

CHAPTER 7

Clusters and Competition

*New Agendas for
Companies, Governments,
and Institutions*

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THINKING ABOUT COMPETITION and strategy at the company level has been dominated by what goes on inside companies. Thinking about the competitiveness of nations and states has focused on the economy as a whole, with national economic policy seen as the dominant influence. In both competition and competitiveness the role of location is all but absent. If anything, the tendency has been to see location as diminishing in importance.¹ Globalization allows companies to source capital, goods, and technology from anywhere and to locate operations wherever it is most cost effective. Governments are widely seen as losing their influence over competition to global forces.

This perspective, although widespread, does not accord with competitive reality. In *The Competitive Advantage of Nations* (1990), I put forward a theory of national, state, and local competitiveness within the context of a global economy. This theory gives clusters a prominent role. Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also

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cooperate. Critical masses of unusual competitive success in particular business areas, clusters are a striking feature of virtually every national, regional, state, and even metropolitan economy, especially those of more economically advanced nations.

While the phenomenon of clusters in one form or another has been recognized and explored in a range of literatures, clusters cannot be understood independently of a broader theory of competition and the influence of location in the global economy. (See the insert “Historical and Intellectual Antecedents of Cluster Theory.”) The prevalence of clusters in economies, rather than isolated firms and industries, reveals important insights into the nature of competition and the role of location in competitive advantage. Even though old reasons for clustering have diminished in importance with globalization, new roles of clusters in competition have taken on growing importance in an increasingly complex, knowledge-based, and dynamic economy.

The cluster concept represents a new way of thinking about national, state, and city economies, and points to new roles for companies, governments, and other institutions striving to enhance competitiveness. The presence of clusters suggests that much of competitive advantage lies outside a given company or even outside its industry, residing instead in the *locations* of its business units. The odds of building a world-class mutual fund company are much higher in Boston than in most any other location; a similar statement applies to textile-related companies in North and South Carolina, high performance auto companies in southern Germany, or fashion shoe companies in Italy.

The importance of clusters creates new management agendas that are rarely recognized. Companies have a tangible stake in the business environments where they are located in ways that go far beyond taxes, electricity costs, and wage rates. The health of the cluster is important to the health of the company. A company may actually benefit from the presence of local competitors. Trade associations can be competitive assets, as well as lobbying and social organizations.

Clusters also create new roles for government. The proper macroeconomic policies for fostering competitiveness are increasingly well understood but they are necessary and not sufficient. Government's more decisive influences are often at the microeconomic level. Removing obstacles to the growth and upgrading of existing and emerging clusters

should be a priority. Clusters are a driving force in increasing exports and magnets for attracting foreign investment. They constitute a forum in which new types of dialogue can, and must, take place among firms, government agencies, and institutions (such as schools, universities, and public utilities).

Knowledge about cluster theory has advanced and continues to spread since publication of *The Competitive Advantage of Nations*, which triggered an ever growing number of formal cluster initiatives at the city, state, country, and even regional level (as in Central America, for example). In this essay, I will assess the current state of knowledge about clusters, their role in competition, and their implications. I will describe the theory of clusters, the process by which they grow and decline, the appropriate roles of the private sector, government, and other institutions in cluster upgrading, and some of the implications clusters hold for company strategy. Finally, I will draw on my participation in many cluster studies and initiatives and on other literature to explore the best ways to organize such initiatives to catalyze positive economic improvement. (An extensive bibliography on clusters and cluster initiatives appears at the end of this chapter.)

What Is a Cluster?

A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. The geographic scope of a cluster can range from a single city or state to a country or even a network of neighboring countries.² Clusters take varying forms depending on their depth and sophistication, but most include end-product or service companies; suppliers of specialized inputs, components, machinery, and services; financial institutions; and firms in related industries. Clusters also often include firms in downstream industries (that is, channels or customers); producers of complementary products; specialized infrastructure providers; government and other institutions providing specialized training, education, information, research, and technical support (such as universities, think tanks, vocational training providers); and standards-setting agencies. Government agencies that significantly influence a cluster can be considered part of it. Finally, many clusters

include trade associations and other collective private sector bodies that support cluster members. (See the insert “Historical and Intellectual Antecedents of Cluster Theory.”)

Identifying the constituent parts of a cluster involves starting with a large firm or concentration of like firms and then looking upstream and downstream in the vertical chain of firms and institutions. The next step is to look horizontally to identify industries that pass through common channels or that produce complementary products and services. Additional horizontal chains of industries are identified based on the use of similar specialized inputs or technologies or with other supply-side linkages. The next step after identification of a cluster’s industries and firms involves isolating the institutions that provide it with specialized skills, technology, information, capital, or infrastructure and any collective bodies covering cluster participants. The final step is to seek out government or other regulatory bodies that significantly influence participants in the cluster.

Figures 7.1 and 7.2 present schematic diagrams of the Italian leather footwear and fashion cluster and the California wine cluster. While

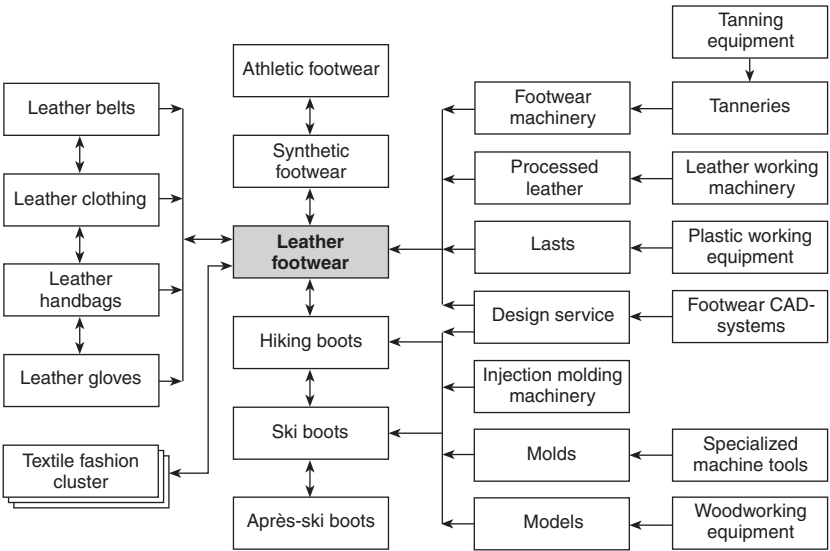


Figure 7.1 The Italian Footwear and Fashion Cluster
Source: Research by Claas van der Linde, 1993.

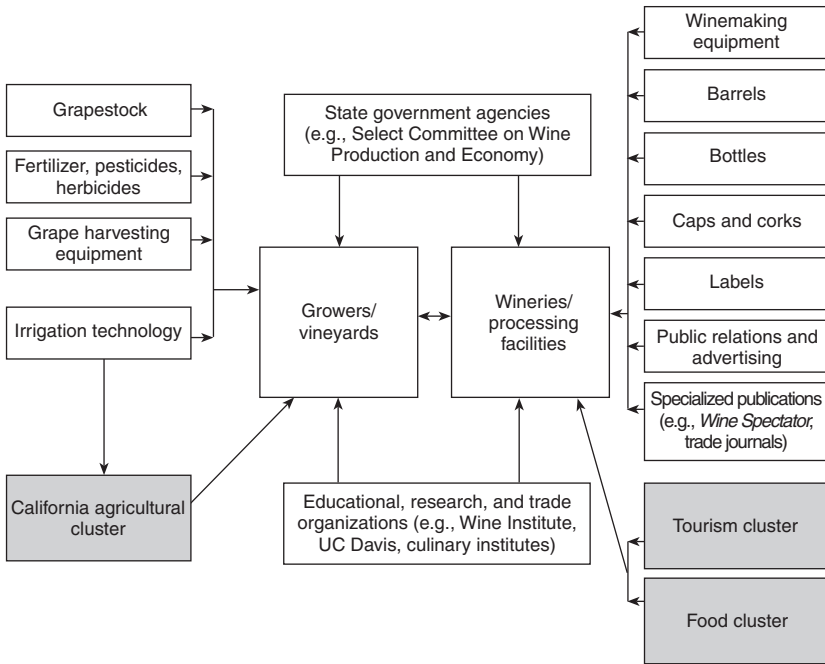


Figure 7.2 The California Wine Cluster

Sources: Based on research by Harvard MBA students R. Alexander, R. Arney, N. Black, E. Frost, and A. Shivananda.

neither diagram can include all the entities comprising the respective clusters, each illustrates important cluster attributes. Figure 7.1, for example, demonstrates the several chains of related industries involved in the Italian leather footwear and fashion cluster, including those relating to different types of leather goods (complementary products, common, common inputs, similar technologies), different types of footwear (overlapping channels, similar inputs, and technologies), and different types of fashion goods (complementary products). These industries also employ common marketing media and compete with similar images in similar customer segments. The extraordinary strength of the Italian cluster can be attributed, at least in part, to the multiple cross-firm linkages and synergies that Italian firms enjoy.

The California wine cluster includes an extensive complement of supporting industries to both winemaking and grape growing. On the

growing side, there are strong connections to the larger California agricultural cluster. On the winemaking side, the cluster enjoys strong links to both the California restaurant and food preparation industries (complementary products) and the tourism cluster in Napa and other wine-producing regions of the state. Figure 7.2 also illustrates the host of local institutions involved with wine, for example, the world-renowned viticulture and enology program at the University of California at Davis and special committees of the California senate and assembly.

Drawing cluster boundaries is often a matter of degree, and involves a creative process informed by understanding the most important linkages and complementarities across industries and institutions to competition. The strength of these “spillovers” and their importance to productivity and innovation determine the ultimate boundaries. The institutional furnishings cluster located in the Grand Rapids, Michigan, area illustrates the kinds of choices made when drawing cluster boundaries (see Figure 7.3). Office furniture and partitions clearly belong in the cluster, as does seating for stadia, classrooms, and transportation vehicles. These products have important commonalities in product attributes, features, components, and technology. Nearby metal parts and equipment manufacturers, plastics manufacturers, and printing companies are cluster suppliers. These supplier industries may also be part of other clusters, because they serve other customer industries such as automobile manufacturers. Particularly in metal parts, the prior existence of automotive suppliers serving the nearby Detroit automotive cluster contributed importantly to development of the furnishing cluster. Cluster boundaries should encompass all firms, industries, and institutions with strong linkages, whether vertical, horizontal, or institutional; those with weak or non-existent linkages can safely be left out.³

Clusters encompassing broad groupings, such as manufacturing, consumer goods, or high tech, have been too broadly conceived. Such aggregates exhibit, at best, weak connections among the industries included. Discussions about cluster constraints and bottlenecks in such groupings fall into generalities. Conversely, labeling a single industry as a cluster overlooks crucial cross-industry and institutional interconnections that strongly affect competitiveness.⁴

Clusters occur in many types of industries, in both larger and smaller fields, and even in some local businesses, such as restaurants, car dealers,

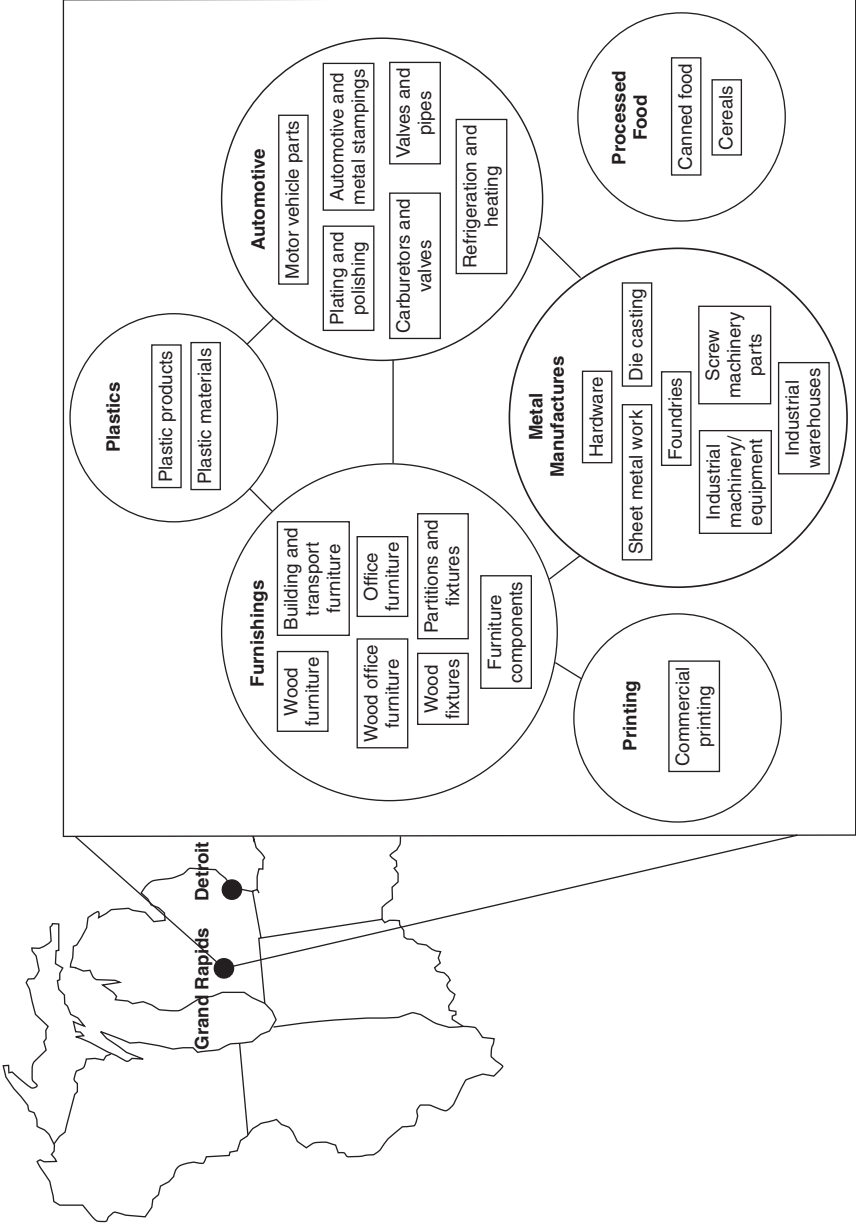


Figure 7-3 Greater Grand Rapids Clusters

and antique shops. They are present in large and small economies, in rural and urban areas, and at several geographic levels (for example, nations, states, metropolitan regions, and cities). Clusters occur in both advanced and developing economies, although clusters in advanced economies tend to be far better developed.

Cluster boundaries rarely conform to standard industrial classification systems, which fail to capture many important actors in competition as well as linkages across industries. Clusters normally consist of a combination of end-product, machinery, materials, and service industries, usually classified in separate categories. They often involve (or potentially involve) both traditional and high-tech industries. Clusters, then, represent a distinct way of organizing economic data and viewing the economy.

Because parts of a cluster often fall within different traditional industrial or service categories, significant clusters may be obscured or even go unrecognized. In Massachusetts, for example, more than four hundred companies, representing at least 39,000 high-paying jobs, were involved in some way in medical devices. The cluster long remained all but invisible, however, buried within several larger and overlapping industry categories, such as electronic equipment and plastic products. Executives in the cluster had never come together before despite the fact that firms shared many common constraints, problems, and opportunities. The discovery of this cluster, the subsequent organization of an association, MassMedic, and the initiation of a productive dialogue with government will be explored below.

Clusters vary in size, breadth, and state of development. Some clusters consist primarily of small- and medium-sized firms (for example, the Italian footwear and the North Carolina home furniture clusters).⁵ Other clusters involve both large and small firms (for example, Hollywood or the German chemical clusters). Some clusters center on research universities, while others have no important university connection.⁶ These differences in the nature of clusters reflect differences in the structures of their constituent industries. More developed clusters have deeper and more specialized supplier bases, a wider array of related industries, and more extensive supporting institutions.

The boundaries of clusters continually evolve as new firms and industries emerge, established industries shrink or decline, and local institutions develop and change. Technological and market developments

spawn new industries, create new linkages, or alter served markets. Regulatory changes also contribute to shifting boundaries, as they have, for example, in telecommunications and transport.

Clusters can be examined at various levels of aggregation, thus exposing different issues. In California, for example, there is a large agribusiness cluster. Mapping and analyzing this broad cluster reveals important competitive insights. The wine cluster already discussed is embedded within the broad cluster. Analysis at this level reveals some more specific and distinct issues (for example, the linkage with the tourism clusters).

The appropriate definition of a cluster can differ in different locations, depending on the segments in which the member companies compete and the strategies they employ. The lower Manhattan multimedia cluster, for example, consists primarily of content providers and firms in related industries, such as publishing, broadcast media, and graphics and visual arts. The San Francisco Bay area multimedia cluster, in contrast, contains many hardware and software industries that provide enabling technology.

Why view economies through the lens of clusters rather than of more traditional groupings such as companies, industries, or sectors, such as manufacturing or services? Foremost because clusters align better with the nature of competition and the sources of competitive advantage. Clusters, broader than industries, capture important linkages, complementarities, and spillovers of technology, skills, information, marketing, and customer needs that cut across firms and industries. As will be discussed below, such connections are fundamental to competition, to productivity, and, especially, to the direction and pace of new business formation and innovation. Most cluster participants do not compete directly, but serve different industry segments. Yet they do share many common needs and opportunities and encounter many common constraints and obstacles to productivity. Viewing a group of companies and institutions as a cluster highlights opportunities for coordination and mutual improvement in areas of common concern without threatening or distorting competition or limiting the intensity of rivalry. The cluster provides a constructive and efficient forum for dialogue among related companies and their suppliers, government, and other salient institutions. Public and private investments to improve conditions for clusters benefit many firms.

Viewing the world in terms of industries or narrow sectors such as automotive products, in contrast, often degenerates into lobbying over subsidies and tax breaks by the participating companies. Resulting public investments create fewer spillover benefits for other industries and may, therefore, distort markets. Because a large proportion of participants directly compete, there is a very real threat that the intensity of rivalry will be diminished. Companies are also often hesitant about participating for fear of aiding direct competitors. An industry or narrow sectoral perspective tends to result in distorting competition, then, while a cluster perspective focuses on enhancing competition. I will return to these issues when I explore the implications of clusters for companies and governments.

Historical and Intellectual Antecedents of Cluster Theory

Clusters have long been part of the economic landscape, with geographic concentrations of trades and companies in particular industries dating back for centuries. However, the role of clusters was arguably more limited. The depth and breadth of clusters, however, have increased as competition has evolved and as modern economies have grown in complexity. Globalization, together with rising knowledge intensity, have greatly altered the role of clusters in competition.

Intellectual antecedents of cluster theory date back at least to Alfred Marshall, who included a fascinating chapter on the externalities of specialized industrial locations in his *Principles of Economics* (originally published in 1890). During the first fifty years of this century, economic

geography was a recognized field with an extensive literature. With the mid-century advent of neoclassical economics, however, location moved out of the economics mainstream. More recently, increasing returns have started to play a central role in new theories of growth and international trade, and interest in the field of economic geography has been growing.^a

In the management literature, as well, attention to geography or location has been minimal. If treated at all, consideration of geography has often been reduced to assessments of cultural and other differences when doing business in various countries. Corporate location has been treated as a narrow subspecialty of operations management. The recent preoccupation with globalization has, if

anything, created a tendency to regard location as of diminished and diminishing importance.

A variety of bodies of literature have in some respects recognized and shed light on the phenomenon of clusters, including those on growth poles and backward and forward linkages,^b agglomeration economies,^c economic geography,^d urban and regional economics,^e national innovation systems,^f regional science,^g industrial districts,^h and social networks.ⁱ

The literature on urban economics and on regional science focuses on generalized urban agglomeration economies, reflected in the infrastructure, communications technology, input access, diverse industrial base, and markets available in concentrated urban areas. These types of economies, which are independent of the types of firms and clusters present, appear to be most important in developing countries. Overall, however, generalized urban agglomeration economies seem to be diminishing in importance as the opening of trade and the fall in communication and transportation costs allow easier access to inputs and markets and as more locations and countries develop comparable infrastructures.^j

Other studies focus on geographic concentrations of companies operating in particular fields, which can be seen as special cases of clusters. Italian-style industrial districts of small- and medium-sized firms dominating a local economy prevail in some types of industries. In other

fields, a mixture of large domestic firms, large foreign-owned firms, and an array of smaller companies is the rule.

Some clusters center on research universities, while others draw little on the resources of formal technological institutions. Clusters occur both in high tech and traditional industries, in manufacturing as well as in service industries. Indeed, clusters often mix high tech, low tech, manufacturing, and services. Some regions contain a single dominant cluster, while others contain several. Clusters appear in both developing and advanced economies, though the lack of depth of clusters in developing nations is a characteristic constraint to development.

Earlier studies have, nonetheless, contributed to our understanding of the influence of clusters on competition. The literature on agglomeration economies stresses input cost minimization, input specialization made possible because of the extent of the local market, and the advantages of locating near markets. The economic development literature focuses on induced demand and supply, certainly an element of cluster formation. The normative implication of the concept of backward and forward linkages, however, emphasizes the need to build industries with linkages to many others. Cluster theory, in contrast, advocates building on emerging concentrations of companies and encouraging the development of those fields with the strongest linkages to or spillovers within each cluster.

Overall, most past theories address particular aspects of clusters or clusters of a particular type. Many traditional agglomeration arguments for the existence of clusters have been undercut by the globalization of supply sources and markets. Yet the modern, knowledge-based economy creates a far more textured role for clusters.

The broader role of clusters in competition is only now becoming widely recognized. To understand this role requires embedding clusters in a broader and dynamic theory of competition that encompasses both cost and differentiation and both static efficiency and continuous improvement and innovation, and that recognizes a world of global factor and product markets. Some of the most important agglomeration economies represent dynamic rather than static efficiencies and revolve around innovation and the rate of learning. Clusters occupy a more complex and integral role in the modern economy than has been previously recognized.

Clusters, then, constitute an important multi-organizational form, a central influence on competition, and a prominent characteristic of market economies. The state of an economy's clusters reveals important insights into its productive potential and the constraints on its future development. The role of clusters in competition raises important implications for companies, government, and other institutions.

a. See Krugman (1991A, 1991B).

b. Hirschman (1958).

c. *There is an extensive literature on agglomeration including Weber (1929); Lösch (1954); Harris (1954); Isard (1956); Lloyd and Dicken (1977); Goldstein and Gronberg (1984); Rivera-Batiz (1988); McCann (1995B); Ciccone and Hall (1996); and Fujita and Thisse (1996).*

d. *See Storper and Salais (1997A, 1997B); Storper (1997); Amin and Thrift (1992); and papers by Storper, Gertler, Mair, Swyngedouw, and Cox in Cox (1993).*

e. *Scott (1991); Glaeser, Kallal, Sheinkman, and Shleifer (1992); Glaeser (1994); Henderson (1994); Glaeser, Scheinkman and Shleifer (1995); Henderson, Kuncoro, and Turner (1995); and Henderson (1996) are some interesting examples.*

f. *See Bengt-Åke (1992); Dosi, Gianetti, and Toninelli (1992); Nelson (1993); and Cimoli and Dosi (1995).*

g. *See, for example, Giarratani (1994) and Markusen (1995A).*

h. *This literature includes the work of Piore and Sabel (1984); Becattini (1987); Pyke, Becattini, and Sengenberger (1990); Pyke and Sengenberger (1992); and Harrison (1992).*

i. *See, for example, Burt (1997); Granovetter (1985); Henton, Melville, and Walesh (1997); Nohria (1992); Perrow (1992); Putnam, Leonardi, and Nanetti (1993); Fukuyama (1995); and Harrison and Weiss (1998).*

j. *Harrison, Kelley, and Grant (1996) construct an imaginative test of the relative importance of industry and urbanization economies in the diffusion of innovation in machining and find that urbanization effects are more significant. They acknowledge, however, that the test is far from definitive. This is because, among other reasons, they picked a widely applicable (versus specialized) innovation in a not very geographically concentrated field. Metalworking, indeed, is not normally a cluster itself but part of other clusters.*

Location and Competition

In recent decades, thinking about the influence of location on competition has taken a relatively simple view of how companies compete. Competition has been seen as largely static and as resting on cost minimization in relatively closed economies. Here comparative advantage in factors of production (labor and capital) is decisive, or, in the most recent analyses, economies of scale.

Yet this picture fails to represent real competition. Competition is dynamic and rests on innovation and the search for strategic differences. Three conditions contribute to rendering factor inputs per se less valuable: the expanded input supply as more countries open to the global economy; the greater efficiency of national and international factor markets; and the diminishing factor intensity of competition. Instead, close linkages with buyers, suppliers, and other institutions contribute importantly not only to efficiency but to the rate of improvement and innovation. While extensive vertical integration (for example, in-house production of parts, services, or training) may have once been the norm, a more dynamic environment can render vertical integration inefficient, ineffective, and inflexible.

In this broader and more dynamic view of competition, location affects competitive advantage through its influence on *productivity* and especially on *productivity growth*. Productivity is the value created per day of work and unit of capital or physical resources employed. Generic factor inputs themselves are usually abundant and readily accessed. Prosperity depends on the productivity with which factors are used and upgraded in a particular location.

The productivity and prosperity of a location rest not on the industries in which its firms compete, but on *how* they compete. Firms can be more productive in any industry—shoes, agriculture, or semiconductors—if they employ sophisticated methods, use advanced technology, and offer unique products and services. All industries can employ high technology, all industries can be knowledge intensive. The term *high tech*, normally used to refer to fields such as information technology and biotechnology, thus has questionable relevance. A more descriptive term might be *enabling technology*, signifying fields providing tools that enhance technology in many industries.

Conversely, the mere presence of high tech in an industry does not by itself guarantee prosperity if the firms are unproductive. Traditional distinctions between industries, such as high or low tech, manufacturing or services, resource-based or knowledge-based have in themselves little relevance. The proper goal is to improve the productivity of *all* industries, enhancing prosperity both directly and indirectly, as the improved productivity of one industry increases the productivity of others.

The prosperity of a location depends, then, on the productivity of what firms located there choose to do. This sets the wages that can be sustained and the profits that can be earned. Both domestic and foreign firms contribute to the prosperity of a location, based on the productivity of their activities there. The presence of sophisticated foreign firms often enhances the productivity of domestic firms and vice versa.

The sophistication and productivity with which companies compete in a location is strongly influenced by the *quality of the business environment*. Firms cannot employ advanced logistical techniques, for example, unless a high-quality transportation infrastructure is available. Firms cannot compete using high-service strategies unless they can access well-educated people. Firms cannot operate efficiently under onerous amounts of regulatory red tape, requiring endless dialogue with government, or under a court system that fails to resolve disputes quickly and fairly. All of these situations consume resources and management time without contributing to customer value. The effects of some aspects of the business environment, such as the road system, corporate tax rates, and the legal system, cut across all industries. These economywide (or horizontal) areas can represent the binding constraints to competitiveness in developing economies. For both more advanced economies and, increasingly, everywhere, however, the more decisive aspects of the business environment are often *cluster specific* (for example, the presence of particular types of suppliers or university departments). Cluster thinking thus assumes an important role in both company strategy and economic policy.

Capturing the nature of the business environment in a location is challenging given the myriad of locational influences on productivity and productivity growth. In *The Competitive Advantage of Nations*, I modeled the effect of location on competition using four interrelated influences, graphically depicted in a diamond, a metaphor that has be-

come a shorthand reference to the theory (see Figure 7.4).⁷ A few elements of this framework deserve highlighting here because they are important to understanding the role of clusters in competition.

As Figure 7.4 shows, factor inputs include tangible assets (such as physical infrastructure), information, the legal system, and university research institutes that firms draw upon in competition. To increase productivity, factor inputs must improve in efficiency, quality, and, ultimately specialization to particular cluster areas. Specialized factors, especially those integral to innovation and upgrading (for example, a specialized university research institute), not only foster high levels of productivity but tend to be less tradable or available from elsewhere.

The context for firm strategy and rivalry refers to the rules, incentives, and norms governing the type and intensity of local rivalry. Economies with low productivity demonstrate little local rivalry: Most competition, if it is present at all, comes from imports; local rivalry, if it occurs at all, involves imitation. Price is the sole competitive variable, and firms

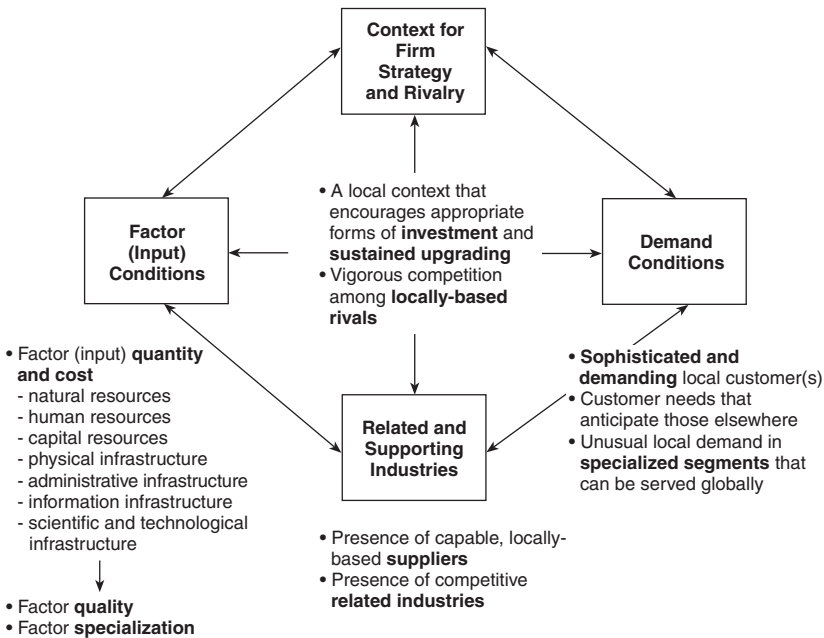


Figure 7.4 Sources of Locational Competitive Advantage

hold down wages to lower cost. Such competition involves minimal investment.

The move to an advanced economy requires developing vigorous local rivalry. Rivalry must shift from low wages to low total cost, which requires upgrading the efficiency of manufacturing and service delivery. Ultimately, rivalry must also evolve beyond cost to include differentiation. Competition must shift from imitation to innovation and from low investment to high investment, not only in physical assets but in intangibles such as skills and technology. Clusters, as will be evident, play an integral role in these transitions.

The context for strategy and rivalry can be divided into two primary dimensions. One is the climate for investment in its various forms. A rising investment intensity of competition is necessary for support of more sophisticated forms of competition and higher levels of productivity. Macroeconomic and political stability sets the context for investment, but microeconomic policies are also important: the structure of the tax system, the corporate governance system, labor market policies affecting workforce development incentives, and intellectual property rules and their enforcement, among others.

The other dimension of the context for competition is local policies affecting rivalry itself. Openness to trade and foreign investment, government ownership, licensing rules, antitrust policy, and the influence of corruption, among other things, have a vital role in setting the intensity of local rivalry. The character of rivalry is also strongly influenced by many other aspects of the business environment (such as the available factors and local demand conditions).

Demand conditions at home have much to do with whether firms can and will move from imitative, low-quality products and services to competing on differentiation. Firms in low productivity economies learn about demand primarily from foreign markets. Advancement requires the development of increasingly demanding local markets. The presence or emergence of sophisticated and demanding home customers presses firms to improve and provides insights into existing and future needs difficult to gain through foreign markets alone. Local demand can also reveal market segments in which firms can differentiate. In a global economy, the *quality* of local demand matters far more than its size.

Clusters of linked industries play a central role in setting demand conditions.

Clusters and Competitive Advantage

Clusters constitute one facet of the diamond (related and supporting industries), but they are best seen as a manifestation of the interactions among all four facets. Clusters affect competition in three broad ways: first, by increasing the productivity of constituent firms or industries; second, by increasing their capacity for innovation and thus for productivity growth; and third, by stimulating new business formation that supports innovation and expands the cluster. Many cluster advantages rest on external economies or spillovers across firms and industries of various sorts. (Many cluster advantages also apply to sub-units *within* firms, such as R&D and production.) A cluster may thus be defined as a system of interconnected firms and institutions whose value as a whole is greater than the sum of its parts.

As noted above, scholars have sought to explain concentrations of firms in terms of economies of agglomeration.⁸ These have normally been seen as arising either at the industry level or in a diversified urban economy. Many treatments of agglomeration economies stress cost minimization due to proximity to inputs or proximity to markets. These explanations, though, have been undercut by the globalization of markets, technology, and supply sources, increased mobility, and lower transportation and communication costs. Today, economies of agglomeration have shifted in nature, becoming increasingly important at the cluster level and not just within narrowly-defined industries.

The competitive advantages of clusters will not be equally great in all fields, although clusters appear to occur quite broadly in economies. Generally, the stronger the advantages of clusters and the more tradable the products and services involved, the fewer the number of viable cluster locations. The importance of clusters rises with the sophistication of competition, meaning clusters tend to increase in number as economies develop.

Each of the three broad influences of clusters on competition depends to some extent on personal relationships, face-to-face communication,

and interaction among networks of individuals and institutions. While the existence of a cluster makes such relationships more likely to develop and more effective once in place, the process is far from automatic. Formal and informal organizing mechanisms and cultural norms often play a role in the development and functioning of clusters, as will become more evident below.

CLUSTERS AND PRODUCTIVITY

Access to Specialized Inputs and Employees. Locating within a cluster can provide superior or lower-cost access to specialized inputs such as components, machinery, business services, and personnel, as compared to the alternatives—vertical integration, formal alliances with outside entities, or “importing” inputs from distant locations. The cluster, then, represents a spatial organizational form that can be an inherently more efficient or effective means of assembling inputs—if competitive local suppliers are available. Sourcing outside the cluster may be necessary where competent local suppliers are unavailable, but that is not the ideal arrangement.

Sourcing inputs from cluster participants (“local” outsourcing) can result in lower transactions costs than those incurred when using distant sources (“distant” outsourcing). Local outsourcing minimizes the need for inventory and eliminates importing costs and delays. It curbs opportunistic behavior by suppliers to overprice or renege on commitments because of the transparency and ongoing nature of local relationships and the adverse effect poor performance will have on their reputations with other cluster participants. Sourcing within the cluster eases communication, reduces the cost of tailoring, and facilitates the joint provision of ancillary or support services, such as installation, debugging, user training, troubleshooting, and timely repair. Other things being equal, then, local outsourcing often dominates distant outsourcing, especially for advanced and specialized inputs involving embedded technology, information, or service content. (Note that “local” refers to a firm with substantial investment within the cluster, including technical resources, even though the parent company is headquartered elsewhere.)

Formal alliances with distant suppliers can mitigate some of the disadvantages of distant outsourcing. However, forming formal alliances with

either distant or nearby firms introduces complex bargaining and governance problems and can inhibit a firm's flexibility. The close, informal relationships possible between firms in a local cluster can offer a superior solution.

Access to inputs within a cluster can also be more efficient or effective than vertical integration. Outside specialists are often more cost effective and responsive than in-house units, not only in component production but also in areas such as training. Vertical integration consumes management attention that may be better spent elsewhere. In contrast, obtaining inputs from nearby vendors with whom a firm has close and special relationships offers cost and quality advantages. Proximity of vendors allows efficient quasi-vertical integration while preserving strong incentives.

Expanding the range of inputs available from specialized suppliers at a single location has long been observed to be one of the benefits of agglomeration.⁹ This remains true, although the globalization of markets undercuts the traditional rationale. The division of labor is no longer limited by the extent of the market, because the market is international. Suppliers rarely need to rely on the local market for most of their volume.

In the modern economy, the greater depth and specialization of suppliers within clusters arises from the easier recognition of market opportunities and from risk reduction due to the presence of multiple local customers. Moreover, developed clusters consist not only of one industry but of a number of related industries. These industries frequently draw on common or very similar inputs, thus expanding opportunities for suppliers. For this reason, and because of the importance of externalities and spillovers within clusters, the breadth and depth of a cluster rather than the size of individual firms or industries within the cluster is often more significant for competitive advantage.

Clusters also offer advantages in obtaining inputs best sourced from a distance. The presence of a cluster can lower the costs of importing distant inputs because suppliers will price more aggressively and firms can use more efficient means of delivery. (Lower supplier prices will reflect not only the attractiveness of penetrating a large, concentrated potential market but also the efficiencies in serving it.) Suppliers may also be willing to make greater investments to make their products or services more available. Because of the depth of Boston's financial ser-

vices cluster, for example, senior executives on road shows invariably visit Boston, substantially lowering the cost to Boston institutions of direct contact with the managements of the companies in which they invest.

Clusters offer similar, although not identical, sourcing advantages in the area of specialized and experienced employees. A cluster represents a pool of such employees. This lowers search and transactions costs for recruiting and makes possible more efficient matching of jobs to people. In addition, because a cluster signals opportunity and reduces the risk to employees of relocation, clusters may reduce the cost of sourcing specialized employees from other locations.¹⁰

Working against a cluster's advantages in assembling inputs and labor is the possibility that such concentration will render these resources scarce and bid up their cost. (Another potential cost of clustering, costs of congestion, apply more to large, diversified urban concentrations rather than to clusters per se.) Yet the ability to outsource many inputs limits any cost penalty relative to other locations. More importantly, the presence of a cluster not only increases the demand for specialized inputs but also increases their supply. Where a cluster exists, the availability of specialized personnel, services, and components and the number of entities creating them usually far exceeds the levels at other locations, a distinct benefit, despite the greater competition.

The absence of capable, locally based suppliers also works against cluster input advantages. If competitive suppliers or other institutions are entrenched elsewhere, distant outsourcing or formal alliances may be necessary. Given the inherent benefits of clusters, however, forces encouraging local suppliers to upgrade will be strong, and cluster constituent firms will have an incentive to encourage the entry of new suppliers or local investments by distant suppliers.

Access to Information. Extensive market, technical, and other specialized information accumulates within a cluster in firms and local institutions. This can be accessed better or at lower cost from within the cluster, thus allowing firms to enhance productivity and get closer to the productivity frontier. This effect also applies to the flow of information between units of the same company.¹¹ Proximity, supply and technological linkages, and the existence of repeated, personal relationships and

community ties fostering trust facilitate the information flow within clusters. (These conditions all make sticky or impacted information more transferable.) An important special case of the informational benefits of clusters is the availability of information about current buyer needs. Sophisticated buyers are often part of clusters, and other cluster participants often gain and share information about buyer needs.¹²

Complementarities. A cluster enhances productivity not only via the acquisition and assembly of inputs but by facilitating complementarities between the activities of cluster participants. The most obvious form of complementarities are among products. In tourism, for example, the quality of the visitor's experience depends not only on the appeal of the primary attraction (for example, beaches or historical sites) but also on the comfort and service of area hotels, restaurants, souvenir outlets, airport and other transportation facilities, and so on. As this example illustrates, the parts of the cluster are often truly mutually dependent. Bad performance by one part of the cluster can undermine the success of the others.

Such complementarities across products to create buyer value are pervasive, not only in service delivery but in product design, logistics, and after-sales service. Coordination and internal pressures for improvement among parts of a cluster, made possible by co-location, can substantially improve its overall quality or efficiency. Co-location makes it easier to achieve technological linkages and accomplish ongoing coordination. As with access to inputs, achieving these and other complementarities internally within a cluster offers advantages over having to resort to formal alliances.

Marketing provides another form of complementarity within clusters. The presence of a group of related firms and industries in a location offers efficiencies in joint marketing (for example, firm referrals, trade fairs, trade magazines, and marketing delegations). It can also enhance the reputation of a location in a particular field, making it more likely that buyers will consider a vendor or manufacturer based there. Italy, for example, has established a strong reputation for fashion and design that benefits firms in footwear, leather goods, apparel, and accessories. This reputation constitutes a type of public good for all Italian-based companies in fashion-related industries.

The presence of a cluster also can enhance buying efficiency. Visiting buyers can see numerous firms in a single trip. The presence in a location of multiple sources for a product or service can also reduce perceived buying risk by offering buyers the potential to multisource or switch vendors if the need arises. Hong Kong thrives as a source of fashion apparel in part for this reason.¹³

Other complementarities arising within clusters involve the better alignment of activities among cluster participants. In the wood products cluster, for example, the efficiency of sawmills depends on a reliable supply of good-quality timber and the ability to maximize the utilization of timber in either furniture (highest quality), pallets and boxes (lower quality), or wood chips (lowest quality). Portuguese sawmills suffered from poor timber quality because landowners would not invest in timber management.¹⁴ Hence most timber was processed for use in pallets and boxes, a lower value use that limited the price paid to landowners. Substantial improvement in productivity was possible, but only if several parts of the cluster changed simultaneously. Logging operations, for example, had to modify cutting and sorting procedures while sawmills had to develop the capacity to process in more sophisticated ways. Coordination to develop standard wood classifications and measures was an important enabling step. Such linkages can be recognized and captured more easily within clusters than among dispersed participants.

Access to Institutions and Public Goods. Clusters make many inputs that would otherwise be costly into public or quasi-public goods. The ability to recruit employees trained in local programs, for example, eliminates or lowers the cost of internal training. Firms can often access benefits, such as specialized infrastructure or advice from experts in local institutions at very low cost. Indeed, the information built up in a cluster can in itself be seen as a quasi-public good.

The public goods held in clusters may better be termed quasi-public goods, because accessing them involves some cost, although well below full cost. The analysis of public goods in economics has been limited to the pure cases of a fairly narrow range of largely governmental functions. Clusters create a far broader array of circumstances in which something approaching a public-good asset arises and include many instances in which *private* institutions and investments help create them.

Some of the public or quasi-public goods available in clusters are similar to conventional public goods in that they are closely linked to government and to public institutions. Public investment in specialized infrastructure, educational programs, information, trade fairs, and other forms that benefit a cluster is encouraged by the number and visibility of cluster participants and by the number of firms likely to experience spillover benefits from such investment. Other quasi-public goods available to cluster participants arise as natural by-products of competition. These include information and technology pools, the reputation accrued by the cluster location, and some of the marketing and sourcing advantages described above.

In addition, public or quasi-public goods at cluster locations often result from *private* investments in training programs, infrastructure, quality centers, and so on. While public goods are associated with public institutions, they may also arise in private or partially private institutions created at cluster locations (for example, testing laboratories or trade journals). Such private investments are common because cluster participants perceive the potential for collective benefits. Often such investments take place via trade associations or other collective mechanisms.

Incentives and Performance Measurement. Clusters help to solve or mitigate some agency problems that arise in more isolated locations and in more vertically integrated firms. Clusters improve the incentives within companies for achieving high productivity for several reasons. Foremost is competitive pressure. Rivalry with locally based competitors has particularly strong incentive effects because of the ease of constant comparison and because local rivals have similar general circumstances (for example, labor costs and local market access), so that competition must take place on other things. In addition, peer pressure amplifies competitive pressure within a cluster, even among indirectly competing or non-competing firms. Pride and the desire to look good in the local community motivate firms in their attempts to outdo each other.

Clusters also facilitate measurement of the performance of in-house activities because, often, other local firms perform similar functions. Managers gain wider opportunities to compare internal costs with arms-

length transactions, and lower employee monitoring costs by comparing employee performance with others locally. The accumulation of cluster knowledge in financial institutions, for example, should make loan decisions and other financing choices better informed and improve customer monitoring. As mentioned above, clusters also offer the advantage of limiting opportunistic behavior as when one participant takes advantage of another or provides shoddy products or services.¹⁵ Because of repeated interactions, the easy spread of information, the spread of reputation, and the desire to maintain a standing in the local community, cluster participants usually strive for constructive interactions that will positively affect their long-term interests.

* * *

As has been noted, many of these productivity advantages of clusters involve location-specific public goods or benefits that depend on physical proximity, face-to-face contact, close and ongoing relationships, and “insider” access to information. The benefits of cluster membership can thus be difficult if not impossible to access unless firms participate actively, with a significant local presence. Clusters can and do include foreign firms, but only when such firms make a permanent investment in achieving a significant local presence.

Many of the advantages of clustering also apply to sub-units *within a single company*. Co-locating R&D, component fabrication, assembly, marketing, customer support, and other activities can facilitate internal efficiencies in sourcing and information flow, as well as complementarities and other benefits. Companies sometimes disperse units in order to lower costs of labor, utilities, or taxes, thus unwittingly sacrificing the powerful system cost benefits of clusters and their advantages in fostering dynamism and innovation.

CLUSTERS AND INNOVATION

The benefits of clusters in innovation and productivity growth, compared to an isolated location, can be more important than those in current productivity, though there are some risks as well. Some of the same cluster characteristics that enhance current productivity are even more important to innovation.

Firms within a cluster are often able to more clearly and rapidly perceive new buyer needs. Just as with current buyer needs, firms in a cluster benefit from the concentration of firms with buyer knowledge and relationships, the juxtaposition of firms in related industries, the concentration of specialized information-generating entities, and buyer sophistication. Cluster firms can often discern buyer trends faster than can isolated competitors. Silicon Valley and Austin-based computer companies, for example, plug into customer needs and trends quickly and effectively, with an ease impossible to match elsewhere.

Cluster participation also offers advantages in perceiving new technological, operating, or delivery possibilities. Participants learn early and consistently about evolving technology, component and machinery availability, service and marketing concepts, and so on, facilitated by ongoing relationships with other cluster entities, the ease of site visits, and frequent face-to-face contacts. Cluster membership makes possible direct observation of other firms. The isolated firm, in contrast, faces higher costs and steeper impediments to acquiring information and a corresponding increase in the need to devote resources to generating such knowledge internally.¹⁶

The potential advantages of clusters in perceiving both the need and the opportunity for innovation are significant, but equally important can be the flexibility and capacity they provide to act rapidly on these insights. A firm within a cluster often can more rapidly source the new components, services, machinery, and other elements needed to implement innovations, whether a new product line, a new process, or a new logistical model. Local suppliers and partners can and do get closely involved in the innovation process, thus ensuring that the inputs they supply better meet the firm's requirements. New, specialized personnel can often be recruited locally to fill gaps required to pursue new approaches. The complementarities involved in innovating are more easily achieved among nearby participants.

Firms within a cluster can experiment at lower cost and can delay large commitments until they are more assured that a new product, process, or service will pan out. In contrast, a firm relying on distant outsourcing faces greater challenges in contracting, securing delivery, obtaining associated technical and service support, and coordinating across complementary entities, and a firm relying on vertical integration

faces inertia, difficult tradeoffs if the innovation erodes the value of in-house assets, and constraints if current products or processes must be maintained while new ones are developed.

Reinforcing these other advantages for innovation is the sheer pressure—competitive pressure, peer pressure, and constant comparison—occurring in geographically concentrated clusters. The similarity of basic circumstances (for example, labor and utility costs) combined with the presence of multiple rivals forces firms to distinguish themselves creatively. The pressure to innovate is elevated. Individual firms in the cluster have difficulty staying ahead for long, but many firms progress faster than do those based at other locations.

Under certain circumstances, however, cluster participation can retard innovation. When a cluster shares a uniform approach to competing, a sort of groupthink often reinforces old behaviors, suppresses new ideas, and creates rigidities that prevent adoption of improvements.¹⁷ Clusters also may not support truly radical innovation, which tends to invalidate the existing pools of talent, information, suppliers, and infrastructure. In these circumstances, a cluster participant may be no worse off, in principle, than an isolated firm (because both can outsource), but the firm in an established cluster may suffer from greater barriers to perceiving the need to change and from inertia against severing past relationships that no longer contribute to competitive advantage. I will explore these issues further in the context of the processes by which clusters emerge and decline.

* * *

The geographic concentration of clusters occurs because proximity serves to amplify many of the productivity and innovation benefits of clustering already described.¹⁸ Transactions costs are reduced, the creation and flow of information improves, local institutions respond more readily to a cluster's specialized needs, and peer pressure and competitive pressure are more keenly felt.

Clusters clearly represent a combination of competition and cooperation. Vigorous competition occurs in winning customers and retaining them. The presence of multiple rivals and strong incentives often accentuates the intensity of competition among clusters. Yet cooperation must occur in a variety of areas I identified above. Much of it is vertical,

involves related industries and is with local institutions. Competition and cooperation can coexist because they occur on different dimensions and between different players; cooperation in some dimensions aids successful competition in others.

A number of the mechanisms through which clusters affect productivity and innovation echo findings in other literatures. Management literature shows growing awareness of the importance of close linkages with suppliers and buyers and of the value of outsourcing or partnering. The literature on innovation highlights the role of customers, suppliers, and universities in the innovation process, while the literature on the diffusion of innovation stresses such notions as demonstration effects, contagion, experimentation, and ease of observability—all clearly influenced by the presence of clusters.¹⁹ Many studies in economics highlight the importance of transactions costs, and others explore the organizational incentive problems that stand in the way of efficiency.

Little of this thinking, however, has been connected to location. It is as if linkages, transactions, and information flow took place outside time and space. Yet proximity clearly affects linkages and transactions costs. Incentive misalignments difficult to resolve with feasible contracts may right themselves under the strong influence of repeated interaction and other aspects of location and clusters. The resort to formal partnerships and alliances, undertaken despite complex incentive and governance problems, overlooks the relative ease of achieving many of the same benefits more simply and informally within clusters. Bringing these various theoretical approaches together with an understanding of location and clusters can extend their usefulness and deepen our understanding of the effect of clusters on competition.

More broadly, the geographically proximate cluster of independent and informally linked firms and institutions represents a robust organizational form in the continuum between markets and hierarchies—but one still little explored in theory. Location can powerfully shape the tradeoffs between markets and hierarchies. Clusters offer obvious advantages in transactions cost over other forms and seem to ameliorate many incentive problems. Repeated interactions and informal contracts within a cluster structure result from living and working in a circumscribed geographic area and foster trust, open communication, and lower the costs of severing and recombining market relationships.

CLUSTERS AND NEW BUSINESS FORMATION

Many if not most new businesses (that is, headquarters, not branch offices or ancillary facilities) form within existing clusters rather than at isolated locations. This occurs for a variety of reasons. First, clusters provide inducement to entry through better information about opportunities. The existence of a cluster in itself signals an opportunity. Individuals working somewhere in or near the cluster more easily perceive gaps in products, services, or suppliers to fill. Having had this insight, these individuals more readily leave established firms to start new ones aimed at filling the perceived gaps.

Opportunities perceived at cluster locations are pursued there because *barriers to entry are lower than elsewhere*. Needed assets, skills, inputs, and staff, often readily available at the cluster location, can be assembled more easily for a new enterprise. Local financial institutions and investors, already possessing familiarity with the cluster, may require a lower risk premium on capital. In addition, the cluster often presents a significant local market. The entrepreneur seeking to benefit from established relationships often prefers to stay in the same community. All of these factors—lower entry barriers, multiple potential local customers, established relationships, and the presence of other local firms that have “made it”—reduce the perceived risks of entry. The barriers to exit at a cluster can also be lower due to reduced need for specialized investment, deeper markets for specialized assets, and other factors.²⁰

While local entrepreneurs are likely entrants to a cluster, entrepreneurs based outside a cluster frequently relocate, sooner or later, to a cluster location. The same lower entry barriers attract them, as does the potential to create more economic value from their ideas and skills at the cluster location or the ability to operate more productively.

Established companies based in non-cluster locations (foreign and domestic) often establish subsidiaries at clusters, seeking the productivity benefits and innovation advantages discussed above. The presence of an established cluster not only lowers the barriers to entry for outside firms, but it also reduces, as noted above, the perceived risk. (This is particularly the case where other “foreign” firms have already moved into the cluster.) Many firms have relocated entire business units to a cluster location or have designated their cluster-based

subsidiary as their regional or world headquarters for that particular line of business.

The advantages of a cluster in new business formation can play a major role in speeding up the process of cluster innovation. Large companies often face constraints or impediments of various sorts to innovating. Spin-off companies often pick up the slack, sometimes with the blessing of the original company. (A large company, for example, may support a smaller firm serving a niche it cannot address economically.) Larger companies in a cluster develop close relationships with innovative smaller ones, helping in their establishment, and acquiring them if they become successful.

Because of new business formation, clusters often grow in depth and breadth over time, further enhancing cluster advantages. The intense competition within a cluster, together with lower entry and exit barriers, sometimes leads to high rates of both entry and exit at these locations. The net result is that many of the surviving firms in the cluster can gain position vis-à-vis rivals at other locations. Location and the state of clusters not only affect barriers to entry and exit but most other aspects of industry structure. Analysts are just beginning to explore the connections between location and industrial organization.

The Socioeconomy of Clusters

The mere presence of firms, suppliers, and institutions in a location creates the *potential* for economic value, but it does not necessarily ensure the realization of this potential. Social glue binds clusters together, contributing to the value creation process. Many of the competitive advantages of clusters depend on the free flow of information, the discovery of value-adding exchanges or transactions, the willingness to align agendas and to work across organizations, and strong motivation for improvement. Relationships, networks, and a sense of common interest undergird these circumstances. The social structure of clusters thus takes on central importance.

A growing economic and organizational literature examines the importance of network relationships found in effective companies and communities.²¹ Economic activities are seen as “embedded” in ongoing social relationships. Much research undertakes to map these networks,

to understand the number of nodes feasible, and to verify the importance of repeated interaction and of time in making networks effective. Examinations of the structure of networks has revealed that the social relationships among individuals, or their "social capital," greatly facilitates access to important resources and information.

Cluster theory focuses on how juxtaposition of economically linked firms and institutions in a specific geographic location affects competitiveness. While some cluster advantages are largely independent of social relationships (for example, available pools of capital or employees), most if not all have at least a relationship component. A firm's identification with and sense of community, derived from membership in a cluster, and its "civic engagement" beyond its own narrow confines as a single entity translate directly, according to cluster theory, into economic value. Cluster theory further extends notions of social capital by exploring the mechanisms through which a structure of network relationships within a geographic location produce benefits for particular firms. The benefits of trust and organizational permeability, fostered through repeated interactions and a sense of mutual dependence within a region or city, clearly grease the interactions within clusters that enhance productivity, spur innovation, and result in the creation of new businesses.

Cluster theory bridges network theory and competition. A cluster is a form of a network that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions. Well-functioning clusters move beyond hierarchical networks to become lattices of numerous overlapping and fluid connections among individuals, firms, and institutions. These connections are repeated, constantly shift, and often expand to related industries. Both "strong ties" and "weak ties" occur together. Modest changes in the pattern of relationships within a cluster may have significant consequences for productivity and the direction of innovation.

Network theory can greatly inform understanding of the way clusters work and of how clusters can become more productive. As will be discussed further, successful cluster upgrading depends on paying explicit attention to relationship building, an important characteristic of cluster development initiatives. Trade associations play important roles in facilitating the formation of networks.

For its part, cluster theory also provides a way to connect theories of networks, social capital, and civic engagements more tightly to business competition and economic prosperity—and to extend them. Cluster theory identifies who needs to be in the network for what relationships and why. Clusters offer a new way of exploring the mechanisms by which networks, social capital, and civic engagement affect competition and market outcomes. Cluster theory helps isolate the most beneficial forms of networks. Relationships and trust resulting in cartels, for example, undermine economic value, while those facilitating open information exchange between customers and suppliers enhance it. The workings of clusters also suggest the efficiency and flexibility possible in network structures built on proximity and informal local links compared to those defined by formal or hierarchical relationships between companies or between institutions and companies. Cluster theory may also reveal how network relationships form and how social capital is acquired, helping to unscramble questions of cause and effect; for example, do strong relationships and trust arise because a cluster exists or are clusters more likely to develop from existing networks? Cluster theory, then, helps illuminate the causes of network structure, the substance of network activity, and the link between network characteristics and outcomes.

Clusters and Economic Geography

Specialization characterizes the economic geography of cities, states, and nations, especially of prosperous ones, and appears to increase as an economy becomes more advanced.²² A relatively small number of clusters usually account for a major share of the economy within a geographic area as well as an overwhelming share of the outward-oriented economic activity (for example, exports to other locations and investment in other locations by locally based firms).²³ Outward-oriented clusters are juxtaposed with two other types of business: localized industries and clusters that do not compete with other locations (for example, restaurants, entertainment, logistical services, real estate, and construction); and local subsidiaries of competitive firms based elsewhere that primarily serve the local market (for example, sales offices, customer support centers, branch offices, and assembly plants).

The outward-oriented clusters based in a geographic area constitute the area's primary *long-run* source of economic growth and prosperity. Such clusters can grow far beyond the size of the local market, absorbing workers from less productive firms and industries. The demand for local industries, in contrast, is inherently limited and derives primarily, either directly or indirectly, from the success of outward-oriented clusters.

The partial cluster map in Figure 7.5 illustrates the geographic distribution of clusters in the United States, a highly advanced economy. The map shows just a few of the many geographically concentrated clusters present in the United States, ranging from familiar ones, such as entertainment in Hollywood, finance in New York City, and household furniture in High Point, North Carolina, to less familiar clusters, such as golf equipment in Carlsbad, California, and optics in Arizona. Figure 7.6 shows regional clusters in a less advanced economy, Portugal. Figure 7.7 maps the dominant clusters in a single U.S. state, Massachusetts, and Figure 7.8 shows the clusters in a single U.S. metropolitan region, greater Pittsburgh. Not evident from these maps are the striking differences in cluster specialization even between nearby economic areas: The Massachusetts economy, for example, looks quite different from that of neighboring Connecticut.

In identifying clusters, outward-oriented industries must be distinguished from those that primarily serve the local market. Every economy will include local clusters, such as real estate and construction, as well as the local operations of exporting clusters based elsewhere. It is also important to recognize that the co-location of parts of a cluster does not ensure that linkages and interactions within the cluster function effectively. In Pittsburgh, for example, the potential for innovation within and across clusters has not been fully realized.

While cluster boundaries often fit within political boundaries, they may also cross state and even national borders, especially in smaller states and nations and in cities located near borders. A thriving photonics (or electro-optics) cluster in Massachusetts, centered around Sturbridge, for example, extends into Connecticut, where another 135 companies are based, about 50 of them in counties abutting the Massachusetts border. In another example, a European chemicals cluster encompasses

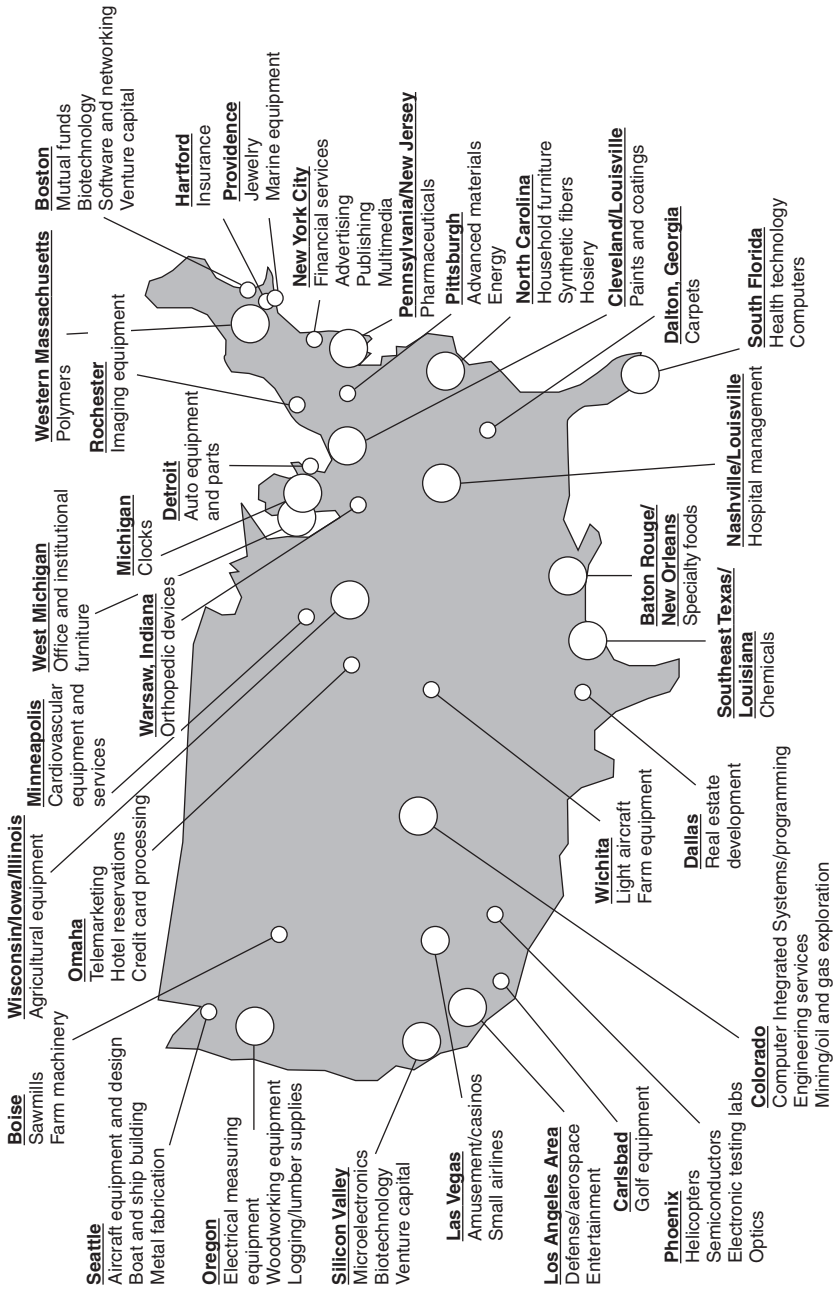


Figure 7.5 Selected Regional Clusters of Competitive U.S. Industries

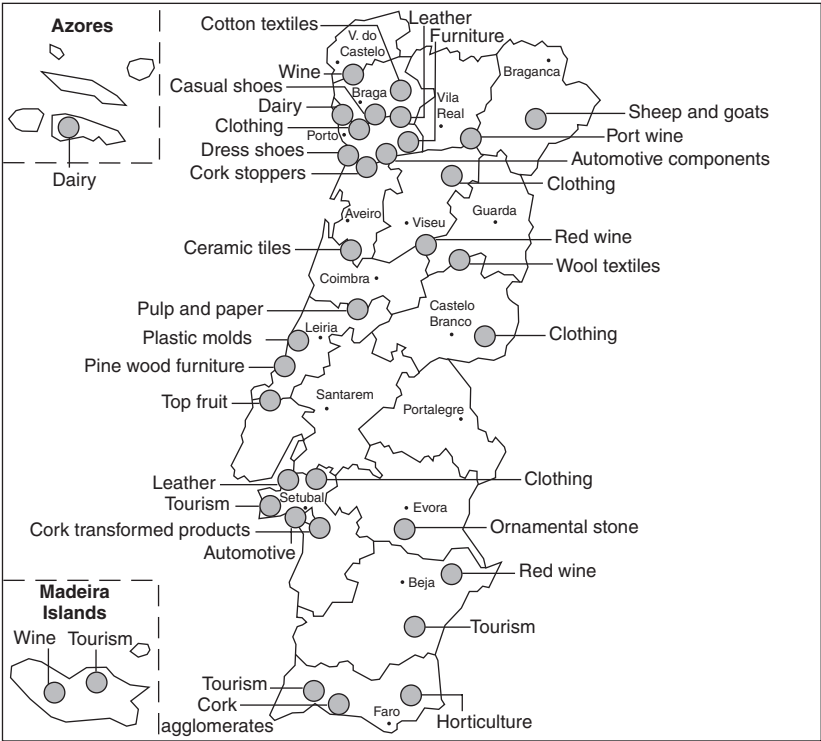


Figure 7.6 Selected Regional Clusters in Portugal
Source: Monitor Company, Cambridge, Massachusetts.

firms in both Germany and the German-speaking part of Switzerland. Clusters are more likely to span political borders where there is a common language, short physical distances (e.g., 200 miles or less between business locations), similar legal systems and other institutions, and minimal trade or investment barriers.

CLUSTERS AND DEVELOPING ECONOMIES

Clusters are normally most pronounced in advanced economies, where the depth and breadth of clusters is usually greater. In developing economies, a greater proportion of industries are locally based or are foreign

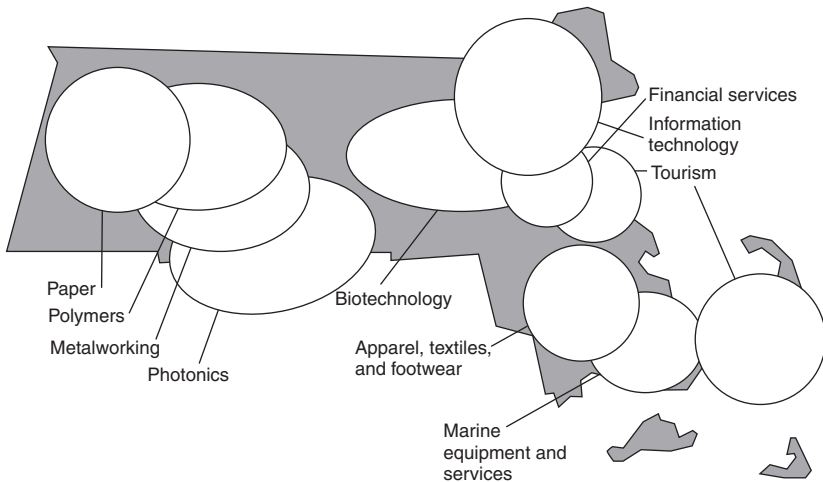


Figure 7.7 Massachusetts Clusters

subsidiaries serving the local market. Exporting industries tend to be resource- or labor-intensive. Clusters in developing economies tend to be shallow and to rely primarily on foreign components, services, and technology. Firms in such locations must often vertically integrate, producing not only their own components but even back-up electricity as well; they must sometimes also build and operate not only physical infrastructure but their own schools and other services. The relatively competitive companies in developing economies tend to operate more like islands rather than as cluster participants.²⁴ Figure 7.9 contrasts the forest products cluster in Sweden, an advanced economy, with that of Portugal, a middle income economy, illustrating some of these differences.

As compared to those in advanced economies, clusters in developing economies not only involve fewer participants but often differ as well in their sociometrics. Many take the form of hierarchical, hub-and-spoke networks surrounding a few large companies, government entities, or distributors. Communication is limited, and linkages between existing firms and institutions are not well developed. In contrast, successful clusters in advanced economies involve a dense mesh of continually evolving relationships and linkages.

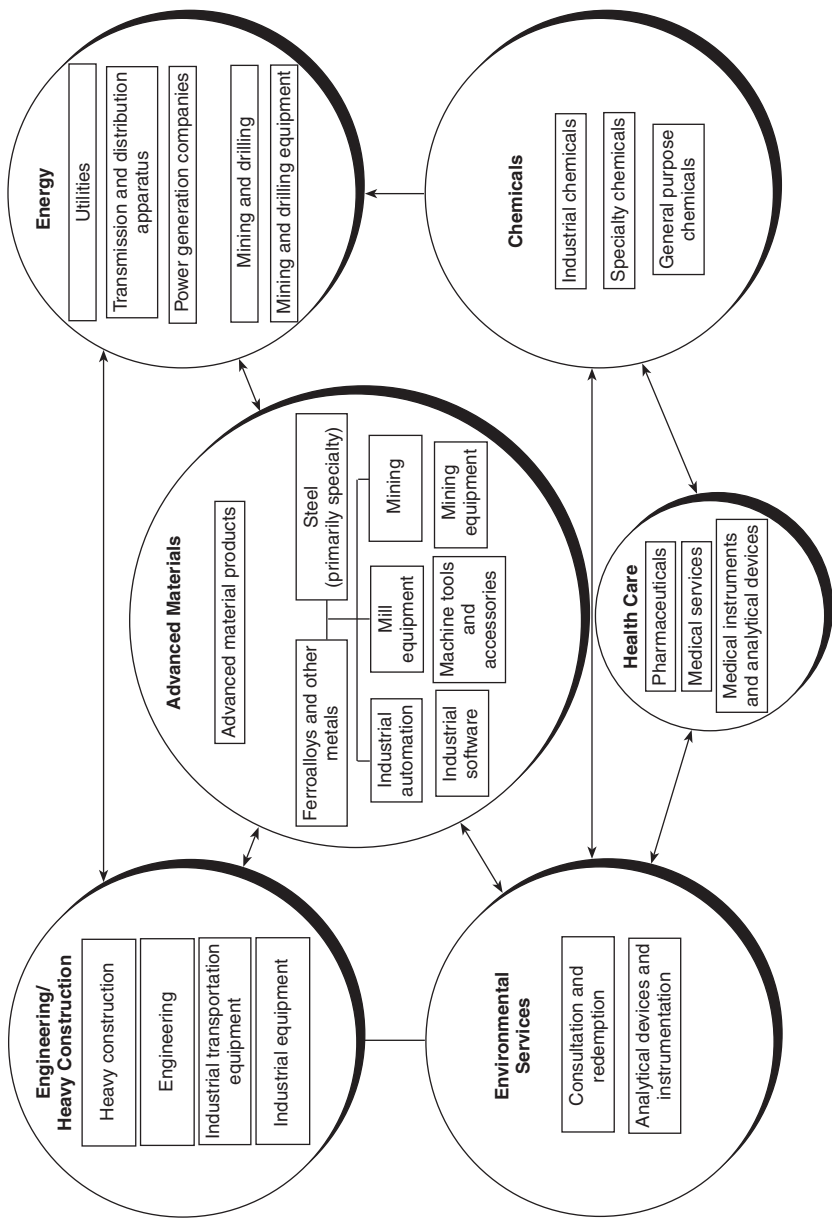


Figure 7.8 Greater Pittsburgh Clusters

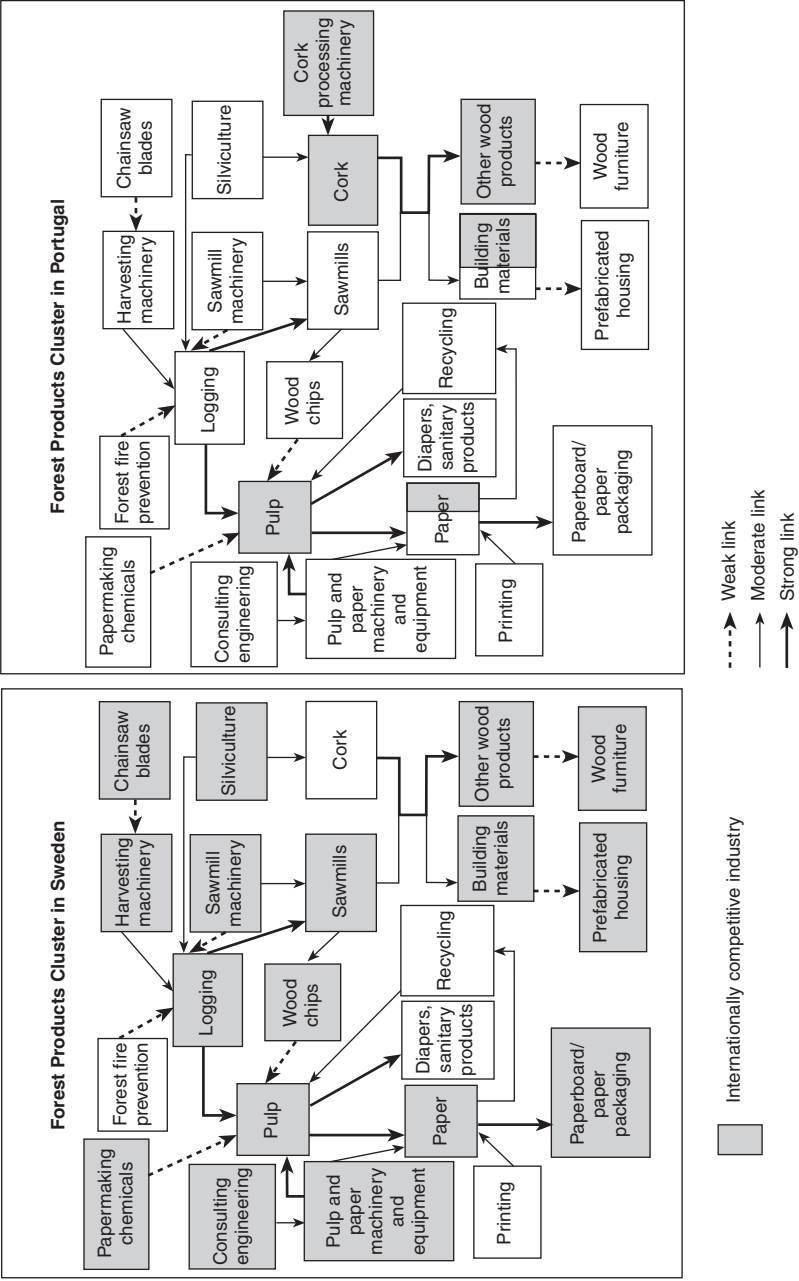


Figure 7.9 Forest Products Clusters in Sweden and Portugal
Sources: Monitor Company (1994) and Porter, Sölvell, and Zander (1991).

The development of well-functioning clusters is one of the essential steps in moving to an advanced economy. In developing economies, cluster formation is impeded by low local education and skill levels, weaknesses in technology, lack of access to capital, and poorly developed institutions. Government policy may also work against cluster formation. Restrictions on industrial location and subsidies artificially spread out companies. University and technical school curricula, centrally dictated, fail to adapt to cluster needs. Finally, protected from competition, companies engage in monopolistic behavior that further retards cluster development.

The paucity of clusters in developing countries does not mean that such countries cannot compete, but it impedes upgrading and productivity improvement. While exports can grow for a time based on low-cost local labor or natural resources exploited with imported technology, such an approach is ultimately limiting. To improve profits, wages, and the standard of living, the challenge over time is to raise productivity and increase product value. To allow a location to become more productive, develop local capacity to improve products and processes, and, ultimately, to innovate, a cluster must build up over time. Otherwise, the natural tendency for local costs to rise over time cannot be counteracted, and other locations with lower factor costs or offering greater subsidies will take over production.

The successful deepening and broadening of clusters, then, is integral to successful economic development.²⁵ Cluster development seems to be a controlling factor in moving from a lower middle income (per capita income of \$8,000 to 15,000) to an advanced economy. Even in advanced, high-wage economies, however, the need for cluster upgrading is never-ending. It remains essential to allow the continuing rise of productivity and incomes. The wealthier the economy, the more necessary becomes true innovation in products, services, and methods of production to support rising wages and to replace jobs freed up by improvements in efficiency.

INTERNAL TRADE AND INVESTMENT

While international trade and investment are widely recognized as powerful forces for productivity growth, the role of internal trade and invest-

ment has been largely ignored. The geographic dispersion of clusters and the specialization of geographic regions by cluster is normally greatest in advanced economies. In nations such as the United States, Italy, Switzerland, and Germany, internal specialization, trade, and investment contribute significantly to productivity and productivity growth. Internal competition motivates improvements by state and local governments and by local institutions, because these entities face far more competitive pressure than do federal government or institutional monopolies. Trading within a nation, made easier by proximity, national similarities, and, often, fewer trade barriers outside of a nation's control, provides a stepping-stone from which firms can build the skills needed to internationalize.

In developing economies, a large proportion of economic activity tends to concentrate around large capital cities, such as in Bangkok and Bogota. This concentration reflects the absence of infrastructure and institutions in outlying areas and the almost total lack of available suppliers. It may also reflect an intrusive role by the central government in controlling competition, a force that leads firms to locate near the seat of power and the agencies whose approval they require to do business. In many developing economies, industries crowd together, and little or no activity takes place in outlying areas, other than agriculture and resource production.

This pattern of economic geography inflicts high costs in terms of productivity as compared to geographic dispersion and specialization. Congestion, bottlenecks, and inflexibility lead to high administrative costs and major inefficiencies, not to mention a diminished quality of life. Companies cannot easily move out from the center, however, because neither infrastructure nor rudimentary clusters exist in the smaller cities and towns. The transition from a concentrated to a dispersed economy, with specialized industries and clusters, represents another essential challenge of economic development. (The building of a tourism cluster in developing economies can be a positive force in improving outlying infrastructure and dispersing economic activity.)

Even in advanced economies, however, economic activity may be concentrated in a few geographic areas. Japan offers a particularly striking case, with nearly 50 percent of total manufacturing shipments located around Tokyo and Osaka. This is due less to inadequacies in

infrastructure in outlying areas and more to the powerful and intrusive central government, with its centralizing bias in policies and institutions. The Japanese case illustrates vividly the major inefficiencies and productivity costs resulting from such an economic geography even for advanced nations. Addressing its pattern of economic geography is a major policy issue facing Japan.

Traditional treatments of economic geography often stress the benefits of highly diversified metropolitan economies, citing advantages in terms of available inputs, infrastructure, communication, and access to a large local market. The forces of globalization have greatly diminished such generalized urbanization advantages, while cluster-specific advantages have increased. In advanced economies, even large metropolitan areas are often quite specialized in terms of exporting clusters. An economic geography characterized by a number of metropolitan areas, each specializing in an array of clusters, appears to be a far more productive industrial organization than one based on one or two huge, diversified cities. Most developing countries also suffer from the lack of multiple metropolitan areas that compete with one another.

THE LOCATION PARADOX

Economic geography in an era of global competition, then, involves a paradox. In an economy with rapid transportation and communication and accessible global markets, location remains fundamental to competition. It has been widely recognized that changes in technology and competition have diminished many of the traditional roles of location. Resources, capital, and other inputs can be efficiently sourced in global markets. Firms can access immobile inputs via corporate networks. They need no longer locate near large markets.

Naturally, perhaps, the first response to globalization has been to pursue these benefits by moving assembly plants and other factor cost-sensitive activities to low-cost locations. Anything that can be efficiently sourced from a distance, however, has been essentially *nullified* as a competitive advantage in advanced economies. Information and relationships that can be accessed and maintained via fax or e-mail are available to anyone. While global sourcing and communication mitigates disadvantages, it does not create advantages. Moreover, distant

sourcing is normally a second-best solution compared to accessing a competitive local cluster, in terms of both total productivity and innovation.

Paradoxically, then, the enduring competitive advantages in a global economy are often heavily local, arising from concentrations of highly specialized skills and knowledge, institutions, rivals, related businesses, and sophisticated customers in a particular nation or region. Proximity in geographic, cultural, and institutional terms allows special access, special relationships, better information, powerful incentives, and other advantages in productivity and productivity growth that are difficult to tap from a distance. Standard inputs, information, and technologies are readily available via globalization, then, while more advanced dimensions of competition remain geographically bounded. Location matters, albeit in different ways at the turn of the twenty-first century than in earlier decades.²⁶

Economic geography in many parts of the world, however, remains in a state of major transition. The relaxation of barriers to trade and investment, still comparatively recent in many countries, is incomplete. The fall of transportation and communication costs has been rapid, while investments in plant and equipment often last for many decades. As a result, many overly broad national and subnational economies persist, as do many clusters in countries and regions that lack a real competitive advantage.

The Birth, Evolution, and Decline of Clusters

A cluster's roots can often be traced to parts of the diamond that are present in a location due to historical circumstances.²⁷ One prominent motivation for the formation of early companies is the availability of pools of factors, such as specialized skills, university research expertise, an efficient physical location, or particularly good or appropriate infrastructure. Many Massachusetts clusters, for example, had their beginnings in research done at MIT or Harvard while a number of prominent Finnish clusters emerged from the presence of natural resources. The Dutch transportation cluster owes much to a central location within Europe, a network of waterways, the efficiency of the port of Rotterdam,

and the skills accumulated by the Dutch through Holland's long maritime history.

Clusters may also arise from unusual, sophisticated, or stringent local demand. Israel's cluster in irrigation equipment and other advanced agricultural technologies reflects that nation's strong desire for a self-sufficient food supply, coupled with its scarcity of water and its hot, arid growing conditions. Finland's environmental cluster emerged from pollution problems created by local process industries (for example, metals, forestry, chemicals, energy), as did the environment cluster in greater Pittsburgh (see Figure 7.8).

Prior existence of supplier industries, related industries, or entire related clusters provides yet another seed for new clusters. The golf equipment cluster near San Diego, California, for example, has its roots in the southern California aerospace cluster. This cluster created a pool of available suppliers for castings and advanced materials and of engineers with the requisite experience in working with these technologies.

New clusters may also arise from one or two innovative companies that stimulate the growth of many others. Medtronic played this role in helping to create the Minneapolis medical devices cluster. Similarly, MCI and America OnLine have been spin-off hubs for the telecommunications cluster in the Washington, D.C., metropolitan area.

Chance events are often important to the birth of a cluster. The early formation of companies in a location often reflects acts of entrepreneurship not completely explainable by reference to favorable local circumstances. These companies, in other words, could have sprouted at any one of a number of comparable locations. The establishment of cluster pioneer Callaway Golf in Carlsbad rather than another southern California town had much to do with chance.

Chance, however, often has locational antecedents, making its role less than it at first appears. The location of pacemaker pioneer Medtronic in the Minneapolis area provides an interesting example. Medtronic, which now employs over twelve thousand people, provided the seed for the entire Minnesota medical devices cluster, now encompassing more than one hundred Minnesota companies—all with roots traceable to Medtronic employees or technologies.²⁸ In 1949, Earl Bakken, an electrical engineering graduate student working part time at a Minneapolis

hospital, founded Medtronic, with Palmer Hermundslie, as a medical equipment repair company. By the early 1950s, Medtronic was building custom equipment for medical researchers. In the mid 1950s, the company developed a relationship with Dr. C. W. Lillehei, a pioneer in open heart surgery at the University of Minnesota Medical School. The university had a national reputation in both electrical engineering and surgery. Medtronic engineers worked with Dr. Lillehei to improve the bulky and dangerous devices then being used to stimulate heart activity. By 1957, the breakthrough Bakken battery-powered pacemaker was in use. The next breakthrough, in electrodes, was developed in 1958, the result of a collaboration with Dr. Samuel Hunter of St. Joseph Hospital in St. Paul. By 1960, Medtronic had evolved into a world-recognized pacemaker competitor. While the developments leading to the company's initial success arose partly by chance, the founding and success of the company were inextricably entwined with the area's local university and medical institutions.

Chance events can also be important in the chain of causality leading to company formation by creating advantageous factor or demand conditions. The telemarketing cluster in Omaha, Nebraska, for example, owes much to the decision by the U.S. Air Force to locate the Strategic Air Command (SAC) there. Charged with a key role in America's nuclear deterrence strategy, SAC was the site of the first installation of fiber-optic telecommunications cables in the United States. In addition, the local Bell operating company (now U.S. West) developed unusual capability through dealing with such a demanding customer. The extraordinary telecommunication infrastructure that consequently developed in Omaha, coupled with less unique attributes, such as its central time zone location and easy-to-understand local accent, provided the underpinnings of the area's telemarketing cluster.

Some recent treatments of industry evolution have emphasized chance, but chance must be considered in its locational context. What looks like chance may be as much the result of preexisting local circumstances, as the above examples, and others, suggest. Moreover, even when chance provides a central explanation for a development, it is almost never the sole explanation. The influences of location not only raise the odds that chance events will occur, they also raise the odds

that chance events will lead to competitive firms and industries. Chance alone rarely explains why a cluster takes root or its subsequent growth and development.

The limited explanatory role of chance raises serious doubts about whether clusters can be seeded in locations where no important advantages already exist. The appropriate policy towards cluster development, then, should be to *build on existing or emerging fields* that have passed a market test, a subject to which I will return below.

CLUSTER DEVELOPMENT

While the birth of clusters has many causes, the development or lack of development of clusters is more predictable. Though there is no guarantee that a cluster will develop, once the process gets started it is like a chain reaction in which the lines of causality quickly become blurred. The process depends heavily on the efficacy of the diamond's arrows or feedback loops, on how well, for example, local educational, regulatory, and other institutions respond to the cluster's needs, or how rapidly capable suppliers respond to the cluster opportunity. Three particular areas deserve special attention: intensity of local competition, the location's overall environment for new business formation, and the efficacy of formal and informal mechanisms for bringing cluster participants together. Healthy rivalry is an essential driver of rapid improvement and entrepreneurship. The entrepreneurial climate is important because the creation of new firms and institutions is so integral to cluster development. Finally, organizational and relationship-building mechanisms are necessary because a cluster's advantages rely heavily on linkages and connections among individuals and groups.

In a healthy cluster, the initial critical mass of firms triggers a self-reinforcing process in which specialized suppliers emerge; information accumulates; local institutions develop specialized training, research, infrastructure and appropriate regulations; and cluster visibility and prestige grows. Perceiving a market opportunity and facing falling entry barriers, entrepreneurs create new companies. Spinoffs from existing companies develop, and new suppliers emerge. Recognition of the cluster's existence constitutes a milestone. As more institutions and firms recognize the cluster's importance, a growing number of specialized

products and services become available and specialized expertise responsive to the cluster arises among local financial services providers, construction firms, and the like. Informal and formal organizations and modes of communication involving cluster participants develop.²⁹ As the cluster grows, it develops greater influence not only over what other firms do but also over public and private institutions and government policies. Policies that have deterred cluster upgrading are often modified.

From numerous case studies, it appears that clusters require a decade or more to develop depth and to gain real competitive advantage—one reason why government attempts to create clusters normally fail. Clusters at different locations often develop unique subspecializations, notably in product segment coverage, the array of suppliers and complementary industries, and the prevailing modes of competing.

Cluster development often becomes particularly vibrant at the intersection of clusters. Here, insights, skills, and technologies from different fields merge, sparking new businesses. The presence of multiple intersecting clusters further lowers barriers to entry, because potential entrants and spinoffs come from several directions. Diversity of learning stimulates innovation. Germany, for example, has both a home appliance cluster and a household furniture cluster. At the intersection of these clusters is built-in kitchens and built-in appliances, products in which Germany has a higher share of world exports than in either appliances or furniture overall. Figure 7.10 illustrates some cluster intersections in Massachusetts that have proven to be fertile breeding grounds for new companies.

In a national or global economy, cluster development can be greatly accelerated by attracting cluster participants from other states or nations. A growing cluster begins to attract in-bound foreign direct investment (FDI) in the form of manufacturing or service operations and supplier facilities. Companies relocate from less productive locations or invest in subsidiaries to access cluster expertise in particular segments. This occurred in golf equipment, for example, when east coast manufacturers established R&D centers and operations in Carlsbad, California. Suppliers move to the emerging location to gain better access and closer relationships with a growing customer base.

Developing clusters also attract—and cluster participants seek out—people and ideas that reinforce the cluster. Growing clusters attract

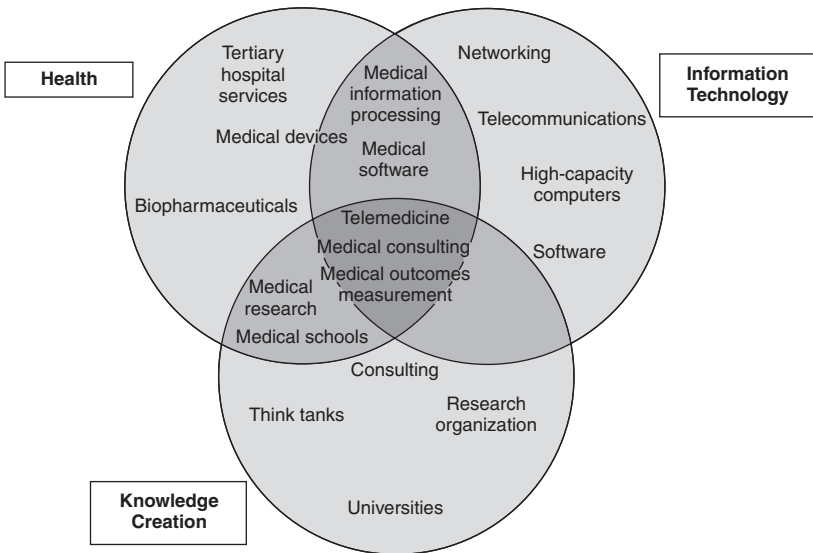


Figure 7.10 Cluster Intersections in Massachusetts

skilled people through offering greater opportunities. Entrepreneurs or individuals with ideas migrate to the cluster from other locations, as well, because a growing cluster signals opportunity. A cluster's success stories help attract the best talent.

As noted, cluster participants often play a role in this process, seeking out people, technologies, and even suppliers from elsewhere. The later history of Medtronic provides a good example. In 1960, two Buffalo, New York, physicians and an electrical engineer published a paper on a self-contained, transistorized, implantable pacemaker. Medtronic, working on the same problem, immediately recognized the significance of the work, and within months had contracted for exclusive rights to the new pacemaker. Lacking a local cluster, the Buffalo inventors quickly realized that the economic value of their idea would be much greater if an established company in a growing cluster commercialized it.

As a cluster evolves, cluster participants tend to develop increasingly global strategies. They market products in more and more countries, and sometimes source the more generic or basic inputs from other locations. Over time, less productive activities are internationalized to lower cost and improve access to foreign markets. As long as such

internationalization results not from internal rigidities but from active pursuit of opportunities, this process makes the cluster more competitive. A cluster in which many participants compete globally is healthier because this not only opens up more growth opportunities but enriches knowledge and stimulates new ideas. Any effort to keep cluster participants local to protect advantages is misguided and ultimately counter-productive.

Nascent clusters can never develop if the market forces and feedback loops of the kind described here prove weak or nonfunctioning. Local institutions may have other agendas. Inbound foreign investments may be blocked by government policy. Dominant firms or cartels may keep out new competition. Dominant suppliers may be entrenched elsewhere. Artificial barriers to new business formation may stunt competition and retard innovation and specialization. Government policy can also impede clustering and cluster upgrading in a myriad of ways.

In a world economy in which many national and local markets are still protected to some extent or are only slowly opening, there are still numerous clusters lacking any competitive advantage. As more and more of the world economy opens to competition, however, these clusters will shrink and wither away.

CLUSTER DECLINE

Clusters can maintain vibrancy as competitive locations for centuries, and most successful clusters prosper at least for decades. Just as the development of a cluster is not assured, however, neither is its continued ability to compete.

The causes of cluster atrophy and decline can also be found in the elements of the diamond. They can be grouped into two broad categories: endogenous, or deriving from the location itself, and exogenous, or due to developments or discontinuities in the external environment.

Internal sources of decline stem from internal rigidities that diminish productivity and innovation. The onset of restrictive union rules or regulatory inflexibility can slow down productivity improvement. Over-consolidation, mutual understandings, cartels, or other barriers to competition can undermine local rivalry. Institutions such as schools and universities can suffer from their own rigidities and fail to upgrade and

change. Groupthink among cluster participants, another form of rigidity, was discussed above.

Such rigidities in clusters tend to arise in locations in which government is prone to suspend or intervene in competition. When internal rigidities arise, the rate of improvement and innovation in a cluster falters. Increases in the cost of doing business begin to outrun the ability to upgrade. Such internal rigidities currently work against a variety of clusters in Switzerland and Germany.

As long as rivalry remains sufficiently vigorous, companies can partially compensate for local problems through globalization. Outsourcing can compensate for supplier problems, and foreign production can offset local wages that rise ahead of productivity. German firms in the 1990s, for example, have been rapidly outsourcing and outlocating to mitigate the effect of local cost problems. Unless internal rigidities ease, however, a cluster will eventually lose its productivity and dynamism. Competitive advantage will migrate to other locations.

External threats to cluster success arise in several areas. Technological discontinuities are perhaps the most significant, because they can neutralize many cluster advantages simultaneously. Market information, employee skills, scientific and technical expertise, and supplier bases may be rendered inappropriate. Unless the requisite new technologies and skills are available from other local institutions or can be rapidly developed, competitive advantage will shift to another location. The shift of golf equipment manufacturing from New England to California provides a good example. The New England cluster was based on steel shafts, steel irons, and wooden-headed woods. When the notion of making golf clubs with advanced materials was pioneered, east coast producers had difficulty competing. Some east coast firms joined the California cluster; others died or declined.

A shift in buyer needs, creating a divergence between local needs and needs elsewhere, constitutes another external threat to cluster productivity and innovation. American firms in a variety of clusters, for example, suffered when energy efficiency grew in importance in most parts of the world while the United States maintained low energy prices, retarding innovation. As this example illustrates, however, the threat posed by external developments often relates to local choices and policies.

As with internal threats to cluster competitiveness, aggressive firms in a location can, for a time, use globalization to compensate for external

discontinuities. Technology can be licensed or sourced from other locations, product development can be moved elsewhere, and components and equipment can be outsourced. Over time, however, a location that fails to build up a critical mass in a major new technology or in meeting a major new need will wane as a home base for innovative companies.

The competitive decline of a cluster should not be confused with reductions in employment or total revenue that may result from upgrading. Rising local wages and profits reflect economic success. This means that less skilled and less productive activities *should* move to other locations. The ultimate test of the health or decline of a cluster is its rate of innovation. A cluster that is investing and innovating at home is of far less concern than one that improves productivity only through shrinking and outsourcing.

The Role of Government

Government inevitably plays a variety of roles in an economy. Identifying the broad types of these roles helps put government's proper policies toward clusters in context.

Government's most basic role in an economy is to achieve macroeconomic and political stability. It does this by establishing stable government institutions, a consistent basic economic framework, and sound macroeconomic policies, including prudent government finances and low inflation. Government's second role is to improve general microeconomic capacity of the economy by improving the efficiency and quality of the general purpose inputs to business identified in the diamond (an educated workforce, appropriate physical infrastructure, and accurate and timely economic information) and the institutions that provide them. Such inputs are required across the entire economy and are a foundation upon which everything else is built. Government's third role is to establish the overall microeconomic rules and incentives governing competition that will encourage productivity growth. Such rules and incentives, present throughout the diamond, include a competition policy enhancing rivalry, a tax system and intellectual property laws encouraging investment, a fair and efficient legal system, laws providing consumer recourse, corporate governance rules holding managers accountable for performance, and an efficient regulatory process promoting innovation rather than freezing the status quo.

While these roles of government are necessary for economic progress, however, they may not be sufficient. Especially as government begins to make headway in its more basic roles, a fourth role—that of facilitating cluster development and upgrading—takes on prominence. Government should aim to reinforce the development and upgrading of *all* clusters, not choose among them. While the general business environment is central to competitiveness, cluster circumstances are increasingly important in allowing an economy to move beyond factor-cost competition. Government policies inevitably affect the opportunities for upgrading clusters. At the same time, many of the productivity and innovation advantages of clusters rest on spillovers and externalities that involve government entities. In addition to modifying its own policies and practices, government can also motivate, facilitate, and provide incentives for collective action by the private sector. (Government's role in cluster development and upgrading is not the same as so-called industrial policy. See the insert "Clusters versus Industrial Policy.")

Government's final role in an economy is in developing and implementing a positive, distinctive, long-term economic action program or change process which mobilizes government, business, institutions, and citizens to upgrade both the general business environment and the array of local clusters. Economic progress is thwarted as much by inaction as by a lack of knowing what steps are necessary. Strong forces oppose economic upgrading, ranging from obsolete views about competitiveness to entrenched interests that prosper from the status quo. Only a long-term process, with accompanying institutions, can counteract these forces. The process must involve all key constituencies and rise above the politics of any particular administration or government. The process must encompass the general conditions affecting all industries as well as the upgrading of clusters. Ideally, such a process will occur not only at the national level but at the state and city level as well.

GOVERNMENT POLICY AT THE CLUSTER LEVEL

All clusters offer opportunities to improve productivity and support rising wages, even those that do not compete with other locations. Every cluster not only contributes directly to national productivity but can affect the productivity of *other* clusters as well. This means that tradi-

tional clusters, such as agriculture, should not be abandoned but upgraded. Efforts to upgrade clusters may have to be sequenced for practical reasons, but the goal should be to encompass all of them eventually. Not all clusters will succeed, of course, and upgrading in some clusters will reduce employment as firms move to more productive activities. These outcomes should be determined by market forces, however, not by government decisions.

Government should reinforce and build on established and emerging clusters, rather than attempt to create entirely new ones. New industries and new clusters emerge best from established ones. Businesses involving advanced technology do not succeed in a vacuum, but where there is already a base of less sophisticated activities in the field. Most clusters form independently of government action—and sometimes in spite of it. Clusters form where a foundation of locational advantages exists to build on. To justify cluster development efforts, some seeds of a cluster should have already passed a market test.

Cluster development efforts must embrace the pursuit of competitive advantage and specialization, rather than attempt to imitate exactly what is present in other locations. This requires building on local differences and sources of uniqueness where possible, turning them into strengths. Finding areas of specialization normally proves more effective than head-on competition with well-established rival locations. Specialization also offers the potential to meet new needs and expand the market.

Cluster development can be seeded and reinforced by inbound FDI. The most effective efforts at attracting FDI concentrate on attracting multiple companies in the same field, supported by parallel investments in specialized training, infrastructure, and other aspects of the business environment.

Cluster upgrading involves recognizing the presence of a cluster, and then removing obstacles, relaxing constraints, and eliminating inefficiencies that impede cluster productivity and innovation. Constraints include those of human resources, infrastructure, and regulation. Some can be addressed to varying degrees by private initiatives, but others result from government policies and institutions and must be addressed by government. Government regulations, for example, may create unnecessary inefficiencies; important infrastructure may be lacking; edu-

cation and training policies may overlook cluster needs. Ideally, all government policies that inflict costs on firms without conferring any compensating, long-term competitive value should be minimized or eliminated. Upgrading clusters, then, requires going beyond improvements in the general business environment to evaluating and, if necessary, changing policies and institutions that affect particular concentrations of related firms and industries.

Governments are often drawn into developing policies, such as subsidies or technology grants, that attempt to enhance the competitiveness of individual firms. Much policy attention has also addressed the industry level, also narrower than clusters. Conversely, other policy thinking is concerned with broad sectors, such as machinery, manufacturing, or services. None of these approaches is well aligned with modern competition. Setting policies to benefit individual firms distorts markets and

Clusters versus Industrial Policy

A cluster-based approach to economic development is sometimes confused with industrial policy. In reality, cluster theory and industrial policy differ fundamentally in both their intellectual foundations and their implications for government policy.

Industrial policy rests on a view of international (or more generally, locational) competition in which some industries offer greater wealth-creating prospects than others. Desirable industries—that is, those that are growing or industries that employ high tech—should be “targeted” for support. Industrial policy sees competitive advantage as heavily determined by increasing returns to scale.

Given the importance of scale, governments should nurture priority emerging, “infant” industries until they reach a critical mass, through subsidies, eliminating “destructive” or “wasteful” internal competition, selective protection from imports, and restricting foreign investment. Subsidies and suspension of internal competition should concentrate on scale-sensitive areas, such as R&D and facilities investment. Through such intervention, government attempts to tilt competitive outcomes (and international market share) in a nation’s favor. Sometimes the notion of industrial policy seems to reflect a zero-sum view of international competition, where there is a fixed pool of demand to be

served and the goal is to gain a larger share for a particular nation.^a

Cluster theory could hardly be more different. The concept of clusters rests on a broader, more dynamic view of competition among firms and locations based on the growth of productivity. Interconnections and spillovers within a cluster often influence productivity growth more than does the scale of individual firms.

All clusters can be desirable, and all offer the potential to contribute to prosperity. What matters is not what a nation (location) competes in, but how. Instead of targeting, therefore, all existing and emerging clusters deserve attention. All clusters can improve their productivity. Rather than recommending the exclusion of foreign firms, cluster theory calls for welcoming them. Foreign firms enhance cluster externalities and productivity, and their activities in a nation contribute directly to local employment and investment. Rather than advocate blocking imports, cluster theory stresses the need for timely and steady opening

of the local market to imports that boost local efficiency, provide needed inputs, upgrade local demand conditions, and stimulate rivalry.

While industrial policy aims to distort competition in favor of a particular location, cluster theory focuses on removing constraints to productivity and productivity growth. Cluster theory emphasizes not market share but dynamic improvement. This results in a positive sum underlying view of competition, in which productivity improvements and trade expand the market and many locations prosper if they can become more productive and innovative.

a. The intellectual foundations of industrial policy go back for centuries and can be traced to works on mercantilism and arguments for protecting of infant industries, among others. Industrial policy received major impetus in work that viewed it as an important explanation for Japan's economic success. The intellectual rigor of industrial policy was also greatly enhanced by "strategic trade theory." See, for example, Krugman (1986) and Tyson (1992).

uses government resources inefficiently. Focusing policy at the industry level presumes that some industries are better than others and runs grave risks of distorting or limiting competition. Often, firms are wary of participating along with their competitors. Sectors, in contrast, are too broad to be competitively significant, and distinctions such as manufacturing versus services or high tech versus low tech no longer hold meaning.

A cluster focus highlights the externalities, linkages, spillovers, and supporting institutions so important to competition. By grouping together firms, suppliers, related industries, service providers, and institutions, government initiatives and investments address problems common to many firms and industries without threatening competition. A government role in cluster upgrading, then, will encourage competition rather than distort it. A cluster focus will also encourage the buildup of public or quasi-public goods that significantly impact many linked businesses. Government investments focused on improving the business environment in clusters, then, other things being equal, may well earn a higher return than those aimed at individual firms or industries or at the broad economy.

Emphasizing clusters might seem to encourage unhealthy economic specialization, but upgrading all clusters rather than choosing among them avoids this. Moreover, clusters function as powerful sources of new business formation, and new clusters often emerge out of existing ones. Also, the presence of clusters can facilitate the adjustment of local firms to changing economic conditions, reducing risk to the local economy rather than increasing it.³⁰

More broadly, clusters represent a new and complementary way of dividing and understanding an economy, organizing economic development thinking and practice, and setting public policy. Clusters, together with the diamond model, reveal the process by which wealth is actually created in an economy and make competitiveness more concrete and operational. (Nonbusiness constituencies, especially, benefit from the demystification of competition.) Policy analyses and recommendations can address systematically the needs of business. In the Netherlands, for example, cluster development represents an important priority of government policy. Clusters provide a vehicle for bringing companies, government, and local institutions together in a constructive dialogue about upgrading and offer a new mechanism for business-government collaboration. Dialogue with more broadly defined business groupings inevitably gravitates toward discussion of the general business environment, and issues such as taxes, currency value, and overall complaints about the inefficiencies of government. Businesses get to vent their grievances against the government, but quickly lose patience. Government gains little useful information from such critiques and representa-

tives quickly tire of listening to repetitive lobbying over the same old issues. A business-government dialogue convened around narrowly defined industries inhibits productive interchange as participants grow wary of revealing their needs and problems in front of competitors. Such discussions often gravitate toward subsidies, import protections, and limits to competition. Dialogues that engage cluster participants, in contrast, avoid these difficulties by bringing together all the affected players and focusing on common constraints and linkages among related firms. The presence of suppliers, channels, and often customers checks any incipient effort to suppress competition.

GOVERNMENT INFLUENCES ON CLUSTER UPGRADING

Figure 7.11 illustrates some specific government roles in cluster upgrading. Government influences on a cluster appear throughout the diamond. At one end of the spectrum, governments might convene forums of

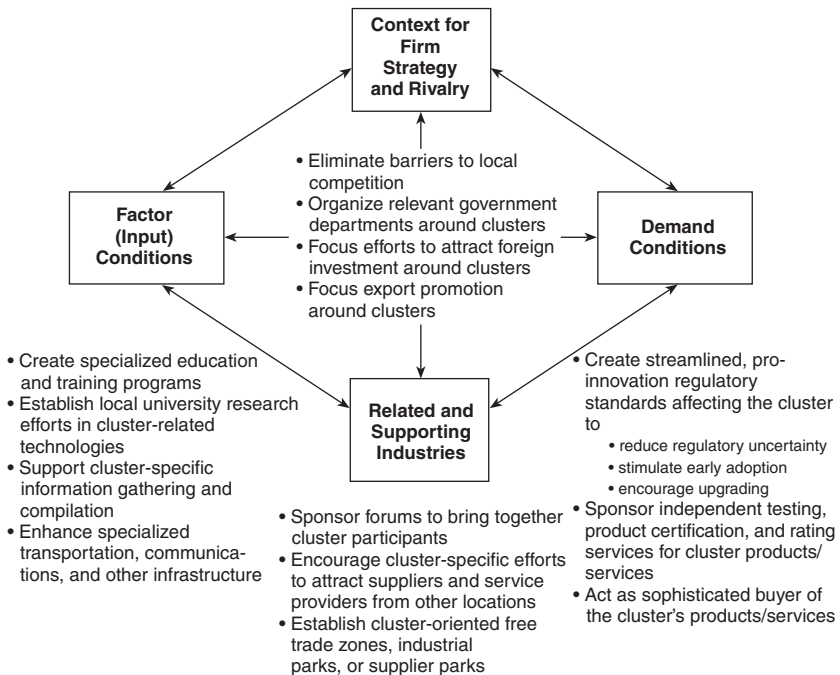


Figure 7.11 Government Influences on Cluster Upgrading

firms, institutions, and appropriate government agencies. At the other end, government has more direct roles such as collecting and compiling cluster-specific information; setting educational policies encouraging public universities and schools to respond to local cluster needs; clarifying and simplifying regulations significantly affecting the cluster; and improving the sophistication of local demand for cluster products and services. At times, cluster upgrading can be as simple as colocating public with private investments. In New Zealand forestry, for example, the cluster centers on the North Island, while the main university institution supporting the cluster, at the University of Canterbury, is on the South Island. (See the insert "Microclusters in Catalonia" for another specific case example.)

Clusters offer a new way for governments to collect and organize information. The Standard Industrial Classification System, for example, aligns poorly with clusters and with the actual nature of competition; dated groupings, such as machinery, products, and services, fail to capture the most important linkages among industries. Some regions, such as Massachusetts, have begun to retabulate economic data focusing on clusters, although much remains to be done.³¹

As clusters mature and develop and as the sources of their competitive advantage shift, the appropriate government priorities change. Early priorities involve improving infrastructure and eliminating diamond disadvantages. Later roles revolve more around removing constraints and impediments to innovation.

An important tool for encouraging cluster growth in developing countries is attracting foreign investment. Attracting one or two multinationals in a field can attract others, which in turn triggers local developments. In Costa Rica, for example, an Intel plant announced in November 1996 and a Microsoft investment announced in September 1997 have led to serious expressions of interest in the nation from other information technology producers. Foreign investment alone, however, is insufficient to build clusters. Also necessary are systematic efforts to improve local conditions throughout the diamond. Costa Rica's plan to create the conditions for growing an information technology cluster includes initiatives in areas such as improving training, enhancing the data communications infrastructure, and encouraging use of computers in schools.

Even when attempting to seed clusters with FDI, however, success requires the presence of prior locational advantages. Costa Rica spends 6 percent of GDP on education, one of the highest expenditures in the region. It also has an established network of research centers and enjoys the highest index of computers per capita in Latin America. These conditions, together with a long history of political stability, were what attracted Intel and Microsoft in the first place.

In developing economies, foreign investment promotion, free trade zones, and industrial parks also act as prominent policy levers favoring cluster growth. Free trade zones and industrial parks can better foster economic upgrading if they have a cluster rather than a general focus, supported by tailored regulations and supporting infrastructure. Free trade zones and industrial parks may have to begin as enclaves in an otherwise inefficient business environment, with virtually all inputs imported, all outputs exported, and little or no contact with the rest of the economy. Over time, however, such zones should build links with the rest of the economy. Programs and regulations must encourage the use and development of local suppliers, for example, and the forging of links with local educational and training institutions. In addition, government must move aggressively to improve infrastructure and reduce inefficiencies *throughout* the economy. The use of enclaves cannot be allowed to reduce the sense of urgency about needed improvements in the general business environment, still the only way to achieve sustained improvements in prosperity.

CLUSTERS AND OVERALL ECONOMIC POLICY

The cluster concept provides a way of organizing thinking about many policy areas that goes beyond the common needs of the entire economy, as shown in Figure 7.12. Cluster-based thinking can help guide policies in science and technology, education and training, and promotion of exports and foreign investment, among others. A location's best chance of attracting foreign investment and promoting exports, for example, lies in its existing or emerging clusters.

A cluster orientation highlights the fact that more parts of government have an influence on competitiveness, often not recognized within gov-

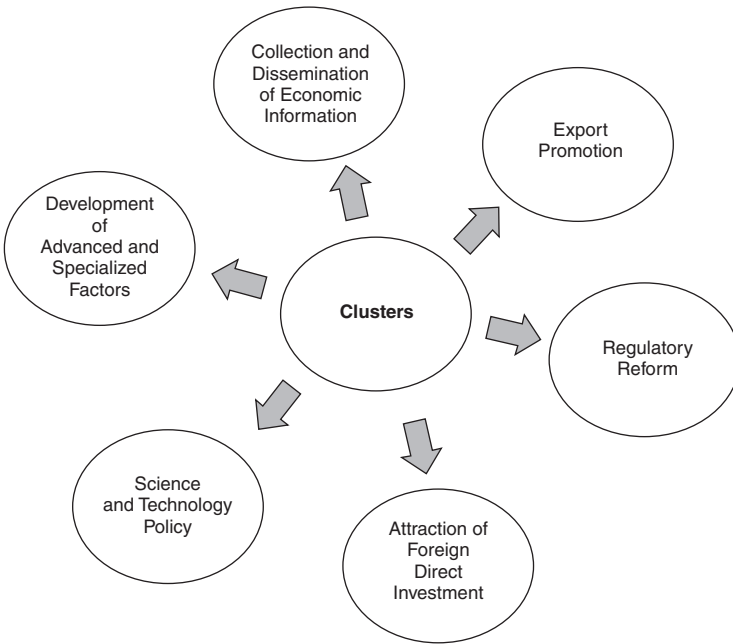


Figure 7.12 Clusters and Economic Policy

ernment itself. Cluster theory clarifies the impacts on competitive position of government policies and makes needed actions more operational. Effective solutions often require collaboration among different parts of government. (See the insert “Microclusters in Catalonia” for an example.)

In some locations, government agencies that relate to business have begun to organize themselves internally to align with local clusters. In Arizona, for example, the Department of Commerce now develops staff as experts on particular clusters, in contrast to a past focus on individual foreign countries (for example, Canada or Japan). A cluster orientation in government also provides a mechanism through which officials can become better informed about the practical costs and benefits of policies and better motivated to make policies and government organizations more cost effective. Ongoing cluster assessments represent a powerful tool for identifying and validating economy-wide policy deficiencies and for finding practical solutions. A problem that surfaces in several different clusters clearly should be a priority.

Finally, cluster thinking also highlights the important roles of government at a number of geographic levels. The traditional focus of economic policy has been at the national level, where many aspects of the general business environment are best addressed. Recently, globalization has focused attention on worldwide multilateral institutions. State, metropolitan region, and local governments, however, also significantly influence the general business environment in a location. At the cluster level, these influences often dominate, and consideration of clusters should represent an important component of state and local economic policy.

Each level of government exerts an important influence on the overall business environment and on clusters. National policies should set minimum standards while pushing public investment choices down to smaller geographic levels, and they should avoid centralization and rigidities that obstruct policies tailored for implementation at the state and local level.³² Economic development programs should increasingly involve parallel efforts at multiple geographic levels. In New Zealand, for example, cluster development began at the national level but has spread to the state and local level. Almost three-quarters of all local economic development agencies in New Zealand have adopted the identification and upgrading of clusters as an integral part of their activities.³³

Finally, while far less common, influences on productivity—and clusters themselves—sometimes cross national borders. Coordination among transportation systems, energy networks, and other areas among neighboring countries can benefit productivity in ways that go well beyond customs unions and free trade zones. Groups of neighboring countries, then, also have a joint role to play in formulating economic policy. Figure 7.13 illustrates the broadening geographic units of policy analysis important in modern competition.

The Corporate Role in Cluster Development

The existence of clusters suggests that much of a company's potential to achieve competitive advantage, both in operational effectiveness and in establishing a unique strategy, lies outside the company and even outside the industry. The presence of a well-developed cluster provides

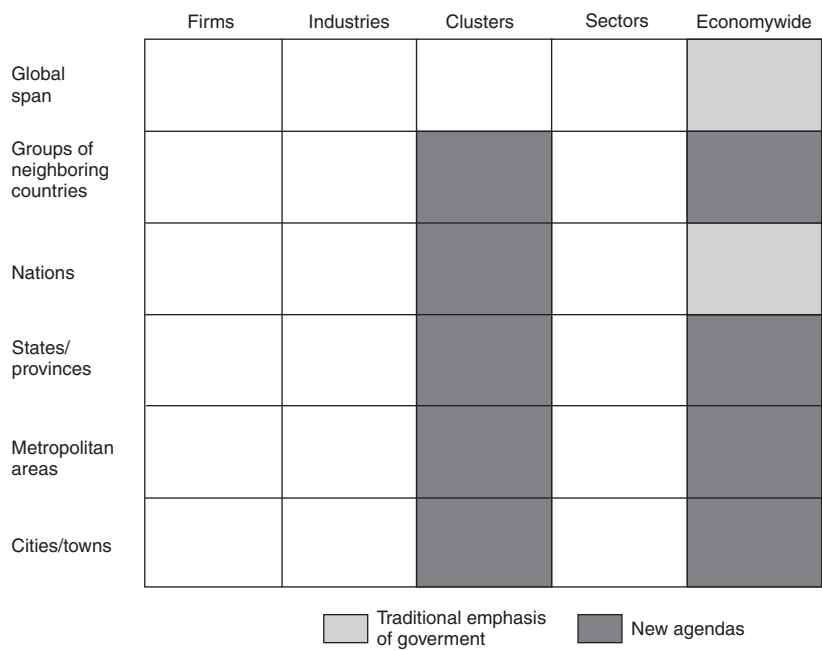


Figure 7.13 Government Influences on Competitiveness

powerful benefits to productivity and to the capacity for innovation that are difficult for firms based elsewhere to match. Often, for a given field, only a few locations in the world can achieve such an environment.

Even though clusters offer tangible competitive benefits, the first reaction of managers is often to be wary of them. There are concerns that the expansion of a cluster will invite unwanted competition and drive up the costs of employees and inputs. Managers have nightmare visions of losing valued employees to rivals or spinoffs. As their understanding of the cluster concept grows, however, managers realize that many cluster participants do not directly compete. Although a company may face competition for employees and other inputs, the presence of the cluster expands their supply. The net access to specialized skills, services, technology, and information in a cluster often increases. Any increases in competition comes with cluster benefits in productivity, flexibility, and innovation.

Cluster theory suggests new tasks and roles for companies. Cluster analysis must become part of competitive assessments, along with com-

pany and industry analysis. Private sector roles in cluster upgrading can be found in all parts of the diamond, as shown in Figure 7.14. Improving factor conditions provides the most obvious example, with efforts possible in enhancing the supply of appropriately trained personnel, the quality and appropriateness of local university research activities, the creation of specialized physical infrastructure, and the supply of cluster-specific information. Ongoing relationships with government bodies and local institutions, such as utilities, schools, and research groups, are necessary to attain these benefits. There is also a role for private investment by cluster participants to establish common specialized infrastructure, such as port or handling facilities, satellite communication links, and testing laboratories. Often such investments can be made and administered through third parties, for example, universities or trade associations.

In the area of related and supporting industries, firms have a role in attracting suppliers, services, and complementary-product producers to the cluster, as well as in forming supplier businesses to fill gaps. Joint

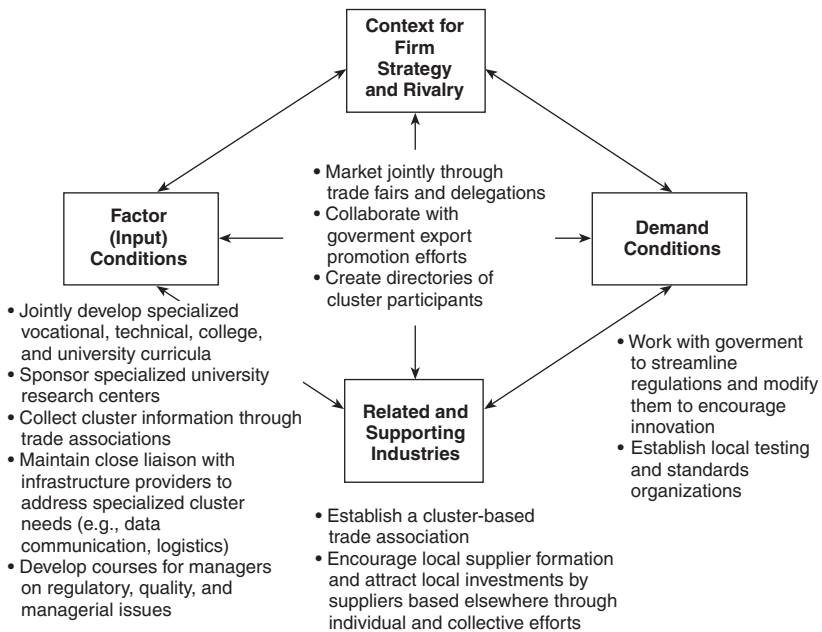


Figure 7.14 Private Sector Influences on Cluster Upgrading

ventures are sometimes used to establish local capability in essential supporting industries.

The need for cluster participants to inform and prod government to address the constraints or weaknesses under its control cuts across all parts of the diamond. Individual departments or units of government that impact the cluster must be engaged and educated on the effect of regulations and policies and on the quality of government services. An open, constructive dialogue must replace self-serving lobbying or paternalism in these relationships.

THE ROLE OF TRADE ASSOCIATIONS AND COLLECTIVE BODIES

Individual companies can independently influence cluster development, and cluster pioneers or leading firms often play this role because they gain major benefits. Given the important externalities and public goods involved in clusters, however, informal networks and formal trade associations, consortia, and other collective bodies often become necessary and appropriate. Trade associations representing all or most cluster participants can command greater attention and achieve greater influence than can individual members, and an association or collective body (for example, a joint research center or testing laboratory) creates a vehicle for cost sharing.

Many trade associations do little more than lobby government, compile some statistics, and host social functions. The opportunity for associations to enhance cluster competitiveness, however, is much greater. Associations or collective bodies institutionalize cluster linkages. In addition to providing a neutral forum for identifying common needs, constraints, and opportunities, associations can serve as focal points for efforts to address them. Associations often take the lead in organizing national and international fairs and delegations; they create training programs in conjunction with local institutions, manage purchasing consortia, establish university-based research programs and testing facilities, collect cluster-related information, offer forums on common managerial problems, investigate solutions to environmental issues, and pursue many other common interests. These activities are in addition to performance of the traditional task of interfacing with local, state,

and national government, guiding regulatory reform, and representing the cluster with other business groups.

Associations fulfill especially important functions for clusters consisting of many small- and medium-sized firms (for example, tourism, apparel, or agriculture). Such clusters have a particularly great need for a collective body to take on scale-sensitive functions. In the Netherlands, for example, grower cooperatives built the specialized auction and handling facilities that constitute one of the Dutch flower cluster's greatest competitive advantages. The Dutch Flower Council and the Association of Dutch Flower Growers Research Groups, in which most growers participate, have taken on other functions as well, such as marketing and applied research.

At times, cluster-based trade associations may not exist. Or, existing associations may be too narrow, including industry participants but not suppliers, companies in related industries, or local institutions. Existing trade organizations may be national rather than local in scope. National associations have been the norm, as most associations have seen their primary role as lobbying government, with the national government viewed as most important. National associations, however, are rarely effective in addressing many of the training, infrastructure, and other issues most important to cluster productivity. Another typical pattern among a location's business organizations is chambers of commerce, roundtables, or councils cutting across the entire economy or large parts of it. Once again, these inevitably focus primarily on government lobbying and general business issues. Cluster-based associations are also needed. In other cases, several associations may be present that would be more useful if combined or at least coordinated. Given individuals' and companies' limited time and money for participation in associations, the more integrated the efforts of various groups, the better.

Surprisingly often, cluster participants never meet, and there is little public or government recognition of the cluster's significance to the local economy. Both situations existed in the Massachusetts medical-devices cluster. Where absent, the formation of associations should be part of a location's economic development agenda. In Massachusetts, this effort was undertaken by the Governor's Council on Economic Growth and Technology. This private-sector advisory body, composed of leaders from firms, universities, and other entities, convened a series

of task forces to examine Massachusetts clusters that led to the formation of new and permanent associations where they did not yet exist, as in telecommunications and medical devices.

CORPORATE LOCATION

Globalization and the ease of transportation and communication have led to a surge of outsourcing, with companies relocating many facilities to locations with low wages, low taxes, and low utility costs. Outsourcing some activities to tap lower cost inputs can indeed reduce locational disadvantages. Cluster theory, however, suggests a more complex view of corporate locational choices: Corporate location involves far more than simply building offices or factories.

First, cluster theory suggests that locational choices should weigh overall productivity potential, not just input costs or taxes. In locating activities, the aim is low total cost. Locations with low wages and low taxes, however, often lack efficient infrastructure, available suppliers, timely maintenance, and other conditions that clusters offer. Logistical costs and costs of introducing new models may be substantial. Many companies have discovered that such productivity disadvantages can be more than offsetting. Yet the effects of low wages, low taxes, and low utility costs are easy to measure up front, while productivity costs remain hidden and unanticipated.

Locating in an existing or developing cluster, then, often involves lower total systems cost and greatly improved capacity for innovation. A shift back toward clusters is beginning among companies who once believed in the cost savings of highly dispersed activities. This trend is evident in choices of international locations (with activities being moved back to places such as the United States) and locations within nations (with clusters gaining in appeal over remote Sun Belt or other sites).

Second, firms must capture the cost advantages of spreading activities across locations while *also* harnessing advantages of clusters. (See Chapter 8 for a full treatment of global strategy, or, more broadly, of competition across locations.) The determinants of location differ markedly for various activities. For activities such as assembly plants, manufacture of stable, labor-intensive components, and software translation,

locational choices often should be driven by factor cost and market access. For what I term “home base” activities, however, the basis for choice should be very different. Home base activities are those involved in the creation and renewal of the firm’s product, processes, and services. This includes activities, such as fabrication of frequently redesigned components, that involve substantial, ongoing changes.

The location of home base activities should be heavily driven by total systems cost and by innovation potential. Clusters usually provide conditions favorable for innovation. Home base activities should sometimes move to locations outside the company’s nation of principal ownership or the nation containing its corporate headquarters—if a more vibrant cluster exists elsewhere. This rule applies especially to product lines, but also to entire business units. The siting of regional headquarters should also involve consideration of clusters, not just of tax considerations or the convenience of executives.

Cluster thinking also underscores the desirability of moving groups of linked activities to the same place rather than spreading them across numerous states and nations. Grouping in this way lowers total system costs, eases sharing of internal information, facilitates and spreads innovation, creates critical mass for supporting company infrastructure and facilities, and extends deeper roots into local clusters that increase the ability to capture externalities and spillovers.

Finally, activities located in places isolated from other firms in the same field require firms to begin building a cluster. The process calls for wooing suppliers, encouraging local institutions to make supporting investments, and finding ways to build the local stock of specialized inputs. Corporate location, then, is not something to be delegated to operations departments but is part of overall strategy.

Organizing Cluster Development Initiatives

Numerous cluster-related initiatives—to organize participants, assess advantages and disadvantages, and catalyze public and private action—have arisen at the national, state, and city levels, as illustrated by the examples in Table 7.1. Some relatively recent efforts have begun to develop initiatives around clusters that cross the borders of neighboring

Table 7.1 Examples of Cluster Initiatives*

Multi-Country Regions	Nations	Regions/States/ Provinces	Cities/ Metropolitan Areas
Central America Middle East	Andorra	Arizona	Bogota
	Bermuda	Atlantic region	Charlotte
	Bolivia	(Canada)	Christchurch
	Bulgaria	Basque Region	Long Island
	Canada	(Spain)	Minneapolis
	Colombia	California	Rotterdam
	Costa Rica	Catalonia	Silicon Valley
	Denmark	Connecticut	Sonoma, CA
	Egypt	Chihuahua	Tampa
	El Salvador	Massachusetts	Wellington
	Finland	Minnesota	Worcester, MA
	Hong Kong	North Carolina	
	India	Ohio	
	Israel	Oregon	
	Jordan	Scotland	
	Malaysia	Quebec	
	Morocco		
	Northern Ireland		
	Norway		
	Netherlands		
	New Zealand		
	Panama		
	Portugal		
	Peru		
	Republic of Ireland		
	South Africa		
	Sweden		
	Tatarstan		
	Venezuela		

*Citations of the published output of many of these initiatives appear in the references at the end of this chapter.

countries in Central America and in the Middle East, a practice that would benefit other regions, as well.

Cluster initiatives provide a new way of organizing economic development efforts that go beyond traditional efforts to reduce the cost of doing business and enhance the overall business environment. Efforts

focusing on clusters draw firms to become much more interested and engaged than in broad, economy-wide efforts that must necessarily gravitate to general issues, such as tax policy and export promotion. Business-government-university dialogue tends to take place on a more concrete level, making action possible. Cluster initiatives can not only bring focus to discussions of government policy, but can reveal and help address issues within the private sector, as well.³⁴

One cluster initiative is profiled in the insert "Microclusters in Catalonia." Similar profiles of other efforts in Arizona, Chihuahua, the Netherlands, and New Zealand are available.³⁵

These and other successful cluster initiatives have a number of common characteristics:

- ***A shared understanding of competitiveness and the role of clusters in competitive advantage.*** Productivity and innovation, not low wages, low taxes, or a devalued currency, are the definition of competitiveness. Participants understand the influences that bear on productivity and how clusters enhance it. Roles for both business and government are well understood, and not confused with market distortion or with picking winners. Early and ongoing communication and discussion educates cluster participants about competitiveness and helps to shift mindsets. In addition to government and businesses, other constituencies share the understanding of competitiveness. Labor unions and non-governmental organizations that may fear lost jobs, lower pay, and watered-down regulations concerning safety, working conditions, and environmental impact are brought to recognize that competitiveness depends on productivity, which supports rising wages, and on an improved quality of life.
- ***A focus on removing obstacles and easing constraints to cluster upgrading.*** Explicit, upfront discussion of goals at the beginning of a cluster initiative and regular reinforcement of those goals helps overcome the urge to seek subsidies or limit competition. The presence of suppliers and customers in the cluster process provides a natural check to these tendencies. Some participants may cling to the status quo and may join the cluster initiative only to influence its efforts in that direction. Successful cluster initiatives remain alert against these tendencies.

- ***A structure that embraces all clusters in a nation or state.*** Setting priorities among clusters is not only bad economics, it disenfranchises large parts of the private sector. Successful cluster initiatives include traditional clusters, such as agriculture and tourism, and even declining clusters. They include emerging clusters as well as established ones. To avoid misguided attempts at creating clusters that have no assets on which to build, emerging clusters should have a demonstrable local foundation and a base of firms that have met a market test. Practical considerations may require the sequencing of cluster projects, but early clusters where work is undertaken should involve a representative spectrum of the types of clusters present (for example, a traditional cluster, an emerging cluster and a declining cluster) and should strive to demonstrate the value of the cluster approach. Careful choices early on help disseminate the concepts and processes to clusters that will be included in later initiatives.
- ***Appropriate cluster boundaries.*** By definition, clusters include industries and institutions with important linkages or spillovers, rather than broad sectors (for example, manufacturing or high tech) or individual industries (for example, plastic machinery or Italian restaurants). Cluster boundaries should reflect economic reality, not necessarily political boundaries. In the Atlantic provinces of Canada, for example, several clusters cross provincial borders, and the cluster initiative there was structured accordingly.
- ***Wide involvement of cluster participants and associated institutions.*** Cluster initiatives should include firms of all sizes, as well as representatives of all important constituencies. Excluding individuals, even (or especially) difficult ones, invites opposition. While any effort will have its share of the skeptical, parochial, self-serving, and opportunistic, the most successful cluster initiatives make an effort to reach out and educate them. Individuals who then choose not to participate have less ground for criticizing or opposing recommendations. Ultimately, cluster initiatives must carry on with those who are willing to work to improve conditions for all.

- ***Private-sector leadership.*** Active government participation in a private-led effort, rather than an initiative controlled by government, will have a better chance of success. Companies can usually better identify the obstacles and constraints in their path, as well as the opportunities, than can government. Letting the private sector lead also reduces the initiative's political content, while taking advantage of the private sector's often superior implementation ability. Cluster initiatives should be as nonpartisan as possible and remain independent of any party or administration's political agenda. Legislators and the executive branch, the opposition parties, and those in power must all be involved. Ideally, the cluster initiative will take place through an entity *independent* of government. Otherwise, promising efforts may be dropped when a new government takes office.³⁶
- ***Close attention to personal relationships.*** In itself, the presence of an established or emerging cluster does not guarantee functioning cluster linkages. Many of the benefits of clusters flow from the personal relationships which facilitate linkages, foster open communication, and build trust. Information is essential to productivity, and relationships that improve its flow will endure and even strengthen after a cluster project ends. Instigating communications is the essence of successful cluster initiatives. Neutral facilitators often help with this where trust is lacking and relationships are undeveloped. From the outset, major efforts will be required to ensure efficient and regular communication, both internal and external. Successes should be widely publicized.
- ***A bias towards action.*** Cluster initiatives must be motivated by the desire to achieve results; they should not be driven by academic institutions, think tanks, or government agencies that see research as an end in itself. Diagnosis and a broad vision for the future must be combined with concrete, active steps. Strong, senior champions are needed in both government and the private sector. Entrepreneurial leadership and the involvement of opinion leaders characterize virtually all successful initiatives.
- ***Institutionalization.*** Cluster upgrading is a long-term process that must have a life beyond a one-shot effort. It requires institutional-

ization of concepts, relationships, and linkages among constituencies. In the private sector, new or revitalized trade associations often take leading roles in the continuing upgrading of clusters. In government, cluster upgrading can be institutionalized by appropriately organizing government agencies, organization through the gathering and dissemination of economic statistics, and by controlling the structure and membership of business advisory groups.

Summary

A cluster is a system of interconnected firms and institutions the whole of which is greater than the sum of the parts. Clusters play an important role in competition, and these raise important implications for companies, governments, universities, and other institutions in an economy.

Clusters represent a new and complementary way of understanding an economy, organizing economic development, and setting public policy. Understanding the state of clusters in a location provides important insights into the productive potential of its economy and the constraints on its future development. Paradoxically, then, the most enduring competitive advantages in a global economy will often be local.

Microclusters in Catalonia

History

Catalonia, one of Spain's seventeen autonomous regions, accounts for 13 percent of the national population but almost 20 percent of its GDP and about 40 percent of its industrial exports. In December 1989, Antoni Subirà was appointed Catalonia's Minister of Industry, Trade and Commerce. Soon after, he obtained a manuscript copy of *The Competitive Advantage of Nations* and circu-

lated several chapters within the ministry. With Spain facing entry into the European Common Market in 1992, Subirà sought to develop a new approach to industrial policy in Catalonia. He chose clusters as a central element.

Since then, approximately twenty Catalan clusters have been studied in detail. As of 1997, clusters continued to be used in Catalonia as the main methodology for assessing the

region's industrial competitiveness and for identifying areas in which the government could improve the environment for companies.

Actors

Initially, Subirà asked Professors Eduard Ballarin and Josep Faus from IESE, a top business school based in Barcelona, to apply the cluster methodology to the study of Catalonia's industry. Their preliminary work set the stage for a larger report, prepared together with Monitor Company, a consulting firm.^a The report offered an overall diagnosis of Catalonia's strengths and weaknesses and was well received. It defined groups of clusters (for example, mass-market consumption goods) and provided some general guidelines about what was needed to enhance their competitive advantage.

Subirà decided to take this work one step further and to study discrete clusters in more detail. Already-existing capabilities within the Ministry of Industry, Trade and Commerce were reorganized, and a local consulting firm—CLUSTER Competitiveness—was asked to lead a series of cluster initiatives. Each study involved companies, suppliers, trade associations, business schools, universities, and many government departments.

Cluster Definition

Catalan clusters included wooden toys, agricultural machinery, jewelry, leather, knitting, processed

meats, publishing, consumer electronics, and furniture.^b Specific clusters were defined relatively narrowly. In furniture, for example, three separate clusters were isolated in different parts of Catalonia, each competing in different segments and facing different challenges. Estimates indicate that Catalonia has more than one hundred such narrowly defined clusters, or microclusters.

Each microcluster study included firms, suppliers, universities, and a wide range of other interested participants. Cluster boundaries and participation emerged as a result of the study process. Self-selection was the rule: All firms interested in participating were considered part of the cluster.

All clusters were viewed as equally desirable. For practical reasons, however, cluster studies were sequenced. Some clusters were initially much better organized than others. One goal of the process was to establish effective trade organizations to serve each cluster.

Process of Change

The cluster studies in Catalonia took place in three stages. In the first, the cluster's problems and opportunities were identified and the basic concepts of cluster upgrading, such as the goal of enhancing rather than suppressing competition, were laid out. At times, the study revealed a view of the cluster's problems that differed from that presented by con-

ventional wisdom. Members of the Catalan leather-tanning cluster, for example, had attributed their decline in competitiveness to the laxity of environmental regulations in LDCs.^c Research revealed, however, that the environmental regulations of their most significant rivals, the Italians, were, in fact, more stringent than those in Catalonia. As a result, Catalan leather tanners who had previously been asking for a relaxation of government environmental legislation decided to set up a joint cleaning and tanning plant and an R&D center. The cluster process convinced them that caring for the environment would actually improve their competitiveness.

The second stage of the study process involved the attempt to achieve a consensus vision of the cluster's future that would unite all participants and facilitate change. In the third stage, cluster participants created strategies and action steps for fulfilling the vision. Specific individuals were identified to lead the action initiatives.

Results

The cluster process equipped the Catalan government with the knowledge it needed to influence Spanish national policy more effectively. More importantly, however, it resulted in a new and more productive dialogue between government and business within Catalonia. Previously, broad, sector-wide organizations had sought general measures,

such as subsidies and tax cuts. The cluster process allowed businesses to assess competitive position in specific, operational terms. Companies requested more specific and pro-competitive government support, such as help in establishing research laboratories or promoting foreign trade. Participants agreed that the competitive advantage of the region's industries had clearly benefited from taking a cluster perspective.

The cluster approach helped numerous firms (many of them small and medium sized) to think more strategically about their problems. Examples of resulting initiatives included the transfer of a leather research center from the Universidad de Barcelona to a location near the leather cluster in Igualada; a series of seminars that helped textile producers make the transition from a production to a retailing focus; and a project for developing a common sub-assembly facility to serve the local Honda, Yamaha, and Derbi motorcycle factories. Some clusters initially lacked effective associations (for example, the furniture cluster in Montsia); others were part of organizations that represented a too broad constituency (for example, lathe operators); still others had ineffective associations (for example, the leather tanners' cluster in Igualada). Following the cluster effort, new and more cluster-specific associations were created and old associations were revived.

Catalan government policies shifted toward cluster upgrading: improving

the market access of clusters; facilitating foreign direct investment; introducing product certification programs; and instituting policies for upgrading technology. Based on cluster studies, for example, the government provided assistance for a cork research and applications center in Parafrugell (currently developing an international standard for cork quality). In follow-up discussions, however, some firms expressed the view that the best service provided by the government was the stimulation of dialogue among cluster participants.

In one of the major benefits of the cluster process, government officials were transformed into an informed audience for firms. The dialogue among various agencies and departments within the Catalan government also increased and coordination improved.

Catalonia's experience offers many lessons about applying cluster

methodology. First, one of the major benefits of convening a cluster is to explore common opportunities, not just discuss common problems. Second, leaders stressed the value to the cluster process of keeping a low profile; limiting publicity during the early stages helped avoid creating premature, unrealistic expectations and helped minimize formation of political and other opposition. Third, the particular leaders that emerged in a given cluster had much to do with its success in improving. Finally, the cluster initiative benefited greatly from the close and aggressive support and follow-up by Minister Subirà, who, with his business training and orientation, insulated the process from politics.

a. See Monitor Company (1992).

b. See Conejos, et al. (1997).

c. See Rodríguez, Prats, Enright, and Ballarín (1995).

NOTES

1. For a recent example, see Cairncross (1997).
2. See Enright (1993B) for examples illustrating clusters' varying geographic scope.
3. Enright (1993C) offers an interesting discussion of how to draw cluster boundaries.
4. While industry analysis properly involves suppliers, channels, and customers, cluster analysis widens the scope considerably to include chains or related industries at all levels, as well as a wide range of institutions.
5. The case of Italy, where such clusters are quite common, helped spawn a literature on industrial districts. Industrial districts are a special case of clusters.
6. The literature about such cases uses a number of alternate terms, such as *technopoles* and *science cities*. See A. Advani (1997) for one example.
7. See Porter (1990), Chapters 3 and 4.
8. See Harrison, Kelley, and Gant (1996) for a good summary. Static agglomeration economies consist of a local concentration of customers (or downstream firms) suffi-

cient to permit suppliers to achieve economies of scale in production or distribution, great enough for local firms to amass sufficient demand to warrant the provision (usually by or via local governments) of specialized infrastructure, and large enough to realize a specialized local division of labor. So-called dynamic agglomeration economies consist of advantages in terms of technological learning and improvement.

9. Stigler (1951). For a more recent re-statement, see Krugman (1991B).

10. An extensive literature has explored these advantages, including Pascal and McCall (1980), Angel (1990), Rauch (1993), and Glaeser and Maré (1994).

11. Adams and Jaffe (1996), for example, found that the influence of parent firm R&D on plant-level productivity diminishes with geographic distance.

12. Saxenian (1994) describes the workings of the remarkable information flow within Silicon Valley.

13. For a model capturing some of these elements, see Stahl (1982).

14. See Monitor Company (1994).

15. Enright (1990).

16. Strong empirical support exists for the spillover effects among firms and between universities and firms in R&D and innovation. Jaffe, Trajtenberg, and Henderson (1993) show geographic localization of knowledge spillovers. Audretsch and Feldman (1996) find a strong association between the importance of new knowledge and spatial clustering. Harrison, Kelley, and Gant (1996) also highlight the geographic dimension of innovation.

17. For an example drawn from the Swiss watch industry, see Glasmeier (1991).

18. Enright (1990), building on Porter (1990), provides the foundational treatment of the role of geographic concentration. See also Enright (1993A).

19. See, for example, von Hippel (1988), Case (1992), and Rogers (1995).

20. See Porter and Caves (1977).

21. See, for example, Burt (1997); Granovetter (1985); Henton, Melville, and Walesh (1997); Nohria (1992); Perrow (1992); Putnam, Leonard, and Naneth (1993); Fukuyama (1995); and Harrison and Weiss (1998).

22. Some empirical research is beginning to explore the effect of clustering on the rate of growth of cities. Glaeser et al. (1992) and Henderson, Kuncoro, and Turner (1995) find support for a positive association.

23. I use the term *exports* to apply to industries that compete outside a geographic area, even if destined for another state and not a foreign country. Note that most exports actually move to other locations, while other exporting industries (mainly services) attract outside customers to the home location.

24. See Ingham (1995).

25. More efforts are under way to bring cluster thinking into the mainstream of economic development. Cluster development has become a core approach in the World Bank's Private Sector Development Department, for example. See also Fairbanks and Lindsay (1997B) and Rosenfeld (1997).

26. Interesting recent work by economic geographers explores the synthesis between globalization and location. See Cox (1997) and Storper (1997).

27. My book *The Competitive Advantage of Nations* (1990) contains the basic treatment of the life cycle of clusters. Many other cluster studies provide some

historical perspective, as well. A particularly detailed historical analysis of the development of an array of Swedish clusters is contained in Porter, Sölvell, and Zander (1993). See also van der Linde (1992) and Hernesniemi, Lammi, and Ylä-Anttila (1996).

28. See Metropolitan Council (1995B).

29. For some interesting examples, see Rosenfeld (1997).

30. See Rosenfeld (1996B).

31. My research team has created a classification that regroups all SIC and SITC industries into clusters; this system is designed to serve as a consistent starting point for statistical research, recognizing that local modifications will usually be needed. The classification is available from the author.

32. See Markusen (1995B) and Porter (1995A).

33. See Ffowcs-Williams (1996) and Mitchell (1997).

34. See Waits (1996) for a discussion of the cluster approach taken in Arizona. See Jacobs and de Man (1996) for a discussion of some of the practical considerations that arise when formulating cluster-based economic policies and strategies.

35. Contact the author for more information.

36. See Andorra, Govern d', *Andorra Pla Estratégic* (1993).

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