

Clusters and the New Economics of Competition

by Michael E. Porter



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Paradoxically, the enduring competitive advantages in a global economy lie increasingly in local things – knowledge, relationships, and motivation that distant rivals cannot match.

CLUSTERS AND THE NEW ECONOMICS OF COMPETITION

BY MICHAEL E. PORTER

NOW THAT COMPANIES can source capital, goods, information, and technology from around the world, often with the click of a mouse, much of the conventional wisdom about how companies and nations compete needs to be overhauled. In theory, more open global markets and faster transportation and communication should diminish the role of location in competition. After all, anything that can be efficiently sourced from a distance through global markets and corporate networks is available to any company and therefore is essentially nullified as a source of competitive advantage.

Michael E. Porter is the C. Roland Christensen Professor of Business Administration at the Harvard Business School in Boston, Massachusetts. Further discussion of clusters can be found in two new essays – “Clusters and Competition” and “Competing Across Locations” – in his new collection titled On Competition (Harvard Business School Press, 1998).

But if location matters less, why, then, is it true that the odds of finding a world-class mutual-fund company in Boston are much higher than in most any other place? Why could the same be said of textile-related companies in North Carolina and South Carolina, of high-performance auto companies in southern Germany, or of fashion shoe companies in northern Italy?

Today's economic map of the world is dominated by what I call *clusters*: critical masses – in one place – of unusual competitive success in particular fields. Clusters are a striking feature of virtually every national, regional, state, and even metropolitan economy, especially in more economically advanced nations. Silicon Valley and Hollywood may be the world's best-known clusters. Clusters are not unique, however; they are highly typical – and therein lies a paradox: the enduring competitive advantages in a global economy lie increasingly in local things – knowledge, relationships, motivation – that distant rivals cannot match.

Although location remains fundamental to competition, its role today differs vastly from a generation ago. In an era when competition was driven heavily by input costs, locations with some important endowment – a natural harbor, for example, or a supply of cheap labor – often enjoyed a *comparative advantage* that was both competitively decisive and persistent over time.

Competition in today's economy is far more dynamic. Companies can mitigate many input-cost disadvantages through global sourcing, rendering the old notion of comparative advantage less rele-

Untangling the paradox of location in a global economy offers insights into how companies continually create competitive advantage.

vant. Instead, competitive advantage rests on making more productive use of inputs, which requires continual innovation.

Untangling the paradox of location in a global economy reveals a number of key insights about how companies continually create competitive advantage. What happens *inside* companies is important, but clusters reveal that the immediate business environment *outside* companies plays a vital role as well. This role of locations has been long overlooked, despite striking evidence that innova-

tion and competitive success in so many fields are geographically concentrated – whether it's entertainment in Hollywood, finance on Wall Street, or consumer electronics in Japan.

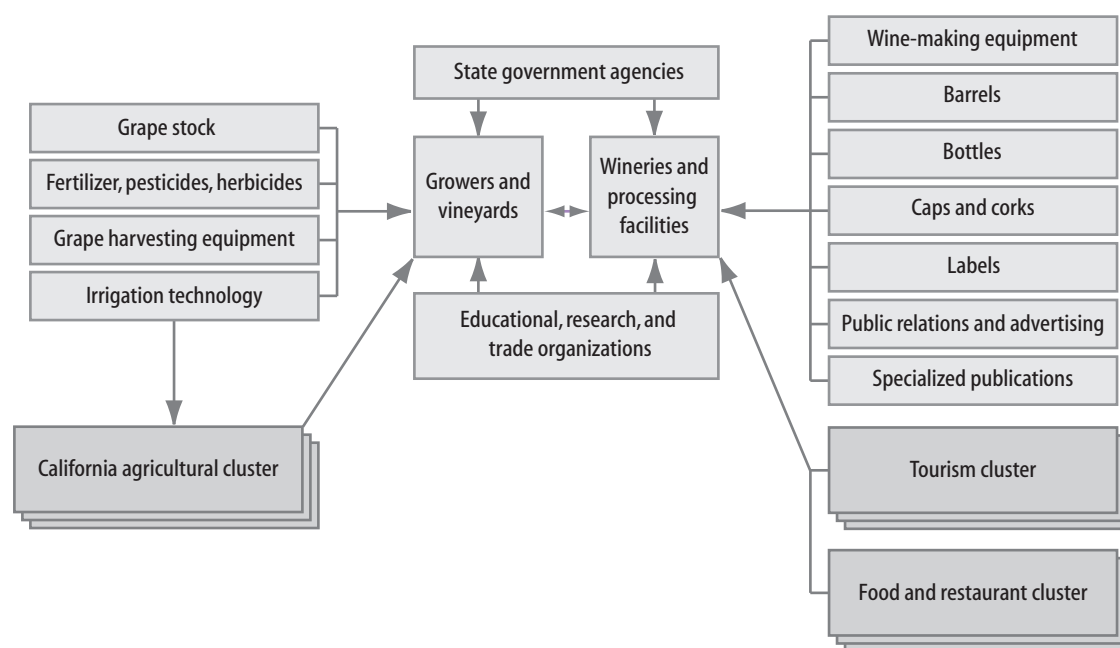
Clusters affect competitiveness within countries as well as across national borders. Therefore, they lead to new agendas for all business executives – not just those who compete globally. More broadly, clusters represent a new way of thinking about location, challenging much of the conventional wisdom about how companies should be configured, how institutions such as universities can contribute to competitive success, and how governments can promote economic development and prosperity.

What Is a Cluster?

Clusters are geographic concentrations of interconnected companies and institutions in a particular field. 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, and providers of specialized infrastructure. Clusters also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies, or common inputs. Finally, many clusters include governmental and other institutions – such as universities, standards-setting agencies, think tanks, vocational training providers, and trade associations – that provide specialized training, education, information, research, and technical support.

The California wine cluster is a good example. It includes 680 commercial wineries as well as several thousand independent wine grape growers. (See the exhibit “Anatomy of the California Wine Cluster.”) An extensive complement of industries supporting both wine making and grape growing exists, including suppliers of grape stock, 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 is involved with wine, such as the world-renowned viticulture and enology program at the University of California at Davis, the Wine Institute, and special committees of the California senate and assembly. The cluster also enjoys weaker linkages to other California clusters in agriculture, food and restaurants, and wine-country tourism.

ANATOMY OF THE CALIFORNIA WINE CLUSTER



Consider also the Italian leather fashion cluster, which contains well-known shoe companies such as Ferragamo and Gucci as well as a host of specialized suppliers of footwear components, machinery, molds, design services, and tanned leather. (See the exhibit "Mapping the Italian Leather Fashion Cluster.") It also consists of several chains of related industries, including those producing different types of leather goods (linked by common inputs and technologies) and different types of footwear (linked by overlapping channels and technologies). These industries employ common marketing media and compete with similar images in similar customer segments. A related Italian cluster in textile fashion, including clothing, scarves, and accessories, produces complementary products that often employ common channels. The extraordinary strength of the Italian leather fashion cluster can be attributed, at least in part, to the multiple linkages and synergies that participating Italian businesses enjoy.

A cluster's boundaries are defined by the linkages and complementarities across industries and institutions that are most important to competition. Although clusters often fit within political boundaries, they may cross state or even national borders. In the United States, for example, a pharmaceuticals cluster straddles New Jersey and Pennsylvania

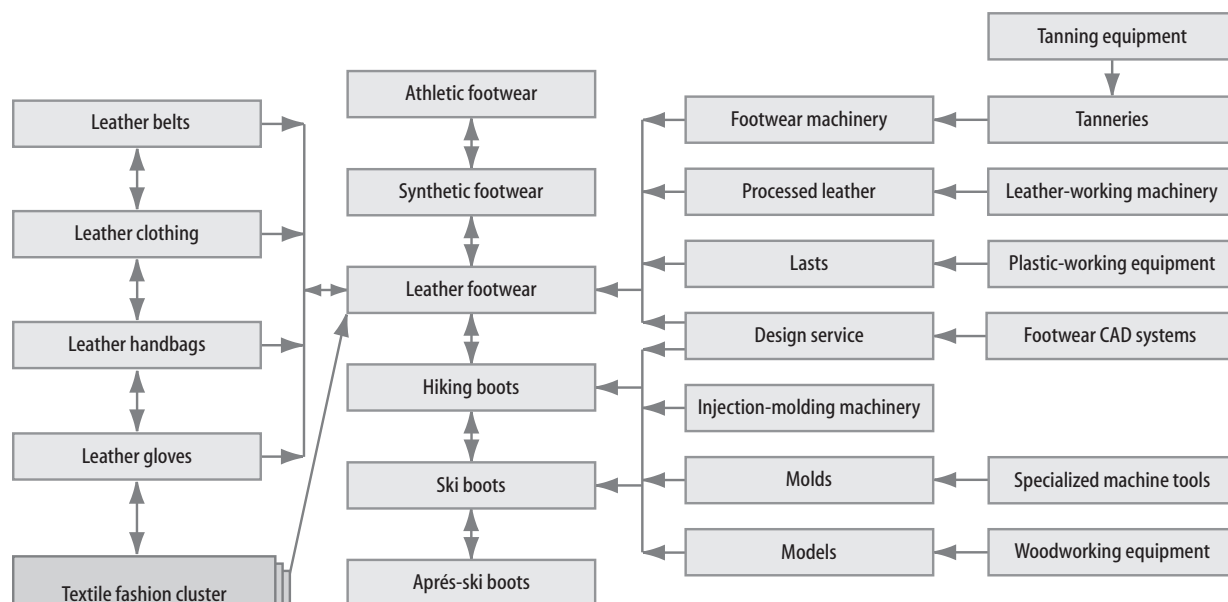
near Philadelphia. Similarly, a chemicals cluster in Germany crosses over into German-speaking Switzerland.

Clusters rarely conform to standard industrial classification systems, which fail to capture many important actors and relationships in competition. Thus significant clusters may be obscured or even go unrecognized. In Massachusetts, for example, more than 400 companies, representing at least 39,000 high-paying jobs, are involved in medical devices in some way. The cluster long remained all but invisible, however, buried within larger and overlapping industry categories such as electronic equipment and plastic products. Executives in the medical devices cluster have only recently come together to work on issues that will benefit them all.

Clusters promote both competition and cooperation. Rivals compete intensely to win and retain customers. Without vigorous competition, a cluster will fail. Yet there is also cooperation, much of it vertical, involving companies in related industries and local institutions. Competition can coexist with cooperation because they occur on different dimensions and among different players.

Clusters represent a kind of new spatial organizational form in between arm's-length markets on the one hand and hierarchies, or vertical integration, on the other. A cluster, then, is an alternative

MAPPING THE ITALIAN LEATHER FASHION CLUSTER



way of organizing the value chain. Compared with market transactions among dispersed and random buyers and sellers, the proximity of companies and institutions in one location—and the repeated exchanges among them—fosters better coordination and trust. Thus clusters mitigate the problems inherent in arm's-length relationships without imposing the inflexibilities of vertical integration or the management challenges of creating and maintaining formal linkages such as networks, alliances, and partnerships. A cluster of independent and informally linked companies and institutions represents a robust organizational form that offers advantages in efficiency, effectiveness, and flexibility.

Why Clusters Are Critical to Competition

Modern competition depends on productivity, not on access to inputs or the scale of individual enterprises. Productivity rests on *how* companies compete, not on the particular fields they compete in. Companies can be highly 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 advanced technology; all industries can be knowledge intensive.

The sophistication with which companies compete in a particular location, however, is strongly influenced by the quality of the local business environment.¹ Companies cannot employ advanced logistical techniques, for example, without a high-quality transportation infrastructure. Nor can companies effectively compete on sophisticated service without well-educated employees. Businesses cannot operate efficiently under onerous regulatory red tape or under a court system that fails to resolve disputes quickly and fairly. Some aspects of the business environment, such as the legal system, for example, or corporate tax rates, affect all industries. In advanced economies, however, the more decisive aspects of the business environment are often cluster specific; these constitute some of the most important microeconomic foundations for competition.

Clusters affect competition in three broad ways: first, by increasing the productivity of companies based in the area; second, by driving the direction and pace of innovation, which underpins future productivity growth; and third, by stimulating the formation of new businesses, which expands and strengthens the cluster itself. A cluster allows each member to benefit *as if* it had greater scale or *as if* it had joined with others formally—without requiring it to sacrifice its flexibility.

Clusters and Productivity. Being part of a cluster allows companies to operate more productively in sourcing inputs; accessing information, technology, and needed institutions; coordinating with related companies; and measuring and motivating improvement.

Better Access to Employees and Suppliers. Companies in vibrant clusters can tap into an existing pool of specialized and experienced employees, thereby lowering their search and transaction costs in recruiting. Because a cluster signals opportunity and reduces the risk of relocation for employees, it can also be easier to attract talented people from other locations, a decisive advantage in some industries.

A well-developed cluster also provides an efficient means of obtaining other important inputs. Such a cluster offers a deep and specialized supplier base. Sourcing locally instead of from distant suppliers lowers transaction costs. It minimizes the need for inventory, eliminates importing costs and delays, and—because local reputation is important—lowers the risk that suppliers will overprice or renege on commitments. Proximity improves communications and makes it easier for suppliers to provide ancillary or support services such as installation and debugging. Other things being equal, then, local outsourcing is a better solution than distant outsourcing, especially for advanced and specialized inputs involving embedded technology, information, and service content.

Formal alliances with distant suppliers can mitigate some of the disadvantages of distant outsourcing. But all formal alliances involve their own complex bargaining and governance problems and can inhibit a company's flexibility. The close, informal relationships possible among companies in a cluster are often a superior arrangement.

In many cases, clusters are also a better alternative to vertical integration. Compared with in-house units, outside specialists are often more cost effective and responsive, not only in component production but also in services such as training. Although extensive vertical integration may have once been the norm, a fast-changing environment can render vertical integration inefficient, ineffective, and inflexible.

Even when some inputs are best sourced from a distance, clusters offer advantages. Suppliers trying to penetrate a large, concentrated market will price more aggressively, knowing that as they do so they can realize efficiencies in marketing and in service.

Working against a cluster's advantages in assembling resources is the possibility that competition will render them more expensive and scarce. But companies do have the alternative of outsourcing many inputs from other locations, which tends to limit potential cost penalties. More important, clusters increase not only the demand for specialized inputs but also their supply.

Access to Specialized Information. Extensive market, technical, and competitive information accumulates within a cluster, and members have preferred access to it. In addition, personal relationships and community ties foster trust and facilitate the flow of information. These conditions make information more transferable.

Complementarities. A host of linkages among cluster members results in a whole greater than the sum of its parts. In a typical tourism cluster, for example, the quality of a visitor's experience depends not only on the appeal of the primary attraction but also on the quality and efficiency of complementary businesses such as hotels, restaurants, shopping outlets, and transportation facilities. Because members of the cluster are mutually dependent, good performance by one can boost the success of the others.

Complementarities come in many forms. The most obvious is when products complement one another in meeting customers' needs, as the tourism example illustrates. Another form is the coordination of activities across companies to optimize their collective productivity. In wood products, for instance, the efficiency of sawmills depends on a

A cluster allows each member to benefit *as if* it had greater scale or *as if* it had joined with others without sacrificing its flexibility.

reliable supply of high-quality timber and the ability to put all the timber to use—in furniture (highest quality), pallets and boxes (lower quality), or wood chips (lowest quality). In the early 1990s, Portuguese sawmills suffered from poor timber quality because local landowners did not invest in timber management. 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 wood in more sophisticated ways. Coordination to develop standard wood classifications and measures was an impor-

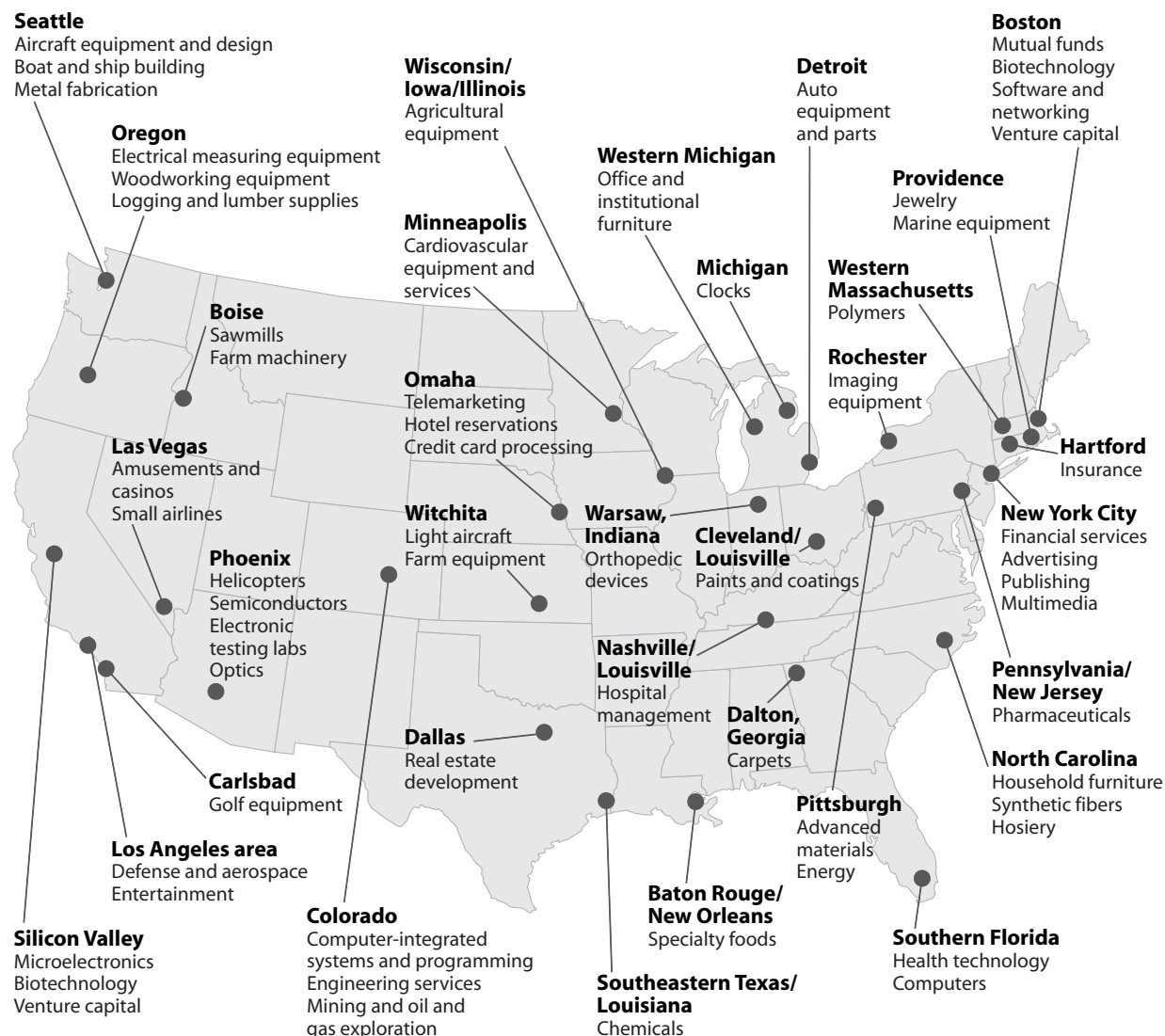
tant enabling step. Geographically dispersed companies are less likely to recognize and capture such linkages.

Other complementarities arise in marketing. A cluster frequently enhances the reputation of a lo-

MAPPING SELECTED U.S. CLUSTERS

Here are just some of the clusters in the United States. A few—Hollywood’s entertainment cluster and High Point, North Carolina’s household-furniture cluster—are well known. Others are less familiar, such as golf equipment in Carlsbad, California, and optics in Phoenix, Arizona. A relatively small number of clusters usually account for a major share of the economy within a geographic area as well as for an overwhelm-

ing share of its economic activity that is “exported” to other locations. *Exporting clusters*—those that export products or make investments to compete outside the local area—are the primary source of an area’s economic growth and prosperity over the long run. The demand for local industries is inherently limited by the size of the local market, but exporting clusters can grow far beyond that limit.



cation in a particular field, making it more likely that buyers will turn to a vendor based there. Italy's strong reputation for fashion and design, for example, benefits companies involved in leather goods, footwear, apparel, and accessories. Beyond reputation, cluster members often profit from a variety of joint marketing mechanisms, such as company referrals, trade fairs, trade magazines, and marketing delegations.

Finally, complementarities can make buying from a cluster more attractive for customers. Visiting buyers can see many vendors in a single trip. They also may perceive their buying risk to be lower because one location provides alternative suppliers. That allows them to multisource or to switch vendors if the need arises. Hong Kong thrives as a source of fashion apparel in part for this reason.

Access to Institutions and Public Goods. Investments made by government or other public institutions—such as public spending for specialized infrastructure or educational programs—can enhance a company's productivity. The ability to recruit employees trained at local programs, for example, lowers the cost of internal training. Other quasi-public goods, such as the cluster's information and technology pools and its reputation, arise as natural by-products of competition.

It is not just governments that create public goods that enhance productivity in the private sector. Investments by companies—in training programs, infrastructure, quality centers, testing laboratories, and so on—also contribute to increased productivity. Such private investments are often made collectively because cluster participants recognize the potential for collective benefits.

Better Motivation and Measurement. Local rivalry is highly motivating. Peer pressure amplifies competitive pressure within a cluster, even among noncompeting or indirectly competing companies. Pride and the desire to look good in the local community spur executives to attempt to outdo one another.

Clusters also often make it easier to measure and compare performances because local rivals share general circumstances—for example, labor costs and local market access—and they perform similar activities. Companies within clusters typically have intimate knowledge of their suppliers' costs. Managers are able to compare costs and employees' performance with other local companies. Additionally, financial institutions can accumulate knowledge about the cluster that can be used to monitor performance.

Clusters and Innovation. In addition to enhancing productivity, clusters play a vital role in a company's ongoing ability to innovate. Some of the same characteristics that enhance current productivity have an even more dramatic effect on innovation and productivity growth.

Because sophisticated buyers are often part of a cluster, companies inside clusters usually have a better window on the market than isolated competitors do. Computer companies based in Silicon Valley and Austin, Texas, for example, plug into customer needs and trends with a speed difficult to match by companies located elsewhere. The ongoing relationships with other entities within the cluster also help companies to learn early about evolving technology, component and machinery availability, service and marketing concepts, and so on. Such learning is facilitated by the ease of making site visits and frequent face-to-face contact.

Clusters do more than make opportunities for innovation more visible. They also provide the capacity and the flexibility to act rapidly. A company within a cluster often can source what it needs to implement innovations more quickly. Local suppliers and partners can and do get closely involved in the innovation process, thus ensuring a better match with customers' requirements.

Companies within a cluster can experiment at lower cost and can delay large commitments until they are more assured that a given innovation will pan out. In contrast, a company relying on distant suppliers faces greater challenges in every activity

Peer pressure, pride, and the desire to look good in the community spur executives to outdo one another.

it coordinates with other organizations—in contracting, for example, or securing delivery or obtaining associated technical and service support. Innovation can be even harder in vertically integrated companies, especially in those that face difficult trade-offs if the innovation erodes the value of in-house assets or if current products or processes must be maintained while new ones are developed.

Reinforcing the other advantages for innovation is the sheer pressure—competitive pressure, peer pressure, constant comparison—that occurs in a cluster. Executives vie with one another to set their companies apart. For all these reasons, clusters can remain centers of innovation for decades.

Clusters and New Business Formation. It is not surprising, then, that many new companies grow up within an existing cluster rather than at isolated locations. New suppliers, for example, proliferate within a cluster because a concentrated customer base lowers their risks and makes it easier for them to spot market opportunities. Moreover, because developed clusters comprise related industries that normally draw on common or very similar inputs, suppliers enjoy expanded opportunities.

Clusters are conducive to new business formation for a variety of reasons. Individuals working within a cluster can more easily perceive gaps in products or services around which they can build

At the intersection of clusters, insights and skills from various fields merge, sparking new businesses.

businesses. Beyond that, barriers to entry are lower than elsewhere. Needed assets, skills, inputs, and staff are often readily available at the cluster location, waiting to be assembled into a new enterprise. Local financial institutions and investors, already familiar with the cluster, may require a lower risk premium on capital. In addition, the cluster often presents a significant local market, and an entrepreneur may benefit from established relationships. All of these factors reduce the perceived risks of entry – and of exit, should the enterprise fail.

The formation of new businesses within a cluster is part of a positive feedback loop. An expanded cluster amplifies all the benefits I have described – it increases the collective pool of competitive resources, which benefits all the cluster's members. The net result is that companies in the cluster advance relative to rivals at other locations.

Birth, Evolution, and Decline

A cluster's roots can often be traced to historical circumstances. In Massachusetts, for example, several clusters had their beginnings in research done at MIT or Harvard. The Dutch transportation cluster owes much to Holland's central location within Europe, an extensive 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 self-sufficiency in food together with a scarcity of water and hot, arid growing conditions. The environmental cluster in Finland emerged as a result of pollution problems created by local process industries such as metals, forestry, chemicals, and energy.

Prior existence of supplier industries, related industries, or even entire related clusters provides yet another seed for new clusters. The golf equipment cluster near San Diego, for example, has its roots in southern California's aerospace cluster. That cluster created a pool of suppliers for castings and advanced materials as well as engineers with the requisite experience in those 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-device cluster. Similarly, MCI and America Online have been hubs for growing new businesses in the telecommunications cluster in the Washington, D.C., metropolitan area.

Sometimes a chance event creates some advantageous factor that, in turn, fosters cluster development – although chance rarely provides the sole explanation for a cluster's success in a location. The telemarketing cluster in Omaha, Nebraska, for example, owes much to the decision by the United States Air Force to locate the Strategic Air Command (SAC) there. Charged with a key role in the country's nuclear deterrence strategy, SAC was the site of the first installation of fiber-optic telecommunications cables in the United States. The local Bell operating company (now U.S. West) developed unusual capabilities through its dealings with such a demanding customer. The extraordinary telecommunications capability and infrastructure that consequently developed in Omaha, coupled with less unique attributes such as its central-time-zone location and easily understandable local accent, provided the underpinnings of the area's telemarketing cluster.

Once a cluster begins to form, a self-reinforcing cycle promotes its growth, especially when local institutions are supportive and local competition is vigorous. As the cluster expands, so does its influence with government and with public and private institutions.

A growing cluster signals opportunity, and its success stories help attract the best talent. Entre-

preneurs take notice, and individuals with ideas or relevant skills migrate in from other locations. Specialized suppliers emerge; information accumulates; local institutions develop specialized training, research, and infrastructure; and the cluster's strength and visibility grow. Eventually, the cluster broadens to encompass related industries. Numerous case studies suggest that clusters require a decade or more to develop depth and real competitive advantage.²

Cluster development is often particularly vibrant at the intersection of clusters, where insights, skills, and technologies from various fields merge, sparking innovation and new businesses. An example from Germany illustrates this point. The country has distinct clusters in both home appliances and household furniture, each based on different technologies and inputs. At the intersection of the two, though, is a cluster of built-in kitchens and appliances, an area in which Germany commands a higher share of world exports than in either appliances or furniture.

Clusters continually evolve as new companies and industries emerge or decline and as local institutions develop and change. They can maintain vibrancy as competitive locations for centuries; most successful clusters prosper for decades at least. However, they can and do lose their competitive edge due to both external and internal forces. Technological discontinuities are perhaps the most significant of the external threats because they can neutralize many advantages simultaneously. A cluster's assets—market information, employees' skills, scientific and technical expertise, and supplier bases—may all become irrelevant. New England's loss of market share in golf equipment is a good example. The New England cluster was based on steel shafts, steel irons, and wooden-headed woods. When companies in California began making golf clubs with advanced materials, East Coast producers had difficulty competing. A number of them were acquired or went out of business.

A shift in buyers' needs, creating a divergence between local needs and needs elsewhere, constitutes another external threat. U.S. companies 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. Lacking both pressure to improve and insight into customer needs, U.S. companies were slow to innovate, and they lost ground to European and Japanese competitors.

Clusters are at least as vulnerable to internal rigidities as they are to external threats. Overconsolidation, mutual understandings, cartels, and other restraints to competition undermine local rivalry. Regulatory inflexibility or the introduction of restrictive union rules slows productivity improvement. The quality of institutions such as schools and universities can stagnate.

Groupthink among cluster participants—Detroit's attachment to gas-guzzling autos in the 1970s is one example—can be another powerful form of rigidity. If companies in a cluster are too inward looking, the whole cluster suffers from a collective inertia, making it harder for individual companies to embrace new ideas, much less perceive the need for radical innovation.

Such rigidities tend to arise when government suspends or intervenes in competition or when companies persist in old behaviors and relationships that no longer contribute to competitive advantage. Increases in the cost of doing business begin to outrun the ability to upgrade. Rigidities of this nature currently work against a variety of clusters in Switzerland and Germany.

As long as rivalry remains sufficiently vigorous, companies can partially compensate for some decline in the cluster's competitiveness by outsourcing to distant suppliers or moving part or all of production elsewhere to offset local wages that rise ahead of productivity. German companies in the 1990s, for example, have been doing just that. Tech-

The term *high tech* has created the misconception that only a handful of businesses compete in sophisticated ways.

nology can be licensed or sourced from other locations, and product development can be moved. Over time, however, a location will decline if it fails to build capabilities in major new technologies or needed supporting firms and institutions.

Implications for Companies

In the new economics of competition, what matters most is not inputs and scale, but productivity—and that is true in all industries. The term *high tech*, normally used to refer to fields such as information technology and biotechnology, has distorted

CLUSTERS, GEOGRAPHY, AND ECONOMIC DEVELOPMENT

Poor countries lack well-developed clusters; they compete in the world market with cheap labor and natural resources. To move beyond this stage, the development of well-functioning clusters is essential. Clusters become an especially controlling factor for countries moving from a middle-income to an advanced economy. Even in high-wage economies, however, the need for cluster upgrading is constant. The wealthier the economy, the more it will require innovation to support rising wages and to replace jobs eliminated by improvements in efficiency and the migration of standard production to low-cost areas.

Promoting cluster formation in developing economies means starting at the most basic level. Policymakers must first address the foundations: improving education and skill levels, building capacity in technology, opening access to capital markets, and improving institutions. Over time, additional investment in more cluster-specific assets is necessary.

Government policies in developing economies often unwittingly work against cluster formation. Restrictions on industrial location and subsidies to invest in distressed areas, for example, can disperse companies artificially. Protecting local companies from competition leads to excessive vertical integration and blunted pressure for innovation, retarding cluster development.

In the early stages of economic development, countries should expand internal trade among cities and states and trade with neighboring countries as important stepping stones to building the skills to compete globally. Such trade greatly enhances cluster development. Instead, attention is typically riveted on the large, advanced markets, an orientation that has often been reinforced by protectionist policies restricting trade with nearby markets. However, the kinds of goods developing countries can trade with advanced economies are limited to commodities and to activities sensitive to labor costs.

While it is essential that clusters form, *where* they form also matters. In developing economies, a large

proportion of economic activity tends to concentrate around capital cities such as Bangkok and Bogotá. That is usually because outlying areas lack infrastructure, institutions, and suppliers. It may also reflect an intrusive role by the central government in controlling competition, leading companies to locate near the seat of power and the agencies whose approval they require to do business.

This pattern of economic geography inflicts high costs on productivity. 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 building of a tourism cluster in developing economies can be a positive force in improving the outlying infrastructure and in dispersing economic activity.)

Even in advanced economies, however, economic activity may be geographically concentrated. Japan offers a particularly striking case, with nearly 50% of total manufacturing shipments located around Tokyo and Osaka. This is due less to inadequacies in infrastructure in outlying areas than to a powerful and intrusive central government, with its centralizing bias in policies and institutions. The Japanese case vividly illustrates the major inefficiencies and productivity costs resulting from such a pattern of economic geography, even for advanced nations. It is a major policy issue facing Japan.

An economic geography characterized by specialization and dispersion—that is, 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. In nations such as Germany, Italy, Switzerland, and the United States, this kind of internal specialization and trade—and internal competition among locations—fuels productivity growth and hones the ability of companies to compete effectively in the global arena.

thinking about competition, creating the misconception that only a handful of businesses compete in sophisticated ways.

In fact, there is no such thing as a low-tech industry. There are only low-tech companies—that is, companies that fail to use world-class technology and practices to enhance productivity and inno-

vation. A vibrant cluster can help any company in any industry compete in the most sophisticated ways, using the most advanced, relevant skills and technologies.

Thus executives must extend their thinking beyond what goes on inside their own organizations and within their own industries. Strategy must also

MAPPING PORTUGAL'S CLUSTERS

In a middle-income economy like Portugal, exporting clusters tend to be more natural-resource or labor intensive.



address what goes on outside. Extensive vertical integration may once have been appropriate, but companies today must forge close linkages with buyers, suppliers, and other institutions.

Specifically, understanding clusters adds the following four issues to the strategic agenda.

1. *Choosing Locations.* Globalization and the ease of transportation and communication have led many companies to move some or all of their operations to locations with low wages, taxes, and utility costs. What we know about clusters suggests, first, that some of those cost advantages may well turn out to be illusory. Locations with those advantages often lack efficient infrastructure, sophisticated suppliers, and other cluster benefits that can more than offset any savings from lower input costs. Sav-

ings in wages, utilities, and taxes may be highly visible and easy to measure up front, but productivity penalties remain hidden and unanticipated.

More important to ongoing competitiveness is the role of location in innovation. Yes, companies have to spread activities globally to source inputs and gain access to markets. Failure to do so will lead to a competitive *disadvantage*. And for stable, labor-intensive activities such as assembly and software translation, low factor costs are often decisive in driving locational choices.

For a company's "home base" for each product line, however, clusters are critical. Home base activities – strategy development, core product and process R&D, a critical mass of the most sophisticated production or service provision – create and renew the company's product, processes, and services. Therefore locational decisions must be based on both total systems costs and innovation potential, not on input costs alone. Cluster thinking suggests that every product line needs a home base, and the most vibrant cluster will offer the best location. Within the United States, for example, Hewlett-Packard has chosen cluster locations for the home bases of its major product lines: California, where almost all of the world's leading personal computer and workstation businesses are located, is home to personal computers and workstations; Massachusetts, which has an extraordinary concentration of world-renowned research hospitals and leading medical instrument companies, is home to medical instruments.

As global competition nullifies traditional comparative advantages and exposes companies to the best rivals from around the world, a growing number of multinationals are shifting their home bases to more vibrant clusters – often using acquisitions as a means of establishing themselves as insiders in a new location. Nestlé, for example, after acquiring Rowntree Mackintosh, relocated its confectionary business to York, England, where Rowntree was originally based, because a vibrant food cluster thrives there. England, with its sweet-toothed consumers, sophisticated retailers, advanced advertising agencies, and highly competitive media companies, constitutes a more dynamic environment for competing in mass-market candy than Switzerland did. Similarly, Nestlé has moved its headquarters for bottled water to France, the most competitive location in that industry. North-

ern Telecom has relocated its home base for central office switching from Canada to the United States—drawn by the vibrancy of the U.S. telecommunications-equipment cluster.

Cluster thinking also suggests that it is better to move groups of linked activities to the same place than to spread them across numerous locations. Colocating R&D, component fabrication, assembly, marketing, customer support, and even related businesses can facilitate internal efficiencies in sourcing and in sharing technology and information. Grouping activities into campuses also allows companies to extend deeper roots into local clusters, improving their ability to capture potential benefits.

2. Engaging Locally. The social glue that binds clusters together also facilitates access to important resources and information. Tapping into the competitively valuable assets within a cluster requires personal relationships, face-to-face contact, a sense of common interest, and “insider” status. The mere collocation of companies, suppliers, and institutions creates the *potential* for economic value; it does not necessarily ensure its realization.

To maximize the benefits of cluster involvement, companies must participate actively and establish a significant local presence. They must have a substantial local investment even if the parent company is headquartered elsewhere. And they must foster ongoing relationships with government bodies and local institutions such as utilities, schools, and research groups.

Companies have much to gain by engaging beyond their narrow confines as single entities. Yet managers tend to be wary, at least initially. They fear that a growing cluster will attract competition,

Tapping into the competitively valuable assets within a cluster requires personal relationships and “insider” status.

drive up costs, or cause them to lose valued employees to rivals or spin-offs. As their understanding of the cluster concept grows, however, managers realize that many participants in the cluster do not compete directly and that the offsetting benefits, such as a greater supply of better trained people, for example, can outweigh any increase in competition.

3. Upgrading the Cluster. Because the health of the local business environment is important to the health of the company, upgrading the cluster should be part of management’s agenda. Companies upgrade their clusters in a variety of ways.

Consider Genzyme. Massachusetts is home to a vibrant biotechnology cluster, which draws on the region’s strong universities, medical centers, and venture capital firms. Once Genzyme reached the stage in its development when it needed a manufacturing facility, CEO Henri Termeer initially considered the pharmaceuticals cluster in the New Jersey and Philadelphia area because it had what Massachusetts lacked: established expertise in drug manufacturing. Upon further reflection, however, Termeer decided to influence the process of creating a manufacturing capability in Genzyme’s home base, reasoning that if his plans were successful, the company could become more competitive.

Thus Genzyme deliberately chose to work with contractors committed to the Boston area, bypassing the many specialized engineering firms located near Philadelphia. In addition, it undertook a number of initiatives, with the help of city and state government, to improve the labor force, such as offering scholarships and internships to local youth. More broadly, Genzyme has worked to build critical mass for its cluster. Termeer believes that Genzyme’s success is linked to the cluster’s—and that all members will benefit from a strong base of supporting functions and institutions.

4. Working Collectively. The way clusters operate suggests a new agenda of collective action in the private sector. Investing in public goods is normally seen as a function of government, yet cluster thinking clearly demonstrates how companies benefit from local assets and institutions.

In the past, collective action in the private sector has focused on seeking government subsidies and special favors that often distort competition. But executives’ long-term interests would be better served by working to promote a higher plane of competition. They can begin by rethinking the role of trade associations, which often do little more than lobby government, compile some statistics, and host social functions. The associations are missing an important opportunity.

Trade associations can provide a forum for the exchange of ideas and a focal point for collective action in overcoming obstacles to productivity and growth. Associations can take the lead in such activities as establishing university-based testing fa-

cilities and training or research programs; collecting cluster-related information; offering forums on common managerial problems; investigating solutions to environmental issues; organizing trade fairs and delegations; and managing purchasing consortia.

For clusters consisting of many small and mid-size companies—such as tourism, apparel, and agriculture—the need is particularly great for collective bodies to assume scale-sensitive functions. In the Netherlands, for instance, 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 applied research and marketing.

Most existing trade associations are too narrow; they represent industries, not clusters. In addition, because their role is defined as lobbying the federal government, their scope is national rather than local. National associations, however, are rarely sufficient to address the local issues that are most important to cluster productivity.

By revealing how business and government together create the conditions that promote growth, clusters offer a constructive way to change the nature of the dialogue between the public and private sectors. With a better understanding of what fosters true competitiveness, executives can start asking government for the right things. The example of MassMEDIC, an association formed in 1996 by the Massachusetts medical-devices cluster, illustrates this point. It recently worked successfully with the U.S. Food and Drug Administration to streamline the approval process for medical devices. Such a step clearly benefits cluster members and enhances competition at the same time.

What's Wrong with Industrial Policy

Productivity, not exports or natural resources, determines the prosperity of any state or nation. Recognizing this, governments should strive to create an environment that supports rising productivity. Sound macroeconomic policy is necessary but not sufficient. The microeconomic foundations for competition will ultimately determine productivity and competitiveness.

Governments—both national and local—have new roles to play. They must ensure the supply of

high-quality inputs such as educated citizens and physical infrastructure. They must set the rules of competition—by protecting intellectual property and enforcing antitrust laws, for example—so that productivity and innovation will govern success in the economy. Finally, governments should promote cluster formation and upgrading and the buildup of public or quasi-public goods that have a significant impact on many linked businesses.

This sort of role for government is a far cry from industrial policy. In industrial policy, governments target “desirable” industries and intervene—through

Clusters offer a constructive way to change the nature of the dialogue between the public and private sectors.

subsidies or restrictions on investments by foreign companies, for example—to favor local companies. In contrast, the aim of cluster policy is to reinforce the development of *all* clusters. This means that a traditional cluster such as agriculture should not be abandoned; it should be upgraded. Governments should not choose among clusters, because each one offers opportunities to improve productivity and support rising wages. Every cluster not only contributes directly to national productivity but also affects the productivity of *other* clusters. Not all clusters will succeed, of course, but market forces—not government decisions—should determine the outcomes.

Government, working with the private sector, should reinforce and build on existing and emerging clusters rather than attempt to create entirely new ones. Successful new industries and clusters often grow out of established ones. Businesses involving advanced technology succeed not in a vacuum but where there is already a base of related activities in the field. In fact, most clusters form independently of government action—and sometimes in spite of it. They form where a foundation of locational advantages exists. To justify cluster development efforts, some seeds of a cluster should have already passed a market test.

Cluster development initiatives should embrace the pursuit of competitive advantage and specialization rather than simply imitate successful clusters in other locations. This requires building on local sources of uniqueness. Finding areas of spe-

cialization normally proves more effective than head-on competition with well-established rival locations.

New Public-Private Responsibilities

Economic geography in an era of global competition, then, poses a paradox. In a global economy—which boasts rapid transportation, high-speed communication, and accessible markets—one would expect location to diminish in importance. But the opposite is true. 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. Geographic, cultural, and institutional proximity leads to special access, closer relationships, better information, powerful incentives, and other advantages in productivity and innovation that are difficult to tap from a distance. The more the world economy becomes complex, knowledge based, and dynamic, the more this is true.

Leaders of businesses, government, and institutions all have a stake—and a role to play—in the new economics of competition. Clusters reveal the mutual dependence and collective responsibility of all

these entities for creating the conditions for productive competition. This task will require fresh thinking on the part of leaders and the willingness to abandon the traditional categories that drive our thinking about who does what in the economy. The lines between public and private investment blur. Companies, no less than governments and universities, have a stake in education. Universities have a stake in the competitiveness of local businesses. By revealing the process by which wealth is actually created in an economy, clusters open new public-private avenues for constructive action.

1. I first made this argument in *The Competitive Advantage of Nations* (New York: Free Press, 1990). I modeled the effect of the local business environment on competition in terms of four interrelated influences, graphically depicted in a diamond: factor conditions (the cost and quality of inputs); demand conditions (the sophistication of local customers); the context for firm strategy and rivalry (the nature and intensity of local competition); and related and supporting industries (the local extent and sophistication of suppliers and related industries). Diamond theory stresses how these elements combine to produce a dynamic, stimulating, and intensely competitive business environment.

A cluster is the manifestation of the diamond at work. Proximity—the collocation of companies, customers, and suppliers—amplifies all of the pressures to innovate and upgrade.

2. Selected case studies are described in “Clusters and Competition” in my book *On Competition* (Boston: Harvard Business School Press, 1998), which also includes citations of the published output of a number of cluster initiatives. Readers can also find a full treatment of the intellectual roots of cluster thinking, along with an extensive bibliography.

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Porter explains how clusters affect competition in three broad ways: first, by increasing the productivity of companies based in the area; second, by driving the direction and pace of innovation; and third, by stimulating the formation of new businesses within the cluster. Geographic, cultural, and institutional proximity provides companies with special access, closer relationships, better information, powerful incentives, and other advantages that are difficult to tap from a distance. The more complex, knowledge-based, and dynamic the world economy becomes, the more this is true. Competitive