An Industry Cluster Analysis for the NewVa Region of Virginia

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Executive Summary

The NewVa Region (including the counties and cities of the Roanoke Valley, Alleghany Highlands, and New River Valley) is the primary economic center for western Virginia, serving as hub for retail trade, health care, business services, higher education, and travel/tourism. More than 228,000 people work in the region's nine counties and four independent cities, according to 2002 Virginia Employment Commission data.

The Fifth Planning District Regional Alliance commissioned a study to examine existing industrial clusters and to explore possible economic linkages between the New River Valley and the Roanoke Valley-Alleghany Highlands.[1] The study looks at clusters as groups of industries that have existing or potential relationships. Firms within clusters are often interconnected – buying and selling from one another, buying similar inputs as other firms in their cluster, selling to similar clients, or sharing labor markets. Firms within a cluster may have no direct transactional relationship between one another, but share a common set of customers, labor needs, or suppliers. Furthermore, firms may appear in multiple clusters if they offer different products or use unique processes that result in a variety of relationships.

This study of the NewVA region's clusters and related economic characteristics provides insights on existing relationships, potential relationships, and gaps in the region's existing economic structure. The goal is to help policy makers and economic development professionals focus attention on the industries likely to have the greatest impact on local economic growth.

To assess which clusters are most important, the analysts looked at three dimensions of the region's clusters:

- Their relative size in the region (how many people are actually employed in that cluster?),
- Their relative concentration in the regional economy (how specialized is the region in that cluster?), and
- Their wages relative to the local economy (are these good jobs?).

These three characteristics offer a snapshot of the importance of a variety of possible clusters at a point in time. It is also important to examine changes over time to determine the cluster's current health and contributions to the local economy. By analyzing how quickly cluster industries have grown or declined, the average wages paid by industry companies, and the cluster relative concentration, economically important clusters can be more readily identified.

[1] *The Center for Regional Economic Competitiveness, a non-profit Arlington-based research and consulting organization affiliated with George Mason University, and the Roanoke Valley-Alleghany Regional Commission teamed up to analyze economic statistics for the past decade and talk with a number of business leaders in the region.*

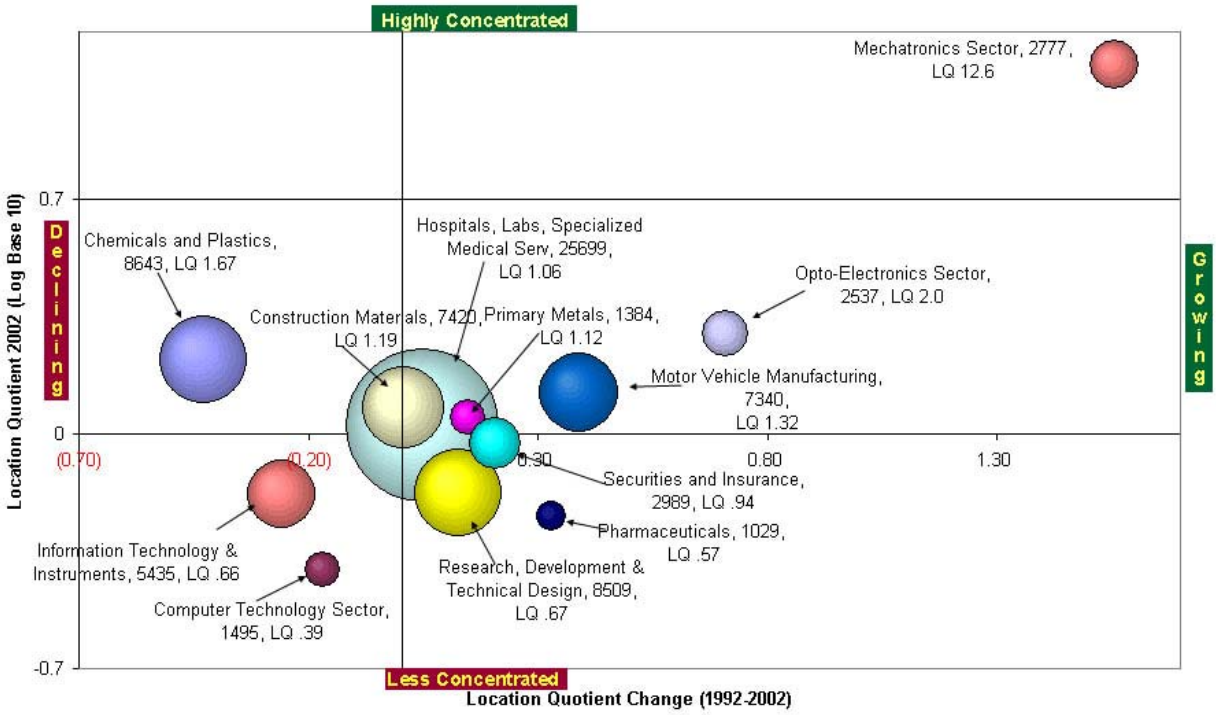
The study found that the industries historically important to the NewVa region may not be the basis for future economic growth. For instance, higher education has suffered from major cutbacks in state spending. Growth in health care and business services has been strong, but the growth of these clusters tends to reflect national trends rather than a regional competitive advantage.

Where the region is "bucking" national trends and growing faster than average are in the opto-electronics, motor vehicles, and pharmaceutical manufacturing clusters. During the past decade, significant numbers of new jobs were added in research, development & technical design and transportation, shipping, and logistics. Many of these clusters pay higher than average wages or offer "replacement" jobs for dislocated lower-wage workers.

Figure 1 provides an illustration of the size of many of the clusters paying the highest wages, their growth rates, and their level of concentration in the region. Each "bubble" represents a national industry cluster in terms of its employment size, relative concentration in the study region, and the growth of that concentration. Larger bubbles represent larger clusters. Bubbles near the top of the figure appear to be more highly concentrated in the region as defined in terms of the cluster's "location quotient," (an index that measures relative concentration of employment in the region as compared with national employment in that cluster). Clusters with location quotients above one (1.0) are more greatly represented in the local economy than nationally-averaged data might predict, and thus appear to have a local competitive advantage. Bubbles near the right side of the graph have grown more rapidly than the national average between 1992 and 2002 (the study time frame). Thus, a particularly large bubble located in the upper right corner represents a fast-growing, highly specialized concentration of high wage industries.

Those clusters on the right side of the graph – including mechatronics, opto-electronics, motor vehicle manufacturing, pharmaceuticals, securities and insurance, primary metals, and research, development & technical design – represent important opportunities for building emerging new clusters or expanding existing company networks throughout the region. Several of these clusters have relatively small concentrations, but they grew during the past decade more rapidly in the region than in the nation. Since all of these rapidly growing industries pay significantly higher than average wages, they could combine to provide a strong basis for future economic growth in the NewVa region. The mechatronics cluster, in particular, has an enormous regional concentration with a location quotient of 12.6. This means that the 2,777 mechatronics industry jobs found in the region is approximately 12.6 times the number that one might typically expect to find locally. Employment levels in the mechatronics sector are about the same as that found in the opto-electronics cluster. The mechatronics and opto-electronics clusters each represent between 1 and 2 percent of overall regional employment. These jobs represent small, but potentially critically important economic engines for the region's future.

Figure 1: Cluster Concentrations and Growths for NewVa



By comparison, the health-related clusters represent a large proportion of local jobs – more than 11 percent of the region's workforce. Figure 1 illustrates that although the hospitals, labs, and specialized medical services cluster has a relatively large level of employment (25,699 jobs), this cluster's concentration (or location quotient) is very close to 1.00. The cluster is about as large as one might expect to find, given relative size of this cluster in other regions and the industry's national growth trends.

The Chemicals and Plastics cluster, a traditionally competitive industry and large regional employer, has a large concentration (location quotient of 1.67). But, this cluster has declined in its competitive position during the past decade. Information Technology and Instruments and the Computer Technology Sector are high-wage industries that have grown during the past decade, but not as rapidly as these clusters have in other parts of the country.

The study found that many of the more technology-oriented clusters tend to be concentrating in Blacksburg. The region's service-related industries (finance, health care, and tourism) tend to be concentrating in Roanoke. The rural areas are providing access to available land for manufacturing activities, including chemicals, plastics, and construction materials. This finding may suggest that Roanoke, Blacksburg, and the Alleghany Highlands will depend upon one another even more heavily in the future as Roanoke firms turn to Blacksburg

firms for new innovations and technologies while Roanoke provides financial support and cultural amenities for the entire NewVa region's firms and their workers. The heavier manufacturing that remains in the region will most likely focus in the rural areas where the administrative support services are nearby, land is plentiful, and costs are lower.

After examining 45 US benchmark clusters, the study team identified 12 high wage clusters that should be the focus of attention for the NewVa region's public policy makers and economic developers in terms of retention, attraction, and entrepreneurial development activities. Some of these clusters are **at-risk** or **potential missed opportunity targets**. These clusters are growing very slowly or declining and may need to be the focus of business retention activities. They include:

- Chemicals and plastics
- Construction materials
- Information technology and instruments
- Computer technology

Several other clusters are important to the local economic base, and are growing (some more rapidly than others). These constitute the **basic** or **emerging opportunity targets**, including:

- Mechatronics
- Motor vehicle manufacturing
- Research, development and technical design
- Hospitals, labs, and specialized medical services
- Opto-electronics
- Pharmaceuticals
- Securities and insurance
- Primary Metals

To support these targeted clusters, the region should identify the key challenges which limit their growth, and focus its resources on addressing the key challenges facing them. Many of these challenges were addressed by the 2002 Regional Economic Strategy. This research should help regional leaders focus their attention on strategies that respond to the needs of these 12 clusters.

An Industry Cluster Analysis for the NewVa Region of Virginia

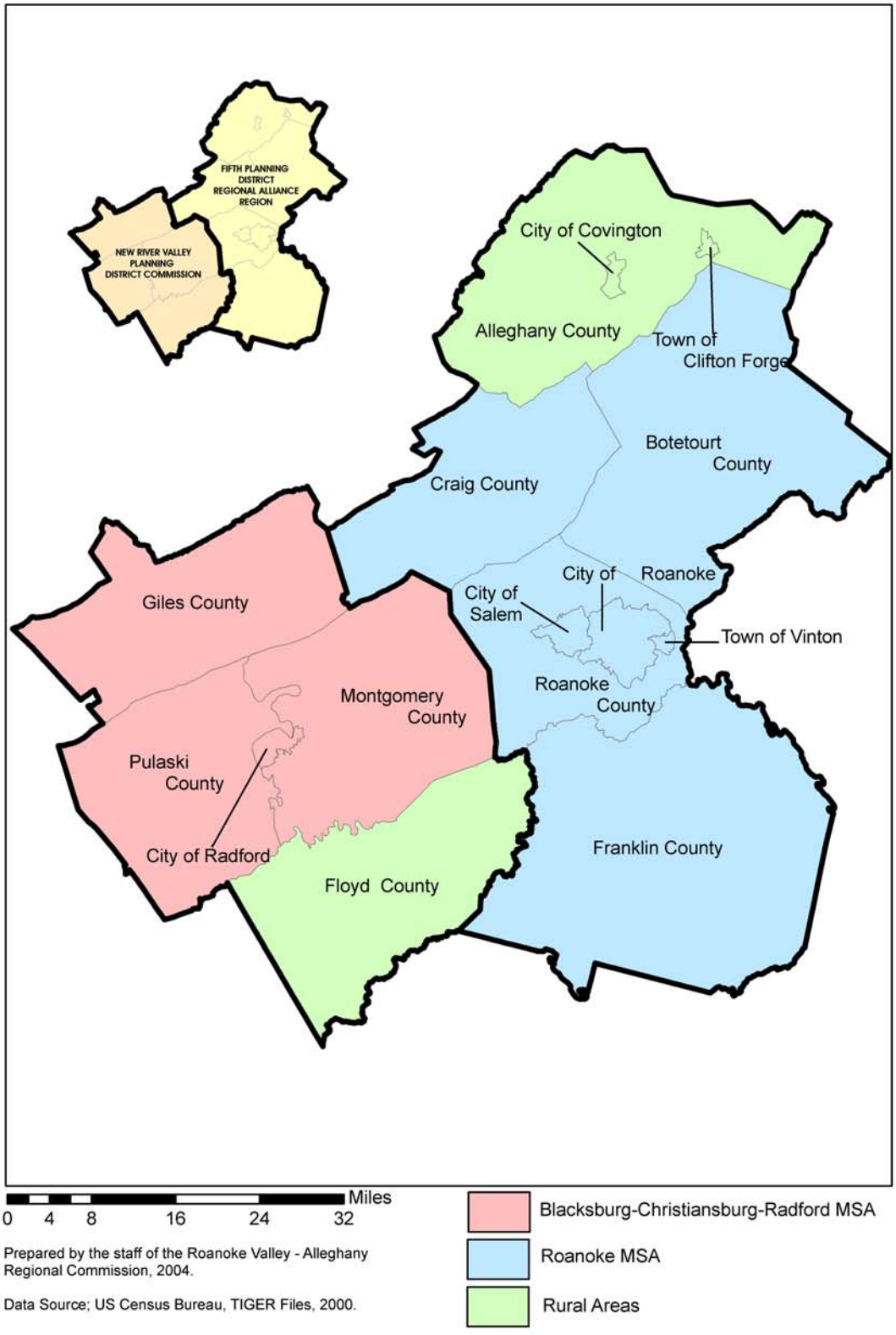
Background & Overview

In July 2002, the Fifth Planning District Regional Alliance – a public-private collaboration of leaders in the Fifth Planning District of western Virginia – developed a Regional Economic Strategy. The strategy called for communities in Virginia's NewVa Region (including the Alleghany Highlands, Roanoke Valley, and New River Valley – as shown in Map 1) to work together to build on their respective assets for future prosperity. This strategy identified potential ways for the three sub-regions to work on a number of key strategies. The communities included in the NewVa region are the counties of Alleghany, Botetourt, Craig, Floyd, Franklin, Giles, Montgomery, Pulaski, and Roanoke, and the cities of Covington, Radford, Roanoke, and Salem. The analysis aims to provide a better understanding of how the economies of these localities complement one another, providing the basis for working together as a single economic region.

One common challenge facing the region is the need to create high-paying jobs that will seed a more diverse economy and ensure future prosperity. In 1999, the ICF consulting firm conducted a study of industry clusters in the Roanoke Valley-Alleghany Highlands. The analysis was based on data from the mid-1990s, and local leaders felt it should be updated to reflect the impacts of the recent recession and its subsequent impact on local technology sectors. In addition, local leaders wanted to better understand the role of the Roanoke Valley-Alleghany Highlands economy within the context of a larger economic region serving western Virginia.

In 2003, the Fifth Planning District Regional Alliance (the Alliance) commissioned a study of the regional economy to identify emerging industries and potentially important clusters of industries. The Alliance contracted with the Center for Regional Economic Competitiveness (CREC), a non-profit organization affiliated with George Mason University, and the Roanoke Valley-Alleghany Regional Commission (RVARC) to design and conduct an industry cluster analysis for the communities in the service area of the New River Valley Planning and the Fifth Planning Districts – coinciding with the NewVA region. The ultimate goal of the study is to help local leaders direct economic development resources and facilitate economic development activities on behalf of critical elements of the entire regional economy.

Map 1: Industry Cluster Analysis - NewVa Region



Methodology and Approach

This 2004 cluster analysis looks at employment to identify clusters of industries that appear to have a comparative advantage in the NewVA communities relative to other regions. Determining these industries can help public officials and economic development organizations focus economic development efforts on industries that have the greatest likelihood of growing successfully.

Because the Alliance was interested in the relationships among a number of industry sectors, the consultants opted to implement an analysis that examines local industries as unique groups (or clusters), reflecting how they interact in the local and national economy. Industry clusters represent groups of industries that have existing or potential relationships. Firms within clusters are often interconnected – buying and selling from one another, buying similar inputs, selling to similar clients, or sharing labor markets. It is important to note that local firms that are considered part of the same cluster need not interact directly with one another. Firms and industries are grouped or clustered based on their behavior at a national level rather than local interactions. Thus, two regional firms may be categorized in the same cluster even though they have no direct relationship because these firms may interact with other cluster-related firms elsewhere in the US. Interaction may take the form of buying or selling relationships, competition or collaboration in meeting common market demands, or sharing of inputs or resources (including sources of labor, ideas, innovations, or raw materials).

The study uses a different methodology than the 1999 ICF study, reflecting advances in our understanding of cluster analysis studies since the late 1990s. Thus, although the overall economy of the Fifth Planning District (the subject of the 1999 study) is not expected to have undergone dramatic changes, we do expect a few important differences in the study outcomes. This analysis also provides an important understanding of the existing and growing relationship between the economies of the Roanoke and Blacksburg metropolitan statistical areas (MSAs).

The study methodology uses existing employment data to identify concentrations of industry in the region. The Center for Regional Economic Competitiveness and the Roanoke Valley-Alleghany Regional Commission designed the methodology based on similar studies completed in other regions and the unique issues facing the local economy. The study includes some quantitative analysis as well as follow-up interviews with leading industry leaders.

Policy makers and researchers have often asked how well the economies of the sub-regions within NewVA have become integrated. As part of the quantitative analysis, employment data was gathered and analyzed first for the communities of both the New River Valley Planning District and Fifth Planning Districts, then separately for the Roanoke MSA (Botetourt County, Craig County, Franklin County, Roanoke County, City of Roanoke, and City of Salem), the Blacksburg MSA (Giles County, Montgomery County, Pulaski County, and Radford city), and

the rural areas of the planning districts (Alleghany County, Floyd County and the City of Covington). The study then reviewed clusters for the entire NewVa region as well as economic sub-areas of the region, including the Roanoke MSA, Blacksburg MSA, and the combined rural areas of the planning districts. By examining the sub-areas separately, it was possible to gain a clearer picture of local competitive advantages and the economic interaction of industries among the local sub-areas.

An industry cluster analysis seeks to examine groups of industries with high-degrees of potential interconnectedness within a geographic area. Firms within these industry groups may have either cooperative relationships (such as buyer-supplier) or competitive relationships (competing within an industry). Economic development professionals typically use cluster analysis studies to highlight industries for which a geographic area has a competitive advantage. Having a competitive advantage implies that an area can produce particular goods or services more efficiently than other areas.

At times, it may be difficult to ascertain what the specific advantages are that a region possesses. One might speculate, for example, that access to a certain university research center or a natural geographic advantage helped the region to develop an advantage. An analyst presumes that some advantage exists if a region has a higher concentration of an industry or cluster than might be expected. In contrast, the analyst presumes a disadvantage if the region has a significantly smaller concentration of economic activity than one might expect.

Typically, researchers use employment data to represent that concentration, but it is quite conceivable that a lower concentration of workers in an industry may reflect higher productivity and the need for fewer workers than in other regions. Thus, any quantitative analysis should be partnered with a process of interviewing local business leaders to ensure that the data is revealing an accurate story.

CREC and RVARC approached the study's design by performing a comprehensive literature review of previous cluster studies. Dr. Michael Porter of Harvard University completed the groundbreaking academic work, and Dr. Edward Feser of the University of Illinois (formerly University of North Carolina at Chapel Hill) has completed extensive applied research on clusters in the Appalachian region and in North Carolina. Both Porter and Feser are recognized experts in the cluster analysis field, and their previous work helped guide our construction of "benchmark" cluster industries. These "benchmark" clusters represent the industries that are commonly aggregated and identified as clusters within the U.S. national economy.[2]

According to the academic literature, there is no standardized method for "constructing" a cluster of service-based industries. Consequently, the project

[2] Edward Feser, "An Assessment of North Carolina's Industry and Higher Education Technology Strengths and Opportunities, NC Board of Science and Technology and NC Alliance for Competitive Technologies," December 1999. Feser's "High-Tech" study was especially helpful in aggregating goods producing industries into clusters.

team assembled an expert panel to provide technical advice on how best to conduct an analysis in an applied research setting. The panel included recognized cluster analysis experts Dr. Harrison Campbell from the University of North Carolina – Charlotte, Dr. Roger Stough from George Mason University, and Dr. Edward Feser from the University of Illinois.

Service industries have not typically been examined in cluster studies because the focus of most past studies has been on linkages in the manufacturing sector. Since this effort aimed to better understand the service sector linkages and growing clusters in the region, the team sought to identify appropriate cluster linkages.

Input from the expert panel led to the use of IMPLAN® economic modeling software to construct service industry clusters by analyzing the relationships between individual industries. IMPLAN® includes estimates of industry-to-industry transactions at the regional level based on a national survey of industries conducted annually for the US Bureau of Economic Analysis. To identify linkages in a simple and straightforward manner, the team examined the prospective impact of a hypothetical event representing a large influx of capital for each industry in the NewVA region. When this event was simulated using the economic modeling software, the analysts took note of other industries that demonstrated an expectedly large impact. If a hypothetical increase in employment or sales in one industry leveraged an increase in sales in another industry of two percent or more, then the two industries were viewed as interrelated.[3]

The research team also interviewed several individuals familiar with the regional economy and identified three “non-traditional” groups of industries or “sectors” (opto-electronics, mechatronics, and computer technology) as locally specialized sectors requiring further examination. Mechatronics, the interdisciplinary field combining mechanical engineering, electrical engineering, and software engineering, was known to have substantial local representation in the electronic controls industry. In addition, opto-electronics, the application of electronic devices and lenses that interact with light, also has a large presence. Computer technology represents much of the hardware driving productivity growth in almost every sector of the regional and national economy.

[3] Industries with linkage correlations of .02 or greater were flagged as interrelated. 2000 IMPLAN Data was used to construct the impact models.

Findings

The clusters identified in Table 1 were based on the "benchmark" manufacturing clusters identified by Feser in his seminal work combined with additional service-oriented clusters identified though this analysis using IMPLAN. The individual industrial sectors (identified by Standard Industrial Classification code) associated with each cluster are indexed (and cross-indexed) in Appendix 1. As the research team studied the clusters, it was found that some clusters existed in very small measure in the region while others were quite important as a source of employment.

Table 1:
"Benchmark" Industry Clusters

Advertising	Aerospace	Aluminum	Banking and Finance	Business Services
Canned and Bottled Beverages	Chemicals and Plastics	Computer Sales and Service	Computer Technology Sector	Construction Contractors and Supplies Sector
Construction Materials	Customer Service Sector	Entertainment/Creative Leisure	Food Oil Mills	Government Sector
Higher Education	Hospitals, Labs, Specialized Medical Services	Imaging/ Photography	Information Technology & Instruments	Jewelry
Leather Goods	Legal Services	Mechatronics Sector	Metalworking and industrial machinery	Motor Vehicle Manufacturing
Opto-electronics	Packaged Food Products	Petroleum Products	Pharmaceuticals	Platemaking and Typesetting
Primary Metals	Printing and Publishing	Private Educational Services	Research, Development & Technical Design	Retail Trade Sector
Securities and Insurance	Stone, Clay and Glass Products	Technology-intensive Communications Services & Software	Technology-intensive Household Appliances	Textiles
Tobacco Products	Transportation, Shipping & Logistics	Travel/Tourism	Wholesaling-except transportation	Wood Products and Furniture

Chart prepared by the Center for Regional Economic Competitiveness based on data from Feser (1999) and CREC analysis.

Cluster Size

Employment and establishment data were gathered for each of the groups of industries (at a four-digit SIC level) for the years 1992 and 2002. The data were then aggregated for the entire NewVa region, the Roanoke MSA, the Blacksburg MSA, and the rural parts of the region. Table 2 provides employment by area for 2002 for those clusters that employ more than 500 workers in the NewVA region.

Table 2:
Employment by Cluster, 2002

CLUSTER	NewVa Region	Roanoke MSA	Rural areas in NewVa	Blacksburg MSA
Total Employment-All sectors	228,510	152,587	12,018	63,905
Retail Trade Sector	47,120	32,447	2,264	12,409
Hospitals, Labs, Specialized Medical Services	25,699	19,586	1,062	5,051
Business Services	24,488	19,324	716	4,448
Higher Education	23,831	11,519	779	11,533
Imaging/Photography	21,552	16,684	541	4,327
Travel/Tourism	19,591	13,126	815	5,650
Private Educational Services	18,879	15,072	610	3,197
Printing and Publishing	17,790	13,681	862	3,247
Construction Contractors and Supplies	14,899	10,880	787	3,232
Transportation, Shipping & Logistics	14,185	12,270	670	1,245
Wholesaling-except transportation	12,889	10,865	311	1,713
Chemicals and Plastics	8,643	3,249	2,293	3,101
Metalworking and industrial machinery	8,552	3,860	61	4,631
Research, Development & Technical Design	8,509	4,976	82	3,451
Customer Service Sector	7,891	6,600	20	1,271
Construction Materials	7,420	5,281	548	1,591
Government Sector	7,341	5,087	461	1,793
Motor Vehicle Manufacturing	7,340	2,528	701	4,111
Computer Sales and Service	7,078	4,873	275	1,930
Wood Products and Furniture	7,037	3,056	1,696	2,285
Banking and Finance	5,752	4,693	213	846
Information Tech & Instruments	5,435	4,494	5	936
Textiles	5,320	1,583	531	3,206
Advertising	4,304	3,074	44	1,186
Entertainment/Creative Leisure	3,970	2,453	38	1,479
Tech Communications Services & Software	3,641	2,169	27	1,445
Securities and Insurance	2,989	2,618	15	356
Mechatronics Sector	2,777	1,067	-	1,710
Opto-electronics Sector	2,537	2,166	-	433
Packaged Food Products	1,568	1,473	84	11
Computer Technology Sector	1,495	923	5	567
Primary Metals	1,384	697	-	687
Legal Services	1,233	1,002	35	196
Pharmaceuticals	1,029	690	4	340

Source: Virginia Employment Commission, Quarterly Covered Employment and Wages
Note: Cluster Definitions found in Appendix 1
Data points highlighted in yellow represent clusters that employ more than 10 percent of total area workers
Data points highlighted in blue represent clusters that employ 5-10 percent of total area workers

It is important to note at this point that summing up the individual clusters is not intended to equal the total employment. Using the approach that Feser and the research team have taken in identifying clusters, individual firms and the industry groups in which they operate can often be found in multiple clusters. For instance a plastics injection molding firm that makes both auto parts and medical

devices would turn up in the motor vehicle, hospitals/labs, and chemicals and plastics clusters. A number of firms fall into multiple cluster categories. As mentioned previously, the basic idea behind the cluster concept is to focus on the existing or potential inter-relationships among firms, not simply to sort firms into new groupings for the sake of a new categorization.

For every region, retail trade led the way in employment. Some of the key economic drivers in the region were different in the Roanoke MSA, the Blacksburg MSA, and the rural areas of the region. For instance, in the Roanoke MSA, hospitals, labs, and specialized medical services, business services, and imaging/photography were the largest clusters. The health care-related cluster leads the region in employment, with Carilion Health Systems representing the largest employer. Both business services and imaging/photography are clusters with extensive ties to the area's employers. Imaging/photography equipment are used in banking, insurance, government contracting (especially defense and homeland security), and medical services. One subset of imaging/photography is the opto-electronics sector – an important regional specialty.

In the Blacksburg MSA, higher education remains a driver of the local economy. Virginia Tech and Radford University have suffered in the past few years from cutbacks in the state budget for higher education and employment in this cluster has declined as a consequence. Travel and tourism are significant employers in the area due to the high number of motels/hotels and restaurants that support the Virginia Tech community and the region's proximity to the intersection of I-81/I-77. Medical services also appears as an important cluster to the Blacksburg MSA, resulting from the area's three hospitals and supporting medical services.

In the rural parts of the region, the clusters are more closely related to traditional manufacturing. Chemicals and plastics dominate the economic landscape, resulting from large employment by MeadWestvaco (which makes packaging and film as well as bleach board), Acadia Polymers (producers of seals and gaskets production), Lear Corporation (makers of panels for the Ford Explorer truck), and AET (which makes plastic film for product labeling and health care and filtration applications). The paper production activities as MeadWestvaco are also a vital part of the region's wood products cluster.

Cluster Concentration

By knowing the largest clusters, we are able to better understand some of the region's key economic drivers, but we need to know more about the region in order to assess emerging clusters that are growing. For example, some clusters – like retail – are relatively large and their presence depends on the size of the local marketplace. However, other clusters may be relatively small, but vitally important because a significant portion of the US economic activity in that cluster is occurring within the region. This higher-than-expected local presence implies a local competitive advantage worth further study.

By comparing the proportion of local employment in a cluster to the national employment, the research team is able to assess the relative concentration of

different clusters in the region. Cluster industry concentrations are typically measured by using location quotients.[4] Clusters with concentrations of 1.0 have exactly the same proportion of their employment in the region as one might find in the nation as a whole. Location quotients above 2.0 mean that the cluster is twice as concentrated in the NewVa as one might find in the nation as a whole. Table 3 includes a list of the 40 most highly concentrated clusters with their respective location quotients in the study area.[5]

Table 3 is instructive because it puts the employment levels of the retail sector into perspective. While it is the largest employer, the retail sector is only about 15 percent larger in the region than one might expect from national industry concentration patterns. The sector is most highly concentrated in the Roanoke MSA, reflecting Roanoke's role as a regional retail center for western Virginia and southeastern West Virginia. This reinforces the notion that the retail trade area served by Roanoke goes well beyond the boundaries of the NewVa region.

The table also shows the relative concentration of travel/tourism activities and customer service centers in the area. In addition, the wood products and furniture cluster is still relatively large, due in large part to the importance of paper and pulp production in the Alleghany Highlands, and the remaining furniture companies in Franklin County and the New River Valley.

Because the Roanoke MSA accounts for two-thirds of employment in the study region, it is not surprising that the clusters that are important to the Roanoke MSA are the same ones identified as vital to the entire region. However, customer services, opto-electronics, and transportation and logistics all stand out as clusters particularly concentrated in the Roanoke MSA.

Several key clusters are particularly important to the Blacksburg MSA. As noted earlier, Virginia Tech and Radford University lead a strong higher education cluster, but other clusters are also significant to the area. For instance, even though mechatronics is highly concentrated in both MSAs, it appears to be particularly oriented toward the New River Valley. The Blacksburg MSA still has a few vestiges of the textile and wood products industry that was once its economic base, but many firms in these clusters have closed or relocated. Motor vehicle manufacturing, chemicals and plastics production, and primary metal production are important manufacturing clusters in the Blacksburg MSA.

[4] A Location Quotient is a simple index that compares the proportion of the local economy's employment in a cluster to the proportion of the national economy's employment in that cluster. An index (or location quotient) of 1.0 means that the local economy has the same proportion of its employment in that cluster as the nation as a whole.

[5] Cluster industries with location quotients greater than 1.0 were defined as having above average representation in the study area. Cluster industries with location quotients equal to 1.0 were defined as having average representation, and industries with location quotients less than 1.0 were defined as having less than average representation. For our analysis, clusters with location quotients greater than 1.5 are considered significantly concentrated in the region.

Table 3: Measures of Industry Cluster Concentration, Location Quotient, 2002

CLUSTER	NewVa region	Roanoke MSA	Rural areas in NewVa region	Blacksburg MSA
Mechatronics Sector	12.60	7.25	0.00	27.75
Wood Products and Furniture	3.60	2.34	16.49	4.18
Travel/Tourism	3.06	3.07	2.42	3.15
Customer Service Sector	2.38	2.98	0.11	1.37
Opto-electronics Sector	2.00	2.56	0.00	1.22
Textiles	1.99	0.89	3.78	4.29
Chemicals and Plastics	1.67	0.94	8.41	2.14
Transportation, Shipping & Logistics	1.49	1.93	1.34	0.47
Motor Vehicle Manufacturing	1.32	0.68	2.40	2.65
Higher Education	1.25	0.91	0.78	2.17
Construction Materials	1.19	1.27	1.67	0.91
Retail Trade Sector	1.15	1.18	1.05	1.08
Primary Metals	1.12	0.85	0.00	2.00
Construction Contractors and Supplies Sector	1.09	1.20	1.10	0.85
Jewelry	1.08	1.56	0.00	0.16
Hospitals, Labs, Specialized Medical Serv	1.06	1.21	0.83	0.74
Banking and Finance	0.99	1.21	0.70	0.52
Metalworking and industrial machinery	0.94	0.64	0.13	1.82
Securities and Insurance	0.94	1.23	0.09	0.40
Printing and Publishing	0.93	1.07	0.85	0.60
Business Services	0.82	0.97	0.45	0.53
Wholesaling-except transportation	0.81	1.03	0.37	0.39
Stone, Clay and Glass Products	0.79	0.74	0.00	1.06
Advertising	0.76	0.81	0.15	0.75
Imaging/Photography	0.73	0.85	0.35	0.53
Entertainment/Creative Leisure	0.72	0.66	0.13	0.96
Legal Services	0.69	0.84	0.37	0.39
Private Educational Services	0.69	0.82	0.42	0.42
Research, Development & Technical Design	0.67	0.58	0.12	0.96
Information Technology & Instruments	0.66	0.82	0.01	0.41
Packaged Food Products	0.64	0.90	0.65	0.02
Computer Sales and Service	0.62	0.64	0.46	0.61
Government Sector	0.60	0.62	0.72	0.52
Tech Communications Services & Software	0.57	0.51	0.08	0.81
Pharmaceuticals	0.57	0.57	0.04	0.67
Canned and Bottled Beverages	0.55	0.32	0.00	1.22
Computer Technology Sector	0.39	0.37	0.03	0.54
Biomedical	0.21	0.30	0.00	0.03
Tech Household Appliances	0.19	0.28	0.00	0.00
Platemaking and Typesetting	0.11	0.14	0.00	0.05

Source: Virginia Employment Commission, Quarterly Covered Employment and Wages
Note: Cluster Definitions found in Appendix 1
Data points highlighted in yellow have location quotients greater than or equal to 2.00
Data points highlighted in blue indicate clusters with location quotients between 1.00 and 2.00

Except for travel/tourism, all of the intensely concentrated rural clusters are manufacturing-related. Wood products, chemicals/plastics, and construction materials are important to rural communities. Unfortunately, many of these manufacturing clusters are facing severe structural challenges due to global outsourcing and technological change.

Changes in Cluster Concentration

Another important factor in understanding the local economy is assessing how the cluster concentrations have changed over time. Large changes in this statistic suggest that the area has been gaining (or losing) its competitive advantage within the cluster relative to the rest of the US. This change reflects growth (or decline) in the local cluster's employment size relative to employment in that cluster at the national level. The research team calculated the location quotients for all of the clusters in 1992 and compared those indexes with the data generated for 2002. 1992 was selected as an appropriate benchmark year because at that time the United States was in the early stages of coming out of a recession as was the case in 2002. Table 4 provides a list of the changes in concentration for the area's larger clusters.[6]

Using this change-over-time measure, some very interesting characteristics emerge. Mechatronics, growing in its size and concentration in the region, seems to be coalescing in the Blacksburg MSA. No doubt this industry group is drawn to the resources of Virginia Tech's engineering research and teaching. These resources are extensive as exemplified in Table 5.

While the losses in textiles are not surprising, the declines in the region's concentration in computer technology and information technology/instruments related sectors have been strongly felt in the Roanoke MSA. The industries continue to grow, but nowhere near as rapidly in the U.S. as a whole, suggesting a local competitive disadvantage. Furthermore, these small, emerging industries suffered employment declines during the most recent recession. Because the size of these clusters is relatively small already, the region's information technology and computer technology sectors continue to struggle with creating a critical mass of firms and market presence. These firms will have a significant challenge in staging a comeback.

The data appears to illustrate that the rural areas of the region continue to depend on a declining cluster – wood products and furniture cluster -- for employment. However, chemicals and plastics appear to be concentrating in these communities. Rural areas continue to be vulnerable as they continue to depend on manufacturing industries, many of which are at great risk to global economic forces.

The news is not all good for the Blacksburg MSA either. The declines in state budgets for higher education have had a profound effect on its higher education cluster. Those same cuts have affected the entire study region. According to a recent study "A Summary of the University's Economic Effects" completed by Virginia Tech, in 1999, more than 15,000 jobs in the New River-Roanoke Valley area could be traced to the activities of Virginia Tech (its students, employees, and visitors). Our analysis suggests that number may be even higher (with nearly 24,000 jobs dependent on this cluster). The region has 11 two-year and

[6]Changes in location quotient of 0.3 or more (either positive or negative) were considered to be a significant decrease and are highlighted in the table. Those of 0.7 or more are especially important to our analysis.

Table 4: Increasing and Decreasing Cluster Concentrations, Change in Location Quotients (1992-2002)

CLUSTER	NewVa region	Roanoke MSA	Rural areas in NewVa region	Blacksburg MSA
Mechatronics Sector	1.56	(4.50)	0.00	16.12
Opto-electronics Sector	0.71	0.71	(0.08)	1.02
Motor Vehicle Manufacturing	0.39	0.21	0.69	0.61
Jewelry	0.37	0.49	0.00	0.16
Pharmaceuticals*	0.33	0.34	(0.03)	0.36
Banking and Finance	0.29	0.40	0.21	0.00
Customer Service Sector	0.28	(0.08)	(0.06)	1.20
Packaged Food Products*	0.23	0.32	0.32	(0.02)
Canned and Bottled Beverages	0.23	(0.05)	0.00	0.93
Securities and Insurance	0.21	0.34	0.04	(0.09)
Transportation, Shipping & Logistics	0.20	0.21	0.60	0.07
Entertainment/Creative Leisure*	0.20	(0.02)	(0.01)	0.75
Tech Household Appliances	0.19	0.28	0.00	0.00
Primary Metals	0.15	(0.07)	0.00	0.68
Research, Development & Technical Design*	0.13	(0.01)	(0.00)	0.46
Government Sector	0.09	0.06	0.02	0.11
Advertising	0.07	0.04	0.08	0.14
Hospitals, Labs, Specialized Medical Serv	0.05	0.07	(0.72)	0.02
Metalworking and industrial machinery	0.03	(0.14)	0.03	0.41
Retail Trade Sector	0.03	0.01	0.03	(0.01)
Construction Materials	0.01	(0.01)	0.96	(0.20)
Legal Services	0.01	0.01	(0.13)	(0.02)
Travel/Tourism	0.01	0.04	(0.58)	(0.21)
Business Services	0.01	(0.09)	0.13	0.18
Food Oil Mills	0.00	0.00	0.00	0.00
Leather Goods	0.00	0.00	0.00	0.00
Tobacco Products	0.00	0.00	0.00	0.00
Platemaking and Typesetting	(0.02)	(0.04)	0.00	0.03
Printing and Publishing	(0.02)	0.01	(0.95)	(0.04)
Petroleum Products	(0.03)	(0.04)	0.00	0.00
Tech Communications Services & Software	(0.06)	(0.19)	(0.03)	0.23
Imaging/Photography	(0.08)	(0.24)	0.12	0.23
Chemicals and Plastics	(0.09)	0.02	6.45	(1.79)
Computer Sales and Service	(0.10)	(0.19)	0.19	0.06
Private Educational Services	(0.13)	(0.26)	0.10	0.10
Wholesaling-except transportation	(0.14)	(0.27)	0.14	0.11
Construction Contractors and Supplies	(0.14)	(0.15)	(0.80)	(0.13)
Computer Technology Sector***	(0.17)	(0.37)	(0.16)	0.30
Information Technology & Instruments***	(0.26)	(0.38)	(0.03)	(0.01)
Higher Education**	(0.31)	(0.19)	(0.27)	(0.72)
Wood Products and Furniture	(0.31)	(0.80)	(11.87)	1.10
Stone, Clay and Glass Products	(0.65)	(0.72)	0.00	(0.63)
Textiles**	(0.75)	(0.97)	(0.22)	(0.69)

*small LQ, but growing rapidly, **large LQ, but declining rapidly, ***small LQ and declining rapidly

Source: Virginia Employment Commission, Quarterly Covered Employment and Wages

Note: Cluster Definitions found in Appendix 1. Data points highlighted in **yellow** have location quotients changes greater than or equal to two standard deviations from the mean. This means that there is less than a 5 percent chance that this change occurred randomly. Data points highlighted in **blue** indicate clusters with location quotients between one and two standard deviations from the mean. This means that there is less than a 32 percent chance that this change occurred randomly.

Table 5: Clusters and Related Research and Development Opportunities	
Cluster	**Related Virginia Polytechnic Institute and State University Centers**
Chemicals and Plastics	➢ Center for Unit Load Design ➢ Center for Adhesive & Sealant Science ➢ Center for Self-Assembled Nanostructures and Devices ➢ Materials Research Institute Macromolecules and Interfaces at Virginia Tech ➢ Systems Research Center ➢ Virginia Bioinformatics Institute ➢ Glade Road Research Center ➢ Energy Management Institute ➢ Impact Biomechanics Laboratory - Mechanical Engineering ➢ Laboratory for Neurotoxicity Studies ➢ Microwave Processing Laboratory ➢ Multi-Phase Flow Laboratory ➢ Reacting Flows Lab and the Virginia Active Combustion Control Group ➢ Tribology/Biotribology Laboratory
Computer Technology Sector	➢ Center for Human Computer Interaction ➢ Institute for Particle Physics and Astro-Physics ➢ Interdisciplinary Center for Applied Mathematics ➢ Internet Technology Innovation Center ➢ Macromolecules and Interfaces at Virginia Tech ➢ Systems Research Center ➢ High Performance Computational Fluid Thermal Science and Engineering Group ➢ Virginia Bioinformatics Institute ➢ Virginia Tech Transportation Institute
Construction Materials	➢ Center for Environmental Applications of Remote Sensing at Virginia Tech ➢ Energy Management Institute ➢ Impact Biomechanics Laboratory - Mechanical Engineering ➢ Model Analysis Laboratory ➢ Reacting Flows Lab and the Virginia Active Combustion Control Group ➢ Center for Housing Research
Hospitals, Labs, Specialized Medical Services	➢ Center for Gerontology ➢ Center for Human Computer Interaction ➢ Fralin Biotechnology Center ➢ Metropolitan Institute ➢ Virginia Tech Applied Biosciences Center ➢ Tribology/Biotribology Laboratory ➢ Virginia Bioinformatics Institute ➢ Center for Environmental Applications of Remote Sensing at Virginia Tech ➢ Developmental Cognitive Neuroscience Lab ➢ Impact Biomechanics Laboratory - Mechanical Engineering ➢ Laboratory for Neurotoxicity Studies ➢ Center for Comparative Oncology
Information Technology & Instruments	➢ Center for Human Computer Interaction ➢ Institute for Particle Physics and Astro-Physics ➢ Interdisciplinary Center for Applied Mathematics ➢ Internet Technology Innovation Center ➢ Macromolecules and Interfaces at Virginia Tech ➢ Impact Biomechanics Laboratory - Mechanical Engineering ➢ Systems Research Center ➢ High Performance Computational Fluid Thermal Science and Engineering Group
Mechatronics Sector	➢ Center for Power Electronic Systems ➢ Center for Intelligent Material Systems and Structures ➢ Center for Adhesive & Sealant Science ➢ Interdisciplinary Center for Applied Mathematics ➢ Macromolecules and Interfaces at Virginia Tech ➢ Systems Research Center

Table 5: Clusters and Related Research and Development Opportunities	
Cluster	**Related Virginia Polytechnic Institute and State University Centers**
	➢ Virginia Center for Coal+Energy Research ➢ Center for Turbomachinery & Propulsion Research ➢ High Performance Computational Fluid Thermal Science and Engineering Group ➢ Rotor Dynamics Laboratory
Motor Vehicle Manufacturing	➢ Center for Geospatial Information Technology ➢ Systems Research Center ➢ Virginia Tech Transportation Institute ➢ Center for Automotive Fuel Cell Systems ➢ Energy Management Institute ➢ Impact Biomechanics Laboratory - Mechanical Engineering ➢ Microwave Processing Laboratory ➢ Vibrations and Acoustics Laboratory
Opto-electronics	➢ Center for Self-Assembled Nanostructures and Devices ➢ Fiber and Electro-Optics Research Center ➢ Virginia Tech Applied Biosciences Center ➢ Systems Research Center
Pharmaceuticals	➢ Fralin Biotechnology Center ➢ Macromolecules and Interfaces at Virginia Tech ➢ Virginia Tech Applied Biosciences Center ➢ Laboratory for Neurotoxicity Studies ➢ Center for Comparative Oncology
Primary Metals	➢ Materials Research Institute ➢ Macromolecules and Interfaces at Virginia Tech ➢ Powell River Project
Research, Development & Technical Design	➢ Center for Geospatial Information Technology ➢ Center for Human Computer Interaction ➢ Institute for Particle Physics and Astro-Physics ➢ Interdisciplinary Center for Applied Mathematics ➢ Internet Technology Innovation Center ➢ Materials Research Institute ➢ Systems Research Center ➢ Virginia Bioinformatics Institute ➢ High Performance Computational Fluid Thermal Science and Engineering Group ➢ Impact Biomechanics Laboratory - Mechanical Engineering ➢ Model Analysis Laboratory ➢ Reacting Flows Lab and the Virginia Active Combustion Control Group ➢ Tribology/Biotribology Laboratory ➢ Virginia Tech Experimental Computational and Convection Laboratory
Securities & Insurance	➢ Internet Technology Innovation Center
Wood Products and Furniture	➢ Center for Adhesive & Sealant Science ➢ Interdisciplinary Center for Applied Mathematics ➢ Macromolecules and Interfaces at Virginia Tech ➢ Powell River Project ➢ Virginia Bioinformatics Institute ➢ Reynolds Homestead Forest Resources Research Center ➢ Center for Environmental Applications of Remote Sensing at Virginia Tech ➢ Conservation Management Institute ➢ Sustainable Engineered Materials Institute
Chart prepared by the Center for Regional Economic Competitiveness	

four-year post-secondary institutions. These facilities account for more than 25 percent of all jobs in Montgomery County, and over 6 percent of all jobs in the New River-Roanoke Valley area according to the Virginia Tech study. Clearly, the revitalization of higher education funding is critical – not just to Blacksburg, but to the entire region.

Opto-electronics and the motor vehicle manufacturing clusters appear to be bright spots in terms of growth and increasing regional competitive advantage. The opto-electronics and mechatronics clusters may well be related as electronics and imaging technologies are increasingly integrated with machine controls production. Pharmaceuticals production is growing nationally at a tremendous rate, and the region seems to be capturing its share. In the last decade, pharmaceuticals employment grew 32 percent faster in the area than nationally.

Employment in the banking sector has grown 28 percent faster in the area than nationally. This growth continues in the region even after the merger of several banking institutions. The region has managed to capture significant back office banking operations. These operations are also at risk of globalization as financial and customer service firms look at out-sourcing and “off-shoring” to cut costs and expand services to their customers.

Comparison with Competitor Regions

Cluster strategies can examine nearby regions to identify those that may be potential economic collaborators and those that may be potential competitors. The consultants examined comparable data in the Lynchburg MSA, Hickory-Morganton-Lenoir MSA, and Asheville MSA. These MSAs represent nearby areas of comparable size that may potentially compete or collaborate with the Roanoke and Blacksburg MSAs, depending on each region's respective industry cluster mix.

As shown in Table 6, NewVA shares a number of highly concentrated clusters with nearby competitor regions. For example, mechatronics is highly concentrated in the Asheville MSA (location quotient of 3.0), and opto-electronics is highly concentrated in the Hickory-Morganton-Lenoir MSA (location quotient of 7.2) and Asheville MSA (location quotient of 3.9).

Table 6:
Competitor Regions and their Cluster Specializations (in Rank Order by LQ)

NewVa region- Top 10 Industries by Cluster Concentration	Lynchburg MSA - Top 10 Industries by Cluster Concentration	Hickory-Morganton-Lenoir MSA - Top 10 Industries by Cluster Concentration	Asheville MSA - Top 10 Industries by Cluster Concentration
Mechatronics Sector	**Wood Products and Furniture**	**Textiles**	Leather Goods
Wood Products and Furniture	Leather Goods	Primary Metals	Stone, Clay and Glass Products
Travel/Tourism	**Travel/Tourism**	**Opto-electronics Sector**	**Opto-electronics Sector**
Customer Service Sector	Metalworking and industrial machinery	**Wood Products and Furniture**	**Mechatronics Sector**
Opto-electronics Sector	Primary Metals	Leather Goods	**Textiles**
Textiles	Packaged Food Products	Construction Materials	**Chemicals and Plastics**
Chemicals and Plastics	**Customer Service Sector**	**Motor Vehicle Manufacturing**	**Higher Education**
Transportation, Shipping & Logistics	**Textiles**	**Chemicals and Plastics**	Information Technology & Instruments
Motor Vehicle Manufacturing	Construction Contractors and Supplies Sector	**Transportation, Shipping & Logistics**	Hospitals, Labs, Specialized Medical Serv
Higher Education	**Chemicals and Plastics**	Platemaking and Typesetting	Metalworking and industrial machinery

Chart prepared by the Center for Regional Economic Competitiveness using Virginia Employment Commission, Quarterly Covered Employment and Wages Data. Note that colors reflect the large cluster concentrations found in the New River Valley/Fifth Planning District region that are also found in competitor regions.

It is interesting to note that all of the largest cluster concentrations found in Roanoke are also found in one or more of the other regions. At the same time, however, each of these areas offers potential for collaboration that might be considered in development activities. For example, Lynchburg's strength in the customer service sector may help spur growth in Roanoke's customer service industry due to cooperative supplier/consumer relationships. A closer, detailed examination of specific companies that compose Lynchburg's customer service sector would be useful to help identify potential and new, collaborative relationships.

All three of the competitor regions have strong cluster specializations in chemicals and plastics, a sign that the NewVa region should perhaps pay close attention to the health of this particular cluster. The high concentration of chemicals and plastics in Roanoke and the three competitor areas implies that the cluster is a relatively mature industry with a high degree of related services and industries developed to support the cluster in western Virginia and North Carolina. This cluster is an asset to the Roanoke area, but some elements of the cluster have experienced recent declines, and should be monitored for employment changes.

The Lynchburg MSA, Hickory-Morganton-Lenoir (Hickory) MSA, and Asheville MSA top industry concentrations are shown in Tables 7, 8 and 9. Dr. Harrison Campbell of UNC Charlotte used employment data from 1992 to 2001 in compiling data for Tables 8 and 9.[7]

[7] Comparable 2002 data for North Carolina was not available. NC stopped classifying companies using the Standard Industrial Classification scheme in 2001; however, most cluster benchmarking research had been done using SIC codes.

Lynchburg has a very high concentration in traditional industries, including wood products and leather goods. Like Roanoke, travel and tourism is an important industry to Lynchburg. Lynchburg appears to have an established manufacturing base in primary metals and packaged foods. The customer service sector is strong here and Lynchburg should be considered a competitor location for regional back-office activities.

Table 7: Lynchburg MSA - Top Ten Industries 2002

Cluster Name	Location Quotient - 2002
Wood Products and Furniture	3.3
Leather Goods	3.3
Travel/Tourism	2.7
Metalworking and industrial machinery	2.1
Primary Metals	1.9
Packaged Food Products	1.6
Customer Service Sector	1.5
Textiles	1.5
Construction Contractors and Supplies Sector	1.4
Chemicals and Plastics	1.4

Figure 2: Cluster Concentrations and Growths for the Lynchburg MSA

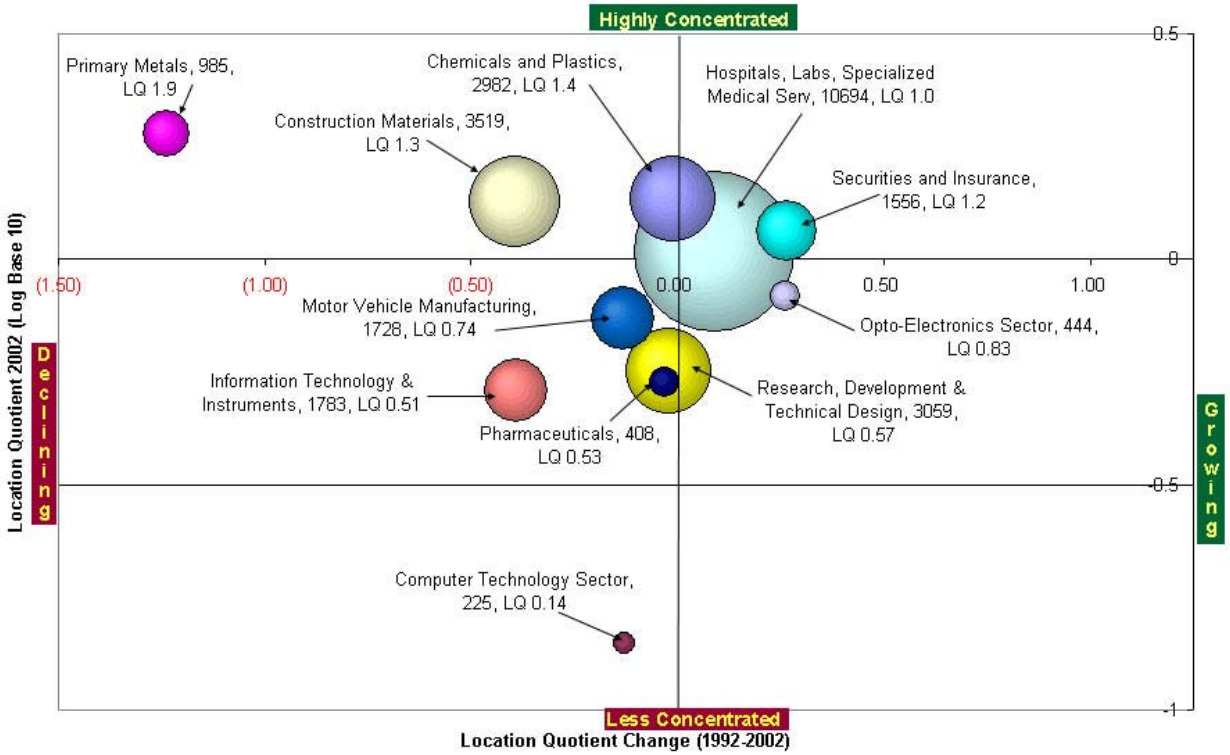


Chart prepared by the Center for Regional Economic Competitiveness using Virginia Employment Commission, Quarterly Covered Employment and Wages Data

The Hickory MSA cluster information in Table 8 illustrates that the region has resource-dependent industries, such as textiles, primary metals, wood products and furniture, and leather goods. It is also showing significant strengths in the opto-electronics and transportation, shipping and logistics sectors. The Hickory MSA may be targeted as either a potential collaborator or competitor for growing these industries in Roanoke.

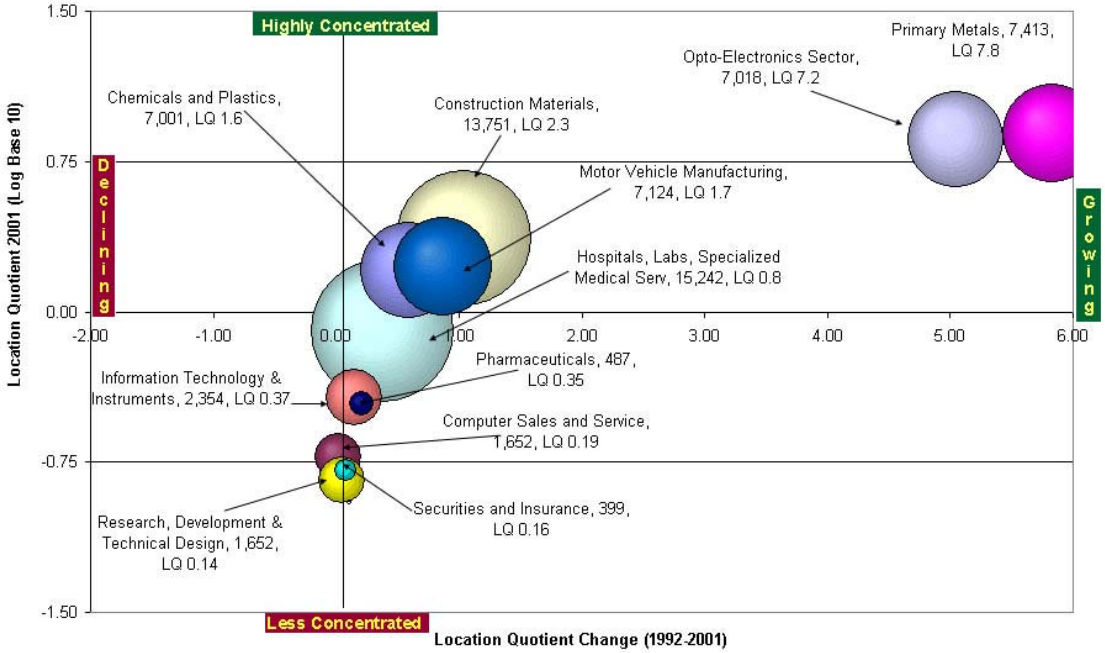
Table 8: Hickory MSA - Top Ten Cluster Concentrations, 2001

Cluster Name	Location Quotient, 2001
Textiles	15.66
Primary Metals	7.82
Opto-electronics Sector	7.18
Wood Products and Furniture	4.21
Leather Goods	2.81
Construction Materials	2.34
Motor Vehicle Manufacturing	1.67
Chemicals and Plastics	1.61
Transportation, Shipping & Logistics	1.08

Compiled by Dr. Harrison Campbell, UNC-Charlotte from NC Employment Security data

Figure 3 reveals the relative importance of primary metals and opto-electronics, which are larger clusters in Hickory. It is important to note that the opto-electronics sector is more highly dependent on fiber optic cables, which suffered a tremendous downturn in 2001 and 2002, but is expected to rebound to some degree in the coming years. This is a very different make-up of the cluster than imaging and optics technology that drives the sector in the NewVa region.

Figure 3: Cluster Concentrations and Growths for the Hickory-Morganton-Lenoir MSA



Graph prepared by the Center for Regional Economic Competitiveness using data from the North Carolina Employment Security Commission compiled by Dr. Harrison Campbell, UNC Charlotte.

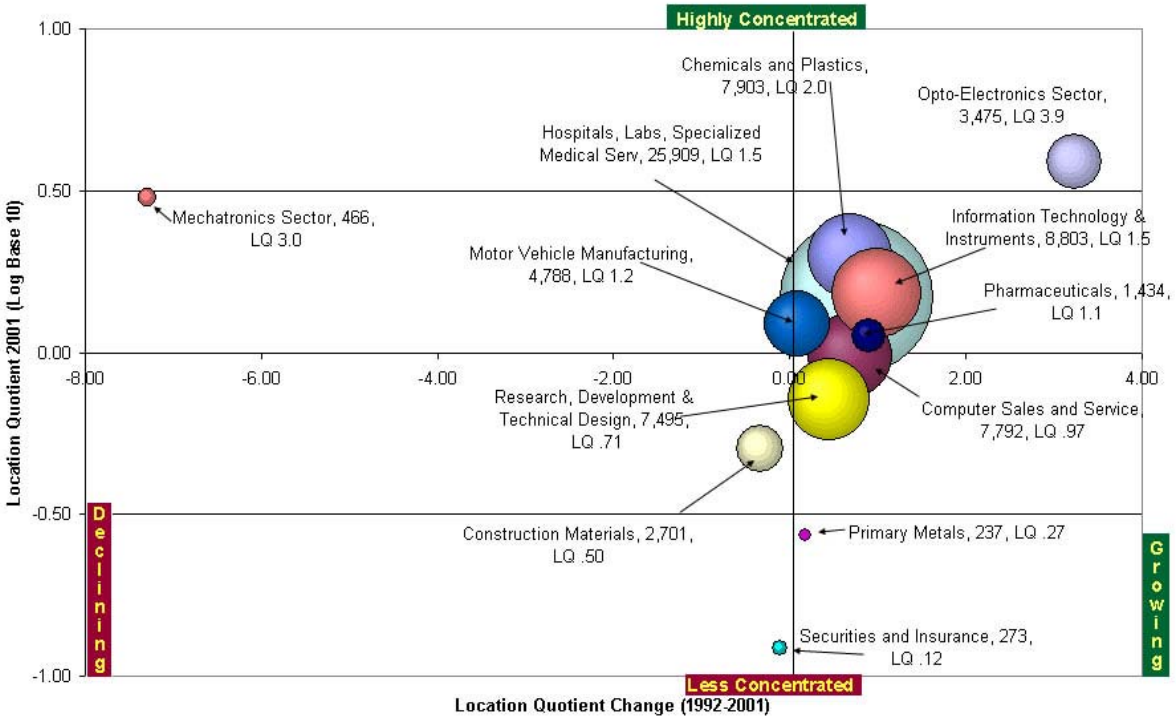
Table 9 reveals the Asheville MSA's strong concentration of activity in the opto-electronics, mechatronics, and information technology & instruments sectors. Recognizing that Asheville already possesses significant strengths in these industries, it may be possible to increase local industry growth by encouraging local complimentary services, suppliers, or buyers.

Table 9: Asheville MSA – Top Ten Industries 2001

Cluster Name	Location Quotient, 2001
Leather Goods	12.50
Stone, Clay and Glass Products	8.68
Opto-electronics Sector	3.90
Mechatronics Sector	3.01
Textiles	2.33
Chemicals and Plastics	1.99
Higher Education	1.67
Information Technology & Instruments	1.52
Hospitals, Labs, Specialized Medical Serv	1.49

Compiled by Dr. Harrison Campbell, UNC-Charlotte from NC Employment Security data

Figure 4: Cluster Concentrations and Growths for the Asheville MSA



Graph prepared by the Center for Regional Economic Competitiveness using North Carolina Employment Security data compiled by Dr. Harrison Campbell, UNC-Charlotte.

Asheville and Lynchburg may be significant competitors for Motor Vehicle Manufacturing. With its proximity, Lynchburg may also be a potential

collaborator. Both of these MSAs also have significant clusters of production technology. Lynchburg is building a pharmaceutical base that could potentially collaborate or compete with Roanoke and Blacksburg firms. Hickory's importance as an automotive supply center may offer critical partnering opportunities for the region's motor driven products cluster. Asheville and Hickory appear to have a concentration in Chemical and Plastics that could serve as a competitor to or ally for the Roanoke Chemicals and Plastics cluster. The challenge for economic developers in the region is to understand the unique nature of the clusters in NewVa region compared with similar clusters in nearby regions. The goal is to identify opportunities for collaboration and understand potential linkages between local firms and those located in nearby regions.

Targeting Clusters for Economic Development Action

In determining the specific clusters to target for action, one more dimension needs to be considered: the quality of the jobs being created. A surrogate measure for job quality is the wages that a firm, industry, or cluster pays its employees. The study team examined the average wages for 27 clusters identified as the most significant in terms of size and concentration in the region.

Wages in Concentrated Clusters

In developing a list of targeted clusters, one goal is to facilitate the creation of high-wage jobs. Table 10 provides the average wages by all of the key clusters of interest. Eighteen clusters offer average wages above the regional average of $33,664, and twelve of those clusters offer average wages of 21 percent or higher than the regional average (or $40,734). Recent research suggests that economic developers should focus their attention on industries that pay at least 21 percent higher than the region's average to ensure that all of the related jobs generated by the new job help to increase the regional average.[8]

It is important to note that at the top of the list of average wages paid are two clusters – the computer and information technology/instruments – growing more slowly in the region than in the nation as a whole. Also, the opto-electronics and mechatronics sectors are among the highest wage payers. Pharmaceuticals manufacturing – a small but growing cluster – also emerged as one of the top five clusters for wages.

At the bottom end of the wage scale, travel/tourism, retail trade, and customer services reflect a substantial portion of jobs in the region. Packaged food products and entertainment/creative leisure are two clusters that are relatively small and growing rapidly. They also tend to offer relatively low wage jobs. These sectors may be important as transition jobs for dislocated workers and a source for part-time employment for low-skill workers.

Identifying the Target Clusters

In identifying the most important clusters of interest to economic development policy makers, targets may differ depending on the needs of various users. Furthermore, efforts to enhance and promote clusters should take a variety of approaches. Economic developers focused on attracting new industry may be interested in working with clusters that have shown tremendous growth and expansion in recent years. Those focused on retaining the existing economic base may be concerned about clusters that are already relatively large and are not growing as rapidly as one might expect. These efforts might involve identifying individual firms or networks of firms within these "at-risk" clusters that might be the target of help. Workforce developers concerned about re-employing

[8] John R. Lombard, John W. Whaley, and Sean LaCroix, "Demonstrating The Wage Impact of New Jobs on a Regional Economy?" *Applied Research in Economic Development,* 2003, Volume 1, Number 1.

Table 10:
Average Wages by Cluster

CLUSTER	NewVA Employment	NewVA Annual Wages
All Sectors	228,510	$33,664
Computer Technology Sector	1,495	$61,078
Information Technology & Instruments	5,435	$55,718
Opto-electronics Sector	2,537	$55,337
Pharmaceuticals	1,029	$51,312
Mechatronics Sector	2,777	$48,677
Securities and Insurance	2,989	$46,205
Primary Metals	1,384	$45,396
Motor Vehicle Manufacturing	7,340	$44,020
Chemicals and Plastics	8,643	$43,919
Research, Development & Technical Design	8,509	$41,859
Hospitals, Labs, Specialized Medical Services	25,699	$41,555
Construction Materials	7,420	$41,276
Wholesaling-except transportation	12,889	$40,583
Metalworking and industrial machinery	8,552	$38,588
Printing and Publishing	17,790	$38,517
Banking and Finance	5,752	$37,421
Higher Education	23,831	$35,938
Wood Products and Furniture	7,037	$34,784
Business Services	24,488	$32,754
Textiles	5,320	$31,459
Transportation, Shipping & Logistics	14,185	$31,379
Construction Contractors and Supplies Sector	14,899	$31,140
Packaged Food Products	1,568	$30,829
Entertainment/Creative Leisure	3,970	$25,306
Customer Service Sector	7,891	$24,578
Retail Trade Sector	47,120	$17,411
Travel/Tourism	19,591	$13,385

Source: Virginia Employment Commission, Quarterly Covered Employment and Wages
Note: Cluster Definitions found in Appendix 1
Data points highlighted in yellow pay wages greater than 20 percent above state average wages.
Data points highlighted in blue pay above average wages.

dislocated workers may be interested in transition industries that can offer jobs requiring short-term training or growing industries that require skills similar to those in declining industries. Additionally, this data provides entrepreneurs in the NewVa region with guidance on which industry groups show the greatest potential for continued growth.

As a consequence, we are using an approach that categorizes clusters along five dimensions: (1) the size of the cluster's employment, (2) the rate of growth of that cluster's employment over time; (3) the concentration of that industry relative to national employment in the industry; (4) the change in that concentration during the most recent business cycle; and (5) the average wages paid by firms in the cluster. In our analysis, we found 27 of 45 national clusters that have a significant local presence. In Table 11, these 27 important local clusters are categorized into 12 different categories reflecting their size, growth, and wage

levels. While all 27 clusters are important contributors to the local economy, 12 appear to pay significantly higher than average wages, offering tremendous opportunities for creating or retaining jobs that improve the local standard of living. Seven of these clusters are growing faster than might otherwise be expected and they offer strong foundations for building the future economic base of the NewVa region.

Table 11: Target Clusters

	At-Risk Clusters (Large, but Growing Slowly or Declining)	Potential Missed Opportunities (Small, Growing Slowly or Declining)	Economic "Engine" Clusters (Large and Fast Growing Clusters)	Emerging Clusters (Small, Fast Growing Clusters)
High Wage (>21% above regional average)	➢ **Chemicals and Plastics** ➢ Construction Materials	➢ **Information Technology & Instruments** ➢ **Computer Technology** ➢ **Primary Metals**	➢ **Motor Vehicle Manufacturing** ➢ **Research, Development & Technical Design** ➢ Hospitals, Labs, Specialized Medical Services	➢ **Opto-electronics Sector** ➢ **Pharmaceuticals** ➢ **Securities and Insurance** ➢ **Mechatronics**
Medium Wage (0-20% above regional average)	➢ **Wholesaling-except transportation** ➢ Metalworking and industrial machinery ➢ Printing and Publishing ➢ **Wood Products and Furniture**		➢ **Banking and Finance** ➢ **Higher Education**	
Low Wage (below regional average)	➢ Retail Trade Sector	➢ **Textiles**	➢ Business Services ➢ **Transportation, Shipping & Logistics** ➢ **Construction Contractors and Supplies Sector** ➢ **Customer Service Sector** ➢ Travel/Tourism	➢ **Packaged Food Products** ➢ **Entertainment/ Creative Leisure**

*Clusters highlighted in **blue** are increasing in their concentration in the study region (meaning that they are growing faster or declining slower within the region than for the nation as a whole). Clusters highlighted in **red** are decreasing their concentration in the region, suggesting a possible competitive disadvantage that must be overcome. Clusters with no highlights are growing at approximately the same rate in the region as in the nation as a whole.*

Chart prepared by the Center for Regional Economic Competitiveness using Virginia Employment Commission, Quarterly Covered Employment and Wages Data.

In table 11, those clusters with significant employment levels that are declining or growing very slowly are identified as **"at-risk."** Even though their growth is slow, these clusters are important because they employ a lot of people or pay relatively good wages. Perhaps, local cluster-building activities could help to improve growth in these industries. Examples of cluster-building activities for these at-risk industries include providing information about procurement opportunities in related industries or networking events and technical assistance to help business owners identify or deploy state-of-the-art technologies.

Chemicals and plastics and construction materials are high wage clusters that fit this category. In particular, chemicals and plastics employment is declining more rapidly within the region than the cluster's national employment. Wholesaling, metalworking and industrial machinery manufacturing, and printing and publishing are mid-wage sectors that also fall into this category. Wholesaling is declining more rapidly in the region than it is nationally. Wood products and furniture has traditionally been an important cluster for the rural areas. With off-shoring in wood processing industries, this cluster is increasingly dependent on a few sizable facilities, such as the MeadWestvaco plant in the Alleghany Highlands. The concern is twofold. First, the area may be becoming overly dependent on a few large firms. Second, declines in these industries may be problematic if the firms are not investing sufficiently in their own operations or if certain parts of the cluster are consolidating at locations outside the region.

Retail trade is a huge sector in the region and its growth has been relatively slow – in large part because population growth has been modest. Retailing in Roanoke is certainly more highly concentrated, but not tremendously larger than one might expect in the region. In addition, wages in the cluster are relatively low – due in part to its dependence on part-time or low-skill workers. Since the cluster appears to be growing at about the same level as the nation, it is probably not important to emphasize investment in this cluster, except as a tactic for providing employment opportunities for low skill or semi-skilled workers dislocated from other segments of the economy or as a strategy to support desired growth in the travel and tourism cluster.

Four clusters fall into our category of **"potential missed opportunities."** These are relatively small sectors that are growing more slowly than the clusters at the national level. In some cases, they may actually be losing employment. We can assume that they are not currently competing effectively in the region, but it would be worthwhile to examine the reasons for that competitive disadvantage. Textiles are a very familiar example of this competitive challenge. The region's remaining textiles firms offer relatively low wage jobs in apparel manufacturing, and the local decline in employment has been more rapid than that of the nation as a whole. Few are sanguine about the prospects of protecting the remaining elements of these industries.

Three high wage clusters that could be important in terms of offering jobs with family-supporting wages appear to be struggling in the region – information technology & instruments, computer technology, and primary metals. Employment in information technology/instruments and computer technology declined during the past decade, likely resulting from the bust in the information technology market in the late 1990s. A focus group discussion with information technology firms suggested that the keys to future success in this industry may be related to tying the region much more closely to the growth occurring in Northern Virginia and in meeting the Defense and Homeland Security needs of the federal government. The mechatronics sector has seen some transitioning of firms as it increasingly concentrates its activity in the Blacksburg MSA.

The computer technology sector is growing slower than the national average. Even though employment in the computer technology cluster in the region grew by nearly two-thirds during the past decade, this rapid growth was still slower than the cluster's national growth rate. With a slower than average growth rate, local issues, such as poor transportation linkages to external markets or inadequate access to talented entrepreneurs, may be inhibiting the region's computer technology cluster from becoming globally competitive.

The primary metals cluster continues to add employees at a relatively slow pace, but it appears to be growing faster (however modestly) within the study area than in the US as a whole. This cluster may offer opportunities for attraction from other regions of the country as industries in the cluster consolidate and look to make a choice of locations.

"Economic engine clusters" are those that are sufficiently large and growing such that they could serve the critical function of powering the region's future growth. Three high wage clusters fall into this category of clusters: motor vehicle manufacturing; research, development & technical design, and hospitals, labs, specialized medical services. It is important to note that two of these clusters – motor vehicles and R&D/technical design – appear to be concentrating in the New River Valley (where the clusters are growing three times faster than in the Roanoke Valley). Growth in the hospitals and medical services cluster is concentrating in the Roanoke Valley.

Large, growing clusters are those that employ a significant number of local residents and are growing both in real and relative terms. These sectors may offer opportunities for new business development as the region attempts to "broaden" the cluster by finding additional industries to support the cluster. Hospitals, labs, and special medical services and motor vehicle manufacturing are clusters that fit this category.

Banking and finance is a moderate wage sector that appears to be concentrating in the region – with a particular emphasis on growth in the Roanoke MSA. Large back-office activity – such as the Wachovia regional customer service center – may help explain the growth in this industry. Higher education, which has a significant presence in both the Roanoke and Blacksburg MSAs, has been struggling and may only rebound with increases in state spending on these institutions.

At the lower end of the wage scale, Roanoke, in particular, is enjoying the fruits of success resulting from growth and an increasing concentration of the transportation/logistics and customer service centers in the region. Unfortunately, wages in these sectors are somewhat comparable to those of the textile industry – slightly below the regional average wage.

Four sectors hold promise as **"emerging cluster"** opportunities, which are relatively small clusters that are growing in the region. They offer opportunities for economic developers to promote entrepreneurial activity aimed at "deepening" the cluster – increasing its presence in an effort to create a critical

mass of activity. These emerging clusters include: mechatronics, opto-electronics, pharmaceuticals, and securities and insurance. Of these, mechatronics employs relatively few (2,777 workers), but is so highly concentrated (LQ=12.6) that it has the potential to become a major economic driver in the years to come. By comparison, opto-electronics, employing 2,537 local workers, and growing fairly quickly (LQ=0.7) is also an emerging cluster with a great deal of economic promise.

On the lower end of the wage scale, job opportunities are emerging in the food packaging and entertainment/leisure clusters. Regional employment in food packaging industries grew 22 percent faster locally than it did nationally, and entertainment/leisure industries grew 18 percent faster locally than nationally. The entertainment/leisure cluster is an important foundation for promoting the region's tourism/travel industry. Public funding cuts to arts and cultural organizations and other non-profit groups have created new challenges for continued growth in this cluster.

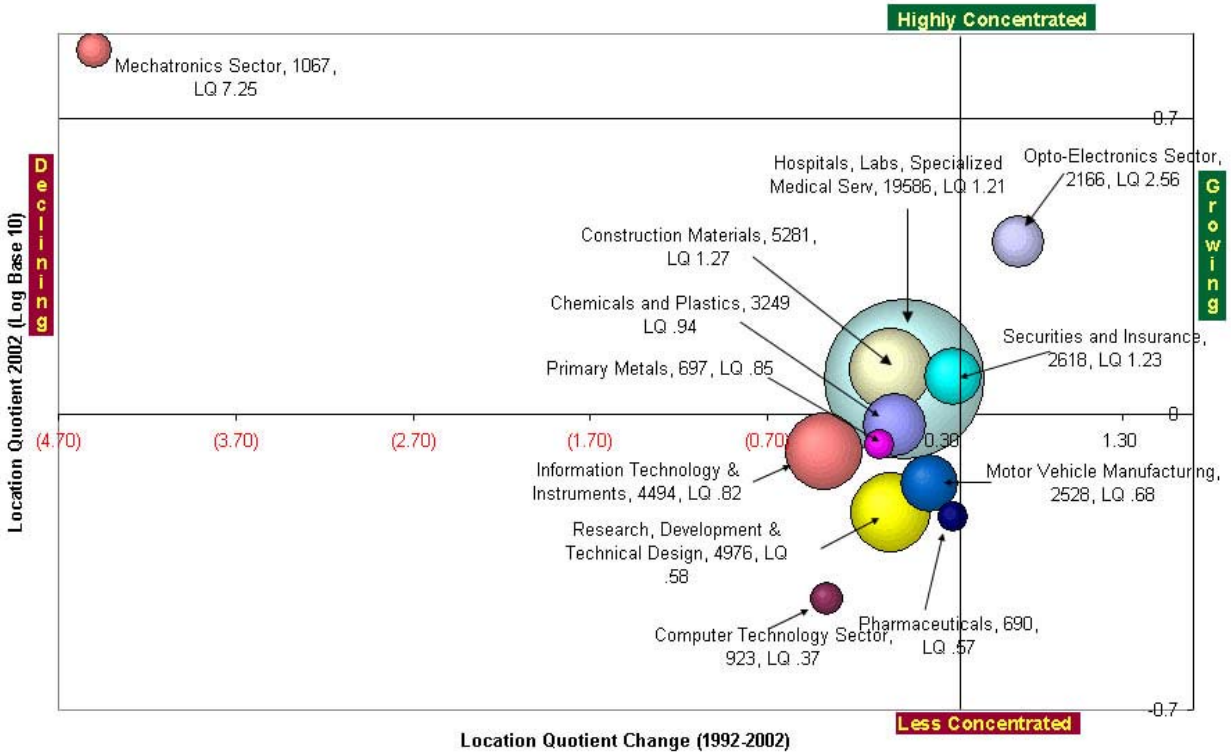
Subregion Differences

The target clusters identified in the prior section were identified by region-wide data. This section looks more closely at the unique differences among the three subregions of the study area: the Roanoke MSA, the Blacksburg MSA, and the region's rural area.

The following series of charts provide details about key clusters in each of the subregions. The size of each bubble reflects the relative number of workers employed in that cluster. The placement of each bubble reflects the respective cluster's average wage and growth rate. While all of the clusters in the graph pay average wages above 21 percent of the region average, the highest wage, fast-growing clusters appear in the upper right corner of the graph and clusters with slower growth rates and wages closer to the region's average wage appear in the bottom left corner.

Figure 5 illustrates the significant importance of hospitals, labs, and specialized medical services to the Roanoke MSA economy. It also reinforces the opportunities that pharmaceuticals, securities and insurance, opto-electronics, and computer technology offer the metro area. The chart also reflects the industry concentration declines that have occurred during the past decade in mechatronics, information technology, and primary metals.

Figure 5: Cluster Concentrations and Growths for the Roanoke MSA



Graph prepared by the Center for Regional Economic Competitiveness using Virginia Employment Commission, Quarterly Covered Employment and Wages Data

Figure 6 also demonstrates that hospitals, labs, and specialized medical services are also a large employer in the Blacksburg MSA. However, unlike the Roanoke economy, with such a large relative concentration of health care services, Blacksburg's economy has a broader balance with significant employment in motor vehicles, chemicals and plastics as well as research, development, and technical design. The figure also shows the emergence of computer technology, opto-electronics, and the burgeoning research, development & technical design clusters as fast growing, high wage segments of that area's economy. R&D doubled in size and opto-electronics and computer technology quadrupled in employment during the past decade alone. At the same time that these sectors were emerging, securities and insurance employment declined, apparently consolidating in the Roanoke metro area. The metro area also saw declines in chemicals and plastics and construction materials.

Figure 6: Cluster Concentrations and Growths for the Blacksburg-Christiansburg-Radford MSA

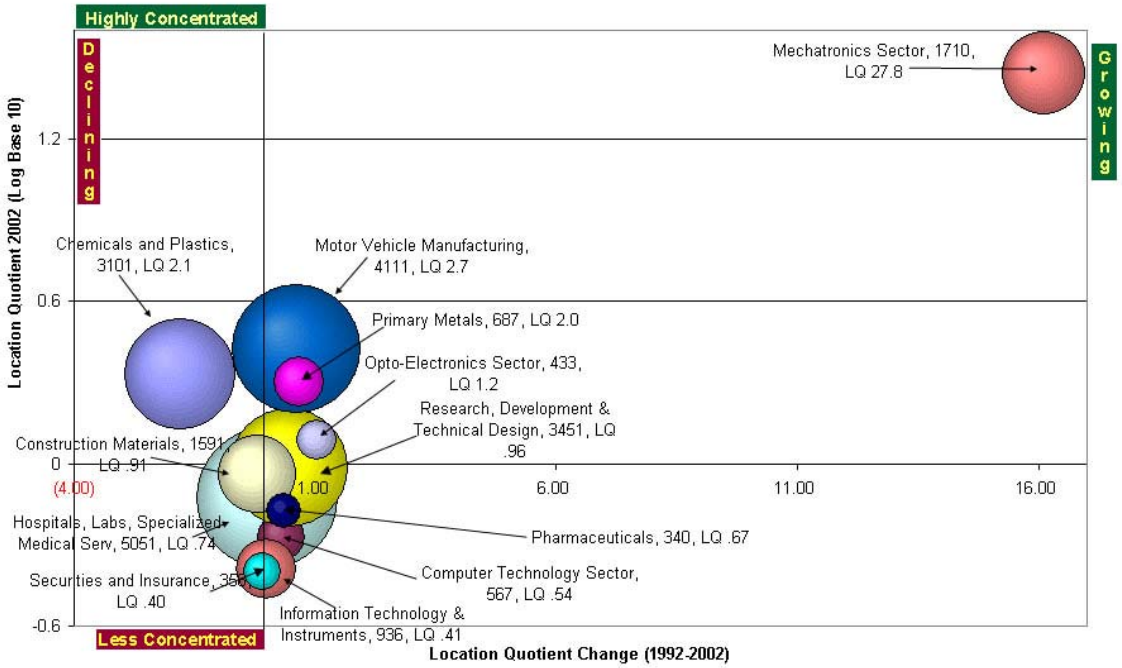


Chart prepared by the Center for Regional Economic Competitiveness using Virginia Employment Commission, Quarterly Covered Employment and Wages Data

Figure 7 displays the importance of chemicals and plastics, motor vehicle manufacturing, construction materials, and health care services to the region's rural economy. However, unlike the urban economies of Roanoke and Blacksburg, the rural communities have very little activity in any other high wage clusters. Almost all of the rural growth has been in chemical and plastics and construction materials. Health care employment has declined slightly as these services consolidate into larger medical complexes in the urban areas.

Figure 7: Cluster Concentrations and Growths for the Rural Area

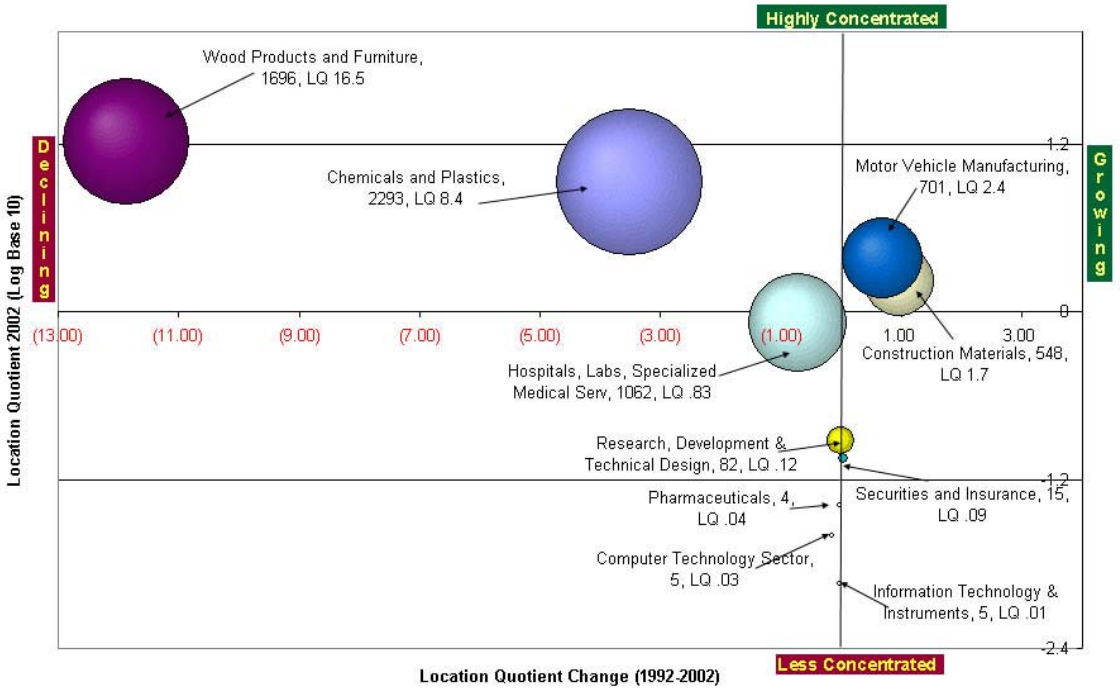


Chart prepared by the Center for Regional Economic Competitiveness using Virginia Employment Commission, Quarterly Covered Employment and Wages Data

These figures reflect the unique nature of the economies of the subregions of the NewVa region. The Roanoke Valley is serving as the financial, health care, and distribution center of the region. The New River Valley is an important manufacturing and technology center. The rural area of the region is providing a location for heavy manufacturing support, but most dependent on the metro areas for job opportunities. Combined, these three areas complement one another, resulting in a diversified economic base with complementary industries that appear to be competitive with other small to mid-sized metro areas.

Roanoke Valley Cluster Profiles

To gain a more in-depth understanding of a few of these clusters, the project team conducted a series of focus group sessions with representative firms in four important clusters. During March 2004, the team met with representatives from banking and finance, information technology, transportation/logistics, and travel/tourism. These interviews offered insights about how certain industries within these clusters relate to one another and the region.

Banking and Finance Industry

The region's banking and finance sector is larger than one might expect, especially in Roanoke, but a closer look reveals that the region is dependent on customer service centers serving the banking industry. Roanoke has been a particularly strong location for attracting back office data processing centers (especially customer service centers that handle in-bound calls) serving the mid-Atlantic's banking industry. The Wachovia center on Plantation Road accounts for a substantial portion of the back office employment in the region. Access to Charlotte, Richmond, Washington, DC, and Raleigh-Durham appear to be a critical location factor for these operations. While Roanoke compared well in terms of costs and other factors to other possible locations for these processing center, they may be at great risk if the tide of global outsourcing affects the financial services industry the way that it has affected other sectors of the economy.

Another important element of the local financial industry is access to securities and other financial services. This industry is partially driving the growth in back office activities, but demographics are also driving the cluster's growth. As more baby boomers acquire greater assets in preparation for retirement, greater amounts of money must be managed. Many firms are developing direct-to-customer financial planning services aimed at filling a strong need among middle class customers that have never before been tapped. Growth in this economic sector is expected to continue through the retirement years of the baby boom demographic cohort and is also tied to efforts aimed at attracting wealthy retirees to locations such as Smith Mountain Lake.

Workforce issues dominated the focus group discussion as the key challenge to continued success. Banks indicated that they encounter difficulties in hiring and retaining entry-level workers, such as bank tellers. Financial service firms indicated that finding local programs aimed at intermediate and advanced financial planning certifications were difficult. All of the focus group participants cited the Roanoke Higher Education Center as an important resource for bringing training programs to the region, but wondered how well the offerings of the Center reflected the actual needs of the banking and financial services cluster. Post-interview research into the Higher Education Center's offerings revealed the availability of basic business and accounting courses, but nothing targeted to the needs identified during the focus group session.

Information Technology and Instruments

The information services and instruments industry has weathered severe economic challenges during the past five years. The industry's outlook seems to be brightening, but it is still early in the economic recovery process. The challenge facing the information technology cluster in Roanoke is access to markets and clients and this is a paramount concern.

Service firms in this cluster appear to be particularly interested in access to the major metro areas to the east. Every entrepreneur participating in the discussion indicated that his or her market is outside western Virginia. Washington, DC, Northern Virginia, Hampton Roads, Raleigh and Charlotte were all mentioned as prime locations for clients. To a degree, the major markets for local firms are within a four-hour drive of Roanoke. This appears to represent the "first circle" of the NewVa region's marketplace for information technology services. Beyond that, business representatives indicated that they needed to be able to service clients located across the U.S. and anywhere in the world. They discussed issues associated with the region's airport at length. Flexibility of schedules and destinations appear to be the critical impediment raised, and access to more flights and enhanced schedules through Greensboro's airport (and to a lesser degree Washington Dulles) appears to be very important for many long-distance travelers.

Those represented in the cluster focus group all expressed that they could easily be located elsewhere but chose to operate their business in Roanoke because of their perceptions of the local quality of life. In each case, market forces – the demands of clients or the calls from prospects – are pulling them toward larger metro areas to the north, east, or south. With lower labor rates than nearby metros, industry representatives feel that they have a competitive cost advantage in bidding for projects in these markets.

However, with dramatic changes occurring in telecommunication technologies, the NewVa region's competitive advantage may be more strongly focused on the region's quality of life and personal/professional ties. Building professional networks, social networks and creating incentives for entrepreneurial activities might have its biggest payoff in supporting these types of companies. To strengthen the information technology sector, the region must position its quality of life advantages rather than its location advantages. The region should also support and enhance local efforts to create peer-to-peer ties between local firms as potential strategic partners as well as among local firms and potential markets across the U.S.

Travel and Tourism

Travel and tourism remained relatively steady in the region after September 11, 2001. While long distance travel may have declined, regional travel expanded to make up for it. Local hoteliers indicated that the first quarter of 2003 was challenging due in large part to significant reductions in state government spending and the multiplier impact that reduction had on business conferences and corporate events. While the region appears to be an important destination

for statewide groups seeking a western Virginia location, sporting events (including NASCAR races, Virginia Tech events, and amateur sports tournaments) are important contributors to local travel and hotel occupancies. Advance bookings for these sporting events often begin as much as one year before the event. Local business people believe that much of the travel and tourism market for the region is within a day's drive of the region and air travel accounts for only a small portion of the overall visitor market. The leisure travel market is much more price sensitive than the business travel market and air travel costs were cited as a potential impediment for fly-in tourists.

The NewVa region has an array of lodging offerings – ranging from the business traveler/conventioneer to the leisure traveler. Local travel and tourism advocates believe that the region could grow this cluster by expanding recreational and/or entertainment attractions for tourists and expanding the array of services for business travelers. More funding to enhance regional marketing efforts would also pay dividends in terms of expanded local tourism.

The lack of a dedicated funding streams, such as a dedicated hotel occupancy tax, for regional tourism promotion limits the resources available for tourism and makes a collaborative regional marketing effort challenging. Marketing efforts to draw tourists to the region are often perceived as inadequate. For instance, recent state funding cutbacks for cooperative marketing efforts with regional groups, as well as cutbacks to non-profit visitors' attractions, have significantly reduced the region's opportunity to "sell" the area to potential tourists. Hoteliers participating in the focus group believe that more of the lodging tax should flow back to the regional tourism organizations for expanded marketing activities. This challenge may be a result of the lack of a local hotel/motel association to advocate on travel-related issues, including local development activities that might encourage increased tourism.

Transportation, Shipping and Logistics

The transportation industry attributed its concentration in the Roanoke Valley due to the historic role that Roanoke played as distribution hub. The local industry appears to primarily ship out finished goods to regional destinations. Interstate 81 is a lifeline for East Coast trucking, linking southern manufacturers to northeastern markets. Roanoke is a hub for transferring shipments destined northward to major metropolitan markets.

As the region has grown up around the industry, conflicting public policy may be creating tensions that could drive the cluster out of the center of the region. For example, long-standing firms located within the center city are now complaining that local ordinances – especially related to traffic flow and business expansion needs – are restricting their business or do not respond to the concerns of the transportation sector. Neither do industry representatives see alternative plans to respond to these concerns in locations in the outlying areas of the region.

Labor force issues are critical as the industry experiences high turnover rates due to the demanding nature of the work. Customers are increasingly

demanding long haul shipments while drivers are unwilling to take long haul jobs. This creates “breakpoints” in the transportation flow of commercial goods as goods are shifted from one driver to another on its way to a final destination.

Clearly, highway access is important, but support services are also needed along the I-81 corridor. For instance, this major trucking corridor has very few truck stops so trucks are forced to park on highway ramps or exit in congested commercial areas to give drivers legally required rest breaks. This has increased conflicts for both the trucks and local residents.

The industry leaders feel left out of the regional and city economic and development planning. They wish to be invited to help create constructive solutions to land use, transportation, and workforce issues.

Findings and Follow up

While the purpose of this study was to provide background data, a few recurring themes were mentioned by many of the cluster representatives participating in the focus groups and were reflected in the data. This section is intended to highlight those issues and link them to the strategies and tactics currently being implemented in the region. During the interviews, several individuals noted that they felt left out of the economic planning process, and did not feel as though local government officials cared about the challenges their industries faced. Industry representatives spoke highly of the Roanoke Higher Education Center, but wondered if more classes could be offered that responded to industry-specific training needs. The Roanoke Airport was cited as an underutilized resource that could become a more valuable asset to local industry.

The analysis and follow-up interviews reinforced the themes highlighted in the 2002 Regional Economic Strategy.

1. **Visibility** – The data analysis reinforces the strategic approach of creating the NewVA brand for the entire economic region, recognizing that the Roanoke Valley, New River Valley, and Allegheny Highlands together represent a stronger, more economically diverse region. The region and its component clusters are competing in a global marketplace. In our interviews with travel/tourism and information technology firms, business executives voiced an inherent need to expand the market for local firms and products by building a stronger image for the economic region. Successful strategies point to greater public and private collaboration to heighten awareness of the region, encourage greater investment of public funding in key institutions and marketing efforts in the region, and a well developed brand that would appeal and be presented to a national/international – not just a regional – market.

2. **Connectivity** – From the financial services, health care, and transportation found in the Roanoke MSA economy to higher education, mechatronics, and motor vehicle manufacturing so important to the New River Valley and rural areas of the region, the economic foundations and key growth clusters depend heavily on their linkages to ideas, data, and people located elsewhere. All of these industries depend on the interstate highways and airport. Many business executives expressed concerns about challenges facing an underutilized Roanoke airport and an over-congested road network. Solutions to the region's highway limitations focus on expanding capacity to I-81, especially for trucking, enhancing linkages to Lynchburg/Richmond and Greensboro.

For the airport, the size of the local market of travelers hampers the airport from competing for lower fares and increased flexibility in air schedules. If the airport had a larger "catchment" area with greater population, demand for air travel would increase, thereby improving local schedules, prices, and making air travel from Roanoke more competitive. Improved highway access might help to address the Roanoke Airport's challenges of improving linkages to potential travelers to a wide area of western Virginia.

Any real solution aimed at competing with the Greensboro airport would engage the leaders of Roanoke, Blacksburg, and Lynchburg to create a truly regional airport that would serve a larger area of central-western Virginia. The solution to this challenge is long-term. Without considering a very different solution however, the growth of key service and technology industries in the region will be stunted because of their inability to compete in national and international markets. Lack of easy air access may become an increasingly critical liability for NewVa and all of western Virginia.

3. **Quality of Life Amenities** – Several of the key emerging industries – including mechatronics, opto-electronics, and research, development, and technical design are dominated by small entrepreneurial firms. These and other fast-growing clusters also employ high-wage knowledge workers. Amenities help to attract and retain these firms and workers to the NewVa region. During the focus groups, the feel of a "connection" to the community and the easy pace of business were both identified as assets that helped to overcome some of the economic disadvantages the region's location created for firms. With declines in funding for cultural and arts amenities, the region appears to be hampering its ability to attract, grow, and retain the very kinds of skilled workers and high paying businesses that must drive the region's future.

4. **Knowledge Workforce** – All of the highest growth, higher wage clusters identified in this study require access to workers with greater skills than traditional industries required. For firms in these clusters to grow, they must have access to a pool of engineers, technicians, financial analysts, and high-skill production workers to compete globally for the most technologically advanced work. The skills required could not be developed from a six-month training course – the tact that many worker training programs take. Instead, these careers require years of academic and practical training as well as on-the-job experience. Most of the industry representatives that we spoke with indicated that qualified workers were available, but their challenge was in keeping those workers "state-of-the-art." Many industries feel that the Roanoke Higher Education Center is an invaluable asset in ensuring that talented workers become world class. Even its greatest supporters, however, indicated their concern about the Center's ability to offer flexible, specialized training that in response to the demands of high growth, fast-changing firms.

5. **Innovation and Entrepreneurship** – The emerging clusters – such as opto-electronics, mechatronics, health care, research and design – are hotbeds for innovative ideas and products or services. The key for the NewVA region will be in creating an environment in which entrepreneurs transform these ideas into commercially viable products within the region. The challenge is in recognizing the needs of a dynamic group of companies that may not be organized to express their needs. Many business representatives interviewed felt that the private sector was not organized to coordinate the delivery of consistent and clear messages about the experiences and concerns of entrepreneurs to public

policy makers. As a result, many firms feel that their voice was not being heard by local industry groups or by government.

As the needs of entrepreneurial firms change so should their industry representatives and the government responses to business. Many of the emerging clusters in the region are replete with technology-oriented firms. These rely heavily on research and development to fuel innovation. Most of the firms are quite small. Organizing these smaller firms is extremely difficult since they rarely have the time or inclination to address issues beyond their day-to-day business issues. Existing institutions, such as the regional chamber, regional technology council, as well as local governments will need to allocate more of their attention to efforts aimed at effectively reaching these fast-growing firms.

6. **Economic Transformation** – Roanoke traditionally depended on banking and the railroads. As the study demonstrates, while the banking industry is still important to the region, the role of banking in the region has changed dramatically. The region has become a location for back-office customer support rather than as a regional headquarters. Emerging service-based sectors such as health care, computer support services, and opto-electronics (including high speed scanning in support of the customer support, health care, and computer clusters) are transforming the role of the local economy. Education and spin-off research are also driving the new economic base.

Once important textiles and furniture are no longer vital to the economy, but this transition is not yet complete. Many workers are still being affected by the down-sizing within traditional industries and the businesses that served those industries. The future of the local economy and the success of local workforce retraining efforts will be tied to continuing the region's economic transition in the years to come. From this research, we now have a better sense of how the economy is transforming. We now have a better sense of what makes the regional economy tick. Now, our challenge is to integrate this understanding into our public policy efforts and our economic development initiatives.