Innovation: Location Matters
Michael E Porter; Scott Stern
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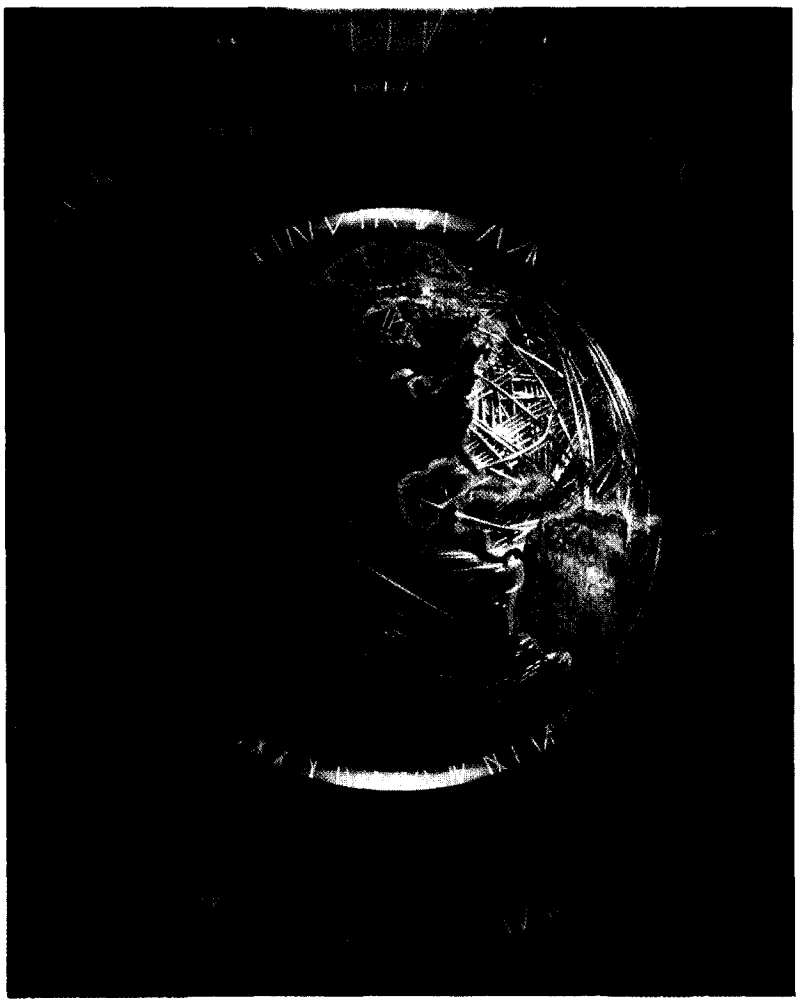

Innovation has become the defining challenge for global competitiveness. To manage it well, companies must harness the power of location in creating and commercializing new ideas.

Michael E. Porter and Scott Stern

The defining challenge for competitiveness has shifted, especially in advanced nations and regions. The challenges of a decade ago were to restructure, lower cost and raise quality. Today, continued operational improvement is a given, and many companies are able to acquire and deploy the best current technology. In advanced nations, producing standard products using standard methods will not sustain competitive advantage. Companies must be able to innovate at the global frontier. They must create and commercialize a stream of new products and processes that shift the technology frontier, progressing as fast as their rivals catch up.

What are the drivers of innovation? Traditional thinking about the management of innovation focuses almost exclusively on *internal* factors — the capabilities and processes within companies for creating and commercializing technology. Although the importance of these factors is undeniable, the *external* environment for innovation is at least as important. For example, the striking innovative output of Israeli firms is due not simply to more effective technology management, but also to Israel's favorable environment for innovation, including strong university-industry linkages and a large pool of highly trained scientists and engineers. The most fertile location for innovation also varies markedly across fields. The United States has been an especially attractive environment for innovation in pharmaceuticals in the 1990s, while Sweden and Finland have seen extraordinary rates of innovation in wireless technology.

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Our research has documented the patterns of innovation across the Organization for Economic Cooperation and Development (OECD) as well as in emerging nations over the past quarter century in order to understand how national circumstances explain differences in innovative output. We find that a relatively small number of characteristics of a nation's business environment explains a striking proportion of the large differences in innovative output across countries. Our findings reveal the striking degree to which the local environment matters for success in innovative activity and show the sharp differences in the relative progress of OECD and emerging countries in innovative vitality.

Location matters for innovation, and companies must broaden their approaches to the management of innovation accordingly: by developing and commercializing innovation in the most attractive location, taking active steps to access locational strengths, and proactively enhancing the environment for innovation and commercialization in locations where they operate.

The Role of National Innovative Capacity

The vitality of innovation in a location is shaped by *national innovative capacity*. National innovative capacity is a country's potential — as both a political and economic entity — to produce a stream of commercially relevant innovations. It is not simply the realized level of innovation but also reflects the fundamental conditions, investments and policy choices that create the environment for innovation in a particular location.

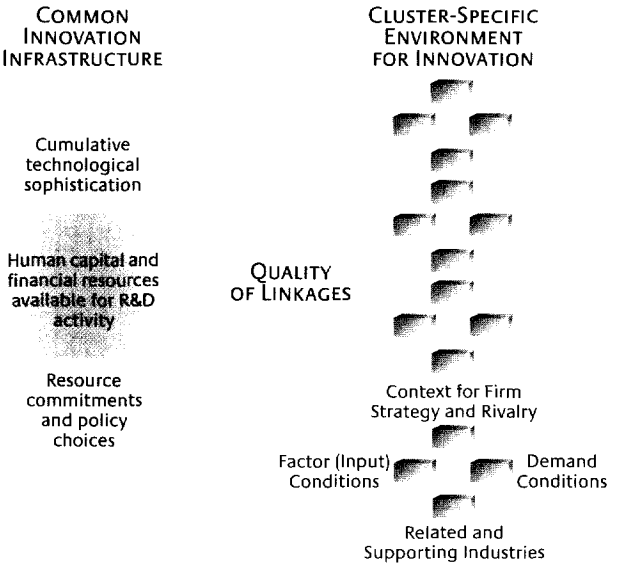
We have developed a framework to identify the sources of innovative capacity that enable a nation to innovate at the global frontier.[1] Although the framework was created for application at the national level, managers can also use it to evaluate innovative capacity at the regional or local level.[2] The framework includes three broad elements. (See "Elements of the National Innovative Capacity Framework.") Together, they capture how location shapes a company's ability to innovate at the global frontier.

The Common Innovation Infrastructure This is the set of crosscutting factors that support innovation throughout an entire economy. They include the overall human and financial resources a country devotes to scientific and technological advances, the public policies bearing on innovative activity and the economy's level of technological sophistication. Important policy choices include the protection of intellectual property, the extent of tax-based incentives for innovation, the degree to which antitrust enforcement encourages innovation-based competition and the openness of the economy to trade and investment. A strong common innovation infrastructure requires national investments and policy choices stretching over decades.

The Cluster-Specific Environment for Innovation While the common innovation infrastructure sets the basic conditions for innovation, it is ultimately companies that introduce and commercialize innovations. Innovation and the commercialization of new technologies take place disproportionately in clusters — geographic concentrations of interconnected companies and institutions in a particular field. The cluster-specific innovation environment is captured in the "diamond" framework introduced in 1990.[3] Four attributes of a location's microeconomic environment affect overall competitiveness as well as innovation — the presence of high-quality and specialized inputs; a context that encourages investment together with intense local rivalry; pressure and insight gleaned from sophisticated local demand; and the local presence of related and supporting industries. (See "What Drives Innovation in an Industrial Cluster?")

Clusters offer potential advantages in perceiving both the need and the opportunity for innovation. Equally important, however, is the flexibility and capacity clusters can provide to act rapidly to turn new ideas into reality. A company within a cluster can often more rapidly source the new components, services, machinery and other elements necessary to implement innovations. Local suppliers and partners can and do get involved in the innovation process; the complementary relationships involved

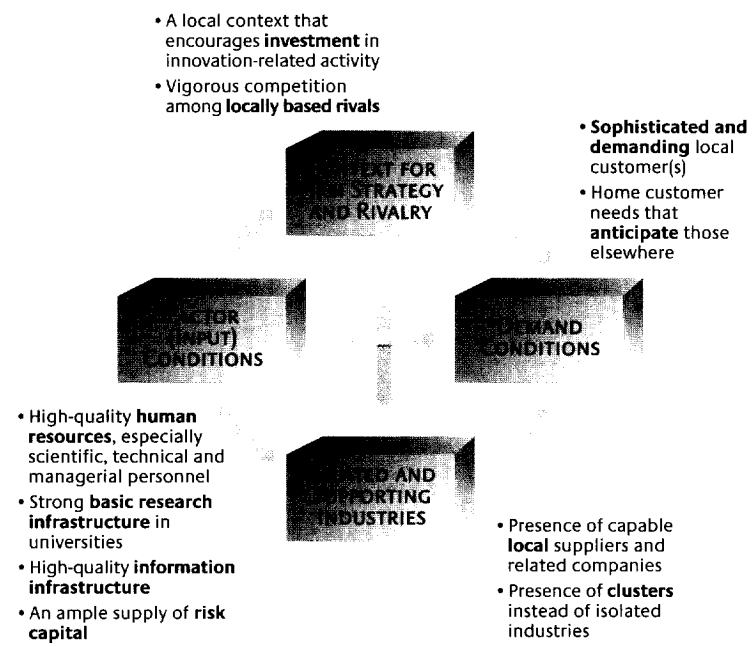
Elements of the National Innovative Capacity Framework



in innovating are more easily achieved among participants that are nearby. Reinforcing these advantages for innovation is the sheer pressure — competitive pressure, peer pressure, customer pressure and constant comparison — that is inherent within a cluster. We focus on clusters (e.g., information technology) rather than individual industries (e.g., printers), then, because of powerful spillovers and externalities across discrete industries that are vital to the rate of innovation.

The competitiveness of a cluster and its innovativeness depend on the quality of the diamond in a country. For example, the Finnish pulp-and-paper cluster benefits from the twin advantages of pressures from demanding domestic consumers and intense local rivalry, and Finnish process-equipment manufacturers are world leaders, with companies such as Kamyr and Sunds leading the world in the commercialization of innovative bleaching equipment. And this is only one example. A strong innovation environment within national clusters is the foundation for global competitive advantage in many fields, from pharmaceuticals in the United States to semiconductor fabrication in Taiwan.

What Drives Innovation in an Industrial Cluster?



The Quality of Linkages The relationship between the common innovation infrastructure and a nation's industrial clusters is reciprocal: Strong clusters feed the common infrastructure and also benefit from it. A variety of formal and informal organizations and networks — which we call "institutions for collaboration" — can link the two areas. A particularly important example is a nation's university system, which provides a bridge between technology and companies. Without strong linkages, upstream scientific and technical advances may diffuse to other countries more quickly than they can be exploited at home. For example, although early elements of VCR technology were developed in the United States, it was three companies in the Japanese consumer electronics cluster that successfully commercialized this innovation on a global scale in the late 1970s. Of course, taking advantage of the national environment for innovation is far from automatic, and companies based in the same location will differ markedly in their success at innovation. Nevertheless, sharp differences in innovative output in different locations suggest that location exerts a strong influence.

Explaining National Innovative Output

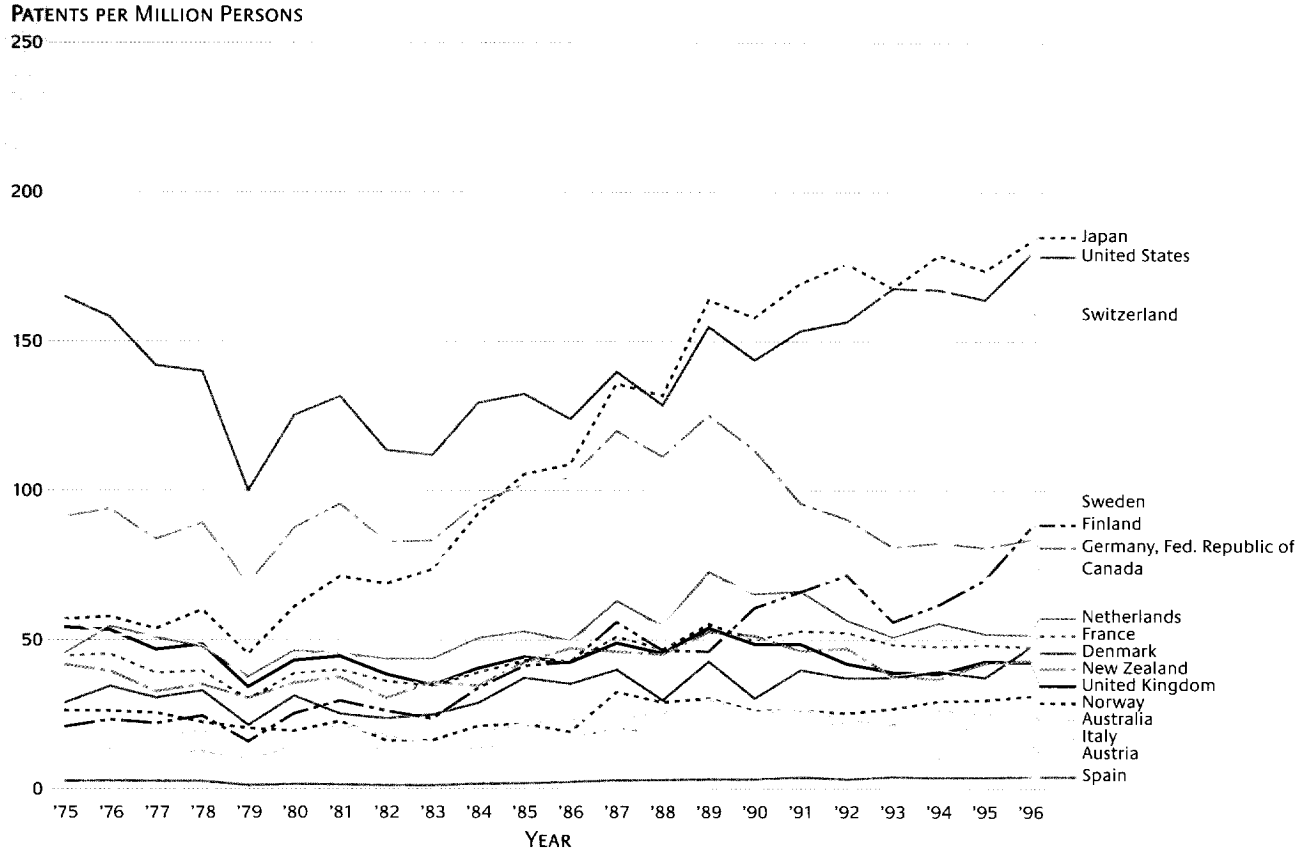
To understand how location affects innovation, we set out to explain the differences in innovative output across countries using measures drawn from the national innovative capacity framework. Our measure of innovation output is the number of international patents granted by the U.S. Patent and Trademark Office to inventors from a country, expressed on a per capita basis to control for the size of the country. We compiled data on international patenting in 17 OECD countries over the past 25 years, as well as in a group of emerging economies. We then related patenting output to measures of the common innovation infrastructure, the quality of the clusters' innovation environment and the strength of the linkages between these two elements. (See "How We Measured National Innovative Capacity.")

Offering insights into the important influences on national innovative capacity and the relative weight of different factors, this approach makes it easier to compare innovative capacity across countries and over time. To measure each country's innovative capacity in a given year, we used its *expected* per capita international patenting rate as determined by the country's policies and the resources it was devoting to innovation during that period.

Our findings are striking. The measures we used explain *more than 99%* of the variation in international patenting across countries during this time. Overall, the propensity of companies within a given nation to innovate is strongly related to the features of the national innovation environment. Our results show that national innovative output is most significantly affected by the number of scientists and technologists in the work force, the aggregate level of R&D spending, the effectiveness of intellectual property protection, openness to international competition and the intensity of spending on higher education. Patenting productivity is also significantly affected by

Tracking the Innovative Capacity of 17 OECD Nations

The annual innovative capacity of each country is equal to its *expected* international patenting productivity as determined by the national environment for innovation.



Source: M.E. Porter and S. Stern, "The New Challenge to America's Prosperity: Findings From the Innovation Index" (Washington, D.C.: Council on Competitiveness, 1999), 34.

the extent to which R&D is *financed* by industry, *performed* by universities and *specialized* within a range of technologies.

Moreover, no single national attribute is dominant in explaining innovative output. Favorable national innovative capacity results from strength along multiple dimensions rather than from superiority in one or two particular areas. Also, the locational determinants of innovation have been remarkably stable over time.

Innovation in OECD Countries From our statistical findings, we constructed an index of national innovative capacity for the OECD nations. (See "Tracking the National Innovative Capacity of 17 OECD Nations.") The index reveals how the innovation environment has been changing.

The innovative capacity of OECD countries has converged substantially over the last quarter century. Although the United States and Switzerland maintain their top-tier positions across three decades, the *relative advantage* of these leaders has declined. Countries such as Japan and Germany, as well as a group of Scandinavian nations, have invested in the conditions underpinning national innovative capacity and improved their relative standing as innovators.

Improvements by countries in national innovative capacity are the result of concerted improvements along several dimensions. Denmark and Finland have made major gains in innovative capacity since the mid-1980s, for example, by substantially increasing their R&D work force, raising R&D investment (particularly in the private sector) and emphasizing policies that support open international competition and strong intellectual property protection. They join Sweden in establishing a region of world-class innovation. However, had Denmark and Finland simply raised R&D expenditures without addressing other areas, they would have had a much more limited impact.

National innovative capacity is not the same thing as short-term competitiveness. Japan, for example, continues to improve its environment for innovation, as it has since the early

How We Measured National Innovative Capacity

To understand how location matters for innovation, we undertook a series of quantitative studies to examine the relationship between national innovative output and measures of national innovative capacity.* These studies offer insight into the most important influences on national innovative capacity and how to weight the relative impact of each. They also allow a comparison of innovative capacity across countries and over time.

Because our focus was on innovation at the technology frontier and on comparing innovation across nations, we measured national innovative output using the number of patents the U.S. Patent and Trademark Office (USPTO) granted to foreign and U.S. inventors from the late 1970s through the mid-1990s.† Over this time, the rate of international patenting at the USPTO increased dramatically — from fewer than 25,000 per year in the late 1970s to more than 75,000 by the late 1990s.

We used USPTO patents as an indication of innovative intensity for several reasons. When a foreign inventor files a U.S. patent, it is a sign of the innovation's potential economic value because of the costs involved. Also, the use of U.S. patents ensures a commitment to a standard of technological excellence that is at or near the global technology frontier.

Of course, no single measure of innovation is ideal. We therefore also explored several alternative measures of innovation success, such as the pattern of exports in international high-technology markets. Overall, however, international patents constitute the best available measure of innovation that is consistent across time and location.

Using data from 17 OECD countries over the past quarter century, we examined the linkage between international patenting productivity and various measures of national innovative capacity. Although these measures cannot capture the full subtlety of national innovative capacity, our results suggest that this set of measures of the nation's innovation environment can explain the overwhelming share of the variation in international patenting rates across countries and time.

COMMON INNOVATION INFRASTRUCTURE

Measures that indicate the strength of a nation's common innovation infrastructure are relatively available. We used the number of employed scientists and engineers, the overall level of R&D expenditures, the share of GDP devoted to expenditures on higher education, a measure of the effectiveness of intellectual property protection, and a measure of the economy's openness to international trade. We used GDP per capita as a control for the economy's aggregate technical sophistication. Each of these measures varies substantially across countries and time. For example, though their living standards are similar, the percentage of the work force who are scientists and engineers is three times higher in Japan than in Italy or Spain.

CLUSTER-SPECIFIC INNOVATION ENVIRONMENT

Measuring cluster-specific conditions is more difficult, and we used proxies that were less direct. We used the share of national R&D expenditures funded by the private sector to reflect the overall private R&D environment. The robustness of an industrial cluster is also reflected in a second indirect measure, the degree of technological specialization, which we determined by looking at the relative concentration of patenting activity across technological fields. If a country's innovation resources are more focused, other things being equal, R&D productivity should be higher.

QUALITY OF LINKAGES

Measures here are also necessarily indirect and include the share of national R&D expenditures *performed* within the university sector. Universities are perhaps the single most important institution linking a nation's clusters and the common innovation infrastructure. Linkages also take place through channels that are more difficult to measure, such as venture capital networks, the Blue List Institutes in Germany and other informal company networks.

* For a more detailed discussion of our empirical methodology, see S. Stern, M.E. Porter and J.L. Furman, "The Determinants of National Innovative Capacity," working paper 7876 (Cambridge, Massachusetts, National Bureau of Economic Research, 2000).

† For a useful introduction to the application of patent statistics for evaluating innovation, see Z. Griliches, "Patent Statistics as Economic Indicators: A Survey," Journal of Economic Literature 28, no. 4 (1990): 1661-1701; and J. Eaton and S. Kortum, "International Technology Diffusion: Theory and Measurement," International Economic Review 40, no. 3 (1999): 537-570.

Assessing National Innovative Capacity: Latin America

Although Latin American companies have greatly improved their competitiveness in international markets in recent decades, they continue to produce very little new-to-the-world technology. For example, several countries in Latin America are awarded fewer than 10 U.S. patents per year. In 1997, for example, many Latin American countries registered per capita rates of international patenting that were less than *one-fiftieth* the rates in most western European countries though per capita incomes were greater than one-fifth of those of western Europe. In other words, Latin American firms were 50 times less likely to patent a world-class innovation than their western European counterparts. What is behind this low rate of innovation performance, and how does Latin America differ from other emerging areas that *are* producing world-class technological innovation?*

The Latin American innovation shortfall is the result of several factors. For example, in leading innovator economies, the university system provides training and also undertakes basic research. Throughout the Spanish-speaking world, however, universities have historically played a limited role in the innovation process. Latin American higher education has often remained isolated from industry and only loosely involved in national science and technology policy. Similarly, even though openness to international competition encourages innovation by fostering knowledge spillovers and competitive pressures, Latin American economies have a history of being largely closed, which has lowered their rates of innovation.

Latin American Innovative Performance Relative to Emerging Asian Economies[a]

Country	1976–1980	1995–1999	Growth Rate
Emerging Latin American Economies			
Argentina	115	228	0.98
Brazil	136	494	2.62
Chile	12	60	4.00
Costa Rica	22	48	1.18
Mexico	124	431	2.48
Emerging Asian Economies			
China	3	557	191.33
Hong Kong	176	1,694	8.63
Singapore	17	725	41.65
South Korea	23	12,062	523.43
Taiwan	135	15,871	116.56

[a] The first two columns are the total number of U.S. patents in each country during each five-year period.

During the late 1970s, several Latin American countries actually realized a higher level of international patenting than a comparison group of emerging Asian economies; in sharp contrast, by the second half of the 1990s, patenting in the Asian economies dwarfs the Latin American output. (See "Latin American Innovative Performance Relative to Emerging Asian Economies.") This difference in performance reflects, at least in part, the Asian economies' high rate of investments in national innovative capacity relative to those of Latin American nations.

Some Determinants of National Innovative Capacities in Six Latin American Countries in 1998[a]

Country	Full-Time Equivalent R&D Workers per Million Population	R&D Expenditure ($million) per Million Population	Strength of Intellectual Property Protection[b]	Openness to International Competition and Trade[c]
Argentina	1,212.2	32.8	4.7	8.5
Brazil	433.7	35.3	3.3	5.4
Chile	639.2	32.0	6.1	8.8
Colombia	—	9.0	5.0	5.0
Costa Rica	557.0	32.2	6.0	6.0
Mexico	365.3	15.2	6.1	7.9

[a] Calculations are based on data from the Ibero American Network of Science and Technology Indicators (the RICYT), 2000, and the "World Competitiveness Yearbook" (Lausanne, Switzerland: IMD, 1998).
[b] Ranking is based on a 1–10 scale, where 1 = "weakest" and 10 = "strongest."
[c] Ranking is based on a 1–10 scale, where 1 = "least open" and 10 = "most open."

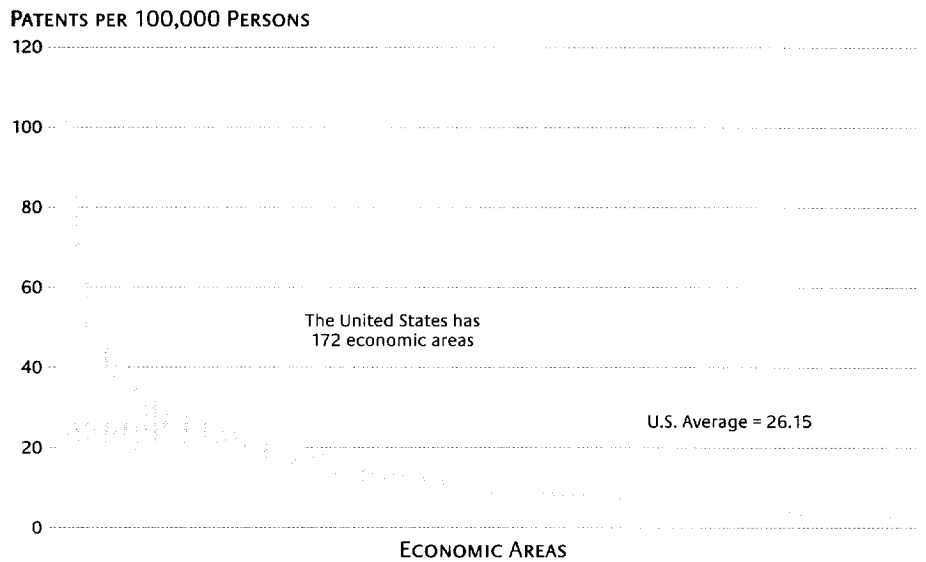
Within Latin America, national innovative capacities differ substantially. (See "Some Determinants of National Innovative Capacity in Six Latin American Countries in 1998.") Argentina employed the greatest number of scientists and engineers per capita. Argentina, Chile and Brazil maintain high per capita R&D expenditures and engage in intellectual property and competitiveness policies that support innovative activity, relevant to Colombia, Costa Rica and Mexico.

Despite rapid economic growth in much of Latin America over the last decade, the region still faces substantial challenges in developing innovative capacity at a level commensurate with those of leading OECD countries. Some Latin American countries seem to be moving to address this challenge. The Costa Rican government is encouraging the development of an information technology cluster; these policies are, in turn, helping to upgrade each element of Costa Rica's national innovative capacity.† Maintaining a consistent record of investments and policy choices to enhance the innovation environment will be essential to determining whether Latin America is able to sustain and enhance its competitiveness over the next generation.

* M.E. Porter, J.L. Furman and S. Stern, "Los Factores Impulsores de la Capacidad Innovadora Nacional: Implicaciones Para Espana y America Latina" in "Claves de la Economia Mundial" (Madrid: ICEX, 2000), 78-88. (For an English-language version, see M.E. Porter, J.L. Furman and S. Stern, "The Drivers of National Innovative Capacity: Implications for Spain and Latin America," working paper 01-004, Harvard Business School, Boston, 2000.)

† See M.E. Porter and N. Kettelhohn, "Building a Cluster: Electronic and Information Technology in Costa Rica," draft, Harvard Business School, 2000.

Patenting per Capita Across the United States in 1997



Source: Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School.

such as Costa Rica.[4] (See "Assessing National Innovative Capacity: Latin America.")

Regional Differences Although our focus is on national differences in innovative capacity, sharp differences also occur between states and regions within nations. (See "Patenting per Capita Across the United States in 1997.") These regional differences reflect the same considerations we have described at the national level. The quality of common innovation infrastructure often varies by region, and clusters are often concentrated geographically.

1970s, despite continued economic stagnation and difficulties in reforming other aspects of its economy. Conversely, several western European countries, including the United Kingdom, France and Italy, have at best maintained innovative capacity, despite some success in current competitiveness. Although each nation possesses strengths that support innovation in some parts of its economy, the commitment to innovation has been mixed. Italy boasts a vibrant textile cluster, for example, and the United Kingdom supports an outstanding scientific research system, yet neither has increased its overall commitment to innovation commensurate with the leading innovator countries. The consequences for long-term national living standards are beginning to be felt.

Innovation in Emerging Nations Our study also shows that new centers of innovative activity are emerging outside the OECD. Singapore, Taiwan, South Korea and Israel have made substantial investments in upgrading their innovative capacities over the past decade and achieved large increases in patenting rates. Ireland has also established the infrastructure and industrial clusters consistent with strong innovative activity.

Conversely, several countries that have drawn much attention as potential economic powers — India, China and Malaysia — are not yet generating meaningful levels of world-class innovative output on an absolute or relative basis. These countries have developed neither a base for innovation nor clusters with a large innovative capacity.

We also used the national innovative capacity framework to rationalize the weak overall innovation performance of Latin American economies and the recent positive trends in countries

Implications for Innovation Management

Innovation is strongly affected by location: the *external* environment for innovation. This insight holds critical implications for companies and creates a new, broader agenda for management. Choosing R&D locations and managing relationships with outside organizations should not be driven by input costs, taxes, subsidies or even the wage rates for scientists and engineers (as they often are). Instead, R&D investments should flow preferentially to the most fertile locations for innovation. (See "Mapping Innovative Capacity: A Tool for Managers.") Harnessing and extending locational advantages takes an equal weight to R&D process management. Locational advantages — rooted in proprietary information flows, special relationships and special access to institutions — are competitive advantages that are difficult for outsiders to overcome. They help explain an apparent paradox of globalization: Ideas and technologies that can be accessed from a distance cannot serve as a foundation for competitive advantage because they are widely available. In a global economy, this makes harnessing local advantages crucial.

Locate R&D investments and commercialize new technologies in environments with strong innovative capacity. Though innovation is often serendipitous and internal project management has an important impact on success, opportunities for effectively developing new products, processes and services arise by locating in countries (and regions within countries) with a favorable common innovation infrastructure and strong clusters in their field.

A location may be favorable for other reasons (such as offering low manufacturing costs or access to key markets) but unfa-

Mapping Innovative Capacity: A Tool for Managers

The national innovative capacity framework provides a means to access the locational influences of innovation. A good starting point for using this framework is to compile data on the national or regional track record of innovation: domestic patents, international patents, trademark applications and counts of new products. Evaluating a region's innovation performance requires collecting and analyzing measures in the context of the framework's three elements.

COMMON INNOVATION INFRASTRUCTURE

Comparisons across countries can include the size and composition of the science and engineering work force, the country's overall level of educational attainment and the funding for R&D over time. To evaluate national innovation policies, the "Global Competitiveness Report" offers nuanced measures including the strength of intellectual property protection, the effectiveness of antitrust enforcement, the availability of risk capital and the economy's openness to international product market competition.*

CLUSTER-SPECIFIC INNOVATION ENVIRONMENT

Defining clusters and drawing cluster boundaries is a creative process informed by understanding the most important complementary relationships across industries and institutions to competition. Cluster boundaries should encompass all firms, industries and institutions with strong linkages, whether vertical or horizontal. Clusters normally consist of a combination of end-product, machinery, materials, and service industries, usually classified in separate categories. They often involve (or potentially involve) both traditional and high-tech industries. Clusters vary in their state of development, and cluster boundaries evolve as new companies and industries emerge, established industries shrink or decline, and local institutions develop and change. Technological and market developments spawn new industries, create new linkages or alter served markets. Regulatory changes also contribute to shifting boundaries. After clusters are defined, the task is to assess the state of the cluster diamond.†

LINKAGES

Managers must also assess the quality and the depth of the institutions in a nation or region to link together firms and institutions, particularly the local university system. A competitive university system combines teaching and research with a history of responsiveness to industrial innovation opportunities. This combination provides a powerful mechanism for connecting the common innovative infrastructure to the needs of clusters. In countries such as England, however, the presence of universities with a strong scientific orientation has not historically translated into an engaged player in the coordination and management of innovation.

Another important linking mechanism is risk capital providers. In the United States, venture capitalists play this role. In other countries, provision of risk capital takes place in various ways, from banking institutions to public-private financing entities.

DEFINING THE RELEVANT GEOGRAPHIC REGION

While the nation is an appropriate focus for many fields, innovative capacity often varies *within* countries. In these cases, national policy differences may be less important than evaluating the local innovation infrastructures and understanding the dynamics of local clusters.

* The "Global Competitiveness Report" is published annually by Oxford University Press.

† M.E. Porter, "On Competition" (Boston: Harvard Business School Press, 1998), 197-287.

vorable for innovation. Managers must make R&D locational choices strategically, recognizing that there tend to be only a few true innovation centers in each industry and that even modest improvements in the innovation environment can hold dramatic consequences for competitive advantage. For example, though biomedical research takes place throughout the world, more than three-fourths of all biotechnology pharmaceutical patents have their origin in a handful of regional clusters in the United States.

R&D locational choices are particularly important for companies that aspire to global strategies. It is important to establish a presence in countries whose innovation environments are the most favorable. When dispersing R&D, however, it is important that one location remains the home base for each product line or business unit. Otherwise, disparate locations can create problems that slow down innovation and commercialization rather than enhance it.

Locations with strong intracluster knowledge spillovers can make it harder to protect ideas from local competitors.

However, most companies within a cluster are usually not direct competitors but sources of complementary ideas, products or services. Strong innovation clusters, then, can progress much faster than other locations even though some firms and subsidiaries within the cluster have trouble staying ahead.

Proactively access the local strengths. Capturing locational advantages in innovation involves more than sending delegations or establishing R&D listening posts. Companies must proactively invest to tap into the strengths of their local environment. This involves such things as active participation in industry associations, investing to build deep relationships with local universities, cultivating and assisting programs that train skilled personnel and paying particular attention to the most sophisticated local customers.

Companies in the same locational cluster may differ in how they leverage the local cluster's capacity for innovation. For example, most high-technology companies in the Route 128 corridor around Boston, Massachusetts, take advantage of the ready supply of engineers and the spillovers among firms within the local information technology and life sciences clusters. Yet only a subset of these companies have directed resources toward interactions with local academic researchers and membership in partnership programs with MIT research centers.

Enhance local innovative capacity. In most cases, the question is not just where to locate internationally but how to shape the local environment to make it more conducive to innovation. Companies have an important stake in regional innovative capacity. This means that, even individually, they should encourage public investment and policies that enhance the national innovation infrastructure and improve the clusters. The most effective role for government is not to simply subsidize R&D (a policy which is likely to increase R&D wages without commensurate increases in the level of innovation), but to improve the innovation environment. Industry associations can offer a unified voice in encouraging appropriate government policies. However, collective private-sector organizations also have an important independent role in such areas as establishing training programs, creating new research centers and supporting standards organizations. Here, private investments create "public goods" that can be of immense competitive value.

A Broader Agenda

Building a foundation for competitive advantage requires a clear understanding of the role location plays in both innovation and competitiveness. Reduced communication costs and more open borders actually enhance the importance of location as traditional sources of advantages are "competed away." Managers can no longer simply manage the innovation process within their companies; they must also manage the process of how their companies enhance and take advantage of opportunities in the local environment. Indeed, long-term competitive advantage relies on being able to avoid imitation by competitors. Ironically, then, location-based advantages in innovation may prove more sustainable than simply implementing corporate best practices.

ACKNOWLEDGMENT

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1. A full exposition of the National Innovative Capacity Framework as well as a full reference list of our prior research in this area is included in S. Stern, M.E. Porter and J.L. Furman, "The Determinants of National Innovative Capacity," working paper 7876 (Cambridge, Massachusetts, National Bureau of Economic Research, 2000). This framework synthesizes and extends three areas of prior theory: ideas-driven endogenous growth, described in P. Romer, "Endogenous Technological Change," Journal of Political Economy 98: S71-S102; cluster-based national industrial competitive advantage, described in M. Porter, "The Competitive Advantage of Nations" (New York: Free Press, 1990); and national innovation systems, described in "National Innovation Systems: A Comparative Analysis," ed. R.R. Nelson (New York: Oxford University Press, 1993).

2. The Cluster Mapping Project, based at the Institute for Strategy and Competitiveness at the Harvard Business School, has charted striking differences in the patterns of innovation across the United States' economic areas.

3. The "diamond" framework, introduced in M. Porter, "The Competitive Advantage of Nations," has been used extensively to understand the foundations of global competitive advantage. The national innovative capacity framework emphasizes the linkage between industrial clusters and innovation.

4. M.E. Porter, J.L. Furman and S. Stern, "Los Factores Impulsores de la Capacidad Innovadora Nacional: Implicaciones Para Espana y America Latina" in "Claves de la Economia Mundial" (Madrid: ICEX, 2000), pp. 78-88. (For an English-language version, see M.E. Porter, J.L. Furman and S. Stern, "The Drivers of National Innovative Capacity: Implications for Spain and Latin America," working paper 01-004, Harvard Business School, Boston, 2000.)

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