PART TWO: OBSERVATIONS, ANALYSES, AND LESSONS FROM EXPERIENCE

This second part of the report draws on all of the information from the seven targeted industry clusters acquired from surveys, interviews, reports, and extant data to (1) assess export performance, competitive advantages, and potential for improved performance; (2) estimate small and mid-sized companies' potential for exports and competitiveness; and consider the strength of the systems in which they operate. Although the information was gathered from within the Geographically constrained clusters, the lessons are not limited to those sub-regions. Much the what has been learned from firms and services applies to the industry throughout the ARC region.

Most of the new information was obtained from personal and telephone interviews. In each cluster the team interviewed ten exporters, ten non-exporters, and at least six service providers. The analysis also includes a small number of interviews with firms outside of the cluster in areas of the ARC region without significant concentrations of companies ("clusterless") in order to learn more about the effects of distance from a specialized infrastructure. Because we chose to gather in-depth information from a small number of companies rather than cursory information from a large number, there was no attempt to select random samples. In fact, the process of using local industry experts to gain access to small and mid-sized firms and convince them to give us the time that was required to complete the detailed survey most likely resulted in biasing some part of the information collected; many of our contacts suggested firms with which they had worked, and some of these firms are probably somewhat atypical just by the fact that they had used external services.

In considering the data, there were striking differences between exporters and non-exporters responding to the surveys. Exporting firms, for example, were on average larger than non-exporters. Of the exporters interviewed, 48 percent had fewer than 100 and 28 percent had more than 250 employees. Of the non-exporters, 70 percent had fewer than 100 employees and 17 percent had more than 250 employees. Exporters purchased a larger share of their inputs locally; 86 percent purchased more than 10 percent and 52 percent purchased more than half of their inputs from suppliers within 100 miles of their plant. Among non-exporters, 66 percent purchased more than 10 percent locally and 34 percent purchased more than half locally. This is somewhat surprising, since larger, exporting firms might be expected to have more contacts and options among potential suppliers and to draw from a larger area.

Each cluster is assessed on its own merits but, where appropriate, information is pooled across clusters to make some assessments of particular strengths and weaknesses in the region.

A. Setting Cluster Boundaries

On the assumption that space and distance affect relationships and thus some of the competitive advantages of clusters, the project team estimated geographic boundaries for each of the sectors studied. This was accomplished by mapping concentrations of companies and employees and

calculating location quotients for establishments and employment (i.e., the ratio of the fraction of total establishments or employment in the sector in the county divided by the same fraction in the nation as a whole) by ARC county. The raw numbers and relative concentrations were mapped to search for groups of counties that fit both criteria. When these data were mapped, natural "breaks," where concentrations and location quotients dropped dramatically became obvious. The resulting cluster geographies are described in the following paragraphs. Many of the clusters, of course, overlap into non-ARC counties. Thus, border areas may actually be home to some of the specialized service used by ARC-based companies, and some of the services interviewed were just outside of the ARC boundaries. But firm-specific data was collected only from firms within the region. The geographies of the seven clusters are described below.

Household furniture companies are heavily concentrated in seven ARC counties in Mississippi that are home to 139 furniture companies employing almost 16,000, and in three ARC counties in Alabama which have 49 companies employing almost 3,000. Although published data establishes the boundaries of this "cluster," a careful analysis reveals that the concentration of companies is not really a single cluster but divided between two distinct clusters in adjoining regions that are separated by not only a state boundary but also by history and types of product. Alabama companies make an assortment of wood pieces while Mississippi's niche is upholstered furniture, and there is little sharing between the two.

The **knitting mill** cluster, which is dominated by hosiery manufacturers, extends through western North Carolina, adjacent counties in Virginia, and slightly into Tennessee. It also includes a smaller number of knitwear manufacturers producing among other things sweaters and blankets. Nine North Carolina counties contain 251 knitting industry firms employing over 25,000 workers and three Virginia counties have eight companies employing 2,500. The location quotients for employment in the cluster are greater than "20" in eleven counties in this cluster, i.e. the industry is at least twenty times as concentrated in those counties as in the nation as a whole. Much of the support for hosiery resides in Hickory in Catawba County, adjacent to the ARC region's boundary.

The **plastic parts** cluster is centered in the city of Erie and includes eight counties in Pennsylvania and four in Ohio. These plastics manufacturers are primarily sub-assemblers of products for large original equipment manufacturers. The Pennsylvania counties are home to 151 companies with 10,000 employees and the Ohio counties have 36 firms with 2,600 employees. Location quotients are higher than 3.0 in eight of the counties, which is quite striking in an industry so ubiquitous in the U.S.

The **environmental technologies** cluster is the one cluster not defined by counties because the firms comprising the cluster include a wide range of types of businesses that are not easily aggregated. Instead this cluster follows a "technology corridor" in Tennessee that runs along a 100 mile stretch of interstate connecting Oak Ridge with the city of Chattanooga. The two poles of the cluster, however, represent different types of interest and expertise in environmental technology. Oak Ridge is characterized by nuclear-based environmental technologies and services and R&D while Chattanooga is an older industrial city committed to both a clean environment and to developing a local environmental technology industry base.

Industrial machinery manufacturers are highly concentrated in the South Carolina ARC counties, and is one of the nation's premier clusters according to DRI/McGraw-Hill.[13] in terms of scale and importance to the region's manufacturing base. The six South Carolina counties have 301 companies employing 12,800 people. This cluster also extends into the more urban counties of western North Carolina, where 83 industrial machinery companies employ 1,900 workers. The cluster comprises about five percent of all employment but—in South Carolina—about a sixth of all manufacturing employment.

The **electronic component** industry is concentrated in the nine ARC counties that comprise the southern tier of New York (16,500 jobs) and spills over into the northern adjacent counties of Pennsylvania (8,700 jobs). Like industrial machinery, this cluster was recognized by DRI/McGraw Hill as one of the nations' premier clusters. The location quotients in four of the New York counties are greater than 1110,11, meaning that the proportion of employment in this sector is ten times the national ratio of employment. Two of the Pennsylvania counties have location quotients of four or greater.

The **medical devices** industry is concentrated in seven counties surrounding and including Pittsburgh, although compared to the other six clusters in terms of scale and concentration, it is quite weak. There are 45 companies with SIC 3840 in the eight counties employing 3,400 workers. The one county that also has a high employment location quotient is the site of a single large manufacturer.

B. The Birth of Clusters: Innovations and Branch Plants

Each of the geographic areas selected for the analyses have some of the characteristics of effective or working clusters, most of which have developed over many decades. The roots of these clusters, as of most dusters, are imbedded in some serendipitous historical event. Many of these clusters can trace their origins to either (1) a technological innovation or (2) a branch plant location, followed by (3) entrepreneurial energy of employees who see opportunities for new or competing market niches and start their own companies.

- **Mississippi's furniture cluster** grew out of the region's successful recruitment of Futorian Furniture Company to the state in 1948, which first introduced mass production technologies to the furniture industry, previously operated as a craft. Many of the largest companies are part of the progeny of that single innovative company and the owners proudly call themselves "graduates of Futorian University."

- **Alabama's furniture cluster** developed opportunistically, to take advantage of the region's growing mobile home industry. Workers trained in that industry saw opportunities to design and build promotional furniture for the customers of that low-cost housing industry.

- **Pennsylvania's plastics parts cluster** developed to support Erie Resistor, a plastics manufacturer that, in 1935, became the first company in the nation to use injection molding. Many of its employees took that new technology outside and started their own companies, and that entrepreneurial spin-off mentality persist today. Two companies interviewed, for example, were started by employees of a third. The area's large and successful tool and die

industry was able to support the industry with the precision molds it needed and helped spark growth. By 1953, 14 million pounds of plastic were shipped into the region to leave as products ranging from buttons to auto parts.

- **Tennessee's environmental technologies cluster** was a response to environmental problems, i.e., high rates of pollution from nuclear products at Oak Ridge and heavy industry in Chattanooga. The need to clean up these two areas gave rise to the birth of a new industry. The Oak Ridge National Laboratories was became a source of expertise and entrepreneurs, and many of its former professional employees are the entrepreneurs behind recent startups.

- **South Carolina's industrial machinery cluster** began in the 1950s when textile magnates attracted foreign machine tool builders to support and enhance their industry. Leaders in that traditional industry were able to connect the importance of access to the latest advances in technology to their own success, and to bring that technology closer to home, they successfully recruited Swiss and German machine tool builders.

- **New York's electronic components cluster** evolved in the 1960s from employees of the large IBM facility there. In this relatively young cluster, enough company employees took the skills and knowledge honed at IBM to develop their own independent market niches or to become suppliers of IBM.

- **North Carolina's hosiery cluster** owes its scale to the large branch plants such as Sara Lee and Kaiser-Roth that located there much earlier and then gradually discontinued lines or moved operations to lower cost regions. Many of the employees took their skills and borrowed capital to purchase used equipment and set up shop themselves.

These diverse histories illustrate that clusters cannot be formed out of whole cloth even with strong public policies accompanied by sufficient resources. Certain conditions must exist. But clusters can be made more effective and stronger when their interconnections and collective needs are recognized by government and taken into account policy implementation.

Specialized Services and Skilled Workers

One of the main advantages of clusters is their tendency to create and attract highly specialized services and knowledge and to develop skilled labor markets to meet their employment needs. Specialized assistance is more useful and valuable to firms than general knowledge. Engineers who know the language of the industry and know about special advanced technologies in use and in development, bankers who understand the trends and patterns of the industry, and market specialists who know where and who the customers are more likely to solve problems, make loans, and find new markets than their counterparts who know their respective discipline but not the specifics of the industry. Similarly, workers who are familiar with the industry are more highly valued than those who are not. Even though corporate leaders proclaim their desire for employees with general abilities, who know how to learn, problem solve, and communicate, owners of small companies without human resource directors or training programs (and even the line managers of large corporations) prefer new hires who know the business.

What sort of specialized services and skilled labor forces have the seven clusters been able to attract or develop?

- **North Carolina's knitting mill cluster (hosiery subset)**, as a result of its regional trade association, acquired state support for a hosiery technology center located at the local community college and, in 1996, was able to add a satellite center at another community college located on the periphery of the cluster. The local bank president attends association meetings and, according to industry spokespersons, is the only banker in the state with intimate knowledge of the hosiery business. North Carolina State University and 21 cluster members formed a network to attempt to develop an advanced boarding technology, and the university's technology extension service will soon assign an engineer to work with the cluster. Although marketing and exporting expertise are still concentrated in New York, this cluster, with assistance from the North Carolina Alliance for Competitive Technologies, is attempting to build capacity locally. The skilled labor market in the area is also considered a major advantage by firms, although there is concern about the shrinking labor market as youth turn away from manufacturing.

- **New York's electronic components cluster** relies on a number of strong federal and state funded research and development facilities, one at Cornell University, one at Alfred University, and another at State University at Binghamton. A manufacturing extension service center staffed by people with electronics industry experience provides technical and managerial assistance. Further, the region has a number of banks, advertising agencies, and legal services with staff with knowledge of the industry. There is little industry expertise within the cluster, however, in marketing and exports.

- **Pennsylvania's plastics parts cluster**, as it developed fostered the accumulation of technical expertise, including the Penn State-Erie plastics center and Plastics Technology Deployment Center (PTDC), and there is a considerable pool of skilled workers due to the large number of family businesses and local plastics training programs. But no export programs in the area yet target the cluster.

- **South Carolina's industrial machinery cluster** is supported by a number of organizations, such as the Southeast Manufacturing Technology Center and the area's three technical colleges, with expertise in their specific process technologies. But none of the support services and associations interviewed engaged in exports professed any expertise in the cluster.

- The scale of **Mississippi/Alabama's household furniture cluster** has led to a number of targeted support services, including an automated upholstered furniture technology center at the community college, a furniture mart, a furniture research center at the University in Mississippi, and an export/technology forestry team and trade experts at the University of Alabama and in Mississippi. There is a sizable labor pool familiar with and experienced in the industry, but business is concerned that it is both diminishing and not able to adapt to the new technologies. Government services do not appear to be targeted to or expert in the needs of the furniture industry.

- **Tennessee's environmental technologies cluster** is supported by the very services and institutions that gave birth to it—the federal labs and agencies, state universities, and the Tennessee Valley Authority. The university and two technical colleges have special advanced and associate degree and shorter certificate programs in environmental technologies. Further, the state's department of economic and community development has an environmental technologies sector team. An environmental technologies specialist will be assigned to the U.S. Department of Commerce's International Trade Export Assistance Office in Chattanooga.

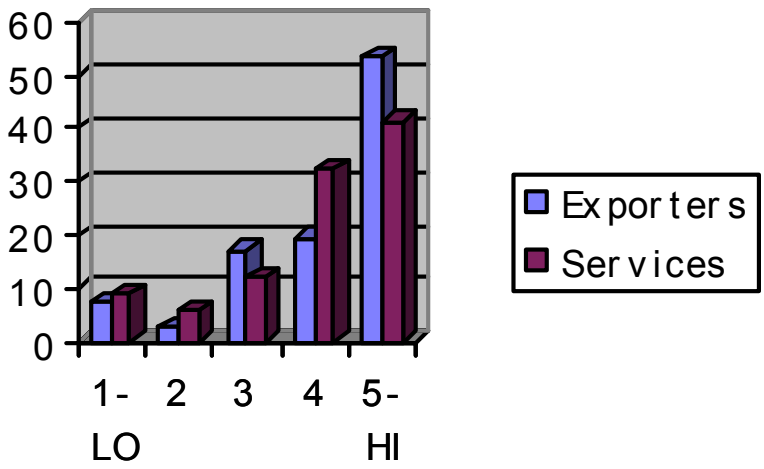
C. Becoming Global: Export assistance and performance

The seven clusters selected for analysis each exhibit somewhat different export market characteristics and structures, which have implications for the types of services they need. Two clusters—knitting mills and household furniture—sell to retail markets and therefore depend heavily on distributors, trade shows, and field agents to find customers. Most firms are simply order takers, and only the more aggressive companies actively pursue new foreign markets. Their most important capabilities are delivery and design so that they can adapt to changing consumer tastes. Two clusters—industrial machinery and environmental technologies—sell their products to other industries and depend on trade journals, shows, and sales offices, and reputation. Their most important capabilities are quality and service, which generally requires on-site attention after the sale. Two other clusters—plastics parts and electronic components—are integrated into more complex industrial or consumer products that may eventually be sold overseas. These companies are less likely to be direct exporters unless they have some special patent or unique product feature or competency needed by foreign companies, in which case the product sells itself. Their most important capabilities are reliability and design, and they may have to meet special foreign product design requirements. Finally, medical devices are sold to professionals, and the firms interviewed in the area selected exhibit little export potential.

For the most part, firms interviewed believed that exports are important to their future business performance. Even though many exporters only export a small fraction of their total output, more than half rated foreign markets as "very important" to their business and another 20 percent rated it as "important" (see Figure 5). Almost 70 percent of support services rated foreign markets as "important."

Exporters in the seven clusters relied slightly more on private sources for trade leads the public sources. Export consultants and agents were the most frequent source of general leads, but customers themselves were the most frequent source of specific leads, especially in environmental technologies. Universities were used only by the furniture cluster, which probably can be attributed to the source of contacts being the university. Knitting mills used federal agencies for general but not specific leads, and the industrial machinery cluster used state agencies for general leads but not specific leads.

Figure 5
Ratings of Importance of Foreign Markets by Exports and Support Services, Percent



Highlighting Clusters' Export Activity

In the **household furniture** cluster, exporting is a passive activity. Companies show their products and respond to orders-which may or may not originate in other countries. The companies interviewed rate exporting as "important" and, in principal, are more than willing to export. But few make any concerted efforts to find new export markets. In each furniture sub-cluster (solid wood in Alabama and upholstered furniture in Mississippi), the larger companies are both the major exporters and more advanced companies most likely to invest in new equipment and training. The strongest specialized services of both regions are for technology and training, with little support for export, with the exception of the University of Alabama. Both states will provide limited assistance when asked, but neither has any significant expertise in or support for exporting household furniture on staff.

Knitting mills in western North Carolina, like furniture, have been relatively passive exporters, relying on trade shows and marketing brokers to find outlets for their goods. A few small firms aggressively pursue new foreign markets, but these are exceptions and their exports generally are only a small percent of their total sales. Exporting is not commonplace. In fact, it was difficult to find active exporters in this industry cluster. Sock producers are split between greige, finishers, and integrated firms, and the companies producing greige (an input to the final product) would be unlikely to export. The women's sheer hosiery and knit underwear producers are mainly larger multi-national corporations, not SMEs, and, therefore, more likely to export. Most companies make low- or mid-price range products for sale in discount and department store chains, but those making high-end and specialized niche products for domestic outlets can also succeed in Japanese and European markets where "Made in the USA" labels on knit goods carry a certain cache and are valued for their design and quality. Some companies export under

their own brand name while others profit from licensing agreements to make products under brand names such as "Keds" or "Wrangler."

In the **industrial machinery** cluster, virtually all mid-size and large firms that can export are already doing so—mainly with overseas shipments directly from the plant. Nation-wide, 92 percent of plants with more than 500 employees and 72 percent of plants with 100-500 employees export. For this group, growth will come from increasing export sales not from introducing new-to-export firms to the benefits of international marketing. There is still substantial opportunity for growth in exports per firm, given that direct exports average only 23 percent of sales for the largest plants and 18 percent for the mid-size plants. Non-direct exporters are the job shops and suppliers of common parts and components. Most of the exporters polled had been exporting for over 20 years, and exports exceeded 20 percent of sales for 7 of the 10 exporting firms.

The **environmental technology** cluster, despite huge projected global market for the industry, are not major exporters. That may be because so much of the Oak Ridge cluster views government, not the private sector, as its primary client, and foreign governments may resist hiring a U.S. firm, preferring to purchase the technology and do it themselves. Given the specialized nature of their products or services, they market directly to the customer. Exporting does not require product changes; most projects are tailored to a specific client and situation in the U.S. and elsewhere. However, exporting does require adjustments to accommodate differences in culture and in business practices—and usually requires an off-site partner, which adds to the difficulties and costs. Despite the obstacles, U.S. environmental technologies firms are becoming increasingly interested in export opportunities. And because of their dependence on government for contracts, they look to the federal agencies for export information and assistance more than other clusters.

The **medical devices** cluster in the Pittsburgh area is not yet a significant exporter, and exhibits little promise for future exports. Many of the firms manufacture surgical supplies, which tend to be unsuited to export. Most are low-tech and some such as orthopedic appliances, which account for 20 percent of the employment in this sub-sector-serve local customers who request products designed to fit particular patients. Further, employment in this sub-sector is made up almost entirely of two large companies, one a manufacturer of personal safety devices for the mining industry, and the other a manufacturer of respiratory and patient ventilation products. Most interviewed believe that exports are "very important" to their industry's future. Yet, clearly, any significant future export development is contingent on building on the region's technical expertise to expand the cluster's product lines or by recruiting new companies.

The firms in the **plastics parts** cluster in the Erie area, like the plastics sector nationally, do not heavily export because so many of the skills and technologies used in the industry are common to so many localities. Many of the inputs customers require are injected molded parts, which can be manufactured nearly anywhere. Therefore few niche markets exist for this miscellaneous products cluster. Most companies receive large orders and produce them to a customer's design, competing more on quality, delivery, and price than on innovative or unique design. The cluster's major strength is its proximity to industries in the larger, heavily industrialized Great Lakes region and its technology infrastructure.

Barriers to Exporting

What are some of the obstacles to exporting? During interviews, executives from both exporting and non-exporting firms were asked to rank factors that made exporting difficult or not an option for their firm. Service providers also were asked to rank factors inhibiting export activity in the target industry. Aggregating the weighted averages of the responses produced a ranking of export barriers as perceived by exporters, non-exporters, and support services (see Table 8).

While there was some agreement among the three classes of respondents—for example, all three ranked lack of information very high—there were also striking disparities. The largest difference in opinion was in "getting paid." Exporters, who obviously had experienced the problem frequently, ranked it as their largest obstacle. The support services, however, rated it last and non-exporters, well below average. Another disparity occurred in trade barriers, which exporters ranked third, non-exporters, last, and support services, eighth of ten. Lack of time was ranked the second biggest obstacle by support services, fifth by non-exporters, but only seventh by exporters. Unfamiliarity with the exporting process was scored high by services (third) and non-exporters (fourth) but low by exporters. Foreign regulations, not explicitly included on the survey instrument nevertheless also was mentioned frequently by firms.

Clearly, doing business abroad imposes additional costs on small firms. Transportation costs were a distant second biggest obstacle for non-exporters, followed closely by high exporting costs, and lack of familiarity with the exporting process. Non-exporters do not know enough about foreign markets, are wary about the added costs, and not willing to invest time and money to see if exporting would be profitable.

There were also significant differences among clusters. Each had a slightly different perspective that reflects the natures of their products and markets. *Household furniture* producers, for example, were concerned about foreign exchange rate fluctuations and high tariffs. The *industrial machinery* companies viewed' financing their high cost products as a primary obstacle facing local firms. *Environmental technology* firms noted the high cost of establishing and maintaining an overseas presence, which is exacerbated by the lag between starting to market abroad and realizing revenues from the typical project. They also noted difficulties in finding dependable foreign on-site partners and then maintaining communications between the home base and projects multiple time zones away. *Plastics* firms added concerns about foreign regulations of imports and taxes. Medical devices had the same concern. Other nations have stringent requirements about products entering their markets and require all imports to meet product design standards.

Technology-based clusters encounter difficulties from U.S. government regulations related to technology secrecy and, for the *medical devices* firms, difficulty on both ends of the sale in getting necessary government approvals of their product. A representative of one medical devices firm suggested worldwide standards for medical devices. The *environmental technologies* cluster specializes in nuclear issues and works with top secret facilities, and consequently frequently faces a web of red tape. Similar complaints were voiced by *electronic components* firms, and some work through congressional offices to speed trade approvals.

Table 8
Rankings of Barriers to Exporting by Exporters, Non Exporters, and Support Services

Barrier	Exporter	Non-Exporter	Support Service
Getting paid	1	7	10
Lack of information	2	1	1
Tariffs/trade barriers	3	10	8
High marketing/sales costs	4	3	7
Transportation costs	5	2	6
Lack of capital	6	6	4.5
Too little time	7	5	2
Unfamiliar with process	8	4	3
Design specifications	9	9	4.5
Language	10	8	9

Rating Export Capabilities

Based on the results of the interviews and the lead researchers' best judgment, Table 9 represents an attempt to assign a preliminary relative rating to each element of infrastructure that supports exports within each of the seven clusters. The scale is only an exploratory attempt to formulate a quantitative profile of a cluster's export infrastructure and a rough indicator of export capabilities. It will require considerable additional work to further refine it and assess its validity. Where possible—such as interest in exporting and assigned importance to exporting—the interview results are applied. Elements not obtained from data are based on researchers' educated best guesses. Each element is ranked on a scale from 1 (low) to 5 (high). Although comparisons must be taken with a great deal of caution since the ratings were made on an individual basis without standards, they suggest, for example, that household furniture and industrial machinery (end use machines) products are most universally appropriate for export and that furniture has the best access to generic information about foreign markets.

Table 9
Comparative Ratings of Export Infrastructure

FACTOR	Hous. Furn.	Indust. Mach.	Knit. Mills	Elec. Com.	Med. Dev.	Env. Tech.	Plas. Parts
Transportation and distribution	5	5	5	3	4	1	4
Generic information and services	5	4	3	3	4	2	4
Specialized information and services	4	3	3	3	1	1	4
Importance of exports	3	4	4	4	3	4	2
Appropriateness of products	5	5	3	4	3	4	2
Interest in exporting	5	5	3	4	3	4	2
Capital availability	n/a	n/a	2	3	3	1	3

D. Making Things Better: Competitiveness and Modernization Assistance

One of the most important assumptions driving current industrial modernization policy is that U.S. manufacturers no longer can compete on the basis of price alone. Quality, reliability, design, and delivery times are equally, if not, more important to increasingly discriminating and demanding customers. Therefore, the project team asked companies and support services surveyed to select the two factors most important to their competitiveness from among those in Table 10 asked them to add their own. Among exporters, product quality and customer service garnered the most votes.

- Quality ranked particularly high in the knitwear and plastics clusters.

- Reputation and customer service were highest among industrial machinery exporters and non-exporters, who tend to work closely with users to customize their machines to their needs.

Non-exporters' choices were distributed more evenly, with all but timely delivery selected about the same number of times. Support services strongly emphasized product quality, and also product design.

Despite the number of national initiatives to organize programs to help SMEs modernize, few have reached the firms in these clusters. Few companies are customers and many remain unaware of them as sources of information for exporters, with the exception of universities for

the furniture industry. By and large they rely heavily on other companies for information, e.g., suppliers, customers, equipment producers, and even competitors. Most industrial machinery firms surveyed had never received export assistance from trade promotion organizations, did not seek out information about exporting or export services from public sources, and were in fact unfamiliar with the availability of such services. When public sector agencies were named by companies, it may be simply because these same services were used as contacts to identify respondents (in order to gain cooperation). Thus, on this particular question, the responses may be biased.

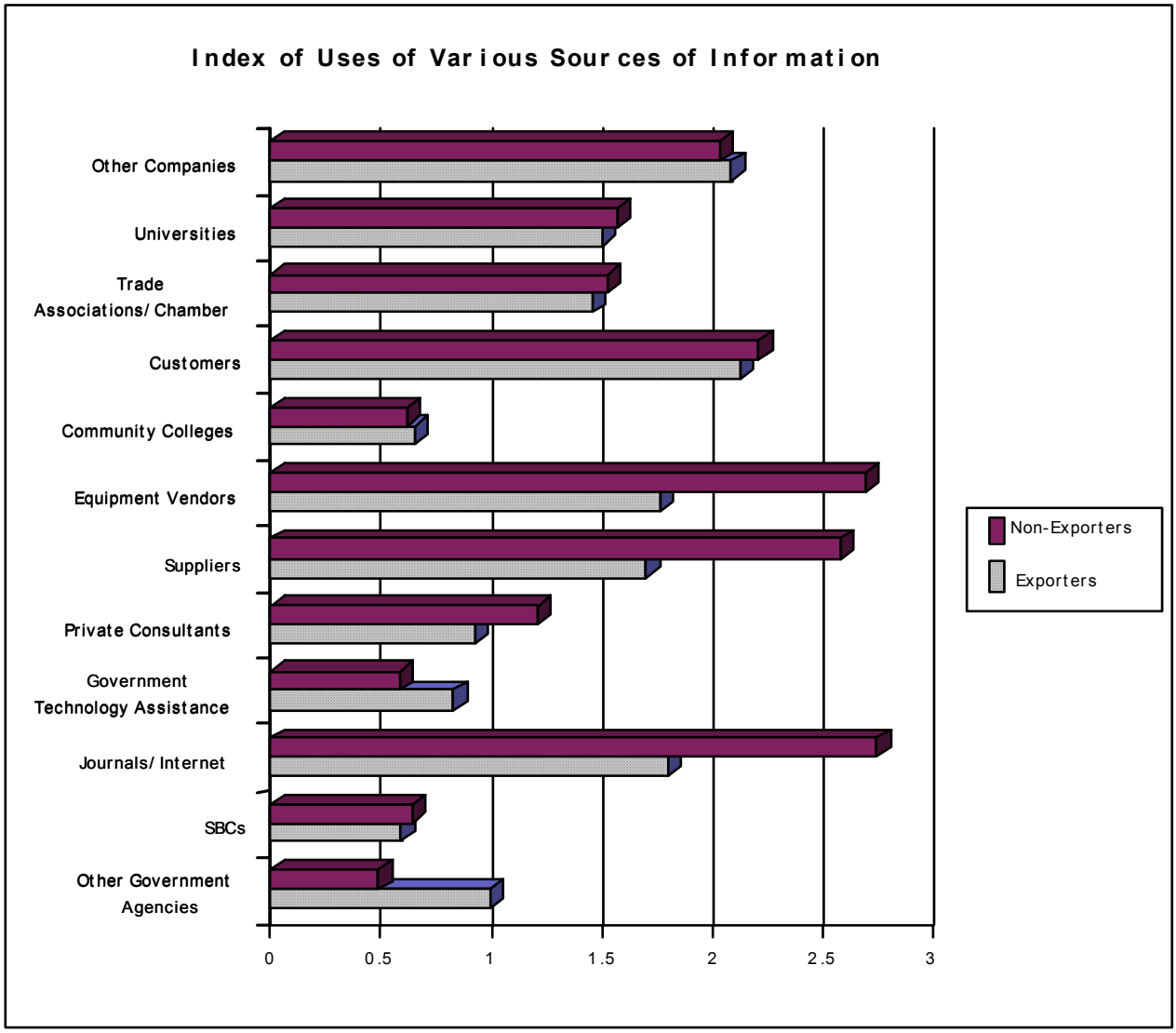
Table 10
Number of Times Factor Was Selected As One of Two Most Important Competitive Advantages and Rank Order (in parentheses)

Advantage	Non-Exporters	Exporters	Services	Not Inside**
Product design	14 (3)	15 (2/3)	16 (2)	3 (3/4)
Customer service	20 (2)	12 (5)	8 (5)	3 (3/4)
Price	12 (4/5)	14 (4)	9 (3/4)	2 (5)
On time delivery	7 (6)	3 (6/7)	7 (6/7)	1 (6)
Product quality	24 (1)	15 (2/3)	18 (1)	5 (1)
Reputation	12 (4/5)	16 (1)	9 (3/4)	4 (2)
Other*	1 (7)	3 (6/7)	7 (6/7)	0 (7)

* Support services and one exporter added location (1)and labor force skills (4) as leading advantages.
** Companies, both exporters and non exporters, located in areas distant from the cluster.

Figure 6 displays an index of the degree of use of a variety of sources of technical information for the combined clusters. Among exporters, which were generally slightly larger companies, the largest source of information was other companies. Therefore, despite the mistrust and competitiveness, these companies look to other firms most frequently for information. A close second source was customers and third was trade journals/internet and universities. Environmental technologies was the single cluster that did make considerable use of government sources, in part because government is so readily accessible in the Oak Ridge area and in part because it is a leading customer.

Figure 6

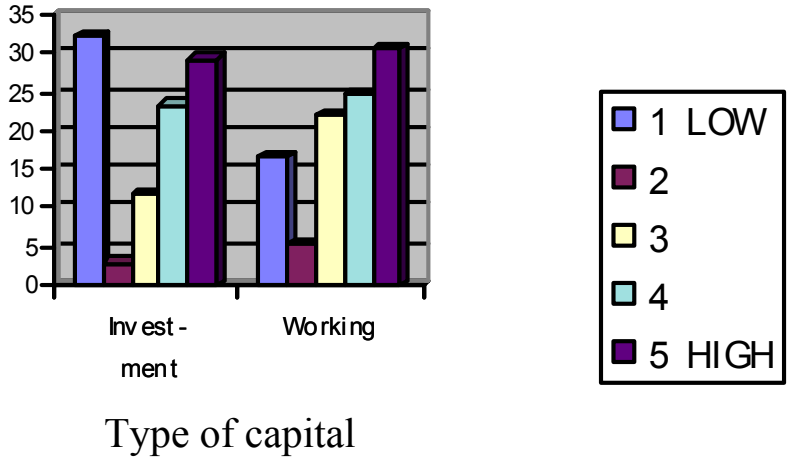


Note: The score is weighted according to the reported frequency of use and divided by the number of respondents.

Access to Capital

Policy-makers often view capital as a potential barrier for companies outside of major metropolitan financial centers—particularly for SMEs. The project team asked non-exporters to rate the degree to which both lack of investment and working capital impeded their efforts. Across all clusters, working capital was more problematic than investment capital (see Figure 7). Sixty percent of the firms cited it as a problem. Responses to investment capital were split with a third of the firms rating it as a very big problem, a third as no problem, and a third somewhere in the middle. Breaking the issue down by cluster, it was of greatest concern in South Carolina's industrial machinery cluster and New York's electronics components cluster, where all but two firms rated investment capital needs high and two-thirds rated working capital needs high.

Figure 7
Percent Distribution of Ratings of Capital Availability Among Non-Exporters



E. Cluster Power: Impacts of proximity, association, and interdependence

The project team selected regional boundaries for clusters on the basis of concentrations of employers and employees and importance to local economics. The factors that make these groups of firms "clusters" and influence their ability to generate synergy, however, are more than mere counts of businesses. Rather, successful clusters arise from dynamic activities and resources, such as access to specialized information and assistance, means and tendencies to associate and learn from one another, reliance on local suppliers, availability of skilled and experienced labor, tough competition, entrepreneurial energy, and shared vision.

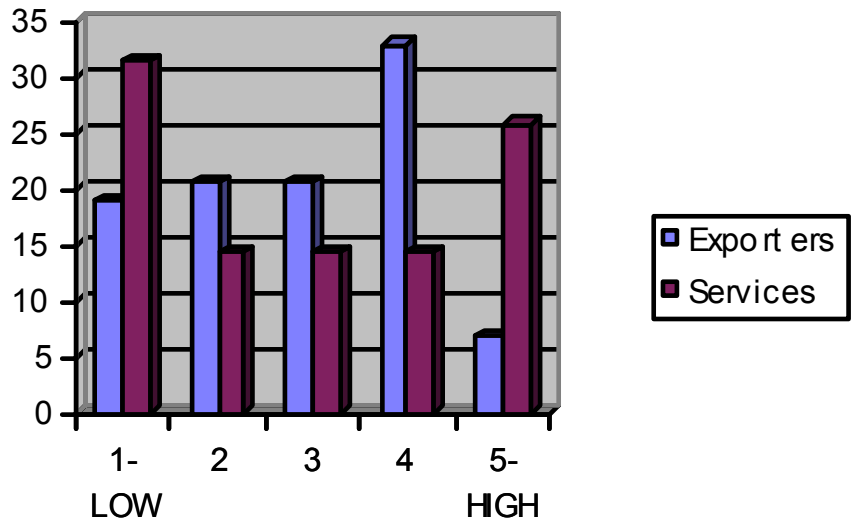
Each of the seven clusters has some of these elements, but in some they are much stronger than in others. For example, knitting mills, household furniture, environmental technologies, and

plastics are the most self-aware clusters. Their members recognize their importance to the regional economy, take advantage of their strength of numbers, collectively address common needs and problems, and rely heavily on other local companies. Medical devices is a weaker cluster with its members overshadowed by other sectors in the heavily industrialized metropolitan area. Although it has been targeted by the state because of the industry's growth potential, there is little unity or interaction among member firms and minimal export activity.

The industrial machinery cluster is imbedded in a diverse web of manufacturing companies and its members relate as much to the industry they serve as other firms in their industries. (As comedian Steve Wright once said, "Anywhere is walking distance—if you have the time.") Therefore, although they have many common needs and specialized services, these companies' most valued relationships are with the member firms of the clusters that their customers represent as much as each other. Textile machine builders, for example, are part of the region's textile cluster, metal-bending or cutting machines may be linked to the auto industry, and extrusion machines to the plastics industry.

Trust is a major factor in the strength of a cluster, increasing the opportunities for firms to take advantage of their collective capabilities and knowledge. Increasingly respected experts, borrowing heavily from the writings of Alexis de Tocqueville, are relating economic growth to high levels of trust.[14] Considering the clusters as a whole, ratings of trust were dichotomous. Exactly half of the respondents rated trust above average and half rated it below average (see Figure 8). Support services, which had a more global view of the cluster, tended to rate it higher. Within clusters, industrial machinery exporters and household furniture exporters rated themselves lowest and electronics components, environmental technologies, and knitting mills the highest.

Figure 8
Distribution of Ratings of Trust Among Exporters and Support Services, Percent



Highlighting the Clusters' Inner Workings

Household furniture cluster is bifurcated between the two states. Each has elements of an autonomous cluster with Mississippi, where concentrations and numbers are greater, exhibiting a stronger cluster structure. Synergy is fostered in part by common resources and in part through an informal social infrastructure and labor market than allows information and innovations to travel freely as employees and managers move from firm to firm. With respect to marketing, there are common elements that provide opportunity to connect the two: they both produce promotional, low-to mid-price range household furniture and both sell to similar markets. Moreover, their products are complimentary, not competitive. Therefore, cooperative export development seems feasible.

The hosiery firms that make up the largest segment of the **knitting mill** cluster is tightly bound by an active regional trade association and a regional industry-led technology and training hub at the community college, both of which provide the social glue that builds trust. The strength of this trade organization and the cohesiveness it has imbued in its members have brought to the cluster new specialized services and resources and resulted in a regional plan for the cluster that highlights collective marketing and exporting goals. Many members freely associate and take pride in their high levels of cooperation. They in fact view collaboration as their best chance to adjust to changing technologies and a consolidating customer base and to survive in highly competitive markets.

Plastic parts service providers indicated that the clusters' atmosphere is fairly conducive to trust because many companies—especially those exporting—are not in direct competition with each other. Firms are quite aware of the strength and scale of their sector. Collectively, the larger

companies have helped establish the Penn State-Erie plastics center which, along with the Plastics Technology Deployment Center, sponsors "consortia" geared to particular elements of the plastics industry. For example, the "blow molding consortium" supplies specific training and technical assistance to firms specializing in that method of plastics processing. The Society of Plastics Engineers is also quite active and provides networking opportunities. For the smaller companies, most collaboration revolves around meeting orders too large to fill alone. Many of the firms indicated a willingness to explore other formal forms of collaboration.

Environmental technologies companies in Oak Ridge have several characteristics of a successful cluster. A highly skilled labor force follows government contracts from firm to firm. Although competitive firms, they draw on a network of technical expertise that strengthens all participants, and it is common for firms to form partnerships on a project-by-project basis to compile the strongest array of skills. Vertical partnerships include mentoring relationships with small firms, especially firms that are classified as disadvantaged or certified by the Small Business Administration 8(a) program. On their own, small and medium sized firms partner horizontally and vertically, acting as sub-contractors on some contracts and prime contractors on others. Most Oak Ridge firms belong to and participate in local business associations, such as the East Tennessee Environmental Business Association and the East Tennessee Economic Council, both of which foster exchange among members. Further, the labor market is very fluid and, similar to Silicon Valley, people move freely from firm to firm taking knowledge with them. The industry concentrations act as an information resource for firms, but it is also apparent that information technology is moving free of geographic bounds. Those asked how often they used various sources of information most frequently cited other companies and the internet.

Industrial machinery is highly concentrated in the South Carolina ARC counties—one of the nation's premier clusters according to quantitative analyses by DRI/McGraw-Hill. It is a cluster in terms of scale and importance to the region's manufacturing base. Yet this research suggests that industrial machinery companies in this region do not have a strong tradition of working together. The mid-sized machine builders in the cluster are not highly competitive with each other since these high exporting firms generally have narrow market niches. Instead, these companies are oriented toward their customers and the clusters in which their equipment is used. They are, in fact, often a source of innovation within their customer clusters. Inter-firm relationships tend to be vertical, with their suppliers. Yet the concentration has led to a number of specialized services, especially in the technical colleges. The smaller and less direct export-prone supplier companies in the cluster, such as tool and die makers, are more likely to network and take advantage of interdependencies, both with their peers and their machine builder customers.

The **medical devices** companies examined in this research do not meet the requirements generally associated with a cluster. The concentration of firms is low compared to other sectors, there is no self awareness of any concentration of firms or of the competencies and/or products of others in the cluster. In addition, there are no specialized trade associations to facilitate interaction (except for those that serve all high tech firms), and, as a result, little cooperation among firms. The main positive attributes of the area are the local sources of technology development and expertise, and the markets created by a large medical sector—both of which create possibilities for future growth. And, indeed, Pennsylvania would like to develop this

cluster, building upon the research and development resources in place, because of its national growth potential.

Electronic components firms are cognizant of the importance of their industry to the entire region. Specialized technology, marketing and work force training institutions exist that probably are not matched anywhere else in Appalachia. A number of larger customer firms in the region—many of them Original Equipment Manufacturers (OEMs)—drive and shape demand, and smaller, specialized supplier firms both cooperate and compete to meet those needs. The cluster has a history technological capability in sophisticated packaging processes, several entrepreneurial firms, a strong research and development base supported by higher education institutions, and a large and well skilled work force.

F. Locational Advantage

If firms do in fact cluster—which data on plant location by SIC confirm—one might ask what conditions or local factors cause that to happen? What are locational advantages that companies and services view as most important to the clusters' competitiveness? The industry specific skills of the work force ranked first (Table 11). Even in areas where there are labor shortages, a density of companies creates an experienced labor pool from which new and growing companies can draw. Despite some poaching from one another, as Mississippi's furniture companies noted, the advantages of a large number of workers knowledgeable in the industry outweighs such disadvantages. This is important to the industrial machinery cluster in South Carolina, which is supported by specialized training programs at the region's three technical colleges, and knitting mills, which are not well served by most community colleges and therefore rely heavily on the specialized training developed within the region. Human resources are crucial to knowledge-base industries. For example, the environmental technologies industry also depends upon a skilled labor force.

The second most important factor was proximity to suppliers and customers and good distribution channels. Even though in today's global world of manufacturers suppliers can be anywhere, most companies would choose to have suppliers nearby if at all possible. Proximity to suppliers is important to the furniture cluster, which uses inputs having a high shipping cost to value ratio. Similarly, proximity to customers is important to greige manufacturers in the knitting products cluster. Proximity to customers is also important for specialized products produced to individual situations, a situation common to segments of the medical devices and industrial machinery industries. Proximity to suppliers is less important for inputs with low shipping cost to value ratios such as specialized instruments used by environmental technology firms. Overall, more than half of the exporters interviewed buy more than half of their inputs from companies within a 100 mile radius of their plant.

The next most important factor cited in interviews was the intangible "quality of life." Most people like where they live and work or they would not be there. Most of the companies are not recruited but started as spin-offs from larger companies that may have been recruited years earlier and long time residents of the area. This was especially common in the industrial machinery cluster. Quality of life is a key factor predicting that the environmental technologies cluster in East Tennessee will survive the closure of its primary local customer. Fewer

companies rated factors relating to opportunities to interact, such as proximity of other firms or good industry associations, among the most important locational factors.

Table 11
Rankings of Weighted Ratings of Geographic Advantages

Advantage	Rank/SMEs	Rank/Services
Proximity to customers	4	8
Distribution channels	3	1
Quality of Life	6	4.5
Skilled labor force	2	2
Government support	9	7
Close to other like firms	7	6
Access to R&D, Technical services	8	3
Proximity to suppliers	1	4.5
Industry associations	5	9

Outside of the cluster

The team appended interviews with nine companies in industry sectors selected but located in regions outside of the cluster boundaries (Kentucky, West Virginia, and Virginia) to gain any insights into differences in responses that might indicate a disadvantage. Based on limited responses from this very small sample, there were no discernible differences in the distribution of responses (one example shown in Table 7). Combining responses from exporters and non-exporters, the relative rankings of competitive advantages, barriers, and sources of information were quite similar among firms in and outside of the cluster. The scale of the effort and design of the research, unfortunately, did not allow for an actual comparison of the elements that would be expected to vary between clustered and non-clustered firms, such as level of access to information, technical assistance, strength of capital and labor markets.

G. Building a Profile of Cluster Power

Clusters are generally described in literature and in research studies in terms of quantitative measures of industry concentration and scale. System attributes are generally limited to supplier linkages. Our analysis moves beyond these quantitative factors and attempts to look at clusters as interdependent systems. The central element is, in each case, the firms in the cluster. Supporting elements are the (a) sources of innovation, technology, research and development (b) suppliers of parts, materials, and equipment, (c) specialized services, (d) distribution infrastructure, and (e) customers. The connecting arrows represent dominant flows of capital, products, and information.

Because clusters are complex systems and not simple agglomerations, however, they cannot be simply represented by indices or even graphics. Therefore, as with export power, we have

developed a preliminary profile for rating the "power" of the cluster using a set of elements that characterize strong clusters throughout the world. This is not a scientific profile based on hard data; it is simply an attempt to develop a potential model that can look beyond the counts of companies and bodies and offer an alternative view of a cluster effectiveness and ability to produce synergy.

The first element represents concentration and scale, the common measures of cluster power. The second element estimates innovation within the cluster, and whether members firms are on the cutting edge of adopting new technologies. The third, fourth, and fifth elements estimate the presence of and level of specialization of support services, suppliers, and the cluster's labor pool. The sixth and seventh elements are indicators of the flow of information and innovation within the cluster, and opportunities for interaction and association that represents. The eighth and ninth are estimates of the strengths of leadership and self-awareness. The final two elements represent entrepreneurial energy and competition.

Unlike the export capacity cluster (Table 9), the competitiveness profile for each of the seven clusters was rated by multiple team members, but with lead researchers' judgment given greater weight. Like the earlier profile, it uses a scale of 1 (lowest) to 5 (highest).

Table 12
Estimated Comparative Competitive Profile of Cluster Power:
A Preliminary Model

FACTOR	Hous. Furn.	ndust Mach	Knit. Mills	Elec. Com.	Med. Dev.	Env. Tech.	Plas. Parts
Concentration/scale (critical mass of companies in region, loc. quotients.)	4.8	4.2	5.0	4.2	1.4	4.2	4.2
Adoption of advanced techniques and technology (rates of investment)	3.4	4.0	3.5	4.0	3.3	5.0	3.6
Specialized support services (knowledge of and value to services)	2.4	3.0	3.8	3.0	2.0	1.8	4.6
Local subs/supply relationships (links between regional businesses)	4.6	4.0	4.5	3.8	2.8	3.0	4.3
Skilled work force (size of labor pool w/experience in industry)	2.0	4.8	3.8	3.0	3.2	4.5	4.3
Social Infrastructure: associations (membership and activity)	3.0	2.6	4.3	3.6	1.4	3.8	3.6
Networking (sharing, pooling resources, alliances)	1.6	2.2	4.0	3.8	1.0	3.5	3.4
Export infrastructure (average ratings from Table 7)	4.5	4.3	3.3	3.4	3.0	2.4	3.0
Cluster awareness (recognition of interdependencies)	4.2	2.2	4.8	3.4	1.0	4.0	4.8
Leadership (numbers of lead and innovative firms)	4.8	2.3	3.8	3.5	1.8	3.5	4.0
Entrepreneurial energy (rate of new business spin-offs)	4.5	4.0	2.3	3.5	1.6	3.8	3.7
Competition (strengths of other local companies)	4.6	3.6	4.0	4.0	2.0	4.2	3.5

Table 12 shows the team's best estimate of the relative strengths and weaknesses of each cluster. The ratings in the table suggest, for example, that household furniture and knitting mills are the most concentrated clusters; that knitting mills and plastics the most self-aware clusters, furniture the most entrepreneurial (perhaps because the initial investment is lowest); industrial machinery and environmental technologies have the most highly skilled and specialized work forces; and environmental technologies the quickest to adopt new technologies. With additional effort, more rigorous measures for each dimensions could be developed and benchmark established.

Perhaps more important, the profiles point out shortcomings and gaps that suggest attention. For example, skilled work force rates low for household furniture and electronic components. This

could reflect a gap in specialized training or simply a shortage in labor market supply. Environmental technologies, medical devices, and furniture all rate low in specialized support services. And there was little evidence of industry leadership in the industrial machinery cluster. Social infrastructure was lowest in medical devices and industrial machinery. Environmental technology, plastics, and medical devices were rated relatively weak in export infrastructure. Shoring up these weaknesses ought to improve the cluster as a whole.

H. Opportunities for Improving Export Performance and Competitive Advantage

Increasing Exports

Economic development theory tells you to exploit competitive advantages and counter the disadvantages and for export promotion, suggests a focus on industries with products most likely to find a market overseas. Research and site visits revealed that the seven ARC target clusters include four very different categories of firms based upon the export outlook for their product. The following discussion refers to the target cluster, not to a national industry. Firms in a single cluster often are divided between these categories.

The first two categories offer the most promising targets for export promotion, those firms with products appropriate for exporting. Some of these firms already are exporting, looking to increased exports as a business opportunity, and seeking larger foreign orders. The first category is firms that sell final products for consumption through retailers. These companies are generally, but by no means all, larger firms. Selling to retailers requires knowledge of consumer tastes and preferences and quick response. Numerous firms in the household furniture cluster and the finished hosiery segment of the knitting cluster fall into this category.

The second category is firms that usually sell to other companies and have unique products or occupy special niches. Certain producers of industrial equipment and electronic components as well as many environmental technology firms fall into this category. Selling to industry or government requires an intimate knowledge of the customer's facilities and needs and often, the ability to provide continuing service and training. Any follow-up requirements add complexity to the export process, but numerous firms in these industries have demonstrated that export sales can be profitable. In this arena, the technological expertise of US firms is a distinct competitive advantage.

The third category is also firms that usually sell to other companies, but their products tend to be standardized commodities on the market. These firms face difficulties in foreign markets, because their products are low value and easily replicated in localities with lower wage rates than the US. Shipping costs add to the exporting disadvantage when the products have a high shipping cost to value ratio. This third category includes portions of the knitting and plastics clusters, the firms that manufacture greige (unfinished) hosiery or simple extruded plastic parts. It also includes portions of the electronics components industry, manufacturers of less sophisticated coils, transformers, and printed circuit boards. Some of these suppliers, such as the plastics parts and electronic components manufacturers, may export indirectly, by making parts used in goods that are sold to foreign markets. While these companies often have to meet

foreign quality standards, they do not have to process exports or have internal expertise; their customer is the exporter.

The final category is the firms that have little or extremely limited export potential. this may be because their customers are local, or because their product is tailored to the individual customer. This category includes that portion of the medical devices industry most often found in the target area, firms manufacturing prosthetics for local physicians. It also includes the tool and die companies that support industrial machinery or plastics companies. For these firms, proximity to customers is crucial to competitive advantage, and by definition, exporting involves distance from customers.

Firms in categories one and two offer the most likely targets for increased export sales, but they still face barriers to exporting. Reducing those barriers offers a strategy for increasing exports, and the cluster structure includes strategic avenues for interventions. The interviews found that lack of information kept firms out of export markets. Information on export markets and information about exporting procedures is available from public and private sources. Apparently, the target audience is not aware of the available information or else that information is too difficult to access and use. Improved services to SMEs would address these barriers. An industry or trade association is an excellent conduit for enhanced services.

Other frequently mentioned barriers relate to the additional marketing and transportation costs associated with doing business overseas. These costs can be reduced through group services and collective exporting, which is an option if firms in a cluster have built the trust and networks so that they can work together. Again, industry or trade associations provide a structure for this activity. The following recommendations describe specific options to address export barriers that were mentioned in discussions with firms and service providers.

- **Overcoming SMEs' difficulty in "getting paid":** Community banks are likely to know clusters the best but have little expertise in exporting. Large banks that know exporting have little expertise in clusters or want to deal with SMEs. A number of niche export finance intermediaries are emerging that are targeting small and mid-sized exporters. One suggestion is to help connect these new companies with the community banks that are more familiar with and accessible to SMEs.

- **Reducing unit costs of international marketing and sales**: Expense was cited as a major barrier to entering export markets. National programs in British Columbia, New Zealand, and Australia have proven quite effective in establishing exporting networks that allow forms with complementary products to target foreign markets and share the costs of doing business there. A suggested action is to develop a cadre of skilled brokers and offer incentives for export cooperatives.

- **Increasing participation in trade shows**: Overseas trade shows, although costly, are important sources of sales leads. A suggested action is to organize groups of small and mid-sized companies to attend trade shows together, sharing costs of booths, or simply gathering information and making contacts that would be shared with others in cluster. Another possible intervention is support for reverse trade missions, bringing delegations from other countries to visit the cluster, become familiar with its products and capabilities, and build

personal relationships. Such reverse trade shows are especially suited to high tech clusters, giving firms a chance to showcase their capabilities.

- **Improving education and information about export procedures and foreign market requirements**: These services exist in most states but are not easily accessed by rural or remote companies. One suggestion is to help SMEs make greater use of telecommunications, both for education and information. For example, Trident Technical College in South Carolina and West Virginia University at Parkersburg are developing a export certification program that will be able to be accessed and delivered via the internet anywhere in the ARC region.

Improving Competitiveness

Exports and competitiveness are intrinsically interconnected. Exporters must be globally competitive, and therefore actions that improve the performance of a company with respect, for example, to quality delivery, design or costs, improve its export capacity. Government agencies have recently come to the realization that SMEs are important to regional economies and that they have distinctive needs and that scarce resources can be best optimized by addressing collective and common needs of clustered SMEs.

The assumption behind sector or cluster analysis is that specialized services and infrastructures, tailored to the specific needs of an industry, are more useful to companies than generic services and infrastructures. Companies prefer to deal with—and receive better service from—others who understand their business. That leads to policies for industry-specific services with their hubs in the general vicinity of the largest concentrations of companies. Other competitive advantages accrue from closer access to suppliers and equipment manufacturers, particularly in situations where suppliers' expertise and knowledge is vital to the final product and interaction enhances the design, where transportation costs are high, and where technologies are changing rapidly. The last is particularly important now that leading economists have discovered that "proximity of others users of advanced technologies is associated with higher rates of adoption."[15] They accrue from labor markets able to meet changing employment needs with minimal retraining.

All of these factors are part of what economists call "external economies of scale." They are optimized in regions where leadership, vision, social infrastructure, and levels of trust allow technology and knowledge transfer to flourish and companies to take advantage of their mutual complementarities and interdependencies.

- **Identify and target gaps in cluster**. View the cluster as a system and look for disruptions in or impediments to the flow of information and business transactions between firms, or weak elements such as a lack of important suppliers or industry specific training. Then look for strategies that improve the entire systems.

- **Improve flow of expert information to SMEs**: One of the major weaknesses in most of the systems analyzed was the use of public sector services. While support services believed they were serving the companies well, the companies claimed it is too general. Therefore, they look most often to the private sector for specific information. Yet the responses from

businesses suggest a dearth of the very specific, niche-market oriented information companies need to export, which can best be obtained from experts in the industry. Regional brokers could help SMEs locate the information or, if unavailable, contract for and partially subsidize the studies, and put together companies with similar needs to share the information costs.

- **Emphasize design**: Although design ranked high among competitive factors, it is given little emphasis and short shrift by educational programs and services. Those that do may emphasize design for manufacturability but not the creative and aesthetic qualities of final products that are increasingly important when competing in global markets with nations noted for their design, such as Denmark or Italy. Colleges ought to play a key role in integrating design into technical curricula and support services ought to include specialized design firms.

- **Merge export/marketing programs with technology diffusion/business assistance programs that target clusters:** SMEs have considerable trouble sorting out and evaluating the multitude of technical assistance programs at their disposal. A "one stop" agency-a long sought ideal of many public agencies-might be more effective of organized around industries rather than functions. Some Manufacturing Extension Program agencies are moving in this direction, enlarging their scopes to address a fuller range of needs of SMEs, yet they are, at the core of their mission, still engineering oriented. Community colleges may be better positioned to serve in this capacity, brokering specialized services for the cluster. Itawamba Community College in Mississippi, for example, specializes in upholstered furniture production and Catawba Valley Community College in North Carolina specializes in hosiery production. The latter is also becoming involved in marketing and exporting issues.

- **Encourage networking**: Although there is no long-standing and well-patterned "habits of cooperation" among firms in most regions, many see a potential for creating new mechanisms to allow firms to explore opportunities for joint export development. While many of these firms do compete with each other in regional markets to supply larger customers, a large number have differentiated themselves with their special capabilities over the past few years, thus increasing the likelihood of cooperating on mutually beneficial issues. Thus, they may find there is now less direct competition and more opportunities for cooperation. In fact, virtually all of the firms surveyed for this project expressed interest in at least exploring new and closer forms of cooperation. The knitting mills in North Carolina have carried this the farthest among the seven clusters, creating informal production networks and formal marketing and R&D networks.

I. Conclusions

This study focused on places in Appalachia where sectors are clustered. Does clustering matter and how does it affect businesses' ability to learn, modernize, and export? It is difficult to make meaningful generalizations that can be applied to other locations because each cluster selected and studied is unique and the way it functions is a product of the type of goods it produces, the customers it targets, and the level of interdependencies among its companies and services (See Table 13).

In fact, the clusters as defined by products and the places with the highest concentrations of companies making those products did not all turn out to be clusters as defined by interdependencies and system characteristics. The medical devices cluster, for example, comprised too few firms with too diverse products and customers and is imbedded in too large an industrial base to be considered a cluster in any sense of the word. Industrial machinery producers are more tightly linked to their customers' clusters than each other, although the smaller supplier firms may constitute a truer and more interconnected cluster. Too little information was gathered about the latter firms to judge their degree of interconnections. Plastic parts and electronics components are clusters of suppliers that achieve external economies as a result of their numbers and are dependent on their customers.

An analysis of two other clusters, household furniture and environmental technologies, revealed that they were each actually two distinct clusters. This illustrates the danger of using only low-level (two- or three-digit) SIC codes to define clusters. Household furniture producers operate as a strong cluster producing upholstered furniture in northeastern Mississippi and a slightly weaker cluster producing solid wood pieces in northern Alabama. In Tennessee, the cluster around Oak Ridge concentrates on nuclear energy and waste and the cluster around Chattanooga on conventional manufacturing environmental problems. Knitting mills as an entire sector is not a cluster but its largest component, hosiery, is a very complex cluster, again illustrating the problem in using three-digit or lower SIC codes. Hosiery firms are tightly linked to each other but not to other types of knitting mills.

In only three of the clusters do concentrations and connections appear to improve firms' interest in and ability to export. Knitting mills (hosiery), furniture, and environmental technologies are favorably affected by collective marketing and/or better access to information. Electronic components has the potential to benefit from such activities but does not yet. Industrial machinery markets are too diverse and customer specific, and are dependent on customer relationships. The medical devices cluster around Pittsburgh, as defined by current members, is tied to local customers, and plastic parts has little potential because its capabilities are too ubiquitous and readily replicable locally.

Despite the individuality of the clusters, the accumulated knowledge does lead to some findings about export potential. Each cluster has some but not all of the strengths necessary for success in exporting, and therefore each has areas in which it can improve its performance—if it so chooses.

- Clusters that are mainly suppliers of larger firms (e.g., plastics parts and electrical components) are less likely to export than those that sell to final users (e.g., industrial machinery and household furniture).
- Clusters that compete on design or innovation (e.g., environmental technologies and industrial machinery) are more likely to have a future in exporting than those that compete on the basis of lowest price (e.g., plastics parts and knitwear).
- Clusters that are internally networked and can take advantage of external economies of scale (e.g., hosiery and environmental technologies) are more likely to be able to export and adopt new technologies than those that are not (e.g., medical devices).
- Clusters that are composed of larger companies (e.g., industrial machinery and are more likely to export than those comprised of small companies (e.g., knitting mills and .
- Clusters with strong and specialized support services—especially those with marketing expertise, (e.g., hosiery and plastics parts)—are more likely to export than those with fragmented or generic services (e.g., medical devices and industrial machinery).
- Clusters with pro-active companies that seek out markets (e.g., industrial machinery and environmental technologies) are more likely to export than those that are "order takers" (e.g., household furniture).
- Within clusters, firms that are more technologically advanced (often the larger SMEs) are more likely to be exporters than the less advanced firms.

Finally, for the benefit of future cluster analyses, it is important to note that three-digit SIC codes do not adequately classify clusters. Some are too broad (i.e., hosiery is a cluster but other knitting mills in SIC 225 are dissimilar and unconnected); some are too restrictive (i.e., they miss vertically integrated clusters where suppliers are part of cluster); and some are too new and undefined by product (i.e., environmental technologies).

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[1] Percentages are based on surveys that include about two-thirds of all exporters.
[1] Exports exceed output
[1] Much of this information was collected and reported by Mississippi State University graduate student Albert Nylander. It is supplemented by this author's interviews with business leaders in Tupelo.
[1] Numbers in this section are for all Furniture and Fixtures (SIC 25), the only level at which state export statistics are available. Household furniture is a subset of this group.
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