RESEARCH AND PRACTICE

Location, Competition, and Economic Development: Local Clusters in a Global Economy

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Economic geography during an era of global competition involves a paradox. It is widely recognized that changes in technology and competition have diminished many of the traditional roles of location. Yet clusters, or geographic concentrations of interconnected companies, are a striking feature of virtually every national, regional, state, and even metropolitan economy, especially in more advanced nations. The prevalence of clusters reveals important insights about the microeconomics of competition and the role of location in competitive advantage. Even as old reasons for clustering have diminished in importance with globalization, new influences of clusters on competition have taken on growing importance in an increasingly complex, knowledge-based, and dynamic economy. Clusters represent a new way of thinking about national, state, and local economies, and they necessitate new roles for companies, government, and other institutions in enhancing competitiveness.

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Economic geography in an era of global competition involves a paradox. It is widely recognized that changes in technology and competition have diminished many of the traditional roles of location. Resources, capital, technology, and other inputs can be efficiently sourced in global markets. Firms can access immobile inputs via corporate networks. It no longer is necessary to locate near large markets to serve them. Governments are widely seen as losing their influence over competition to global forces. It is easy to conclude, then, that location is diminishing in importance.[1]

This perspective, although widespread, is hard to reconcile with competitive reality. In *The Competitive Advantage of Nations* (Porter, 1990), I put forward a microeconomically based theory of national, state, and local competitiveness in the global economy. In this theory, clusters have a prominent role. Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate. Clusters, or critical masses of unusual competitive success in particular business areas, are a striking feature of virtually every national, regional, state, and even metropolitan economy, especially in more advanced nations.

AUTHOR'S NOTE: This article has benefited from extensive research by Veronica H. Ingham, with research assistance by John Kelleher and Raymond Fisman. I also am grateful for comments by Joseph Babiec, Gregory Bond, Michael Fairbanks, Ifor Ffowcs-Williams, Anne Habiby, Bennett Harrison, David L. Kang, Lucia Marshall, Ian Smith, Claas van der Linde, and Marjorie Williams.

ECONOMIC DEVELOPMENT QUARTERLY, Vol. 14 No. 1, February 2000 15-34

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Although the phenomenon of clusters in one form or another has been recognized and explored in a range of literatures, clusters cannot be understood independent of a broader theory of competition and competitive strategy in a global economy. The prevalence of clusters reveals important insights about the microeconomics of competition and the role of location in competitive advantage. Even as old reasons for clustering have diminished in importance with globalization, new influences of clusters on competition have taken on growing importance in an increasingly complex, knowledge-based, and dynamic economy.

Clusters represent a new way of thinking about national, state, and local economies, and they necessitate new roles for companies, for various levels of government, and for other institutions in enhancing competitiveness. For companies, thinking about competition and strategy has been dominated by what goes on inside the organization. Clusters suggest that a good deal of competitive advantage lies *outside* companies and even outside their industries, residing instead in the locations at which their business units are based. This creates important new agendas for management that rarely are recognized. For example, clusters represent a new unit of competitive analysis along with the firm and industry. Cluster thinking suggests that companies have a tangible and important 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. Companies might actually benefit from having more local competitors. Trade associations can be competitive assets, not merely lobbying and social organizations.

For governments, thinking about the competitiveness of nations and states has focused on the overall economy, with national-level policy as the dominant influence. The importance of clusters suggests new roles for government at the federal, state, and local levels. In the global economy, sound macroeconomic policies are necessary but not sufficient. Government's more decisive and inevitable influences are at the microeconomic level. Among them, removing obstacles to the growth and upgrading of existing and emerging clusters takes on a priority. Clusters are a driving force in increasing exports and are magnets for attracting foreign investment. Clusters also represent an important forum in which new types of dialogue can and must take place among companies, government agencies, and institutions such as schools, universities, and public utilities.

Knowledge about cluster theory has advanced, and the publication of *The Competitive Advantage of Nations* (Porter, 1990) helped trigger a large and growing number of formal cluster initiatives in countries, states, cities, and even entire regions such as Central America. My purpose here is to summarize the current state of knowledge about clusters, their role in competition, and some of their implications.[2] I outline the theory of clusters and the appropriate roles of government in cluster upgrading.[3] Finally, I draw on my direct or indirect participation in many cluster studies and initiatives, as well as on other literature, to explore some of the best ways in which to organize such initiatives so as to catalyze economic development.

WHAT IS A CLUSTER?

Clusters have long been part of the economic landscape, with geographic concentrations of trades and companies in particular industries dating back for centuries. The intellectual antecedents of clusters date back at least to Marshall (1890/1920), who included a fascinating chapter on the externalities of specialized industrial locations in his *Principles of Economics*.[4]

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 clusters ranges from a region, a state, or even a single city to span nearby or neighboring countries (e.g., southern Germany and German-speaking Switzerland).[5] The geographic scope of a cluster relates to the distance over which informational, transactional, incentive, and other efficiencies occur.[6]

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More than single industries, clusters encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services as well as providers of specialized infrastructure. Clusters also often extend downstream to channels or customers and laterally to manufacturers of

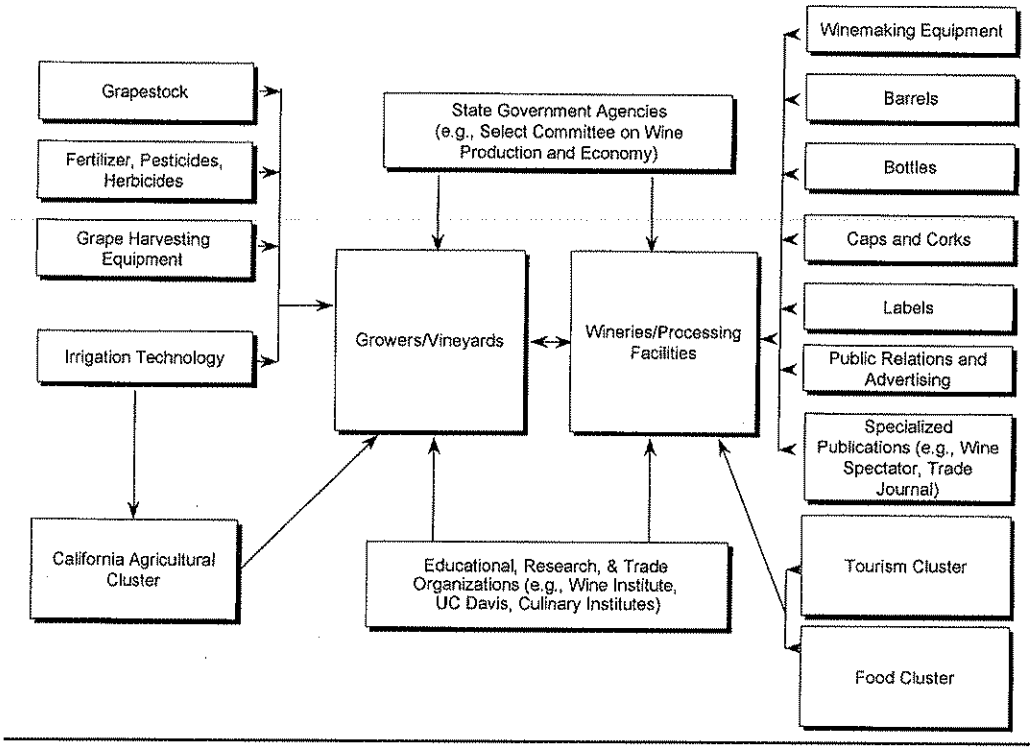

Figure 1: The California Wine Cluster
SOURCE: Based on research by Harvard M.B.A. students R. Alexander, R. Arney, N. Black, E. Frost, and A. Shivananda.

complementary products or companies related by skills, technologies, or common inputs. Many clusters include governmental and other institutions (e.g., universities, think tanks, vocational training providers, standards-setting agencies, trade associations) that provide specialized training, education, information, research, and technical support. Many clusters include trade associations and other collective bodies involving cluster members. Finally, foreign firms can be and are part of clusters, but only if they make permanent investments in a significant local presence.

Figure 1 shows a schematic diagram of the wine cluster in California. This cluster includes 680 commercial wineries and several thousand independent wine grape growers. An extensive complement of supporting industries to both wine making and grape growing exists including suppliers of grapestock, irrigation and harvesting equipment, barrels, and labels; specialized public relations and advertising firms; and numerous wine publications aimed at consumer and trade audiences. A host of local institutions are involved with wine such as the Wine Institute, special committees of the California state senate and assembly, and the world-renowned viticulture and enology program at the University of California, Davis. The cluster also enjoys weaker linkages to other California clusters in agriculture, food and restaurants, and wine country tourism.

Drawing cluster boundaries often is a matter of degree and involves a creative process informed by understanding the linkages and complementarities across industries and institutions that are most important to competition in a particular field. The strength of these "spillovers" and their importance to productivity and innovation often are the ultimate boundary-determining factors.

Clusters are defined too broadly if they are aggregates such as manufacturing, services, consumer goods, or "high tech." Here, the connections among included industries are weak at best, and discussion about cluster constraints and potential bottlenecks will tend to gravitate to generalities. Conversely, equating a cluster with a single industry misses the crucial interconnections with other industries and institutions that strongly affect competitiveness.

Clusters occur in many types of industries, in smaller fields, and even in some local industries such as restaurants, car dealers, and antique shops. They are present in large and small economies, in rural and urban areas, and at several geographic levels (e.g., nations, states, metropolitan regions, cities). Clusters occur in both advanced and developing economies, although clusters in advanced economies tend to be far more developed (Porter, 1998b).

Cluster boundaries rarely conform to standard industrial classification systems, which fail to capture many important actors in competition and linkages across industries. Because parts of a cluster often are put into different traditional industrial or service categories, significant clusters might be obscured or even unrecognized. In Massachusetts, for example, there proved to be more than 400 companies connected in some way to medical devices, representing at least 39,000 high-paying jobs. The cluster was all but invisible, buried in several larger and overlapping industry categories such as electronic equipment and plastic products.

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 graphic and visual arts. The San Francisco Bay area multimedia cluster, by contrast, contains many hardware and software industries that provide enabling technology. Clusters also can be examined at various levels of aggregation (e.g., agriculture cluster, wine cluster), thereby exposing different issues.

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

Why view economies using the lens of clusters instead of, or in addition to, more traditional groupings such as companies, industries, SIC codes, and sectors (e.g., manufacturing, services)? The most important reason is that the cluster as a unit of analysis is better aligned with the nature of competition and appropriate roles of government. Clusters, broader than traditional industry categorizations, capture important linkages, complementarities, and spillovers in terms of technology, skills, information, marketing, and customer needs that cut across firms and industries. These externalities create a possible rationale for collective action and a role for government.

As will be discussed further, such connections across firms and industries are fundamental to competition, to productivity, and (especially) to the direction and pace of new business formation and innovation. Most cluster participants are not direct competitors but rather serve different segments of industries. Yet they share many common needs, opportunities, constraints, and obstacles to productivity. The cluster provides a constructive and efficient forum for dialogue among related companies, their suppliers, government, and other institutions. Because of externalities, public and private investments to improve cluster circumstances benefit many firms. Seeing a group of companies and institutions as a cluster also highlights opportunities for coordination and mutual improvement in areas of common concern with less of a risk of distorting competition or limiting the intensity of rivalry.

Viewing the world in terms of narrower industries or sectors, conversely, often degenerates to lobbying over subsidies and tax breaks. Resulting public investments involve fewer spillover benefits across firms and industries and, therefore, are prone to distort markets. Because large proportions of participants in such narrow groupings often are direct competitors, there is a very real threat that rivalry will be diminished. Companies also often are hesitant about participating for fear of aiding direct competitors. An industry or narrow sectoral perspective tends to result in distorting competition (anti-competitive rent-seeking behavior), then, whereas a cluster perspective focuses on enhancing competition (pro-competitive). The presence of customers, suppliers, and firms from related industries in the dialogue helps to police proposals that will limit competition. I return to these issues when I explore the implications of clusters for government policy.

LOCATION AND COMPETITION

During recent decades, thinking about the influence of location on competition has been based on relatively simple views of how companies compete. These see competition as largely static and resting on cost minimization in a relatively closed economy. Here comparative advantage in factors of production is decisive. In more recent thinking, increasing returns to scale play a central role.

Yet actual competition is far different. Competition is dynamic and rests on innovation and the search for strategic differences. Close linkages with buyers, suppliers, and other institutions are important, not only to efficiency but also to the rate of improvement and innovation. Location affects competitive advantage through its influence on *productivity* and especially on *productivity growth*. Generic factor inputs themselves usually are abundant and readily accessed. Prosperity depends on the productivity with which factors are used and upgraded in a particular location.

Economic development seeks to achieve long-term sustainable development in a nation's standard of living, adjusted for purchasing power parity.[7] Standard of living is determined by the productivity of a nation's economy, which is measured by the value of the goods and services (products) produced per unit of the nation's human, capital, and physical resources. Productivity, then, defines competitiveness. The concept of productivity must encompass both the value (prices) that a nation's products command in the marketplace and the efficiency with which standard units are produced.

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

Conversely, the mere presence in any industry does not by itself guarantee prosperity if firms there are unproductive. Traditional distinctions between high tech and low tech, manufacturing and services, resource based and knowledge based, and others have little relevance per se. Improving the productivity of all industries enhances prosperity, both directly and through the influence one industry has on the productivity of others.

National productivity ultimately is set by the sophistication (e.g., technology, skill) with which companies compete. Unless companies become more productive, an economy cannot become more productive. The sophistication of companies' approaches to competing determines the prices that their products and services can command and the efficiency with which they produce.

Company sophistication in competing can be thought of in two parts. The first and most basic is what I term *operational effectiveness*, or the extent to which companies in a nation approach *best practice* in areas such as production processes, technologies, and management techniques (Porter, 1996). The second aspect of company sophistication relates to the types of strategies companies employ such as the ability to compete on differentiation and not just cost, the array of services that can be provided, and the approaches used in selling internationally.

Yet the sophistication of how companies compete in a location is strongly influenced by the *quality of the microeconomic business environment*. Some aspects of the business environment (e.g., the road system, corporate tax rates, the legal system) cut across all industries. These economy-wide (or "horizontal") areas are important and often represent the binding constraints to competitiveness in developing economies. In more advanced economies and increasingly elsewhere, however, the more decisive aspects of the business environment for competitiveness often are cluster specific (e.g., the presence of particular types of suppliers, skills, or university departments).

Capturing 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* (Porter, 1990), I model the effect of location on competition through four interrelated influences,

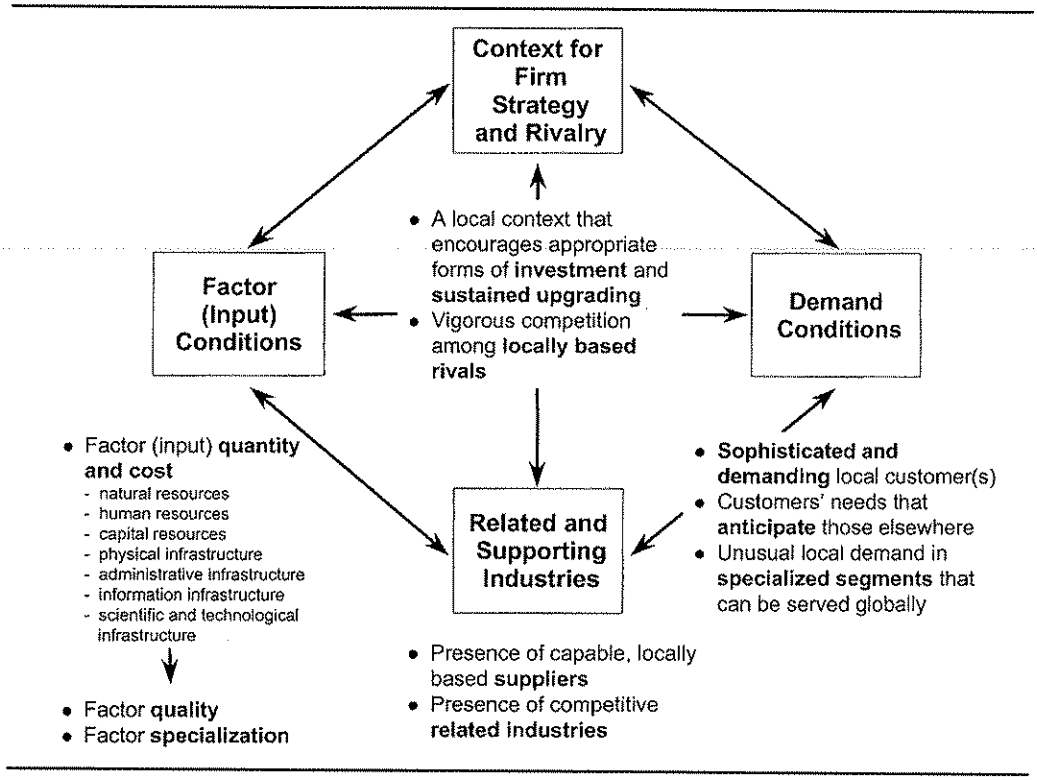

Figure 2: Sources of Locational Competitive Advantage

Parallel improvements in the sophistication of company operations and strategies and the quality of the diamond provide the microeconomic foundations of economic development.

graphically depicted in a diamond; the diamond metaphor has become common in referring to the theory (Figure 2).[8] In a recent two-part article, I explore and statistically test the sequential process by which the diamond must upgrade if an economy is to advance (Porter, 1998b). Parallel improvements in the sophistication of company operations and strategies and the quality of the diamond provide the microeconomic foundations of economic development.

A few elements of this framework deserve highlighting because they are important to understanding the role of clusters in competition. Factor inputs range from tangible assets such as physical infrastructure to information, the legal system, and university research institutes that all firms draw on 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 (e.g., a specialized university research institute), not only are necessary to attain high levels of productivity but also 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 are characterized by little local rivalry. Most competition, if present at all, comes from imports. Local rivalry, if occurring at all, involves imitation. Price is the sole competitive variable, and firms hold down wages to compete in local and foreign markets. Competition involves minimal investment.

Moving to an advanced economy requires that vigorous local rivalry develop. Rivalry must shift from low wages to low total cost, and this requires upgrading the efficiency of manufacturing and service delivery. Ultimately, rivalry also must evolve from cost to include differentiation. Competition must shift from imitation to innovation and from low investment to high investment in not only physical assets but also intangibles (e.g., skills, technology). Clusters, as will be evident, play an integral role in these transitions.

The character of rivalry in a location is strongly influenced by many aspects of the business environment (e.g., the available factors, local demand conditions). Yet the investment climate and policies toward competition set the context. Things such as the macroeconomic and political stability, the tax system, labor market policies affecting the incentives for workforce development, and intellectual property rules and their enforcement contribute to the willingness of companies to invest in upgrading capital equipment, skills, and technology. Antitrust policy; government ownership and licensing rules; and policies toward trade, foreign investment, and corruption have a vital role in setting the intensity of local rivalry.

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. In low-productivity economies, the focus is heavily on foreign markets. Advancement requires the development of more 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 that are hard to gain in foreign markets. Local demand also can reveal segments of the market where firms can differentiate themselves. In a global economy, the quality of local demand matters far more than does its size. Clusters of linked industries play a central role in giving rise to demand-side advantages.

A cluster is the manifestation of the diamond at work. Proximity, arising from the co-location of companies, customers, suppliers, and other institutions, amplifies all of the pressures to innovate and upgrade. In the *Global Competitiveness Report 1998* article (Porter, 1998b), I find evidence of the role of clusters in economic development. I test statistically across a broad sample of countries and find empirical support for the overall theory about the relationship between the microeconomic business environment and the prosperity of national economies and, in particular, for the impact of local clusters on economic development.[9] The presence of a well-developed cluster provides powerful benefits to productivity and the capacity to innovate that are hard to match by firms based elsewhere.

CLUSTERS AND COMPETITIVE ADVANTAGE

Clusters affect competition in three broad ways that both reflect and amplify the parts of the diamond: (a) increasing the current (static) productivity of constituent firms or industries, (b) increasing the capacity of cluster participants for innovation and productivity growth, and (c) stimulating new business formation that supports innovation and expands the cluster. Many cluster advantages rest on external economies or spillovers across firms, industries, and institutions of various sorts.[10] Thus, a cluster is a system of interconnected firms and institutions whose whole is more than the sum of its parts.

Each of the three broad influences of clusters on competition depends, to some extent, on personal relationships, face-to-face communication, and networks of individuals and institutions that interact. Although the existence of a cluster makes such relationships more likely to develop and become effective, they are far from automatic. Formal and informal organizing mechanisms and cultural norms often play a role in the functioning and development of clusters.[11]

Clusters and Productivity

Scholars have sought to explain concentrations of firms in terms of economies of "agglomeration."[12] These normally have been seen to arise at either the industry level or for a diversified urban economy. Many treatments of agglomeration economies rest on cost minimization due to proximity to inputs or proximity to markets. These explanations, however, have been undercut by the globalization of markets, technology, and supply sources; easier mobility; and lower transportation and communication costs. Today, the nature of economies of agglomeration has shifted toward the cluster level and away from either narrower industries or urban areas per se.

Access to specialized inputs and employees. Location within a cluster can provide superior or lower cost access to specialized inputs such as components, machinery, business services, and

personnel compared to vertical integration, formal alliances with outside entities, or "importing" inputs from distant locations.[13] The cluster, then, is a spatial organizational form that can be an inherently more efficient or effective means of assembling inputs than the alternatives, provided that competitive local suppliers are available. Sourcing outside the cluster might be necessary if competent local suppliers are unavailable, but it is not the ideal (first best) outcome. Given the inherent benefits of clusters, however, forces encouraging local supplier development and upgrading are strong, and constituent firms have an incentive to encourage entry of new suppliers or local investments by distant suppliers.

Countervailing the advantages of clusters in assembling inputs and labor is the possibility that the concentration of cluster participants bids up the cost of scarce specialized inputs and personnel.[14] Yet the ability to outsource many inputs limits any such cost penalty relative to other locations. More important, however, the presence of a cluster not only increases the demand for specialized inputs but also *increases their supply.* The availability of specialized personnel, services, and components, and the number of entities creating them, often is far greater at clusters than elsewhere despite the greater competition.

Access to information. Extensive market, technical, and other specialized information accumulates in the firms and local institutions within a cluster that can be accessed better or at lower cost, allowing firms to raise current productivity by getting closer to the productivity frontier. This also applies to the flow of information between units of the same company.[15] Proximity, supply and technological linkages, and the existence of repeated personal relationships and community ties fostering trust facilitate the information flow within clusters.[16] Obtaining information about current buyer needs is an important special case of the informational benefits of clusters. Sophisticated buyers often are part of clusters, and other cluster participants have information about buyer needs that often is shared.

Complementarities. A cluster enhances productivity not only through the acquisition and assembly of inputs but also through facilitating complementarities between the activities of cluster participants. Some of the most important types of complementarities are the following[17]:

- *Complementary products for the buyer.* In tourism, for example, the visitor's experience is affected not only by the appeal and quality of the attraction (e.g., beach, historical site) but also by the quality of the hotels, restaurants, souvenirs, airport facilities, and transportation, making the different parts of the cluster mutually dependent. Such complementarities across products in creating buyer value are common, being present not only in service delivery but also in product design, logistics, and after-sales service.[18] The co-location of firms and industries within a cluster makes it easier to achieve product-service coordination and creates internal pressures for improvement among parts of a cluster in ways that can substantially improve overall quality and/or efficiency.
- *Marketing complementarities.* The presence of a group of related firms and industries in a location offers efficiencies in joint marketing (e.g., firm referrals, trade fairs, trade magazines, marketing delegations). It also can enhance the reputation of a location in a particular field and makes it more likely that buyers will consider a vendor or manufacturer based there. Buyers can see multiple firms in a single visit. The presence of multiple sources for a product or service in a location also can reduce perceived buying risk by offering buyers the potential to multisource or switch vendors if the need arises.
- *Complementarities due to a better alignment of activities among cluster participants.* Linkages with suppliers, channels, and downstream industries are recognized and captured more easily within clusters than among dispersed participants. Substantial improvements in productivity also sometimes are possible when several parts of a cluster change simultaneously (e.g., coordination to develop cluster standards and measures).

Access to institutions and public goods. Clusters make many inputs that otherwise would be costly into public or quasi-public goods. The ability to recruit employees already trained in local training programs, for example, eliminates or lowers the cost of internal training. Firms often can

access specialized infrastructure, advice from experts in local institutions, and the like at very low cost. Indeed, the information built up at a cluster can be seen as a quasi-public good.[19]

Some of the public or quasi-public goods available in clusters are similar to conventional public goods in the sense that they are closely linked to government and public institutions (e.g., public investment in specialized infrastructure, educational programs, information and trade fairs). However, other quasi-public goods available to cluster participants are created as a natural byproduct of competition. These include information and pools of technology, the reputation of the cluster location, and some of the marketing and sourcing advantages described earlier.

In addition, public or quasi-public goods at cluster locations often are the result of private investments in training programs, private infrastructure, quality centers, and other forms that benefit a cluster. Private investments in cluster-specific public goods or quasi-public goods are common because of the collective benefits perceived by cluster participants. Often, such private investments in public goods take place through 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.[20] Clusters improve the incentives within companies for achieving high productivity for several reasons. The first 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 (e.g., labor costs, local market access, utility costs), so that competition must take place on other dimensions. Second, the competitive pressure in a cluster is amplified by peer pressure, even among indirect or noncompeting firms. Pride and the desire to look good in the local community motivate firms to attempt to outdo each other.

Clusters also make it easier to measure the performance of in-house activities because there often are local firms that perform similar functions. Managers, then, have wider opportunities to compare internal costs with arm's-length transactions as well as lower monitoring costs in comparing employee performance to that of others locally. The accumulation of knowledge in financial institutions should make lending and other financing choices better informed and should improve monitoring. Clusters also offer advantages in terms of limiting opportunistic behavior in which one participant takes advantage of another or provides shoddy products or services (Enright, 1990). Because of repeated interaction, easy spread of information and reputation, and desire for standing in the local community, interactions among cluster participants are more prone to be constructive and reflect long-term interests.

Clusters and Innovation

As important as, or more important than, their benefits in current productivity is the role of clusters in innovation and productivity growth.[21] Cluster participation offers many potential advantages in innovation and upgrading (although it involves some risks as well) compared to an isolated location. Some of the cluster characteristics that enhance current productivity are even more important to innovation.

Firms within a cluster often are 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 often can discern buyer trends faster than can isolated competitors. Silicon Valley and Texas-based computer companies, for example, plug into customer needs and trends quickly and effectively and with an ease impossible to match elsewhere.

Cluster participation also offers advantages in *perceiving new technological, operating, or delivery possibilities.* Participants can be exposed to richer insights into evolving technology, component and machinery availability, service and marketing concepts, and the like. Ongoing relationships with other entities within the cluster (including universities) facilitate such learning, as do the ease of site visits and face-to-face contact. Direct observation of other firms is facilitated. The isolated firm, by contrast, faces higher costs and steeper impediments to assembling insights as well as a greater need to create knowledge in-house.[22]

The potential advantages of clusters in perceiving both the need and the opportunity for innovation are significant, but of equal importance can be the flexibility and capacity to act on them quickly. A firm within a cluster often can more rapidly source the new components, services, machinery, and other elements needed to implement innovations, whether in the form of a new product line, a new process, or a new logistical model. Local suppliers/partners can and do get closely involved in the innovation process, so that the inputs they supply better meet the firm's requirements. New specialized personnel often can be recruited locally to fill gaps required for new approaches. Complementarities involved in innovation are more easily achieved.

Firms within a cluster can experiment at lower cost or delay large commitments until there is greater assurance that a new product, process, or service will pan out. By contrast, a firm relying on distant outsourcing faces greater challenges of contracting, securing delivery, obtaining associated technical and service support, and coordinating across complementary entities. The firm relying on vertical integration faces inertia, difficult trade-offs 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 (e.g., labor costs, utility costs), combined with the presence of multiple rivals, forces firms to seek creative ways in which to distinguish themselves. Pressure to innovate is elevated. Individual firms in the cluster have difficulty in staying ahead for long, but many firms often are able to progress much faster than 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. Clusters also might not support truly radical innovation, which tends to invalidate the existing pools of talent, information, suppliers, and infrastructure.

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.[23] Clusters also might not support truly radical innovation, which tends to invalidate the existing pools of talent, information, suppliers, and infrastructure. In these circumstances, a cluster participant might be no worse off, in principle, than an isolated firm (because both can outsource), but the firm in an established cluster might suffer from greater barriers to perceiving the need to change and from inertia against severing past relationships that no longer contribute to competitive advantage.

Clusters and New Business Formation

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

The opportunity perceived at a cluster location is pursued there because the barriers to entry are lower than they are elsewhere. Needed assets, skills, inputs, and staff often are readily available at the cluster location and are assembled more easily there. Local financial institutions and investors with industry familiarity might require a lower risk premium on capital. A significant local market also often is present. The entrepreneur has established relationships and often prefers to stay in the same community. Lower entry barriers, the existence of multiple potential local customers, established relationships, and the presence of other local firms that have "made it" can reduce the perceived risks of entry. Note that barriers to exit at a cluster also can be lower due to less need for specialized investment, deeper markets for specialized assets, and other factors (Caves & Porter, 1977).

Although local entrepreneurs are likely entrants to a cluster, entrepreneurs based elsewhere 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 or to raise the productivity of their emerging companies.

Established companies based in other locations (both foreign and domestic) also are drawn to establish subsidiaries in cluster locations, seeking the productivity benefits and innovation advantages discussed previously. The presence of an established cluster not only lowers the barriers to entry to a location facing outside firms but also reduces the perceived risk (particularly if other "foreign" cluster participants already are present). There also are numerous examples of firms that have relocated entire business units to cluster locations or designated their subsidiaries located there as the regional or world headquarters for lines 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 various sorts of constraints and impediments to innovating. Spin-off companies often pick up the slack, sometimes with the blessing of the former companies.[24] It is not uncommon to see larger companies in a cluster develop close relationships with innovative smaller ones, help establish them, and even acquire them if they become successful.

Because of new business formation, the depth and breadth of clusters often grow over time, enhancing cluster advantages. The intense competition within a cluster, together with lower entry and exit barriers, sometimes leads to both more entry and more exit at these locations. However, the net result is that many of the surviving firms in the cluster can gain position vis-à-vis rivals at other locations.[25]

Clusters and Competition

These influences of clusters amplify the parts of the diamond and the feedbacks among them. Proximity amplifies rivalry, for example, while elevating the benefits of locally available factors or suppliers. Co-location shortens the process by which rivalry spills over to encourage local supplier development and the speed with which related industries give rise to new competitors.

It should be clear that clusters represent a combination of competition and cooperation. Vigorous competition occurs in winning customers and retaining them. Because of the presence of multiple rivals and strong incentives, the intensity of competition among clusters often is accentuated. Yet cooperation must occur in a variety of areas I have identified. Much of it is vertical (buyer-supplier), with related industries, and with local institutions. Competition and cooperation can coexist because they are on different dimensions or because cooperation at some levels is part of winning the competition at other levels.

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A 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 that still is little explored in the management field. Location is a powerful variable shaping the trade-offs between markets and hierarchies. Clusters offer obvious transaction cost advantages over other forms and seem to ameliorate many incentive problems. Repeated interaction and informality of contracts within the structure resulting from living and working in a geographic area foster trust and open communication while reducing the costs of severing and recombining market relationships.

The advantages of clusters will not be equally great for all fields, although clusters appear to occur quite broadly in economies. The stronger the advantages of clusters and the more tradable the field, the fewer viable cluster locations there tend to be. The importance of clusters rises with the sophistication of competition and the concomitant rise in knowledge and innovation intensity, meaning that the incidence of clusters tends to increase with economic development.

The connection between clusters and competition carries important implications for the economic geography of cities, states, nations, and groups of neighboring countries (Porter, 1998a). Internal trade within nations is a powerful force for improving productivity, as is trade with immediately neighboring countries (Porter, 1998b). The formation of clusters is an important part of economic development. The process by which clusters emerge, develop, and decline is beginning to be understood and is a topic I explore elsewhere (Porter, 1998a).

THE ROLE OF GOVERNMENT

Government inevitably plays a variety of roles in an economy. Its most basic role is to achieve macroeconomic and political stability. A second role of government is to improve general microeconomic capacity through improving the quality and efficiency of general-purpose inputs to business and the institutions that provide them identified in diamond theory such as an educated workforce, an appropriate physical infrastructure, and accurate and timely economic information. The third role of government is to establish the overall microeconomic rules and incentives governing competition that will encourage productivity growth. A fourth role of government is to develop and implement a positive, distinctive, long-term economic action program, or change process, that mobilizes government, business, institutions, and citizens. Economic progress often is thwarted by inaction and by a lack of consensus on what steps are necessary. A healthy change process must involve all the key constituencies and must rise above the interests of any particular administration or government. Ideally, such an action program will occur not only at the national level but also at the level of states and cities.

Although these roles of government are necessary for economic development, they might not be sufficient. Especially as government begins to make headway in its more basic roles, a fifth role, *facilitating cluster development and upgrading*, takes on prominence. Although the general business environment is important to competitiveness, cluster circumstances become increasingly important to allow 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 public entities. Moreover, in addition to modifying its own policies and practices, government can motivate, facilitate, and provide incentives for collective action by the private sector.

Government Influences on Cluster Upgrading

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 also can affect the productivity of other clusters. This means that traditional clusters, such as agriculture, should not be abandoned; rather, they should be upgraded. Efforts to upgrade clusters might have to be sequenced for practical reasons, but the goal should be to eventually encompass all of them. Upgrading in some clusters will reduce employment as firms move to more productive activities, but market forces—and not government decisions—should determine which clusters will succeed or fail.

Government should reinforce and build on established and emerging clusters rather than attempt to create entirely new ones. New industries and new clusters emerge from established ones as economies develop. Advanced technology activities are more likely to develop where there already is a base of less sophisticated activities in the field. Clusters form when there is a foundation of locational advantages on which to build. Most clusters form independently of government and sometimes in spite of it. There should be some seeds of a cluster that have passed a market test before cluster development efforts are justified.

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The process of cluster upgrading involves recognition that a cluster is present and then *removing obstacles, relaxing constraints, and eliminating inefficiencies* that impede productivity and innovation in the cluster. Constraints include human resource, infrastructure, and regulatory constraints. Some of these can be addressed to varying degrees by private initiatives. Other constraints, however, are the result of government policies and institutions and must be addressed by government. Government regulations, for example, might create unnecessary inefficiencies. Important infrastructure might be lacking. Education and training policies might be overlooking cluster needs. Ideally, all government policies that inflict costs on firms without any compensating, long-term competitive or social value should be minimized or eliminated. Upgrading clusters, then, requires going beyond improvements in the general business environment to see how policies and institutions affect particular concentrations of related firms and industries.

Governments often are drawn into developing policies, such as subsidies and technology grants, that attempt to enhance the competitiveness of individual firms. In addition, much policy attention focuses on the industry level, a unit of analysis that also is narrower than clusters. Conversely, other policy thinking is concerned with broad sectors such as machinery, manufacturing, and services. None of these approaches is well aligned with modern competition. Setting policies to benefit individual firms distorts markets and 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 in the efforts that involve their direct competitors. Sectors, by contrast, are too broad to be competitively significant, and distinctions such as manufacturing versus services and high tech versus low tech no longer hold meaning.

A cluster focus highlights the externalities, linkages, spillovers, and supporting institutions so important to modern 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 the building of public or quasi-public goods that significantly affect many linked businesses. Government investments focused on improving the business environment in clusters, other things being equal, might well earn a higher return than those aimed at individual firms or industries or at the broad economy.

Some specific roles of government in cluster upgrading are shown in Figure 3.[26] The appropriate government priorities change as a cluster matures and develops and as its sources of competitive advantage shift. Early priorities involve improving infrastructure and eliminating diamond disadvantages. Later roles revolve more around constraints and impediments to innovation.

Clusters Versus Industrial Policy

A role for government cluster development and upgrading should not be confused with the notion of industrial policy. Indeed, the intellectual foundations of cluster theory and industrial policy are fundamentally different, as are 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 (e.g., high tech, growing) 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 high-priority emerging ("infant") industries until they reach a critical mass through subsidies, elimination of "destructive" or "wasteful" internal competition, selective import protection, and restrictions on foreign investment. Subsidies and suspension of internal competition should concentrate on scale-sensitive areas such as research and development (R&D) and facilities investment.[27]

Industrial policy tends to centralize intervention decisions at the national level. 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 in which there is a fixed pool of demand to be served and the aim is to gain a larger share for a particular nation.

Cluster theory could hardly be more different. The concept of clusters rests on a broader and dynamic view of competition among firms and locations, based on the growth of productivity. Interconnections and spillovers within a cluster often are more important to productivity growth than is 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 rather *how* it does so. Instead of targeting, therefore, all existing and emerging clusters deserve attention. All clusters can improve their productivity including traditional clusters such as agriculture. 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 or state contribute directly to local employment and investment. Rather than advocate blocking imports, cluster theory stresses the need for timely and

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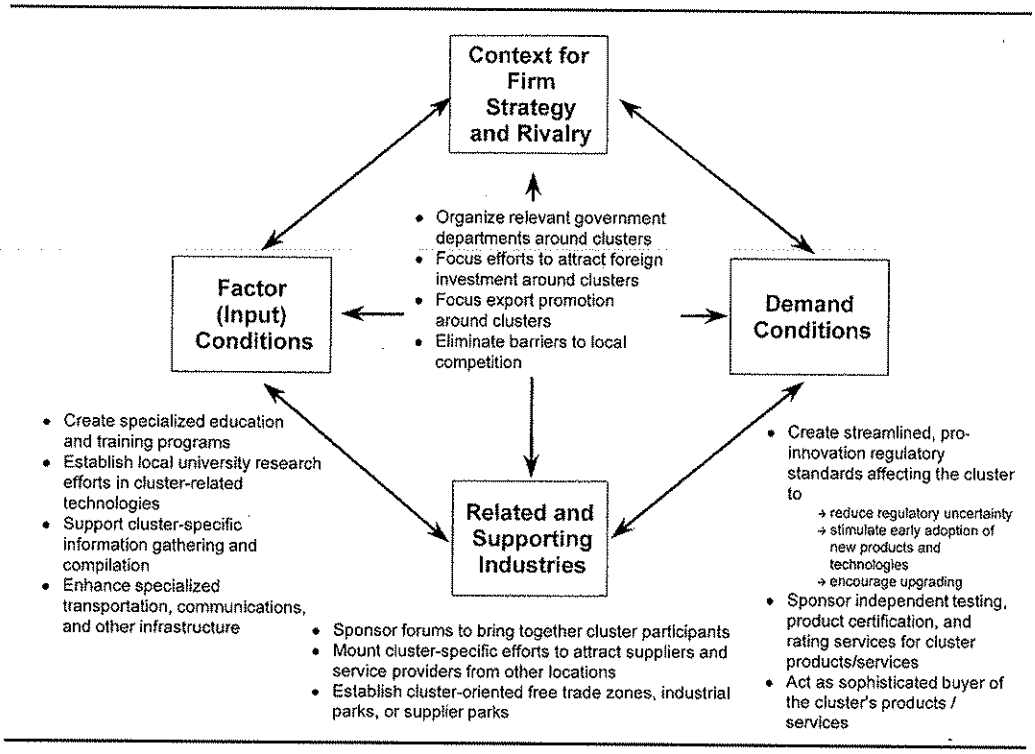

Figure 3: Government Influences on Cluster Upgrading

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

Cluster thinking recognizes the importance of initiative at the state and local levels. Government at multiple levels should embrace the pursuit of competitive advantage and specialization. Where possible, local differences and sources of uniqueness are built on and turned into strengths. Specialization also promises to lead to differentiated products that meet new needs and expand the market.

Although industrial policy aims to distort competition in favor of a particular location, cluster theory focuses on removing obstacles, relaxing constraints, and eliminating inefficiencies to productivity and productivity growth. The emphasis in cluster theory is not on market share but rather on dynamic improvement. Cluster policy's underlying view of competition is positive sum in which productivity improvements and trade will expand the market and many locations can prosper if they become more productive and innovative.

Clusters and Overall Economic Policy

Clusters provide a way of organizing thinking about many policy areas that goes beyond the common needs of the entire economy, as shown in Figure 4. Cluster-based thinking can help focus priorities and guide policies in science and technology, education and training, export and foreign investment promotion, and a wide variety of other areas. A location's best chance of attracting foreign investment and promoting exports, for example, is in existing or emerging clusters.

A cluster orientation highlights the fact that more parts of government have an influence on competitiveness than normally are recognized, especially within government itself. Cluster theory makes the impacts of policies on competitive position much clearer and more operational. Effective solutions often require different parts of government to collaborate.

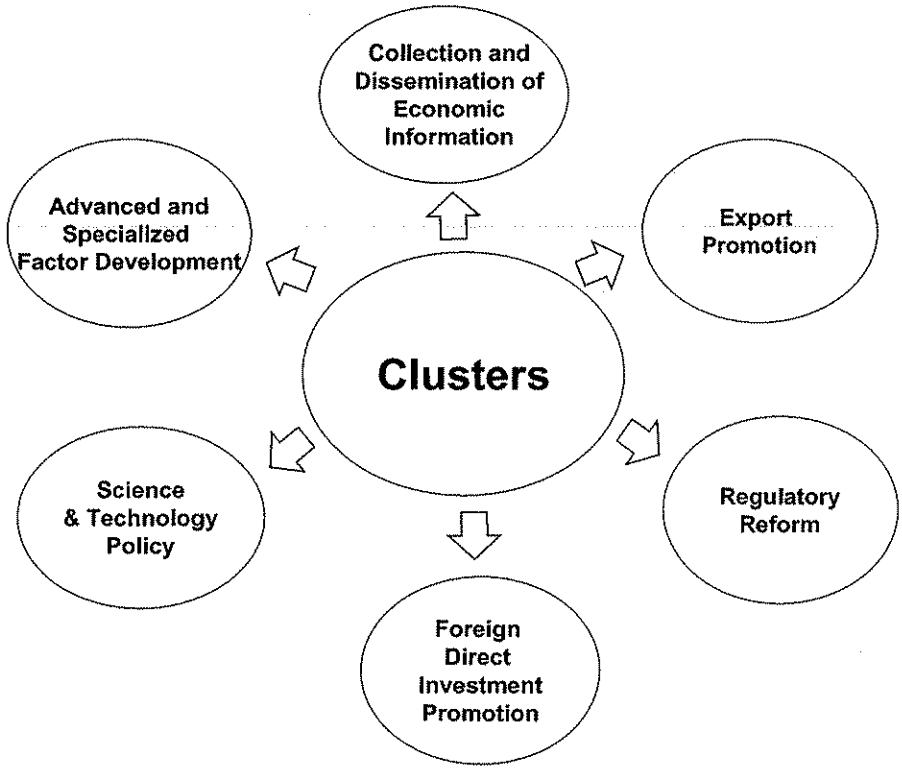

Figure 4: Clusters and Economic Policy

Finally, in addition to complementing policy attention at the economy-wide level, cluster thinking highlights the important roles of government at *several geographic levels*. The traditional focus of economic policy has been at the national level, and many aspects of the general business are best addressed there. Recently, globalization has focused attention on worldwide multilateral institutions. However, state, metropolitan region, and local governments also have an important influence on the general business environment in a location. At the cluster level, these influences often are dominant, and clusters should represent an important component of state and local economic policy. A good example is the city of York in the United Kingdom. As a result of a recent government reorganization, York City became a unitary council with responsibility for not just the city but also a broader geographical area. Since the reorganization, the council has set up an aggressive industrial development unit that has been working closely with members of the region's growing bioscience cluster.

Cluster theory also suggests new roles for companies, which I explore in detail elsewhere (Porter, 1998a). Private sector roles in cluster upgrading are present in all parts of the diamond. The most obvious areas are in improving factor conditions including the supply of appropriately trained personnel, the quality and appropriateness of local research activities at universities, the creation of physical infrastructure matched to cluster needs, and the supply of cluster-specific information. Ongoing company relationships with government bodies and local institutions such as utilities, schools, and research groups are necessary to attain these benefits, as is investment by cluster participants to establish common specialized infrastructure such as port or handling facilities, satellite communication links, and testing laboratories. Cutting across all these areas is the need for cluster participants to inform and prod government to address the constraints or weaknesses under its control.

Individual companies can independently influence cluster development, but the importance of externalities and public goods means that informal networks and formal trade associations, consortia, and other collective bodies often are necessary and appropriate. Trade associations representing all or most cluster participants can command greater attention and have greater influence than do individual members, and an association or a collective body (e.g., joint research center, testing laboratory) creates a vehicle for cost sharing.

ORGANIZING CLUSTER-BASED ECONOMIC DEVELOPMENT INITIATIVES

Clusters provide a vehicle to bring companies, government, and local institutions together in a constructive dialogue about upgrading, offering a new mechanism for business-government collaboration. Initiatives to organize cluster participants, assess cluster advantages and disadvantages, and catalyze public and private action have become numerous at the national, state, and city levels (Table 1).[28] There are relatively recent efforts to develop initiatives around clusters that cross borders of neighboring countries in Central America and the Middle East, and this practice would benefit other regions.

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. By focusing on clusters, firms often are much more interested and engaged than they are in broad efforts that must necessarily gravitate to general issues such as tax policy and export promotion. Business-government-university dialogue moves to a more concrete level at which action can be taken. Cluster initiatives not only can bring focus to questions of government policy but also can reveal and help to address these issues within the private sector.

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 on productivity as well as the role and importance of clusters in productivity enhancement. Early and ongoing communication and discussion educate cluster participants about competitiveness and help to shift mind-sets.
- *A focus on removing obstacles and easing constraints to cluster upgrading.* Explicit upfront discussion of goals at the beginning of a cluster initiative, followed by regular reinforcement of these goals, helps to overcome the urge to seek subsidies or limit competition. The presence of suppliers and customers in the cluster process provides a natural check on these tendencies. Some participants might cling to the status quo and 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 not only is bad economics, it disenfranchises large parts of the private sector. Successful cluster initiatives include traditional clusters (e.g., agriculture, tourism) and even declining clusters. They include both emerging clusters and established ones. To avoid misguided attempts at creating clusters that have no assets on which to build, emerging clusters should have demonstrable local foundations and bases of firms that have met market tests. Practical considerations might require the sequencing of cluster projects, but early clusters where work is undertaken should involve a representative spectrum of the types of clusters present (e.g., 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 to disseminate the concepts and processes to clusters that will be included in the later initiatives.
- *Appropriate cluster boundaries.* By definition, clusters include industries and institutions with important linkages or spillovers rather than broad sectors (e.g., manufacturing, high tech) or individual industries (e.g., plastic machinery, Italian restaurants). Cluster bounda-

TABLE 1
Examples of Cluster-Based Economic Development Initiatives

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

ries 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 the important constituencies. Excluding individuals, even (or especially) difficult ones, invites opposition. Although any effort might have its share of skeptical, parochial, self-serving, and opportunistic individuals, the most successful cluster initiatives make an effort to reach out and educate them. Individuals who then choose not to participate have fewer grounds 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 privately led effort, rather than an initiative controlled by government, will have a better chance of success. Companies usually can better identify the obstacles and constraints (as well as the opportunities) in their paths 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 should remain independent of any party or administration's political agenda. Legislators and the executive branch, the opposition parties, and those in power all must be involved. Ideally, the cluster initiative will take place through an entity independent of government. Otherwise, promising efforts might be dropped when a new government takes office (Govern d'Andorra, 1993).

- *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 that 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 toward action.* Cluster initiatives must be motivated by the desire to achieve results. Academic institutions, think tanks, or government agencies that see research as an end in itself should not drive them. Diagnosis and a broad vision for the future must be combined with concrete action 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 institutionalization 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, by gathering and disseminating economic statistics, and by controlling the structure and membership of business advisory groups.

CONCLUSIONS

Clusters are 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. As a result, in a cluster, the whole is greater than the sum of the parts.

Clusters represent a new and complementary way of understanding an economy, organizing economic development thinking and practice, and setting public policy. The state of clusters reveals important insights into the productive potential of an economy and the constraints on its future development. A cluster approach to economic development encourages behavior that is pro-competitive.

Globalization and the ease of transportation and communication have led to a surge of outsourcing in which companies have relocated many facilities to low-cost locations. However, these same forces have created the location paradox. Anything that can be efficiently sourced from a distance has essentially been *nullified* as a competitive advantage in advanced economies. Information and relationships that can be accessed and maintained through fax or e-mail are available to anyone. Although global sourcing mitigates disadvantages, it does not create advantages. Moreover, distant sourcing normally is a second-best solution compared to accessing a competitive local cluster in terms of productivity and innovation. Paradoxically, the most enduring competitive advantages in a global economy seem to be local.

There still is much to learn about clusters and their implications for the theory and practice of economic development. We need an integrated approach that frames clusters generally rather than homing in on special cases. Cluster theory can inform, and be informed by, a range of literatures in economics and management. For practitioners, the promise of cluster-based approaches lies in their positive-sum view of competition and locational competitiveness coupled with their ability to catalyze constructive actions that span constituencies.

NOTES

1. For a recent example, see Cairncross (1997).

2. For a more extensive treatment, see Porter (1998a), which also contains an extensive bibliography on clusters and cluster initiatives.

3. For company and institutional implications, see Porter (1998a).

4. Readers can find a full treatment of the intellectual roots of cluster thinking in Porter (1998a).

5. Enright (1993) illustrates the varying geographic scope of clusters.

6. Overly restrictive or overly extensive definitions of clusters can obscure the influence of clustering and lead to flawed statistical results. For example, Suarez-Villa and Walrod (1997) state, "An establishment located in a cluster was, at most, within one quarter of a mile of the nearest one" (p. 1349). A more appropriate boundary in the field investigated probably is location within the same metropolitan area, so it is not surprising that the authors' statistical tests do not reveal the benefits of clustering.

7. The same issues apply to cities, states, or regions within nations. This discussion will be primarily set at the level of the nation, although internal specialization and trade among states within larger nations prove to be an important determinant of prosperity.

8. See Porter (1990), especially chapters 3 and 4.

9. A specific finding about the role of clusters in economic development is that the quantity of local suppliers and especially local supplier quality both matter.

10. Many cluster advantages also apply to subunits within firms such as research and development (R&D) and production.

11. A growing economic and organizational literature focuses on the importance of network relationships, social capital, and civic engagement found in effective companies and communities. Clusters offer a new way of exploring the mechanisms by which these social linkages affect business competition and economic prosperity. For a more detailed account of the socioeconomy of clusters, see Porter (1998a).

12. See Harrison, Kelley, and Gant (1996) for a good summary. "Static" agglomeration economies consist of a local concentration of customers (or downstream firms) sufficient to permit suppliers to achieve economies of scale in production or distribution, large enough for local firms to amass sufficient demand to warrant the provision (usually by or through 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.

13. For a more detailed treatment of the increased sourcing efficiencies associated with clusters relative to alternative mechanisms, see Porter (1998a).

14. Costs of congestion are another potential cost of clustering, but these apply more to large, diversified urban concentrations than to clusters per se.

15. Adams and Jaffe (1996), for example, found that the effect of parent firm R&D on plant-level productivity is diminished by geographic distance.

16. These circumstances all make sticky or "impacted" information more transferable.

17. For a detailed treatment, see Porter (1998a).

18. Brandenburger and Nalebuff (1996), for example, highlight such complementarities in competition.

19. The public goods at clusters often are better termed quasi-public goods because accessing them involves some cost, although well below full cost.

20. Agency problems or costs arise in situations where one party (the "principal") delegates responsibility to another party (the "agent") to take decisions on its behalf. A typical agency problem exists between shareholders and managers. Although agency relationships usually increase total utility, several costs are involved including the costs of drawing up, monitoring, and enforcing the contract.

21. Other management and economics literatures (e.g., buyer-supplier relationships, outsourcing or partnering, co-opetition [i.e., network effects and complementarity], innovation, the diffusion of innovation, transaction costs, a literature that examines organizational incentive problems that stand in the way of efficiency) explore the mechanisms through which clusters affect productivity and innovation. However, little of this thinking connects to location in spite of the fact that proximity clearly affects the ability to harness linkages and the size of transaction costs.

22. There is strong empirical support for spillover effects among firms and between universities and firms in R&D and innovation. See Audretsch and Feldman (1996); Harrison, Kelley, and Gant. (1996); and Jaffe, Trajtenberg, and Henderson (1993).

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

24. For example, a large company might support a smaller firm that serves a niche it cannot address economically.

25. Location and the state of clusters affect not only barriers to entry and exit but also most other aspects of industry structure. The connections between location and industrial organization are just beginning to be explored. See Porter (1998a, pp. 13-17).

26. For more cross-cutting government policy implications, many of which also benefit clusters, see Porter (1990).

27. The intellectual foundations of industrial policy go back for centuries in works on mercantilism, arguments for the protection of infant industries, and other sources. Industrial policy received major impetus in work on Japan, which viewed such policy as an important explanation for that nation's success. The intellectual rigor of industrial policy also was greatly enhanced by "strategic trade theory." See Krugman (1986, 1993) and Tyson (1992).

28. Selected case studies are described in Porter (1998a), which also includes citations of the published output of these initiatives. Examples of cluster studies are available from the author. See also 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.

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