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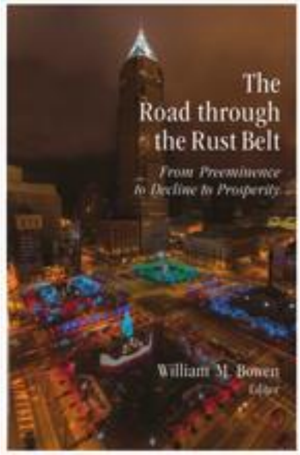

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From Preeminence to Decline to Prosperity

William M. Bowen
Editor

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The Evolution of Clusters and Implications for the Revival of Old Industrial Cities

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It has long been thought that firms cluster to gain shared economic benefits related to scale, access to skilled labor forces, and transportation costs. Over time the concept of clusters has evolved, no more so than in the Rust Belt cities of the Midwest.

The study of industrial or regional clusters has a long history. Alfred Marshall (1920) discussed the localization of firms within the same area to pursue a shared labor pool, local provision of industrial inputs, and spillovers of knowledge and information. The neoclassical tradition emphasizes the impact of transportation costs and economies of scale on shaping the location of firms (Hoover 1937; Isard 1951; Krugman 1991). Following the economic transformation from Fordist capitalism to post-Fordist capitalism in the developed world, there has been renewed attention on agglomeration and clusters for the past three decades. Scholars with a variety of backgrounds, including economics, regional science, geography, planning, and business management, have sought the reasons for clustering or agglomeration economies. These researchers have pursued new perspectives, including increasing returns, flexible production, innovation, entrepreneurship, knowledge spillovers, and networks (Acs and Varga 2005; Gordon and McCann 2000; Jacobs 1969; Markusen 1996; Porter 1998; Scott 1988).

Witnessing the success of U.S. high-technology clusters, such as Silicon Valley in California; Austin, Texas; and Research Triangle Park in North Carolina, policymakers have increasingly considered clusters as an effective tool for economic development. President Obama, for instance, supported a federal initiative to bolster regional innovation clusters, with $100 million requested in his proposed fiscal year 2010 budget. This has been especially inspired by the work of Harvard Business School Professor Michael Porter (1998, 2003), who has sought to operationalize the identification of clusters. Professor Porter was invited to speak on clusters at the 2011 annual meeting of the National Governors Association. Meanwhile, as of July 2011, 7 of the 10 most read articles in *Economic Development Quarterly*, a journal focusing on economic development policy and practice, included "cluster" in their titles.[1]

The purpose of this chapter is to survey the literature on the evolution of clusters and explore its implications for the revival of old industrial or Rust Belt cities. Many old industrial cities feature declining or declined clusters and are struggling to revitalize their economies. The chapter starts with a review of definitions and typologies of clusters. It then summarizes four streams of literature discussing the evolution of clusters and endeavors to identify some major forces behind the dynamics of clusters, based on the limited research available. It does not solely address clusters manifested in old industrial cities (e.g., the industrial complexes identified by Iammarino and McCann [2006]), since one type of cluster may evolve into another type. The chapter further examines cluster development in the U.S. Rust Belt, using Cleveland as an example, and explores the implications of clusters' evolution paths for the revival of old industrial cities.

CLUSTERS: DEFINITIONS AND TYPOLOGIES

There are several terms associated with clusters, which have been increasingly used in an interchangeable fashion, including "agglomeration," "new industrial districts/places," and "regional/industrial/business clusters," among others. The first wave of cluster research was primarily propelled by the seminal work of Marshall (1920), who popularized an agglomeration approach to understanding the phenomenon. This perspective was carried forward in the work of Hoover (1937, 1948), Mills (1972), and Krugman (1991). Together with Isard's industrial complex approach (e.g., Isard and Vietorisz 1955), the agglomeration view explored the benefits of spatial or geographical clusters in terms of transportation costs, economies of scale, shared labor and industry-specific inputs, and to a lesser extent, knowledge spillovers. Hoover (1937, 1948) classified agglomeration as consisting of firms' internal expansion, localization economies, and urbanization economies. Internal expansion represents a firm's economies of scale; localization economies address cost reductions as a result of the spatial concentration of businesses from the same sector; and urbanization economies consider the benefits of agglomeration irrespective of sectors.

Clusters regained scholarly attention in the early 1980s among not only economists but geographers, planners, regional scientists, and management scholars. This second wave commenced from several case studies of the artisanal and design industries in the "Third Italy" (e.g., Brusco 1982) and was later extended to the film industry in Los Angeles (Storper and Christopherson 1987) and to high technology, particularly in Silicon Valley (Saxenian 1994; Scott and Angel 1987).[2] Scott (1988) terms these places "new industrial spaces," which are characterized by flexible production, social division of labor, formation of external economies, dissolution of labor market rigidities, and reagglomeration of production. These industrial districts feature "a congeries of interconnected producers and associated local labour markets" (Scott 1988, p. 182).

Markusen (1996) provides an influential typology of the industrial district, which she defines as "a sizable and spatially delimited area of trade-oriented economic activity which has a distinctive economic specialization" (p. 296). She argues that there are other types of "sticky" industrial districts beyond Scott's new industrial places that have demonstrated resilience, and proposes four types of industrial districts.

The first type, called "Marshallian industrial districts," features a business structure dominated by small and locally owned firms. In these districts, there is a substantial amount of trade among locally embedded suppliers and buyers, which is generally secured by long-term contracts, and a flexible labor pool internal to the district instead of to any specific firms. Compared with the classic Marshallian industrial district, its Italianate extension is more innovative, cooperative, embedded, and government led.

The second type of industrial district, the "hub-and-spoke," is one in which one or several large firm headquarters play a pivotal role in local business. These firms are vertically integrated, surrounded by local suppliers, and embedded nonlocally. They are also globally oriented in terms of their input, products or services, and investment decision making.

The third type is coined “satellite industrial platforms” and has a business structure dominated by large branch facilities that are externally owned and headquartered. These branches can range in the nature of production from routinized assembly plants to research facilities, as long as they are able to “stand alone.” Because the facility is controlled by its remote headquarters, its cooperation with other local facilities is generally low.

The last type, named “state-anchored industrial districts,” involves a business scenario dominated by the local presence of state or national capitals, large government institutions, or big public universities.

Porter (1998) proposes the most influential framework of clusters. He defines clusters as “geographic concentrations of interconnected companies and institutions in a particular field” (p. 78). He considers clusters to be a strategy for regions to build competitive advantage. Consistent with his diamond model (Porter 1990), clusters involve other industries connected with the core industry via both backward linkages (i.e., suppliers) and forward linkages (i.e., channels and customers), and supporting institutions such as governments, universities, and trade associations.

Porter argues that clusters encourage both competition and cooperation and promote innovation, entrepreneurship, and productivity. He further operationalized his concept of clusters, using a combination of location quotient analysis, locational correlation analysis, and input-output models to identify the clusters of traded industries in a specific region (Porter 2003). The Porter school of cluster theory soon gained popularity among not only scholars but also planners, practitioners, and policymakers. This occurred despite the seemingly traditional policy instruments Porter has proposed, such as improving human capital, infrastructure, and intellectual property protection (Porter 1998). However, Martin and Sunley (2003) suggest cautious use of clusters as a development strategy.

Porter’s concept of clusters is extended by Hill and Brennan (2000), who define a “competitive industry cluster” as “a geographic concentration of competitive firms or establishments in the same industry that either have close buy-sell relationships with other industries in the region, use common technologies, or share a specialized labor pool that provides firms with a competitive advantage over the same industry in other places" (pp. 67–68). This idea advances the research by providing a methodology based primarily on cluster analysis and discriminant analysis to identify the clusters with competitive advantages in a region.

Gordon and McCann (2000) and Iammarino and McCann (2006) develop a typology of industrial clusters in terms of transaction costs. Under their deductive approach, categories of industrial clusters include "pure agglomeration" following the tradition of Marshall (1920); "the industrial complex" following the perspective of Isard (Isard 1951; Isard and Kuenne 1953; Isard and Vietorisz 1955); and the "social network" following the work of Granovetter (1973). The first type, echoing Marshallian industrial districts in Markusen's typology, is structured by atomistic firms with unstable trading relations. Industrial complexes, with one or several large firms surrounded by local suppliers, represent identifiable and stable trading relations, and are structurally consistent with the hub-and-spoke model. And the social-network model is characterized by the role of trust and social capital in forming business relations and is "essentially aspatial" (Iammarino and McCann 2006).

The aspatial nature of the social-network model discussed by Iammarino and McCann (2006) suggests that the geographic unit for clusters is indeed flexible. Although every cluster has a geographic scope, what matters for a cluster is interconnectedness of economic agents (Porter 1998). The geographic unit of a cluster can be very small or very large, depending on the spatial extent to which economic activities interact. By the same token, the geographic boundary of a cluster is rarely consistent with any administrative boundaries and may even be transnational (e.g., the Seattle-Vancouver technology corridor). The unclear geographical scope of clusters has incurred criticism, such as from Martin and Sunley (2003).

It should also be noted that, within the same region, different types of clusters might coexist. An example is Silicon Valley, which, as Markusen (1996) points out, hosts all of the four types of clusters she identifies. According to Scott and Angel (1987) and Saxenian (1994), Silicon Valley is a typical Marshallian district. However, it also features the hub-and-spoke model with the presence of major hubs such as Stanford University and Hewlett-Packard, the satellite industrial platform with the presence of branches of IBM, Oki, NTK Ceramics, Hyundai, and Samsung, and the state-anchored model with the presence of a strong defense electronics and communications sector (Markusen 1996).

THE EVOLUTION OF INDUSTRIAL CLUSTERS

To date, the literature on clusters' evolution has been relatively insufficient for at least two reasons. First, clusters did not regain scholarly attention until the 1980s, and the most influential studies to date are concerned with definitional and typological issues in the context of post-Fordism and generally consider clusters to be static (e.g., Markusen 1996). Second, different types of clusters (and even those within the same type) may exhibit diverse paths of evolution, which make it difficult to find commonalities. Efforts to explain the evolution of industrial clusters have been made for some specific cases (e.g., Feldman, Francis, and Bercovitz 2005; Huggins 2008). Despite the difficulties of generalization, a few scholars have discussed cluster evolution, and the resulting literature may be categorized into four streams: 1) an industrial cluster evolves following the product cycle of its core industry, 2) technical changes lead to new industrial composition of a cluster, 3) an industrial cluster transforms itself from one type to another, and 4) an existing cluster or even an incumbent firm may incubate a new cluster. Each stream is discussed in detail in this section.

The Product Life Cycle Approach

The product life cycle theory, introduced by Vernon (1966) in the context of international trade, describes the evolution of products, which can be applied to the evolution of the associated industries. A typical product life cycle can be decomposed into four stages: introduction, growth, maturity, and decline. In the first stage, a new product is introduced to the market and produced locally. As it is increasingly accepted by consumers both locally and from outside the region, the industry experiences a rapid expansion in the second stage, and production starts to move to other areas seeking lower costs, especially in terms of land and labor. At the third stage, the market demand for this product is stable or even starts to fall, the production process is mature, and production facilities are primarily located in areas with low costs. Last, new products emerge as better substitutes, and the industry declines. Jacobs (1969) finds that large diversified cities are cradles of innovation and are thus the natural environment for the first stage of the product life cycle. Duranton and Puga (2001) further reveal that innovations generally occur in diversified cities, but production may relocate to specialized cities with lower costs once the production process becomes standardized.

In his seminal paper, Porter (1998) also addresses the evolution of clusters in a way similar to the product life cycle approach. He lists some forces behind the birth, growth, and decline of a cluster, arguing that a cluster may emerge simply by a chance event, or as a result of historical circumstances or new demand. An incumbent cluster or large firms may also serve as the incubator of a new cluster. Once a cluster starts emerging, according to Porter, its growth and expansion are characterized by a self-reinforcing process, in which opportunities in the new cluster will bring dynamic, collective actions of talent, specialized suppliers and forward channels, service providers, and related government agencies. A vigorous local business climate and supportive institutions provide jurisdictional advantages for the region, facilitate the growth of clusters, and enable long-term prosperity for the region and the cluster. The decline of a cluster, as Porter argues, generally comes with technological discontinuities, failure to meet consumers' changing demand, and internal rigidities.

Change of Industrial Composition

In addition to the product/industry/cluster life cycle approach, some quantitative scholars trace cluster changes over time in terms of their industrial composition. A cluster in the Porter school involves not only one or more traded industries but also linked industries as suppliers and channels or consumers. These interindustry linkages can be identified through the input-output model. Industries may also be interconnected through shared labor pools and knowledge spillovers, as suggested by Marshall (1920) and Hill and Brennan (2000), but these flows are much less measurable than interindustry trade.

The industrial makeup of a cluster may be altered over time, reflecting technical developments occurring during that period. Montana and Nenide (2008) adopt this approach and examine evolving clusters in California's central San Joaquin Valley and northeast Indiana from 1997 to 2002. The business and innovation services cluster in northeast Indiana, for instance, was composed of five four-digit North American Industrial Classification System (NAICS) industries in 1997: 1) printing and related support activities (3231); 2) other financial investment activities (5239); 3) agencies, brokerages, and other insurance-related activities (5242); 4) insurance and employee benefit funds (5251); and 5) employment services (5612). By 2002, this cluster had evolved by adding five newly related industries: 1) Internet publishing and broadcasting (5161); 2) securities and commodity contracts, intermediation and brokerage (5231); 3) management, scientific, and technical consulting services (5416); 4) office administrative services (5611); and 5) facilities support services (5613).

Cluster Transformation between Different Types

As the third evolutionary approach, a cluster can be transformed from one type to another under a given typology. Historically, regions hosting the automobile cluster, e.g., Detroit, were transformed from Marshallian industrial districts in the early decades of the twentieth century to hub-and-spoke districts (Markusen 1996), or from the pure agglomeration model to the industrial complex model (Iammarino and McCann 2006). Today, there are only a few oligopolistic producers dominating the local business structure in these regions. The financial market in London, the fashion cluster in New York, and the semiconductor and electronics sector in Silicon Valley evolved from the social network type to pure agglomeration (Iammarino and McCann 2006). As Iammarino and McCann (2006) point out, even for the high-tech industrial sector, its cluster type and evolution path may vary from case to case: Unlike its counterpart in Silicon Valley, the electronics industry in Scotland has remained an industrial complex cluster for the past 40 years.

New Cluster Born out of Incumbent Clusters and Firms

The fourth type of evolution focuses on the role of one or several incumbent clusters in incubating new clusters. Southern California's aerospace cluster, which has attracted talent and suppliers specialized in castings and advanced materials, was associated with the birth of the golf equipment cluster in San Diego (Porter 1998). Gray, Golob, and Markusen (1996) and Markusen (1996) report that the aircraft/spacecraft cluster in Seattle anchored by the giant company Boeing contributed to the formation of other clusters such as port-related activities, software, and biotechnology. Sometimes, several clusters may jointly foster the formation of a new cluster. Porter (1998) finds that a cluster producing built-in kitchens and appliances was developed at the intersection of the home appliances and household furniture clusters in Germany.

Alternatively, the "incubator" may not be existing clusters but simply large and innovative firms or institutions. A new cluster may emerge as a result of massive spin-offs from an incumbent firm in a region. For instance, Fairchild Semiconductor played a critical role in shaping the semiconductor cluster in Silicon Valley, spinning off a large number of new entries, including major players such as AMD, Intel, and National. According to Klepper (2011), a majority of the top performers in the semiconductor industry were located in Silicon Valley and descended from Fairchild Semiconductor, directly or indirectly. Klepper also reports that the influence of B.F. Goodrich is associated with the creation of Diamond Rubber, Kelly-Springfield, Goodyear Tire & Rubber, and Firestone Tire & Rubber, which collectively underpinned the tire cluster in Akron, Ohio. Similarly, America Online and MCI were the hubs that facilitated the formation of the telecommunications cluster in the Washington, D.C., metropolitan area (Porter 1998).

CLUSTER DEVELOPMENT: THE CASE OF CLEVELAND

This chapter seeks implications of the evolution of clusters for the revival of old industrial cities. This is a challenging task, because there have been various evolutionary paths and because the diversity among old industrial cities implies different cluster-based economic revitalization strategies. The old U.S. industrial cities in the Rust Belt, such as Chicago, Cleveland, Detroit, and Pittsburgh, differ from each other in terms of their industrial base and industrial organization, as well as the extent of their progress toward renewal. As a result, it is inappropriate to discuss cluster development in the general context of old industrial cities.

This chapter's focus is on the Cleveland-Elyria-Mentor metropolitan area. Cleveland has been declining for the past several decades, suffering both population loss and stagnant economic performance. The 2010 census data show that Cleveland was still among the top 30 largest metropolitan areas, with a population slightly above 2 million, down 3.3 percent from 2000. Economically speaking, employment had a 14 percent drop for the period of 1998–2009, as indicated by the census metropolitan statistical area (MSA) business pattern data. This section presents the pattern of cluster development in the Cleveland metropolitan area, and the next section will discuss the implications of the cluster evolution literature for the revitalization of this region.

Given the emphasis on cluster evolution, examining the longitudinal data is critical. Longitudinal cluster development in Cleveland will be described using two sets of data. One is from the Cluster Mapping Project led by Porter, which identifies clusters for each metropolitan area using a combination of location quotient, locational correlation, and input-output analysis (Porter 2003). At the core of each cluster is one four-digit Standard Industrial Classification (SIC) code industry that exports products, with a group of local industries supplying inputs. The size of each cluster is measured by total employment in both the traded and supplier industries.

There are two interrelated problems in using this data set for this research. First, it covers only the time period of 1998–2008 (as of March 2011). When looking at the evolution of clusters, long-term historical data are needed, since it generally takes decades for clusters to evolve (Sallet, Paisley, and Masterman 2009). Data for one decade shed little light on the long-term evolution of clusters. Second, because Cleveland started to lose its competitive advantage in the 1960s, data for only the latest decade may not provide insights into the sources of the decline. Technically, as long as employment data by industry are available, it is possible to extend Porter's methodology into earlier periods. However, input-output relationships among industries, which are needed to identify clusters, are not stable in the long term. The industrial composition of the same cluster hence could be very different over a long time period due to technical changes in production. As a consequence, it is almost impossible to examine the growth and decline of a cluster defined in terms of a static industrial composition. However, if changes in input-output relationships are accounted for, as in Montana and Nenide (2008), a cluster could change significantly in its structure over a long time period, making the temporal data less comparable at different times. This approach might be feasible for investigating one or a few clusters based on the case study methodology, which allows for reporting details of cluster structural changes along time, but might not be appropriate for studying all clusters in a region.

As complementary information, long-term employment changes of Cleveland's leading traded industries, without considering intraindustry linkages, will also be studied. Traded or export industries are identified using the methodology introduced by Porter (2003) and the 2002 employment data by industry (four-digit NAICS code).[3] The industry data used in this chapter are from Moody's Analytics Web site, (2013) economy .com. The advantages of this site are that its data reach back to 1970 and address the suppressed data problem that appears in the federal data source—the County Business Patterns (CBP). In the latter case, industry employment data are occasionally suppressed to avoid disclosing information of individual businesses. These leading traded industries are likely to be the core of major clusters and thus can be used to track their evolution in Cleveland to some extent.

Table 4.1 presents the national ranking of major clusters in the Cleveland metropolitan area based on Porter's Cluster Mapping Project. A cluster is considered "major" and included in the table if its employment size in Cleveland was among the nation's top 20 either in 1998, the earliest year with available data in the Cluster Mapping Project, or in 2008, the latest year with available data (as of March 2011 [Porter 2011]). The table also shows the percentage change in employment during this decade. It can be seen that major clusters in Cleveland are all in manufacturing, reflecting the historical economic base of the city. In terms of employment size, the three largest among these clusters are metal manufacturing (the largest both in 1998 and in 2008), production technology (the third largest in 1998 and the second largest in

Table 4.1 National Rankings (by Employment) of Major Clusters in Cleveland, Ohio, 1998 and 2008

Cluster name	Ranking 1998	Ranking 2008	% change in employment (1998–2008)
Automotive	4	7	−44
Lighting and electrical equipment	4	10	−51
Metal manufacturing	**4**	**3**	**−29**
Production technology	**5**	**3**	**−21**
Motor driven products	8	>40	n/a
Building fixtures, equipment, and services	**10**	**5**	**62**
Plastics	10	11	−23
Chemical products	12	14	−25
Medical devices	13	26	−33
Power generation and transmission	14	21	−31
Biopharmaceuticals	16	20	−28
Aerospace engines	**17**	**13**	**−3**
Construction materials	**19**	**12**	**−2**
Heavy machinery	**29**	**11**	**81**

NOTE: Bold type indicates a rise in ranking.

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

2008), and automotive (the second largest in 1998 and the third largest in 2008), as the Cluster Mapping Project data show. In terms of national rankings, which provide insights into regional competitive advantage, Cleveland placed in the top five nationally in employment in the automotive, lighting and electrical equipment, metal manufacturing, and production technology clusters in 1998. In 2008, the leading clusters were metal manufacturing and production technology. Cleveland was among the nation's top three in these two clusters. In addition, Cleveland had the nation's fifth-largest building fixtures, equipment and services cluster in 2008.

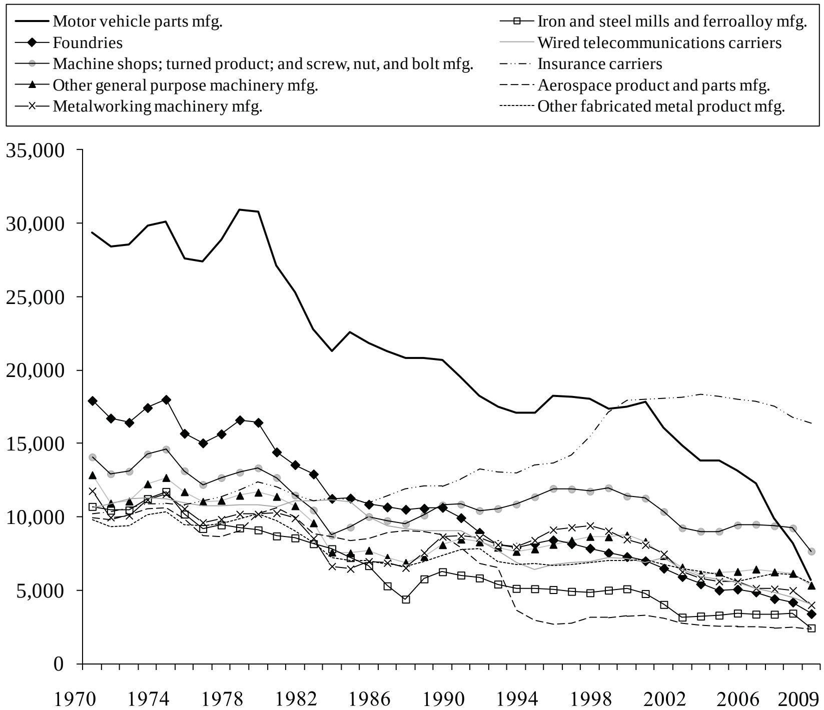
As for changes between 1998 and 2008, Cleveland gained competitive advantage, as evidenced by rising national rankings, in 6 out of the 14 listed clusters: 10 metal manufacturing; 2) production technology; 3) building fixtures, equipment and services; 4) aerospace engines; 5) construction materials; and 6) heavy machinery. Among them, the heavy machinery cluster marked the most significant improvement, jumping from number 29 to number 11. Following that, Cleveland moved up by at least four spots in the construction materials, aerospace engines, and building fixtures, equipment, and services clusters. It is worth noting that, although Cleveland had a higher rank in 6 out of 14 clusters in 2008, only two clusters—heavy machinery and building fixtures, equipment, and services—experienced employment growth in this decade.

In comparison, Cleveland's rank in 8 of the 14 clusters worsened during the period. Among them, Cleveland's motor driven products cluster was number 8 in the nation in 1998, but dropped below number 40 in 2008. Other significant declines occurred for the medical devices, power generation and transmission, and lighting and electrical equipment clusters, each moving down in the ranking by at least six spots.

Now we turn to industry data for the time period of 1970–2009, which provide better information for studying evolution trajectories. Figure 4.1 demonstrates the longitudinal change of Cleveland's top-10 traded industries as ranked by their 1970 employment. Only 2 out of these 10 industries—wired telecommunications carriers and insurance carriers—are not manufacturing based. In 1970, the dominant traded industry was motor vehicle parts manufacturing (with total employment of roughly 30,000), which shrank tremendously in the ensuing 39 years through 2009. Likewise, other top-traded industries in Cleveland also declined during this period, although not as significantly. One exception was the insurance carriers industry, which grew by 60 percent, thanks to the expansion of a few large insurance companies based in Cleveland, such as Medical Mutual of Ohio and Progressive.

Figure 4.2 exhibits the industrial evolution of the 10 most specialized traded industries in Cleveland as ranked by their 1970 location quotient;these are all in manufacturing, except interurban and rural bus transportation.[4] Using the location quotient instead of employment size can control for the national growth trend of industries (i.e., product/industry life cycles) and thus can better represent the dynamics of Cleveland's economy relative to the nation or other regions. Four manufacturing industries also appear in Figure 4.1 among the largest traded industries: 1) foundries; 2) machine shops, turned product, and screw, nut, and bolt manufacturing; 3) metalworking machinery manufacturing; and 4) motor vehicle parts manufacturing. Changes in the

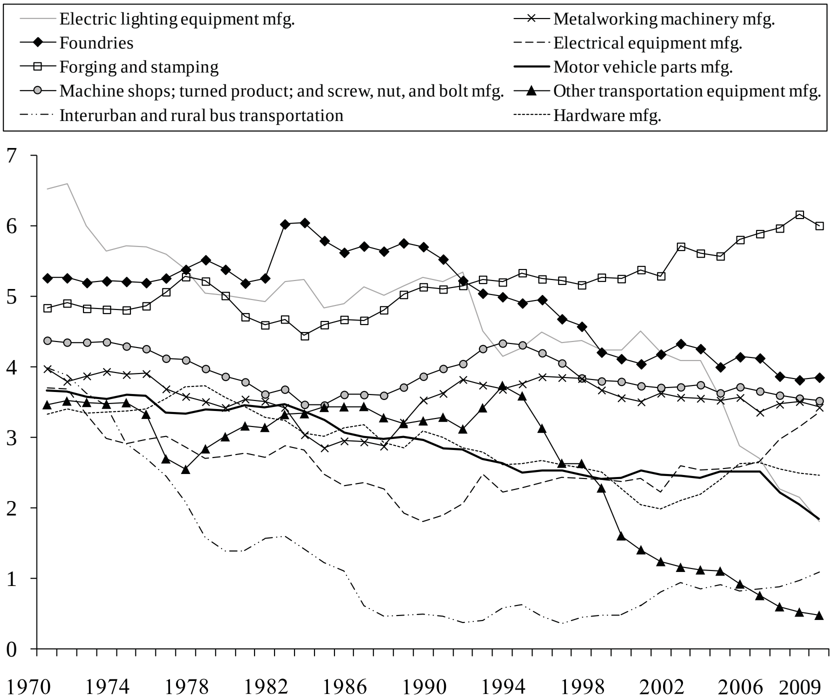
Figure 4.1 Employment of Top 10 Traded Industries, 1970–2009, as Ranked by 1970 Employment, Cleveland MSA, Ohio



SOURCE: Moody's Analytics (2013).

location quotient of these most specialized traded industries exhibit more diversified patterns than does the employment change in the major traded industries listed in Figure 4.1. The location quotient of the electric lighting equipment manufacturing industry, in which Cleveland was most specialized in 1970, dropped from 6.5 to 1.8 from 1970 to 2009. Significant drops also occurred in the other transportation equipment manufacturing industry, the motor vehicle parts manufacturing industry, and the interurban and rural bus transportation industry. By contrast, specialization in the forging and stamping industry intensified during the same period. The longitudinal location quotient for the electrical equipment manufacturing industry shows an interesting U-shaped

Figure 4.2 Location Quotients of Top 10 Traded Industries, 1970–2009, as Ranked by 1970 Location Quotient, Cleveland MSA, Ohio

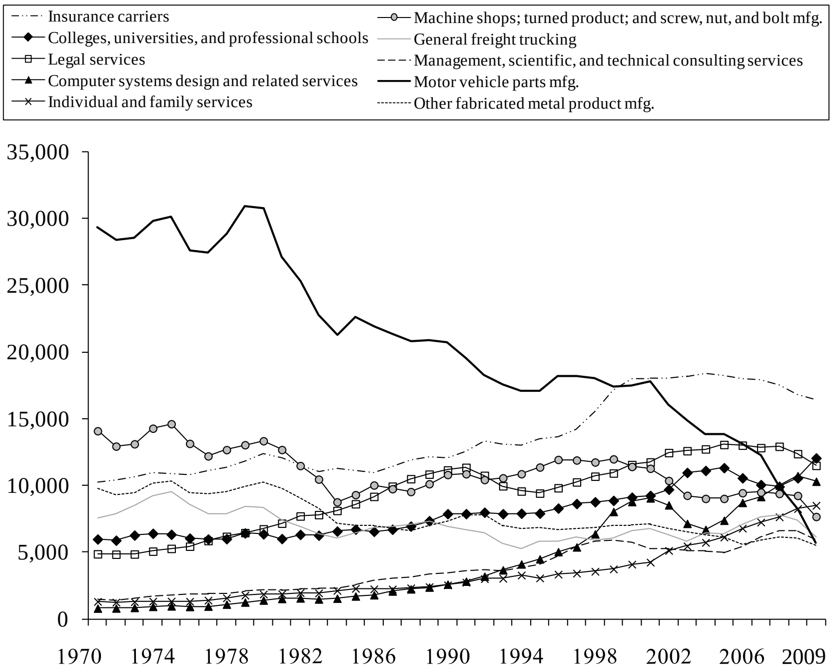


SOURCE: Moody's Analytics (2013).

curve, first becoming less specialized and after the 1990s regaining its proportion relative to the national level. Changes in other traded industries were moderate.

Figures 4.3 and 4.4 replicate Figures 4.1 and 4.2, respectively, except that the industries are identified based on the 2009 data. A comparison between industries included in Figure 4.3 with those included in Figure 3.1 suggests major shifts of leading traded industries between 1970 and 2009. In 2009, the top five largest traded industries were all service based. Only 3 out of the top 10 were manufacturing industries: 1) the motor vehicle parts manufacturing industry; 2) the machine shops, turned product, and screw, nut, and bolt manufacturing industry; and 3) the other fabricated metal product manufacturing industry. As shown

Figure 4.3 Employment of Top 10 Traded Industries, 1970–2009, as Ranked by 2009 Employment, Cleveland MSA, Ohio

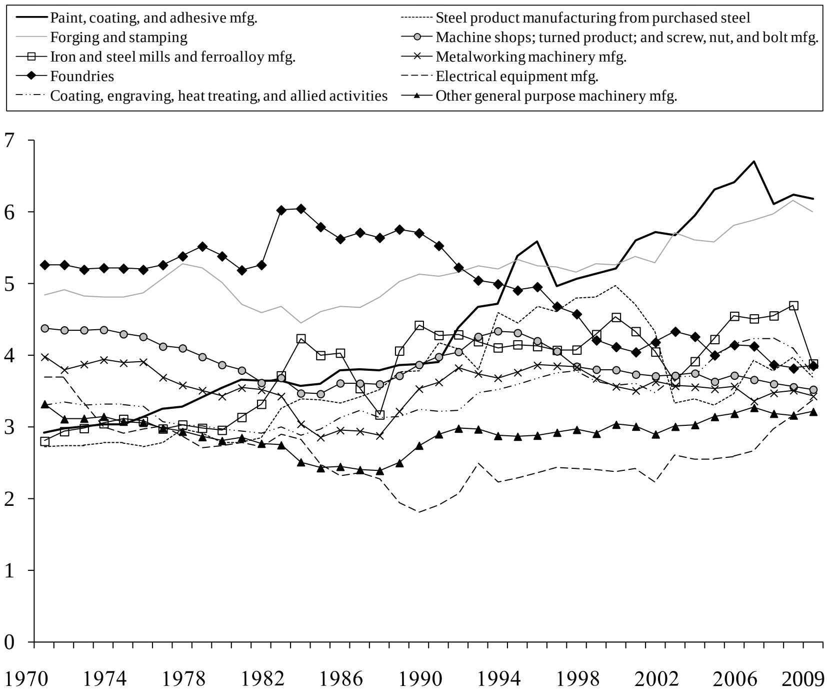


SOURCE: Moody's Analytics (2013).

in Figure 4.1, these were also among the largest traded industries in 1970 but declined since then. The "big four" traded industries—insurance carriers; colleges, universities, and professional schools; legal services; and computer systems design and related services—have expanded significantly since 1970 and each hired over 10,000 employees in 2009. Behind the high rank of the individual and family services industry was Cleveland's largest employer, the Cleveland Clinic.

In contrast to Figure 4.3, Figure 4.4 reveals that the 10 traded industries with the highest location quotients in 2009 were exclusively manufacturing industries, and 5 of them were also among the top 10 most specialized traded industries in 1970. The most remarkable change between 1970 and 2009 was in the paint, coating, and adhesive manu-

Figure 4.4 Location Quotients of Top 10 Traded Industries, 1970–2009, as Ranked by 2009 Location Quotient, Cleveland, Ohio



SOURCE: Moody's Analytics (2013).

facturing industry, with an increase in its location quotient from 2.9 to 6.2. Location quotient changes for other traded industries were moderate, providing evidence that Cleveland has been consistently specialized in these manufacturing industries.

What can be learned about cluster development and the evolution of traded industries in Cleveland based on these data? Three observations merit attention. To begin with, manufacturing clusters and industries are foundational to Cleveland's economy. Table 4.1 demonstrates that all clusters with a high national rank (by employment) are manufacturing based, as of 1998 or 2008. Similarly, Figures 4.2 and 4.4 show that Cleveland was consistently specialized in manufacturing industries between 1970 and 2009.

In addition, Cleveland's manufacturing clusters and industries have declined, but to a large extent due to product life cycles—the nationwide downsizing of manufacturing employment. In the case of clusters, the decade following 1998 witnessed employment growth in 2 of the 14 leading clusters in Cleveland; however, Cleveland moved upward in the national rankings of 6 of these 14 clusters. In the case of traded industries, while nearly all of Cleveland's top-10 largest traded industries in 1970 shrank in the following decades, changes in location quotients for Cleveland's 10 most-specialized traded industries in 1970 (9 of which were manufacturing industries) were rather diversified. For example, Cleveland in 2009 lost 80 percent of its1970 employment in the foundries industry; its location quotient by contrast went down only slightly, from 5.3 to 3.9.

Last but not least, some service-based traded industries have exhibited their vibrancy and have been driving job creation in Cleveland for the past four decades; however, they have yet to build standout competitive advantage nationally. For example, the insurance carriers industry had over 16,000 employees in 2009 and was Cleveland's largest traded industry, but had only a modestly high location quotient of 1.7. The location quotient for Cleveland's second-largest traded industry in 2009—colleges, universities, and professional schools—was only 1.2.

THE EVOLUTION OF CLUSTERS: IMPLICATIONS FOR CLEVELAND

How may the literature on the evolution of clusters shed light on the revitalization of a declining manufacturing city like Cleveland? The four streams of literature on cluster evolution introduced previously may have the following implications for cluster-based economic development and revival strategies.

To begin with, economic development strategies should reflect the primacy of the market in cluster development. As Porter (1998) has argued, the growth of a cluster is a self-reinforcing process in which entrepreneurs seize market opportunities embedded in the dynamics of cluster emergence. Entrepreneurship and competition are fundamentally important for cluster development, irrespective of the cluster type. Even for the industrial complex model identified by Gordon and McCann (2000), or similarly the hub-and-spoke districts defined by Markusen (1996), the barriers to or opportunities for entrepreneurship created by one or a few large firms are critical to the performance of a cluster. While Seattle is generally considered a success (Markusen 1996), Detroit is notorious for the rigidity and inflexibility brought by the "Detroit Three" automakers.

Industrial policy, represented by tax incentives and government subsidies specific to certain industries or firms, has been a popular practice. One of the latest cases of this kind of policy in Cleveland was a 15-year, $93.5 million incentive package put together by the state government in 2011 to retain the headquarters of American Greetings, a Fortune 1000 company, in northeast Ohio.[5] This case is discussed in Chapter 3 of this book. Industrial policy, which reflects the preference of the government and not necessarily competitiveness in the market, may distort competition, discourage new entries, and create opportunities for rent seeking and destructive entrepreneurship—not to mention the generally higher-than-minimum costs taxpayers have to bear due to information asymmetry between the government and incentive receivers. This type of policy challenges market primacy, is a threat to healthy cluster development, and thus should be abandoned.

The acceptance of market primacy and the repeal of industrial policy do not, however, mean that there is no role for government in cluster development. As Porter (1998) suggests, intellectual property protection and antitrust law enforcement at the national level and human capital development and physical infrastructure improvement at the subnational level are important aspects of cluster policy. The decline of population in Cleveland has made physical infrastructure sufficient for cluster development. The focus should be on investing and retaining human capital. Based on 2000 census data, only 23 percent of Cleveland's adult population has a bachelor's degree, a proportion that ranks as 157 among the 331 U.S. metropolitan areas. Human capital is critical to both knowledge creation and entrepreneurship (Qian and Acs 2013) and accordingly plays an important role in maintaining the vibrancy of clusters.

The second implication from the literature is that economic development strategies should take into account the path-dependent nature of cluster evolution. Cleveland, as it has been for most of its history, is still specialized in manufacturing production both for clusters and for traded industries. Nationally, most of these are declined or declining industries, constituting the major source of the stagnancy of Cleveland's economy. Despite that, any proposed cluster development strategy for Cleveland cannot simply overlook its manufacturing base. The history of the city renders its infrastructure, supply chains, business climate, and institutional setting all favorable to the manufacturing sector. The competitive advantage of Cleveland lies in its support systems for manufacturing. For the last several decades, growth has been remarkable in service areas such as insurance carriers and legal industries, yet these services are very competitive given the values of their location quotient. Policies or strategies in favor of service industries over manufacturing industries would be fundamentally wrong.

In fact, it is not "shameful" to be manufacturing based. It is good to have a specialization in "sexy" industries where that reflects genuine competitive advantage, such as within high-tech industries in Silicon Valley or Research Triangle Park, financial and fashion industries in New York City, or entertainment industries in Los Angeles, but manufacturing industries can also be drivers of economic growth. According to Markusen (1996), when the national manufacturing employment growth rate between 1970 and 1990 was almost zero, the manufacturing employment of industrial cities that grew most rapidly during this period increased by at least 50 percent. Porter (1998) states that "all industries can employ advanced technology; all industries can be knowledge intensive" (p. 80).

Consequently, cities like Cleveland should not think of abandoning manufacturing, but rather should focus on building regional capacity and jurisdictional advantages that reinforce the competitiveness of manufacturing clusters. As long as Cleveland maintains its competitive advantage, a manufacturing industry in the city may still grow by taking a higher share of this nationally shrinking industry. At the core of the competitiveness of manufacturing clusters is continuous innovation. Such changes are not specific to high-tech industries; they are fundamentally important for sustaining the growth of all industries or clusters. This imperative also calls for public policy to strengthen regional or local human capital.

The third implication from the literature is that there is a supporting role that public policy may play in facilitating the emergence of the next competitive cluster in Cleveland. As Klepper (2011), Markusen (1996), and Porter (1998) have contended, the emergence of a cluster may result from the incubation activity of existing clusters, large incumbent firms, or institutions like universities. Irrespective of industry, knowledge spillovers and entrepreneurship are critical in the formation of clusters this way. In fact, these two factors are interrelated; as Acs et al. (2009) and Qian and Acs (2013) argue, entrepreneurial activity may serve as a mechanism of transmitting knowledge spillovers. Cleveland's productivity in knowledge creation, as measured by patents per capita in year 2000, ranked 144 out of 331 metropolitan areas; by contrast, its entrepreneurial activity, as measured by new firms per capita in year 2000, ranked 224 out of 361 metropolitan areas.[6] These measures suggest that not only knowledge creation and spillovers but also entrepreneurship in Cleveland need to be strengthened to foster the development of new clusters.

Beyond human capital investment and retention, as discussed under the first implication, public efforts may be put into small business support programs, like business incubators and Small Business Development Centers. Business incubators, for example, may facilitate both knowledge spillovers (through the networking opportunities they provide) and entrepreneurship (through the various primary and professional services they offer). The publicly funded business support programs, in accord with cluster policy, should service local businesses from all industries.

Last but not least, it does not matter when a regional cluster was transformed from one type to another under a typology like Markusen's (1996) or from one industrial composition to another one as suggested by Montana and Nenide (2008), as long as the cluster maintains its competitiveness. The fall of Detroit was not because its automobile cluster evolved from a Marshallian industrial district to a hub-and-spoke district (Markusen 1996), but because, along with this transformation, the oligopolistic Detroit Three lapsed into rigidities that deferred entrepreneurial new entries (Chinitz 1961). Cleveland used to be one of the most entrepreneurial cities in the United States a century ago, and its decline was largely attributed to the loss of that spirit. Cleveland's clusters, as elsewhere, have been evolving, and today its leading clusters more or less cover all of the four types of industrial districts identified by Markusen. All these types of clusters could be competitive, or not.

Regardless of cluster type and industrial composition, the true sources of clusters' competitiveness in a region are high stocks of human capital, well-developed infrastructure, and social, business, and institutional climates that encourage learning and innovative and entrepreneurial activities. Cluster development policy in Cleveland and other old industrial cities should be made in these directions.

CONCLUDING REMARKS

This chapter focuses on the evolution of clusters and the associated implications for the revival of old industrial cities, using Cleveland as an example. It reviews the literature on the definitions, typologies, and evolution paths of clusters and also introduces some facts about Cleveland's cluster development based on the Cluster Mapping Project and Moody's economy.com data. At the core of the discussion is how cluster evolution theories may shed light on the revitalization of Cleveland. Four implications are drawn from the literature: 1) highlighting the roles of primacy of market, 2) path dependency, 3) public policy in the emergence of clusters, and 4) the irrelevance of cluster types in the context of economic development. In conclusion, human capital, innovation, and entrepreneurship should be the targets of Cleveland's focus in building competitive clusters and regaining economic vibrancy. The capacity building approach to cluster development, as Sallet, Paisley, and Masterman (2009) have noted, may mean that it will be decades before Cleveland regains its former stature in the national economy, and it may require collective leadership from both public and private sectors.

Notes

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1. See http://edq.sagepub.com/reports/most-read (accessed August 18, 2011).
2. The Third Italy refers to the central and northeast regions of Italy.
3. Porter (2003) gives three primary criteria for traded industries: 1) all states with a location quotient greater or equal to 1 account for at least half of the total employ-

ment, 2) the top five states represent an average location quotient of at least 2, and 3) the Gini index is at least 0.3. Following Porter's suggestion, we also excluded resource-based industries, in this case all four-digit NAICS industries under Agriculture, Forestry, Fishing and Hunting (NAICS code 11) and Mining, Quarrying, and Oil and Gas Extraction (NAICS code 21).

4. Location quotient is the share of employment in an industry in a region divided by the share of employment in the same industry in the nation. It reflects the extent to which the region is specialized in the industry compared with the nation as a benchmark.
5. For details, see http://www.cleveland.com/business/index.ssf/2011/03/american_greetings_to_stay_in.html (accessed October 1, 2011).
6. Patent data and new firm formation data used the 1999 metropolitan statistical areas (MSAs) definition and the 2003 MSAs definition, respectively, leading to different total numbers of MSAs. Patent data were provided by Kevin Stolarick (University of Toronto); population data were from the 2000 census; and new firm formation data were from Business Information Tracking System of the U.S. Census Bureau.

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