

**A Governor's Guide to
Cluster-Based Economic
Development**

Since their initial meeting in 1908 to discuss interstate water problems, the governors have worked through the National Governors Association to deal collectively with issues of public policy and governance. The association's ongoing mission is to support the work of the governors by providing a bipartisan forum to help shape and implement national policy and to solve state problems.

The members of the National Governors Association (NGA) are the governors of the fifty states, the territories of American Samoa, Guam, and the Virgin Islands, and the commonwealths of the Northern Mariana Islands and Puerto Rico. The association has a nine-member executive committee and three standing committees—on Economic Development and Commerce, Human Resources, and Natural Resources. Through NGA's committees, governors examine and develop policy and address key state and national issues. Special task forces often are created to focus gubernatorial attention on federal legislation or on state-level issues.

The association works closely with the Administration and Congress on state-federal policy issues through its offices in the Hall of the States in Washington, D.C. The association serves as a vehicle for sharing knowledge of innovative programs among the states and provides technical assistance and consultant services to governors on a wide range of management and policy issues.

The Center for Best Practices shares knowledge about innovative state activities, explores the impact of federal initiatives on state government, and provides technical assistance to states. The center works in a number of policy fields, including agriculture and rural development, economic development, education, energy and environment, health, social services, technology, trade, transportation, and workforce development.

ISBN: 1-55877-356-8

Copyright 2002 by the National Governors Association, 444 North Capitol Street, Washington, D.C. 20001-1512. All rights reserved.

The responsibility for the accuracy of the analysis and for the judgments expressed lies with the authors; this document does not constitute policy positions of the National Governors Association or individual governors.

For more information, visit the NGA Web site at: www.nga.org.

Table of Contents

	Foreword .....	.5
	Acknowledgements .....	.6
I.	How to Use this Guide .....	.7
II.	Why Pay Attention to Clusters? .....	.9
	Benefits to Business from Clustering .....	.9
	Hard and Soft Benefits from Clustering .....	.9
	New Policies for Economic Development .....	.11
III.	How Clusters Grow .....	.13
	Concepts .....	.13
	Connections .....	.14
	Competencies .....	.15
IV.	Knowing the Cluster, Understanding the Economy .....	.16
V.	Policy Options to Support Competitive Clusters .....	.21
	Organize and Deliver Government-Supported Services to Clusters .....	.22
	Target Investments to Clusters .....	.24
	Strengthen Networking and Associative Behavior .....	.27
	Develop Human Resources for Clusters .....	.30
VI.	Policies for Promoting Equity .....	.35
	Engage Community-Based Employment Intermediaries .....	.35
	Support Industry Associations and Intermediaries in Distressed Regions .....	.35
	Encourage Civic Responsibility Among Clusters .....	.36
	Provide Incentives and Subsidies to Encourage Employment of Low-Income People in Distressed Regions .....	.36
VII.	Glossary of Terms .....	.37
VIII.	Resources on Cluster Methodologies .....	.39
IX.	Selected Cluster Web Sites .....	.41
X.	Endnotes .....	.43
XI.	Appendix A - Benchmarking Guide for Clusters .....	.45
XII.	Appendix B - Mapping Social Capital Among Employees .....	.47

Foreword

State Leadership in the Global Economy Task Force

Governor John Engler, Michigan, *Co-Chair*

Governor Paul E. Patton, Kentucky, *Co-Chair*

Governor Don Siegelman, Alabama

Governor Mike Huckabee, Arkansas

Governor Bill Owens, Colorado

Governor Dirk Kempthorne, Idaho

Governor Thomas J. Vilsack, Iowa

Governor Parris N. Glendening, Maryland

Governor Ronnie Musgrove, Mississippi

Governor Michael O. Leavitt, Utah

Governor Howard Dean, M.D., Vermont

Governor Scott McCallum, Wisconsin

Dr. Charles M. Vest, President,
Massachusetts Institute of Technology,
Co-Chair

Mr. F. Duane Ackerman, Chairman and Chief
Executive Officer, BellSouth Corporation,
Co-Chair

Mr. Augustine P. Gallego, Chancellor, San
Diego Community College District

Mr. James P. Hoffa, General President,
International Brotherhood of Teamsters

Dr. Irwin Mark Jacobs, Chairman of the Board
and Chief Executive Officer, QUALCOMM
Incorporated

Mr. Edward Sullivan, President, Building and
Construction Trades Department, AFL-CIO

Mr. Charles Whitehead, President,
Ashland Inc. Foundation

As it did 100 years ago, America enters a new century marked by an economic environment of free trade, international competition, and global business relationships. In such an environment, U.S. economic strength depends on the ability of each state to “compete” successfully in the world marketplace. Each state must exploit the unique advantages it has relative to other states and build on the strengths found in its local “clusters of innovation”—distinct groups of competing and cooperating companies, suppliers, service providers, and research institutions.

To help their clusters of innovation thrive and compete worldwide, governors will need to work with their educational institutions and the private sector to build a skilled labor force that is second to none. State governments will need to leverage public research dollars and coordinate efforts with industry to build the science and technology infrastructure that brings new ideas to the marketplace and new technologies to traditional industries. Finally, states will need to eliminate barriers to business innovation, workforce training, and international trade.

In partnership with the Council on Competitiveness, the National Governors Association (NGA) has conducted a year-long effort helping governors develop economic strategies for a global marketplace. These strategies are designed to provide lifelong learning and training for employers and employees, strengthen science and technology capacity, develop international markets, and bring prosperity to disadvantaged communities. This new approach to economic development

is a major shift from the traditional approach—which chiefly relied on location-based tax incentives to attract large manufacturing entities—and represents a more effective strategy for competing in the global economy.

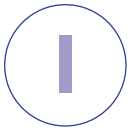
To implement this effort, which began in July 2001, the NGA and Council formed a Task Force on State Leadership in the Global Economy. Under the task force, the NGA and Council sponsored regional workshops for state policy teams from around the nation to teach and discuss the approaches for cluster-based economic development. The NGA and Council also published four reports providing tools and recommendations for governors on the following topics:

- how to build a cluster-based economic development strategy,
- programs and policies for building a 21st-century workforce,
- maximizing public leadership in promoting international trade, and
- the role of science and technology in fostering an economy based on innovation.

State economies are the economic engine of America. To achieve their potential—both in terms of technology and human capital—governors must have access to the most sophisticated tools available for helping workers and industry stay competitive. The tools provided to states under this initiative should help foster a new understanding of economic development and ready states for the 21st century.

Acknowledgements

Lead writer for this report was Stuart Rosenfeld of Regional Technology Strategies in Carrboro, North Carolina (www.rtsinc.org). The National Governors Association Center for Best Practices also acknowledges the generous financial support of the U.S. Department of Commerce Economic Development Administration (EDA), the Ford Foundation, the Alfred P. Sloan Foundation, and the U.S. Department of Labor for supporting this project.



How to Use This Guide

This guide aims to help readers navigate the vast literature on business clusters and provide parameters and tools for applying the information and integrating the concepts into economic development policy wisely and efficiently. It is both a primer on clusters for those unfamiliar with the basic concepts and a repository of policy options for those responsible for growing and strengthening clusters.

The guide draws on research studies and case studies of clusters and on the author's visits to clusters and interviews with cluster actors, activists, and analysts to suggest a cluster-based framework for state policymakers. It summarizes lessons learned about how state governments can strengthen their economies by supporting the competitiveness of clusters. It seeks to impart to readers:

- an appreciation of the value of attending to the distinctive assets and needs of state and regional economies;
- an understanding of the advantages of clusters and forces that make them develop, grow, mature, and reinvent themselves as they decline; and
- policies that develop, assist, and propel clusters in urban and rural, rich and poor regions.

The guide begins by explaining why clustering happens and why businesses choose to locate near their peers. **Section 2** also suggests ways that states can take advantage of the internal organization of their economies to create jobs and wealth.

Section 3 addresses a few characteristics and idiosyncrasies of clusters to help explain how clusters develop and function. **Section 4** illustrates how clusters produce concepts, connections, and competencies that build competitive economies. It summarizes some of the most commonly used techniques for identifying, sizing up, and portraying clusters: analyzing existing databases, inventorying support structures, assessing the competitive environment, and mapping relationships. The definitions and descriptions then flow into the real power of clusters, the factors that drive cluster growth and comparative advantage.

Section 5 presents some basic tools that have been used successfully in some regions to develop, assist, and propel clusters and build stronger economies. These tools, frequently illustrated by example, are broadly structured around four themes: organizing the delivery of services, targeting investments, strengthening networks, and developing human resources.

Section 6 addresses the civic and social responsibilities of government and suggests ways to increase the likelihood that the economic opportunities associated with cluster-based growth reach disadvantaged and disconnected places and populations. Finally, the guide contains a glossary of terms and paper-based and Web-based references and resources for readers seeking further information.



Why Pay Attention to Clusters?

Conceptually, industry clusters have become the *sine qua non* of economic development policy across the United States. State economies, because of historical accident or investments, targeted recruitment, or geographic peculiarities, have distinctive structures. Certain industries are more highly concentrated in some places than in others. The competitive advantages of various regions of a state are best understood by the competitive advantages of their most prominent industries. Every place wants to be exceptionally good at something that can be translated into reputation and success in the marketplace.

There is surprisingly little disagreement over the formal definition of a “cluster.” Most experts define it as a geographically bounded concentration of similar, related or complementary businesses, with active channels for business transactions, communications and dialogue, that share specialized infrastructure, labor markets and services, and that are faced with common opportunities and threats.

A cluster differs from a sector in its geographic boundaries; the inclusion of resource, supply, and knowledge chains; and the importance of how they are connected. Clusters are best understood and used as regional systems. Sectors, which states have traditionally used for planning purposes and identifying economic opportunities, are treated mainly as concentrations.

The most obvious reason states should think about and act on clusters is businesses do. Companies tend to locate near one another, including competitors, because the advantage of external economies and access to labor and knowledge outweigh the disadvantages that competitors may steal their employees or find out their trade secrets.

Benefits to Business from Clustering

Concentration, or clustering, gives businesses an advantage over more isolated competitors. It provides access to more suppliers and customized support services, to experienced and skilled labor pools, and to the inevitable transfer of knowledge that occurs where people casually meet and talk business. Clustering enables companies to focus on what they know and do best; they need not do things they do not do well. Firms also benefit from synergy. Companies able to operate more or less as a system can use their resources more efficiently and collectively produce more than the sum of their individual outputs.

Among all of the advantages of clustering, none is as important as access to innovation, knowledge, and know-how. In the New Economy—defined by knowledge-intensive traditional and emerging industries—companies look for their main competitive advantages in access to ideas and talent, which requires geographic proximity to professional colleagues, cut-

ting-edge suppliers, discriminating customers, highly skilled labor pools, research and development facilities, and industry leaders. Industry-specific knowledge and know-how accumulate and disperse through entrepreneurial areas and innovative companies. Clustering gives firms quicker information about advances in technologies and changes in customer or consumer preferences. Not incidentally, it reduces transaction costs.

Hard and Soft Benefits from Clustering

These advantages can be separated into “hard” benefits and “soft” benefits. Hard benefits are gained from more efficient business transactions, wiser investments, and reduced expenditures that produce profits and jobs. Soft benefits are derived from the learning, benchmarking, and sharing that expands knowledge and leads to innovation, imitation, and improvement.

The most quickly recognized and easily measured advantages to firms are those resulting from the concentration of the resources necessary to do business. Clustered firms can choose from a greater number of more tailored services. These services include bankers and accountants who understand their technologies and markets, trusted consultants who can solve specific problems, marketing and advertising companies that know their customers, and the small business center that can assess their procedures and give advice. Moreover, local firms can



purchase these resources faster and at a lower cost than their more distant competitors.

Among the most important hard benefits is access to a knowledgeable and experienced workforce, particularly the mid-skilled workers who are deeply rooted in the region and who typically have attended the local vocational schools and community and technical colleges (see Table 1). Except for the small number of jobs that are telecommutable, such as back office workers in Asia, these skills cannot be purchased over the Internet and delivered overnight.

The presence of potential local suppliers is an advantage, but mainly in industries where significant knowledge is embedded in the product. In today's economy, overnight deliveries and Internet communications reduce the importance of proximity for standardized parts and supplies. Companies increasingly use electronic auctions for parts, and proximity matters most for critical components or supplies that are knowledge-intensive and depend on interactive research and design or special support in assembly or utilization. Supply chains are advantageous, but less so today than in the 20th century.

The soft benefits of clustering are the intangible assets that are not so directly transferred to a profit-and-loss statement, but potentially have an even greater impact on the bottom line than the hard externalities (see Table 2).

Table 1: “Hard” Benefits of Clusters

Asset	Benefits
Local supply chains	Design efficiencies
Specialized workforce	Higher productivity
Specialized services	Faster and easier access
Choice of inputs	Lower costs, higher quality
Range of firms	Joint ventures, network opportunities

Table 2: “Soft” Benefits of Clusters

Asset	Benefits
Association	Collective vision, planning, influence
Trust	Inter-firm collaboration and networks
Learning (1)	Technology transfer and innovation
Learning (2)	Tacit knowledge and know-how
Informal labor markets	Efficiencies, career ladders

The advantages of these assets are derived from a mobile workforce and the flow of knowledge among firms through formal and informal discussions with peers, suppliers, and customers. Innovation is a collective and iterative process, and an environment that encourages people to share and play off one another's ideas promotes innovations in technologies, products, and processes.

Advantage also comes from the more efficient acquisition of tacit knowledge—sometimes called know-how—that is carried in the heads of individuals and in the routines of organizations and is not published or otherwise formally recorded. Transfer of this knowledge requires the face-to-face contact that occurs in business-to-business interactions and social, professional, and trade meetings. The greatest advantage of social capital and trust is derived from planned collaboration and network formation.

The precursors of programs to develop clusters typically were state programs designed to form networks among groups of firms. These programs were about addressing business needs collectively and achieving economies of scale. In retrospect, states' emphasis on networks put the cart before the horse, because networks naturally develop out of the relationships that exist in strong clusters. Although the terms "network" and "cluster" are sometimes used interchangeably, there are critical differences. Networks create economies of scale by deliberately sharing resources, expertise, or information. There is nothing necessarily deliberate about the naturally occurring efficiencies that are part of the cluster's business environment.

New Policies for Economic Development

Economists and geographers have studied spatial concentrations of companies for more than a century. Yet economic development policymakers have paid little attention to the advantages of concentration and specialization. Instead, they have supported diversification, considering industry concentration more a liability and threat to long-term sustainability than an asset to be nurtured.

Where clusters have developed and flourished, the public sector's main contributions has been through segmented agencies that serve specific functions (e.g., financing, training, technical assistance, or exporting) common to all kinds of businesses.

Why change now?

First, the needs of a state's customer-companies are systemic and rarely defined by single business functions, so companies have difficulty trying to find and assemble the help they need to solve problems.¹ State agency personnel cannot have detailed knowledge of all the industries they are expected to serve.

Second, cluster-directed policies increase the efficiency of government in light of increasingly volatile and competitive markets and discriminating customers who expect rapid and customized responses and have eschewed loyalties. Successful companies must continually innovate to survive in the new environment and want a government that understands their special conditions, will be innovative itself, and can provide services in the same quick and customized ways that companies are expected to act. This poses a real challenge for public agencies that are often mired in bureaucracy.

Third, clusters may lead to more self-sustaining state economic growth. The advantages of place draw similar and complementary enterprises; with encouragement, these enterprises can ultimately breed other clusters. The textile cluster in **South Carolina** attracted enough machine and tool builders to become an industrial machinery cluster in its own right. The conversion to Web-based printing, publishing, and advertising created a new media cluster in **New York City**.

Clusters can expand opportunities.

Clusters can, but do not automatically, expand opportunity for low-income places or populations. Clusters that have organized to set their priorities and articulate their interests have rarely placed equity very high on their agenda. For demand-driven development efforts to include social goals, there must also be a payoff in profits (e.g., increased productivity, good will that results in additional sales, or reduced turnover). In tight labor markets, that payoff might be an ability to maintain a full workforce. This benefits some poorer regions that may have surplus labor forces, and it causes companies to invest more heavily in the training of less-educated populations to meet their employment needs. In weak labor markets, companies may prefer to operate in places where educational levels and wages are lower or to find employees for occupations that despite good salaries are associated with lower socioeconomic status, such as machinists and tool-and-die makers.

As any good business manager knows, most changes that occur in a plant are systemic and affect the functioning of the entire production process. Effective interventions take into account the entire system. Similarly, regional economies are systems defined by interdependent business elements. Interventions that are systemic will have the greatest impacts. Thus government agencies are gradually turning their attention from individual firms and places to collections of firms or "clusters."



Through clusters states can better understand economies as systems and leverage change. This suggests new policies for strengthening and sustaining economies that enable governments to be more strategic, systematic, and efficient in their uses of public monies.

No single sequence of actions fits all clusters, just as no solution fits every business situation. Each cluster has its own culture and conditions, and its needs and potential must be individually assessed. Policies have to be tailored, but there are experiences on which states can draw and some guidelines to help design appropriate policies. The policies address service delivery, investments, accelerated learning, and workforce preparation.

1. Policies to more efficiently organize and deliver services.

Government services typically are organized by function. Small business services, training, technology extension, marketing, and recruiting are separate programs staffed by specialists in a particular discipline, not industry. Clusters provide a better organizational framework for delivering services that are more tailored to industry demand because they are problem-oriented, not program-oriented; address needs interdependently, not independently; and work with customers collectively, not individually.

2. Policies that target investments to clusters. States already make investments to strengthen their key industries or gain a foothold in emerging industries. They support university-based research and development (R&D) and its commercialization and build industrial sites. Some regions have tried, with mixed success, to buy clusters with incentives and investments. However, states have been less sensitive to their mature clusters when investing in innovation and entrepreneurship. Investment strategies will help less research-oriented cluster members absorb new technologies and become more innovative.

3. Policies to increase clusters' networking and learning. Government agencies that recognize clusters—and, where appropriate, help clusters organize—become more effective partners and negotiators. They are better able to learn about and react to industry needs, monitor clusters' progress, and help clusters adjust to environmental changes. Strengthening clusters this way also helps regions develop unique expertise and “brands” that can supplement regions' general competitive advantages.

4. Policies that improve the clusters' workforce. The single most important resource of any cluster in today's economy is its human capital. Access to a labor pool that knows how to apply its knowledge to the business of the cluster is a key to success. The challenge for states is to effectively interject the right level of cluster context into postsecondary education and the appropriate degree of specialization into higher institutions to meet the needs of clusters that operate in diversified regional economies.

Finally, states have a responsibility to see that the economic outcomes from their policies ultimately have a chance to reach all corners of the state and all segments of the population. Clusters offer ways to restructure equity policies to more effectively serve less-advantaged regions and lower-income and less-educated populations.



How Clusters Grow

What causes a cluster in one place to become more competitive than a cluster in another place? Some clusters might fare better because they innovate and develop new comparative advantages, some because they operate in an entrepreneurial environment, and others because they have the foresight to shift their competencies to enter new and emerging markets. Rosabeth Moss Kantor attributes economic growth to three factors: concepts, connections, and competencies.²

Concepts

Innovation, imitation, and entrepreneurship are what propel competitive clusters. Although the success of a firm depends on its ability to protect its own technological advances, new products, or designs, the success of the cluster in which it operates depends on widespread diffusion, access to innovations and information, and spin-offs of new enterprises. The porosity of clusters presses competitors within the cluster to continually improve and innovate to maintain their advantages over imitators.

Innovation. Innovators generate and commercialize new ideas, find more efficient production processes, or create new markets. Innovations occur in all aspects of business (e.g., the application of technologies, design of management systems, marketing of products, and use of labor). Universities, research centers, customers, suppliers, and machine

The polymer cluster in northeast Ohio grew out of the expertise and success of B.F. Goodrich's rubber factory, which opened in Akron in the 1870s. Spurred by the demand for rubber from the new automobile industry, the region became the "rubber capital of the world." A shortage of raw materials during World War II led to synthetic rubber and plastic substitutes. The industry thrived until the late 1970s, when global competitors began producing at lower costs and jobs moved off shore. The survivors were higher value-added firms that succeeded by focusing on niche markets and process innovations. To help the industry rebuild, in 1984 Ohio established the Edison Polymer Innovation Corporation as one of its first Edison centers. In cooperation with the University of Akron and Case Western University, the corporation became an R&D consortium for polymers. Over time, it developed into a "virtual organization" that organizes and facilitates consortia of companies willing to invest in R&D. After a difficult period of restructuring and state investments in R&D, the cluster has been able to renew itself and become one of the nation's premier clusters of polymer processors (visit <http://www.prosavvy.com/affiliates/otnet/epic.html>).

builders are important sources of innovation. Yet the innovations that may be of most importance to mature clusters are the creative solutions to problems by a technician, engineer, or systems analyst and the improvements that result from the spread of knowledge among employees and companies.

Imitation and competition.

Innovation builds a strong company;

imitation and the competition that follows build a strong cluster. Imitation is as important to a cluster as innovation because it is what circulates new concepts and practices among companies and spurs further innovation. It is the reason companies look for benchmarks among their peers. Many of the imitators become innovators by improving on the practices they adopt, and this cycle of innovation and imitation drives clusters toward excellence. If a

Mississippi's upholstered furniture cluster started in 1948, when a new company, Futorian Furniture, began applying mass production methods to furniture in Tupelo. Over time many of its employees acquired a sufficient store of skills and knowledge of the industry to leave and set up their own shops. Referring to themselves as graduates of the "University of Futorian," these workers spawned factory after factory. As companies multiplied, they attracted suppliers and support services. The basis of this cluster of more than 200 companies is imitation, and their demand for training, technicians, and new technologies is low. Former business associates and friends are fierce competitors and intensely protective of their designs and innovations. Yet community cohesiveness and worker mobility serve to diffuse knowledge and make it difficult to maintain secrecy for long. Owners admit that within the tight social fabric of this church- and school-centered community, competing firms often help one another in times of need, and new knowledge and news of innovation travel quickly and freely.



cluster has a collective persona and its markets are global, it views imitation as strengthening the cluster. In **North Carolina**, for example, members of the embattled hosiery cluster proudly note there are no secrets among them. They are competing far less with one another than collectively with Turkey, Korea, and Mexico.

Entrepreneurial energy.

Entrepreneurial capacity is the fuel that drives the expansion of cluster growth. Recruitment may be a vitamin regimen that fortifies it, but it is the rare location that can recruit a cluster. The genesis of most clusters can be traced to the employees of one or two companies who left to start their own company. Sometimes the impetus is survival when a parent firm moves, downsizes, or goes out of business.

Connections

The most successful clusters build mechanisms that can speed the movement of ideas, innovations, and information from firm to firm throughout the economy. The dynamics of clusters, not the individual accomplishments, create the learning region and innovation cluster. The mechanisms and entities for collecting and disseminating knowledge—the gatekeepers, brokers, and intermediaries that encourage and facilitate all forms of associative behavior—provide the value embodied in social capital that is so important to cluster competitiveness.

Networking and networks.

The single most important operating principle of competitive clusters is the ability to network extensively and form networks selectively. Networking is the process that moves and spreads ideas, information, and best practices throughout a cluster and imports them from other places. A “network,” as

defined for this guide, is the collaborative structure among small and mid-sized enterprises. By the late 1980s, networks had become a popular policy tool throughout the industrialized world. These networks were formally structured coalitions of firms that ranged from joint ventures created by legal contracts to business associations formed by nothing more binding than annual membership dues. The former depended heavily on cooperation and trust, the latter on the value of services and networking opportunities. A region that is home to a critical mass of interdependent companies and that has a social infrastructure and multiple intermediaries facilitating associative behavior and specialized support services produces networks with or without government-sponsored network programs.

Connections and intermediaries. The limits or constraints to active participation in a successful cluster are largely a function of “connections” or deficits in social capital. Some of a state’s stock of social capital resides in its civic and professional associations, and its economic value is deeply embedded in the functions of groups that bring people together to share ideas and knowledge. Various entities that work with clusters, such as technology centers, community colleges, and community-based organizations, serve as linking agents and gateways to information, knowledge, and labor.

The automotive cluster centered on Detroit, Michigan, began in earnest when Ransom E. Olds began mass producing the Oldsmobile in 1901. After a fire destroyed his factory, Olds put all his resources into producing the “Curved Dash Olds” (the only vehicle saved from the fire). The cluster grew around a number of entrepreneurial firms, including Olds, Dodge, Cadillac, Ford, and Chrysler, that quickly developed over the next several years. For example, before building its own model, Dodge built transmissions for Olds and engines and axles for Ford. Likewise, the original Cadillac was produced by Henry Ford’s former partners using an engine design that Olds had rejected. As the industry matured and consolidated with the formation of General Motors in 1908, expertise in automotive engineering and manufacturing concentrated in the region. Today, the Big 3 automakers retain headquarters, research, engineering, and design functions in or around Detroit. The automotive industry, with \$1 trillion in annual sales, spends more than any other U.S. industrial sector on R&D, and Michigan ranks second to California in total private research and development spending.

Competencies

Although many factors affect the competitive advantages of clusters, none is as important as the competencies they embody. Learning and knowledge transfer represent the lifeblood—and skilled labor the gene pool—of clusters.³

Specialized workforce. The skills and knowledge of the workforce have soared to the top of the list of businesses' requirements. As businesses become more technology-dependent, they need more highly skilled, educated, and talented employees. Although other cluster inputs, such as parts, suppliers, and services can more easily be outsourced than using the Internet and overnight deliveries, the workforce remains a local resource constrained by acceptable commuting patterns. Changing demographics and preferences only reinforce the critical nature of a skilled labor supply. Declining birthrates in industrialized nations, coupled with diminished interest among youth in pursuing industrial careers, have increased the pressures to locate where a labor pool already exists.

Industry leaders. Behind every successful cluster is a group of innovative firms led by people who value learning, are committed to their community, and are willing to work toward a collective vision for their industry. These leading companies may have a niche or rapidly growing market that is not threatened by competition, or they may face such intense global competition that the benefits of mutual support and learning outweigh concerns about confidentiality. The key to building and sustaining a cluster organization often rests with the support of these leading companies.

Talent. Regions are beginning to use incentives to recruit talent as they once recruited branch plants. Universities want faculty who can attract research dollars and bright graduate students. Clusters, especially in knowledge-intensive sectors, need bright young people to attract other new firms and young companies. Talent is attracted not just by salaries, but also by the chance to interact with peers in their field, opportunities for professional development, and membership in local professional associations. Less-advantaged and peripheral

regions—or even low-income communities in relatively advantaged regions—have trouble keeping their brightest graduates from moving to the “cool” places that cater to diversity and offer high culture, stellar recreational activities, and good job choices.

Tacit knowledge. Successful regions are home to institutions, individuals, and organizations that serve as storehouses and disseminators of undocumented knowledge. The knowledge resides in research and technology centers and their staff, education institutions and their faculty, and companies and their employees. It extends well beyond whatever may be recorded. Those that develop and work with new systems, techniques, and technologies know far more about how these systems, techniques, and technologies work under different circumstances than is ever documented.

IV

Knowing the Cluster, Understanding the Economy

The first step in any policy directed to clusters is to identify the state's clusters. By seeing an economy through the lens of various regional production and innovation systems, states can more accurately identify market imperfections, find pressure points, predict systemic failures, and determine what interventions can have the greatest impacts. Assessing strengths, weaknesses, threats, and opportunities for an entire economy at best works for generic factors and at worst masks real problems by averaging across sectors. For example, under the same general economic conditions and with access to the same infrastructure, textiles or tobacco might be in deep trouble while biotechnology or electronics is growing rapidly. Most challenges and opportunities are based on circumstances that vary from market to market and product to product.

The best-known model for describing the various elements of a cluster is the four-point “diamond,” which was developed by Michael Porter and a team from the Harvard Business School. The model includes (1) firm structure and rivalry, (2) local demand, (3) related and support industries, and (4) “factor conditions,” defined as skills, infrastructure, R&D, capital, etc. The other commonly applied model, originally devised by SRI International, takes the form of a pyramid. The leading export-oriented companies are situated at the peak, the suppliers and services are below, and the five “foundation factors”—skilled

and adaptable human resources, accessible technology, availability of capital, advanced physical infrastructure, and competitive tax and regulatory climate—form the base.⁴

Whatever methodology a state chooses, the starting point for any cluster strategy is an analysis of existing clustering in the economy, beginning with the recognition and construction of the clusters and moving toward a deeper understanding of how they work. Some basic tools can help states through this process (see Appendix A).

Determining cluster constructs. States have at their disposal various methodologies for identifying clusters based on scales, concentrations, value chains, and other systemic relationships. Although the analytical tools are important starting points, the results of even the most rigorous methodologies are no better than the quality of the input data and the ways the clusters are defined. The critical decision is determining the logic for combining firms into clusters, which could be based on common products, similar processes, value-added chains, core technologies, skill requirements, or proximity to natural resources.

Gaining recognition as a cluster has political significance to firms because it draws special attention from funding agencies, aids in establishing an international reputation or accepted trademark in the marketplace, and attracts specialized resources. It has

political or policy significance to states to the extent that it develops and strengthens the state's economy, contributes to its growth, and furthers its social goals of creating better opportunities for less-advantaged regions and lower-income and less-educated populations.

Cluster labels typically are conferred by a state on groups of sectors that meet some litmus test based on comparative criteria. If the bar is set too high, clusters will be exceptions found in relatively few places. If the bar is set too low, clusters become ill-defined, loose systems of firms with little in common other than traditional cross-cutting economic development issues, such as taxes, zoning, infrastructure, and basic education. Ultimately, however, clusters self-select based on how individual employers and institutions define their missions, set their priorities, use the region's resources, and form relationships. States can encourage even underdeveloped clusters to improve their collective advantages by defining themselves as a cluster and strengthening relationships.

The most common basis for clusters is related groups of industry sectors. Wood products, for example, may be matched with lumber, apparel with textiles, chemicals with plastics, and information technology with communications. Places with a particular niche may focus their clusters more narrowly. Northeast Mississippi's

concentration of upholstered motion furniture companies and **North Carolina**'s concentration of men's hosiery manufacturers each operates independently as a cluster. In other regions that are less populated or less specialized, companies may cross sectors and find interdependencies related to the workforce, technologies, or natural resources. Most cluster groupings also include key supplier industries based on national input-output tables that show the per-unit cost of inputs by sector relative to the per-unit cost of output by sector. Supply-chain relationships, however, manifest only possible, not actual, relationships among companies. Local firms in the supply-chain sectors may not be qualified and/or chosen to be suppliers.

States have considerable discretion to select the companies they choose to include in each cluster. The best decisions rely as much on experience, common sense, and prudence as on rigorous rules for inclusion or exclusion.

The difficulty in relying too heavily on standard industry codes is many companies have a wide range of products and multiple core competencies. In **Connecticut**, for example, some of the largest producers of plastic parts and employers of plastics technicians—Lego, BIC, and Schick—are not classified as “plastics” companies. One must apply common sense and depend on on-the-ground observers to identify the roots and members of clusters. Thus another extremely

Proximity matters. The geography of clusters is set by where member firms find their advantages. That generally means the distances and times people are willing to travel for employment and company employees and owners think are reasonable for meeting and networking. Distance is influenced by traffic and transportation systems as well as by cultural identity, personal preferences, and social hierarchies. In a city with heavy traffic congestion, the ostensible cluster limits may be the metropolitan area or even closer. Silicon Alley is located in Manhattan, **New York**, south of 41st Street. Long Island's related information technology cluster, though just over a bridge, might as well be in another country. In some neighborhoods, social barriers created by class or race may restrict residents' real connections and related opportunities to a much smaller area than the full cluster.

In rural areas where roads are relatively free of traffic and people are more accustomed to driving long distances, a cluster may include a region that encompasses up to a 100-mile radius. The metalworking companies in western **Minnesota** and eastern **North Dakota** and **South Dakota** that joined together to form the Tri-State Manufacturers' Association have been willing to drive that 100 miles for planned functions. Political considerations also affect cluster boundaries, but it is important not to overlook “edge” clusters that may cross state boundaries. The sizable metalworking cluster in western Minnesota near the North and South Dakota borders was not obvious even to the firms operating there before a foundation-led effort to develop the cluster. *Although distance matters and creates advantage, geographic boundaries must be porous enough for local actors to be exposed to innovations, find markets, and do business anywhere in the world. Proximity adds value to a much larger storehouse of knowledge and opportunity.*

important source of information is expert opinion, which can add a fresh and perhaps totally different perspective. Asking local actors through surveys, interviews, or focus groups what they see as dominant or vital to the economy can reinforce or alter the results of the quantitative analyses.

Sizing up clusters. Most descriptions of clusters begin by measuring numbers of establishments and employees by sector based on association directories and existing databases, such as County Business Patterns, Employment Service 202 reports, Dunn & Bradstreet, Harris, and CorpTech. These numbers are used to assess absolute scale, relative concen-

tration, and changes in both over time. The latter typically compares the ratio of employment or establishments in a cluster to the same ratio for the nation. The result is called a location quotient, with a ratio of greater than 1.0 representing higher-than-average concentration.

Researchers have found ways to combine factors in creative ways to describe and distinguish the relative importance of clusters. DRI-McGraw Hill, under a grant from the U.S. Economic Development Administration, created an index that combines location quotients for establishments and for employees, growth rates, and concentrations along supply

chains into a single index.⁵ This measure produced 19 general clusters that drive the U.S. economy and account for about 57 percent of all employment. The Council on Competitiveness, using more detailed measures, such as exports, venture capital investments, and patents, identified 41 traded clusters that include 244 more narrowly defined subclusters.⁶ To enable regional comparisons, researchers at the University of North Carolina have grouped industries into 23 value-added chains that measure how tightly suppliers are coupled.⁷

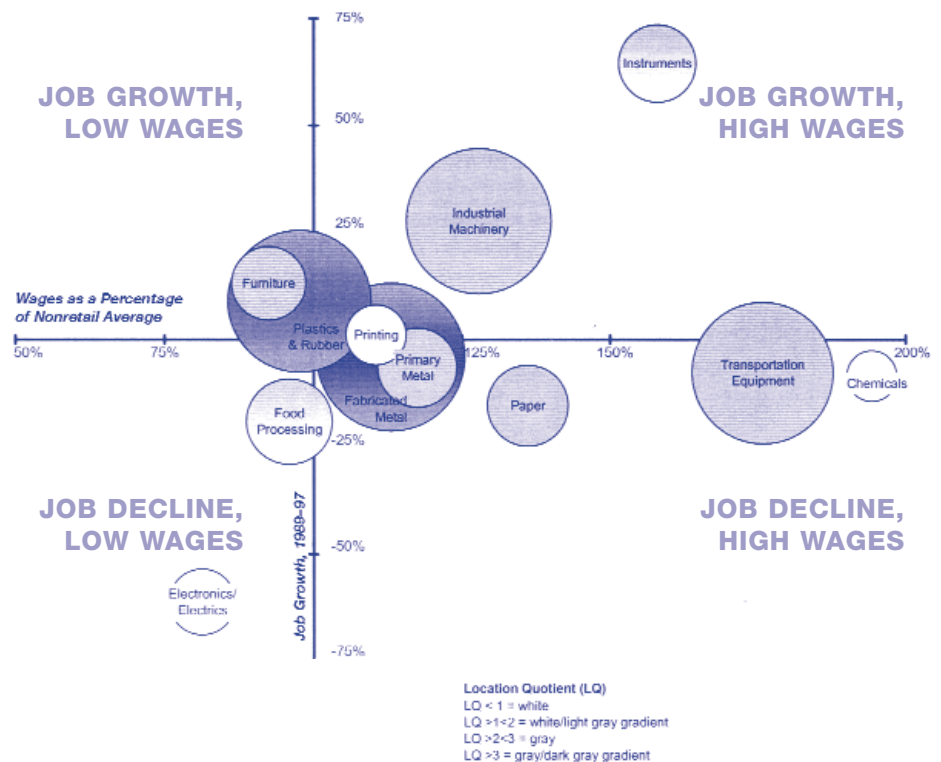
Still other measures focus on rates of innovation and knowledge associated with clusters, such as comparing the proportions of workers in occupations classified as knowledge-intensive, or comparing patent rates by organizations and employees in clusters. Each measure is a useful but limited estimating procedure. One drawback is knowledge is now embedded in most jobs and has little to do with position titles. Moreover, only a small percentage of innovations are ever patented, and many of those end up being commercialized in regions other than where they are developed.

Although some researchers devise formulas to combine measures into single indices, the most popular method for visualizing and comparing clusters, which does not require assigning degrees of importance to measures, is the “bubble chart” (see Figure 1). Two variables are chosen for

Both Large- and Small-Scale Clusters Matter. The minimum firm density necessary for a cluster is that which creates sufficient efficiencies to yield economies of scale. Companies attain this two ways. The most common means is with a critical mass of demand—a sufficient number of firms and/or employees with common or complementary needs—to attract the specialized services, supplies, and resources that are less available to more dispersed and distant firms. To reach scale, states also sometimes combine multiple sectors, such as wood products with furniture, textiles with apparel, chemicals with plastics, or communications with information technologies. The danger in setting broad criteria is the interdependencies become weaker and common interests drop to a lowest common denominator.

Clusters that lack scale may still have strategic value to a state and the potential to take off. Biotechnology in central **Kentucky** and life sciences around New Orleans, **Louisiana**, though small in numbers, have the research and development base and entrepreneurial energy to reach scale. A cluster’s value may be its contribution to sustaining the economic stability of a region or its potential for creating jobs in a distressed region. Film and video at coastal sites in **North Carolina** and **South Carolina**, gambling along the Mississippi River, and Global TransPark in eastern North Carolina are cluster-based efforts to bring jobs to poor, rural areas. A cluster can be a contributor to the success of other industries but have a culture of its own, such as information technology services or distribution/logistics. Only by distinguishing among types of clusters can governments find the most effective strategies.

Figure 1: Bubble Chart for Mid-Sized Metropolitan Area in Northeast



Asset Inventory Checklist

- ✓ Distributors and exporters
- ✓ Education programs
- ✓ Engineering consultants
- ✓ Financial institutions
- ✓ Industry lawyers and accountants
- ✓ Maintenance and repair facilities
- ✓ Marketing consultants
- ✓ Nonprofit organizations with industry focus
- ✓ R&D centers
- ✓ Technology extension centers
- ✓ Trade and labor organizations
- ✓ Training programs
- ✓ Testing laboratories

the “x” axis and “y” axis, which might be location quotients and growth rates or, as in this case, job growth and wages. A third variable is represented by the size (radius) of a circle around the point on the graph—in this case, the number of establishments. A fourth variable can be represented by the degree of shading in the circles, which in this case is the location quotient.

Inventorying cluster assets.

Because the value of clustering is so closely linked to the firms’ access to specialized services and resources, a state should know what those assets are and where they are located. Listing the assets available to and used by a cluster is a prerequisite for completing any picture of the cluster and understanding how it functions. Those assets include the education programs that match the cluster’s workforce needs, the consultants who are familiar with the cluster’s industries, and the research and development that relates

to the cluster. They also include the freight forwarders and exporters who know its markets; the banks and accountants who have developed relationships with the cluster; and the trade, labor, and professional associations that provide the networking opportunities (see “Asset Inventory Checklist”).

Finding the connections. The most time-consuming and difficult part of understanding clusters is finding the real interdependencies—the cluster dynamics that produce the flows of ideas and innovations and create the synergies. Sociologists have already developed the methodology but rarely have applied it to clusters (see Appendix B). It requires surveying a sample of members’ relationships to learn, for example:

- to whom companies turn for help with business problems;
- where they would go to see benchmark practices;
- what services and resources they regularly use;
- with whom they trust enough to collaborate;
- in which business or professional associations they are active; and
- on what advisory boards or councils they serve.

The presence of a specialized resource does not necessarily mean it brings value to the cluster. For example, when **Oregon** created the

Oregon Wood Products Competitiveness Corporation, its private-sector board traveled to Sweden to benchmark the competition. A Swedish businessman happened to comment on the corporation’s advantageous proximity to Oregon State University’s wood products R&D center, which none of the Oregon-based companies had used or was aware existed.

Clusters depend on relationships and connections.

Clusters are systems of place-based systemic relationships that provide comparative advantages for companies. The companies that comprise a cluster are determined by relationships that are important to its members’ success. There are three general types of systemic relationships that are based on increasing levels of trust. The first and simplest relationship is to the specialized services, resources, and labor pool that are available where there is a critical mass of customers. This type requires no trust-based interfirm collaboration. The second type is the set of transactions among local firms associated with the buying and selling of products or services. Some transactions may be standard purchasing agreements, but others may be joint ventures that require shared knowledge and trust. The third type is the untraded transaction, which involves sharing information, experiences, and tacit knowledge. This reciprocal relationship often results in innovation and requires the most trust.

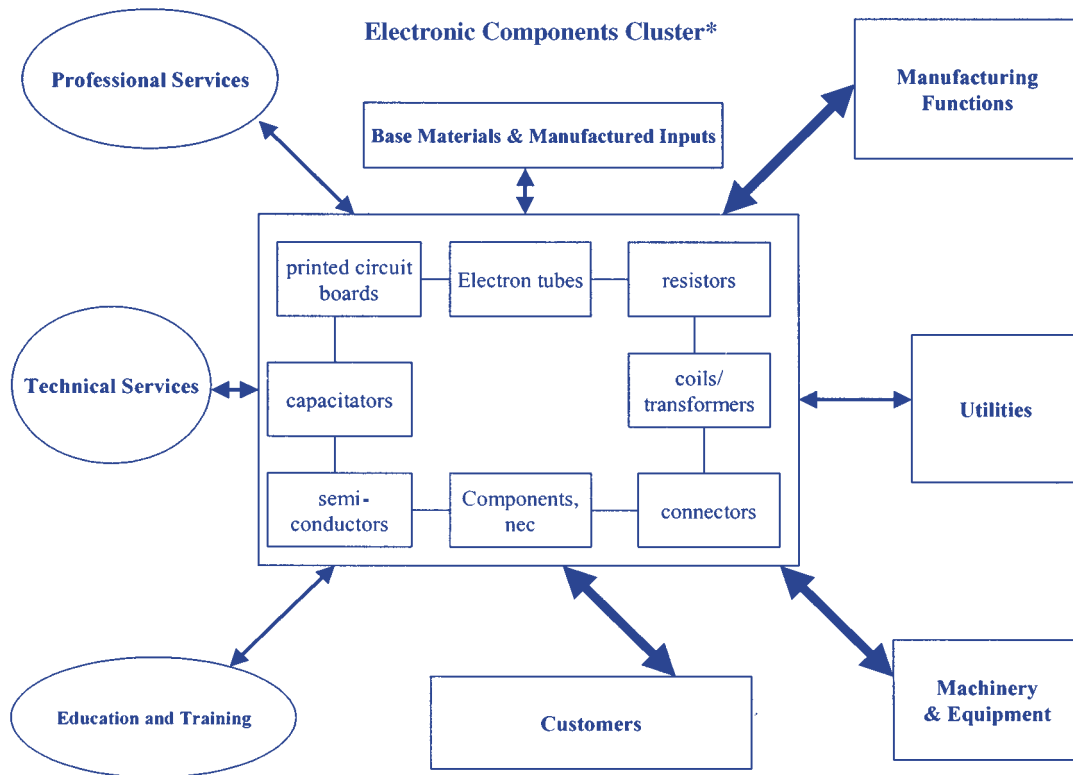
By mapping the intensity of connections, a state can discover how tightly its clusters are bound internally; the degree to which any cluster is connected and dependent on organizations outside the region or to other regional clusters; which intermediaries are most effective; and where better information channels could be useful. These maps would help states establish baseline information and benchmark against other clusters; identify the most active and leading members and networking opportunities; expand membership; pinpoint effective intermediaries; identify information needs;

and illustrate benchmarking and learning paths.

Mapping relationships. Once the members are identified, special resources and services inventoried, and relationships approximated, a cluster can be mapped (see Figure 2). Most mapping efforts skip most of the preliminaries and rely on known or assumed cluster-specific relationships among classes of firms and other organizations. These show what is possible, not what is. A few gather the required data and develop detailed maps. The most common map is a flow

diagram in which boxes symbolize key parts of the cluster—the companies, suppliers, services, supporting institutions, and trade, business, and labor associations—and shows connections by directional arrows. A few use the thickness of the arrows to estimate the intensity of the linkages. Clusters are very complex systems, so these maps are only rough portraits of a cluster. *Remember, the feature that distinguishes a competitive cluster from an agglomeration of firms is what happens between, not inside, the boxes and ovals.*

Figure 2: Electronics in New York’s Southern Tier



Note: * The thickness of the arrows approximates the intensity of the relationships.



Policy Options to Support Competitive Clusters

If clusters represent the way economies are organized, then how can that knowledge be used to devise more effective public policies for creating jobs and raising standards of living? Unfortunately, there is no single “correct” recipe for states to follow that will meet the needs of every cluster in every place. Because clusters encompass so many different types of systemic relationships and industries and function under so many different circumstances, they require individual analysis and customized responses. Fortunately, the cumulative experience of a decade of policy experimentation and implementation in the United States has produced state policy options.

Selecting the policy options to emphasize in each case depends on many factors, including the cluster’s stage of development, state budget circumstances, cluster priorities, and market imperfections and preferences. It is helpful to organize the policy options into four categories that repre-

Clusters require different supports at different levels of maturity. Clusters represent sets of industries that are in different stages of their product and technology life cycles. The stage of development shapes a cluster’s needs and interests and thus how the state should respond. An *embryonic* cluster involves a product or service in an early stage of development, and its social and support structures are also just emerging and underdeveloped. Clusters in this stage may require more support for entrepreneurs, R&D, and seed or venture capital. Once a cluster has developed markets and attracted imitators but retains a competitive edge based on its innovative capacity, reputation, and labor skills, it enters a *growth* stage. This cluster needs the foundations that support expansion and broaden the region’s overall cluster portfolio. It may need entrepreneurial support, product and supply-chain development, and expansion capital.

A cluster has reached the *mature phase* when its process becomes routine, more and more imitators enter the market, and price becomes the key advantage. At this stage, clusters need to modernize with new process technologies, new kinds of marketing, and new product development. When the product becomes replaceable with lower-cost or more-effective substitutes, it enters its *declining phase*. Members of the cluster not locally owned may begin disinvesting while looking for lower-price production sites. Even local companies may encourage their cluster members to pursue careers in more promising industries.

sent the ways a state might:

- organize service delivery;
- target investments;
- strengthen networking opportunities; and
- develop human resources.

The policy options described are specific to clusters and assume certain foundation factors exist to support economic growth in all sectors and in all places (see “State Policy Options”). For example, all companies and their employees need a sound basic education, good transportation infrastructure, reasonably priced public utilities, housing options, shopping, a safe environment, and cultural and recreational amenities. Together, these factors contribute to the quality of life. They are essential to attract and keep talent that is increasingly mobile and can afford to be discriminating in its choice of where to live and work. Nearly all the options have proven successful in one or more places. A few, however, stretch the limits and suggest best practices from other fields or circumstances that could be even more effective if focused on clusters.

State Policy Options

- Organize service delivery around clusters
 - Aggregate, collect, and sort information by cluster
 - Form cross-agency quick-response teams
 - Encourage and support multifirm activity
 - Build incentives for multifirm applications to funding programs
- Target investments to clusters
 - Invest in cluster R&D and innovation
 - Invest in cluster technology centers or parks
 - Support cluster entrepreneurial activity
 - Market clusters and build cluster markets
- Strengthen networking and build bridges
 - Establish or recognize cluster organizations and alliances
 - Facilitate external linkages
 - Encourage cluster communications channels
- Develop human resources for clusters
 - Develop a skilled and specialized labor force
 - Engage community-based employment intermediaries
 - Qualify people for cluster employment
 - Establish cluster skills centers
 - Support regional skill alliances



Organize and deliver government-supported services to clusters

Potentially the most effective but least used policy option available to state agencies is to reorganize and/or deliver their services around clusters. Most government services, from the perspectives of small and mid-sized businesses, are fragmented and poorly coordinated. States offer training, education, financing, technical assistance, research, and marketing support through different agencies. Companies have the difficult, if not impossible, task of sorting out the services, finding what they need, and applying for assistance. Agency officials have the equally thorny task of understanding the special needs of all industries and customers. As an organizing strategy, clusters shift the focus from seeking customers for programs to assessing customers' needs and solving complex problems—from independent to interdependent needs and from individual to collective interests. This requires a coordinated interagency team staffed by people who understand the cluster and can speak its language. One of the early design parameters for the U.S. Manufacturing Extension Partnership (MEP) was that all the interdependent services needed to support modernization would be delivered in a coordinated fashion through a single organizational point of entry. Moreover, these points of entry would develop special expertise around key regional industry clusters.

1. Aggregate, collect, and sort information by cluster

Most states organize and publish economic data by sector and economic region or labor market area, but not by cluster. Various agencies request information and conduct needs assessments, often calling on the same firms. Organizing the data by cluster and coordinating the collection of survey data through cluster organizations would provide useful information to local development agencies, cluster organizations, and service providers and minimize paperwork demands on companies. Historically, states have carried out sector analyses for marketing purposes. Periodic cluster benchmark studies, which some states have already done, offer an even more in-depth and focused analysis of industry trends and needs (see Appendix A). **New York** and northeast **Ohio**, for example, have carried out studies of their key clusters that are descriptive but also analytical. Each study identifies competitiveness issues, needs, strengths, and weaknesses.

2. Form cross-agency quick-response teams

An alternative to the radical restructuring of agencies around clusters is to form teams across agencies to coordinate and customize services for clusters. Many states already use special teams to meet, greet, and woo branch plants being recruited that typically include representatives from community colleges, economic devel-

opment agencies, technology assistance entities, and chambers of commerce. In some states, the MEP sends out teams of individuals with different expertise to conduct its technology assessments of small and mid-sized enterprises. Teams of individuals who know or will invest in learning about the cluster are low-cost means for states to address clusters' needs specifically and systemically.

3. Encourage and support multi-firm activities

Both “networks,” which are multi-firm business activities, and “networking,” which is a process for learning and acquiring information from others, are vitally important but complementary outcomes of competitive clusters. The former is a formally structured alliance of firms; the latter a social phenomenon that finds, moves, and spreads ideas, information, and best practices among companies. Networks require high levels of trust; networking depends on an associative infrastructure.

The roots of many clusters lie in the myriad projects that have encouraged and supported business networks during the past decade. States developed the tools for stimulating and supporting forms of interfirm collaboration that would enable companies to take risks that firms probably would not have taken alone (see Table 3). Cluster-based business associations were considered essential to the success of joint business ventures, and

Table 3: USNet Partner State Members, Business Network Programs, 1993–1998

State	Sponsoring Agency
Connecticut	Flexible Manufacturing Network Corporation
Delaware	Delaware Manufacturing Alliance
Florida	Enterprise Florida
Illinois	Illinois Department of Commerce and Community Affairs
Louisiana	Louisiana Department of Economic Development
Massachusetts	Bay State Skills Corporation
Minnesota	Minnesota Technology, Inc.
New York	Empire State Development
North Carolina	North Carolina Alliance for Competitive Technologies
Oklahoma	Oklahoma Alliance for Manufacturing Excellence
Washington	Washington Department of Community Development
West Virginia	West Virginia Development Office

many of the “networks” formed were membership organizations that functioned very much as cluster councils. The Berkshire Plastics Network in western **Massachusetts**, the Technology Coast Manufacturing and Engineering Network in the panhandle of **Florida**, the Tri-State Manufacturers’ Association in western **Minnesota**, and WoodNet on the Olympic Peninsula of **Washington** were, in effect, cluster councils. The actual interfirm collaboration called “flexible manufacturing networks” were joint business activities among

selected subsets of members to take advantage of concrete business opportunities.

4. Build incentives for multifirm applications to funding programs

One of the easiest ways to encourage collaboration among firms and achieve greater economies of scale without incurring additional costs is to redirect funds to multifirm proposals. In Italy’s Emilia Romagna, the government passed laws to support concentrations or associations of businesses, award grants to consortia of compa-

Elements of Oregon’s Network Programs (1992–1995)

Network “brokers.” The network broker was the key to each network program, serving as external facilitator or systems integrator for network functions. In some instances, the brokers were consultants, but in most cases they worked for agencies already serving small and mid-sized enterprises. **Oregon** designed and hosted a broker training and certification program. (In 1990 **Arkansas** Governor Bill Clinton supported a similar broker training and certified graduate network brokers.)

Multipliers. These are people very familiar with the companies and able to detect and assess opportunities for collaboration that can be passed on to brokers. Referred to as “scouts,” they include staff of banks, law offices, trade centers, trade associations, accounting firms, technical colleges, chambers of commerce, and technology extension services.

Incentives. Oregon offered incentives to compensate small firms for some of the costs of participating in activities with uncertain returns.

Information campaigns. Oregon widely distributed information through the media, brochures, and newsletters on the potential value of networks and about funding opportunities, including regular articles in *Oregon Business*.

nies for technical and managerial training services, provide capital to consortia of small companies, fund groups of



five or more small companies for innovation; and support credit consortia and loan guarantee cooperatives.⁸

Several U.S. federal agencies have similar objectives. The National Institute of Standards and Technology's Advanced Technology Program, the U.S. Department of Labor's Regional Skills Alliance program, the National Science Foundation's Advanced Technology Centers, and the Fund for the Improvement of Postsecondary Education's United States/European Union program all require multifirm and/or multi-institutional collaboration. It would be relatively easy to require peer support networks for entrepreneurial support or to set aside, for example, part of the Small Business Innovation Research program funds or for Small Business Development Centers to support collaborative cluster-based projects by supporting trade show participation by a few companies. *States can examine their competitive programs to determine how incentives for collaboration among firms in a cluster could produce economies of scale for the state and distribute benefits to more firms.*

Target investments to clusters

Directing major investments to a cluster is a common way to build a cluster's reputation and attract additional firms. Some regions have tried, unsuccessfully, to buy a cluster with sufficient investment. **North Carolina**, for example, has reaped

benefits from its investments in biotechnology but not from its investments in semiconductors or in a rural global transportation hub. Clusters' investment needs are very sensitive to their degree of maturity and ability to absorb and use the investments. Embryonic clusters have very different investment needs than mature clusters, and areas with high levels of education have different needs than those with low levels of education.

1. Invest in cluster R&D and innovation

Most of the R&D budget comes from the private sector and federal government. Yet many states have policies to encourage applied research and development and to cost-share other resources, including tax credits and matching grant programs. A state's technological standing is based largely on the amount of R&D dollars it attracts or generates per capita, not on whether the content of the research is related to state or regional needs and interests. Research conducted at universities, for example, is often supply-driven and based on faculty interests, reputation, and grantsmanship. Only a few programs concern themselves with relevancy to regional economies. Investments in cluster-based R&D in the short term can help attract new specialized talent and firms to a state. In the much longer term, such investments may produce new commercial products and generate new companies. According to the Council on Competitiveness, investments in R&D

over many years developed into clusters in, for example, Pittsburgh, San Diego, and Research Triangle Park.

2. Establish cluster-specific technology centers or parks

In the early 1990s, some states invested heavily in cluster-specific technology centers as their technology development policies to develop potential and desired clusters. Some of these risky and high-cost investments paid dividends if the investment was sustained long enough. Chattanooga tried, unsuccessfully, to develop the environmental technology cluster by creating the space, marketing it, and heavily recruiting firms to it. At the same time, the nearby Oak Ridge-Knoxville area did develop that cluster because the technology and expertise were already embedded in the nuclear industry. **North Carolina** has invested more than \$100 million since 1982 in its microelectronics and biotechnology centers. Although the region has never been able to establish a foothold in microelectronics, it has developed a sizable biotechnology industry—that can now claim to be a cluster—based largely on the research strengths of its three world-class universities but organized and supported by a center. **Michigan** has launched a major state initiative to catalyze the development of an alternative energy and fuels cluster based on technological expertise in the state's automotive industry and research universities. The state has established the Michigan NextEnergy Zone, a 700-acre state-owned site

located near Ann Arbor offering special tax advantages to investing companies.

3. Support cluster-based entrepreneurial activity

New business formation may be the most important but least developed cluster-based strategy. The development of most clusters has followed entrepreneurial paths. Employees of one or two large employers have elected to become a supplier to a former employer or to pursue expanding or related opportunities or respond to a corporate downsizing or closure. Entrepreneurship has often been a major part of national and state technology development and innovation strategies, and the commercialization of research and development is widely supported. Yet these policies have rarely taken on an explicit cluster orientation. One notable exception is the Appalachian Regional Commission's Entrepreneurial Initiative, which encourages and evaluates projects that are linked to industry clusters.

In mature clusters, entrepreneurship has not received the attention it deserves. This may be because mature clusters are composed of existing firms that tend to look at new startups as added competition for their markets and workers. In contrast, embryonic clusters include many new and potential entrepreneurs.

Tips for Establishing Cluster-Specific Technology Centers or Parks

- * Go after talent
- * Find anchor tenants
- * Build on existing amenities
- * Be patient

4. Market clusters and build cluster markers

Industrial recruitment remains the most popular rationale among states to identify clusters. The use of designated clusters to recruit businesses turns the "competitive advantage of nations" on its head by making location an advantage rather than an attribute of the industry. Targeting certain kinds of companies helps states apply their most widely used tool more effectively and boosts their chances of success. This represents a relatively easy transition for economic developers already loaded with recruitment tools.

The support structure for a cluster helps induce new investment in the cluster. An objective of **New York's**

1996 strategic plan was to "market itself as a location with important advantages for small and large businesses in its industry clusters." Marketing staff of Empire State Development (ESD) are now assigned on a cluster basis, and the state's strengths are documented in terms of clusters in marketing information. Knowledge of the clusters helps ESD staff tailor the available sites to potential employers. It also helps identify and attract first- and second-tier suppliers that can benefit from closer proximity to large customers.

An even more ambitious goal is to use recruitment as a tool for creating new clusters. It is not uncommon for states to aspire to create clusters out of whole cloth, particularly in the hottest high-technology sectors. States should not assume that clusters exist as economic entities and are about to "locate" somewhere.

Tips for Supporting Cluster-Based Entrepreneurial Activity

- * Attract similar and related firms to business incubators
- * Embed entrepreneurial education into cluster context
- * Establish cluster expertise at small business assistance centers
- * Form networks of entrepreneurs



Policymakers should remember that clusters are bred, not constructed. Most of the world’s successful clusters have evolved through a serendipitous string of events but with strong roots in place. Public policies may have been catalysts for growth, but usually inadvertently and rarely with the intent of starting a cluster. The growth of the largest clusters has been driven by market demand and entrepreneurial drive. Some clusters began as large companies that originally located in less-populated areas to take advantage of low wages and surplus labor markets and that later disintegrated into smaller firms. This scenario describes the origin of the furniture manufacturers in Tupelo, **Mississippi**, and County Monaghan, Ireland. Others were created by transforming a common local craft into a related value-added cluster, such as straw hats into fashion knitwear in Carpi, Italy, or plastic combs into more advanced plastic parts in Leominster, **Massachusetts**. Still other clusters develop because other places do not want them. Prisons, for example, tend to cluster, as in the northern parts of **New York** or western reaches of Palm Beach County, **Florida**.

However, some regions have succeeded in seeding clusters via recruitment and incentives, usually in weak economies and usually at a high cost. A good example is the auto industry, where companies have agreed to use local supply chains in return for a large number of government incentives and regions have designed policies to develop and embed supply chains. The auto supplier clusters in central **Kentucky** or southern Wales and electronics in Ireland were largely inward-investment driven clusters. Table 4 summarizes the origins of a sample of clusters.

Table 4: Origins of Clusters

Place	Cluster	Year	Originator	Attraction	Growth
Aalborg, Denmark	Mobile telecomm.	1948	SP Radio	Marine industry	Spinoffs, technology, university connections
Dalton, Georgia	Carpets	1918	Craft tufters	Serendipity	Automation, spinoff competitors
Castel Goffredo, Italy	Hosiery	1923	Noemi located plant	Markets	Plant closed, employees buy equipment
Ibi, Spain	Toys	1915	Paya Hermanos S.C.V.L.	Home	Spinoffs of different products
Los Angeles, California	“Toytown”	1968	Immigrant wholesaler	Distribution hub, low costs	Attract new immigrant entpren., design college
North Central Massachusetts	Plastics	1760s	Noyes, shell comb production	Serendipity	Entrepreneurial apprentices, celluloids, new products
San Diego, California	Biotech/ pharmaceutical	1950	Scripps, Scripps Institutes, UCSD, Hybritech	Naval base, climate	New product spinoffs, venture capital
Saussoulo, Italy	Ceramic tiles	1600s	Rubbiani	Clays	Innovations, competitors, value added chains
Scotland	Electronics	1940s	British military electronics	Isolation from attack	Inward investment, government R&D
Lahti, Finland	Furniture	1918	Asko Furniture Oy (1918) & Isku Oy (1928)	Birch, skills, craft education, transport	Specialization, modernization*
Tupelo, Mississippi	Furniture	1948	Futorian located plant	Labor, lumber	Entrepreneurial employees, Recruitment of suppliers*
Springfield, Massachusetts	Metals	1816	Springfield Armory	Water power, ease of logistics	New production methods*

* Challenged by global competition, employment currently in decline.

Strengthen networking and associative behavior

One of the most important attributes of a successful cluster is an associative infrastructure that provides opportunities for members to get to know one another, share ideas, learn, and develop trust. The relational assets, or “social capital,” of a cluster depend on trust and the frequency and depth of personal exchanges (see “Illustrative Measures of Social Capital”). American companies, despite their inclination to join various associations, for the most part are inactive participants. Businesses and individuals are more apt to join organizations for political influence than commercial or intellectual opportunity. Thus it is not surprising that most state cluster initiatives begin by creating, enlarging, or empowering organi-

zations with economic goals so learning and networking can be enabled or accelerated.

1. Reestablish or recognize cluster associations and alliances

An organizational identity is essential to launching cluster strategies (see “Cluster Organization Checklist”). The first state cluster associations were convened in the early 1990s by cluster programs in **Arizona** and **Oregon**. In both early implementer states, the governors recognized the clusters. That official acknowledgement gave them the impetus they needed to attract a core group of members and resources. If a trade association or business organization with offices and staff within the region already represented a cluster, as with **North Carolina**’s hosiery and **Oregon**’s software clusters, the association or

Cluster Organization Checklist

- ✓ Cluster identity and government recognition
- ✓ Corporate status
- ✓ Strong business leadership
- ✓ Active recruitment of members
- ✓ Clear mission, goals, and plan
- ✓ Dedicated staff
- ✓ Interactive Web portal
- ✓ Dues structure or plan for revenue generation
- ✓ Real services
- ✓ Frequent professional and social activities

organization was given the opportunity to represent the cluster. If no appropriate trade or business organization existed, state officials urged interested companies to form one.

In addition to their value to members, cluster organizations can help state government better assess the needs of the state’s economy and target state resources. Most cluster councils begin by identifying and articulating members’ most pressing needs and serving as a point of contact for government agencies and service providers. Most often members cite human resources as their most pressing need. In **Mississippi** the first collective activity of the communications and information technology cluster was to contract for an analysis of the cluster’s workforce needs.

Illustrative Measures of Social Capital

- Number of business or trade associations
- Membership, local meetings per year, and average attendance
- Number of initiatives adopted and number implemented by associations
- Amount of resources shared, by type, by members of association
- Civic leadership positions among businesspeople
- Business membership on boards of directors of service institutions or agencies
- Frequency of contractual and noncontractual networks
- Giving and volunteering among businesses
- Surveyed estimates of trust

Source: Carlos Roman, Learning to Innovate: The Role of Social Capital (Seville, Spain: Institute for Regional Development, University of Seville, 2001).



The association leadership is critical to the success of a cluster council. Directors are expected to increase membership, generate revenues, build recognition, and facilitate networking activities. Clusters that have organized themselves into some association or use existing associative venues to actively promote networking often develop additional services for firms willing to cooperate. For example, the new testing lab that the hosiery cluster in **North Carolina** established gives companies access to sophisticated equipment that no single firm could afford. By the late 1990s, when the value of social capital was better understood, cluster councils worked harder at creating opportunities for companies to network, form relationships, and make deals. The Carolina Hosiery Association's social committee organizes study tours, family barbecues, golf tournaments, and NASCAR entries. An effective cluster association is active on various fronts so it appeals to all members and draws them back.

It is extremely important not to confuse the organization that represents the cluster with the cluster itself. Proximity and systemic relationships define membership in the cluster. Some established clusters may already have well-established and effective informal social infrastructures based on long-time business connections, friendships, churches, schools, or civic associations. Firms that decline to join associations are still in the cluster and get most of the external economies as

The Connecticut Plastics Council. In the early 1990s, as Connecticut was starting up its technology extension program, an agent approached six companies in the Naugatuck Valley to discuss options for working together on modernization issues. To modernize they knew they also needed to upgrade the skills of their workforce. In 1994 the six plastics firms received a \$500,000 grant from Connecticut's State Technology Extension Program (ConnSTEP). By the end of the grant, members had realized sufficient value to cause them to want to stay together as a network. Although the cluster concept had not yet hatched there, the companies knew they needed an active association and set out to form one. The turning point for the network occurred in 1996, when it hosted a seminar in Hartford to describe barriers to growth and showcase their capabilities. When more than 200 legislators, officials, and friends attended, they recognized their collective political strength. As a result, the firms became the Connecticut Plastics Council, growing to 48 members along the Route 8 corridor from Bridgeport north and incorporating in 1997 as a tax-exempt, nonprofit statewide corporation (visit <http://www.ctplastics.org/>).

“free riders.” The risk in putting too much emphasis on an organization is it becomes confused with the cluster itself, and success becomes defined by the membership or income growth of the council rather than the cluster. As Michael Enright told an audience in Tucson, Arizona, in November 2001, not distinguishing between clusters and cluster organizations risks the following kinds of erroneous and dangerous beliefs.

- “Of course we're part of the cluster, I attend every meeting.”
- “Our industry wanted to be a cluster, but the government did not approve us.”
- “Our cluster is very successful; we received X million dollars in government funding last year.”

A Rural Cluster Association. A small group of metals manufacturers located across a region of western **Minnesota** near the **South Dakota** and **North Dakota** borders wanted a forum to discuss common concerns. With support from a foundation's network program, they formed the Tri-State Manufacturers' Association headquartered in Elbow Lake. The six founding firms expected their network might, with luck, reach about 20 companies. Yet once they began organizing meetings, dozens of firms appeared, and Tri-State now has more than 100 members in a radius of more than 75 miles. The association hired an executive director from industry, and members set out to market themselves collectively. One of the first goals was to meet their customers' ISO 9000 quality requirements. Members formed networks to prepare for certification, coach one another, and audit one another's processes. Tri-State also organized a for-profit subsidiary for joint product development.

2. Facilitate external connections

Intercluster connections are as important as intra-cluster connections, especially for benchmarking global competition. Poorer regions and smaller companies, in particular, have limited access to global benchmark practices, innovations, and markets. Clusters that focus exclusively on internal linkages cut themselves off from sources of new knowledge and technology. The Swiss watch industry is an example of a world-renowned

Traveling and Learning. In 1996 a dozen hosiery company owners and managers, Carolina Hosiery Association officials, community college technology center staff, the governor's economic advisor, the director of the state technology agency, and the author traveled to Castel Goffredo and Carpi in northern Italy. The purpose was to meet with and benchmark the hosiery cluster's European counterparts and visit their technology and research centers, trade associations, and tool builders. Following the group's return from that eye-opening trip, the companies, through their association, revamped their technology center at the college. They added research and training for dying as well as marketing and product testing capabilities. They also formed an R&D network with North Carolina State University in which 20 members contributed matching funds or other resources to develop a key technology; established links to the main machine builders in Brescia; and organized export networks.

Tips for Facilitating External Connections

- Organize and leverage study tours
- Conduct international benchmarking
- Formalize intercluster networks
- Support global searches for innovations
- Encourage participation in national and global professional associations

cluster in fine watch manufacture that refused to connect to the Japanese chip industry, held fast to its own mechanical technologies, and missed the shift to digital watches.

The world's most successful clusters include lead firms that are part of global networks and encourage employees to take part in international professional associations and networks. The Internet can complement but not substitute for the value of direct experience and extended personal relationships. States should help companies make connections by encouraging and supporting collective travel, study tours, trade missions, and research networks. In most instances, the opposite occurs—travel for the sake of learning or exploring new markets is discouraged and even disparaged. Firms that have been able to travel to other places and observe their competitors have been dramatically affected by the experience (see “Traveling and Learning”).

3. Encourage intercluster communications channels

Effective cluster organizations communicate frequently with customers, members, and friends through formal channels, such as newsletters, magazines, phone chains, and Web sites. Some have used very simple methods. In the mid-1990s, the Technology Coast Manufacturing and Engineering network passed out “deal-making sheets” at their events to make it easier for firms to find partners and suppliers. The Internet, however, has led clusters to create quite sophisticated communications systems. Because communications systems can bring new business to a state, governments have a reason to support them.

Mississippi's communications and information technology clusters (www.CIT.ms) has a new Web site that includes member company skills, profiles, services, and certifications and provides a partnering format. The Web site of **North Carolina's** hosiery

Legsource Web Site: Sample Communications from a Production Planner

Report for Bob @ Top Gun Hosiery

1. XYZ Mill needs 5,000 dozen 84-needle link and link production, e-mail frank@XYZ.com for details.
2. Big Mill needs 500 dozen cushion cotton women's 9–11 crew socks immediately, e-mail sally@bigmill.com today!



cluster, called the Legsource Information Network, has a manufacturers' database about products, contacts, and capabilities; a supplier database; and a clearinghouse for business opportunities, personnel, job postings, and new technologies (visit www.legsource.com). The cluster created this well-used site with support and funding from the state university and the National Institute of Standards and Technology.

Develop human resources for clusters

Nothing is more important to clusters than the development of their human resources, and in no area are they more dependent on the state. States are the biggest investors in education and training. Since the 1950s, they have linked vocational education and customized training to their economic development efforts, providing subsidies to new and expanding industries. Yet few states have tried to provide the specialized skills that clusters value. Companies value access to a labor pool that is familiar with the operations of their businesses and able to apply their skills in the particular work environment of the cluster. Employers also want “commodity skills” that are easily transferable, but the “leveraged skills” that are industry-specific are scarcer.⁹ Firm-specific “proprietary skills” that are learned on the job are even scarcer; these skills entail how companies build internal intelligence, but also

how knowledge “leaks” between firms when people change jobs.

1. Develop a more skilled and specialized labor force

The context in which learning occurs matters. Educators classify their programs by occupation, but the skills used in the workplace are defined by the context in which they are applied. The context varies from industry to industry, from small firm to large firm. The network administrator working in a division of a large multinational corporation, a government agency, or a small service company have different skill requirements and must operate in a different business culture. **Mississippi** employers comment that they expect more knowledge of “industry practice,” that they expect their employees to “understand the information technology sector and its paradigm shifts,” and that they want schools to “learn more about the business for which they’re providing the training.” Further, a worker in a small firm is likely to have to work directly with a more diverse set of customers, work on small office systems, work within budgets, and be much more flexible.

The cluster as context can be adopted throughout the education system, including elementary and secondary schools, to make the learning more meaningful and introduce youth early to the economy. By designing curricula around the workplace and business of firms in a local cluster, learners can come to appreciate the value of the

cluster, understand more about their regional environment, and perhaps be more inclined to follow career paths in the cluster. At the same time, contextualized education has been shown to raise school retention rates and education achievement levels by making the content of the education more relevant to a locality.

2. Establish Cluster Skills Centers

Rather than expecting every technical and community college to meet the specific needs of all businesses, states could designate centers of excellence around clusters. Cluster skills centers could become the lead entities for surveying industry needs, developing new curricula, staying in touch with cluster councils, updating skill standards, benchmarking practices in other places, and collecting information about cluster occupations and programs. The center’s principal goals are to give students a solid contextual and systemic knowledge and technical skills that relate directly to a cluster (see “Characteristics of Cluster Skills Centers”).

Skills centers can serve as gateways, for example, to help firms bombarded with more information than they can handle determine which training programs are the most familiar with the industry and have the most relevant staff experience, latest technologies, and best track record. Centers also provide onsite outreach and access to socially excluded populations.

This need not be a bricks-and-mortar center, but it could take the form of a virtual center that would organize teams from various colleges to work on specific problems, conduct R&D, or develop curricula—with all products and information available statewide. Such an approach has been designed for, but has not yet been implemented in, **North Carolina's** community college system.

3. Qualify people for employment

The first major hurdle for people lacking relevant work experience is a record of basic educational and/or skill attainment to qualify them to climb onto the first rung of a career ladder. Few employers in value-added clusters will hire a person with less than a high school education, and an increasing number want some postsecondary education or certification. Yet dropout rates in some city school sys-

Characteristics of Cluster Skills Centers

- Is cluster-based, not technology-based
- Emphasizes industry-specific knowledge
- Provides critical links to industry associations
- Uses business, not equipment, as context
- Functions as information repository and information portal
- Stresses staff and curricula in budget, not bricks and mortar
- Shares curricula and information statewide and trains faculty from other places
- Has lead responsibility for cluster needs assessments
- Works with cluster association on skill standards and certifications
- Provides outreach to socially excluded populations

tems approach 50 percent. Raising educational levels has long been considered fundamental to achieving a region's social and economic goals, but the aging of the skilled labor force is making it a necessity. Community colleges are the open-door institutions that serve most low-income people and are a primary resource for basic

and mid-level job skills. Ensuring everyone has an opportunity to get through a technical career program, however, requires considerable basic education and institutional support. Programs such as Community College Career Pathways in Chicago, **Illinois**, and at Portland Community College in **Oregon** work with employers to create modular programs to move individuals from any point toward a marketable credential.

Cluster connections have the potential to strengthen entry-level programs. The most effective preemployment and employment programs embody real experiences and are directly linked to good jobs. Focusing efforts on clusters introduces reality and context into the education and aligns the programs with actual workplace needs. Readiness and basic skills programs that teach in the context of the cluster can accomplish both at

Mine Maintenance Training Program. Nevada is the world's third largest producer of gold, which is mined mainly in the sparsely populated northeastern part of the state. That industry, despite falling prices, is the region's economic engine. Yet skilled workers in occupations critical to the success of modern-day mining's sophisticated operations are scarce. The primary source is Great Basin College (GBC) in Elko, which serves a five-county region that is geographically larger than Indiana but has only about 70,000 people. To create a pipeline of qualified technicians for the industry, GBC created the Mine Maintenance Training Program, a collaborative effort between the college and cluster. It began in the late 1980s, when high prices and new technologies expanded employment to 2,700 employees. The program condensed scheduling and added flexibility and greater industry participation. The industry went so far as to form an independent, nonprofit entity to coordinate industry involvement. Companies offer scholarships to students who work for summers at the sponsoring company, attend classes full time for a semester, and then spend a fourth of their time at school and the rest at work for the remaining 1.5 years. After two years, students earn an associate of science degree.



once. Even the most basic programs, such as vocational English, can be taught more effectively if the vocabulary relates to the terms the cluster uses.

4. Engage community-based employment intermediaries

Much of the responsibility for preparing low-income and unemployed people for employment with career advancement has been delivered or coordinated by sectoral workforce development intermediaries—supported mainly by private foundations. The Aspen Institute’s in-depth study of six programs found that 87 percent completed their training and, on average, participants increased their earnings by 41 percent in one year. The best sectoral organizations are more than brokers or bridges between disadvantaged communities and industry; they help articulate career paths and advancement opportunities, develop standardized industry

The Jane Addams Resource Corporation (JARC) in Chicago, **Illinois**, works in collaboration with small and mid-sized companies to help low-income people obtain decent employment and move up career ladders in metalworking industries. JARC offers a range of training, from preemployment training to advanced technology skills training. It also helps organize companies into networks.

The Garment Industry Development Corporation (GIDC) was started in 1984 as a tripartite effort of government, industry, and labor to help New York City, **New York’s** struggling garment industry, an important source of employment for low-income people. Yet GIDC also sought to introduce systemic changes in the industry that would improve wages and career opportunities. The corporation became a catalyst and information broker, helping to identify new markets and introducing more modern production technologies and methods. In addition, GIDC focused on getting unskilled, displaced, and immigrant workers ready for the new workplace.

training, establish standards for job quality and working conditions, assist with market coordination, broker business networks, and help develop strategic plans.

Successful intermediaries employ staff with solid cluster experience and expertise who understand employers’ needs but also have the trust of the communities they serve. Staff members also recognize the importance of connections. In any economy, whether

skill-based or knowledge-based, people get ahead based as much on whom they know as on what they know because hiring decisions rely on referrals and informal networking. In Silicon Valley, private-sector intermediaries, including temporary help agencies, workforce investment boards, and professional associations, help with the initial contacts for those seeking new or different jobs.

Tips for Qualifying People for Employment

- * Create career paths and ladders
- * Use cluster context for adult basic education and English-as-a-Second-Language programs
- * Establish short modules that reward accomplishment and can be aggregated
- * Work with workforce investment boards

Supply-Chain Training Associations

in Wales. In 1995 the Welsh Development Agency (WDA) led inclusive regional innovation planning processes under a grant from the European Union. One of the resulting plan's cornerstones was to form "supply-chain associations" that would help keep manufacturing operations in the region as well as make the area more attractive to future investors. The goal was to forge stronger links along regional supply chains by providing high-level training. One partnership aimed to increase the quality of components and services provided to AIWA by its Welsh suppliers. Fifteen companies that supply AIWA with packaging, metal pressings, plastic moldings, and printed matter joined the alliance. These partnerships are sponsored by WDA, the lead company, and the Welsh Training and Enterprise Councils (now the Welsh Learning and Skills Councils). The councils finance half the training costs.

5. Support regional skills alliances

Regional skill alliances (RSAs) are networks of firms that come together to acquire—or reduce the costs of—incumbent worker training programs. **Connecticut**, for example, had funded eight of these regional alliances, which it calls "training networks," as of February 2001. They included the Metal Manufacturers Training and Education Alliance (11 members), Housatonic Education for Advanced Technology (7 electronics companies), the Fairfield County Information Technology Consortium (8 information technology companies), and the Connecticut Association of Metal

Finishers (6 finishers). Broad-based RSAs also include the public sector, education and training organizations, and, frequently, organized labor. The most common cause of an alliance's failure is poor choice of vendors. Clearly, the vendor must have the capacity to provide the training—the required expertise and familiarity with the industry. The vendor must know its customer and be flexible enough to offer training where and when the customer needs the training.

The state, along with its economic mission, has social and civic responsibilities that include ensuring its policies ultimately have a chance to benefit all regions and all segments of the population. Consequently, new economic policies have social as well as economic outcomes. To date, most of the impacts of cluster policies on equity have been incidental, not intended. A scan of numerous cluster analyses and studies found few references to distributional or social outcomes according to wealth or examples of specific actions aimed at reaching low- and middle-income populations. This is not surprising because clusters, by definition, are demand-driven, and companies act in their own best interests. Any efforts to address equity concerns must also advance companies' profit goals.

Perhaps the question should be turned on its head. If clusters are not easily able to incorporate equity goals, can state policies that explicitly address equity be more effective if they are integrated into a cluster framework? Will programs charged with addressing social ills and low employment be more effective if they are structured around and connected to clusters?

The following policy options, which are aimed at low- and middle-income people, begin with ways to raise skill levels and get better connected to clusters, including learning from and linking clusters more closely with community-based sector strategies. For weak regions, policy

options include investing in regional alliances, redirecting products and skills embedded in mature clusters toward higher-growth products and services, and strengthening entrepreneurial support networks.

Engage community-based employment intermediaries

Many sector-based workforce development intervention strategies supported by private foundations have successfully prepared low-income and unemployed people for jobs with career ladders. Although sectors and clusters are not exactly the same, they overlap and many sectors have worked successfully with groups of industries in geographic regions that act like clusters.

The best sector-specific organizations, which employ staff with cluster experience and expertise, serve multiple cluster-based functions. They articulate career paths, develop standardized training for an industry, establish minimum standards on job quality, assist with market coordination, do research and development, build networks, and develop strategic plans.

The best intermediaries also recognize that in any type of economy, people get ahead based as much on whom they know as on what they know. Hiring is based on referrals and informal networking, business deals are consummated in bars and coffee shops, and certain club memberships open doors not open to others.

Support industry associations and intermediaries in distressed regions

Weak economies need more than a cluster organization to articulate their collective needs, influence policy, and provide networking. They need someone to deliver services and help them restructure. Cluster organizations in distressed regions have a much bigger challenge and play a more active role in solving problems and delivering services. Some of the most lasting successes in network-building occurred in the early 1990s, when the nation was still in a recession. Many of the networks were disguised cluster strategies in regions with mature industries that were losing their competitive advantages. State and foundation grants helped establish membership organizations to build social capital, provide services, and broker networks. The five regional alliances funded by the Northwest Area Foundation in the mid-1990s targeted clusters in five economically distressed rural regions that would generate sales and create jobs.

The regional alliances operate as business-led associations and intermediaries with a special emphasis on challenged companies and places. They afford their members economies of scale by sharing costs and more confidence by sharing risks. Appalachian by Design in **West Virginia**, the Northeast **Oklahoma** Manufacturers

Council in Okmulgee, and ACENet in southeastern **Ohio** are sustainable cluster initiatives that been able to affect their economies.

Encourage civic responsibility among clusters

The hard facts of economic survival suggest that businesses are not fundamentally altruistic. Yet it is often quite easy to find economic value in actions that benefit disadvantaged people and places. First, companies need a continual supply of employees. With birth rates down and the educational aspirations of youth rising, shortages of workers for entry-level positions exist even in a slow economy. Second, community standing affects the balance sheet by improving the company's image. This can be translated into sales, which is why large corporations have community relations offices. Third, the quality of life in a place is

Appalachian by Design (ABD) is a network of home knitters created in 1992 by a community-based organization in West Virginia in response to few job opportunities and high unemployment among rural women. ABD is a loose network of home knitters that finds markets; works with customers such as Esprit and Soleil; schedules and manages production, quality control, and distribution; and provides training. Although the alliance is headquartered in Lewisburg, different areas statewide are organized into self-help teams to support one another (visit <http://www.abdinc.org>).

one of the most important factors in attracting talent, and the wealthier and better educated the entire community, the more attractive it is.

Moreover, the more socially active the cluster, the greater its sense of collective civic responsibility, in part because the individual actions of members become more transparent to friends and neighbors whose friendships are valued. Cluster organizations increase the likelihood of a collective conscience. *Joint Venture*, Silicon Valley's February 2002 newsletter, invited members to take part in two upcoming corporate workshops on the value of the "Triple Bottom Line" for businesses and ways to develop consistent policies and practices.

To encourage social responsibility, the civic and nonprofit sectors can be engaged in more direct ways with cluster organizations and cluster organizations can be persuaded to introduce civic goals into their agendas. This can best be done by getting the cluster associations to recognize associate memberships or to create working committees on common issues with nongovernmental organizations.

Provide incentives and subsidies to encourage employment of low-income people and in distressed regions.

Incentives to influence private-sector behavior are not new to state government. In 1983 the Advisory Commission on Intergovernmental Relations listed 21 states with special grants or loans to businesses in distressed, blighted, or impoverished areas.¹⁰ Subsidies such as tax breaks, government-sponsored training, and loan guarantees can, at least at the margins, alter bottom-line decisions. These same programs can be directed to develop or revitalize clusters in similar regions. Similarly, states operate federal training programs for low-income and dislocated workers that could be structured to match the needs of clusters. Subsidies for preemployment and employment training that reduce employers' risk by preparing the workforce can influence hiring decisions. Once the door is open, people have the opportunity to prove themselves and build contacts that can have lasting impact.

Associative behavior: Reliance of companies on one another for assistance in carrying out their business activity and the cultural norms of reciprocity—the active dimension of social capital.

Bubble chart: A graph that displays three or more measures of cluster scale and activity. The axis represent two variables and the size of the circle around the point on the graph, or the “bubble,” represents a third.

Business network: A contractual alliance or membership organization in which some firms agree to share resources, costs, or information. Cooperation and some level of trust is required. Networks are often, but not necessarily, embedded in clusters.

Cluster: a geographically limited critical mass (i.e., sufficient to attract specialized services, resources, and suppliers) of companies that have some type of relationship to one another—generally a complementarity or similarity in product, process, or resource.

Cluster associations: A membership-based organization of cluster members that can collectively represent the needs and interests of members, provide services, and/or help members network.

Cluster breadth: The range of industries related by common products, technologies, distribution channels, and end users.

Cluster depth: The range of vertically integrated industries, such as components, parts, materials, equipment manufacturers, and support services.

Contextual education: Education in which practical applications related to a specific work environment explain and demonstrate theories.

External economies (externalities): Cost reductions from increases in the demand for valued services or resources. These economies are often discussed as “localization economies,” where benefits accrue to firms because of the clustering of similar firms, and “urbanization economies,” where benefits are associated with population density.

Innovation: The transformation of knowledge into new products, processes, and services. The act of using something new. The innovation process includes the steps from conceptualization to utilization.

Innovation system: Elements (businesses, agencies, associations, etc.) and the relationships among the elements that interact with production, diffusion, and use of new and economically useful knowledge encompassed within specified geographic boundaries.

Intermediaries: Organizations that improve the flow and exchange between and among the final product or service elements of a cluster and its support resources.

Knowledge clusters: Specialized networks of innovative interrelated firms that derive competitive advantages among local actors through accumulated, embedded, and imported knowledge about highly specific technologies, processes, and/or markets.

Location quotient: The ratio of the relative concentration of establishments or employees in a cluster to total establishments or employees in the economy divided by the same relative concentration in the larger economy (state or nation). A location quotient of 1.0 represents average concentration; a quotient greater than 1.0 represents a higher concentration; and a quotient less than 1.0 represents a smaller concentration.

Networking: Informal interactions and relationships among firms and support organizations that are not contractual or membership-based. They imply something more than simple proximity to like or related firms and deliver more than external economies.

Network broker: An individual or organization that facilitates joint actions among groups of companies.

Region: A geographically bounded territory that has a common hub, labor market, or source of economic growth.

Sectoral programs: Workforce development programs run by nonprofits that address the needs of workers and employers in specific groups of industries.

Social capital: Stocks of social trust, norms, and networks that people can use to solve common problems.

Networks of civic engagement, such as business and neighborhood associations and cooperatives are an essential form of social capital. The denser these networks, the more likely members of a cluster will cooperate for mutual benefit.

Supply (or value-added) chains: All of the companies in the production stream that make the individual systems, parts, and services that are incorporated into a final product purchased by an end customer or user.

Tacit knowledge (know-how): The knowledge acquired directly through interactive learning embodied in people and organizations, is context-dependent, and cannot be articulated and codified.



Resources on Cluster Methodologies

Aspen Institute. *Sectoral Employment Development Learning Project*. Washington, DC: Aspen Institute, 2000. Available at: <http://www.aspeninstitute.org/eop>.

Bergman, Edward and Edward Feser. *Industry and Regional Clusters: Concepts and Comparative Applications*, 1999. Available at: <http://www.rri.wvu.edu/WebBook/Bergman-Feser>, 1999.

Business Clusters in UK Cluster Mapping Project. United Kingdom. Available at: <http://www.dti.gov.uk/clusters/map/>.

Clustering Alliance, Clusters Asia Pacific Inc. For subscriptions contact apd@orac.net.au.

Council on Competitiveness. *Clusters of Innovation: Regional Foundations of U.S. Competitiveness*. Washington, D.C.: Council on Competitiveness, 2002.

Cortright, Joe and Andy Reamer. *Socioeconomic Data for Understanding Your Regional Economy*. Washington, D.C.: U.S. Economic Development Administration, 1998.

Harvard Business School, *Cluster Mapping Project*. Available at: <http://www.isc.hbs.edu/econ-clusters.htm>.

Henton, Douglas, John Melville, and Kimberly Walesh. *Grassroots Leaders for a New Economy*. Jossey-Bass, 1997.

Redman, John. *Understanding State Economies through Industry Studies*. Washington, D.C.: National Governors Association, Council of Governors' Policy Advisors, 1994.

Regional Technology Strategies. *Networking Toolkit*. USNet, Carrboro, N.C.: Regional Technology Strategies, 1997. Available at: <http://www.rtsinc.org>,

Regional Technology Strategies. *Show Me the Money: Business Opportunity Networks*. Carrboro, N.C.: Regional Technology Strategies, Inc., 1997. Available at: <http://www.rtsinc.org>.

Rosenfeld, Stuart, et al. *A People's Guide to Clusters*, Regional Technology Strategies and the Ford Foundation. Available (summer 2002) at: <http://www.rtsinc.org>.



Selected Cluster Web Sites

A. Support Organizations and Research

Appalachian Regional Commission

<http://www.arc.gov/programs/reginit/enteverly/entre-pix.htm>

Biomed clusters worldwide

<http://www.zurichmednet.org/clustersworld.html>

Industry and Regional Clusters: Concepts and Comparative Applications

www.rri.wvu.edu/WebBook/Bergman-Feser

Cluster Navigators (New Zealand)

www.clusternavigators.com

Council on Competitiveness

<http://www.compete.org>

Competitiveness Institute

<http://www.competitiveness.org/home.htm>

Collaborative Economics

<http://www.coecon.com>

Industrial District Club of Italy

<http://www.clubdistretti.it>

Initiative for a Competitive Inner City

<http://www.icic.org/home.html>

National Commission on Entrepreneurship

<http://www.ncoe.org>

National Network of Sector Practitioners

<http://www.nedlc.org/nnsf>

New South Wales, Australia Learning Network Protocol

<http://www.cpsc.nsw.gov.au/roundtable/docs/ln-protocol.pdf>

Regional Technology Strategies

<http://www.rtsinc.org>

Organization for Economic Cooperation and Development LEED program

<http://www.oecd.org/tds/LLEDonline/1.htm>

University of North Carolina cluster course

<http://www.unc.edu/depts/dcrpweb/courses/261/leeven>

The World Bank

<http://www.worldbank.org/urban/led/cluster.html>

B. State/National Cluster Programs

California

<http://typhoon.sdsu.edu/sdeimp/voli.pdf>

Connecticut

<http://www.state.ct.us/ecd/Clusters/default.htm>

Florida

http://www.eflorida.com/all_key.html

Massachusetts

<http://www.mtpc.org/theindex/Dec98forum/sld029.htm>

United Kingdom

<http://www.dti.gov.uk/clusters/map>

Upper Austria

<http://www.tmg.at/defaulte.html>



Wisconsin

<http://www.wisconsin.edu/summit/archive/2000/papers/all.htm>

C. Local/Regional Clusters

Chattanooga

http://www.Chattanooga-chamber.com/porter/art/CRGI_report.pdf

San Diego

<http://www.sdrta.org/sdrta/home/home.html>

Silicon Valley

<http://www.jointventure.org>

Pittsburgh

<http://www.heinz.cmu.edu/ced/topics/t4inc2/cluster.html>

Rochester, New York

<http://www.connectrochester.com/success.htm>

Tucson, Arizona

<http://www.futurewest.com>

Washington Software Alliance

<http://www.wsal.org>

Wellington, New Zealand

http://www.smartwellington.co.nz/smart_industries/p3_1.htm

Western Tier New York

<http://www.develop-wny.com/regional/economics.html>

D. Cluster Web Sites

Connecticut Plastics Council

<http://www.ctplastics.org/>

Mississippi Communications and Information Technology Council

<http://www.cit.ms>

North Carolina Hosiery Association

<http://www.legsource.com>

Northeast Oklahoma Manufacturers Council

<http://www.ocevnet.org/neomc/>

Washington Software Alliance

<http://www.wsal.org>

Endnotes

- ¹ There have been notable exceptions around technology in the past two decades, such as Ohio's Edison centers.
- ² Rosabeth Moss Kantor, *World Class* (New York, N.Y.: Simon & Schuster, 1995).
- ³ Jane Jacobs, *The Nature of Economies* (New York, N.Y.: Modern Library, 2000).
- ⁴ Gary Anderson, "Industry Clustering for Economic Development," *Economic Development Review* (spring 1994): 26–32.
- ⁵ Steven A. Waldhorn, Edmund A. Eagan, and Gene Park, *America's Regions in the Global Economy: A New Framework for Metropolitan Economic Strategy*, unpublished report from the ICF Kaiser International Economic Strategy Group for the Office of Policy Development and Research, U.S. Department of Housing and Urban Development, Washington, D.C., 1998.
- ⁶ Michael E. Porter, *Cluster of Innovation: Regional Foundations of U.S. Competitiveness* (Washington, D.C.: Council on Competitiveness, 2001).
- ⁷ Edward. M. Bergman, E.J. Feser, and S. Sweeney, *Targeting North Carolina Manufacturing: Understanding a State Economy Through National Industrial Cluster Analysis*, IIR Research Report 55 (Vienna, Austria, Vienna University of Economics and Business, 1997).
- ⁸ Emilia Romagna, "Laws and Regulations," unpublished document, Bologna, Italy, 1990.
- ⁹ Thomas A. Stewart, *Intellectual Capital: The New Wealth of Organizations* (New York, N.Y.: Doubleday, 1998).
- ¹⁰ Peter K. Eisinger, *The Rise of the Entrepreneurial State* (Madison, Wis.: University of Wisconsin Press, 1988).



Appendix A: Benchmarking Guide for Clusters

Factor	Description	Typical Measures/Proxies
R&D capacity	Institutes of public or private research in areas related to cluster's products or processes; Expert individual researchers that are available or accessible	R&D expenditures from government and private sources that involve cluster members, products, or processes
Workforce skills and availability	Degree to which labor force skills are tailored to the cluster's needs (i.e., technical skills, general knowledge of the industry, and entrepreneurial skills)	Number of enrollments in relevant programs; Graduates hired by cluster
Education and training	Education and training for the cluster's major occupations, instruction embedded in context of cluster; Instructors with relevant experience; Training for technological and organizational changes	Number of credit and noncredit programs for cluster; Internships/apprentices employed
Proximity to suppliers	Nearby sources of primary and secondary supplies, materials, and services that minimize transaction costs and maximize interaction	Input/output analysis of supply chains; Number of potential first-, second-, and third-tier suppliers; Survey of actual suppliers
Capital availability	Local banks that understand the cluster and know the cluster's key players; Availability of working and startup capital; Access to seed and venture capital to exploit new opportunities	Dollar value of venture capital, loans made in cluster; Participation of bankers in cluster activities
Specialized services	Public-sector services, such as technology extension services, technology centers, export assistance, or small business centers and private-sector services provided by designers, engineering consultants, accountants and lawyers that have special knowledge of the cluster	Number of consultants who specialize in cluster; Services that employ specialists from cluster; Dollar value of local outsourced services
Machine builders and software designers	Access to companies that design and build the machines, tools, and software used by clusters; Working relationships between the tool builders and companies to foster collaborative innovations	Number of companies that produce and sell capital equipment to the cluster
Networks and alliances	Frequency of formal cooperation among cluster members in, for example, joint ventures, production, marketing, training, or problemsolving	Number of joint ventures, skills alliances, marketing consortia, etc.
Social capital	Scale and degree of activity among local business and civic associations in the region; Frequency of interaction; Informal networks of personal business related contacts	Number of professional, business, and trade associations; Membership in each, level of activity; Survey of connections
Entrepreneurial climate	Continual formation of new business ventures by workers and managers within the cluster based on new, complementary, or competitive products or on core competencies	Number of new startups generated by cluster; Number attracted to cluster
Innovation and imitation	New and enhanced technologies and products that are conceived, developed, and adopted or brought to market; Dispersion of innovations to other local firms	Patents and copyrights; Dollar investments in new technologies; New product lines started



Presence of market leaders and innovators	Number of acknowledged market leaders and magnet firms; Marketing and sales of products or services outside the boundaries of the cluster	Number of headquarter operations; Dollar value of exports of cluster products ; Dollar value of U.S. sales outside of state
External connections	Joint ventures, contracts, alliances with firms, contacts/ communications with experts in other regions; Knowledge of international benchmark practices	Study or benchmarking tours, travel to trade shows; Alliances that include external members
Shared vision and leadership	Firms that think of themselves as a “system” (i.e., plan for and share goals, have vision for future); Leaders who take responsibility for collective competitiveness	Collective strategic plan or vision statement; Acceptance of cluster name or brand



Appendix B: Mapping Social Capital Among Employers

If confidentiality requires protecting names, a general response such as “a partner organization is a tooling company in the western suburbs.” Please give approximate closest location for each connection (i.e., same neighborhood, county, same region, state, country)

- List up to five organizations where you know people who represent important sources of information or advice (e.g., a trade school, competitor, customer, supplier, or consultant) and number of contacts in the last year.
- Name up to three individuals (or organizations) with whom you have collaborated in the recent past (e.g., to bid on contracts together, attend trade show together, help fill an order, or share equipment or services), and the type of activity.
- Name up to three organizations that you have recently helped out in some way (e.g., giving advice, loaning employees, sharing information, or loaning equipment) and form of help (advice, production, loaned people)
- Name up to three companies in the same general industry as yours that you consider industry leaders and/or innovators.
- Name up to five business or professional organizations/associations to which you belong and to attend at least one function per year. What is the approximate number of events attended in last six months?
- Do you serve on any formal or informal advisory committees or boards of education or training or local development organizations? If yes, which ones?
- Name up to three organizations you have used (or your employees have used) for education or training in the past year (and type, e.g., basic skills, IT, management, or vendor) and type of training.

