



Beyond Clusters: Current Practices & Future Strategies ***University of Ballarat, Victoria, Australia***

Industry Clusters: Business Choice, Policy Outcome, or Branding Strategy?

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In the mid 1980s, U.S. development agencies were seeking ways to help their struggling industries compete with the modern and remarkably efficient production facilities of western Europe and Japan. That search eventually led them to northern Italy, where scores of technologically advanced but small artisan firms were capturing large shares of European and global markets. I first learned about the now legendary Italian region of Emilia Romagna in 1987, where 40,000 small manufacturers with an average of six employees were able to operate with the efficiency and scale of U.S. multinational corporations. In 1988 I organized a study tour for the Southern Technology Council—science and technology advisors of the governors of the Southern states—to Emilia Romagna, Denmark and Germany’s Baden Wurttemberg. We found that in each place competitiveness was tied to specialization, external economies, and public sector support for both. The specialization was most pronounced in Italy where large numbers of similar and complementary businesses located in close proximity to each other shared resources and cooperated to their mutual advantage. No one had yet applied the word “cluster” to these agglomerations; they were called industrial districts. But under any name, local specialization was the key to their success.

I. What goes around comes around

Agglomeration theory has been a popular area of research for economists and geographers for decades. But for the most part discussions of applications of the theories were limited to the academic community. The conventional economic development has been to pursue diversification and specialization and avoid any sort of “industrial policy” that suggested winners and losers. In 1990, however, Harvard Business School professor Michael Porter took the concept to a new level by examining it from the perspective of the firm. He effectively turned regional specialization, which he called industry clusters, into a national and regional competitiveness strategy. This demand-driven approach legitimated clusters as a target for public policy.

The model used by Porter to describe competitiveness was called the “diamond.” Its four corners were (1) factor conditions; (2) related and supporting industry; (3) demand

conditions; and (4) firm strategy, structure, and rivalry.¹ More important than creating a model for an economy, Porter met—and indeed created—a global demand for policies to fit it. As a result, over the period of about ten years, industry clusters have moved from a relatively obscure idea situated on the periphery of economic development to a core practice. Virtually every nation, every U.S. state, and every large city by now has conducted or contracted for an analysis of its clusters.

Part of the popularity of clusters lies in its vagueness and definitional elusiveness. “Clusters have ‘the discreet charm of obscure objects of desire’² and everyone can own one or more. Clusters have become the pot of gold for economic development. Places that don’t have clusters as defined by researchers either redefine their industries to reach scale, claim them anyway, or aspire and plan to get them. At last count, some 47 U.S. states claimed to have a biotechnology cluster even though 75 percent of all the biotech companies with 100 or more employees are in just nine cities.³

Rarely has an idea captured the imagination of so many leaders in so many regions so quickly, or have theoretical concepts expanded so quickly to fit match local circumstances and expectations. In the course of adapting cluster-based economic models to social and political realities and interpreting them as common occurrences, the large and growing cadre of consultants and clients use the term “cluster” more indiscriminately than Alfred Marshall, or even than Porter did in his initial work. That is, they apply the term to a variety of business arrangements ranging from small manufacturing networks to loosely linked groupings of industries across an entire state that may have few common attributes, such as professional services or high technology.

Clusters that have been identified by development agencies and researchers in recent years range in size from two companies to thousands, cover geographies as small as a neighborhood and as large as nations, and include members as narrowly defined as a four digit industry code such as men’s hosiery and as loosely defined as “professional services” or “high tech.” One might say the same thing about the term “cluster” that Robert Reich said about “competitiveness” in 1992—that “rarely has a term in public discourse gone so directly from obscurity to meaningless without an intervening period of coherence.”

How did these local production systems, or clusters, which had been found in certain places and studied by Alfred Marshall a century ago, become the norm for regional economies and target for public investments? How can the cluster framework be best used for regional development and to expand economic opportunities in the U.S.?

A. Variations on a Theme: Networks, Associations, and Clusters

A small number of small companies that make plastic parts join together to acquire less costly training and pursue contracts that exceed their individual capacities. A group of food processors on the west coast decide to join forces to get into new Asian markets. Upholstered furniture companies in northeast Mississippi reach a scale that attracted suppliers of springs, foam, and textiles and justified an advanced technology center for

furniture upholstery at a local community college. The interdependencies among firms in each of these places gave them certain advantages over more isolated firms. But are they all clusters?

The “associative economy” is the term that encompasses all forms of business-based interdependencies. But that term also includes many distinctive forms of association, e.g., clusters, clubs, and networks. Each represents a means for companies to acquire economies of scale that are external to their firm. But they are quite dissimilar economic structures and respond to very different public sector approaches. A decade ago, networks were the strategy of choice for increasing industrial competitiveness in most of the world, with major programs promoted, supported, and studied by United Nations Industrial Development Organization, the World Bank, USAID, the European Union, and Organization for Economic Cooperation and Development. The transition from policies to build networks to policies to build clusters—and to a large extent back to networks—is a story of evolving economic development practices and the benefits of shared experience.

Firms with like or complementary needs organized themselves into networks and clustered long before these relationships were understood by public policy to be “competitive advantages.” Although recent researchers have highlighted Europe, it was not a foreign concept in the U.S. Despite the commonly held image of the rugged individualistic industrialist, networking was common practice in the early decades of the twentieth century. Firms clustered in industrial cities such as Grand Rapids (furniture), Philadelphia (textiles), Providence (jewelry), and Cincinnati (machine tools). “Clusters of small companies in urban industrial districts offered diverse finished goods to households and enterprises, relying on thick webs of contact and affiliation to organize production and sales.”⁴ Firms represented loose networks...with informal rules of entry, reciprocity, and propriety, that engaged a broadly shared set of technological challenges and common finance, marketing, and labor process dilemmas.” The growth of the vertically integrated corporation never eliminated the small specialty manufacturers that continued to rely on one another to get externalities and solve their problems.

Networks: The “flexible manufacturing network,” like the cluster, was rediscovered in western Europe—particularly in northern Italy—where inter-firm collaboration was documented and explained by researchers such as Sebastiano Brusco and Charles Sabel and described by organizations that enabled it such as the National Confederation of Artisans in Emilia Romagna and the Steinbeis Foundation in Baden Wurttemberg. Spurred by numerous site visits organized with assistance from the German Marshall Fund of the United States, by the mid-1990s nations around the world, U.S. states, and private foundations were all supporting programs that encouraged inter-firm cooperation. The concept was simple: companies would join together to achieve economic goals unattainable by a company on its own. They would network to produce more complex goods, extend their market outreach, acquire costly resources or services, or simply reduce costs.

In 1990, the Danish Technological Institute in Århus designed what became the standards policy model to increase networking among small and mid-sized enterprises (SMEs). It consisted by five steps (Table 1): publicizing the concept among SMEs; training network brokers to organize and facilitate networks; training “multipliers” (e.g., accountants, consultants, and lawyers) to identify potential network opportunities; creating a three phase grants program as incentives for (1) organizing networks that agreed to collaborate on hard business opportunities, (2) developing plans, and (3) implementation; and evaluating the outcomes. Denmark’s goal was, in three years, to create a short-term program that would alter the presumed independent behavior of SMEs and create the culture of cooperation observed in northern Italy.

Figure 1
Elements of the Danish Network Program

Network “brokers” The network broker serves as external facilitator, or systems integrator, for network functions. Some were consultants expecting to earn a living in this role but most worked for agencies that already served small and mid-sized enterprises (SMEs). Denmark process for training and certifying bropkers became the industry standard.

Network “multipliers” These are people intimately familiar with the companies and able to detect and assess opportunities for collaboration that can be passed on to brokers. They include staff of chambers of commerce, trade associations, banks, accounting firms, law offices, trade centers, technical colleges, and technology extension services that serve SMEs.

Incentives Funds were offered to groups of three or more small businesses as incentives for cooperation, to compensate them for costs of participating in activities with uncertain returns. The program awarded grants to organize network (up to \$10,000), to plan activities (up to \$50,000), and to implement programs (up to \$500,000).

Information campaigns The government distributed information widely through the media, brochures, and newsletters on the potential value of networks and funding opportunities. They used distribution venues ranging from conferences to pubs.

Institutional Hubs Although not part of Denmark’s program it was added by many adopters. Because the sector centers in Emilia-Romagna were viewed as essential parts of its cooperative structure, many regions used specialized technical institutes, research centers, and councils for network formation and multi-firm services.

Regional Technology Strategies, Inc. received funding from the National Institute of Standards and Technology in 1993 to work with manufacturing extension programs in 15 states to develop programs that encouraged and supported networks. In the U.S., however, the model differed in one important criterion; U.S. networks had less restrictive requirements for hard outcomes.

In the U.S. networks needed an organizational structure if they hoped to become a common business strategy. Lacking the regionally based industry associations that

provide real services to members and are common in much of western Europe, states used the network programs to form local associations, sometimes referred to as “soft” networks. The Berkshire Plastics Association in Western Massachusetts, the Technology Coast Manufacturing and Engineering Network (TeCMEN) in Florida’s panhandle, WoodNet on the Olympic Peninsula of Washington, Washington Aerospace Suppliers Association, and the Tri-State Manufacturers Association in western Minnesota, although described in the literature and assessed as networks, were really business associations. TeCMEN understood that although they provided real collective services, much of their value was in the hard networks that formed in the parking lot, where deals were made following meetings. These associations provided the social infrastructure necessary to create the trust that enabled firms to do business together and do favors for one another simply on the basis of expected reciprocity. The distinctions among networks, associations, and clusters are shown in Table 2.

Taking lessons from Europe, these associations also realized that they had to be more than lobbying arms of members. Companies wanted the benefit of real services (sources of external economies) that were unavailable or unaffordable individually. For instance, the initial key to the success of the Metalworking Connection in Arkansas (formed as a result of Governor Clinton’s network program) was access to lower cost group health benefits and communications.

The intent of most network programs was to demonstrate the value of cooperation to businesses so that it would eventually be part of the corporate culture and happen spontaneously, as it did in Italy. But network aficionados glossed over the context in which networks formed in Italy, the dense concentrations of like firms, organizational infrastructure, and specialized services. Even if firms saw value in networks, without an industrial environment that could create opportunities for cooperation and support norms of reciprocity, networks would remain the exception, not rule.

In 1993, RTS, with support from foundations and federal agencies, assembled in Aspen Colorado a small number of the world’s leading experts to discuss and assess the state of practice of networks. Experts from Italy, Portugal, Denmark, United Kingdom, and Canada, including MIT’s Chuck Sabel, Mario Pezzini from Bologna, Niels Christian Nielsen, architect of the Danish system, and heads of various U.S. state modernization and economic development programs met with U.S. researchers and practitioners. The group produced the Aspen Statement, a paper with recommendations for adopting networks in public policy. “Significant Others: Exploring the Potential of Manufacturing Networks” became a handbook for network practitioners. In 1996, RTS, with foundation and federal support, repeated the process for clusters at the Grayland Center in Winston-Salem, North Carolina with experts from Europe, Australia, Canada and the U.S. that included Harvard’s Robert Putnam and Michael Enright, Cardiff University’s Phil Cooke. That group produced “Overachievers: Business Clusters that Work,” which defined and explained clusters and moved the development agenda. Finally, in 2002, RTS assembled yet another international group of experts to

examine the equity side of clusters. That group produced “Just Clusters: Economic Development Strategies that Reach More People and More Places.”

Clusters: Even if firms saw value in networks and associations, without an industrial environment to create opportunities for cooperation and support norms of reciprocity, networks would remain an exception, not rule. That environment, observed but underappreciated by visitors to Emilia Romagna, was the industrial district, an antecedent of clusters. Unlike networks or associations, clusters are not based on membership. They are simply geographic concentrations of interrelated companies and institutions of sufficient scale to generate externalities. The minimum number of firms with common or overlapping needs to be acknowledged as a “cluster” is the number that attracts suppliers and specialized services and resources. Clustered firms have access to 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 industrial extension service or small business center able to give advice. The geographic boundaries of clusters are set by the distances that those in firms and entrepreneurs are willing to travel for informal face-to-face meetings and by how far employees are willing to travel to work.

Like networks, clusters are composed of firms that co-locate around a variety of common interests or needs. But, unlike networks, neither “membership” in an organization nor cooperation is required to be “in” a cluster. “Free riders,” simply by virtue of geography, are able to realize non-exclusive external economies that accrue to members of cluster associations. They have access to information that flows informally, the local “buzz.”

Much of the initial research on—and policy actions for—clusters focused on the two corners of the diamond that produce the hard externalities, which Porter calls “factor conditions”⁵ and “related and supporting industries.” In the late 1980s, when delivery, access to information, and time to market were more tightly constrained by geography, these were the advantages of proximity. The advent of the Internet and overnight delivery, however, reduces the value of localization economies, i.e., access to the lower cost intermediary inputs to production, including parts, services, and information at a distance. Proximity still matters for critical components or supplies that are knowledge-intensive and depend on interactive research and design or special expertise for assembly or utilization, but many of the sectors included in standard cluster maps that derived from input-output tables are of diminishing economic advantage.

Many European (and some U.S.) economists, however, have been looking deeper at factors in the success of clusters work and found even greater advantage in the soft externalities that firms gain from greater access to tacit knowledge, the movement of knowledge that occurs intentionally among friends and colleagues and unintentionally when employees change jobs. Clustered firms also have more opportunities for networking and other deliberate acts of cooperation and collaboration that give companies the strength of numbers to influence customers, markets, or policies. This view suggests a social network model of clusters. Hubert Schmitz combines the two

concepts in his “collective efficiency” rationale for clusters, which is the sum of external economies and joint actions.⁶

The glue that continues to make proximity matter consists of “soft” externalities, i.e., greater access to tacit knowledge, opportunities for deliberate acts of cooperation and collaboration that give companies the strength of numbers to influence customers, markets, or policies, and access to experienced labor. This view suggests a social network model of clusters.⁷ Soft externalities are more difficult to quantify, but their value is readily recognized by businesses and entrepreneurs. Leaders depend on personal relationships and trust, such as the acquisition of the tacit knowledge that is buried in the minds of individuals and the routines of organizations and not easily communicated without personal interaction.⁸ They know more about their competitors products and processes and can monitor innovation and benchmark themselves. Robert Putnam’s analysis of Italy’s economy⁹ inserted another academic term, “social capital,” into the vernacular of economic development.

In an evaluation of clusters funded, ostensibly to create networks, by the Northwest Area Foundation (Table 1), firms ranked access to knowledge their most important reason for associating with similar firms, including competitors—over any of the harder business outcomes. Similar studies of networks in Wales and Australia confirmed this finding.¹⁰ In a recent survey of 14 companies in Nova Scotia’s biotechnology cluster, nine estimated that half or more of their knowledge relationships were local (within 100 km) but only three estimated half or more of their supply chain relationships to be local.¹¹

Table 1
Survey of members of four clusters in states of Minnesota and Washington, 1995

Reason for joining network	Very High	High	Very Low/Low
Access to Information	44%	39%	17%
Learning	31%	48%	21%
Joint product development	16%	31%	53%
Joint marketing	23%	31%	46%
Improving quality	15%	45%	40%

Source: Stuart Rosenfeld, *Research Policy* 25(1996) 247:263

Table 2
Organizational structures of the associational economy

	Hard Networks	Associations	Clusters
Membership	Closed	Open, membership based	None required
Relationships	Collaborative	Cooperative	Cooperative and competitive
Basis for agreements	Contractual	Majority determination	Social norms and reciprocity
Value added	Allows firm to focus on core competencies	Aggregates & organizes demand for services	External economies
Major outcomes	Increased profits and sales	Shared resources, lower costs, benchmarking	Access to suppliers, services, labor markets
Basis of external economies	Shared functions and resources	Membership	Location/proximity
Shared goals	Business outcomes	Collective vision	None required

Delegation after delegation traveled to northern Italy to observe cooperation among firms. The networks were not easily observed, however. What we did see is the associational infrastructure, the specialized support system managed by ERVET, the region's development agency, and government agencies programs that require or set aside funds for multi-firm initiatives. The National Confederation of Artisans, with more than 500 employees providing 17,000 firms in Emilia Romagna, with accounting services, payroll, tax assistance, financing, and training was a mandatory stop on the tour; as were the many cluster hubs that offered services to small firms—e.g., CITER's fashion design for knitwear, CERMET's testing labs and quality assurance for metalworking firms, RESFOR for matching suppliers with customers, etc. Networks formed, unformed, and reformed as necessity dictated. The social environment and associational infrastructure created the opportunities.

II. Misperceptions and Misapplications of Clusters

Like any popular and heavily marketed idea, clusters can be an effective strategy but, if misapplied or over-promoted as, for example, panaceas for economic growth and sustainability, it becomes an empty promise. At its best, clusters are means for understanding an economy to formulate effective and cost efficient public sector interventions that serve the public good. At its worst, clusters are gimmicks for justifying poorly conceived public sector interventions.

A. Clusters can be identified by formula

Virtually every analysis of regional economies that sets out to identify clusters begins by

aggregating related industry sectors into clusters. Most rely on national data on enterprises compiled by the sectors in the North American Industrial Classification System (NAICS). Analysts look first for *absolute scale*, as measured by ranking numbers of establishments or employees and *relative scale* as measured by comparing the proportion of total companies or employment in the place of interest to the same proportion in the nation.

The simplest data sources are the U.S. Department of Commerce's *County Business Patterns*, with employment security databases next best. These sources, however, have major limitations. First, they suppress data in places where the numbers might reveal a company's identity. To compensate, a Minnesota-based company has developed an algorithm for estimating establishments and employment where they are suppressed.

Second, they fail to include companies without employees and most micro-enterprises. This is a major flaw in looking for clusters dominated by micro-enterprises, such as tourism or creative enterprises. Third, they classify companies in a single sector when most companies have multiple products and competencies—or they classify them in the wrong sector altogether. In Virginia's Region 2000, for example, if only companies' primary industry had been used, we would have completely missed a sizable industrial machinery cluster. Auto supply chain clusters include many firms not classified as auto suppliers, such as metal stampers, rubber tubing manufacturers, and tool and die makers, because they sell to multiple industries.

Third, many clusters are not classified by industry codes. New Media clusters, where content is combined with IT, Optics and Imaging clusters, which use a common core technology, mining equipment include firms in Subury, Canada cut across a vast array of sectors.

Finally, the scale of a cluster is dependent on the type of relationships the analyst chooses for grouping sectors. The most common grouping is product line or service, but the firms may prefer to locate in places populated by other companies with similar production processes, skill needs, distribution channels, customer bases, or critical resources. For many of these, NAICS codes would not only be insufficient but also would be misleading. Among the largest users of plastics technologies and workers among the many plastics companies in Connecticut's Naugatuck Valley are BIC, Schick, and Lego, none of which is classified as a plastics company. One of the larger employers in New York City's New Media cluster is DoubleClick, which is coded not as an IT company but as an advertising firm. The largest employer in western Massachusetts's creative industries cluster is Yankee Candle—which is classified under the industry "animal fats and liquid oils." Leading employers in Oregon's strong sports apparel cluster that manufacture overseas (e.g., Nike, Addidas) are classified under distribution, not production codes.

The definition of a cluster is vital to any public sector intervention and the choice made—often by a researcher or consultant—determines the cluster's significance. The

groupings of sectors that define a cluster vary from place to place. “Tourism cluster” that include all hotels, restaurants, and transportation systems in a region, for example, will boost the relative scale and importance of that cluster. Many firms, however, fit the criteria for multiple clusters, further complicating the analysis. A recent book on the New Media clusters gave eight different definitions for a New Media cluster.¹²

Determining which companies comprise a cluster requires more than data analysis. Albert Einstein said “not everything that can be counted counts, and not everything that counts can be counted.” Finding the relationships that cause firms to cluster requires local knowledge of the factors that provide the firms their competitive advantage and the relationships that enhance those advantages. Experience with policies to encourage firms to form business networks taught us that the most successful networks—and most successful cluster organizations—are to a large degree self-selecting, built on a core set of pre-existing relationships.

B. In the age of the Internet proximity no longer matters

After many predictions of the death of geography by futurists, companies still find proximity to be important. Companies still cluster, as witnessed by the quickly growing concentrations of similar firms in China’s coastal regions, with firms producing nine billion pair of socks in the cities of Datang (“Socks City”) and Zhuji, a half billion wedding and evening gowns made in Chaozhou, and 300 million ties manufactured in Schengzhou.¹³

Transportation and communications technologies have altered the way clusters function as systems, but their potential for replacing face-to-face relationships has been greatly exaggerated. Companies want knowledge and information beyond what they can get from the literature, Internet, and telecommunications and they want a labor force that understands their work environment. Clusters represent a mediating environment, with norms of reciprocity that support inter-firm relationships and higher levels of un-traded interdependencies, i.e., social capital. In clusters with high levels of social capital, know how and innovation is transferred much more readily. Tacit information and knowledge about new technologies, markets, or services is gleaned from personal friendships among managers and entrepreneurs and collaborative business arrangements. Knowledge flows or “leaks” unintentionally and “technologies spread to smaller companies, for example, “through swapping of employees within a common pool of skilled and technical labor developed around the region’s core technology.”¹⁴

A tight social fabric was considered fundamental to the functioning of the classical Italian industrial districts. Sebastiano Brusco¹⁵ noted that “local know-how is passed on by doing things and seeing how other people do things through informal chit-chat” and workplace knowledge is rooted in places where “people are linked by the bonds of shared history or values...and where codes of behaviour, lifestyles, employment patterns and expectations are inextricably implicated in productive activity.”

C. Clusters require membership

Clusters are eco-systems, not associations. They are geographically bounded groups of firms that depend on other nearby firms and institutions for their livelihood in a variety of ways. The organizations that represent members and individuals are the result, not source, of independencies and one of the key organizations in a cluster but their membership does not constitute a cluster. The danger in promoting cluster associations is that they become confused with the cluster itself and are not just an element of a larger cluster-based strategy. Measures of success of the cluster association, such as membership or grants received, are mistaken for measures of success of the cluster. Cluster activities are defined exclusively by the actions of the association. Moreover, they are believed to be dependent on a broker or facilitator. The “Green Book,” an analysis of cluster activities, claims that 89 percent of all cluster initiatives have a facilitator to manage the activity, most of which do this at least part time and have an office.

This distinction does not reduce the value of membership associations, which can create the milieus in which new relationships are built. But using a system as the framework recognizes that clusters are informal and inclusive and free riders are not only unavoidable but strengthen the cluster. Associations, on the other hand, are formal and exclusive. Members gain advantages over non-members.

D. Clusters are contained within political boundaries

Porter’s model of cluster had no geographic requirements. He used nations, regions, and cities to illustrate his clusters. The geographic boundaries of clusters are defined, in the loosest sense, by the distance and time that people are willing to travel for employment and that employees and owners of companies consider reasonable for meeting and networking.

The geography over which knowhow can efficiently spread is influenced by transportation systems and traffic but also by cultural identity, personal preferences, and social hierarchies. In a city with traffic congestion, the ostensible cluster limits might be a metropolitan area or even a neighborhood. Silicon Alley is located in Manhattan south of 41st street. Long Island’s related information technology cluster, although 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 a circle of up to a hundred mile radius. The metalworking companies in western Minnesota and eastern North and South Dakota that joined together to form the Tri-State Manufacturers Association have been willing to drive up to 100 miles to attend planned functions.

Political considerations also influence cluster boundaries. Even where clusters spill over political borders, government data are collected by political jurisdictions and funds

must be used within certain jurisdictions. Therefore, for all practical purposes governments define clusters by the borders of states, counties, or regional groupings of counties within their states. But it is important to be aware that aggregating data according to political boundaries may miss edge clusters that cross regional boundaries. The sizable metal working cluster in western Minnesota near the North and South Dakota borders was not obvious even to the firms operating there before foundation-led efforts to develop it.

Ultimately, geographic boundaries are porous. There is substantial advantage to firms and people in national and global networks and communities of interest so that the best thinking can be absorbed into the cluster and so that member companies are made aware of benchmark practices and changing markets.

E. The public sector can create clusters

The more attention that is paid to the importance of clusters to regional competitiveness, the more places want one—and usually many. But businesses, not governments, form clusters. The evidence suggests that clusters emerge out of a solid foundation that is either embedded in existing companies, local expertise, or some special resources. The world's best-known clusters have taken a long time—often decades—and were unplanned until they reached a level activity that attracted attention. The roots of clusters can be found in one or two successful companies with entrepreneurial and resourceful employees, in the development of value added chains around very large employers, in efforts by redundant employees to use their competencies in innovative ways, in access to critical natural resources or infrastructure, or by opportunities for commercialization around sources of new technologies.

Most clusters have been historical accidents. No one would have predicted or planned for a carpet cluster in Dalton, Georgia or knitwear in Carpi, Italy. But plastics in western North Carolina had its basis in the competencies within General Electric's plastics plant and the demand for parts from its transformer and naval ordinance divisions in Pittsfield, metalworking along the Connecticut River Valley had its roots in the Springfield Armory, food processing in Chicago can be traced to its position in distribution and transportation for the Midwest agricultural sectors, and oil and gas cluster in southern Louisiana is due to the natural resources in the Gulf.

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 in County Monaghan, Ireland. Others developed by investing the surplus from an agricultural economy into another industry, such as the hosiery industry in Castel Gofredo, Italy. 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.

**Table 3
Selected Cluster origins**

Place	Year	Cluster/Origin	Reason	Catalyst
Aalborg, Denmark	1948	Mobile communications/ SP radio.	Fishing industry	Aalborg Univ ('72), NOVA Science Park, R&D ('85)
Southern Scotland	1940	Electronics/ National security	Safety from attack	Scottish Enterprise ('91)
Carpi, Italy	1950s	Knitwear/ Straw hats	Fashion shift	ERVET ('72) CITER (82)
Tupelo, Mississippi	1948	Motion Furniture/ Futorian Furniture	Surplus labor, Raw materials	Showrooms, Itawamba Comm College, ('84)
North Central Massachusetts	1760s	Plastics/Shell combs	Serendipity	Entrepreneurs
Connecticut River Valley	1816	Springfield Armory	Water power, logistics	Government contracts, training programs
Res. Triangle No. Carolina	1970s	Bioprocessing/Glaxo, Burroughs-Wellcome, universities	Universities RTP	NC Biotechnology Center ('82), venture capital BioWorks ('99)

The serendipitous development of clusters does not mean that the public sector has no role. It has, even if unintentionally, kick started some clusters and in almost all cases has added value by filling gaps and providing incentives for innovation. Public sector initiatives have proven effective in improving clusters' ability to compete and, in selected instances, even influencing growth patterns.¹⁶ In a few instances, that catalyst is a great deal of money, as when the state of Alabama made large investments to attract auto manufacturers and build an auto cluster. But it could only be successful because it had the basic ingredients--a strong metal sector and technical colleges.

The ceramic tile cluster in Sassuolo, Italy traces its roots back two centuries to the Rubbiani firm but took a major leap forward in 1924 when a new firm, Industria Cermica Veggia, introduced a less expensive glazing technology using arsenic. It later replaced that with the even more effective zircon glaze called "Sassuolo white" and a production process using pouring rather than pressing. But over time, the company's protection of its patents and insularity were its downfall. The firm was effectively cut off from other production innovations, and by the 1960s it filed for bankruptcy. Many of the skilled employees used the opportunity to purchase equipment and technology, start their own companies and grow into a cluster. The regional government supported the cluster through a number of Regional Laws that funded collaborative activities, including the Ceramic Tile Research and Testing center at the University of Bologna.

North Carolina has made investments that have contributed to cluster growth. In 1982, the legislature created the North Carolina Biotechnology Center, supported university and workforce development support, and invested in venture capital funds. Those policies have undoubtedly helped put the state in the forefront of bioprocessing. Its much smaller investment in a technology center for hosiery at a critical juncture in the cluster's life helped that cluster survive. In contrast, at the same time when it invested in biotechnology, the state invested heavily in a semiconductor research center to build that cluster. However, this strategy failed, largely because it was based on industrial recruitment. Today North Carolina has no semiconductor cluster to speak of. Similarly, after years of investment in Global Transpark to build a cluster around logistics and distribution, it has little to show for the investment—again, because it was based on recruitment rather than an existing strength.

Despite faulty assumptions about creating clusters, public sector investments have been used very effectively to stabilize, spur growth, and increase competitiveness of clusters. The numerous “cluster initiatives” led by “clusterpreneurs” have increased levels of activity within clusters. Although there have been no rigorous assessments of outcomes, recent global surveys that describe priorities among various kinds of efforts also reveal positive changes in behavior among firms and institutions.¹⁷

F. Clusters are a fair and equitable way to grow an economy

The limitation of a demand driven development strategy is that clusters, if left to their own devices, will not meet the social goals of the public sector. Clusters that have organized in order to set priorities and define their own interests rarely place equity very high on their agendas. Our study of cluster strategies in Palm Beach County, Florida found that despite facing labor market shortages, companies were unfamiliar with, and therefore failed to take advantage of the, communities with large numbers of unemployed and underemployed right under their noses, in their own county. Instead they looked outside the county. A quick scan of the many state, regional, and metropolitan cluster analyses and studies in industrialized nations finds very few references to distributional outcomes according to wealth or to specific intents to reach low- and middle-income populations.

Efforts to improve equity should payoff in profits, such as by increasing productivity, building good will that results in additional sales, or reducing employee turnover. In tight labor markets, the payoff may be the ability to maintain a full work force. This gives some advantage to poorer regions that still have surplus labor forces and it causes companies to invest more in training less educated populations to meet their employment needs. In weak labor markets, manufacturers benefit from an untapped labor force that they can attract into and train for positions that have become unpopular among students, such as machinists and tool and die makers.

Clusters that are dominated by locally owned firms that expect to remain locally owned, in particular, are concerned about fairness. The more dependent clusters are on attracting mobile and discriminating talent, the more important their contributions to building community amenities and supporting a high quality of life. Where community and business interests are intertwined, businesses are willing to make trade offs between maximizing quality of life and maximizing income.

III. Learning from Experience

Porter's diamond provided the first common framework for understanding clusters and, as mentioned earlier, reached high-level policy makers and influenced the first wave of cluster strategies. His model focused initially on the value of factor conditions and rivalry among firms to drive innovation. The first wave of cluster strategies thus emphasized the basic non-specialized conditions for growth and the factors that could be influenced by the public sector—but without appreciably changing the structure of the public sector.

The prior experiences of many of the cluster consultants with programs to form business networks, bolstered by Robert Putnam's findings regarding the value of social capital, enlarged the role of collaboration in Porter's model. As a result, the second wave of strategies emphasized the relationships among firms and value of networking and networks, and strategies targeted cluster organizations. An organization became the symbol of a cluster's very existence, and the growth of the association or its resources a proxy for success of the cluster.

Now that cities and states all over the globe have attempted strategies to create, strengthen, or salvage clusters, what has been learned that can inform future policies? First, even if clusters are as much in the mind of the beholder as a product of analysis, some limits must be set to maintain conceptual integrity. Second, workforce has emerged as the most definitive local externality. Third, cluster success requires some form of differentiation, or brand. Fourth, local amenities and attitudes are closely associated with success of clusters that rely heavily on attracting and keeping talent. Fifth, the competitive advantages of clusters are changing as a result of globalization and technology. Finally, clusters need global pipelines as much as they need local networks and tacit knowledge.

A. Clusters must be kept in proper perspective and meaning

There is a tendency to oversimplify the definition of "cluster" to where clusters are found everywhere (See Appendix). This trivializes the concept, dilutes its real potential as an instrument of economic development policy, and opens it to unwarranted criticism. In today's policy world, clusters are acquiring "the discreet charm of obscure objects of desire."¹⁸ They are tools for better understanding the special comparative strengths of an economy so the public sector can better organize itself to build on those strengths and help companies take better advantage of them. Part of the loss of clarity to the definition of the term clusters is due to resistance to industrial policy and any initiative

that hints of favoritism. That leads regions to want to find enough clusters so that no major employer is excluded—which leads to long lists of local clusters with very generic and inclusive titles. But that policy undermines efforts to support regional specialization and branding and tends to shift cluster initiatives towards basic, more general needs such as education, infrastructure, and capital.

B. Clusters depend on local competencies and knowledge: The workforce imperative.

Paul Krugman derived a theory for what companies knew and acted on, that the advantages of a shared, or pooled, labor force outweighs the disadvantages.¹⁹ There is no technology yet to replace the need for a skilled local labor force and the knowhow they possess. Firms can and do recruit scientists, engineers, and upper level managers, but the technicians, salespeople, and administrators, who are locally educated and less geographically mobile. Nearly every cluster depends heavily on the availability of a mid-skilled and skilled labor force that understands the particular context in which the cluster operates.²⁰ Companies depend on an uninterrupted flow of workers with the necessary skills and the knowledge of the industry to apply them to both routine and unanticipated situations. Most of the mid-skilled labor force are educated at local technical and vocational colleges and institutes and are very likely to come from lower and middle class backgrounds. This is borne out by the fact that when clusters organize themselves to address common needs, workforce development is almost among their highest priorities.

The institutions that play the largest role in preparing the workforce—and are best able to respond quickly to clusters needs—are the community and technical colleges. Some have been able to develop the specialized programs, expertise, and services to support cluster-based economic development strategies. These “Industry Cluster Center” are become places that industry can rely on to understand their particular needs and interests, to help solve skill-related problems, and to help assure a continuing flow of new entrants and source of upgrading its existing work force. A number of state systems are in varying stages of aligning their colleges with clusters (e.g., Connecticut, North Carolina, South Carolina, Washington, Wisconsin).

C. Successful clusters in highly developed regions rely more on customized and design-oriented products and services

Industrialized countries will not be able to compete with places that have the combination of surplus labor and low wages unless they can create products or services for which consumers will pay a premium. Most strategies have looked to the universities as the source of new and distinguishing innovations, and, as a result, cluster analyses use rates of patents and business startups as evidence of innovation. Design, particularly with respect to aesthetic appeal, is a vastly under-rated form of innovation. One of the key and underestimated (by Americans) success factors in northern Italy was the way companies were able integrate art and culture in their products.²¹

D. Local attitudes and amenities matter to “new economy clusters.”

“Creative Centers,” Richard Florida writes, “tend to be the economic winners of our age.”²² These creative centers have the attributes—physical, amenities, diversity, and experiences—to attract what he defines as the creative class. Many of the so-called “new economy” clusters that regions pursue rely heavily on talented workforce that is quite mobile and discriminating in its choice of clusters that depend on a supply of young talented require certain local amenities and attitudes. Florida’s comparisons of creativity and tolerance indices with high tech economy indices in metropolitan areas shows high correlations. Recent research by Joe Cortright on migration patterns of the 25-34 year olds demonstrates the relationship between new economy growth patterns and local amenities plus tolerant attitudes.

The result is that economic development agencies are beginning to recognize the importance of quality of place and give more attention to the arts and culture as part of the cluster support structure. And, some places have recognized that arts and culture represent a value added cluster in its own right, with specialty businesses, networks, and a dedicated support structure. In western Europe, creative clusters have become a growing part of development efforts. Moreover, there are yet to be assessed non-metro counterparts to the metro and university-biased creative economies described in the literature. Much of the migration from cities to rural areas is on places with amenities, tolerance, and physical attributes.

E. Globalization is changing the functions that remain in mature clusters and functions are becoming a raison d’etre for clusters

In industries rapid growth phase in the middle third of the 20th century, cost was king (Table 4). Companies introduced cost reduction programs and organized work to get the lowest possible labor costs. In the last two decades, the adoption of new production technologies and increased competition among advanced nations shifted the arena of competition to quality, delivery, and creative applications of technology. Companies reorganized to achieve these goals. Today, with the competition moving to less developed regions, the focus is again changing.

Even as America’s traditional manufacturing moves off shore to reduce costs, it retains some key functions and some employment in its native country. If the ability to make a good becomes ubiquitous, the competitive advantage of the cluster shifts from the production line to management strategies, transportation and logistics, communications, inventory control, packaging, design, or marketing. Many of these functions remain in the home offices. The challenge for clusters will be to reinvent themselves in ways that keep a level of local employment.

Table 4: Looking for Competitive Advantage

Period	Goal	Advantage	Examples
1960s -1970s	Making things cheaper	Cost	Division of labor, MTS, mass production
1980s -1990s	Making things better	Quality and Speed	TQM, JIT, flexible specialization, automation
2000s	Making better things	Aesthetics and Authenticity	Design, innovation, uniqueness

F. Clusters need global pipelines to avoid stagnation.

To continue to compete as technologies advance and markets change, clusters need “global pipelines” as much as they need “local buzz.”²³ Many strong clusters have failed because they became complacent and shut themselves off from competing regions. London’s furniture industry disappeared because it shut itself off from market trends. The Swiss watch industry and the Jura region refused at first to listen to or work with Japanese firms and found itself losing much of its market to the lower cost and style conscious electronic and digital watches. Successful clusters establish linkages to companies and closely monitor trends in other parts of the world and provide different perspectives. They balance their local networking with connections in distant competition and markets, through international professional associations and trade shows and by extending their value added chain outside of their region.

North Carolina’s hosiery cluster centered in the Catawba Valley had learned to cooperate and knew it needed modernize to compete. Through their association, they convinced the legislature to support the Hosiery Technology Center at the local community college. It was able to get the latest equipment for all to see and try and it did training. But that didn’t seem to be enough. In 1996, I traveled with a dozen CEOs, Center and association staff, and state officials to meet and observe the competition in northern Italy. We started in Lombardia in Brescia where the equipment is made, visited Castel Goffredo, where about 200 firms produce hosiery supported by a technology center, and went on to the knitwear cluster in Carpi and its center, CITER. The cluster was able to look outside its boundaries—and think outside the box. Based on what they saw and learned, the North Carolina Center to refocused on quality standards, dyeing processes, design, and e-commerce, and they established permanent relationships with the equipment producers and lead firms. The result was a niche oriented, up-scale, more competitive cluster.

IV. Where Next

Policy makers have already taken the term clusters well beyond the original industrial district model, both in degree of specialization and in scale. Almost any geographic grouping of similar or complementary firms can now be described as a cluster, whether its two firms in a small town or one large firm with a small number of suppliers. The term also is being used to define a broad array of functions and resources that appear to act as magnets for certain types of businesses. “Innovation clusters” form around universities and other research complexes, “knowledge clusters” have become the alternative rural model, claiming clustering around knowledge based industries, and “functional clusters” are those that form around common corporate functions such as headquarters, distribution, or R&D. All appear to be increasingly influenced by local physical, cultural, and recreational amenities.

While most places have accepted the theory of clusters, many fewer public sector agencies have invested in programs at a scale that would affect the cluster. The efforts of most government agencies have been aimed at altering the behavior of companies, getting them to organize, associate, trust one another, and form networks. Few agencies have made changes in their own behavior by, for example, organizing their services around clusters, creating cluster hubs, or even employing people with special cluster expertise. Investments in cluster initiatives—other than high cost recruitment efforts—have been minimal.

The major benefits of clusters have been to change mindset of public sector officials. They now better understand and accept the value to firms and to growth of associative behavior, networking, and learning. It moves places to pay more attention to niche strengths and branding. It offers a way to aggregate demand and address the collective needs of their economy rather than focusing on individual employers. Finally, the synergy and scale of clusters can produce economies of scale and cost efficiencies for public sector services.

Appendix A Cluster Types

- *Working clusters* are those in which a critical mass of local knowledge, expertise, personnel, and resources create agglomeration economies. Working clusters tend to have dense patterns of interactions among local firms and complex patterns of competition and co-operation. Even if participants do not call themselves a "cluster" there tends to be knowledge of the interdependence of local competitors, suppliers, customers, and institutions.
- *Latent clusters* have a critical mass of firms in related industries sufficient to reap the benefits of clustering but have not developed the level of interaction and information flows necessary to truly benefit from co-location. Such groups of firms do not think of themselves as a cluster and, as a result, do not think of exploring the potential benefits of closer relationships with other local organizations.
- *Potential clusters* are those that have some of the elements necessary for the development of successful clusters, but they must be deepened and broadened to benefit from agglomeration. Often there are important gaps in inputs, services, or information flows that support cluster development.
- *Policy driven clusters* are those chosen by governments for support but lack a critical mass of firms or favorable conditions for organic development. Many electronics and biotechnology "clusters" found in government programs are examples. They tend to rely on the notion that policy can create clusters from a relatively unfavorable base.
- "*Wishful thinking*" clusters are policy driven clusters that lack, not only a critical mass but any particular source of advantage than might promote organic development.

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