The Development of the cluster concept – present experiences and further developments

By

Christian H. M. Ketels

The Development of the cluster concept – present experiences and further developments[*]

Prepared for NRW conference on clusters, Duisburg, Germany, 5 Dec 2003

Dr. Christian Ketels, Harvard Business School

Introduction

Cluster-based economic development has become an increasingly popular topic for researchers and economic development professionals.

A search on academic articles about clusters turns up more than 300 entries for the last three years alone, and the cluster profile database at the Institute for Strategy and Competitiveness contains more than 800 entries from 52 countries.[1] Numerous organizations, including the OECD, the European Commission, the U.S. National Governors Association, and US AID, have devoted major conferences and policy initiatives to this topic in recent years. Finally, a large number of regions and nations have launched initiatives to develop or strengthen clusters; a survey of such initiatives this year triggered responses from more than 250 such efforts worldwide.[2]

The increasing interest in clusters is only one aspect of a broader re-orientation of research and economic policy towards the microeconomic foundations of prosperity and growth.[3] The economic policy debate had in previous decades been to a large degree dominated by macroeconomics and the creation of market institutions in transition economies. But while there is now fairly broad consensus on the type of macroeconomic and legal conditions necessary to achieve economic progress, it is also increasingly becoming clear that these conditions are not sufficient. As a new approach to help economies reap the full potential of an improved macroeconomic and legal context cluster-based efforts have received a lot attention.

While there is little dispute that the cluster concept is becoming increasingly popular, not all researchers agree that this is a positive development. Some critics argue that the definition of clusters is too vague and the concept thus a problematic source of policy advice.[4] Others see cluster-based development as a useful approach, but are concerned about its actual use in projects bearing little resemblance to the original framework. These projects are in danger of creating a serious backlash against this approach when the results of so-called cluster efforts fail to live up to their sometimes-lofty promises. Practitioners, however, are under such intense pressure to develop a new, more effective approach to economic development that they can't afford to wait for these theoretical disputes to be resolved.

---

[*] This paper has benefited strongly from Michael E. Porter's intellectual guidance and the work with him on many projects over the last few years. His contribution goes much beyond the citations of his work. Any opinions expressed and mistakes made remain, however, my own responsibility.

[1] Van der Linde (2001). Rosenfeld (2002) includes a list of cluster websites for examples.

[2] Solvell/Lindqvist/Ketels (2003)

[3] See Porter (2003b) for a more detailed discussion.

[4] See Martin/Sunley (2003), European Commission (2002).

The current discussions are in our view a signal of this young field entering a new stage of its development, not of inherent conceptual weakness. Motivated in large part by Michael Porter's "Competitive Advantage of Nations"[5] the field has over the last two decades seen a lot of case-driven theory development and the experimental use of clusters in economic development, often pushed by committed individuals. A lot has been learned and conceptual thinking especially has become more advanced. Based on these advances, the field is now entering a new stage of data-driven theory development, theory testing, and the development of a consistent framework for policy application.

This review will present an overview of the current research on clusters and cluster-based economic development. It is organized in three parts: *First*, we look at the conceptual foundations of the cluster approach. This section will discuss the definition of clusters, the different types of clusters, the economic benefits that clusters provide, and the factors that influence cluster performance. It aims to concise and focused on a few key concepts; more extensive discussions are available in the literature.[6]

Second, we look at some of the research testing the conceptual framework empirically. These quantitative tests address some of the current public debates about the role of clusters and indicate avenues for further theory development. We concentrate on efforts to empirically identify clusters, track their evolution over time, and test the linkages between clusters and economic performance.

Third, we turn to our current knowledge about cluster-based economic development. While we have a fairly good understanding of clusters as an empirical phenomenon we have far less systematic knowledge about turning this understanding into effective policies. In fact, in much of the current debate clusters as empirical phenomena and clusters as a policy approach are used almost interchangeably. We discuss the theoretical rationale for cluster-based economic development, present evidence on current cluster initiatives, and sketch the profile of a new broader cluster-based approach to achieving microeconomic competitiveness.

While trying to be inclusive, this discussion is based on a specific view of the field driven by our own research at the Institute for Strategy and Competitiveness. It is not a complete review of the existing literature in this field,[7] and it also does not aim to cover at any length the work in related fields such as economic geography, the new growth theory, or the work on industrial districts. Instead, it aims to provide policy makers and researchers with a concise assessment of our view on where we are and what lies ahead.

Conceptual framework

Clusters are groups of companies and institutions co-located in a specific geographic region and linked by interdependencies in providing a related group of products and/or

---

[5] Porter (1990)
[6] Porter (1998a)
[7] For broad reviews see the *Oxford Handbook for Economic Geography* or several journal articles such as Breschi/Malerba (2001) in the special issue of *Industrial Change and Corporate Change* and.

services.[8] Because of the proximity among them – both in terms of geography and of activities – cluster constituents enjoy the economic benefits of several types of positive location-specific externalities. These externalities include, for example, access to specialized human resources and suppliers, knowledge spillovers, pressure for higher performance in head-to-head competition, and learnings from the close interaction with specialized customers and suppliers.

Types of clusters

Clusters differ in many dimensions: the type of products and services they produce, the locational dynamics they are subject to, their stage of development, and the business environment that surrounds them, to name a few.

At a first level, clusters can be classified by the type of product and/or services they provide. There are clusters in automotive, in financial services, in tourism, in ceramic tiles, and many more. Within these clusters, recent research has pointed out how different locations play different roles. The early discussions on clusters focused on clusters with international importance and leading world market positions, such as the financial clusters in New York and London, the media cluster in Hollywood, the IT cluster in Silicon Valley, the automotive clusters in Southern Germany and Detroit, the telecom clusters in Stockholm and Finland, and the textile/fashion clusters in Northern Italy. This characterization of clusters has discouraged many regions with no realistic chance of achieving a similar level of performance in their clusters.

More recent research on clusters indicates that even within a given field there is room for many different successful clusters, each taking a unique, individual role. Clusters are differentiated by their specialization in a particular stage of their field's value chain, by their focus on specific geographic areas, or by targeting selected customer needs or market segments. Take the example of footwear:[9] Northern Italy is home to a very successful, high wage cluster, serving the world market and focusing on design, brand building, and high value production. Portugal is home to another cluster, focused on footwear manufacturing and short production runs serving fashion-conscious markets in Europe. Timisoara, Romania, is emerging as another cluster, functioning as an offspring of the Italian cluster focused on production in the low- to medium value product range. And then there are the major clusters in Asia, China and Vietnam in particular, focused on high-volume contract manufacturing of low value footwear products for the U.S. and European markets respectively.

The same mechanisms are at work within a country as the life sciences cluster in the United States indicates:[10] New Jersey is home to most of the large pharmaceutical companies and many of their manufacturing capacity. More standardized manufacturing

---

[8] This definition builds on Porter (1996, 1990). For discussions see Doeringer/Terkla (1995), Rosenfeld (1997), and European Commission (2002).
[9] This example draws on research by Claas van der Linde and student teams at Harvard Business School.
[10] This example draws on data from the Cluster Mapping Project and research done for the Massachusetts Life Sciences cluster

is prominent in Puerto Rico. Minneapolis/St. Paul and Boston are specialized on medical devices. Biological products are concentrated in Los Angeles and San Francisco. Research hubs are the San Francisco Bay Area, Boston, and – specialized on specific diseases groups – the Research Triangle in North Carolina and San Diego. These examples show that even within a given field there are many different ways to be a successful cluster. Rather than being fixated on becoming a global innovation center, of which there will always be just a few, theory suggests that regional clusters can succeed by identifying what specific role they can play based on improving their current position.

At a second level, clusters can be classified by the type of locational dynamics their constituent industries are subject to.[11] Industries differ by the extent to which they can choose locations. Two main reasons can limit that choice: Many industries are tied to their location by the need to be close to their customers. These *"local" industries* are serving only local markets and are distributed across space roughly according to population. They might cluster in a more narrow geographic sense like a part of a city - mainly due to complementarities in attracting customers - but these effects are not strong enough to influence the locational patterns across regions. Others industries are tied to their location by the need to be close to natural resources. These *"natural resource-dependent industries"* serve global markets and are concentrated across space according to the presence of natural resource. Finally, there are many industries that are essentially free to choose their location according to the quality of the cluster-specific business environment. These *"traded" industries* serve markets in many regions and countries, and concentrate across geographies. The cluster effects in these industries are strong and their presence is a key part of the attractiveness of a specific location. Understanding the differences between these types of industries is important, because it affects the types of policies that are relevant to upgrade them.

At a third level, clusters can be classified by the stage of development they have reached. The stage of development depends on two dimensions: First, it depends on the quality of the external business environment the cluster operates in. Researchers have looked at clusters in less developed economies[12] as well as in less developed regions of advanced economies, such as rural regions[13] or inner cities.[14] This discussion is concerned with the question of whether clusters occur in environments that otherwise do not allow for a high level of sophistication in economic activities. Most of the theoretical literature suggests that clusters are a factor at every stage of economic development but that in weaker environments clusters will tend to be weaker and more narrow as well. Second, the stage of development depends on the progress the cluster has made in mobilizing the potential of its business environment through active cooperation and other internal activities.[15] Researchers have focused on the role of cultural factors, institutions, and individual leadership. There is strong view in the literature that cluster dynamics do not occur automatically, but that they depend on and can be reinforced by purposeful action.

---

[11] See Porter (2003a)
[12] See US AID (2003) and Fairbanks/Lindsay (1997)
[13] See Landabaso (2001), Rosenfeld (2002b), and Porter/Ketels/Miller (2003)
[14] See and Porter (1998b)
[15] Enright (1996)

Evolution of clusters

Clusters develop over time; they are not a phenomenon that just appears or disappears overnight. While the exact understanding of the evolution of clusters is still the subject of much research, a number of observations emerge from case studies and the conceptual thinking.

For many clusters, the roots of their development go back many years. The steel industry around Pittsburgh, for example, owes its existence to the deposits of coal in the region that provided affordable energy.[16] Today, there is still a huge cluster of steel and other production technology companies located around the city, although the local coal deposits are of little remaining importance. Natural factors like resources or the location at a major trading route or river can have effects on the presence of specific clusters that are felt many years after they have lost their direct influence.

Another root for cluster development can be the existence of initial institutions, such as companies or universities, which over time act as an anchor for the cluster spinning-off new businesses and attracting the investment from companies outside the region. In San Diego, the presence of the U.S. Navy with a leading communications research facility provided the ground for the development of a dynamic telecommunication cluster around Qualcomm. In North Carolina, the network of universities in the Research Triangle in the 1960s led to the development of one of the leading biotech clusters in the U.S.

The existing research shows that the evolution of clusters can take many years, often decades. Many clusters have developed without the presence of any dedicated efforts to upgrade them. The inherent economics of proximity have been enough to over time attract increasing numbers of companies and other institutions, leading to a self-reinforcing cycle that was often started by a chance event. But other clusters have developed much faster because of the determined action of regional leaders that had spotted the potential of their region for the cluster.[17]

Clusters and economic performance

Clusters develop and are important because they create economic benefits. The benefits of a cluster come in three dimensions:[18] *First*, companies can operate with a higher level of efficiency, drawing on more specialized assets and suppliers with shorter reaction times than they could in isolation. *Second*, companies and research institutions can achieve higher levels of innovation.[19] Knowledge spillovers and the close interaction with customers and other companies create more new ideas and provide intense pressure to innovate while the cluster environment lowers the cost of experimenting. *Third*, the level

---

[16] For this and the following example see the regional reports of the Clusters of Innovation Initiative by Monitor Company, the Council on Competitiveness, and Michael Porter (2001).
[17] For a more extensive discussion see Porter (1998a)
[18] See Porter (1998a).
[19] Because of the critical importance of innovation for advanced economies 'innovation clusters' have become a particularly popular topic. See OECD (2001) and Monitor Company, Council on Competitiveness, and Michael Porter (2001).

of business formation tends to be higher in clusters. Start-ups are more reliant on external suppliers and partners, all of which they find in a cluster. Clusters also reduce the cost of failure, as entrepreneurs can fall back on local employment opportunities in the many other companies in the same field.

These benefits are important both for cluster participants and for public policy. For companies, they create additional value that outweighs the often-higher costs of more intense competition for specialized real estate, skills, and customers at the location.[20] They are thus the reasons that clusters emerge naturally from profit-maximizing decisions. For public policy, higher productivity and innovation in clusters are critical because they are the factors that in the long term define the sustainable level of prosperity in a region. Note, however, that the interests of these groups are not identical: Public policy is not concerned about the distribution of the cluster benefits among companies, employees, and owners of critical assets such as real estate, while company owners clearly are.

The performance of a cluster at a specific location is driven by the business environment that the cluster is operating in. "Business environment" is a broad and naturally vague term: almost everything – from the quality of the schools to the strategies of local competitors – matters for the level of productivity and innovation that companies in the cluster reach at this specific location.

To organize this complexity, Michael Porter has in 1990 introduced the so-called "diamond" as an analytical tool to assess business environments.[21] The diamond includes the four elements factor conditions (e.g., physical infrastructure, skills, etc.), demand conditions (e.g., sophistication of local customers, product and consumer regulation), the context for strategy and rivalry (e.g. taxation structure, competition laws, and the strategies of competing local companies), and the presence of related and supporting industries (e.g., the breadth and depth of the cluster). These elements interact in their impact on specific companies and clusters; they exhibit system-effects where the weakest element often tends to have the strongest impact on the overall quality.

The diamond can be used to analyze the general quality of the business environment at the national or regional level. But it can also be applied at the regional cluster level, looking at the specific conditions relevant for the cluster in the four categories defined.[22] Note that the impact of different aspects of the business environment depend on the position that the cluster aims to take in the field.

Government policy has an impact on all elements of the cluster-specific diamond. It often has responsibilities for large parts of the infrastructure, it sets key rules and regulations affecting competition and demand, and it affects the cluster presence through, for example, recruiting companies from other locations to make investments. More recent research has emphasized the need to look at government policies in a more differentiated

---

[20] For the implications of clusters on company strategy see Porter (2000b) and Ketels (2002a)
[21] Porter (1990)
[22] For an example see Porter/Council for Competitiveness/Monitor Company (2001)

way, separating the role of government at different geographic levels - from the cross-national, such as the EU or Baltic Rim region[23], to the national to the regional and local[24] - and of different, often quite autonomous government agencies. All these influences culminate at the regional cluster level.

Other recent research has also stressed the importance of different types of "institutions for collaboration",[25] that create specialized platforms for interaction among cluster participants. Because the performance of a cluster depends on the strength of interaction among its constituents, the presence of such institutions that allow knowledge to flow more easily and enable the cluster to organize collective actions has a significant impact on how the available assets in the cluster are being deployed. This research develops earlier work that had stressed the strength of networks and open collaboration within different regions as a key factor for economic success.[26]

Empirical findings

Much of the existing knowledge on clusters and cluster-based economic development has been the outcome of case studies and theory development. The case studies have generated many useful ideas for theory development, and the conceptual framework is by now quite well defined and internally coherent. However, much of future progress will depend on the ability to create more representative datasets that can be used to test the theory and suggest further avenues of research. This section will describe a number of on-going efforts that aim to move in this direction.

Identification of clusters

In the empirical application of the cluster concept two questions in particular have led to a sometimes heated debate: Does what we empirically see in this region meet the criteria of being a cluster? And what are the cluster's exact boundaries, in terms of geography and of constituents? These are simple and important questions that the conceptual framework should be able to answer. We address them in turn.

First, clusters can be seen as elevations in a three-dimensional map of the geographic location of economic activity in a given field, using for example employment to indicate height. The question becomes at what height we deem this elevation significant enough to call it a hill or even a mountain. The exact answer clearly becomes somewhat arbitrary while the overall concept of a hill or mountain relative to the plains is not. For clusters, it takes a minimum critical mass to reach a meaningful level of the type of location-specific externalities that attach economic significance to clusters. Rather than trying to identify the exact measure of this critical mass, it seems more effective to try to evaluate whether joint activities to strengthen the cluster can significantly improve the level of cluster dynamics that are occurring.

---

[23] See Ketels (2002b)
[24] Council for Competitiveness/Monitor Company/Porter (2001)
[25] See Porter/Emmons (2003)
[26] See Saxenian (1996)

Second, clusters are defined by the relationships, market and non-market, that exist among companies and institutions in a given field. Again, the level of these relationships is a continuum without any one clear cut-off point. One way to define these cut-off points is by looking at the actual geographic distribution of economic activity: If across many regions two industries tend to co-locate in terms of their employment, there is a strong indication that they are tied by significantly strong relationship effects.[27] The other approach relies on the perception of relationships by potential cluster participants. As long as they (1) share the same type of barriers in their external environment that (2) can be removed only by joint action, they should be part of the cluster.

The necessary condition to do any kind of systematic empirical work on clusters is to find a consistent definition of what economic activities belong to the cluster. The efforts to develop such cluster definitions based on empirical analysis have been come to known as "Cluster Mapping".

To our knowledge most the extensive cluster mapping exercise has been undertaken by Michael Porter at the Institute for Strategy and Competitiveness, Harvard Business School.[28] He could draw on detailed data on employment and wage levels at the regional level available for the entire U.S. He first identified industries that concentrate across geographies in terms of employment. This allowed local industries to be separated from traded industries competing across regional boundaries. Traded industries account in the U.S. on average for about a third of regional employment, but record significantly higher wages, productivity levels, and innovation rates than the average of the economy.[29] Local industries serving local markets and present at similar densities across regions account for about two-thirds of regional employment, with below economy-wide average levels of wages, productivity, and innovation. The final group of natural resource-dependent industries accounts for less than one percent of U.S. employment but can be more significant in individual regions.

To then identify cluster categories, Porter calculated the correlation of employment by industries across locations. Based on these correlations, industries were grouped into cluster and subcluster categories. Industries were assigned to one cluster as their primary association, giving rise to what we called "narrow" cluster definitions. Many industries, however, were also associated with other clusters so we created "broad" cluster definitions that took account of these relations as well.[30] These broad clusters show the overlaps that exist between clusters and allow new clusters to develop put of existing ones. With these definitions, the leading cluster locations in a cluster category could be identified and compared in size, profile, and performance. The following table includes a list of the 41 traded cluster categories identified in the U.S. economy.

---

[27] This empirical approach has been taken in the Cluster Mapping Project (2003)

[28] For a detailed description of the methodology used see http://data.isc.hbs.edu/isc/cmp_overview.jsp

[29] This typology has been developed in Porter (2003a)

[30] Note that these "broad" cluster definitions imply double-counting of industries that in their locational patterns show significant correlation with more than one cluster.

Traded Clusters in the U.S. Economy

- Business Services
- Financial Services
- Hospitality and Tourism
- Education and Knowledge Cr.
- Distribution Services
- Heavy Construction Services
- Transportation and Logistics
- Metal Manufacturing
- Processed Food
- Automotive
- Entertainment
- Publishing and Printing
- Plastics
- Information Technology
- Analytical Instruments
- Building Fixtures, Equip, a. Serv.
- Production Technology
- Apparel
- Chemical Products
- Communications Equipment

- Heavy Machinery
- Motor Driven Products
- Textiles
- Forest Products
- Furniture
- Medical Devices
- Oil and Gas Prod. and Services
- Aerospace Vehicles and Def.
- Lighting and Electrical Equip.
- Prefabricated Enclosures
- Power Generation and Transmission
- Agricultural Products
- Biopharmaceuticals
- Construction Materials
- Leather Products
- Jewelry and Precious Metals
- Sporting, Recr. and Child. Goods
- Aerospace Engines
- Fishing and Fishing Products
- Tobacco
- Footwear

Note: Sorted by total employment

Copyright 2002 © Professor Michael E. Porter

Outside of the United States, these definitions of clusters have been applied in Canada[31] and in Sweden[32] to map cluster patterns in those countries. These efforts make the assumption that the U.S. economy provides a widely applicable benchmark in terms of the cluster effects that can be expected to occur among individual industries. In the United Kingdom, [33] a related effort assigned industries to specific clusters based mainly on a qualitative process of interviews. Regional clusters were then identified based on location quotients, the national employment share of the region in an industry or cluster relative to the region's overall national employment share. Other empirical efforts have been done or are underway elsewhere, although most of them have either had a smaller geographic focus or used a less systematic approach to identify clusters.[34]

To get a comparative view of clusters across individual nations, current research at the Institute for Strategy and Competitiveness is looking at international trade data. While the identification of clusters using even disaggregated trade data is problematic – countries are not very useful proxies for the regional level at which individual clusters occur -, trade data can be useful to evaluate the position that a country's clusters in a particular category have on world markets. Trade data can also identify interesting differences in the pattern of country specialization across subclusters, further developing the existing attempts to classify exports by relative factor-content or level of processing.

---

[31] See the web site of the Institute for Prosperity and Competitiveness for details, www.competeprosper.ca

[32] See Lindqvist/Malmberg/Solvell (2003)

[33] DTI (2001)

[34] Interesting examples of cluster mapping can be found, for example, in Japan (regional cluster mapping under way) and Norway (clusters identified nationally but not broken down to regions). See Yamawaki (2002) and Reve/Jakobsen (2001)

In the application of cluster concepts to actual policy, some attempts to identify cluster have been made that are problematic. We look at them because they are helpful in further exploring the cluster concept. First, there are a number of cluster initiatives that draw the borders of cluster extensively wide. Some implicitly look at manufacturing as a cluster; others talk about high tech clusters. *Manufacturing* is both broader in some ways and more narrow in others than clusters.[35] It is broader in the sense of consisting of a broad range of industries that face very different challenges. This heterogeneity can be detrimental to the effectiveness of a cluster as a forum to shape policy – the only common interests that remain between companies in such different situations are generic lobbying on less foreign competition, lower taxes, and less government bureaucracy. But manufacturing is also more narrow than a cluster in the sense of not including related services and educational and research institutions. For many industries in manufacturing, however, those activities have critical importance to achieve higher competitiveness.

High-tech clusters are another example of a problematic category with a lot of the same conceptual issues as manufacturing. What is more, however, it creates a very misleading view of the role of technology. Technology has permeated all aspects of economic activity and especially in advanced economies clusters and companies that fail to adopt technology struggle to compete. Designating some clusters as high-tech and by implication others as low-tech does frame the challenge of how to develop and use technology in a distorted way. Also, the focus on high-tech clusters is often an indication that these clusters are perceived as being generically more important than others. The potential of a cluster for a location depends, however, much more on the existing relevant strength of the location relative to this cluster rather than on the generic attractiveness of a particular field. And, as data from the U.S. indicates, the cluster usually included as high-tech account for less than 5% of employment – efforts to increase regional or national prosperity relying exclusively on these clusters are unlikely to succeed.

Evolution of clusters

Systematic empirical analysis of the evolution of clusters is still in its infancy. The statistical analysis of the more than 800 clusters mentioned in the existing literature reviewed in the Cluster Meta Study[36] gives a cross-section of clusters at different stages of development, but so far does not allow to look more deeply at the factors shaping the evolutionary process over time. The Cluster Mapping Data described tracks changes in cluster composition and performance over time, but does not contain data on the factors driving this change.

More data is available on the related question of whether clusters are becoming more prevalent in modern economies. In Europe, there were a number of studies on the change of geographic concentrations in economic activity after the opening of the Common Market in 1992. The evidence was mixed, consistent with the parallel strengthening of some clusters with Europe-wide roles in some locations and the demise of others

---

[35] See, for example, DTI (2002b)
[36] See Van der Linde (2001) and http://data.isc.hbs.edu/cp/index.jsp

uncompetitive after the fall of barriers to competition.[37] These studies did look at broad industries and not clusters. In the United States, the Cluster Mapping Data provides an equally mixed view: the employment share of traded clusters in the economy is decreasing over time (although their GDP share was almost stable), most likely reflecting the growth of the service sector in the economy that tends to be more local. Within traded clusters, however, the concentration on specific clusters across states has on average increased.[38]

In the public debate, an important issue is the impact of information technology on the patterns of geographic concentration of economic activity. Some argue that with the lower cost and the new tools of communication new types of clusters can emerge that supersede the need for physical proximity. Others claim that because of better information and communication technology as well as lower transportation costs we will see a "declustering" of the economy.[39] So far, there is no evidence that either is occurring. It is true that the change in communication and transportation costs leads to a relocation of economic activities. But even the outsourcing of, for example, IT services to India does not disperse activity there but tends to create new clusters such as the IT cluster around Bangalore. Given that many of the cluster effects arise only because of proximity, for example the spillovers from unplanned meetings, it is unlikely that many such "virtual clusters" will arise. The interactions among cluster constituents at a given location involve so many channels and happen at so many levels, that they cannot be captured by even the best communication technology available today.[40]

Clusters and economic performance

Clusters are of interest for economic development professionals and company executives because the conceptual thinking strongly suggests that they affect performance. It is worth noting, however, that the theory makes few predictions about the ultimate distribution of the value being created by clusters. Depending on the relevant market structures, the gains could all go to, for example, consumers, employees, or the owners of real estate in the cluster locations.

A number of recent studies have looked at the impact of cluster presence on overall economic performance. The *Global Competitiveness Report*[41] draws on survey data, in 2003 from more than 8,000 business leaders around the world, to get comparable measures of different aspects of national business environments, including cluster presence. Surveys are the only way to get comparative data on a large set of countries, the current Global Competitiveness Report covers 101, and they provide important insights into the perceptions of the critical private sector-decision makers in the economy. The survey includes a general question about the strengths of clusters in the national

---

[37] See Middelfart et al. (2000) and Aiginger/Pfaffermayr (2000).
[38] See Porter (2003a)
[39] See Kotkin (2001)
[40] See Leamer/Storper (2001) for a detailed discussion.
[41] Porter (2003b). Other examples for such reports on the regional or national level are European Commission (2003b) and DTI (2002a)

economy, and a set of more detailed questions about different aspects of the cluster, for example the availability of specialized research services. The Report finds a positive and statistically significant relationship between each of these questions and GDP per capita, a broad measure of national productivity and prosperity. While the correlation does not prove causality, it strongly suggests that the development of stronger clusters is one aspect of overall economic development.

The *Cluster Mapping Project* data has been used to test the impact of cluster presence on economic performance at the level of U.S. regions.[42] The findings confirm the important role of strong clusters for regional prosperity: First, the share of a region's employment in cluster categories in which the region was strongly specialized (higher concentration of employment in the cluster regionally than nationally) is positively and significantly related to higher average regional wages. More employment in "strong" clusters seems to lead to higher overall wages. Second, the more regions concentrated their employment across clusters over time, the higher their wage growth. Being strong in some fields seems to be more important than having a presence in all fields. Third, within U.S. states there tends to be a strong positive correlation between the relative employment position of the region in a specific cluster category and its relative wage compared to the national average in the cluster category. The stronger a region's employment position in a given cluster category, the higher its wage relative to that category's average level.

Furthermore, the U.S. data allows a closer look at the effect of cluster composition on regional economic performance. Two findings are particularly noteworthy: First, the average level of wages in local industries in a region is positively and significantly related to the average level of wages in traded clusters. This suggests that traded clusters create value in competing across regional boundaries, and that value is then dispersed into the local economy through local consumption. A likely less important reverse relationship is also consistent with this data: Efficient local industries, as indicated by higher wages, provide a helpful environment for traded clusters to compete across regions by providing efficient inputs.[43] Second, the majority of differences in average wages across U.S. regions is explained by differences in the level of wages in individual clusters, not by the relative size of individual clusters in the regional economy. This finding runs counter to the argument that to be economically successful a region has to have a presence in particular high-wage clusters. Instead, it seems more important to be productivity in whatever cluster category a region ends up having a strong position in.

A significant number of studies look at individual aspects of the relationship between locating in a cluster and company performance. The following few examples highlight some of the issues these studies look at. First, there is a significant literature looking at the presence of co-location of different activities within a cluster. In the absence of any cluster effects, theory would suggest that different activities within a cluster or industry would be located at different locations to take advantage of factor price differences. McDaniel/Smarzynska (2001) test this hypothesis and find that across U.S. states production and R&D within industries tend to be co-located, suggesting spillover effects.

---

[42] Porter (2003a)
[43] See Porter, Hirotaka, Sakakibara (2000) for a discussion of this dynamic in Japan

Second, if there is co-location to capture cluster effects, it should show up in some ultimate performance indicators of companies located in clusters. Boasson/MacPherson (2001) look at evidence from U.S. pharmaceutical companies and find a positive relationship between location-specific factors related to clusters and financial and innovation company performance.[44] Third, some researchers argue that a high concentration of companies from a specific field in one location is not enough to generate full cluster effects. Instead, they claim, the extent of cluster benefits depends on the behavior of the cluster participants. Beaudry/Breschi (2003) looks at this issue and finds that the innovative performance of companies in Italy and the UK depends on the innovation propensity of co-located firms. Cluster externalities seem to exist but can go either way: if other companies in your regional cluster do not compete on innovation, your company is less likely to do so, too. Schmitz (2000) looks at the relationship between levels of cooperation within clusters and company performance, using data from South America. He finds that positive cluster effects depend on linkages and are increasing in the level of collaboration between cluster participants.

Finally, there is an increasing debate about the measurement of cluster strengths and the effectiveness of cluster-based economic policies over time. Research projects that aim to develop more consistent measures on the impact of cluster policies are currently being pursued by, for example, the US Administration for International Development (US AID) and the UK Department for Industry and Trade (DTI). Another recent development is the launch of a new independent, not-for-profit foundation for the evaluation of clusters and cluster policies.[45] The initiative for this foundation came from the Government of Catalonia in Spain, an economically successful region that has used a cluster-based economic development approach for many years. The foundation will offer individual clusters around the world a survey-based evaluation tool that can be used for an assessment of strengths and weaknesses and, over time, for the evaluation of cluster policies and the position of the cluster relative to competing locations.

Cluster-based economic development policy

For many practitioners the motivation to look at clusters is not the analysis of an empirical phenomenon per se; it is the promise to develop a new approach for economic policy that can help to develop regional and national economies. It is important to keep these two aspects of research separated: There is increasing evidence and agreement among researchers that clusters exist and that they feature a number of positive economic effects. There is less systematic evidence and agreement that policy interventions are possible and that they can generate value by speeding up the process of cluster development or increasing the effectiveness of existing clusters.

What is needed is a conceptual model for cluster-based economic policy, tested against empirical data. This model would be based on our knowledge about clusters to identify a

---

[44] For work focusing on innovation see Audretsch/Feldman (1996), Jaffe et al. (1993), and Porter/Stern (2001)

[45] See http://www.clustercompetitiveness.org/ ; the Institute for Strategy and Competitiveness will provide the conceptual framework and Professor Michael Porter is member of the Board of Trustees.

set of procedures and activities to be applied when conducting economic policies involving clusters. To take stock of the current progress towards this goal, we divide the discussion of cluster-based economic development into three parts: First, we review the theoretical rationale for upgrading the competitiveness of clusters. Second, we look at the evidence of existing cluster initiatives. And third, we aim to characterize our own view of a broader perspective of cluster-based economic policy.

The economic rationale for cluster-based economic policy

For many practitioners, the evidence on the economic benefits of clusters suggests that they should focus on policies that create or support clusters. For many economists, this triggers instinctive concerns about the distorting effects of interventions into markets.

There is, of course, an underlying economic rationale for cluster-based economic policy that is consistent with standard economic models. But is not often spelled out and it also is often not presented in a language that relates to the models economists use. The argument runs implicitly as follows: First, the externalities that give rise to clusters indicate the presence of multiple equlibria with different levels of prosperity, not only in different locations but also for the sum of all locations. Policy has a role in pushing locations towards more favorable equilibria. Second, these externalities do not all occur automatically but can be triggered or strengthened through purposeful political action. Third, the time it takes for a region to reach its "equilibrium" state is not set and can be significantly influence by policy. This theoretical rationale has direct implications for some of the key questions that practitioners ask:

First, can clusters be created? Based on the (limited) available evidence on cluster evolution it seems likely that the answer is yes. However, this answer is about as relevant as the answer to the question of whether subsidies can "create" employment: the more important question is whether the resources spend to "create" a cluster generate economic value higher than their opportunity cost, and whether the cluster is sustainable once the initial support is removed. The evidence is quite negative, suggesting that cluster creation is a very long and costly process with a high failure rate that for many regions does not pay off and creates long-term dependency on government funds.

The experience of the Research Triangle in North Carolina illustrates this point, even though it is one of the few success cases. In North Carolina the explicit decision was made in the 1960s to invest heavily in universities and a research infrastructure to develop a relatively rural region of the United States. After more than three decades, the region has now managed to become a serious player in the research-dependent life sciences field. It can be argued that a cluster has successfully been created – but the process has taken a very long time and required sustained levels of investment. And it was launched at a time when few other regions were aiming for the same position.

Second, which clusters should be targeted? This question gets to the heart of the confusion of cluster-based economic policy with (strategic) industrial policy.[46] These policies are based on fundamentally different views on the ultimate drivers of economics prosperity. Industrial policy suggests that a few sectors of the economy are inherently more important than others. These sectors, characterized by strong positive externalities (or industry-wide economies of scale), should be targeted to secure their location in a specific country or region. Targeting takes the form of interventions into the competitive process, for example (temporary) trade barriers or government subsidies, to increase market share.

Cluster-based economic policy suggests a different perspective: First, all clusters are important, not only traded or high-tech sectors. The productivity across all of them determines the standard of living a country or region can sustain. Second, cluster efforts are not about targeting – they are a tool that, in principle, is open to all clusters in a region. Because of limited resources it makes sense to concentrate on a few clusters that have both a high ability to succeed and a high willingness to improve at any point in time. But this selection is driven by the specific local circumstances, not by some generic view on which clusters are more valuable. Third, cluster efforts are directed at improving the underlying conditions for higher levels of productivity and innovation, not the outcomes in terms of market share or employment directly. Pro-productivity policies allow competition to move to a higher level of productivity and unique value, not restrict competition.

In our view, cluster creation and industrial policy-type targeting is a very dangerous guide for policy. It leads policy makers across regions to flock to the same type of cluster categories viewed as strategically important for economic development. In such a field, life sciences comes to mind, many locations without relevant competitive advantages will compete for the same number of limited spots sustainable in the industry. And these locations will tend to compete on the amount of financial incentives they give to companies, not on their inherent attractiveness for these activities. This type of locational competition not only leads to a government-centric approach to economic development very costly for public budgets. It often also relies on limiting or distorting the effects of competition[47] – and because high levels of local rivalry are such a critical ingredient in creating competitive clusters, these policies will tend to undermine the very competitiveness they are trying to create.

In our view, a more productive way to think about efforts to develop clusters is "cluster activation". Cluster activation is focused on removing the most serious bottlenecks for higher productivity and innovation for a cluster by mobilizing the capacity of cluster participants to act jointly. This approach is driven by an underlying model of economic development that views clusters as evolving over time depending on the profile of their business environments, the current composition of clusters in the region around them, and other factors driven by location and history. Joint action can affect this evolutionary

---

[46] See Ketels (2002) for a more detailed discussion.
[47] See Nickell (1996) and Sakakibara/Porter (1998)

process by changing the business environment, and by creating institutional structures that help to speed up the process of cluster evolution over time.

Cluster initiatives

Practitioners cannot wait for a fully specified "theory of cluster-based economic development" to emerge. They have, often with the support of researchers trying to test their conceptual thinking in practice, engaged in so-called cluster initiatives.

Most analyses of cluster initiatives are based on selected case studies.[48] Recently, however, the Cluster Initiative Greenbook made the first attempt to document the process and structure of cluster initiatives based on a broader sample of more than 250 such efforts.[49] While more systematic data generation and analysis is needed, this dataset provides interesting initial insights into cluster initiatives.

The profile of cluster initiatives

Cluster initiatives are involved in a broad range of activities. In fact, two-thirds of all cluster initiatives surveyed had activities in at least five out of six broad activity areas (research/networking, policy lobbying, commercial cooperation, education/training, innovation/technology, and investment attraction). This seems consistent with a view of cluster-based policy as a prioritization process across many different policies rather than as new type of program focused only on, say, networking. Interestingly, we find this breadth in activities even in relatively young cluster initiatives. Cluster initiatives seem to increase the intensity of their activities over time, not necessarily the number of parallel efforts.

Despite some heterogeneity, cluster initiatives tend to share some common patterns in their organizational structure. The initiative to form a cluster comes in almost equal shares from government, business, or a combination of both. In most cases, companies are the most influential participants in terms of the setup and governance of the initiative. Government, however, tends to be important in terms of financing the initiative and securing at least some level of organizational support. In almost all cluster initiatives surveyed, a critical role was played by the individual leading the effort, called the cluster facilitator. This individual tends to be an industry insider with a strong network within the cluster. He or she leads the overall effort and guides individual working groups that tackle specific topics.

The data from the survey as well as evidence from case studies suggests that cluster initiatives are going through different phases of a life cycle. There are four main phases that can be identified: *First,* there is often a period before the cluster initiative gets launched in which issues of competitiveness are already being discussed. Sometimes there is even a first attempt to launch a cluster initiative that fails but is important in

---

[48] For an example see Dohse (2000), a discussion of the quite innovative German policies to develop biotech clusters in the mid-1990s.

[49] See Solvell/Lindqvist/Ketels (2003). The publication was commissioned by Vinnova, a Swedish-government agency, for the 6th Annual Conference of The Competitiveness Institute.

providing the ground for later efforts. *Second,* the cluster initiative gets started in earnest, often with an analysis of the cluster and its competitiveness. This process is important to identify areas for action but it also creates and communicates a sense of belonging to the cluster in the relevant community. Based on this analysis, the cluster initiative then develops action plans in specific areas like, say, organizing networking events or a joint presence of the cluster at a trade fair. *Third,* the cluster initiative implements the action plans. In the process, the initiative has to reach out to a much larger part of the cluster to have impact. *Fourth,* over time the project-driven organization transitions into a more stable organizational form. These organizations – typical forms of the institutions for collaboration discussed earlier – can lead periodic reviews of the cluster's action agenda and engage in new activities.

Drivers of success and failure in cluster initiatives

In addition to characterizing the profile of cluster initiatives the Cluster Initiative Greenbook also made an attempt to identify which factors were associated with success or failure. Without an objective outside measure of success available, we needed to rely on the self-assessment of the respondents. Despite this limitation, the data suggests a number of interesting factors.

First, cluster initiatives seem to be more successful if they are focused on a cluster already strong and set in a location with a good business environment. This is consistent with the view that cluster initiatives should focus on activating clusters rather than trying to create them from scratch. It is also consistent with the perspective that cluster initiatives are more successful, if they are part of a broader strategy to improve the microeconomic business environment in a particular region or country. Isolated cluster initiatives have less impact, both overall and on the cluster they are focused on.

Second, cluster initiatives seem to be more successful if they are based on a shared conceptual framework of competitiveness. In fact, the lack of a broad consensus about the drivers of economic performance turns out to be the factor most strongly associated with the failure of cluster initiatives. A more subtle implication is the need to manage the interests of different constituencies in the cluster: Companies tend to be more interested in productivity growth and innovation within existing firms rather than new ones, while government tends to be more interested in job creation than higher productivity.

Third, cluster initiatives need at least a small operational budget to finance an office with a dedicated cluster facilitator. If such a resource is not available, cluster initiatives are very hard to sustain over time. Interestingly, we did find no negative effect of government financing for this budget in the data. As long as the private sector is heavily involved in the governance of the cluster initiative, government seems to have a positive role in providing operational budgets to overcome joint action problems in the private sector, especially in the early phase of a cluster initiative.

Cluster-based economic policy as a new model

Cluster-based economic development should be seen as a new model for microeconomic policies at large, not as a narrow revision of traditional sectoral policies or a mere addition to the tool box available to policy makers. In this context, clusters have a significantly higher potential than just being the motivation for well-intentioned cluster initiatives that are innovative but often isolated and with little sustained impact. In this section, we are trying to characterize some key aspects of this broader view of clusters and their role in cluster-based economic development.

Cluster-based economic development is concerned with the improvement of the overall microeconomic foundations of prosperity in a given location. To improve a location's competitiveness, all elements affecting the context for productivity and innovation in individual firms and clusters have to be looked at. Four dimensions are in our experience critical elements of such a strategy: Regions need to activate their clusters, address cross-cutting weaknesses in their general business environments, create an institutional structure to focus on competitiveness beyond the life cycle of specific administrations, and define an overall understanding of the unique value they intend to provide relative to other locations. Without such a broader microeconomic strategy, cluster efforts are less effective. What is more, they run the danger of alienating the large share of companies and citizens that by definition are not part of the clusters that have mounted a cluster initiative.

While clusters are not everything, they play a critical role in this process for a number of reasons. First, they are critical engines in the overall economic make-up of a region or nation. Affecting the ability of a key cluster to be more productive and innovative has huge benefits for the economy at large. Second, clusters are a more effective way to conduct microeconomic policy. Firm-level interventions are too costly and tend to distort competition, while policies directed at broad sectors or the whole economy will tend to have little effect and miss the levers critical for a specific cluster. Third, clusters can help to identify challenges in the business environment affecting the whole economy, and they can be the testing ground for specific remedies addressing them. The economy-wide perspective often is less effective in reaching level of granularity needed to achieve improvements in microeconomic factors. Finally, clusters can help the private and the public sector to adopt a new approach of economic policy making, characterized by collaboration and joint action along a wide set of players.

This new approach to economic development, focused on the overall business environment as well as specific clusters, stresses the role of a key new challenge decision makers face in microeconomic policy: Prioritization. As discussed earlier, business environments consist of a huge number of factors – "everything matters" for competitiveness. And individually policies are available to address most of these factors, all of which could arguably have some positive impact. Given the limited resources and ability to mount joint action, the prioritization among them is not a technical detail; it is central. While past discussions, especially with regards to the macroeconomic context, where about which policies created economic benefits and which did not, microeconomic

discussions need to select the most effective policies, for a given location at a given time, out of all the available policies that could improve the business environment.

To base the prioritization of policies on all relevant information and to implement them in the most effective way, reliance on the government alone is no longer sufficient. In the old model, government was seen as responsible for a stable macroeconomic and legal context and a functioning infrastructure while companies were to compete on the market place. The realities of modern competition are more complex: Government is an important factor in shaping the business environment but so are companies, universities, and many other institutions. And government itself is not the unitary entity it appeared to be when macroeconomic policies were the focus; at the microeconomic level many different types of government agencies at all levels of geography have an impact. Effective cluster-based development needs to be based on an assessment of the most critical barriers that hold back productivity improvements and innovation. To identify these most limiting factors, companies must be part of the policy process because it is at their level that they have an affect. To act upon these findings, a broad group of institutions will have to work together. Depending on the unique circumstances, all entities related to the cluster – from the government to individual companies to trade associations and universities with relevant research or educational programs – may have to be involved.

Outlook

Cluster-based economic development is entering a new era. As it is moving towards the mainstream of economic policy approaches in many countries and regions, it needs to face up to more rigorous demands:

- It needs to be based on shared conceptual foundations, many of which we argue already exist.

- It needs to make much more extensive use of data to test its hypotheses and to evaluate policies, a process that has just started in earnest.

- It needs to develop a conceptual framework of the implementation process, clearly separating the discussion about clusters from the discussion about cluster-based economic policy.

- And it finally needs to move beyond a narrow focus on clusters to a broader microeconomic policy for enhancing competitiveness

While cluster-based economic policy has a lot of potential, it is no panacea. In fact, the largest danger for this approach may be its current use as the fashionable next "new thing" in economic development. The high hopes pinned to cluster-based economic development can bear fruit. However, it will take both research and practice to step up to the more rigorous demands in this new era.

Sources

Aiginger, K. and M. Pfaffermayr, 2000, *The Single Market and Geographic Concentration in Europe,* WIFO Working Paper: Vienna.

Audretsch, D. and M. Feldman, 1996, "R&D spillovers and the geography of innovation and production?," in: *American Economic Review,* Vol. 86, pp. 630 – 640.

Beaudry, C. and S. Breschi, 2003, "Are Firms in Clusters Really More Innovative?," in: *Economics of Innovation & New Technology,* Vol. 12, No. 4, pp. 325 – 342.

Boasson, V. and A. MacPherson, 2001, "The Role of Geographic Location in the Financial and Innovation Performance of Publicly Traded Pharmaceutical Companies: Empirical Evidence from the United States," in: *Environment & Planning,* Vol. 33, No. 8, pp. 1431 – 1444.

Breschi, S. and F. Malerba, 2001, "The Geography of Innovation and Economic Clustering: Some Introductory Notes," in: *Industrial and Corporate Change,* Vol. 10, No. 4, pp. 817 – 833.

Boekholt, P. and B. Thureiaux, 1999, "*Overview of Cluster Policies in International Perspective*," Dutch Ministry of Economic Affairs: The Hague.

Clark, G. L., M. P. Feldman, and M. S. Gertler, eds., 2000, *The Oxford Handbook of Economic Geography*. New York: Oxford University Press.

Department of Trade and Industry (DTI), 2002a, *Productivity and Competitiveness Indicators – Update 2002*, DTI: London.

Department of Trade and Industry (DTI), 2002b, *The Government's Manufacturing Strategy*, DTI: London.

Department of Trade and Industry (DTI), 2001, *Business Clusters in the UK – A First Assessment*, DTI: London.

Dohse, D., 2000, Technology Policy and the Regions – the Case of the BioRegio contest, *Research Policy*, Vol. 29.

Doeringer, P. and D. Tekla, 1995, Business Strategy and cross-industry clusters, *Economic Development Quarterly*, Vol. 9, pp. 225 – 237.

Enright, M., 1996, "Regional clusters and economic development: A research agenda," in: U. Staber et al. (eds.), *Business Networks: Prospects for Regional Development*, Walter de Gruyter: Berlin.

European Commission, 2003a, *Final Report of the Expert Group on Enterprise Clusters and Networks*, European Commission: Brussels.

European Commission, 2003b, *European Competitiveness Report 2003*. European Commission: Brussels.

European Commission, 2002, *Regional Clusters in Europe*, Observatory of European SMEs, No. 3, Brussels.

Fairbanks, M. and S. Lindsay, 1997, *Plowing the Sea: The Challenge of Competitiveness in the Developing World*, Boston: Harvard Business School Press.

Feldman, M. and D. Audretsch, 1999, "Innovation in Cities: Science-based Diversity, Specialisation, and Localised Competition," in: *European Economic Review*, Vol. 43, pp. 409 – 429.

Florida, R., 2002, "Bohemia and Economic Geography," in: *Journal of Economic Geography*, Vol. 2, No. 1, pp. 55 – 71.

Jaffe, A., M. Trajtenberg, and R. Henderson, 1993, "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations", in: *Quarterly Journal of Economics,* Vol. 108, pp. 577 – 598.

Ketels, C. 2003, "Clusters of Innovation in Europe", in: *Structural Change in Europe 3 – Innovative City and Business Regions,* Bollschweil: Hagbarth Publications.

Ketels, C., 2002a, *Location, Location, Location*, HBS Working Knowledge.

Ketels, C., 2002b, *Cross-National Regions and Competitiveness: BCCA and the Baltic Rim Agenda*, extended version of a keynote speech given at the 10th BCCA Annual Conference, Rostock.

Ketels, C., 2001, *"Competitiveness Policy",* mimeo., Harvard Business School.

King, C., A. Silk, and N. Ketelhöhn, 2003, "Knowledge Spillovers and Growth in the Disagglomeration of the US Advertising-Agency Industry," in: *Journal of Economics and Management Strategy,* Vol. 12, No. 3, pp. 327 – 362.

Kotkin, J., 2001, "*The New Geography: How the Digital Revolution is Reshaping the American Landscape*," Random House: New York.

Landabaso, M., 2001, "*Clusters in Less Prosperous Places: Policy Options in Planning and Implementation*," Draft, European Commission: Brussels.

Leamer, E. and M. Storper, 2001, "*The Economic Geography of the Internet Age*," NBER Working Paper no. 8450, NBER: Boston.

Lindqvist, G., A. Malmberg, and Ö. Sölvell, 2003, *Svenska Clustercartor*, prepared for NUTEK: Uppsala.

Martin, R. and P. Sunley, 2003, "Deconstructing Clusters: Chaotic Concept or Policy Panacea?," in: *Journal of Economic Geography,* Vol. 3, No. 1, pp. 5 – 35..

McDaniel, C. and B. Smarzynska, 2001, "*Evidence of Co-location of Patenting and Production at the Subnational Level*," U.S. International Trade Administration: Washington, D.C.

Midelfart-Knarvik, K.H., H.G. Overman, S.J. Redding, A.J. Venables, 2000, "*The Location of European Industry,*" EU Economic Papers No. 142, European Commission: Brussels.

Nickell, S., 1996, "Competition and Corporate Performance," *Journal of Political Economy*, 104 (1996): 724-746.

OECD, 2001, *Innovative Clusters: Drivers of National Innovation Systems*, OECD: Paris.

Porter, M. E, 2003a, "The Economic Performance of Regions," *Regional Studies*, Vol. 37, No. 6&7, pp. 549–678.

———, 2003b, Building the Microeconomic Foundations of Competitiveness, in: *The Global Competitiveness Report 2002-2003,* World Economic Forum, New York: Oxford University Press.

———, 2000a, "Attitudes, Values, Beliefs, and the Microeconomic of Prosperity," in: L. E. Harrison and S. P. Huntington, eds., *Culture Matters*, New York: Basic Books, pp.14–28.

———, 2000b, "Locations, Clusters, and Company Strategy," in G. L. Clark, M. P. Feldman, and M. S. Gertler (eds.), *The Oxford Handbook of Economic Geography*. New York: Oxford University Press, 253–274.

———, 1998a, "Clusters and Competition: New Agendas for Companies, Governments, and Institutions," In: *On Competition*, Boston: Harvard Business School Press.

———, 1998b, "The Competitive Advantage of the Inner City," In: *On Competition*, Boston: Harvard Business School Press.

———, 1990, *The Competitive Advantage of Nations*, New York: The Free Press.

Porter, M. E., Council on Competitiveness, and Monitor Group, 2001, *Clusters of Innovation Initiative: Regional Foundations of U.S. Competitiveness*. Washington, DC: Council on Competitiveness.

Porter, M.E. and W. Emmons, 2003, "*Institutions for Collaboration: Overview*". Harvard Business School case 9-703-436.

Porter, M. E., T. Hirotaka, and M. Sakakibara, 2000, *Can Japan Compete?*, Basingstoke, England, and New York: Macmillan and Basic Books.

Porter, M. E, C. Ketels, and K. Miller, forthcoming 2003, "*Competitiveness in Rural U.S. Regions: Learning and Research Agenda*," Economic Development Administration, U.S. Department of Commerce: Washington, D.C.

Porter, M. E. and C. Ketels, 2003. "*UK Competitiveness: Moving to the Next Stage*," DTI Economics Paper No.3.

Porter, M. E. and S. Stern, 2001, "Innovation: Location Matters", in: *Sloan Management Review*, Vol. 4, No. 4.

Reve, T., E. Jakobsen, 2001, "*Et verdiskapende Norge,*" Universitetsforlaget: Oslo.

Rosenfeld, S., 2002a, "*A Governor's Guide to Cluster-Based Economic Development,*" National Governors Association: Washington, D.C.

———, 2002b, "*Creating Smart Systems: A Guide to Cluster Strategies in Less Favored Regions,*" European Commission: Brussels

———, 1997, "Bringing Business Clusters into the Mainstream of Economic Development," in: *European Planning Studies,* Vol. 5, No. 1, pp. 3 –23.

Sakakibara, M. and M. E. Porter. 1998. "*Competing at Home to Win Abroad: Evidence from Japanese Industry*," Harvard Business School Working Paper No. 99-036. Cambridge, MA: Harvard Business School Press.

Saxenian, A., 1996, "*Regional Advantage: Culture and Competition in Silicon Valley and Route 128*," Boston: Harvard Business School Press.

Schmitz, H., 2000, "Does Local Co-operation Matter? Evidence from Industrial Clusters in South Asia and Latin America," in: *Oxford Development Studies,* Vol. 28, No. 3, pp. 323 – 336.

Sölvell, Ö., G. Lindqvist, and C. Ketels, 2003, "*The Cluster Initiative Greenbook,*" The Competitiveness Institute (TCI)/Vinnova: Gothenburg.

Turner, R., 2001, "*A Framework for Cluster-Based Economic Development Policies*,"
Albany, NY: The Nelson A. Rockefeller Institute of Government.

Van den Hove, N., T. Roelandt, and T. Grosfeld, 1998, "*Cluster specialization patterns
and innovation styles*," Dutch Ministry of Economic Affairs.

Van der Linde, C., 2001, "*The Cluster Profile Meta-Study: Preliminary Results,*" paper
presented at the 4th Annual TCI Conference.

Waits, M., 2000, "The Added Value of the Industry Cluster Approach to Economic
Analysis, Service Development, and Service Delivery," in: *Economic Development
Quarterly,* Vol. 14, pp. 35 – 51.

Yamawaki, H., 2002, "The Evolution and Structure of Industrial Clusters in Japan," in:
Small Business Economics, Vol. 18, pp. 121 – 140.