coverage of the region had increased and the Arjeplog “brand” became synonymous with “the winter car-testing cluster”.

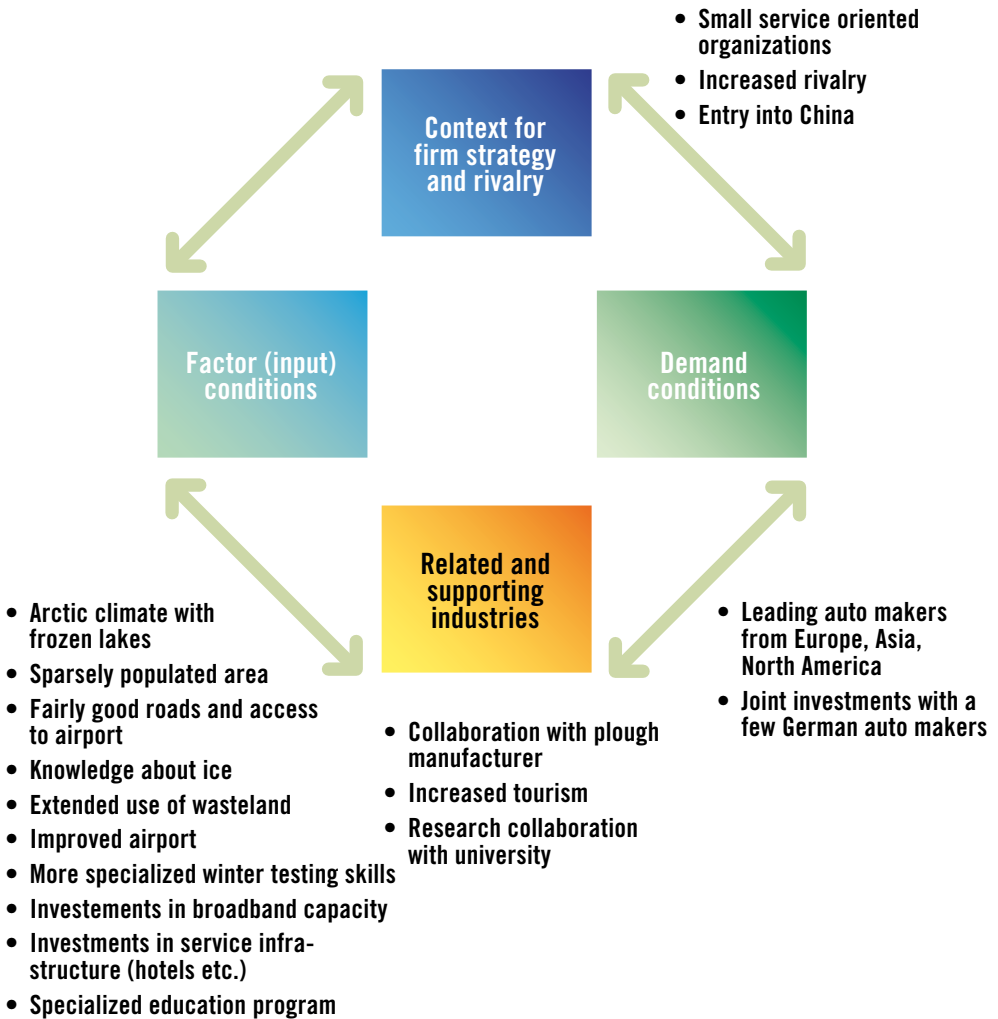


Figure 18. The Full Diamond

Today, in 2008, the Arjeplog cluster scene is still rather small in an absolute sense, but it includes a wide range of actors of competing and cooperating firms and organizations, as well as a wide range of skills, technologies and strategies. The social capital in the area has segued from hunting parties to include a range of networks around the winter car-testing business. Arjeplog is now linked to world markets in a wide variety of different ways. One of the service providers has internationalized and has started to test Chinese cars on frozen lakes in Inner Mongolia, and almost all of the world's automotive companies come to Arjeplog every winter, doubling the size of the population.

With increased investments in hotels and related services, including the four-star Silver Lodge Hotel, tourism and exclusive corporate events are now on the increase. The leading hotel owner, Jan Edvardsson, is now offering car events in summertime.

In the next chapter, we will turn to the more general story of cluster evolution. As was illustrated in this case, the evolutionary forces involved in the process of cluster formation proved to be more important than any constructive forces emanating from regional or industry policies or programs. If anything, the constructive forces came in rather late and jumped onto a wave that was already in motion. In Part II of the book, we will return to a discussion of the constructive forces, to see how they play out today.

The Rise and Fall of Clusters

As we fly over the economic landscape, we see both emerging and dying clusters. Sometimes, only the ruins are visible – and possibly a museum or two. Take a lap around Venice and you will see the remnants of the Arsenale, the world’s leading shipbuilding cluster in the 16th and 17th centuries. The last boat was built during World War I, and you will find a museum nearby showing the great naval history of the area. Head north to Gothenburg and you will find the remnants of another shipbuilding cluster. Here, you see shipyards that have been turned into industrial parks and mundane residential buildings with a beautiful view of the harbor. Clusters simply go through life cycles, and while some ultimately reach the “museum” stage, others will experience a “renaissance”.

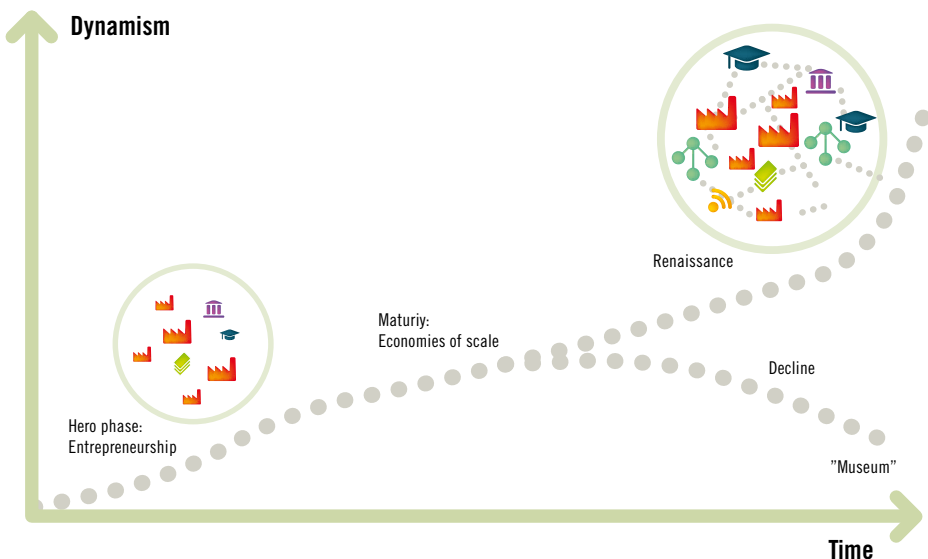


Figure 19. The Cluster Life Cycle

As with every social system, clusters experience birth, growth, decline and death. But where do clusters emerge in the first place? Which clusters take off? And when do they fall into decline? Sometimes, old and static clusters are reinvigorated, leading to a new cycle, such as the wine cluster of Australia, particularly Barossa Valley, which took off in the 1950s after a sleepy period of 150 years.

Birth of a Cluster

The emergence of a cluster in a particular location can be explained in one of two ways. One type of explanation refers to some natural factor advantage, such as a particular climate, soil, ore deposit, forest resource, transportation route or port. The location of wine clusters and forest/pulp and paper clusters are easily explained by the geography of production factors (in addition to transportation costs and location of markets). Early filmmakers in the U.S. found their way to California to shoot on the sunny beaches, and a group of them ended up in what later became Hollywood. In the modern economy, the university often plays the role of the “brain trust” on which emerging clusters thrive.

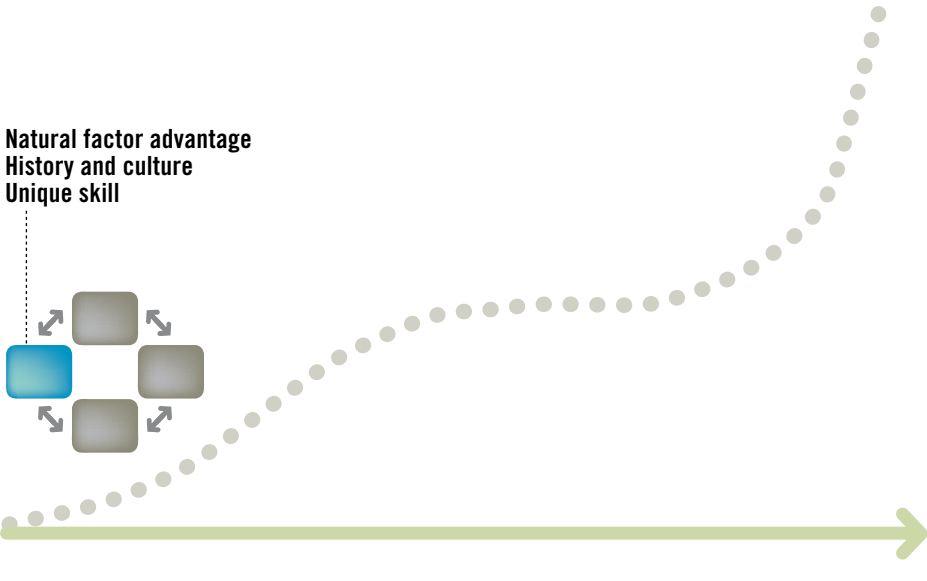


Figure 20. Birth of a Cluster – Factor Advantage

A second type of explanation has to do with historical accidents, where an entrepreneurial person in a particular location happened to start a business, which in due time led to increasing local demand, new firm formation, spin-off firms and so on, and ultimately to a cluster. Once the cluster reaches critical mass and starts to grow, there is often a strong cumulative process, or path dependence, that locks in the cluster. Krugman (1991) often points to the case of carpet manufacturing in the U.S. which became centered in Dalton, Georgia, where the first entrepreneur lived. In order for clusters to grow and prosper, many ingredients are needed, including demand sophistication, factor upgrading and specialization, emerging strategies of competition and cooperation, institutional conditions favoring innovation and change, political actions and so on.

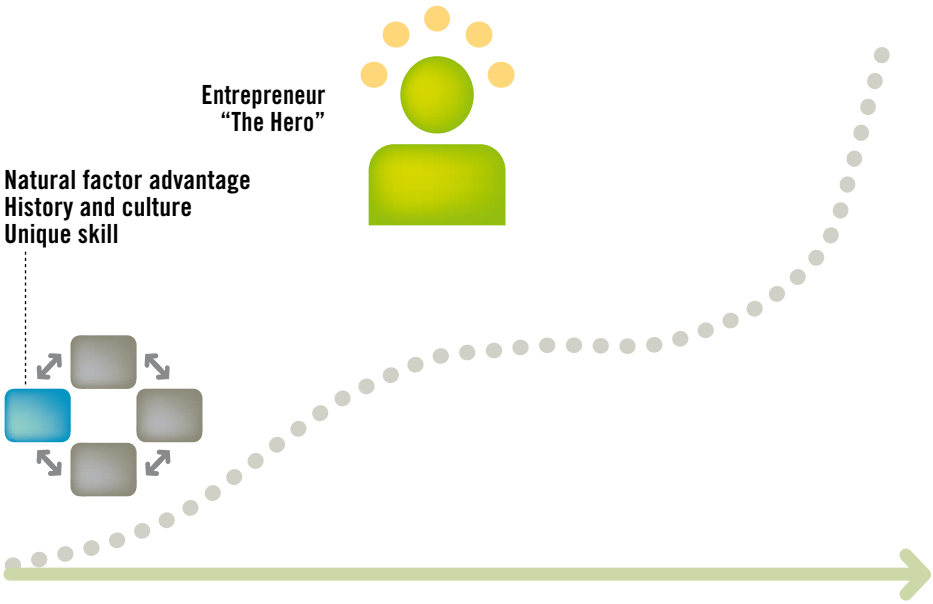


Figure 21. Birth of a Cluster – The Entrepreneur

Many clusters have an identifiable “hero”. In the Arjeplog case, David Sundström was the first entrepreneur to sell services to the German automotive companies. He showed to later entrants that it was, in fact, possible to make good money by sweeping ice on the nearby lakes during the winter months.

Growth of a Cluster

In the Arjeplog case, we saw an emerging service cluster based on many small firms, competing on the one hand and cooperating on the other to increase the attractiveness of the region. In other cases, a cluster is dominated by one or a few large, so-called anchor firms. Silicon Valley had Varian, Shockley Transistor, HP, Fairchild and Intel, which have, as a group, spun off hundreds of new firms. Fairchild was a spin-off from Shockley, while Intel was a spin-off from Fairchild. San Diego had Hybritech in biotech, and Route 128 had Digital Equipment and Wang in mini computers. In addition to the emergence of new entrants and the addition of new strategies, cluster growth involves networking and emerging social capital. Often, the more general social capital within a region must to expand with cluster-specific networks if the cluster is to grow. Often, different “families” or “clans” play a role within the region, where the social fabric is denser.

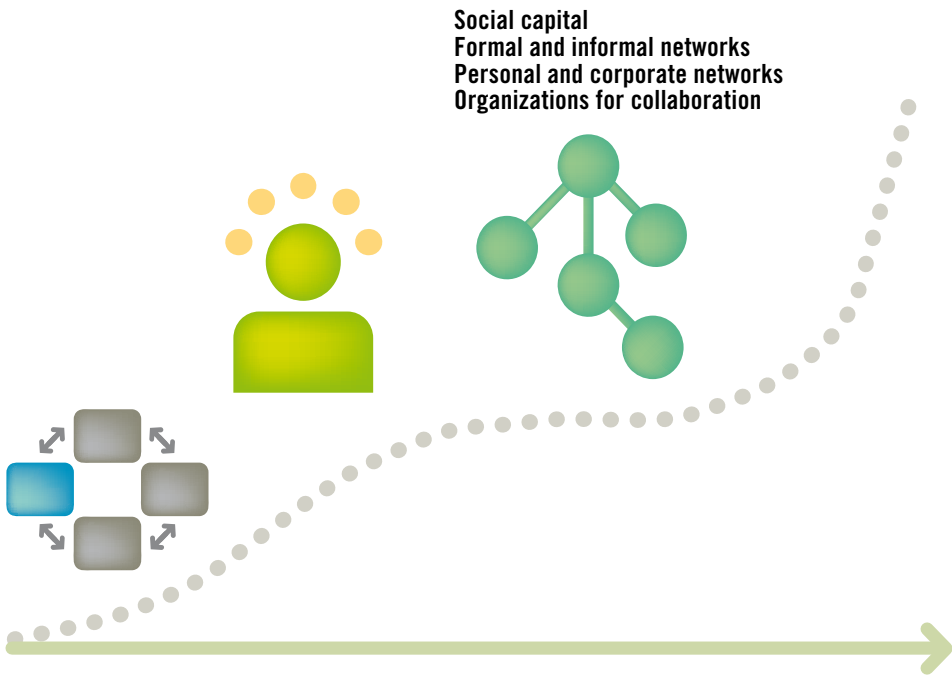


Figure 22. Cluster Growth and Social Capital

The diamond works as an engine of cluster growth and upgrading. If the right circumstances are present (rivalry, cooperation, openness to international markets, lead customers, etc.), the cluster will interact with labor markets and universities to enhance factor specialization and upgrading, and increased demand sophistication. All four drivers begin to interact (see Figure 23 and also Figure 24), and through upstream and downstream linkages, a larger cluster will emerge.

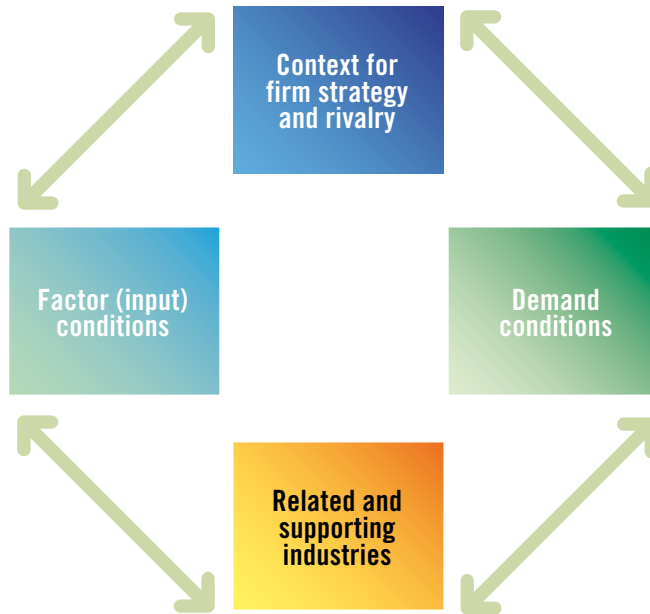


Figure 23. Michael Porter's Diamond Model as a System

It is difficult to detect any particular sequence in the different drivers of cluster evolution at this stage. Many clusters clearly emanate from factor advantages such as natural resources of particular skills, but again, some peculiarities in demand or some related cluster might constitute the initial ground. Many machinery clusters have evolved close to demand, such as the textile machinery cluster in eastern Switzerland and the factory automation cluster around Turin. The pharmaceutical cluster around Basel emerged in close proximity to the German dye industry, and Japan's synthetic-weave cluster emerged as an adjunct to the local silk industry (Enright, 1998). Some advantage in demand or related clusters will help cluster growth, while others will evolve over time. Clusters exhibit different evolutionary patterns; the development of a science-driven cluster such as the San

Diego biotech industry is different from the development of a winter car testing cluster in Arjeplog.

The U.S. biotech industry has an interesting history. Instead of soil or climate, university research has been at its core. Especially in its early phases, if one would have removed universities from the networks, the networks would have collapsed (Owen-Smith and Powell, 2004). A number of cluster seeds emerged, but it was only in three to five places where dynamic clusters took off in the U.S., particularly around Silicon Valley, San Diego, and Cambridge, Massachusetts. In the ensuing decades, these clusters have gained world leadership in many fields. General success ingredients include massive university research, superior legislation (especially the Bayh-Dole act of 1980), the size of the U.S. economy, its attractiveness on skills from around the world, and the availability of venture capital. These factors play a role across the U.S., but underlying these national characteristics we see regional institutional diversity, and complex patterns of competition between private and public systems (including private and public universities).

We also see a multitude of linkages across institutions, as well as the transformation of public science into private science and the commercialization of new knowledge. Mobility of people also plays a critical role, where scientists and industry experts wear many hats, and career paths show great flexibility. University curricula have changed and tech transfer offices have proliferated. VCs offer money, but more importantly, they offer skills and close monitoring. In fact, for some 50 percent of life science VC money within the U.S., the distance between the VC firm and the portfolio firms is less than a 30-minute drive if you avoid traffic jams. Policy and evolution of cluster-specific institutions also play a role. However, there is clearly a lack of a visible-hand planning for cluster growth. The biotech clusters closest to political power largely failed, and the only top-down planned biotech cluster in the U.S. – North Carolina’s Research Triangle – is lagging behind. Each cluster within the U.S. exhibits large institutional differences, rendering the San Diego model as different from the Cambridge model, and so on. Due to this complexity, and outright planning failures, a wholesale transplantation of “the U.S. model” is not recommended to politicians who strive to construct clusters.

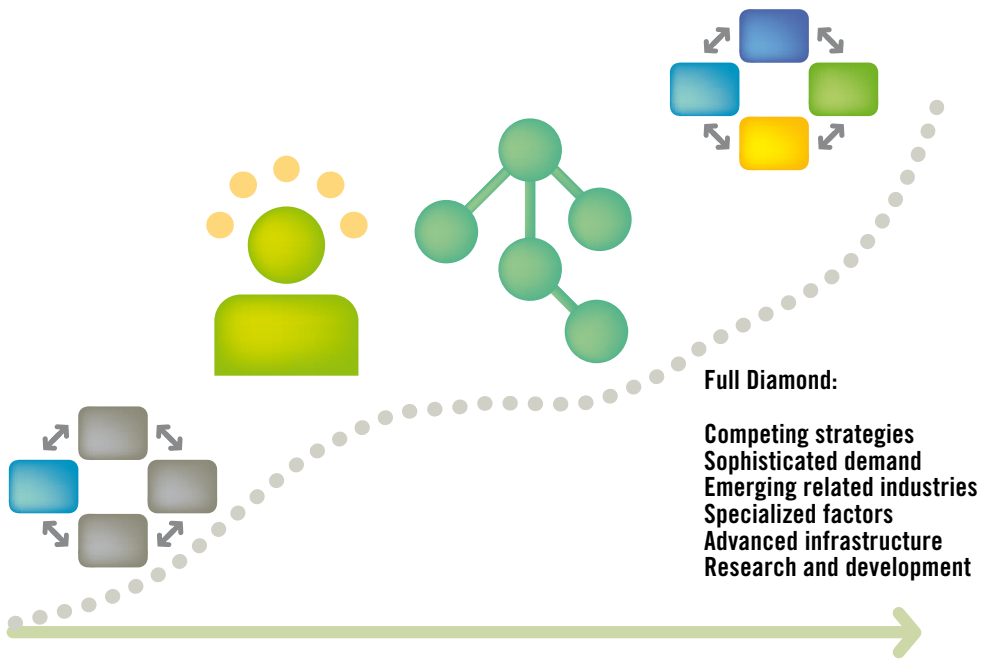


Figure 24. Cluster Growth and the Full Diamond

Cluster growth takes place within a particular political setting (see Figure 25). Regulations and political actions range from antitrust, regional policies, industry policies, and science and innovation policies, including patents and IPR (e.g., rules for how to share license fees between researchers and the university). More general framework policies affect the overall attractiveness of a region to people (housing, transportation, recreation and culture) and companies (land, investment attraction packages, skilled people).

National/regional policy and programs:

**Science/innovation policy
Regional policy
Industry/SME/entrepreneurship policy
Cluster policy and programs**

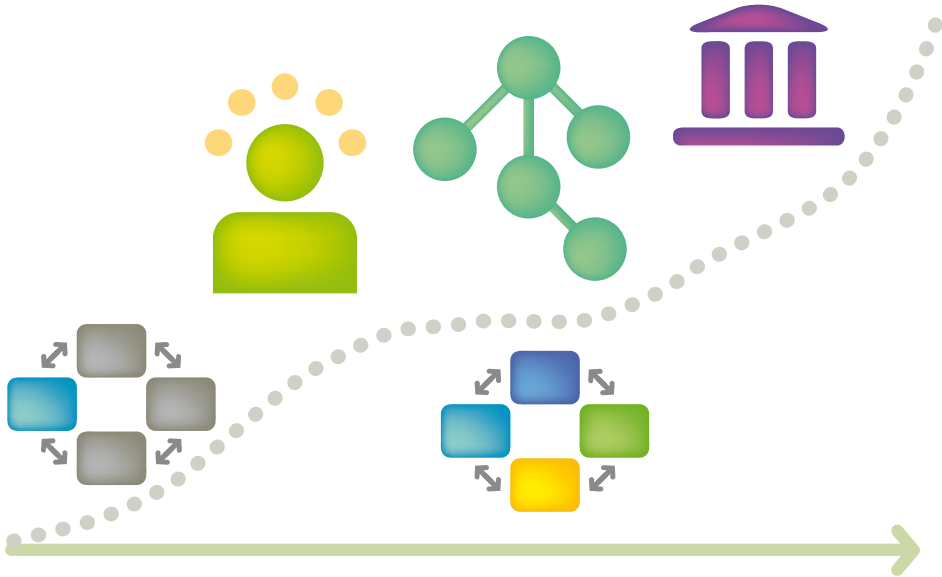


Figure 25. Clusters and Policy

A final feature of a growing cluster involves linkages to international markets, both factor markets and final goods markets (see Figure 26). A dynamic cluster cannot be isolated. For a cluster to continue to prosper, it needs an inflow of people with different skills, inward investments (FDI and VC), imports of materials, components and products, and new technologies. Both people and firms must be attracted to the cluster. Conversely, the cluster must reach out to international markets (outward FDI, exports etc.). Dynamic clusters experience a circulation of ideas, skills and resources, including “brain” circulation.

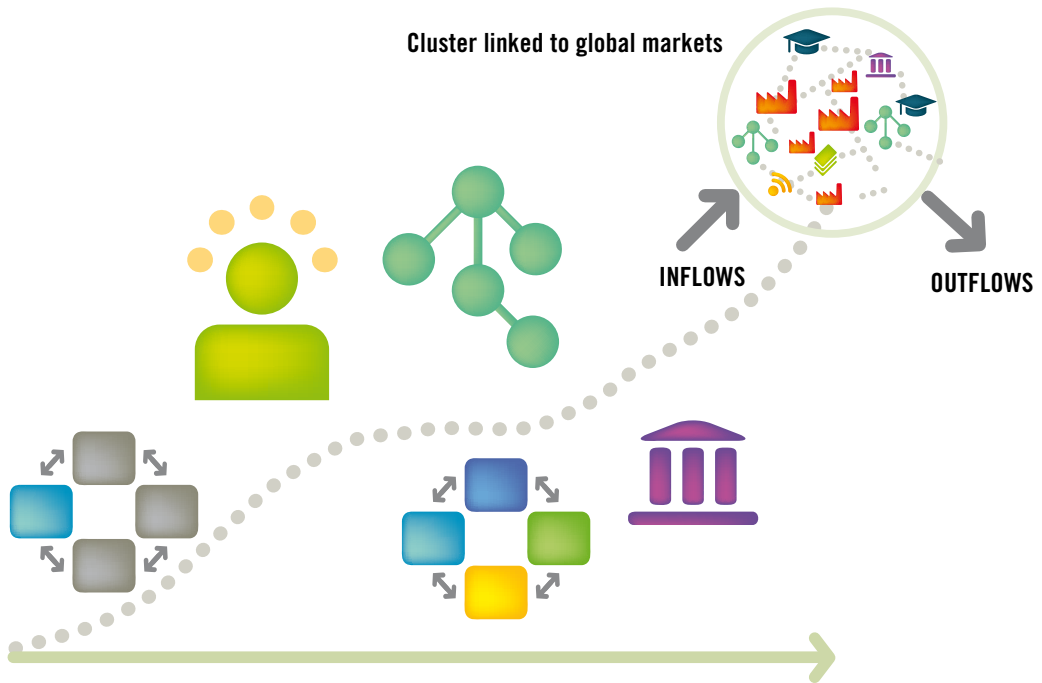


Figure 26. Clusters Linked to Global Markets

Mature Clusters and Renaissance

Growing clusters need a mix of advantageous diamond factors, i.e. framework conditions, vivid entrepreneurship, social capital, strong linkages to international markets, and a portion of good policy. But all good stories must come to an end. Some clusters experience a rather short life cycle before they decline, whereas others survive for centuries. Established clusters typically enter a more static phase at some point, including concentration into fewer firms through mergers and acquisitions and sharply declining rates of entry of new firms. This phase is characterized by efficiency and important economics of scale. In some cases, such as the telecommunications industry, most nations ended up with one main supplier of equipment and one main supplier of services. However, with technological shifts and new regulations, many telecom clusters re-emerged in the 1990s, including the entry of new firms, new business models, new products (e.g. mobile telephony) and a much more dynamic business climate. These clusters underwent a renaissance.

In the Californian wine cluster, there were around 1,000 wineries in 1940, which fell to just over 300 in the late 1960s, but as the cluster went into a renaissance phase, there were over 1,300 wineries active by 1990. Hollywood had the same experience. During the static phase, leading filmmakers were integrating horizontally and vertically, taking over distribution, cinemas and many suppliers during the 1930s and 1940s. Only after tough anti-trust rulings and radical changes in technology did these anchor firms lose some of their dominance, allowing Hollywood to move into a new phase and explore new markets such as TV and animated film. In the next part of the book, a case of a mature cluster experiencing a renaissance is presented, with a focus on the packaging paper cluster in the region of Värmland, located in North-mid Sweden.

The Demise of Clusters

At some point clusters ultimately “die”, and often a museum is the only remnant.

- Excessive concentration
- Heavy government involvement saving and subsidizing companies
- Radical technological shifts originating from other locations
- Radical shifts in demand at other locations
- War and other extreme circumstances

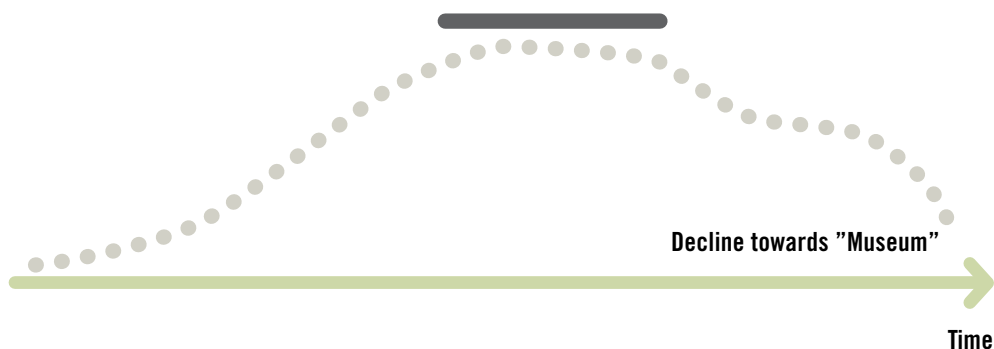


Figure 27. The Demise of a Cluster

A case in point is Akron, Ohio, which was once the rubber tire capital of the world. This case is often referred to by the Nobel laureate Paul Krugman, whose father used to work in the rubber plants. During its heyday, Akron included many of the world’s leading tire companies such as Goodyear, Firestone, and Diamond. Today, Akron is the proud home of the Goodyear World of Rubber museum. Exhibits include a replica of Charles Goodyear’s workshop, a model of a rubber plantation, displays of tires, and other informational resources.

Part II

CONSTRUCTION

Clusters evolve in a complex process that involves firms, organizations, entrepreneurs, and industry, academic and political leaders. Over time, clusters develop complex webs of internal and external linkages, as well as patterns of both competition and cooperation, and both market and policy forces are at play. We have chosen the word “construction”, which evokes conscious effort at both the individual and the organizational levels. We have also added the word “reconstruction”, as we see many old and well-established clusters being impacted by conscious cluster building efforts. Well-crafted cluster programs and initiatives can work like a “turbo” on mature clusters.

In this part of the book, we will use another case from Sweden, the region of Värmland and the larger North-mid Sweden region (Chapter 7), where a reconstruction of a century-old paper cluster took place during the last decade. Just like Upper Norrland, North-mid Sweden is another rural area of the country. Both regions score low on any national or international ranking. But rather than giving up and accepting that market forces sometimes play out with industry close-downs and diminishing populations, positive forces came together, leading to cluster programs and initiatives. With growing success in the paper cluster, the constructive forces have spread to several other clusters in the region, including the neighboring regions Dalarna and Gävleborg. During the last ten years, new actors have entered the cluster scene, including local cluster organizations, three new federative regional public bodies formed by cooperating municipalities, and several projects related to cluster construction and reconstruction. Some initiatives have concentrated on building networks of cluster initiatives across Europe.

While the purpose of Part I of the book was to point to the evolutionary forces and life cycles of clusters, this part is about the policy, planning and deliberate initiatives of leaders who want to construct – or reconstruct – clusters.

Chapter 5

Cluster Policy, Programs and Initiatives

The concept of “construction” can be used in many different ways. To some, construction implies that there is a clear project manager leading the construction. This is not the way we use the concept here. To us, construction is part of development where a few identifiable actors make conscious efforts to “build”, “construct” or “reconstruct” the cluster or larger region. Actors include a range of entrepreneurs, industry, academic and policy leaders. As was discussed in Chapter 1, the constructive forces emanate from both top-down policy and programs and bottom-up cluster initiatives.

National and regional cluster policies and programs are now emerging all around the world. In addition, local cluster initiatives, crossing over public-private-academic organizations, became a popular movement in the 1990s. In Europe alone, we have found more than 1,000 such cluster initiatives, organized with a cluster manager, an office and a website (see cluster organizations under data type in the cluster mapping mode: www.clusterobservatory.eu). Some cluster initiatives emanate bottom-up, whereas others are inspired and mainly financed through a national or regional cluster program. The organization of cluster construction at national, regional and local levels differs widely across nations.

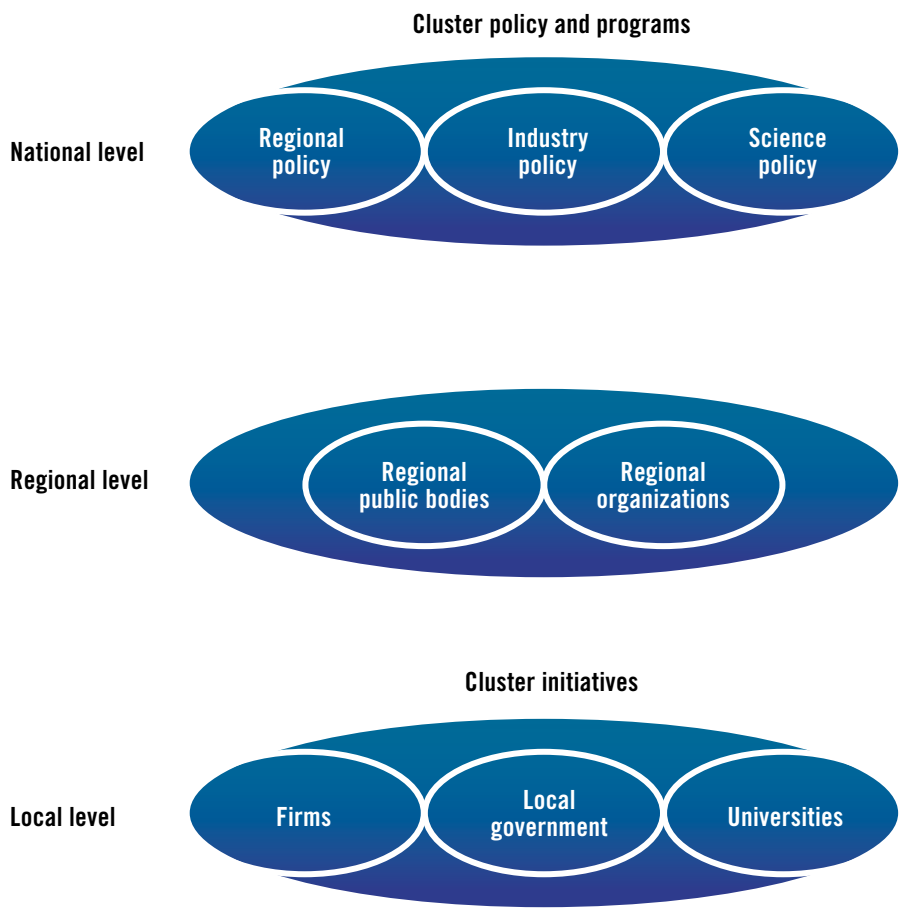


Figure 28. National, Regional and Local Level Actors Involved in Cluster Construction

The evolution of clusters involves a myriad of actors and actions. Most actions, like in any market, are private decisions not intended to improve the overall market or region. The “invisible hand” is at work, or possibly the visible hand of large firms (Chandler, 1977). But in addition to all of this, there are at times conscious efforts by leaders who are implementing new programs and initiatives to affect the regional or local business environment – in other words, to construct clusters. Political leaders work through fiscal policy, implementing laws and regulations and through agitation. Civic leaders work through non-governmental organizations and cluster initiatives to form dialogue, collect resources and implement programs to improve clusters or the larger business environment.

The Construction of Silicon Valley

Even in a market economy such as the U.S., clusters are partly constructed. Both Federal and State fiscal and regulatory policy impact clusters in various ways. Being the largest integrated market in the world, the U.S. is the ground for regional reshuffling of resources, leading to regional specialization and clustering. Silicon Valley is the result of a mix of evolutionary forces and constructive forces. Federal legislation and allocation of research grants is but one visible hand. For example, the Bayh-Dole act in 1980 has favored commercialization of research, which in turn has had tremendous effects on high-tech clusters throughout the U.S. economy.

A more direct and visible hand in Silicon Valley has been managed by Stanford University, where some of its leaders implemented early initiatives. A conscious effort to build world-class research facilities and commercialization channels was present many decades ago. These efforts were further promoted by federal research grants and military spending. The whole notion of a “Silicon Valley” did not exist until media created the icon by writing about it, and this was three decades after the seeds of the electronics cluster had emerged. Beginning in 1971, Don Hoefler, who had worked for Fairchild Semiconductor and RCA, wrote a series of articles – “Silicon Valley USA” – for the weekly tabloid *Electronic News*, using the phrase “Silicon Valley” to describe the agglomeration of electronics firms in the Santa Clara County. This valley, formerly known for its orchards, became the hotspot for IT hardware and software and later Internet industries. Without delving into too much detail about the Silicon Valley cluster (several insightful articles are found in Lee et al., 2000), we can conclude that Stanford University and related research laboratories played a crucial role in offering cluster seeds through educating people and producing advanced research. Key actors included the Stanford Research Institute (1946), the Stanford Industrial Park (1950s) and later a host of organizations involved in linking research and business. The Stanford Research Institute (SRI) had been created as a West Coast center for innovation, with the explicit aim of facilitating economic development in the region. SRI carried out contract research in highly varied fields, computing being only one of many. One important spin-off was the Augmentation Research Center (ARC) involved in information processing work. In the 1950s, Stanford needed new financial means and decided to lease out land to high technology firms in the vicinity – the Stanford Industrial Park was established. Around Stanford, a wide range of research centers has mushroomed over the last 50 years. An early example was the Stanford Artificial Intelligence Laboratory, which was set up in 1963.

In the valley, some firms that had emanated as spin-offs from research became

large and successful. Some became anchor firms, including Shockley Transistor, HP, Fairchild and Intel, as they constituted platforms for new spin-offs. Varian, Shockley Transistor, and HP have spun off hundreds of new firms. The growing electronics and IT industries stimulated specialized service suppliers (legal and business services), venture capital and angel networks. With increasing visibility, the valley began to attract more and more resources from the outside. IBM, Lockheed and NASA had already moved into the valley in the 1950s. Some of these firms had access to large government grants, which have been a central component in the construction of many U.S. high technology clusters. Military spending also constituted the basis for several firms in a few selected corners of the United States, Silicon Valley being one.

Many individuals were instrumental in setting off this process of cluster growth. Professor Frederick Terman, provost of Stanford, was the man behind Stanford Industrial Park, and is one of the persons who have been labeled “the father of Silicon Valley”. While no government agency decided that there should be a world-leading center in electronics, later semiconductors, later computers and even later Internet technologies in Silicon Valley, it is a construction of inventors, entrepreneurs, university leaders, firms, and other organizations. Large investments in scientific discovery led to the creation of new firms, and over time the region increased its attractiveness, leading to even more firms and to students turning into entrepreneurs and inventors. Members of the Homebrew Computer Club, established in 1975 to experiment with home computers, led to the creation of some 20 computer companies in the early heyday, Apple being one. Many entrepreneurs and inventors were educated at Stanford, Berkeley or other universities and colleges in the area. These universities would draw more students, faculty and other talent on a global scale, including many from Asian countries.

Since the 1970s, several non-profit organizations for collaboration have emerged in the valley. The Silicon Manufacturing Valley Group (1977) has facilitated cooperation around issues of quality of life, education and infrastructure challenges such as transportation and energy, and tax regulation. The Joint Venture: Silicon Valley Network, established in 1993, is a network that provides analysis and action on issues affecting the region’s overall economy and quality of life. The organization brings together leaders from business, government, academia, labor and the broader community in order to spotlight issues and work toward a more innovative region. Founded in 1994, CommerceNet has been conducting research and piloting programs that have advanced the commercial use of the Internet. These are conscious and constructive efforts, each having a small but distinct impact

on the evolution of Silicon Valley. There is clearly not one big hand planning it all, but there are a few hands that are much more important than others when it comes to securing the future success of the valley.

Policy for Clusters or Cluster Policy

A central role of government is to stimulate dynamism and upgrading among firms within its territory. Both active fiscal policy and regulatory changes play important roles. Some measures are geared towards the more general macro and micro business environments, whereas others are more targeted towards individual sectors or clusters. The concept of a “cluster policy” is gaining ground. Cluster policy can be interpreted in two ways: microeconomic policies that will impact clusters in more general terms, i.e. policies for clusters, or specific cluster policies targeting particular clusters. Both types of policies play a role in the construction of clusters. The first type includes a number of traditional policy areas.

Policy area	Implication for clusters
Science and innovation	Science-driven clusters are sensitive to investments in science and technology development.
Competition	Rivalry is one of the key ingredients of dynamic clusters.
Trade	Linkages to world markets is of fundamental importance to the dynamism of clusters.
Integration	For example in Europe, the European Union work towards creating one level playing field where resources can flow more freely. Some clusters will gain more resources whereas others will decline, and thus regions will specialize.
Regional	Clusters can gain from regional programs, e.g., promoting infrastructure or training.
Social	Access to superior public services enhances attractiveness of clusters, bringing in new resources from the outside.

The increasing evidence of the important role clusters play in explaining prosperity differences across regions has raised the interest of policymakers. Many are now looking for ways in which policy interventions could lead to the emergence of clusters, or could help existing clusters to grow and prosper. In order to understand cluster policy better, one can distinguish between three different aspects of the issue:

- *Policy*: Often, governments set out their strategic intentions in a specific document, a policy (or white) paper. This document does not have to define

specific tools, allocate funding, or create responsibilities, but it does set the political objectives and define why specific activities are deemed important.

- *Program*: To move from intent to real action, governments design specific programs that allocate funding, create organizational responsibilities and define specific conditions under which funding can be made available.
- *Implementing agency*: It will be the responsibility of a government agency or ministry to implement each program. The program might be their main activity, or it could represent just a small part of their overall responsibilities.

For hard-line economists looking for a rationale for cluster intervention, one can point to two market failures. *Networking failures* emanate from the fact that individual actors in a cluster do not realize the spillovers they create for others, and thus there is too little of activities or investments. Cluster policy can be used to overcome the gap between the private and the public return of such activities in a cluster. *Information asymmetries* are common within clusters. It is our experience that firms within clusters have relatively limited knowledge of each other, and business opportunities are often neglected. Cluster policy and programs can be used to overcome these information asymmetries by supporting dialogue and communication within the cluster.

Cluster Policies and Programs within the EU

All European countries are currently active in developing and implementing cluster policies or programs, either at the national or the regional level (individual country reports carried out by Oxford Research can be found at www.clusterobservatory.eu). This is partly a response to the Lisbon strategy. Also, given the mounting evidence that clusters make a positive contribution to regional performance, pressure is increasing to design policies that can foster the development of clusters or increase their economic benefits. National and regional policies have been complemented by European policies, where the internal market has created a solid base for clustering, i.e., regional specialization, to actually take place. In addition, EU has created a number of programs within the areas of science and innovation policy, regional policy and enterprise and industry policy, facilitating benchmarking and learning across clusters of Europe. In 2007 the European Cluster Observatory was launched, and a EU communication on clusters was published in October 2008.

National Cluster Policy

National cluster policies consist of policy documents, directives and legislation. There may be one overarching policy for clusters outlining specifically how cluster development should be pursued, or how clusters are part of a range of policy fields. The number of European countries adopting a cluster policy in the time periods from 1990-1994, 1995-1999, 2000-2004 and after 2005 is fairly equal. A slight overweight of countries started to use the concept in the period from 1990-1994, i.e., early adopters, and in the period from 2000-2004. Considering the fact that around half the countries used cluster policy for the first time in the period from 2000 until today, the policy area is still at an early stage in many countries. There is also a notable distinction between countries from Eastern and Western Europe. Among the adopters after 2000, many of them are small in population size and/or from Eastern Europe.

There is a huge variation among the countries when it comes to how many and what kinds of national ministries are responsible for the implementation of cluster policy. In thirteen of the countries, at least two ministries are responsible. The clear majority of these thirteen are countries located in Western Europe, but it is hard to identify any regular pattern among them; many different combinations are utilized. The ministries that are most frequently used as implementers of cluster policy are the ministry of industry (16 countries), the ministry of finance/economy (14 countries), and the ministry of science and research (9 countries). In addition, there is a striking division between transition economies and more mature economies. A general impression is that the ministries of finance/economy play a more vital role in the transition economies, while thematic ministries are involved to a greater extent in EU-15.

The importance of cluster policy at a national level varies among the countries. Cluster policy is seen as important in nine countries (30%), of medium importance in 12 countries (40%) and of low importance in nine countries (30%). There is no clear picture regarding which types of countries are among those that find cluster policy important. Among the nine countries that regard cluster policy as important, we find the three largest countries in Western Europe, three Nordic countries and three countries of various sizes from Eastern Europe. Among the nine countries that count cluster policy to be of low importance, there is a wide variety of countries. However, it is possible to identify some uniting characteristics between them. The common denominator is the overall organization of the country. Firstly, national cluster policy plays a less significant role for some countries that are organized as federations. This is probably why Belgium and Switzerland are found in this group. Secondly, the degree of autonomy at a regional level is

also vital. In some countries, the regional level plays a significant role, such as in the case of Denmark (in the fields of innovation and regional development). Italy can also be found in this category.

Clusters play a role as a framework in a number of policy areas. Through the mapping, we have looked at the role of clusters in six more detailed policy areas:

- Business network policy
- FDI attraction policy
- Export promotion policy
- Sector-oriented industry policy
- Science and education policy
- Competition and market integration policy

The importance of clusters varies somewhat from area to area, but the general impression is nonetheless that clusters play only a limited role. The area where clusters play the most prominent role is in the field of *science and education*.

National Agencies and Cluster Programs

Among the European countries there is between zero and seven national agencies responsible for the cluster policy in each country. Some of these agencies have implemented regular national cluster programs, while other agencies deal with cluster policies on a more general level; hence they have not formulated individual cluster programs. Part of the explanation behind the different numbers is to be found in the structure of the states included in the study. In some countries, cluster policies are not particularly relevant on a national level, but they are more relevant on a decentralized regional level. Federal states like Belgium, Italy, Switzerland, the UK, Spain and Turkey are particular examples. In the 31 countries covered by the study, a total of 75 national or state-level cluster agencies have been identified. With seven and eight agencies respectively, Ireland and Finland are the countries that have reported the most cluster agencies. Almost every cluster agency has a range of other tasks in addition to the national cluster policies. Only three of the reported 75 agencies have cluster policy as their only task. One of the few examples of agencies with cluster policy as its only task is the National Office of European Technology Platforms in Lithuania. This agency was founded in 2004 in order to create technology platforms and clusters in Lithuania.

The programs are financed from a variety of sources, but national budgets are the main source of financing, while EU budgets are involved in approximately one in five of the cluster programs. The national cluster programs in Europe have different foci:

- As for geographic coverage, almost all of the programs are national. Only seven out of a total of 69 programs have a regional/local geographical focus.
- 36 of the 69 cluster programs have no particular focus on clusters in a certain lifecycle. The cluster programs that focus on particular lifecycles of clusters tend to focus on emerging or embryonic clusters.
- As for policy sector focus, nearly half of the European cluster programs are classified as being related to either industrial & enterprise policy or science & technology policy. Approximately one in four programs is classified as related to regional policy.
- Nearly all cluster programs have private businesses as their target group. Hence, cluster policy is to a great extent designed to promote innovation in the European private sector. The other major target group is the research institutions – 40 of the 60 programs have R&D institutions as the target group. Only a minority of the European programs name training/education and public authorities as important target groups.
- Of the 69 national cluster programs, a particular focus on SMEs has been identified in 31 programs.
- The R&D involvement in the European cluster programs is high. 29 programs are classified as “high” in terms of R&D involvement. 18 programs are classified as “medium”, while only 11 of the 69 programs are classified as “low” in terms of R&D involvement.
- Half of the European cluster programs include an element of cross border activity. Only a minority is defined as primarily cross-border programs – but a large number of programs include export projects or other activities with cross-border elements.

A majority of the European cluster programs are based on a competitive application process. In 39 of the cluster programs, the selection process was a bottom-up process, while 28 programs have been more top-down oriented in terms of selecting the clusters. In 31 programs, financial support is the only support type. Eight programs only support the clusters with knowledge sharing/network building.

Cluster Initiatives (CI)

According to *The Cluster Initiative Greenbook*, cluster initiatives are defined as:

Cluster initiatives are organized efforts to increase the growth and competitiveness of clusters within a region, involving cluster firms, government and/or the research community.

Source: Sölvell, Lindqvist & Ketels (2003)

The Greenbook dealt with the territory between “organic” and perfectly “planned” clusters (see Figure 29). Cluster initiatives started to grow rapidly during the 1990s. Sometimes they were induced by national or regional governments, but quite often they were initiated by private firms that came together to enhance the attractiveness of the region, or to improve their own competitiveness through commercial collaboration. Cluster initiatives, or just clusters as some refer to these initiatives, became a *tool* for practitioners and policymakers.

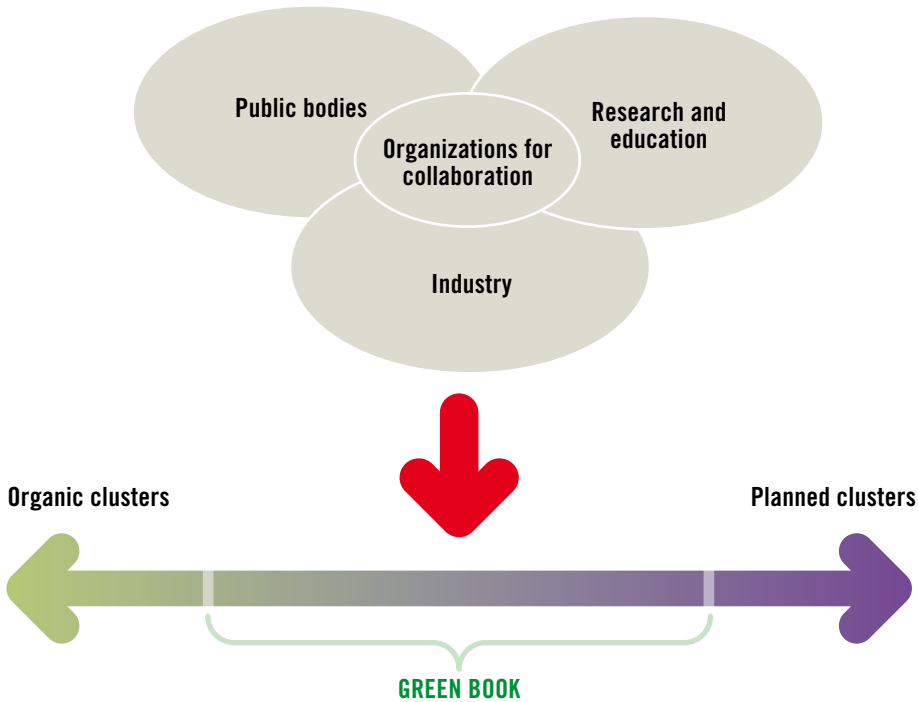


Figure 29. Cluster Initiatives in Between Organic and Planned Clusters

Objectives of Cluster Initiatives

Cluster initiatives involve a number of objectives. Typically, a CI involves several objectives in parallel. The six main objectives include:

- *Human resources upgrading* enhances the available skills pool and involves, for example, vocational training and management education. Such efforts can focus on different target groups of people. One type is intended to attract and retain students for the region – and sometimes, for selected sectors – to ensure the future supply of a skilled workforce. Another type targets managers through management training programs, typically not sector-specific. A third type is sector-specific vocational training and technical training.
- *Cluster expansion* aims to increase the number of firms, through incubators or by promoting inward investment within the region. One way of doing this is to promote the formation of new firms, and by attracting existing firms to the region. Incubators are popular throughout Europe and are therefore a vital element of cluster policies. They often combine provision of physical facilities with assistance in setting up business plans and financial plans, and help entrepreneurs get in touch with financiers and potential customers.
- *Business development* promotes firm operations, for example through export promotion.
- *Commercial cooperation* encourages firms to interact with each other, for example through joint purchasing or sharing services to reduce costs.
- *Innovation* objectives promote product, services and process innovation, for example through increased commercialization of academic research. There are two general approaches to innovation, and they are often combined. One is to promote innovation through enhanced cooperation and networking between firms. The other is to enhance cooperation between the business sector and the research/university sector in order to commercialize academic research.
- *Business environment* objectives, finally, aim at enhancing the microeconomic conditions for business, through improving the legal and institutional setting or improving the physical infrastructure. Improving the business environment means that conditions outside firms are improved. Business environment objectives therefore focus on issues that are in the hands of government, rather than working with firms directly. There are two main aspects of the environment that can be addressed: the physical/technical infrastructure, and the legal/institutional setting. In addition, regional branding is an objective that can be assigned to this category.

Success of Cluster Initiatives

Cluster initiatives differ widely in their profile: their setting, their objectives, and their organization. CIs also differ in terms of their performance, i.e., their impact on improving growth and competitiveness. Performance can be measured along three dimensions: improving the cluster's *competitiveness*, achieving cluster *growth*, and fulfilling the CI's *goals*. Below is a summary of the results from the Greenbook research.

1. Three dimensions of the setting in which a CI operates have a particular influence on its likelihood to succeed: the quality of the business environment, the structure and content of economic policy, and the strength of the underlying cluster.
2. Two aspects of the business environment have a particularly strong influence on the performance of the CI, measured by the successful attraction of new firms. One is strictly economic: the presence of an advanced scientific community and many strong clusters is an asset. The other is more cultural where a high level of trust between companies and between the private and public sector is positive for the CI.
3. Both the content of economic policy and the structure of the economic policymaking process are important for the success of a CI. Economic policies that secure high levels of competition, and promote science and technology, have a positive impact on CI success. A policy process that supports stable and predictable decisions and allocates important decisions to the regional and local level is also positive.
4. A strong tendency is that CIs serving strong clusters perform better, both in terms of increasing competitiveness and generating growth. CIs for clusters that are of national or regional importance are better at attracting new firms, and the same is true for clusters with: long histories, many companies, including internationally competitive buyers and suppliers, and exhibiting tight networks of buyers and suppliers. CIs seem to work best as “turbos” on existing clusters.
5. The CIs that have promotion of innovation and new technologies as an important objective are clearly more successful in improving competitiveness. Other similar objectives with a positive relationship to competitiveness are facilitating higher innovativeness, providing technical training and, to a lesser degree, analyzing technical trends and establishing technical industry

standards. There are also other direct or indirect approaches to increasing competitiveness: brand building and export promotion are both strongly related to improved competitiveness.

6. There is no evidence to suggest that a narrow or focused CI approach is better than a broad one. On the contrary, virtually every performance parameter (except the ability to meet deadlines) is positively related to having a broader range of objectives. Increased competitiveness, contribution to cluster growth and goal fulfillment all follow this pattern. Older CIs do not tend to have more objectives than younger ones, rather the contrary.
7. There are no significant differences in performance for CIs initiated by government, industry, or jointly. Both in terms of growth and in terms of competitiveness, these three groups have fared equally well. Nor is there any significant difference if they are grouped by main financing source. Government-financed CIs do not perform significantly better or worse than those financed primarily by industry or equally by industry and government. The only pattern emerging from the data is that the few CIs initiated primarily by the university sector have performed somewhat better in terms of improving ties between industry and academia, which is not surprising.
8. The findings are mixed regarding government actions on an initial stage to ensure the success of a CI. On the one hand, those CIs that went through a process of competing with other CIs to get government financing tend to perform better in terms of competitiveness, but not in terms of attracting new firms. On the other hand, if government bases its choice of which cluster to support with a CI on research identifying “attractive” industry sectors, this is related to better performance in attracting new firms, but not to increasing competitiveness. There are other types of government intervention, which have no significant effect at all.
9. Limiting the scope of the CI by aiming for a certain subgroup within the cluster as members does not help performance. CIs with most members within one hour’s travel distance, CIs with members on a particular level in the value chain and not their suppliers or customers, CIs avoiding having direct competitors as members, and CIs aiming at large companies rather than small ones have not performed better in attracting new firms or any other aspect of performance. Aiming for domestic companies rather than foreign-owned companies actually has a considerable negative effect on at-

tracting new firms and on improving international competitiveness. Limiting the membership scope to only large companies, one level in the value chain, or only domestic companies is a recipe for failure.

10. Having the right set of resources to work with is important for success. A budget that allows a CI to carry out significant projects without seeking separate funding is strongly related to attracting new firms, as is having an office for the CI. Many CIs have exchange experiences with other CIs. If this involves CIs in the same industry, but in other regions, this is connected to attracting new firms.
11. The facilitator is another factor that has importance for the success of a CI in terms of competitiveness. Facilitators that have deep knowledge of the cluster and a strong network of contacts contribute more to increased competitiveness. Disappointing CIs often have no office or an insufficient budget for significant projects.
12. The framework for a CI can be built based on the specific strengths and capabilities of the cluster in question or by using a more generic framework. The former is strongly related to better performance in increasing competitiveness. It also matters how this framework is shared with the parties involved in the CI. Those CIs that spend time and effort on sharing the framework are more successful. Having achieved consensus about what actions to perform is also related to improved competitiveness. Failure is strongly related to a lack of consensus, as well as to the absence of an explicitly formulated vision for the CI and quantified targets. In failing CIs the framework is not adapted to the cluster's own strengths. Framework issues are more important to competitiveness performance than to growth performance. All the above effects have a less pronounced relationship to attracting new firms than to increasing international competitiveness.

Cluster Initiative Challenges

Cluster initiatives are becoming a widespread instrument targeting clusters. Our analysis indicates a number of challenges that may limit the impact of these policies and programs.

- In some 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 the *low participation of larger companies* creates an implicit bias against foreign multinationals.

While these new efforts have benefits, there is evidence that full cluster effects can only develop if all types of companies are actively engaged, independent of size or ownership. The participation of companies is often limited to companies that have a direct need for the available government support.

- 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 engage the public sector in addressing the barriers to higher competitiveness and innovation that a cluster is facing. Even worse, some cluster initiatives are designed in a process that bypasses the regional governments. This 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, however, the cluster initiative will be less effective.
- At least some of the initiatives are focused on *emerging clusters where only a few companies* and maybe one research institution are present. While such efforts should be part of an overall cluster strategy, they are only one element in a portfolio of activities and will have limited impact and a significant failure rate. The cooperation of regional clusters is so far often limited to a general exchange of operational practices. While this is useful, it does not 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 often more potential lies 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 are less supported by specific cluster policies.

These challenges must be addressed in order to develop world-class clusters. Cluster initiatives involve different types of regional clusters that these policies target. Whereas some countries/regions focus on technology-intensive clusters, others put emphasis on capital- or labor-intensive parts of the economy. Cluster policies can be launched by prosperous regions with a strong business environment or by regions with significant weaknesses. Different policy challenges require different policy responses. The regions can be metropolitan with high population density, or rural with few inhabitants. Policy learning in the field of clusters should pro-

vide room for mutual learning, not by “copying and pasting” but by initiating a dialogue involving all relevant stakeholders in the region.

Let us now turn to the issue of evaluation. If cluster programs and initiatives are to succeed, and produce long-term results, they need to be monitored and evaluated, allowing feedback and improved action.

Cluster Program Evaluation

As cluster policies and programs have become part of the political toolbox, we have witnessed an increasing interest in evaluating the effectiveness of such policies and programs. Arguably the strongest “evaluation culture” exists in the U.S., both at a federal and state level. A strong evaluation culture is founded in rules and regulations specifying that implementation of new policies and programs demand the inclusion of long-term strategic planning, short-term (annual) measurable goals and evaluation to follow up on performance. Good and sound evaluation is important to both legitimize a new policy or program, and to facilitate learning from the process in order to improve it. In spite of a rapid increase in the number of cluster policies and programs, and thousands of local cluster initiatives around the world, we see very little evidence of serious cluster evaluation in our data. If cluster policy is to take a more central place within areas of regional, innovation and industrial policy, evaluation must come to the forefront in the construction and reconstruction of clusters across the world.

Critical Issues in Program Evaluation

Evaluation in the everyday sense refers to the process of determining the merit, worth, and value of something. In policy circles, evaluation is a mechanism for *monitoring, describing, and grading* ongoing or just-finished government interventions, such as policies, programs and projects. Public officials and other stakeholders wish to make rational, equitable and economical decisions. Therefore, evaluation work is necessary in order to find out and judge what happened after interventions were made. Here, we will adopt the following definition of evaluation in connection with cluster programs:

Cluster program evaluation is the careful assessment of the merit, administrative handling, and effects of ongoing or finished public interventions, with the intention to acquire greater knowledge and improve future actions.

What can be evaluated? The answer is almost anything. It can be a new policy, a reform, a plan, a program, or a project. Public interventions vary widely. Some are broad, others exceedingly narrow. Some are regular institutions that have been going on for decades, and may last indefinitely, others are projects expected to be finished at a set date. Some are very local in their scope; others intraregional, national, international or even global. Many are supposed to create uniformity, others to shape diversity from site to site throughout the country. Yet, however wide or narrow, long lasting or short lived, permanent or provisional, uniform or diverse, when evaluated they need to be described in some scheme of categories. It is essential that these portrayals do not render the interventions too idiosyncratic and situation bound.

It may be proper to describe the interventions in terms of their problems, ends and means. What is the substantive problem underlying the intervention? (See discussion on networking failures and information asymmetries in Chapter 5.) What are the causes of the problem? What are the future consequences of the problem if nothing is done about it? What goals are laid down in the intervention mandate? If several goals are set, how are they ranked? What range of policy instruments are incorporated in the intervention? Does the intervention entail regulatory, economic or communication tools of governance, i.e., sticks, carrots, and sermons, as it were? In case several instruments are involved, how are they combined? If only one type of policy instrument is devised – for example, regulations – what kinds of regulations are they? By characterizing interventions with this more elaborated terminology, evaluations will be more relevant and their findings more attended to and used.

Program evaluation is not only about data gathering and analysis on approved public interventions; it is also about the use of such findings by practitioners. Here, we will single out three important problems inherent in cluster evaluation:

- What should be evaluated? Do we focus on evaluating the program or initiative as such, or do we evaluate the impact on the cluster?
- How do we measure impact? By what value criteria should the merits of the intervention be assessed? By what standards can and should success or failure or satisfactory performance be judged?
- How do we identify real impact? To what extent is the outcome – immediate, intermediate and ultimate, intended, unintended – real effects from the intervention? Besides the intervention, what other contingencies or factors contributed to the outcome?

What is evaluated?

The first question to ask is what is evaluated and how. One approach is to evaluate the program or initiative as such. These evaluations tend to measure things such as number of meetings, extension of personal networks, and reports that have been carried out and presented. Other areas include member growth, press coverage and outreach.

A more constructive evaluation approach targets the cluster itself. Do actually firms perform better? Have there been spin-offs from the new incubator? Has the region increased its attractiveness? These are the critical questions to ask (see Figure 30).

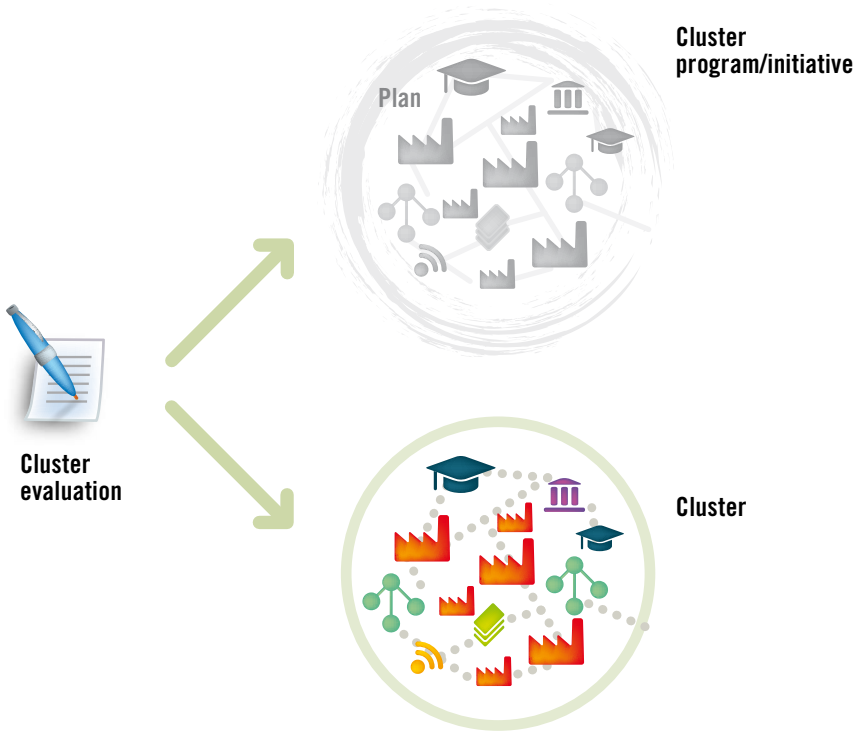


Figure 30. What is Evaluated – The Program/Initiative or the Cluster?

The methods involved in evaluation include interviews, logs, survey instruments, and official statistics. An inherent problem in measuring effects is the “ruler” problem. By what yardstick should we measure impact?

The Ruler Problem

A key process in evaluation is to determine the value or quality of the public intervention under appraisal. The quandary is: what constitutes a valuable public intervention and how can it be measured? This is captured by four exercises:

1. Identification of appropriate criteria of merit to be used in the assessment.
2. On the chosen value criteria, selection of performance standards that constitute success or failure.
3. Measuring the actual performance of the evaluand on each criterion and comparing it to each standard.
4. Decision whether or not to integrate the judgments into a single, overall appraisal of worth of the intervention.

Value criteria can be descriptive or prescriptive. In *descriptive* valuing, the evaluator chooses the values of others as criteria and standards. In *prescriptive* valuing, the evaluator herself advocates the primacy of particular values, such as justice, equality or client needs, regardless of whether these values are adopted by any decision-making body, or held by some stakeholder constituency. Furthermore, the criteria may have been determined before the start of the evaluation (*ex ante*), during the process of doing the evaluation (*ex nunc*), or after the evaluation is finished (*ex post*).

Aside from the general orientations to be adopted (descriptive – prescriptive, *ex ante* – *ex nunc* – *ex post*), the particular measurements preferred in each orientation must be justified. The most commonly used substance criteria, economic criteria and process criteria are listed below:

Substance criteria – what are the goals?

- Goals (effectiveness evaluation)
- Goals plus criteria for assessing side-effects
- Client criteria
- Professional criteria: peer criteria, self-criteria
- Stakeholder concerns and issues

Economic criteria – what are the effects?

- Economy (is it reasonably inexpensive)
- Productivity (ratio output to cost)
- Effectiveness (cost – benefit)

Process merit criteria – are achievement of goals balanced against legal equity, legitimacy, procedural fairness, and openness to public scrutiny?

- Legality
- Equity (rule of law)
- Legitimacy
- Procedural fairness
- Publicity (openness to public scrutiny)
- Client involvement
- Representativity
- Participatory democracy (public participation in final decision-making)

Source: Adapted from Vedung (1997, 2006)

Finally, the concerns and issues of all actors who have an interest in or are affected by the intervention can be employed as evaluative yardsticks. Stakeholders include agency management, middle staff, operators, intermediaries, recipients, concerned politicians from the government and the opposition, and so on. The stakeholders may constitute themselves as the evaluation team and carry out the evaluation, or, the evaluation is conducted by external evaluators (often consultants), who elicit the views of the stakeholders.

The Impact Problem

So how do we know that the cluster program has led to any effects? And that the effects are the same as intended? If there are unintended effects, are they within the target area, i.e., the cluster, or outside the target area? And, are the effects we measure caused by the program? Or are there other explanatory drivers? These are all critical issues in program evaluation (see Figure 31).

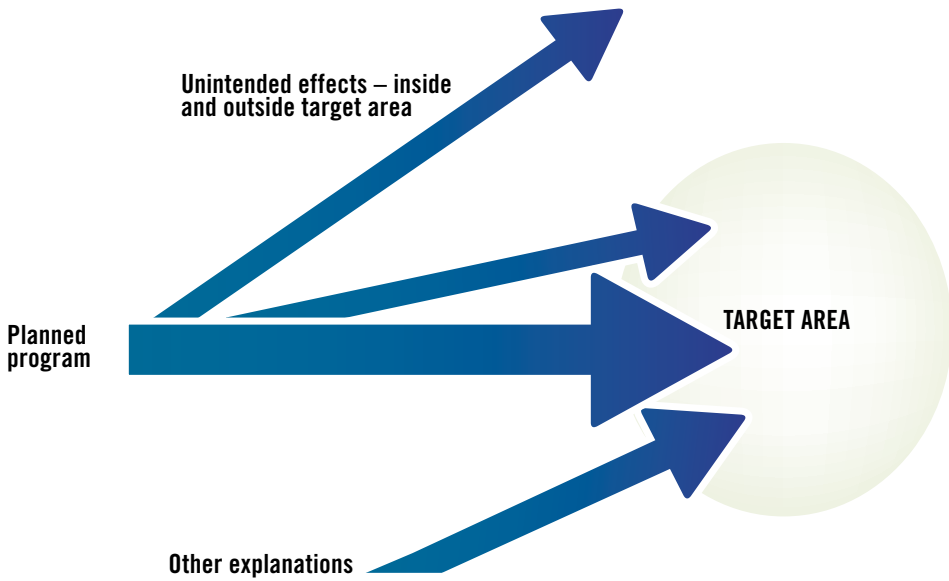


Figure 31. Planned and Unplanned Effects of Cluster Programs

On the one hand, every cluster program must have its carefully planned impact. On the other hand, with strict predetermined goals, there is a risk of blindness to unintended side-effects, some of which might be highly valuable, both inside the cluster itself, and potentially to the larger region. Public sector interventions invariably lead to consequences that were not foreseen in the original decision making process. It is a compelling duty of evaluation to map and assess unanticipated side-effects outside goal areas. Evaluators should always search for side effects. Preset intervention goals should be retained as the fundamental value yardsticks for the main effects. Without unanticipated side effects, there can be no preset intervention goals, so value criteria must be developed either during the evaluation process or ex post, when the evaluation is finished.

Intended and unintended effects are clearly manageable. A more difficult question is to delineate the effects from the cluster program as opposed to effects from other explanations. Surrounding explanatory factors include:

- General business cycle and market context
- Regional transformation (e.g., a regional crisis)
- Another program (originating from another ministry or agency)
- Cluster facilitator background and skills
- Any pre-history of cooperative initiatives (good or bad experiences)

An impact assessment attempts to determine to what extent outcomes are produced by the intervention, or by something else operating besides the intervention. Here, it is important to keep gross outcome and net outcome apart, where the gross outcome equals all outcomes including that caused by other factors than the intervention, while the net outcomes are those affected by the intervention. For those who take evaluation seriously, some form of control must be introduced. There are many types of controls:

- Experiments with randomized controls
- Experiments with matched controls
- Generic controls
- Reflexive controls
- Shadow controls
- Cross-sectional controls
- Process evaluation

Several of these control models are difficult to apply in the case of complex cluster programs. Let us point to the two most important. First, *generic controls* is a model where the intervention is compared to typical or average outcome scores before and after occurring in some reasonably equivalent larger population not covered by the intervention, and to which the targets can reasonably be said to belong to. For example, effects on a certain region following from an intervention can be compared to the country overall, or a particular cluster to other competing clusters. *Shadow controls* involves a model where the measured outcomes in the target is compared to the judgments of experts, program managers, staff, or participants, on what outcomes they believe would have happened without the intervention.

Evaluation in complex settings is often carried out as process evaluation. Process evaluation attempts to trace all kinds of intervention consequences, including intended effects, null effects, perverse effects, and side-effects, whether advertent or inadvertent. Process evaluation seeks to establish a whole pattern of interacting mechanisms between adopted interventions, their implementation, addressee responses, contexts and outcomes. Process tracing concentrates on evaluands in their natural surroundings. It is executed in close interaction with intervention managers, staff and participants. The evaluator seeks contact and interaction with those investigated, not distance and avoidance as in experimentation. Process evaluation does not shun hard statistical data, surveys, and questionnaires, but qualitative data assembly techniques, such as in-depth interviews, focus group interviews, textual analysis, and direct observation through site visits, are typically favorites.

Symbolic politics may influence implementation and results from evaluations. This is due in part to the fact that symbolic politics means that the intervention

is inaugurated for other purposes than to attain substantive results, i.e., to give an impression of being concerned without actually being so. Policymakers may want to satisfy party opinion or strengthen their own party leadership in order to keep party membership in line, to secure votes in general elections, or to facilitate government coalitions. Naturally, agency officials, low-level operators, and other official actors may perceive the symbolic content and devote less energy to implementation than they otherwise would have done.

Cluster Evaluation – An Overview

In this section, we explore the issue of how cluster organizations are evaluated in different countries. Our research shows that cluster organizations and policies are rarely evaluated and hence could benefit from the further development and refinement of such tools.

With the gaining popularity of cluster policies, programs and initiatives, one would expect a commensurate increase in evaluation activity. However, even in 2008, a Google search on “cluster evaluation” returns only a relatively small number of hits, and very few cluster evaluation reports are available online. As part of preparing this book, we conducted a simple survey of cluster evaluation. Data was gathered through a questionnaire sent by e-mail to some 50 cluster organizations, cluster networks and universities in 17 different countries. The questionnaire covered ten questions regarding the evaluation of cluster programs and initiatives. Of the 50 contacted cluster organizations, 20 stated that they were willing to participate in the study. Out of these 20 organizations, eight stated that they had not done any form of evaluation, seven did not answer the questionnaire and only five organizations answered that they had conducted an evaluation and could complete the questionnaire. The fact that only five organizations had conducted formal evaluations is an indication that evaluation indeed is a rare task among cluster organizations. From the answers we received, we could discern no universally held view on what an evaluation should focus on (see discussion above on the intervention problem). In our research, we have seen examples of evaluation of:

- International cluster programs (Europe INNOVA)
- National cluster programs (Innovation Norway, NRC Canada, Vinnova Sweden)
- Regional cluster programs (Regional Development Agency Ostrava, Clusterland Upper Austria, Scottish Enterprise)
- Local cluster initiatives (Swedish examples include: The Packaging Arena,

The Paper Province, Cluster of Steel and Engineering, Compare, Kingdom of Culinary Arts and Meals, Fiber Optic Valley, Future Position X, Triple Steelix, Destination Dalarna, Uppsala Bio)

Europe INNOVA was formed in 2006 and consists of 11 industrial cluster networks across the European space. The objectives of the program include the benchmarking of clusters, fostering of collaboration, and transferring of best practice in cluster initiative management. Coordinators of these European-wide networks reported positive results in 2008. Real evaluations measuring cluster impact have not been widely carried out to date. However, each network of clusters has evaluated the success of their own program activities. For national programs, Innovation Norway and NRC Canada have carried out impressive evaluation work. NRC could show improved access to research facilities and increased R&D activity for involved clusters. Other findings included increased attraction on highly skilled personnel and strengthened cluster networking activity. The evaluation of programs within Innovation Norway identified an increased awareness of the chosen clusters and an increased interest in cluster construction at ministerial and regional levels. Vinnova hired a group of innovation system experts to evaluate the whole program “Vinnväxt” (Vinnova Report 2007:11). Results were generally positive, including the competitive element, long-term financing and more business-led research, but the experts also pointed to a need for developing more international linkages, as well as a pressing need for innovation across cluster boundaries.

Clusterland Upper Austria organizes an impressive range of cluster initiatives and networks. Evaluation showed positive results for corporate cluster members’ growth as compared to industry averages. The evaluation also showed that the image of involved clusters improved, and public awareness of the needs of the clusters (such as lack of skilled personnel) increased. The evaluation led to several tangible actions, such as changed ownership of cluster organizations and higher rates of self-financing. Evaluations by the Regional Development Agency Ostrava showed that the program had increased the proportion of informed stakeholders in the region, increased benchmarking opportunities for cluster members, and increased visibility for the involved clusters.

NATIONAL AND REGIONAL CLUSTER PROGRAMS DOING EVALUATIONS

The National Research Council (NRC) Canada, is an agency of the Government of Canada, and the premier organization for research and development active since 1916. NRC currently funds 11 cluster initiatives which are supported through 5-year cycles of funding. Organized clusters involve:

- Vancouver – Fuel Cell and Hydrogen Technologies
- Edmonton – Nanotechnology
- Saskatoon – Plants for Health and Wellness
- Regina – Sustainable Infrastructure
- Winnipeg – Biomedical Technologies
- Ottawa – Photonics
- Saguenay Region – Aluminum Transformation
- Fredericton & Moncton – Information Technology and e-Business
- Halifax – Life Sciences
- Charlottetown – Nutrisciences and Health
- St. John's – Ocean Technology

Innovation Norway, operated by the Department of Trade and Industry, is responsible for the Norwegian cluster programs, Norwegian Centers of Expertise and Arena, and one sector specific program called Marine Value Creation Programme (MVP). Targeted sectors include: Energy and environment, Maritime, Oil and Gas, Health, IT, Creative industries.

The Regional Development Agency Ostrava (RDAO) Czech Republic was established in 1993 as a pilot project by the European Union to contribute to economic development in the Moravian-Silesian Region. The region is also owner of the agency. In 2003, RDAO founded the first cluster organization in the Czech Republic, the Moravian-Silesian Engineering Cluster. Organized clusters involve: engineering, wood, automotive, IT, renewable energy, and hydrogen technologies.

Clusterland Upper Austria was started in 1998 with an automobile cluster initiative that operated within the framework of the strategic program “Upper Austria 2000+”. Owner TMG is a service-oriented non-profit innovation agency. Five clusters and three networks are part of Clusterland Upper Austria: Automotive Cluster, Plastics Cluster, Furniture & Timber Construction Cluster, Health Technology Cluster, and Mechatronics Cluster. Networks include Design & Media, Human Resources and Environmental Technology.

Complexities in Cluster Evaluation

To evaluate clusters and cluster programs is a complex proposition. It is not just a limited investment project in one organization that is evaluated, but:

A set of objectives being implemented at the same time (HR upgrading, cluster expansion, business development, commercial collaboration, R&D and innovation and business environment upgrading), carrying out a range

of activities (contact brokerage, events, marketing, lobbying, monitoring and reporting), impacting a system of many linked actors, in direct and indirect ways that take decades to bear fruit.

Furthermore, some clusters are affected by several policy instruments in parallel, including regional policies, science and innovation policies and so on, and thus it is difficult to separate out the effects from a particular cluster instrument. Evaluations tend to be carried out within three to five years, and then few if any major effects on the cluster should be detectable, especially if the cluster is an emerging one. Nevertheless, it is important to follow up cluster programs and initiatives in order to see if intended effects are really materializing, and also to learn from the initiative so that actions can be taken to improve the instrument and the way it is carried through.

Many evaluations are mere pre-evaluations, where a report has been commissioned identifying and analyzing the underlying clusters and other general business conditions. This is typically one step in formulating a cluster program or a step in building up commitment for a cluster initiative. For example, the Nottingham City Bioscience initiative carried out this type of feasibility study in 2007 to ascertain if there was sufficient number of bio-science firms and activities in the region to form a cluster initiative. The study was commissioned as part of an EU project (CLOE) and was fed into an action plan and recommendation paper of the Nottingham City Council. The feasibility study led to the discovery of specialized service suppliers, and led to an increased awareness that an actual cluster existed and for which activities an initiative could be most supportive.

So why are cluster programs evaluated? The answers differ, but a first distinction can be made between evaluations that are prescribed by the policy or program, and those that are initiated from within the program or initiative. Most large cluster programs have built-in clauses that regulate when and how evaluations should be carried out. For example, the National Research Council Canada demands that every initiative must be evaluated after the program period of five years has come to its conclusion. Sweden's Vinnova requires that each cluster initiative must hire an external partner to follow the project and make evaluations. There are two other sides to the question as to why programs and initiatives are evaluated. First, member organizations feel compelled to find out about the effects from the program, partly as a means of determining whether they should maintain their membership. In this way, evaluations can also serve to legitimize membership and participation. Furthermore, government agencies handing out grants to cluster programs need feedback to guide future action.

Methods for Evaluation

There is often an inverse relationship between the importance of a certain type of data and its availability. Thus, proper evaluation can be associated with considerable cost. Evaluation of clusters (not the program or initiative) involves a multitude of data. Some examples include:

- Enhanced innovation (new product launches, private R&D)
- Increased research activity (patents, publications, etc.)
- New firm formation (incubator results)
- Job creation
- Sales growth
- Productivity growth
- Investments
- Strengthened cluster dynamics (membership, network meetings, communications)
- Attraction of new resources (inward FDI, skilled personnel)

It is helpful to distinguish between a survey model and an interview model. In the survey model, a large number of surveys are distributed, typically to members within the cluster organization. The interview model often reaches out to different stakeholders (members of the cluster organization, regional governmental bodies, industry associations, universities and others), soliciting opinions on the impact of the initiative. Primary interview data are sometimes complemented by reviews of secondary data, such as documents produced by the cluster organization or related actors (e.g., regional public and public-private organizations). Important documents constitute:

- Board documents and advisory and steering committees
- Cluster manager log
- Strategic plans for the cluster organization

Irrespective of the method of data collection that is used, it is important to guard against potential biases. Results from each type of respondent must be judged against self-interest and other potentially disqualifying conflicts. Different types of respondents are also likely to be more or less informed about the cluster and the initiative. The communication of results includes official reports (e.g., downloadable PDF files on websites), press releases and press coverage, and public and private presentations to financing organizations and other stakeholders. Below, we will present two cases of cluster evaluation, one that involved evaluating a larger regional program (Scottish Enterprise) and one that focused on a local cluster initiative (Uppsala Bio).

Evaluating a Cluster Program: Scottish Enterprise – Improving the Business Environment

Since devolution in 1999 and the establishment of the Scottish Parliament, Scotland has had responsibility for most of the issues of day-to-day concern to the people of Scotland, including health, education, justice, rural affairs, transport and economic development. The Scottish government has set out the key priorities in the Government Economic Strategy whose overall purpose is to drive “sustainable economic growth”. A key strand of this initiative is identifying priority sectors within Scotland that will help deliver that growth.

Scottish Enterprise (SE) is the main economic development agency of the regional government in Scotland. As such, they have a major role in helping deliver the government’s ambitions. SE’s strategic objectives include a particular emphasis on clusters and industries, focusing on:

- Maximizing the competitive advantage of *key industries*
- Increasing companies realizing their *growth potential*
- Helping more companies to exploit *new ideas*

Scottish Enterprise and Clusters

Scottish Enterprise was an early adopter of clusters as a policy tool, first undertaking major analysis in this area in the early 1990s. The organization has adapted and modified this strategy over the intervening years to reflect changing market conditions and industrial strengths both at home and worldwide. In 2005, SE undertook a review of clusters and industries in Scotland in order to better understand not only current strengths, but also the potential future impact and growth. The outcome of this review was the identification of six priority clusters where Scotland was already strong and where there was potential for significant global growth. These clusters were Life Sciences, Energy, Food and Drink, Tourism, Financial Services and Digital Markets & Enabling Technologies. In addition, a number of regional industries were also identified as being significant for certain parts of Scotland, but having less potential for growth (see Figure 32).

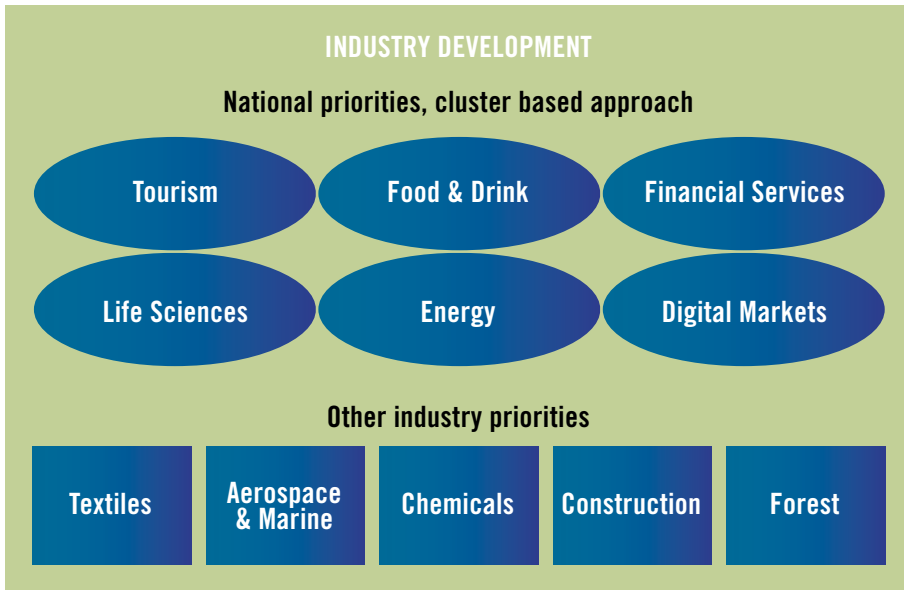


Figure 32. Priority Clusters in Scotland

Scottish Enterprise’s strategy is rooted firmly in working with the private sector and areas of academic research to build on Scotland’s existing strengths, address market gaps and opportunities, and exploit areas where Scotland has potential for growth and global significance. SE teams work with industry, government and other stakeholders to develop an overall vision and strategy for the sector which different players will help to deliver. As such, a key driver for evaluation is to measure the growth of those key sectors and identify SE’s role in stimulating and supporting that growth.

Evaluation Framework and Indicators

The growth of the priority clusters and their impact on the Scottish economy is evaluated by measuring the change in the performance of the cluster. In order to capture all possible impacts, the base lining has been designed to be broad, both in its definition of what comprises the cluster and also in the wider elements where impacts may be recorded. The evaluation covers three broad areas:

- Impact on company base. The evaluation tries to capture the difference made to the businesses within the clusters. This could be a direct effect for a company involved in a cluster, or indirect due to the spillover effect of cluster growth.

- Impact on the research base. The evaluation tries to capture the influence on research investments within the clusters.
- Impact on the cluster and the broader business environment. The evaluation tries to capture wider impacts on the cluster and improvements in the broader business environment (e.g., ability to access funding, skills available, market position, networks evolved).

Measuring impact on the company base was performed by using national statistics, either from Standard Industrial Classification (SIC) codes where appropriate, or by building “from the bottom up”. This latter process was very important for clusters where SIC codes are not appropriate (e.g., Life sciences, Energy – especially renewable energy – and Digital Markets). Whereas this approach does not afford a comprehensive picture of the clusters, national statistical records for the majority of companies grouped by sub-sector were matched, enabling the team to track changes over time of the growth of the sector. Early-stage and very small companies will always be missed by government statistics, but most established and growing businesses will be captured. This, therefore, was felt to be the most robust methodology for tracking cluster growth, and it could easily be repeated in subsequent studies. In addition, some specific sector studies were commissioned to analyze the global sector context and broader economic influences. Indicators used included turnover, employment, gross value added, and net capital expenditure.

Scotland has a very strong research record, with many universities and research institutes of international reputation. Many of the priority clusters have a strong research element. From an evaluation point of view, information was captured as to whether the cluster was successful in attracting funding and researchers to these subject areas. Working with the Scottish Funding Council (the main university funding body in Scotland), information was gathered on the following areas:

- Numbers of research assistants
- PhDs by subject area
- Funding/grants amounts and sources (e.g., government, EU, industry, charity etc.)
- Knowledge transfer metrics (e.g., spinouts, patents, projects with industry)

In addition, SE commissioned studies of the areas in which there were particular strengths in the research field in Scotland for the priority clusters.

Capturing baseline information on companies and research for a cluster so that changes can be tracked is a relatively straightforward approach to cluster evaluation. However, in order for a business to grow, it must be able to access the

necessary external resources and operate within a supportive business environment. This element of the evaluation was designed to try and map the components of a business environment that work external to an individual company, but may have an effect on the ability of that company to grow.

There are many different assets or resources that a company needs to draw upon to support its growth and these will vary at the different stages of its life cycle. The more rapidly a business grows, the more assets it requires; finance, strong management and skills, technology, effective networks, market knowledge and good infrastructure are all key components of sustained growth. Increasingly, the competitiveness of global markets means that businesses need to be able to respond rapidly to take advantage of an emerging opportunity. The environment in which businesses operate is a key driver of their ability to succeed. Businesses that are in an environment that makes it easy for them to grow and take advantage of opportunities are much more likely to be successful. Many cluster interventions focus on building that kind of supportive business environment. External factors that were identified in this analysis and were shown to affect business growth include:

- Money (Financial capital)
- People (Human capital)
- Things (Physical capital)
- Know-how (Intellectual capital)
- Global positioning (Market capital)
- Growth of networks (Social capital)

All firms draw on these assets. However, it is likely that companies undergoing a period of growth will draw more heavily upon these resources. For large companies, these needs may be able to be serviced from within the company by channeling internal resources to support growth. However, small and medium-sized companies generally acquire these resources from external sources, making them more dependent on the business environment in which they operate. In addition, the growth of certain sectors may mean that there is a shortage of certain assets due to high demand. It is important, therefore, that Scotland has a supportive environment in terms of the availability of these key resources, both generally and cluster-specific, to enable its companies and clusters to grow. Scotland has both strengths and weaknesses in its business environment, and these will vary across sectors.

The first stage in understanding the business environment was to clearly define what was meant by these different components. Both quantitative and qualitative data were gathered to establish the current picture of the business environment, including the cluster dimension. Through this work, a snapshot of the current

operating environment for the priority clusters within Scotland has been developed. This enabled the strengths and weaknesses of the Scottish business environment to be highlighted, across clusters, which helps with strategy development and project prioritization. The process of addressing weaknesses in the business environment (e.g., access to finance, skills, infrastructure etc.) should help companies be able to grow more successfully.

Indicators Used for Business Environment Mapping (BEM) Study

A broad range of information sources was used for the BEM study. When possible, the study drew upon readily available public data in order to ensure the repeatability and reliability of the sources. It also meant that those leading the study were able to maintain a beneficial overview of the information being gathered. Examples of data sources used include:

- *Funding – financial capital*
Current picture of equity investment, including levels of investment, active investors. Indicative time and costs to commercialization.
- *Skills and recruitment – human capital*
Recruitment challenges and skills requirements (employers survey). Number and type of graduate numbers. Occupational level and salary average.
- *Assets and infrastructure – physical capital*
Mapping physical assets including incubator centers, test rigs, support labs, etc. Transport and other infrastructure.
- *Intellectual assets – knowledge capital*
Innovation and R&D performance in Scotland compared to OECD competitors. IP landscape for Scotland.
- *Global market position – market capital*
Success or failure information on foreign direct investment and exporting levels.
- *Networks – social capital*
Study of industry organizations and inter-organization joint working. Social network analysis.

These data was then used to map the strengths and weaknesses of the business environment components for each cluster at different stages of development. This analysis was included because a company tends to draw on the business environment in different ways at different times during its existence. New ventures, for example, may have very different needs for skills, finance or business accommodation than will a mature company. Particular issues can then be highlighted for these different stages.

The analysis was also discussed and fed back to cluster groups to compare evidence gathered versus perception viewed from businesses. In addition, a measurement framework has been developed to gather evidence towards the evaluation on an ongoing rather than a periodic and historical basis. More importantly, this helps to measure the performance of interventions. Case studies and survey analysis also gather evidence of SE's contribution to these changes in sector performance.

Exploring Social Capital

Social capital has proven to be the most difficult area to define and to measure, and yet it is probably the most important area for determining cluster growth. Social network analysis was one method used to try and capture this area, yet even this approach has its limitations. SE has subsequently undertaken a study that endeavors to use system thinking methodology to map the sophistication of linkages and collaboration that grows as a cluster matures from being a collection of associated companies to being a truly dynamic environment for growth in a sector.

One challenge is that much of the analysis of the industry sectors only gives a “snapshot” of a cluster, rather than explaining in detail how the cluster operates. Often, it is the system dynamics that have a bigger influence on success of the sector. In order for a clusters approach to be successfully implemented, an in-depth understanding of the dynamics, interrelations and influences of different interested participants needs to be achieved. Government policy interventions can then be targeted to help these dynamics work for the positive growth of the cluster.

SE had identified this aspect of interrelations and dynamics in cluster development as an area of potential research. Beginning in the fall of 2006, SE worked with system thinking experts to build a systems theory approach into an understanding of cluster development. The outcome of this work was a five-stage theoretical model that helped explain how a successful cluster would develop and the changes in behavior and company interaction that might be seen at each stage. The use of this model, including the accompanying descriptions and questions, has been tested and implemented with international partners in a diverse array of regions. There has been widespread interest among cluster practitioners and policymakers in developing this kind of cluster evaluation. Some of the main issues identified include:

- A distinct lack of tools to assess cluster interrelations and dynamics
- The ability to identify the correct interventions for cluster development
- The ability to use this type of assessment to promote strategic conversations with cluster members
- An ability to learn from others internationally who are using the same approach

From the model, a methodology involving a structured questionnaire was developed to help teams analyze performance of their particular cluster. It should be noted that this analysis was carried out in addition to more traditional indicators of cluster growth and performance, e.g., employment, number and size of companies, exporting levels and gross value added. Overall, this approach has proved to be a useful tool in assessing the stage of development of a cluster. The model was felt to be helpful in describing how a cluster has developed, and most importantly, in identifying the interventions that should be made in order to encourage and support that development. Although effectively a self-assessment process, this approach enables the cluster to evaluate the level and depth of cooperation, and to track progress over time.

Key Lessons

Key lessons from the evaluation include:

- Although this broad evaluation approach is relatively time consuming, the methodology has helped build a substantial amount of knowledge and expertise about the priority clusters. As such, it is being used to feed into strategy development, as well as to inform cluster plans on an ongoing basis.
- This has proved a fruitful way of analyzing the broad impacts of a cluster, going beyond (but not forgetting) the usual measures of company numbers, etc. The Scottish Government head of analytical services described the business environment mapping (BEM) methodology as “using hard data for soft issues”. As such, it is now being used for evaluations across SE, and has helped develop a common vocabulary in which to discuss the importance of a supportive business environment.
- Communicating and making the analysis relevant to those working in the clusters has helped to operationalize the model, such that it is now seen as an essential part of strategy formation and implementation. This has helped make ongoing tracking of the cluster growth an important issue and one with which cluster practitioners and those responsible for policy are keen to engage.
- It is worth noting that this analysis was carried out using information and data to give the most comprehensive picture possible. It was only when the study was complete that the evaluation team discussed the findings with industry groups to explore and confirm the preliminary observations. Overwhelmingly, the response was that the outputs resonated with what the companies had experienced. This sequential approach ensured that the evaluation was data-driven, rather than perception-driven, and as such, more robust and repeat-

able for tracking progress. However, where there was a mismatch between the data and industry perception, this disconnect was explored further, as poor perception itself can be a barrier to growth.

- As the number of clusters being analyzed increases, it is possible to review the mapping to see if the same weaknesses are being identified. This would suggest that this area is a weakness for the Scottish business environment, rather than a cluster issue. For example, there are indications that early stage finance is a common issue.

Regarding the evaluation process, SE has learned the following:

- *Clear strategy and objectives.* It is essential to have clear strategy and objectives for a cluster program, and to evaluate that strategy rather than just the individual interventions. Objectives must be focused and not too broad, as overly broad objectives are very difficult to evaluate.
- *Top down and bottom up.* To effectively evaluate the strategy, there needs to be a mixture of top-down and bottom-up analysis, looking at how the cluster has changed in performance and business environment over time, and also seeking to determine the ways in which the delivery outputs from individual projects have contributed to this change.
- *Hard data and soft indicators.* Although hard data on cluster performance is important to be able to track progress in a robust and repeatable way, interactions in clusters are key in understanding the success of a cluster and so must also be included in the analysis.
- *Analysis versus perception.* A combination of analytical techniques is required, including the use of surveys, narrative stories and case studies to back up and substantiate – but not replace – hard data analysis.
- *Difficulty of counterfactual.* When trying to grow a cluster in a region, it is almost impossible to isolate a usable control group without moving so far away from the analysis group that the basis of comparison becomes too tenuous. As such, there is the need for a wide baseline at both a sector and a case study level to be able to identify attribution.
- *Use baseline to inform strategy and interventions.* The additional benefit of developing broad baselines as part of the evaluation approach is that they provide valuable information that can immediately feed into strategy and interventions. By analyzing the strengths and weaknesses in a cluster, evaluators can form a robust evidence base to inform strategies, to build on opportunities, and to remove barriers to growth.

Evaluating a Cluster Initiative: Uppsala BIO – Understanding Diverse Perspectives

Selected by Vinnova, the Swedish Governmental Agency for Innovation Systems, as one of three grant recipients of the national Vinnväxt cluster program, Uppsala BIO, the Life Science Initiative, was started in 2003 to improve the Uppsala region's competitiveness in biotechnology. The initiative dates back to a pilot project in 2001 that observed that collaboration between industry, research, and public policy needed to be increased in order to promote the region's long-term growth in biotechnology. Through the Vinnväxt program, Uppsala BIO will receive a package of financial support for a period of ten years (up to 10 MSEK per year for up to 10 years, to be matched by an equal amount from regional sources).

An important principle of Uppsala BIO's operating strategy has been to develop a means of measuring progress in its key activities, since measurable project goals are a critical part of assessing progress and success in any project. In its original strategy document, Uppsala BIO specified a few quantitative goals: 1) doubled employment in biotech-related positions (with the specific goal of moving from 4,000 to 8,000 employees), 2) an increase in the number of biotech researchers at Uppsala University and at SLU from 900 to 1,500, and 3) an increase in the region's gross regional product of 6 percent on average per year. While these may be relevant performance indicators for the cluster as a whole, it is difficult to determine, however, what effect Uppsala BIO has on the numbers measured by these indicators. These concerns are especially significant since Uppsala BIO typically collaborates with and supports an already established actor in the cluster through the providing of resources in return for the ability to place certain demands on the actor's activities, as opposed to initiating and leading its own activities.

Evaluation Method

Thus, the challenge for Uppsala BIO has been to develop relevant performance indicators that can readily be measured. These may not necessarily be based only on objective data, but they might also take into consideration the subjective opinions of Uppsala BIO's activities. As such, one action that Uppsala BIO has undertaken is to conduct a biannual survey of the region's actors. The first survey was conducted in 2004, the second in 2006, and the third in 2008. All the surveys have included questions that have looked at the perception of the cluster's competitiveness, strengths, and weaknesses; the degree of informal and formal interaction between various sets of actors; and expectations on and satisfaction with Uppsala BIO and its activities.

Of considerable interest is that the focus of the survey has changed with each

new version. In 2004, the focus was on creating a baseline understanding of the perceptions of individuals within the Uppsala biotech cluster of the cluster's competitiveness, as well as of their expectations on Uppsala BIO. The 2006 survey then focused more on evaluating the direct effects of the initiative by measuring people's opinions of the activities to date of Uppsala BIO. Finally, the 2008 survey was focused on the more indirect effects of Uppsala BIO, evaluating the cluster initiative as an agent of change by measuring the impact of Uppsala BIO on the attitudes and behaviors regarding competitiveness of individuals in the cluster.

In each of the surveys, we assessed a pool of individuals from the government, academic, and business sectors using an Internet-based survey tool. Respondents were gathered from desk research on cluster actors, as well as from the mailing list of Uppsala BIO, with the respondent pool growing significantly with each survey to include individuals outside the sphere of Uppsala BIO. Response rates were as follows: 43 percent in 2004, 35 percent in 2006, and roughly 20 percent in 2008. With few exceptions, the questions were based on a seven-step Likert scale (ranging from 1, "strongly disagree" to 7, "strongly agree").

Results from the 2004 Uppsala BIO Survey

The major finding in this survey (see Teigland & Lindqvist, 2007 for a more detailed analysis and report of the 2004 survey) is that there are significant and consistent differences between the private (industry) and public (academia and government) sectors of the competitiveness of the Uppsala biotech cluster, as well as on expectations of Uppsala BIO (see Table 1). To evaluate the cluster's competitiveness, we developed questions based on Porter's diamond model, as well as on the overall perception of the competitive position of the cluster. The public sector respondents consistently rated the cluster competitiveness variables more highly than did the private sector respondents. Moreover, the public sector's positive perception of the cluster's competitiveness is particularly evident for the variables related directly to the performance of the public sector itself. For example, differences for factor conditions were pronounced regarding the effectiveness of local and national government, the physical infrastructure, the responsibility of the public sector, and the quality of the training provided by universities, which are public.

As seen in Table 1, again we find that the public sector consistently has a more positive outlook and a greater appreciation of the competitiveness of the local cluster as well as of the competitiveness of the combined biotech activities in the wider region. Furthermore, the public sector perceives the Uppsala cluster as significantly distinct from the neighboring clusters. A discussion of these results with the steering committee further revealed that the sectors had differing timeframes as

to when they expected to see results from the cluster initiative. The public sector was eager to see results in terms of new jobs and companies; however, the private sector had a longer-term perspective due to its experience that it often takes years to convert research results into jobs in the biotech industry.

Table 1. Significant differences in perceptions of cluster's strengths, weaknesses, and competitive position (Public sector > Private sector)

	Public >Private difference
Factor conditions	
Effective national government	***
Effective local government	***
Advantage of local/regional government	***
General physical infrastructure	**
Quality of recruitment from Stockholm universities	**
Quality of recruitment from Uppsala universities	*
Demand conditions	
Demanding Swedish regulatory standards	**
Swedish demand for new features	**
Demanding European regulatory standards	*
Context for firm strategy and rivalry	
Cooperation – companies with regional financial institutions	***
High number of local/regional competitors	**
Cooperation – companies with IFCs	**
Fierce local/regional competition in the cluster	**
Effective local IFCs	*
Cooperation – companies with academia/healthcare	*
Cooperation – companies with regional government	*
Ease of domestic start-up establishment	*
Cluster's competitive position	
Competitiveness of the Uppsala cluster	***
Uppsala-Stockholm region's world leadership	**
Uppsala's cluster distinct from Stockholm's cluster	*
Uppsala's cluster's share of regional employment	n.s.
Cluster's level of innovation	
Methods and tools for discovery	**
Diagnostics	*
Life sciences in general	n.s.
Drug discovery and development	n.s.
Health food	n.s.
Stem cell research	n.s.
Significance level: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, n.s. not significant	

Results from the 2006 Uppsala BIO Survey

Echoing the results from the 2004 survey, again we find a clear disparity in the results based upon the sectors (see Teigland, Hallencreutz, & Lundequist, 2006; Lundequist & Teigland, 2008 for a more detailed description of Uppsala BIO's first years, as well as the results from the 2006 survey). For this survey, we further broke down the public sector into government and academia subsets. In so doing, we found some interesting results regarding the opinions of Uppsala BIO and its activities. For example, the survey included 14 statements about Uppsala BIO's impact on the cluster in various areas during the previous two years (see Figure 33).

Respondents agreed that Uppsala BIO had made an impact in half of the areas. Looking more closely at these seven statements, we find that these represent the four areas focused on by Uppsala BIO: 1) to promote cross-disciplinary biotech research, 2) to strengthen the region's innovation system through activities such as an incubator, 3) to ensure a long-term supply of relevant competence to the region, and 4) to improve the region's national and international visibility.

A further analysis revealed that the average response across the government, academic, and business sectors was above 4.0 (neutral) for all these statements, with the government sector again measuring as the most positive. However, while respondents felt that Uppsala BIO had made an impact in the above areas, they did not feel that Uppsala BIO had positively impacted the level of patent applications, investment, companies, skilled labor, jobs, and salaries. Moreover, we found that both smaller companies and those that were not yet generating revenues were more negative to the impact of Uppsala BIO.

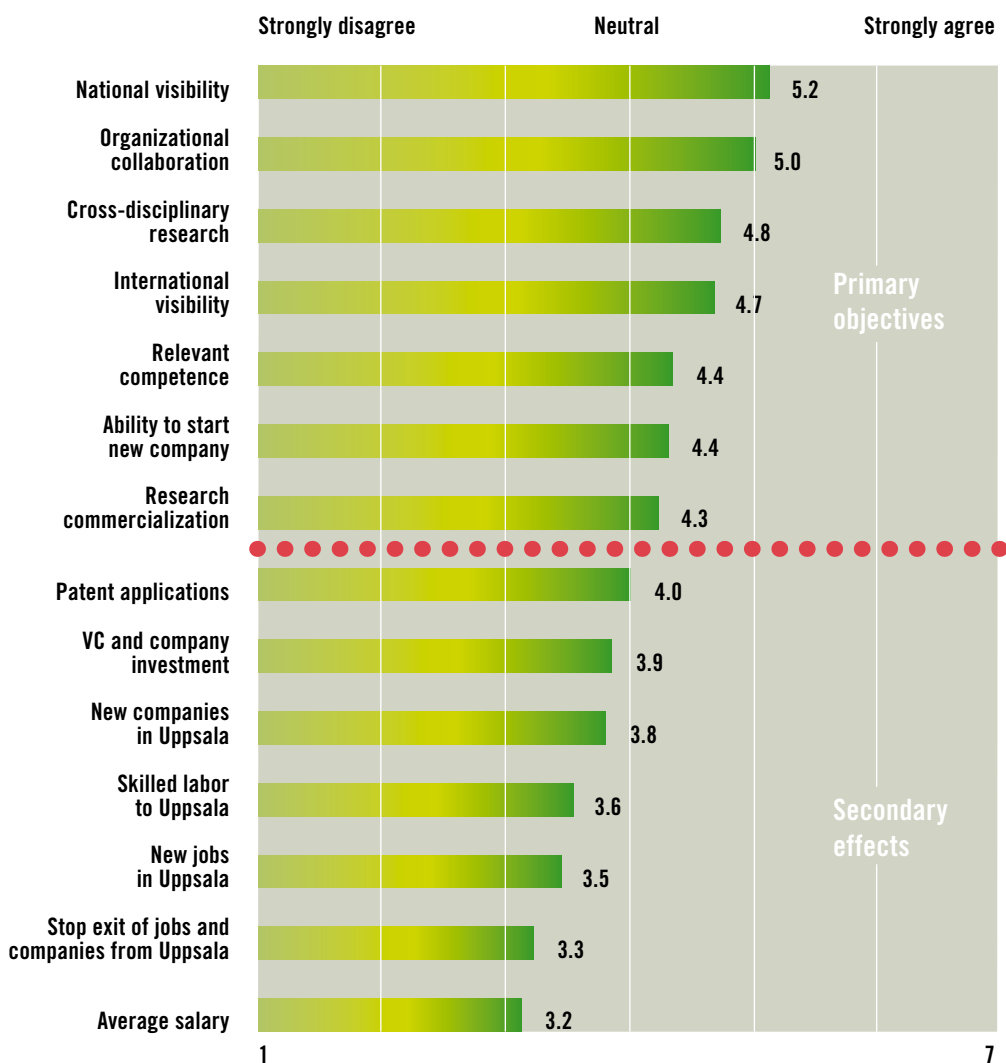


Figure 33. Impact of Uppsala BIO in 14 Selected Areas

Respondents were also asked to answer a set of questions regarding Uppsala BIO's activities. The general response was that the organization's activities were seen as valuable; however, a further analysis showed that the relative value of each activity varies greatly by sector and by degree of involvement on the part of the respondent in Uppsala BIO (see Figure 34). For example, the Bio-Pubs (periodic networking events) were seen as among the most valuable for individuals from the business sector, yet among the least valuable for individuals from the academic and government sectors. This difference was further emphasized in a comment from

one respondent, who said: “I have been to several meetings organized by Uppsala BIO, but as a university professor, I feel really out of place among all those young businessmen in suits. As a natural scientist, who am I supposed to speak with?” Creating an awareness of the differing demands of the various groups within the cluster has been extremely valuable for Uppsala BIO, enabling them to gain a better understanding of the operational challenges it faces while improving and fine-tuning their activities and communication regarding these activities.

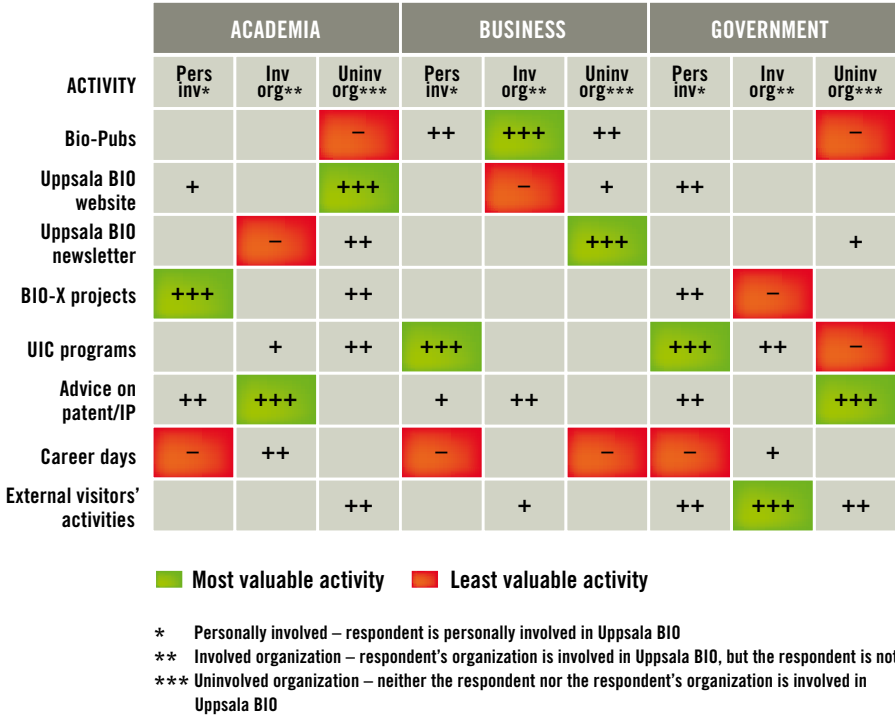


Figure 34. In-depth Analysis of Uppsala BIO Activities

Throughout the 2006 survey, government sector respondents provided the most positive answers, followed by academic and then business sector respondents. In general, younger companies had a more negative opinion of Uppsala BIO as expressed in lower expectations of Uppsala BIO, a sense that Uppsala BIO’s vision and objectives are less clear, a view that the organization uses its resources poorly, and a belief that Uppsala BIO has made only a minor impact.

Looking forward, we also asked respondents in an open-ended question what they viewed as the biggest threats to Uppsala within the next five years (see Fig-

ure 35). The two largest threats indicated were insufficient financing (24% of the answers) and the exit of existing companies from Uppsala (16%). In a set of questions from the Flash Eurobarometer 2004 on Entrepreneurship Report (Flash, 2004) that looked at Uppsala's entrepreneurial climate, lack of financial support was identified as the biggest barrier to starting a new company. As one respondent indicated in a comment field, financing is an important area that requires more attention: "Promoting inflow of venture capital is by far the most important activity for the long term survival of a cluster like Uppsala. Without money no new companies can emerge, it is that simple! All other activities are just glazing the cake!" While Uppsala BIO was aware of the second threat, the fact that insufficient financing was regarded as the largest threat came as a surprise to the initiative. This result led Uppsala BIO to make a concerted effort to coordinate and communicate the financing activities offered by various actors in the cluster.

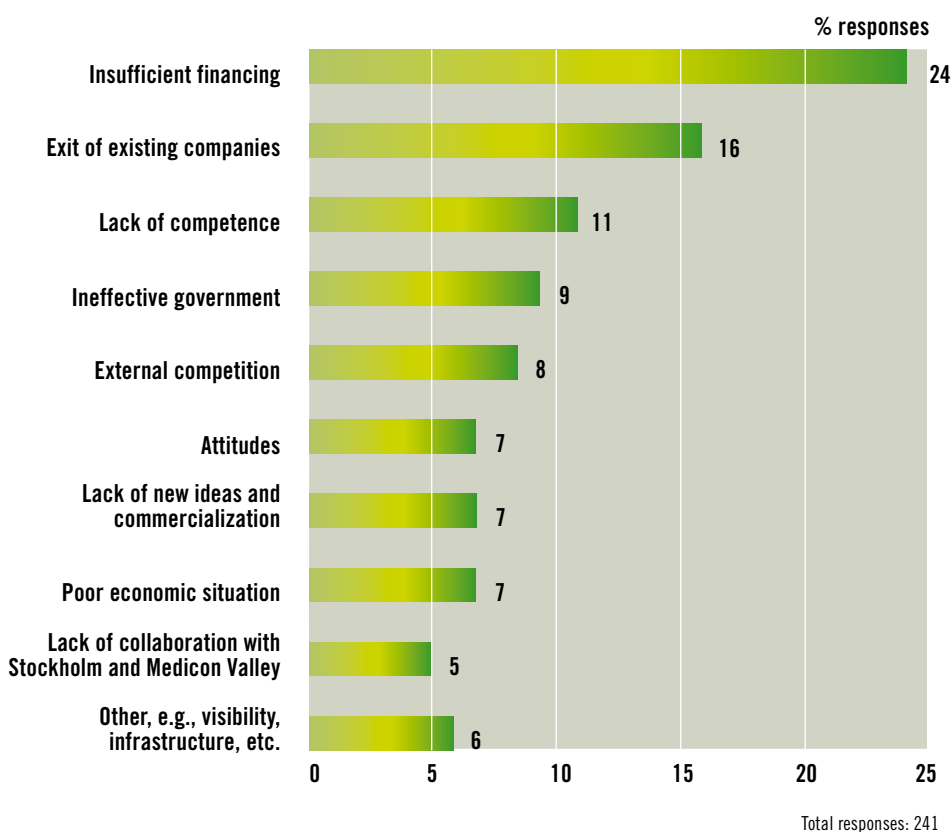


Figure 35. Biggest Threats to the Uppsala Biotech Cluster in Next Five Years

In summary, our findings clearly indicate the importance of evaluating a cluster initiative:

1. in real time
2. on a regular basis
3. by an external party

Without these evaluations, Uppsala BIO would not have had sufficient information on which to refine and refocus its activities, more than likely taking actions to correct its efforts based on only “gut feelings”. Moreover, having an external organization conduct these evaluations also provided a more objective view of the initiative and of the cluster. We were able to challenge the initiative’s assumptions about the cluster and its activities, as well as to encourage discussions on issues that may have been missed or even avoided by the initiative. On several occasions, issues that were not deemed as relevant by the initiative were brought to the surface through this external evaluation, eventually resulting in actions taken by the initiative to improve its efforts. Our results clearly highlight the need for a focus on evaluation by policymakers when designing cluster programs.

Chapter 7

Cluster Reconstruction: The Paper Province, Värmland and North-mid Sweden

Värmland is a region in North-mid Sweden. Traditionally, forestry, mining and steel have been strong sectors in Värmland, and many large companies were built around timber, paper, steel and engineering products, often with extensive exports. During recent years, food, ICT, packaging and design as well as tourism have emerged as other important clusters within the region.

Background – The Cluster Initiatives Take Form

Local cluster initiatives first began to take form in the late 1990s. The Paper Province (pulp and paper particularly within the field of packaging) and Compare (IT and service sector) were early initiatives of this type. The cluster initiatives were based on cooperation between firms, public bodies and institutes of higher education, and have been set up around already strong clusters such as pulp and paper, packaging, steel and related manufacturing, IT and processed food. Today there are five cluster initiatives that are supported financially by Region Värmland (a federative organization of 16 local municipalities within the county and the County Council), the County Administrative Board and Nutek, the national agency for economic and regional growth. The University of Karlstad, located in the regional capital, is also an important partner.

CLUSTER INITIATIVES IN VÄRMLAND

The Paper Province

The Paper Province coordinates and develops cooperation between firms and organizations within the paper and pulp cluster in Värmland and neighboring areas.

Compare

Compare Foundation Karlstad conducts business and competence development within IT and telecom, and offers services to associated companies.

(cont.)

Kingdom of Culinary Arts and Meals

The efforts being invested in the Kingdom of Culinary Arts and Meals drives the development of the region's experience and food cluster initiative.

The Packaging Arena (TPA)

TPA offers cooperation between companies, researchers and designers in Värmland, where consumer needs are transformed into new packages and services.

Cluster of Steel and Engineering

The Cluster of Steel and Engineering supports the steel and manufacturing industries in the region in their cooperation with other regional players.

The cluster initiatives in Värmland are strongly company-driven – most of them having been initiated by industry – and are based on the companies' need for mutual expansion efforts. The initiatives serve as a platform in which companies meet and cooperate across borders with public bodies and academic life. The cooperation between companies and the University of Karlstad has strengthened applied research and increased commercialization of research results.

By taking part in the European cluster cooperation CLOE – Clusters Linked over Europe – the Värmland cluster initiatives have also contributed towards the cluster companies' ability to find new markets and business opportunities.

Reconstruction of a Mature Cluster

Clusters evolve from both evolutionary and constructive forces, and the clusters in Värmland are no exceptions to this. The pulp and paper industry in Värmland started to grow during the nineteenth century due to natural factor advantages such as access to timber, energy, and efficient river transportation. As the number of pulp and paper mills grew, the region soon attracted process equipment and other suppliers, making Värmland a unique center for process innovations that would later come to be used by the pulp and paper industry all around the world. Factor conditions, structure and rivalry, demand conditions and related and supporting industries – all parts of the diamond model were in play.

Using the four cluster perspectives from Chapter 1 to describe the pulp and paper industry in Värmland during the latter years of the 20th century, illustrates a situation with a strong co-location of key actors in a mature industry. Still, few, if any, early observers recognized the pulp and paper industry as a cluster. As such, there were no explicit plans, strategies or policies aimed to foster, grow, or otherwise impact the cluster. So far, the cluster was mostly a result of evolutionary forces.

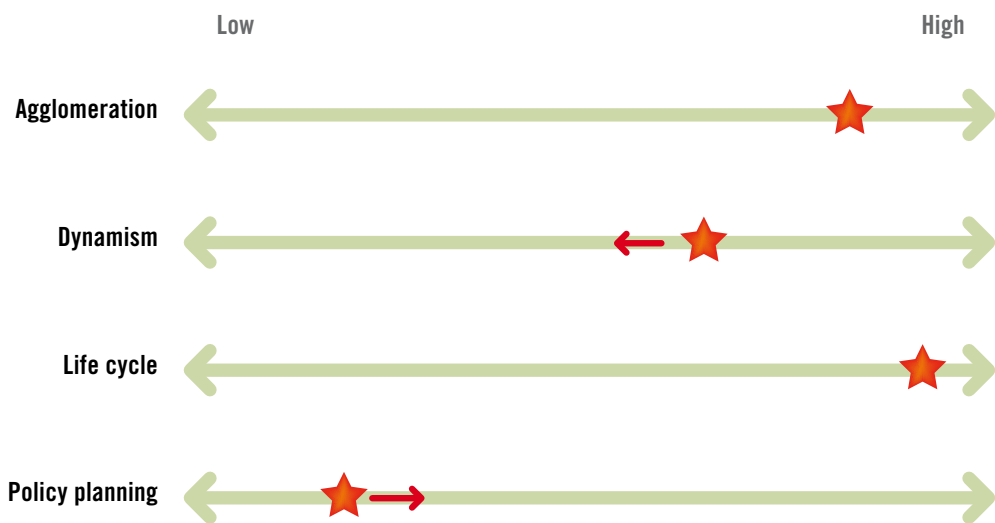


Figure 36. The Pulp and Paper Cluster in Värmland in the 1990's

Motivating Forces Behind the Cluster Initiative

In the mid-1990s, the challenges for the pulp and paper industry increased. Decreased competitiveness, a need for specialization, and increased competition all resulted in structural changes within the mature industry. At the same time, companies were experiencing difficulties in attracting skilled labor to the industry. It was during this tumultuous period that Sune Nilsson, an official at one of the municipalities in Värmland, started to map all of the pulp and paper companies in the region, and their linkages. On a whiteboard, he wrote down all companies he knew of and started to explore how they were connected, the relationships they shared, and how they were doing business with one another.

At an industry gathering, Sune Nilsson later met Clive Voukes, general manager at the Wales Development Agency, and previously at the British Ministry of Enterprise, who had been invited to the conference to talk about clusters. Having seen Nilsson's cluster map, Clive affirmed that it looked like one of the most powerful clusters he had ever come across: "People would kill for this in Europe, and you have it all in front of you – the question is, what you are going to do about this?" This input lent credence to the idea that the industry's challenges could be addressed jointly, which in turn encouraged seven companies to come together to form The Paper Province, Värmland's first cluster initiative, in 1999. The combination of evolutionary and constructive forces had begun.

Increased Dynamism Strengthens the Region

In the early days of its existence, the Paper Province aimed mainly to market the region's pulp and paper industry, as well as to support development through a reliable provision of competence. However, the interest in the cluster initiative grew quickly. By 2002, 25 member companies jointly owned the organization. Soon, more focused plans for the cluster initiative were developed, including strategies for project development and regional growth. As demonstrated in Chapter 1, dynamic clusters offer an environment where different resources can quickly be reshuffled and restructured, allowing for new and better combinations. An example of this occurred within the ranks of the Paper Province in 2003.

Organizational changes within one of the Paper Province's member companies, a global leader in pulp and paper technologies, resulted in a scenario where one of the company's pilot machines for developing paper products probably would be moved abroad. Through the cluster initiative, and after contacts with and support from different regional and national public bodies, Paper Province bought the machine and started an independent industrial research and development company, the Packaging Greenhouse. The Packaging Greenhouse offered pilot machine trials, paper testing, education and other services. This move prevented a loss of jobs and important capabilities were rescued. The pilot machine, previously used only by its owner, now became an asset for a larger number of companies in the region, including a number of SMEs. Since that time, the occupancy rate of the machine has continuously increased. The Packaging Greenhouse has become an important meeting place, which has led to cooperation between the pulp and paper cluster and the University of Karlstad, and has also helped to attract new companies to Värmland. The Packaging Greenhouse has had a positive impact on all aspects of business development, user-driven research, entrepreneurialism, as well as the provision of skilled labor. Other cluster initiatives in Värmland have followed suit and developed their own test facilities.

The Rise of the Värmland Model

As the Paper Province initiative has grown, it has led to increased dialogue and cooperation between industry and other actors in the region, most importantly among various institutes of higher education and research. In 2001, Region Värmland, a public body responsible for promoting regional development, was founded. The general aim of the organization is to create competitiveness and sustainable growth through initiating, coordinating and supporting regional development. Region Värmland soon identified The Paper Province and other cluster initiatives as important partners, since they represented strong sectors within the region. Region Värmland

became one of the partners facilitating linkages between Paper Province and the University of Karlstad. Based on scholarly research, Värmland identified packaging as a potential cluster focus, prompting a project called The Packaging Arena to be established within The Paper Province in 2004. Later, in 2006, The Packaging Arena broadened its scope of activity to also include non-fiber raw materials, with a regional base of firms, launching a new cluster initiative in the process.

By closely monitoring the development of the cluster, Region Värmland was able to create a sort of a “Värmland model” (see Figure 37). The emerging model was built on a foundation of cooperation between local communities, institutes of higher education, and firms – represented by cluster initiatives – and focused on four central processes: business development, entrepreneurship, near-industry research and human resources. These constructive processes interact and influence each other in a complex but fruitful system, leading to improved innovation and growth.

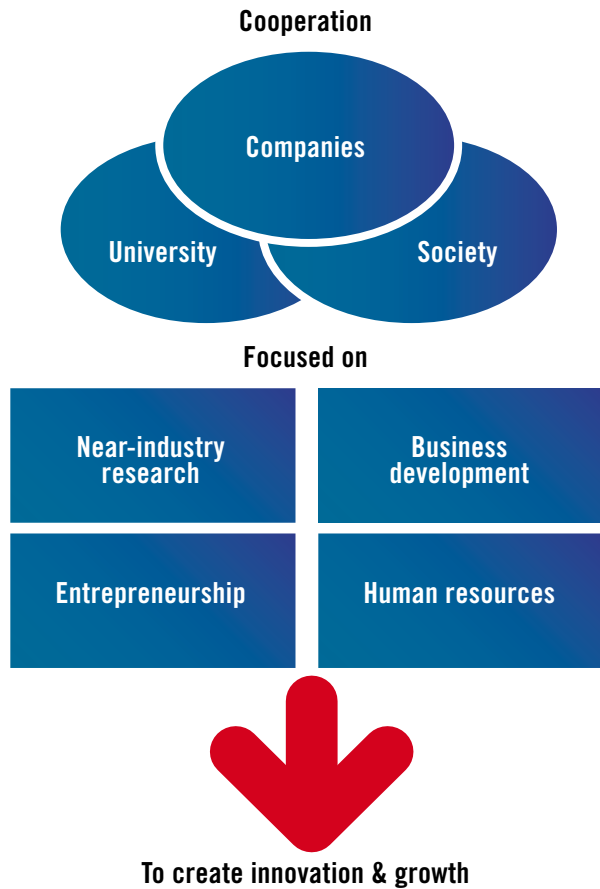


Figure 37. The Värmland Model for Regional Growth

Region Värmland works continuously to initiate, coordinate and support regional development, focusing on all four central processes, creating meeting places and incentives for companies, communities and universities to cooperate. The cluster initiatives' important role is pointed out in the regional development plan and other regional strategies. Cooperation within the pulp and paper industry and between the industry and public and academic actors has developed positively since 1999, and Region Värmland has pushed for common research and development plans between cluster initiatives and the University of Karlstad.

The unique gathering of competence in the region has attracted all main machine and process suppliers within the global pulp and paper industry to establish some presence in the area. As a result, the membership rolls of the Paper Province have expanded dramatically, now encompassing 80 member companies. The cooperation between different actors has also led to the development of new business areas. Supported by governmental funds in connection with the close-down of a local military regiment, the Paper Province in 2007 established “The Energy Square” – an initiative focusing on improving energy usage within the pulp and paper industry. The center is the first in the world to focus on energy savings within the pulp and paper industry. The Energy Square has strengthened the region's international links, as it already has resulted in a joint project between the Paper Province, the University of Karlstad and the China National Pulp and Paper Research Institute.

Today, no one questions the importance of the reconstructive forces that helped to develop the pulp and paper industry in Värmland. These initiatives have created new cooperative ventures and networks, and have served to strengthen significantly existing and established international linkages. In cooperation with the university, industry now has a role in shaping curricula, and the industry has become more attractive to new graduates as research efforts have increased. The university has also been able to piggy-back on the global network of cluster firms in their own quest for more international linkages.

Motivation and Process – Why Bother to Evaluate Cluster Initiatives?

Värmland is the first county in Sweden to systematically measure and assess the results of cluster initiatives across the business community, public sector and university at a regional level. Region Värmland and the County Administrative Board in Värmland have, together with Nutek, developed a method of assessment which, on the basis of cluster development, sheds light on the effects of the cluster initiatives on the development and growth within the region. Assessment is part

of joint efforts of cluster initiatives in Värmland, and serves as a basis for learning and dialogue in connection with continued development. Other aspects of the development work include the coaching of cluster managers and discussions on regional and national instruments for cluster processes.

In early 2003, discussions were convened among the members of Region Värmland's political board about how to use public funds for regional development, and to assess the effects that these investments would have. The board recognized a need to clarify the grounds for prioritization of the activities that were being invested in, and how they had developed. Officials at Region Värmland were therefore tasked with producing basic input to be used by the board in its prioritization of development projects within the region. Region Värmland, together with County Administrative Board staff, worked out a proposal for how an assessment of the cluster initiatives could be designed. During the course of the work, the individuals involved recognized the value in involving national players in the work, as they were participating with the financing of several clusters and regional growth efforts in Värmland. Therefore, the governmental bodies Vinnova, Nutek and Invest in Sweden Agency (ISA) were invited to take part in discussions on cluster development and their effects. The talks resulted in a decision to evaluate the Värmland cluster initiatives in a pilot project, with the aim of developing methods and better management in connection with cluster support.

It was decided that the assessment should be made by independent consultants in order to guarantee neutrality. The project was to run for a period of three years and be financed jointly by Nutek, the County Administrative Board in Värmland, Region Värmland, and to a smaller extent by local firms who were members in the cluster initiatives. The decision to run the assessment over a period of three years was justified by the fact that it contained a significant measure of learning about this type of effect measurement, and it was necessary to be able to correct the measuring methods on the basis of results and experience gained during the course of the project. At the end of 2005, a consulting firm was commissioned to conduct the assessment, which was then carried out over the period 2006-2008, with 2005 (zero base measurement), 2006 and 2007 as measurement years.

Method – Development of the Model

When the assessment model was developed, it was Region Värmland's ambition to measure the effects of cluster initiatives from a systems perspective. In previous projects, Region Värmland had created a model for the development of cluster initiatives that was based on four central processes for cluster development: business development, entrepreneurship, near-industry research and human resources.

These central processes had all been identified through follow-up research by people at the University of Karlstad who were working on some of the earlier cluster initiatives. The system perspective that was developed meant that the effect measurement should cover all four areas.

The choice of measurement variables was thus based on practical knowledge of clusters and on theories around clusters. In the interplay between consultants and county officials, a number of growth indicators were identified within the framework of the assessment model. Another important input value was the collaboration between companies and stakeholders, which is an important element in a dynamic cluster. Finally, measurement values were developed to gauge increased competitiveness since a number of cluster initiatives had this as their goal. The measurements have been conducted at company level within the cluster initiatives. Region Värmland wanted concrete information on what sort of benefits *the companies* identified from the cluster processes. The purpose of the assessment model was therefore to clarify how the cluster initiatives contributed towards growth and development. The ambition was to assess how the respective initiatives contributed towards Värmland's four growth indicators: expansion in existing companies, a greater spirit of entrepreneurship, increased near-industry research and the development of training and education for the upgrading of human resources in the region (see Figure 38).



Figure 38. Assessment of Effects of Cluster Initiatives

The results have been presented at both the regional level as well as to the respective cluster initiatives. Three types of data have been used in the assessment:

- *An Internet-based process log* in which the cluster leaders reflect on business concepts /business ideas and which activities give results and effects in the form of growth and greater competitiveness.
- *A questionnaire survey* by e-mail to member companies in the respective cluster initiatives. During measurement year 2007, a total of 315 companies were asked to respond to the questionnaire, of which 193 responded, which gave a response frequency of 61 percent.
- *Interviews with players* in the clusters, based on the selected focus for the year (academy, companies and public sector players).

Data collection has been structured on the basis of the growth indicators and focuses on process development of the clusters, with an emphasis on cooperation and how the cooperation is developing.

Since the analysis is descriptive, statistical causal connections between the cluster initiatives and the results/effects have not been presented. The assessments are based on the opinions of the companies asked and the cluster leaders' own reflections.

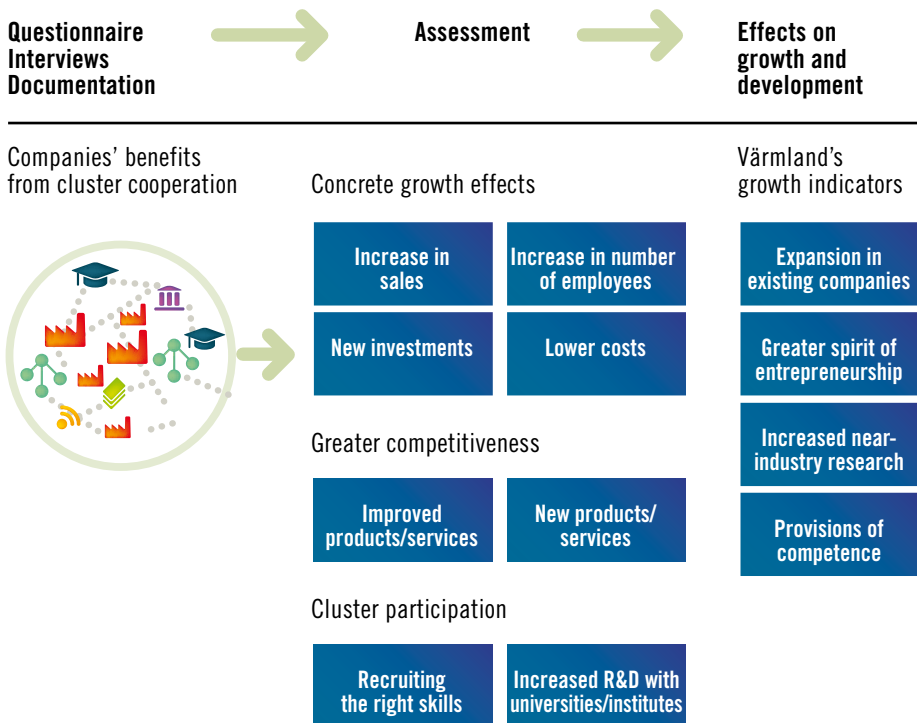


Figure 39. The Värmland Cluster Initiative Evaluation Model

Reliability of the Model

The chosen model combines two components that make it unique in its category among cluster evaluations. On the one hand, the assessment has a strong corporate focus. It is the active companies within the cluster initiative that are asked about their assessment as to the benefits of the initiative. On the other hand, the assessment is conducted in a focused and consistent manner over a lengthy period of time (2006-2008), which makes it possible to see what benefits the companies consider the initiatives create over the course of time. It also provides opportunities to calibrate and develop methods between the annual measurements.

The assessments demonstrated the overall results of how the participating companies regard their own involvement in the cluster initiatives. The most interesting aspect from a cluster development point of view is the opinion of company managers that the initiative has contributed to the long-term competitiveness of their companies through new products and services. This relates directly to the purpose of the cluster initiatives and is an indication that they contribute towards renewal and innovation among companies.

In the assessment, the companies were asked to give their subjective opinion of the concrete growth effects of the cluster initiative, for example in the form of increased sales or more employees. The companies also make a subjective assessment of the extent to which their participation in the initiative is expected to lead to a greater competitive strength in the long term by, for instance, new investments or new or improved products and services in their own companies.

When interpreting the results, it is important to remember that it is the companies' assessments that are being measured, and that it is a selection of companies and individuals that have replied, and furthermore, that the reporting of the companies' responses gives no consideration to the size of the company concerned, or its importance in the cluster initiative, or to other external factors such as fluctuations in the economy, the availability of manpower, etc. The assessment shall thus be regarded as a practical basis for decision-making for the cluster initiatives, as well as for companies and other players in the cluster, and not as a research report.

Further Developments

Värmland was the first region to test the method of allowing participating companies to assess the effects of the cluster initiative. However, the method can also be fully adapted to suit other regions. In the measurements taken during 2007-2008, the geographical survey area was extended to include the cluster initiatives in the regions of Dalarna and Gävleborg, which, together with Värmland, have established a closer cooperation on cluster development within the EU's structural fund area North-mid Sweden. This cooperation comprises process support and learning in cluster initiatives, and also includes eight cluster initiatives with some 500 participating companies and approximately 60,000 employees. The continued evaluation of cluster initiative effects on regional growth and development is an important feature of the cooperation.

CLUSTER INITIATIVES IN DALARNA AND GÄVLEBORG

Triple Steelix

With steel and modern materials as the base, Triple Steelix links together large and small companies to promote increased growth and attraction of the Bergslagen region.

Destination Dalarna

Destination Dalarna is developing an innovative growth environment for companies in the tourism sector by marketing Dalarna on Swedish and international markets.

Fiber Optic Valley

Fiber Optic Valley is a forum for the testing and development of products and services based on fiber optics, in cooperation between the university, society and the business community.

Future Position X (FPX)

Future Position X is a gathering point for companies and organizations that are promoting the innovative use of geographical information (GIS/GIT).

The methodology used in the assessment has also been further developed between the survey years 2005-2007. Certain questions have been added to the questionnaire while others have been removed, but within the framework of being able to make continued comparisons between the years.

Furthermore, on each occasion of measurement, one important aspect of the cluster initiatives has been chosen for detailed study by means of interviews with key players in the clusters. In 2005, the focus was on the University of Karlstad

and how companies regarded the cooperation on research and education, as well as how the university regarded the cooperation with the cluster initiatives. In 2006, case studies were made of one company within each cluster initiative, which was asked to give its opinions as to the competitiveness of Värmland as a region, and the need for collaboration with other companies and the university. In 2007, the focus was on the role of the public sector in the development of clusters and enhanced innovation. The results presented below refer to Region Värmland alone.

Measurable Results – Increased Sales and R&D

The results of the assessment are reported both for each individual cluster initiative as well as at system level for the five cluster initiatives in Värmland together. The evaluation of the results is based on the assessment conducted by the selected cluster companies of the contribution made by “their” cluster initiative towards promoting growth, entrepreneurship, applied research, and the development of education and training for human resources. Examples are given below of the quantitative results from the third measurement year 2007. It is, however, important to regard the precise values that are presented with a certain degree of reservation, bearing in mind the fact that they are based on the companies’ own subjective judgments. Among the companies that took part in the survey, 31 percent were of the opinion that their participation in the cluster initiative has led to increased sales and 13 percent that it has resulted in lower costs. 14 percent considered that the initiative has contributed to an increase in the number of staff and 11 percent that new investments have been made as a result of the cluster initiative. In all, 14 percent of the companies felt that by taking part in the activities of the cluster initiative they have increased their R&D cooperation with other companies, whereas 19 percent state that the initiative has led to increased cooperation with institutes of higher education and industrial research institutes.

Slightly more than four out of ten companies felt that the activities of their respective cluster initiative contributed towards greater competitive strength in the long term as a result of new or improved products and services, while three out of ten companies were of the opinion that the initiative provided cost benefits for the participating companies, and thus contributed to their competitiveness in the long term. Six out of ten companies considered that the cluster initiative has helped to facilitate recruitment of the right competence. The assessment also presented a series of qualitative results. One such result was that the *motive* stated by the companies for their participation in cluster initiatives concurs well with the *results* of the cluster cooperation that the companies value most, namely new

networks, new cooperation and interaction with other companies. The assessments also showed that many activities in the cluster initiatives promoted applied research and training, which forms a good basis for increasing the knowledge content and processing value of products and services, which in turn increases the competitive strength of the companies and the region as a whole. The interviews that were conducted during 2007 with cluster leaders and public sector officials showed that the public sector organizations – local, regional and national – served not only as financiers but have also played an important role in the communication and marketing of the initiative.

Actions – Effects of the Assessment

In addition to contributing with knowledge as to the results of the cluster initiatives, the assessment has also had a number of effects with regard to management, development and mobilization within the region. *Politicians*, who were the ones to request an evaluation in the first place, feel more committed to the cluster initiatives as a result of the assessment. This has meant that politicians have dared to focus on the investments and to be perseverant in their financing. They have been furnished with arguments from the companies to the effect that the initiatives contribute towards growth and development, which means that they now dare to continue with their efforts, and feel secure in the knowledge that the money is well spent. The assessments have also contributed towards increasing the political understanding for working with this type of regional economic development policy.

The first assessment in 2005 led to one cluster initiative being phased out because it was felt that it failed to give adequate results. A further initiative was merged with another organization as a result of the assessment. In this way, the assessments have contributed towards a prioritization of the operations.

In the beginning, the *cluster leaders* had a negative attitude to the assessments. They questioned their value and wondered why they needed to be carried out. Many of them felt it was unnecessary to perform effect measurements as they carried out their own surveys. They felt they had direct feedback in that the companies chose to involve themselves in cluster organizations. After the first assessment had been made, the attitude of the cluster leaders changed to become more positive. A decisive factor in this change was the fact that the cluster leaders felt they had been given access to indicators as to which activities the companies considered to be good. With the assessment as a basis, several cluster initiatives also made investments in new activities that had been requested by the companies. One example of this is greater cooperation with the University of Karlstad within certain areas of

research. Cluster leaders also felt that the assessments, since they were conducted by an independent consultant, legitimized their own efforts, and that the results could be used as arguments in support of planned activities.

A number of cluster initiatives discontinued their own company surveys and instead began to concentrate on becoming involved in structuring questions in the common questionnaire survey, which as a result attracted a higher response rate. According to the cluster leaders, cooperation with Region Värmland has meant that they have developed a better understanding for Region Värmland's approach and motives as a financier. The reverse has also been noticed, or in other words that the officials at Region Värmland have acquired a greater understanding for the activities and approaches adopted by the cluster initiatives.

The assessments have also contributed towards *mobilization within the region* in connection with the importance of the cluster initiatives to regional development. A general feeling among those concerned is that the local media have developed in their reporting on the cluster initiatives after receiving the results of the assessments. It suggests a wider communicative effect of the assessments in disseminating knowledge concerning the content and impact of the cluster initiatives.

Summary of Case

Cluster development and creating favorable conditions for innovation are both complicated processes, the success of which depends on a long series of efforts and preconditions. Isolating the effects of individual efforts is a difficult process. Despite this, there is a considerable need to measure the effects of the contributions made by cluster initiatives in regional development, since substantial public funds are being invested in them. The evaluation of the Värmland cluster initiatives that have been carried out must in view of this be regarded as successful. By measuring the effects at the corporate level, a subjective assessment is obtained from the participating companies of the value that the initiative has added to their companies. Over a period of time, these responses also provide indications as to whether the cluster initiative is developing in a positive direction.

The assessment shows that the companies in general feel that the cluster initiatives are contributing to increased sales, a faster development of new products and services, and employment growth. In addition to the direct results, the assessment has had a number of other positive effects:

- The prioritization and focus by politicians on the cluster initiatives become more clear. As a result of the evaluation, one cluster initiative, for example, was phased out and two others were merged into one.

- The understanding for the work on cluster initiatives on the part of politicians has grown.
- The cluster leaders have been informed as to which activities the companies appreciate and which new activities are in demand. This has led to a positive and demand-driven development for the cluster initiatives.
- The cluster leaders also feel that the assessment has helped to legitimize the activities and facilitate new contacts.
- The regional mobilization around the cluster initiatives has been strengthened and it has been possible to demonstrate the benefits in the regional debate on the use of public funds for regional development.

Conclusion

It all began as an academic exercise. Michael Porter was intent on understanding why certain firms based in certain locations became global leaders where others lost out. Key concepts included competitiveness, nations, clusters and firms. He crafted a conceptual model which has helped us understand these forces. One of four core parts of the model was clusters; regionally concentrated firms, organizations and institutions linked through multiple linkages and spillovers. From being a subcomponent of a theoretical model in the 1990s, clusters turned into a constructive tool in the 2000s.

The Porter Paradox

Professor Porter's book on clusters, *The Competitive Advantage of Nations*, was written almost 20 years ago, and it offered a whole new perspective on competitiveness and clusters. But the paradox is that while the Nations book offered a tool for scholarly analysis, it became much more used as a tool by policymakers. And policymakers have in many cases, while referring to Professor Porter, used the tool for many other purposes than what was originally thought. First, policymakers tend to downplay the role of rivalry, which is central to the diamond model, and overemphasize cooperation. Second, policymakers tend to emphasize planning aspects, even as the book is about evolution and market mechanisms. Third, what is offered around construction in the book is geared to the broader microeconomic framework conditions, i.e. the diamond, and not to particular cluster programs or initiatives. There is clearly a distance between an evolutionary view of the world and a constructive view of the world.

The diamond model – the driver of innovation and upgrading among a nation's or region's firms – is typically less understood by policymakers, whereas the cluster model became a central feature of industrial, innovation and regional policy. So while Professor Porter has been preaching the gospel of rivalry, investments in advanced and specialized factors of production, tough environmental standards and so on, many policymakers, eager to construct world class clusters, were projecting big cluster visions (particularly in new “hot” industries) and often

emphasized cooperation over competition. Here, I have suggested a middle road, balancing the evolutionary and constructive forces.

During the period after the Nations book was published, we have come to learn more, especially about the constructive forces behind clusters. The Nations book focused on the evolutionary forces; in certain locations clusters emerge, and over time as a result of complex interacting forces, not coordinated by some “constructor”, some clusters grew and became more competitive, whereas others declined. Economists typically treat cluster success in this way, as driven by “market” forces where the invisible hand is at work. Others treat cluster success as something resulting from elaborate governmental policies and programs. Our research does not support either of these two opposing views. Instead, as we have argued throughout this book, cluster success is a result of a combination of evolutionary and constructive forces. Some indications of success of cluster construction were offered in the *Cluster Initiative Greenbook*; industry, academic and political leaders were taking initiatives to construct or reconstruct clusters in all corners of the world. Public-private-academic initiatives are based on leadership beyond the boundaries of the firm, organization or university, and have often been a result of a shock to the region. Instead of just allowing market forces to play out, initiatives were taken to improve cluster dynamics and to reinvigorate the broader regional business environment.

Sound Construction and Reconstruction

There is a fair amount of evidence suggesting that governments and cluster initiatives are better at reconstructing than really constructing clusters. This was also pointed out by Professor Porter almost 20 years ago, when he observed that “government at all levels can play a role in reinforcing” the cluster (Porter, 1990: 655). Regarding clusters, he emphasized factor upgrading and infrastructure, but not formal cluster policies, programs or cluster initiatives. And here we have come to learn a lot. Of all the new policies, programs and initiatives being launched with a cluster focus, many will of course fail. But, our research also shows us that there are a lot of constructive initiatives that are successful, leading to more competitive firms and more attractive regions. Successful construction is based on a mix of policy for clusters (general microeconomic framework conditions) and cluster policy (programs targeting clusters).

If many economists are too market oriented, we find that many policymakers are “too constructive”. Governments and agencies in China, Dubai, Saudi Arabia and other places are now implementing large cluster programs, often integral to large real estate projects. Pieces of land are cut out and designated to particular

sectors. Examples include a financial cluster in Dubai and an automotive cluster in Saudi Arabia. Planning includes residential, recreational, and industrial areas. Often these real estate projects, such as the Dubai Health Care City, are more about traditional city planning than real cluster programs. Of course, applying a cluster label in this manner will increase legitimacy of the whole project. However, as was stated in the Nations book, governments have a poor track record in selecting sectors or clusters, and are too often preoccupied with “new” and “hot” industries. To get a “silicon glen” effect of co-located industries is not difficult, but to plan for dynamism of a “silicon valley” kind is much harder, irrespective of how much money is spent by government. An interesting observation by Professor Woody Powell of Stanford is that the biotech clusters that took leadership in the U.S. were not the ones closest to the government or financial muscles. Again, constructive cluster programs and initiatives are more about putting a turbo onto clusters than the true creation of clusters.

Science, Regional and Industry Policy versus Cluster Policy

On the cluster scene, we can study processes of knowledge creation, innovation and refinement of new ideas in networks of competing and cooperating companies and organizations. Regions with strong cluster portfolios are hotbeds of innovation, while regions with more evenly spread out employment across sectors are falling behind. Regions with sophisticated research embedded in clusters are getting more mileage out of every research dollar or euro. Stanford and the SLAC (Stanford Linear Accelerator Center, run by Stanford and the U.S. Department of Energy) research center has generated advanced research leading to several Nobel Prizes (part of the work carried out by two of the three winners in 2008 was done at SLAC). We know that Stanford and associated research centers in close proximity to Silicon Valley have led to hundreds of thousands of jobs and thousands of new firms in high tech areas. It is a region thriving on innovation and commercialization of new technology and scientific discovery. Isolated research, on the other hand, does not lead to innovation, new firm formation, IPOs and dynamic clusters. Adding new money into isolated research offers little promise of economic success.

The equivalent of SLAC in Europe is CERN in Switzerland. CERN (European Organization for Nuclear Research) is also a place populated by thousands of highly educated scientists, leading the way to new scientific discoveries and Nobel Prizes. However, CERN is in total isolation – the cluster is missing and we see very little commercialization and new firm formation in the region or in Europe for that matter. Interestingly enough, the World Wide Web, “www”, as we know it today was first created by people at CERN. However, commercialization and

job creation took place in leading clusters elsewhere, particularly in Silicon Valley, now characterized by firms with household names such as Google and eBay. Russia has a similar research facility, JINR, in Dubna. Again, this is an isolated research environment that has not led to any economic success. More resources spent on science and R&D are integral to the construction of dynamic clusters in many sectors, but there is no straight or easy relationship.

Constructive cluster policies are about realigning traditional policies such as science policy, regional policy and industry policy. By introducing cluster programs, national and regional policy bodies and agencies can inspire and initiate bottom-up local cluster initiatives. Cluster programs should not involve big money. Just like new start-ups in a market need seed money and VC, cluster initiatives need “constructive venture capital”. Cluster programs with a 5-10 year time horizon are preferable. At some point, choices must be made between which cluster initiatives are financed and which are not. This should be done in a fair and transparent process of competition. Clusters and the underlying evolutionary forces must be studied, measured, mapped, and ranked, and statistics must be aligned with the need for mapping of clusters. The government should act as a source of inspiration; it can facilitate process help to cluster initiatives (feasibility studies, business plans for cluster organizations, evaluation and the like), and encourage international exchange and benchmarking with clusters elsewhere.

Successful cluster initiatives act as regional “energizers” in a learning process whereby different actors can focus on enhancing innovation and competitiveness. For example, a cluster initiative can play a neutral role increasing industry-related research and commercialization efforts. Smaller colleges and regional universities can become more involved in regional clusters. It is sometimes difficult for cluster initiatives to accommodate both large and small firms. SMEs have other priorities than large firms. However, to build on the strengths of both large firms, including strong brands, professional organizations and global market presence, and SMEs with innovative solutions and flexibility, holds large promises for such initiatives. Given different incentives among organized cluster members one must not stick to activities where all members are active. Instead, a cluster initiative can differentiate between activities where subsets of members are active.

Take Evaluation Seriously

If cluster programs and initiatives are to play a positive role in cluster construction and reconstruction, evaluation is critical. Both top-down and bottom-up initiated programs and initiatives must be able to show that resources are used wisely and

that the program is open to learning and changed action. Here are some advice on the journey:

- Make sure to build in a *plan for evaluation* as the program or initiative is set up. Complement mid-stage evaluation of the cluster initiative itself, with ex-post evaluation measuring real effects on the cluster.
- An *evaluation culture* should be developed. Unless there are specified goals that are to be fulfilled, it is almost impossible to evaluate performance a few years down the road. The foundation of a good evaluation culture is not the measurement itself, but that actions should follow from evaluation results.
- *Yearly measurement*. Surveys/interviews with organized firms and other organizations in the cluster (subjective view of value of the cluster initiative). Consider generic control compared to a peer cluster, or shadow control with a group of experts judging whether effects are from the program or initiative.
- *Dialogue*. Firms and public authorities typically enter cluster initiatives with different world views, as well as different incentives and motivations. Evaluation work can help put these differences on the table and facilitate a common language and better understanding.
- *Communication* of evaluation results is a way to inform all stakeholders, legitimize the project (if a success), and to attract new resources. Financing parties can check their “return on investment”.
- Consider including *process support* in the cluster program, in order to build competencies within cluster initiatives to carry out high quality evaluations.
- Be prepared for *negative outcomes*, i.e., be open to learning so that actions can be improved. Good evaluation practice is more about action than numbers.

A Final Word

This book has suggested a somewhat more complex understanding of the cluster scene, involving a range of different characters, playing different roles and having a mix of different relationships. It has tried to show that clusters do matter in an era of global competition, and that clusters are best understood as a scene where both evolutionary and constructive forces play out. Clusters are directly critical to innovative performance of regions and firms, and indirectly also to economic prosperity. The role of local and regional clusters is enhanced with global competition.

The world is full of imperfections; actors on many local scenes move around partly in isolation, possessing limited knowledge of each other, and there is limited or no local dialogue on how to move forward within regions or clusters. Information and knowledge is highly asymmetrical and network failures are abound. Universities have vague ideas of what is going in the surrounding cluster, and business leaders have no access to university leaders; there is no dialogue around curriculum development, targeted research etc. Also, business people have limited knowledge about each other. Similarly, there is no or little dialogue between business actors, academic actors and policy makers and their agencies. But there is another model where national, regional and local policy actors, academic actors and business actors play constructive roles. A constant reconstruction of clusters – moving them from a group of co-located companies to dynamic clusters with more innovation, interaction and spillovers – is a central task for all actors on the cluster scene. Cluster initiatives are an important tool to achieve this goal; they help by creating a new type of policy process that involves local and regional public-private-academic constellations and encourage members to open up for dialogue and action across organizational and regulatory boundaries. The new thing about cluster policy is not that it is a new policy field; it is a new process and way of thinking, breaking old barriers and involving actors that are on the cluster scene in a new way, and even adding some new actors in order to construct better clusters.

Bibliography

- Andersson, Å. 1985. Creativity and regional development. *Papers in Regional Science*, 56(1): 5-20.
- Audretsch, D. B. & M.P. Feldman. 1996. R&D spillovers and the geography of innovation and production. *The American Economic Review*, 86(3): 630.
- Basberg, B. L. 1987. Patents and the measurement of technological change: a survey of the literature. *Research Policy*, 16: 131-41.
- Chandler, A.D. Jr. 1977. *The Visible Hand: The Managerial Revolution in American Business*. Belknap Press, Cambridge, Massachusetts.
- Carroll, G. R. & M. T. Hannan. 2000. *The Demography of Corporations and Industries*. Princeton University Press. Princeton, New Jersey.
- Ciccone, A. & R. Hall. 1996. Productivity and the density of economic activity. *The American Economic Review*, 86(1): 54-70.
- Crescenzi, R., A. Rodriguez-Pose & M. Storper. 2007. The Territorial Dynamics of Innovation: A Europe-United States Comparative Analysis. *Journal of Economic Geography* 7: 673-709.
- Ellison, G. & E. L. Glaeser. 1997. Geographic concentration in U.S. manufacturing industries: a dartboard approach. *Journal of Political Economy*, 105(5): 889-928.
- Enright, M. 1998. Regional Clusters and Firm Strategy. In Chandler, A. D., (Jr), P. Hagström & Ö. Sölvell, editors, *The Dynamic Firm - The Role of Technology, Strategy, Organizations, and Regions*. Oxford: Oxford University Press.
- Feldman, M. P. & D. B. Audretsch. 1999. Innovation in cities: science-based diversity, specialization and localized competition. *European Economic Review*, 43(2): 409-29.
- Florida, R. L. 2002. *The rise of the creative class: and how it's transforming work, leisure, community and everyday life*. New York: Basic Books.

- Fredriksson, C. & L. Lindmark. 1979. From firms to systems of firms: a study of interregional dependence in a dynamic society. In Hamilton, F. E. I. & G. J. R Linge, editors, *Spatial analysis, industry, and the industrial environment: progress in research and applications*. Chichester: Wiley.
- Freeman, C. 1991. Networks of innovation: a review and introduction to the issues. *Research Policy*, 20(5): 499-514.
- Freeman, C. 1982. *The economics of industrial innovation*. Second edition. London: Frances Pinter Publishers.
- Furre, H. 2008. *Cluster Policy in Europe - A Brief Summary of Cluster Policies in 31 European Countries*. Unpublished Paper. Norway: Oxford Research AS.
- Hallén, L., J. Johanson, & N. Seyed-Mohamed. 1993. Dyadic business relations and customer technologies. *Journal of Business-to-Business Marketing*, 1(4): 63-90.
- Hannan, M. T. & J. Freeman. 1984. Structural Inertia and Organizational Change, *American Sociological Review*, 49, 149-164.
- Hippel, E. von. 1998. Sticky information and the locus of problem solving: implications for innovation. In Chandler, A. D, P. Hagström & Ö. Sölvell, editors, *The Dynamic Firm - The Role of Technology, Strategy, Organizations, and Regions*. Oxford: Oxford University Press.
- Hoover, E. M. 1948. *The location of economic activity*. New York: McGraw-Hill Book Company.
- Hufbauer, G. C. & J. G. Chilas. 1974. Specialization by industrial countries: extent and consequences. In Giersch, Herbert, editor, *The international division of labour: problems and perspectives*. Tübingen: Mohr.
- Håkansson, H. 1989. *Corporate technological behavior: co-operation and networks*. London: Routledge.
- Håkansson, H. & A.-K. Eriksson. 1993. Getting innovations out of supplier networks. *Journal of Business-to-Business Marketing*, 1(3): 3-34.
- Hägerstrand, T. 1967. *Innovation diffusion as a spatial process*. Chicago: The University of Chicago Press.
- Jaffe, A. B., M. Trajtenberg, & R. Henderson. 1993. Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations *The Quarterly Journal of Economics*, 108(3): 577-98.

- Johannisson, B. 1987. Toward a theory of local entrepreneurship. In Wyckham, Robert G., Lindsay N. Merredith, & Gervase R. Bushe, editors, *The spirit of entrepreneurship*. Vancouver: Simon Fraser University.
- Ketels, C., G. Lindqvist & Ö. Sölvell. 2006. Cluster Initiatives in Developing and Transition Economies. Stockholm: Center for Strategy and Competitiveness at SSE. Working Paper.
- Krugman, P. 1991. *Geography and trade*. Cambridge, Massachusetts: MIT Press.
- Laage-Hellman, J. 1989. Technological development in industrial networks, *Acta Universitatis Upsaliensis 16*. Uppsala: Faculty of Social Sciences, Uppsala University.
- Leonard-Barton, D. 1982. *Swedish entrepreneurs in manufacturing and their sources of information*. Boston: Center for Policy Applications, MIT.
- Lindqvist, G., S. Protsiv & Ö. Sölvell. 2008. *Regions, innovation and economic prosperity: evidence from Europe*. Stockholm: Center for Strategy and Competitiveness. CSC Working Paper 2008 -1.
- Lloyd, P. E. & P. Dicken. 1977. *Location in space: a theoretical approach to economic geography*. 2nd ed. ed. London: Harper & Row.
- Lundequist, P. & R. Teigland. 2008. *Promoting Competitiveness through a Cluster Initiative: The Case of Uppsala BIO – The Life Science Initiative*. Cluster Initiatives. Ahmedabad, India: Icfai University Press.
- Lundequist, P. & R. Teigland. (forthcoming). Cluster Initiatives as Agents of Change? The Case of Uppsala BIO – The Life Science Initiative. In A. Rickne & H. Etzkowitz (eds.) *Innovation Policy Initiatives for Regional Development: The Swedish Experience*.
- Lundvall, B.-Å. 1988. Innovation as an interactive process: from user-producer interaction to the national system of innovation. In Dosi, Giovanni, editor, *Technical change and economic theory*. London: Pinter Publishers.
- Lundvall, B.-Å. 1993. Explaining interfirm cooperation and innovation: limits of the transaction-cost approach. In Grabher, G., editor, *The embedded firm - on the socioeconomics of industrial networks*. London: Routledge.
- Malmberg, A., Ö. Sölvell & I. Zander. 1996. Spatial clustering, local accumulation of knowledge and firm competitiveness. *Geografiska annaler*, 78 B(2): 85-97.

- Marshall, A. 1890/1920. *Principles of Economics*. 8th ed. (1st ed 1890). London: Macmillan.
- Meyer, A. de. 1992. Management of international R&D operations. In Granstrand, O., L. Håkansson & S. Sjölander, editors, *Technology management and international business: internationalization of R&D and technology*. Chichester: Wiley.
- Meyer, A. de. 1991. Tech talk: how managers are stimulating global R&D communication. *Sloan Management Review*, 33: 49-58.
- Midelfart-Knarvik, K. H., H. G. Overman, S. Redding & A. J. Venables. 2000. The location of European industry, *Economic Papers no. 142*: Directorate General for Economic and Financial Affairs, European Commission.
- Myrdal, G. 1957. *Economic theory and underdeveloped regions*. London: Duckworth.
- Nohira, N. & R. G. Eccles. 1992. Face-to-face: making network organizations work. In Nohira, N. & R. G. Eccles, editors, *Networks and organizations: structure, form, and action*. Boston, Massachusetts: Harvard Business School Press.
- Owen-Smith, J. & W. W. Powell. 2004. Knowledge Networks as Channels and Conduits: The Effects of Spillovers in the Boston Biotechnology Community, *Organization Science*, 15 (1), 5-21.
- Pavitt, K. 1991. Key characteristics of the large innovating firm. *British Journal of Management*, 2(1): 41-50.
- Pavitt, K. 1984. Sectoral patterns of technical change: towards a taxonomy and a theory. *Research Policy*, 13: 343-73.
- Pearson, A. W. 1991. Managing innovation: an uncertainty reduction process. In Henry, J. & D. Walker, editors, *Managing innovation*. London: SAGE Publications.
- Piore, M. J. & C. F. Sabel. 1984. *The second industrial divide - possibilities for prosperity*. New York, NY: Basic Books.
- Polanyi, K. 1962. *Personal knowledge: towards a post-critical philosophy*. Chicago: The University of Chicago Press.
- Porter, M. E. 2003. The economic performance of regions. *Regional Studies*, 37(6,7): 549.
- Porter, M. E. 1998. *On Competition*. Boston: HBS Press.

- Porter, M.E. 1990. *The Competitive Advantage of Nations*. New York: The Free Press.
- Powell, W., W., J. Owen-Smith & J. A. Colyvas. 2007. Innovation and Emulation: Lessons from American Universities in Selling Private Rights to Public Knowledge. *Minerva* 45: 121-142.
- Powell, W. W., D. R. White, K. W. Koput W & J. Owen-Smith. 2005. Network Dynamics and Field Evolution: The Growth of Interorganizational Collaboration in the Life Sciences. *American Journal of Sociology*. Volume 110, No. 4.
- Pred, A. 1977. *City systems in advanced economies. Past growth, present processes and future development options*. London: Hutchinson.
- Rosenberg, N. 1976. *Perspective on technology*. Cambridge: Cambridge University Press.
- Rosenberg, N. 1982. *Inside the black box: technology and economics*. Cambridge: Cambridge University Press.
- Rosenberg, N., R. Landau, & D. C. Mowery. 1992. *Technology and the wealth of nations*. Stanford University Press.
- Scherer, F. M. 1984. *Innovation and growth - Schumpeterian perspectives*. Cambridge, Massachusetts: The MIT Press.
- Schmookler, J. 1966. *Inventions and economic growth*. Cambridge, Massachusetts: Harvard University Press.
- Schumpeter, J. 1934. *The Theory of Economic Development*. Cambridge, Massachusetts: Harvard University Press.
- Scott, A. J. 1983. Industrial organization and the logic of intra-metropolitan location: I. Theoretical considerations *Economic Geography*, 59(3): 233-50.
- Scott, A. J. 1988. *New industrial spaces: flexible production organization and regional development in North America and Western Europe*. London: Pion.
- Sölvell, Ö., G. Lindqvist & C. Ketels. 2003. *The Cluster Initiative Greenbook*. Stockholm: Ivory Tower.
- Sölvell, Ö., I. Zander & M. E. Porter. 1991. *Advantage Sweden*. Stockholm: Norstedts Juridik.
- Teigland, R., D. Hallencreutz & P. Lundequist. 2006. Uppsala BIO – the Life Science Initiative: Experiences of and reflections on starting a regional competi-

- tiveness initiative. In MacGregor, R. C. *et al.*, editors, *Small business clustering technologies: applications in marketing, management, IT and economics*. London: Idea Group Inc.
- Teigland, R & G. Lindqvist. 2007. Seeing Eye-to-eye: How do Public and Private Sector Views of a Biotech Cluster and its Cluster Initiative Differ? *European Planning Studies*, 15(6), 767-786.
- Utterback, J. M. 1974. Innovation in industry and the diffusion of technology. *Science*, 183(4125): 620-26.
- Vedung, E. 1997. *Public Policy and Program Evaluation*. New Brunswick, New Jersey and London: Transaction Publishers.
- Vedung, E. 2006. Evaluation Research, in Peters, B. Guy and Jon Pierre, *Handbook of Public Policy*. London: Sage.
- Weber, A. 1909/1929. *Theory of the location of industries*. Chicago: The University of Chicago Press.
- Winter, S. G. 1987. Knowledge and competence as strategic assets. In Teece, D. J., editor, *The Competitive challenge: strategies for industrial innovation and renewal*. Cambridge, Massachusetts: Ballinger Publishing Company.

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Dr Sölvell has published in the areas of multinational firms, competition, competitiveness and clusters. The concepts of clusters and the diamond model were introduced in Sweden through the book *Advantage Sweden* in 1991 (co-authored with Michael Porter and Ivo Zander). Together with Christian Ketels and Göran Lindqvist, he published the widely acclaimed *Cluster Initiative Greenbook* in 2003, which was also translated into the Czech and Polish languages.

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CLUSTERS

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ÖRJAN SÖLVELL

After Michael Porter's seminal work on clusters and competitiveness appeared in the early 1990s, interest in clusters has increased tremendously, both among industry leaders, cluster practitioners and policy makers. In 2003, the *Cluster Initiative Greenbook* was launched, presenting data and analysis on hundreds of cluster initiatives from around the world. The Greenbook pointed to the fact that these constructive forces must be put into the context of underlying cluster strengths and local institutional factors – clusters, in other words, should not be built on thin air. This book adds the political perspective, and builds a new model of clusters involving both evolutionary and constructive forces. Cluster policies and programs are now emerging in all corners of the world, at international, national and regional levels, bringing more resources and legitimacy to cluster construction. If such political initiatives are to succeed they must be based on sound data-driven analysis, and the cluster programs must be carefully evaluated to improve our knowledge of how they affect the complex nature of clusters, and how the constructive work can be improved.

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