

Data ^{2:2} Snapshots

Series 2 No. 2 | September 2014

REGIONAL ECONOMICS:

**Regional Economic
Cluster Analysis**

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The Delaware Valley Regional Planning Commission is dedicated to uniting the region’s elected officials, planning professionals, and the public with a common vision of making a great region even greater. Shaping the way we live, work, and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment, and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia in

Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region — leading the way to a better future.



The symbol in our logo is adapted from the official DVRPC seal and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the

Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources, including federal grants from the U.S. Department of Transportation’s Federal Highway Administration (FHWA) and Federal Transit Administration (FTA); the Pennsylvania and New Jersey departments of transportation; and DVRPC’s state and local member governments. The authors, however, are solely responsible for the findings and conclusions herein, which may not represent the official views or policies of the funding agencies.

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Introduction and Method

The purpose of this report is to identify economic strengths, employment trends, and future economic opportunities by analyzing economic clusters in the Greater Philadelphia region. The analysis is based on the cluster definitions advanced in the U.S. Cluster Mapping Project, an initiative led by the Institute for Strategy and Competitiveness at the Harvard Business School and supported by the U.S. Commerce Department's Economic Development Administration (EDA). The findings of this study informed *Investing in People and Places: Greater Philadelphia's Comprehensive Economic Development Strategy*.

Economic strengths of the region can be measured in terms of how concentrated the employment numbers are for each cluster in our region compared to the larger U.S. economy. This is measured using location quotient analysis. Location quotients compare the employment share of a cluster in a local economy to that of the same cluster in a larger economy.

It is also important to identify how much of the employment change in the region represents a local trend, which can shed light on the strengths and weaknesses of the industries. Some of the employment changes in the Delaware Valley Regional Planning Commission (DVRPC) region may be related to a national economic trend or industry-wide trend, both of which could obscure the true competitiveness of our industries. Shift-share analysis is one method of singling out the local share of employment change from the national trend and industry trend.

Data Sources

This report uses two separate sources of sectoral employment data to compare the region's industry clusters: one to compare the region's economic performance to that of the nation as a whole, and a second to review the geographic locations of specific employers in key economic sectors. The U.S. Census Bureau's County Business Patterns (CBP) provides annual statistics for businesses with paid employees throughout the United States, by industry. Basic data items for CBP are extracted primarily from the Business Register, a database of employer companies maintained and updated by the U.S. Census Bureau. Other sources for CBP data items include the Economic Census, Annual Survey of Manufacturers, and Current Business Surveys, all of which are U.S. Census Bureau programs.

CBP provides some of the more consistent economic statistics for each industry classification. Currently, CBP uses the 2007 North American Industry Classifications System (NAICS) for industry classification. NAICS codes are updated every five years; the decade researched in this analysis (2000–2010) spans two updates: the 2002 NAICS and the 2007 NAICS. The discrepancies between the two are relatively minimal for the purpose of comparing the major industries in the Greater Philadelphia region. The benefits offered by the CBP include the ability to access the relevant data by county for the nine-county Greater Philadelphia region, and to compare Greater Philadelphia to the nation as a whole.

The second data source used for this analysis is the National Establishments Time Series (NETS) database, a proprietary database produced by Walls and Associates. The NETS database is a revised

version of the Dun and Bradstreet database. Using each company's unique Data Universal Numbering System (DUNS) number (or numbers, in cases where separate divisions within a company have unique DUNS numbers), Walls and Associates creates a time series for each business and then screens the data to eliminate duplicates and identify anomalies. If a file contains suspicious information, the data is cross-checked with previous annual records and adjusted or eliminated, as appropriate, based on information collected from other sources (including government and non-profits).

Municipal-level employment data from the 2010 NETS database was reviewed by DVRPC staff to eliminate obvious errors (such as duplications). The data was then reviewed by the region's county planning staffs and further refinements were made based on local knowledge (including errors in location and missing large employers). One advantage of the establishment-based NETS database is that all employment, sales, and other activity is reported at the actual facility—not the headquarters. Unlike government sources of employment data, the NETS database includes sole proprietors, part-time jobs, and farm operations, and has been found to be more accurate in reporting data for small, privately owned firms and public sector employers such as post offices and public schools.

The NETS database used by DVRPC includes the street address and the most current latitude–longitude for each establishment and the origin and destination latitude–longitudes for all significant moves, at the four-decimal-place level. While CBP data is used to compare the region's economy to that of the nation, the NETS database provides location-specific information for individual employers throughout the region, by sector.

It should be noted that the data used in this analysis is from 2010, which may not accurately reflect increases in specific sectors that have occurred as the region recovers from the national recession which began in 2007 and officially ended in late 2009. Similarly, the significance of some emerging sectors, including energy production and distribution, may not be reflected. Future DVRPC work efforts will explore the changes in the economy that have occurred since 2010.

The data from CBP and NETS can provide numerous insights into the regional economy. One of the methods to identify and measure regional economic strengths is to conduct a cluster analysis. However, before delving into the analysis, two questions regarding clusters need to be addressed—“What is a cluster?” and “Why clusters?”

What Is a Cluster?

According to Michael Porter, a Harvard Business School professor who developed and popularized the cluster concept, clusters are defined as “a group of companies and institutions co-located in a specific geographic region and linked by interdependencies in providing a related group of products and/or services”. Embedded in this definition are the three foundational ideas of a cluster: geography, value creation, and business environment. Clusters are formed in close proximity to one another in a relatively compact region. Clusters are also formed by companies that support and collaborate with one another to produce a related group of goods and services. Lastly, formation and performance of clusters are dependent not only on the individual performance of companies but also on the business environment set by companies, anchor institutions, and government agencies.

Why Clusters?

Many of the critical drivers for our nation's competitiveness are regional, and clusters are a central part of the framework. The benefits of a cluster to a regional economy are threefold. First, clusters result in higher productivity. Companies in a cluster have ready access to assets and suppliers, which enables them to be more efficient and productive. Second, clusters encourage knowledge spillovers and innovation. This is especially true for knowledge-intensive industries such as life sciences and education, where competition and cooperation within clusters create an impetus for new ideas and innovation with lower cost. Third, clusters make the formation of new businesses easier. Typically, when a start-up company looks for a place to locate, it seeks a cluster where it can depend on a wealth of partners and suppliers and also where it can find alternative opportunities in case of a failure. Silicon Valley is a classic example of a region reaping the benefits of a cluster.

In 2010, EDA chose the Institute for Strategy and Competitiveness at the Harvard Business School to lead the U.S. Cluster Mapping Project. Headed by Michael Porter, the U.S. Cluster Mapping Project is a federally funded economic development initiative that aims to strengthen U.S. competitiveness by helping clusters and regions improve their economic compositions and performance. The cluster definitions are detailed and informative in helping to understand regional strengths and weaknesses.

Traded Industry Clusters versus Local Industry Clusters

The U.S. Cluster Mapping Project separates all industries into two broad types: traded industries and local industries. Traded industries are concentrated in specific geographic areas and produce goods and/or services that are bought and sold across regions, and sometimes countries. Traded industries include, for example, most manufacturing firms, video and audio production companies, and educational institutions (which "sell" knowledge and innovation). Local industries are present in most if not all regions, generally do not compete across regions, and primarily serve the needs of the people living within the same region. Local industries include, for example, most health care services, utilities, and retail companies, as well as some goods-producing industries (such as newspapers, locally consumed food products, and soft drinks).

This report focuses specifically on clusters of traded industries, which command higher wages and rates of innovation than do local industries and are considered the engines of regional economies. In the Greater Philadelphia region, traded industries represent 37 percent of the total employment. This is in keeping with the national average, where traded industries account for 36 percent of the total employment, 50 percent of total income, and 96.5 percent of all patents. The definitions of clusters used in this report correspond to the 2013 traded industry cluster definitions used by the U.S. Cluster Mapping Project, each of which contains a set of related NAICS industrial classifications.¹ These definitions can be found in Appendix A.

¹ The U.S. Cluster Mapping project has revised its cluster definitions since the data for this report was gathered, and now defines 51 separate traded industry clusters and 16 local clusters. These new definitions will be reflected in future DVRPC analyses.

A Note on Life Sciences and Health Care

Greater Philadelphia has long been known as a leader in life sciences, a broad categorization of related industries that include health care, pharmaceuticals, biotechnology, and all of their related support services. According to Select Greater Philadelphia, the Philadelphia region is the 5th largest life sciences research and development (R&D) hub in the nation, with over \$10.5 billion invested annually. The region is home to 15 leading life science companies, and has almost 200 hospitals, three pharmaceutical schools, more than 15 major health systems, four National Cancer Institute-designated cancer treatment centers, four children's hospitals, and six medical schools.² A 2009 report by the Milken Institute concluded that Greater Philadelphia was second to only Boston in a composite index that considered the impact of the region's life science industries on employment and earnings as well as innovation and small business vitality.³

As noted previously, this report focuses specifically on clusters of traded industries (those that are typically bought and sold across regions and therefore bring wealth in to the region). Some industries included in the broader "life sciences" categorization are analyzed in this report as separate, individual, traded clusters (such as biopharmaceuticals and medical devices). Others are considered as separate components of different clusters, including R&D related to life sciences or biotechnology (included in the *education/knowledge creation* cluster); teaching hospitals (also included in the *education* cluster); insurance (included in the *finance* cluster) and pharmaceutical wholesalers and distributors (included in the *distribution and electronic commerce* cluster).

In addition to these traded industries related to life sciences, health care services (which include doctors, caregivers, and employees of businesses such as hospitals, medical laboratories, medical equipment companies, drugstores, and funeral service providers) are typically defined as local industries, and are therefore not included in the following discussion of traded industries. Unlike traded industries (which produce and sell goods as well as some services, including education), local industries are found in every region, primarily meet the needs of the region's residents, and are typically present in direct proportion to the number of people who live in the region.

Recent data indicates that over 390,000 employees worked in the local health services cluster in the Philadelphia region in 2012, amounting to over 25 percent of the region's total local employment.⁴ The cluster is also growing in this region, with over 65,000 local health service jobs added from 1998 to 2012. It appears likely that people come to this region from other areas to take advantage of the quality health care services provided here, meaning that in Greater Philadelphia, health care is probably an exporting cluster.

Because many of the industries and services that together make up the life sciences are considered as separate parts of other traded clusters, or are considered to be local industries and are therefore not considered at all in the current report, the full combined extent and impact of life sciences on the regional economy is not readily apparent. Future DVRPC research will explore the regional significance and impact of the broader categorization of health care and life sciences.

² See www.selectgreaterphiladelphia.com/industries/life-sciences-and-healthcare/.

³ Milken Institute, *The Greater Philadelphia Life Sciences Cluster 2009: An Economic and Comparative Assessment*, May 2009.

⁴ U.S. Cluster Mapping Project, at <http://clustermapping.us/>.

Identifying Key Regional Traded Industry Clusters

Key regional economic clusters can be identified by considering total employment, location quotients, and the number of basic jobs. While clusters that with many employees are obviously vital to the economy, location quotients (calculated by dividing the employment share of an industry in the local economy by the share of the same cluster in the national economy) identify which clusters are more concentrated in the regional economy than in the nation as a whole. If the location quotient is near or below 1.00, employment in the cluster is no more concentrated in the region than in the nation as a whole, and all of the cluster's employment is considered to be non-basic, with all of the goods or services being sold to consumers within the same region. If the location quotient is above 1.00, however, some of the cluster's jobs are instead basic jobs. Basic industries export goods and services and bring in wealth, while non-basic industries support basic activity, producing goods and services that are purchased primarily by consumers within the region.

Total Employment

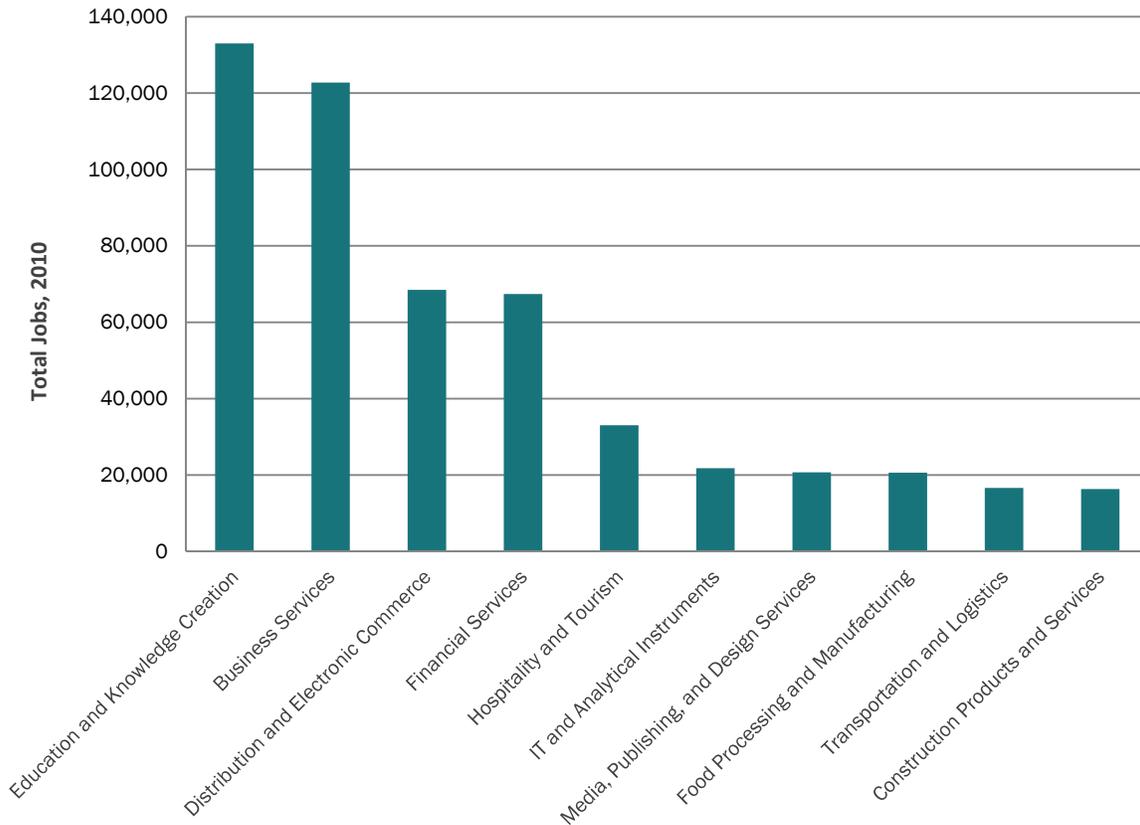
Table 1 identifies the region's top 20 economic clusters, and Figure 1 illustrates the region's top 10 clusters, based on the number of paid employees.

Table 1: Traded Industry Clusters Ranked by Employment, 2010

Rank	Cluster	Jobs, 2010	Percent in the Region's Employment	Percent in the Nation's Employment	Location Quotient
1	Education and Knowledge Creation	133,030	5.78%	2.53%	2.28
2	Business Services	122,771	5.34%	4.80%	1.11
3	Distribution and Electronic Commerce	68,491	2.98%	2.60%	1.15
4	Financial Services	67,409	2.93%	1.76%	1.66
5	Hospitality and Tourism	33,014	1.44%	2.37%	0.61
6	Information Technology and Analytical Instruments	21,788	0.95%	0.91%	1.04
7	Media, Publishing and Design Services	20,681	0.90%	0.67%	1.34
8	Food Processing and Manufacturing	20,628	0.90%	1.11%	0.81
9	Transportation and Logistics	16,624	0.72%	0.76%	0.95
10	Construction Products and Services	16,308	0.71%	0.85%	0.83
11	Plastics	11,727	0.51%	0.63%	0.81
12	Aerospace Vehicles and Defense	11,213	0.49%	0.47%	1.03
13	Production Technology and Heavy Machinery	10,743	0.47%	0.74%	0.63
14	Biopharmaceuticals	9,940	0.43%	0.21%	2.09
15	Paper and Packaging	7,573	0.33%	0.32%	1.03
16	Metalworking Technology	7,509	0.33%	0.40%	0.82
17	Automotive	6,778	0.29%	0.65%	0.45
18	Printing Services	6,337	0.28%	0.23%	1.18
19	Performing Arts	6,133	0.27%	0.27%	0.97
20	Downstream Chemical Products	5,770	0.25%	0.21%	1.19

Source: County Business Patterns, 2010.

Figure 1: Top Traded Industry Clusters by Total Jobs



Source: County Business Patterns, 2010.

The largest cluster in the region in terms of employment is the *education and knowledge creation* cluster, with over 133,000 employees. This cluster includes not only all educational and training institutions but also support services and R&D institutions in life sciences, engineering, biotechnology, and social sciences. With six teaching hospitals and three schools of pharmacy located here, a vital part of Greater Philadelphia’s *education and knowledge creation* cluster are its health education facilities. The ideas and services provided by the *education and knowledge creation* cluster create synergy effects which extend beyond the regional boundaries to attract money and talent into our region. Based on total employment, other top clusters include *business services*, *distribution and electronic commerce*, *financial services*, and *hospitality and tourism*.

Location Quotients

Location quotient analysis assumes that the relative concentration of an industry indicates whether or not it is a basic industry. This is important because basic industries create competitive advantages and help sustain non-basic industries, which produce goods and services that are consumed locally. Since location quotients greater than 1.00 indicate the industry is over-concentrated in the region, the analysis goes beyond the simple question of “what does our region do?” to help answer the equally important question of “how does the mix of industries here compare to other regions?”

A caveat for location quotient analysis is that the method assumes that regional productivity is the same as national productivity. There are two interpretations of a cluster with a location quotient greater than 1.00. First, it could be that the cluster is export oriented and brings money into the region. If the cluster's productivity is lower than the national average, however, it would require more workers to produce the same amount of goods and services, in which case the location quotient greater than 1.00 indicates a weak cluster. It is therefore generally assumed that a location quotient above 1.25 clearly indicates an export-oriented industry.

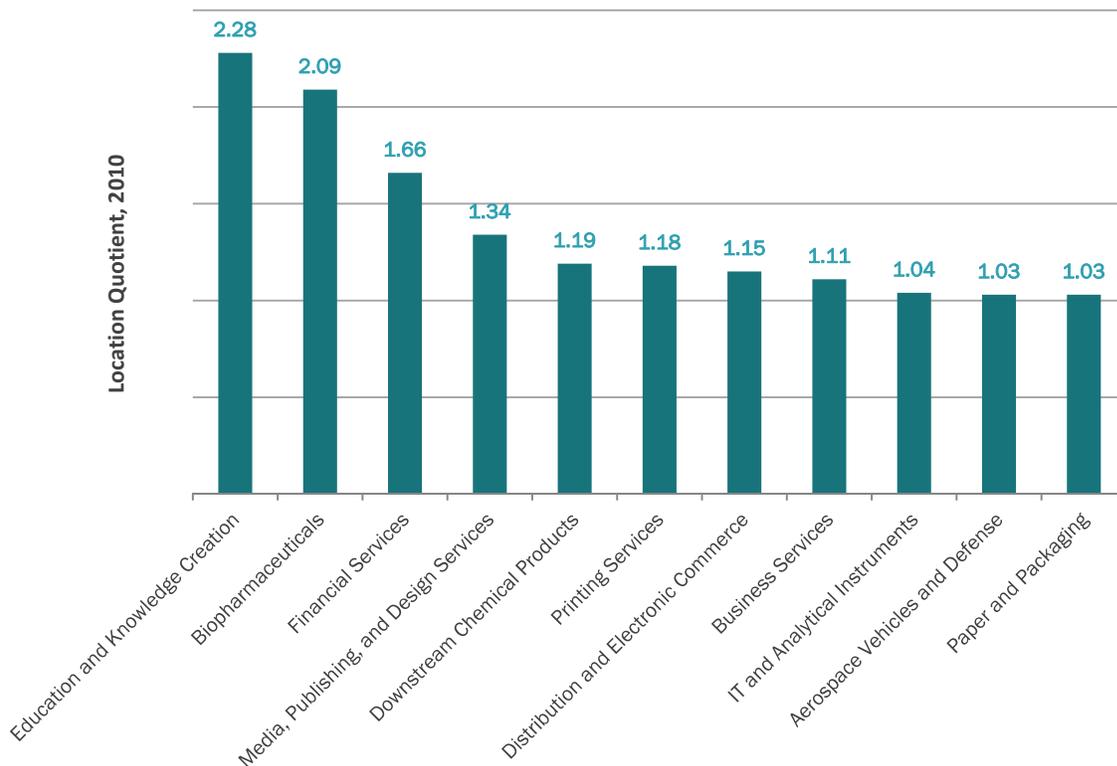
Table 2 identifies the region's top 20 economic clusters and Figure 2 illustrates the region's top 10 clusters based on their location quotients. This list illustrates how concentrated these clusters are in the region relative to the national economy, with *education and knowledge creation* again topping the list. The location quotient of 2.28 indicates that this cluster is more than twice as concentrated as would be expected given national averages and is therefore a basic cluster, exporting knowledge and innovation through students who come to the region from throughout the United States and the world to study.

Table 2: Traded Industry Clusters Ranked by Location Quotient, 2010

Rank	Cluster	Jobs, 2010	Percent of Regional Employment	Percent of National Employment	Location Quotient
1	Education and Knowledge Creation	133,030	5.78%	2.53%	2.28
2	Biopharmaceuticals	9,940	0.43%	0.21%	2.09
3	Financial Services	67,409	2.93%	1.76%	1.66
4	Media, Publishing and Design Services	20,681	0.90%	0.67%	1.34
5	Downstream Chemical Products	5,770	0.25%	0.21%	1.19
6	Printing Services	6,337	0.28%	0.23%	1.18
7	Distribution and Electronic Commerce	68,491	2.98%	2.60%	1.15
8	Business Services	122,771	5.34%	4.80%	1.11
9	Information Technology and Analytical Instruments	21,788	0.95%	0.91%	1.04
10	Aerospace Vehicles and Defense	11,213	0.49%	0.47%	1.03
11	Paper and Packaging	7,573	0.33%	0.32%	1.03
12	Performing Arts	6,133	0.27%	0.27%	0.97
13	Transportation and Logistics	16,624	0.72%	0.76%	0.95
14	Recreational and Small Electric Goods	3,187	0.14%	0.16%	0.89
15	Medical Devices	4,690	0.20%	0.23%	0.89
16	Construction Products and Services	16,308	0.71%	0.85%	0.83
17	Metalworking Technology	7,509	0.33%	0.40%	0.82
18	Apparel	1,777	0.08%	0.09%	0.82
19	Plastics	11,727	0.51%	0.63%	0.81
20	Food Processing and Manufacturing	20,628	0.90%	1.11%	0.81

Note: This analysis does not include either the *tobacco* or the *music and sound recording* clusters, each of which had less than 1,000 jobs and made up less than 0.03 percent of the region's total jobs in 2010. **Source:** County Business Patterns, 2010.

Figure 2: Top Traded Industry Clusters by Location Quotient



Source: County Business Patterns, 2010.

Although there are 11 clusters with location quotients above 1.00, it is safe to assume that only those clusters with location quotients above 1.25 are exporting clusters, due to the unclear veracity of the baseline assumption that regional productivity is the same as the national average. Using 1.25 as the benchmark, there are four clusters that are clearly export-oriented: *education and knowledge creation*; *biopharmaceuticals*; *financial services*; and *media, publishing, and design services*. At the top of the list are two “eds and meds” clusters, namely, the *education and knowledge creation* and the *biopharmaceuticals* clusters, with location quotients of 2.28 and 2.09, respectively.

The *biopharmaceuticals* cluster contains establishments that produce complex chemical and biological substances used in medical applications. The *education and knowledge creation* cluster in particular shares a unique relationship with the other private-sector industries in that its outputs are driven by the private sector. Outputs of this cluster include educated students and ideas and marketable knowledge, such as patents. The demand from the private sector for educated students and Ph.D.s or for patents and licenses from research can drive the outputs and play an important role in the health of the regional economy. The private sector can also support the *education and knowledge creation* cluster when it collaborates with universities on research.⁵ Developing strong ties between the *education and knowledge creation* cluster and the region’s private sector therefore helps create interrelated clusters that can strengthen the regional economy.

⁵ [www.isc.hbs.edu/pdf/Student_Projects/USA_\(MA\)_Higher_Education_and_Knowledge_2010.pdf](http://www.isc.hbs.edu/pdf/Student_Projects/USA_(MA)_Higher_Education_and_Knowledge_2010.pdf).

Along with *biopharmaceuticals*, other strong manufacturing-based clusters include *downstream chemical products, information technology and analytical instruments, aerospace vehicles and defense, and paper and packaging*. Historically, the Greater Philadelphia region has relied on manufacturing as its economic engine. Textiles and automobile parts factories once supplied the majority of the region's job opportunities. Over the years, the role of manufacturing in the region has shifted from job creation to job support.

The relationship between manufacturing and service industries has also reversed. While service industries used to support manufacturing industries, the region's manufacturing industries now produce products and components that support service industries. The *paper and packaging* cluster manufactures paper products used for shipping, packaging, and office supplies while the *information technology and analytical instruments* cluster produces information technology products such as computers and software, most of which are then consumed by service industries. The region's strong service clusters include *financial services; media, publishing, and design services; distribution and electronic commerce; and business services*.

The *hospitality and tourism* cluster is the only one of the top five traded industry clusters in terms of employees that has a location quotient below 1.00, meaning that the cluster constitutes a smaller percentage of the region's employment than it does nationally. With the fifth highest number of paid employees, *hospitality and tourism* is obviously important to the region's economy. The cluster is not, however, highly concentrated here compared to the nation as a whole.

Intuitively, it would seem that the Greater Philadelphia region's tourism industry is significant compared to other areas of the country, and the concentrations of employees in certain subcategories support this. Subcategories with high location quotients include nature parks and similar institutions, sports teams and clubs, zoos and botanical gardens, museums, convention and visitors' bureaus, and inter-urban and rural bus tours. Subcategories that have low location quotients, however, include gambling facilities, skiing facilities, marinas, recreational vehicle parks and campgrounds, amusement and theme parks, and hotels.

Basic Jobs

Although Table 2 and Figure 2 identify the region's strongest clusters, they still do not reveal which clusters are vital to the regional economy. For example, a small cluster with a high location quotient may be an export-oriented cluster but, with relatively few jobs, is not vital to the region's economy. Likewise, a large cluster with a declining location quotient might have significant negative consequences for the regional economy. An additional analysis combining cluster size and location quotients yields a more relevant picture of the regional economy.

Basic jobs are calculated by multiplying the number of jobs in the cluster by the portion of the location quotient that is above 1.00. This method captures a rather broad set of basic jobs because it uses the threshold of 1.00 instead of 1.25. However, the comparative nature of the analysis is not hindered by the broad assumption that the proportion of the location quotient above 1.00 represents basic jobs. According to Harvard Business School's 2008 cluster study, the regional wages relative to

the national average wage are higher if the region is more specialized in a particular cluster.⁶ Basic industries export from the region and bring in wealth from outside the region. Basic jobs generally represent higher wage potentials and serve as a good proxy for the cluster's relevance to the regional economy.

Table 3 and Figure 3 identify the region's basic clusters ranked by their corresponding number of basic jobs. Appendix B lists the specific NAICS codes included in each cluster identified in this report as having basic jobs. The *energy generation/distribution* and *medical devices* clusters are included in this analysis because they had basic jobs in 2000, but not in 2010. This list identifies those clusters that are vital to the region's economy.

As illustrated in Figure 4, the region's top six clusters represent 98 percent of the total basic jobs in the region, and together reveal a particular regional strength. Anchored by *education and knowledge creation*, these clusters are related to one another through the services and products they provide. *Financial services* and *business services* provide financial and capital infrastructure to *biopharmaceuticals* and other manufacturers and enterprises. The symbiotic relationship between research and biopharmaceuticals facilitates and enhances the synergy effect between the *education and knowledge creation* and *biopharmaceuticals* clusters.

Harvard's 2008 cluster study found that the most prosperous regions tend to specialize in a group of related clusters with benefits of higher efficiency and a reduced exposure to the industry-specific shocks.⁷ The reinforcing strengths of these related clusters in the region create a competitive advantage. However, the region's portfolio of basic clusters should be strengthened and diversified in order to bolster the existing group of related clusters. For example, the *medical devices* and *downstream chemical products* clusters should be encouraged to expand, in order to strengthen and take advantage of the already strong position in the existing "eds and meds" clusters.

It is clear that *education and knowledge creation* is an important and essential cluster to the region, no matter how one examines the regional economy, having consistently shown up at the top of each list. Not only does this cluster have the highest number of basic jobs in the region, but it is also one of the few clusters that have gained basic jobs for the 10-year period from 2000 to 2010. In fact, the *education and knowledge creation* cluster has gained more basic jobs (21,330) during this period than the rest of the gains in basic jobs combined (3,232).

Of the 13 basic clusters shown in Table 3, eight lost basic jobs over the 10-year period, and two of these eight (*energy generation and distribution* and *medical devices*) became non-basic clusters (with location quotients less than 1.00). The five clusters that gained basic jobs between 2000 and 2010 include *education and knowledge creation*; *distribution and electronic commerce*; *biopharmaceuticals*; *downstream chemical products*; and *information technology and analytical instruments*.

⁶ U.S. Cluster Mapping Project website, www.clustermapping.us, August 2013.

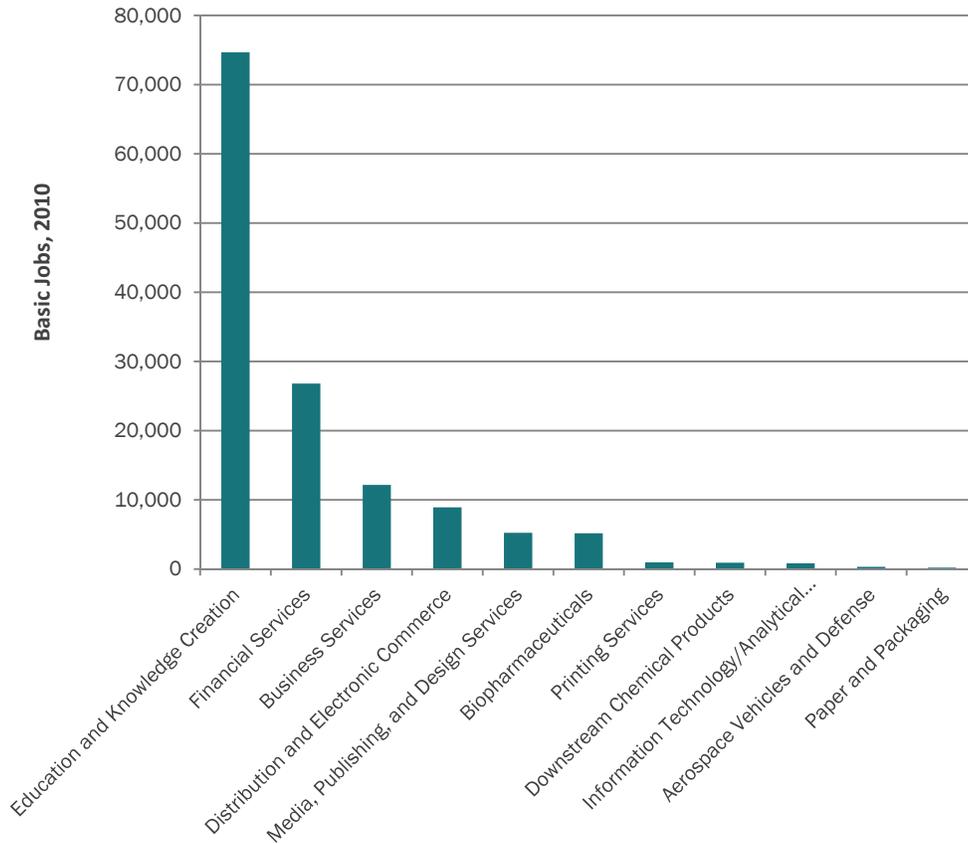
⁷ Ibid.

Table 3: Traded Industry Clusters Ranked by Basic Jobs, 2010

Rank	Cluster	2010			2000			Absolute Change 2000-2010		Percent Change 2000-2010	
		Jobs	Location Quotient	Basic Jobs	Jobs	Location Quotient	Basic Jobs	Jobs	Basic Jobs	Jobs	Basic Jobs
1	Education and Knowledge Creation	133,030	2.28	74,684	94,813	2.29	53,410	38,217	21,330	40%	40%
2	Financial Services	67,409	1.66	26,801	76,688	1.74	32,614	-9,279	-5,762	-12%	-18%
3	Business Services	122,771	1.11	12,166	128,189	1.33	31,806	-5,418	-19,234	-4%	-62%
4	Distribution and Electronic Commerce	68,491	1.15	8,934	56,086	1.15	7,316	12,405	1,332	22%	22%
5	Media, Publishing and Design Services	20,681	1.34	5,247	29,223	1.69	11,931	-8,542	-6,692	-29%	-56%
6	Biopharmaceuticals	9,940	2.09	5,184	9,794	2.07	5,063	146	122	1%	2%
7	Printing Services	6,337	1.18	967	11,957	1.50	3,986	-5,620	-2,980	-47%	-76%
8	Downstream Chemical Products	5,770	1.19	921	6,540	0.95	0	-770	918	-12%	--
9	Information Technology/Analytical Instruments	21,788	1.04	838	26,447	0.83	0	-4,659	860	-18%	--
10	Aerospace Vehicles and Defense	11,213	1.03	327	13,276	1.03	387	-2,063	-23	-16%	-16%
11	Paper and Packaging	7,573	1.03	221	11,519	1.02	226	-3,946	-14	-34%	-2%
12	Energy Generation and Distribution	3,032	0.78	0	7,215	1.72	3,020	-4,183	-3,015	-58%	-100%
13	Medical Devices	4,690	0.89	0	5,439	1.00	18	-749	-18	-14%	-100%

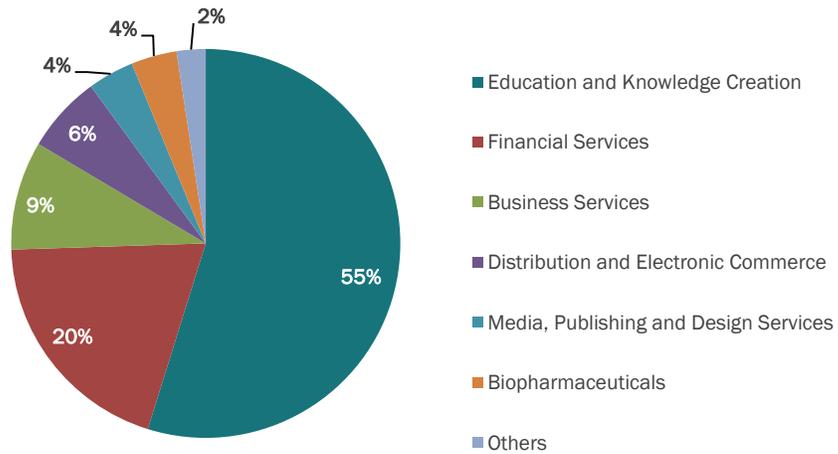
Note: This analysis does not include either the tobacco or the music and sound recording clusters, each of which had less than 1,000 jobs and made up less than 0.03 percent of the region's total jobs in 2010. **Source:** County Business Patterns, 2010.

Figure 3: Top Traded Industry Clusters by Basic Jobs



Source: County Business Patterns, 2010.

Figure 4: Basic Jobs in Greater Philadelphia



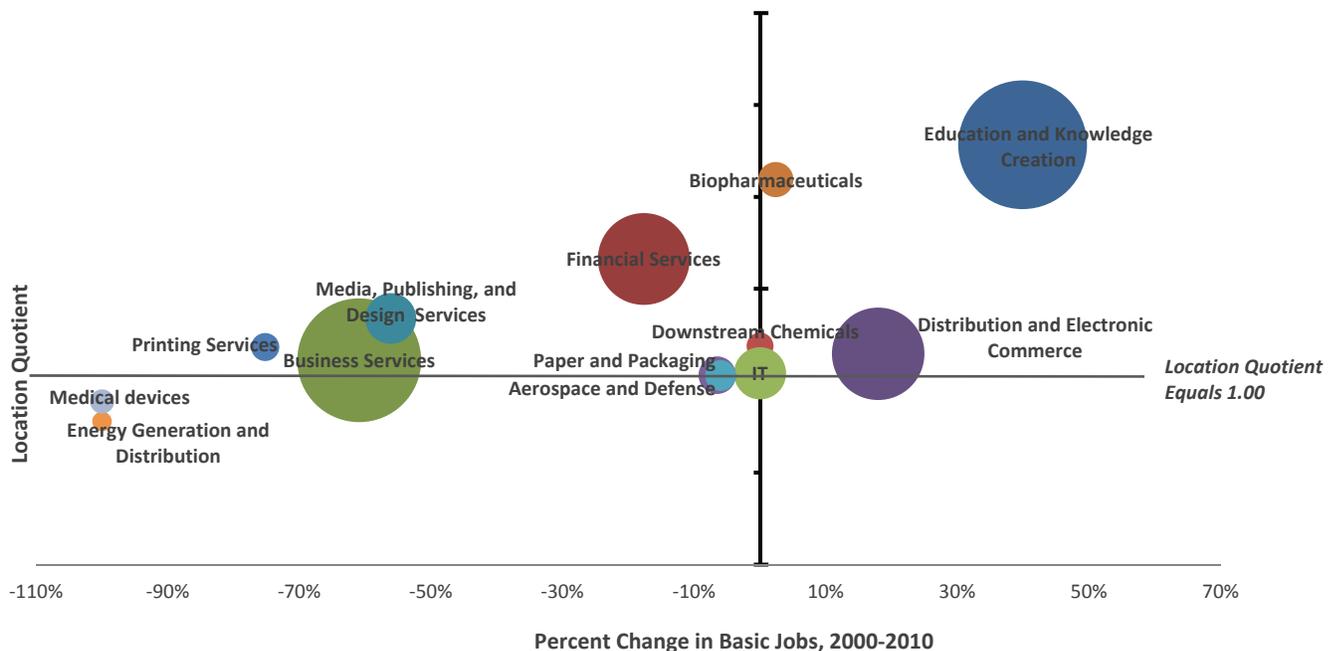
Source: County Business Patterns, 2010.

Tying It All Together: Cluster Size, Location Quotient, and Employment Change

Figure 5 illustrates how each of the 13 basic clusters in Table 3 has fared over the last decade in terms of basic job growth. The size of the bubble indicates the number of jobs for each cluster and the vertical axis equals the location quotient, with the floating gray horizontal line indicating the point at which the location quotient equals 1.00. The horizontal axis illustrates the change in basic jobs between 2000 and 2010, with the bubbles to the right of the vertical axis representing clusters that have gained basic jobs over this period, and the bubbles to the left indicating those clusters that have lost basic jobs. The farther away from the vertical axis, the greater is the magnitude of change.

This diagram clearly illustrates that most of the region's basic clusters lost basic jobs between 2000 and 2010, with only five basic clusters (*education and knowledge creation, distribution and commerce, biopharmaceuticals, downstream chemicals, and information technology and analytical instruments*) having gained jobs. Overall, the region lost approximately 13,000 basic jobs over the course of the decade, despite the fact that the region's basic clusters experienced an overall gain of over 5,700 jobs.

Figure 5: Top Basic Clusters by Location Quotient and Change in Basic Jobs, 2000–2010



Note: The size of each bubble correlates to total number of jobs in the cluster.

Source: Delaware Valley Regional Planning Commission, April 2014.

Two of the region's larger clusters, *education and knowledge creation* and *distribution and electronic commerce*, both gained basic jobs between 2000 and 2010. The troubling signs come from some of the region's other top basic clusters. The *financial services* and *business services* clusters have the second and third highest numbers of basic jobs, respectively, and play vital roles in the regional

economy. Job losses in these two clusters, however, easily erased the notable gains in the *education and knowledge creation* cluster, with a combined loss of almost 25,000 basic jobs during the 10-year period. Again, a large-size cluster with a declining location quotient (which equates to declining basic jobs) endangers the health of the regional economy. The vital roles these two clusters play in the region make the need to address the declining number of basic jobs all the more urgent.

Both the *medical devices* and *energy generation and distribution* clusters have been included in Figure 5 because they each had a location quotient at or above 1.00 in 2000 (and therefore had basic jobs) but not in 2010. Given the already strong “eds and meds” clusters and the expected impact of Pennsylvania’s Marcellus Shale natural gas generation, both of these clusters have the potential for growth in the future.

Relative Strength of Regional Clusters

Finally, analyzing the change in location quotients and job change for the 10-year period from 2000 to 2010 enables a further classification of clusters. Table 4 provides data on the change in the number of jobs and location quotients for clusters of traded industries in Greater Philadelphia. Table 5 summarizes this data by categorizing the region’s clusters into four quadrants, indicating whether a cluster strong or weak compared to the national economy and whether it is gaining or declining in relative importance. In this table, clusters with 2010 location quotients greater than 1.00 are characterized as strong clusters, and the changes in location quotients from 2000 to 2010 indicate whether the clusters are gaining or declining.

It is important to note that the growth or decline shown here does not reflect the size of a cluster, but rather the relative concentration of a cluster. For example, a cluster may have shrunk in terms of the number of employees, yet its location quotient could have increased if its decline was slower than the industry average, leading to its characterization as a growing cluster. Conversely, a cluster may have gained jobs between 2000 and 2010, but at a lower rate than the national average, making it a declining cluster.

This is true, for example of the *education and knowledge creation* cluster, the largest strong but stable or declining cluster, which gained jobs between 2000 and 2010 but saw its location quotient decline slightly, from 2.29 to 2.28. This indicates that although the cluster realized significant growth regionally, it also grew elsewhere in the country, at a faster rate than in Greater Philadelphia. Conversely, the *information technology and analytical instruments*, *aerospace vehicles and defense*, *paper and packaging*, and *downstream chemicals* clusters all lost employment between 2000 and 2010 but saw their location quotients increase, as their job losses were less than the national averages.

Of the 11 basic clusters identified in Table 3, five are strong and growing while six are strong yet not gaining relative to the rest of the nation. The strong and growing clusters represent a potential for economic growth and development in the region. One way to capitalize on the current strengths is to focus policies and economic development around these five clusters: *information technology and analytical instruments*, *aerospace vehicles and defense*, *biopharmaceuticals*, *paper and packaging*, and *downstream chemical products*.

Table 4: Cluster Characterizations Based on Changing Jobs and Location Quotients

Cluster	Jobs, 2000	Jobs, 2010	Change In Jobs, 2000-2010	Location Quotient 2000	Location Quotient 2010	Change in Location Quotient, 2000-2010
Strong and Growing Clusters						
Information Technology and Analytical Instruments	26,447	21,788	-18%	0.83	1.04	25.20%
Aerospace Vehicles and Defense	13,276	11,213	-16%	1.03	1.03	0.30%
Biopharmaceuticals	9,794	9,940	2%	2.07	2.09	1.00%
Paper and Packaging	11,519	7,573	-34%	1.02	1.03	0.90%
Downstream Chemical Products	6,540	5,770	-12%	0.95	1.19	24.80%
Strong but Stable or Declining Clusters						
Education and Knowledge Creation	94,813	133,030	40%	2.29	2.28	-0.40%
Business Services	128,189	122,771	-4%	1.33	1.11	-16.20%
Distribution and Electronic Commerce	56,086	68,491	22%	1.15	1.15	-0.50%
Financial Services	76,688	67,409	-12%	1.74	1.66	-4.50%
Media, Publishing and Design Services	29,223	20,681	-29%	1.69	1.34	-20.80%
Printing Services	11,957	6,337	-47%	1.50	1.18	-20.90%
Weak but Growing Clusters						
Transportation and Logistics	13,864	16,624	20%	0.70	0.95	34.90%
Plastics	16,465	11,727	-29%	0.76	0.81	6.10%
Metalworking Technology	10,909	7,509	-31%	0.79	0.82	4.30%
Automotive	11,338	6,778	-40%	0.40	0.45	13.20%
Performing Arts	4,472	6,133	37%	0.86	0.97	13.90%
Furniture	7,246	5,273	-27%	0.51	0.72	40.30%
Downstream Metal Products	5,900	4,688	-21%	0.52	0.58	10.20%
Recreational and Small Electric Goods	5,249	3,187	-39%	0.83	0.89	7.40%
Wood Products	2,500	2,231	-11%	0.24	0.35	45.50%
Vulcanized and Fired Materials	2,984	2,023	-32%	0.40	0.49	24.50%
Household Textiles and Leather Products	3,230	1,801	-44%	0.49	0.74	51.20%
Textile Manufacturing	2,702	1,177	-56%	0.34	0.40	17.10%
Agricultural Services	349	527	51%	0.29	0.40	35.50%
Jewelry and Precious Metals	445	373	-16%	0.37	0.70	88.60%
Footwear	110	110	0%	0.12	0.35	190.80%
Weak and Stable or Declining Clusters						
Hospitality and Tourism	38,657	33,014	-14.60%	0.68	0.61	-10.80%
Food Processing and Manufacturing	22,119	20,628	-6.70%	0.85	0.81	-4.80%
Construction Products and Services	17,177	16,308	-5.10%	0.83	0.83	-0.40%
Production Technology and Heavy Machinery	16,722	10,743	-35.80%	0.69	0.63	-8.50%
Communications Equipment and Services	11,814	5,713	-51.60%	1.00	0.61	-38.80%
Medical Devices	5,439	4,690	-13.80%	1.00	0.89	-11.60%
Lighting and Electrical Equipment	7,026	3,730	-46.90%	0.81	0.75	-7.80%
Oil and Gas Production	3,545	3,565	0.60%	0.48	0.35	-27.90%
Upstream Metal Manufacturing	9,767	3,479	-64.40%	0.83	0.49	-40.70%
Video Production and Distribution	3,168	3,141	-0.90%	0.95	0.88	-8.00%
Energy Generation and Distribution	7,215	3,032	-58.00%	1.72	0.78	-54.60%
Upstream Chemical Products	2,808	1,866	-33.50%	0.65	0.56	-12.80%
Apparel	8,659	1,777	-79.50%	0.97	0.82	-16.00%
Trailers, Mobile Homes	490	200	-59.18%	0.12	0.10	-16.67%
Fishing and Fishing Products	180	110	-38.89%	0.17	0.14	-17.65%

Note: This analysis does not include either the *tobacco* or the *music and sound recording* clusters, each of which had less than 1,000 jobs and made up less than 0.03 percent of the region's total jobs in 2010. **Source:** County Business Patterns, 2010.

Table 5: Relative Strength of Greater Philadelphia's Economic Clusters

Weak but Growing	Strong and Growing
Transportation and Logistics Plastics Metalworking Technology Automotive Performing Arts Furniture Downstream Metal Products Recreational and Small Electronic Goods Wood Products Vulcanized and Fired Materials Household Textiles and Leather Products Textile Manufacturing Agricultural Services Jewelry and Precious Metals Footwear	Information Technology and Analytical Instruments Aerospace Vehicles and Defense Biopharmaceuticals Paper and Packaging Downstream Chemical Products
Weak and Stable or Declining	Strong but Stable or Declining
Hospitality and Tourism Food Processing and Manufacturing Construction Products and Services Production Technology and Heavy Machinery Communications Equipment and Services Medical Devices Lighting and Electrical Equipment Oil and Gas Production Upstream Metal Manufacturing Video Production and Distribution Energy Generation and Distribution Upstream Chemical Products Apparel Trailers, Mobile Homes, and Appliances Fishing and Fishing Products	Education and Knowledge Creation Business Services Distribution and Electronic Commerce Financial Services Media, Publishing, and Design Services Printing Services

Note: For the purposes of this table, clusters with 2010 location quotients greater than 1.00 are characterized as strong clusters, and the changes in location quotients from 2000 to 2010 indicate whether the clusters are growing or declining. This analysis does not include either the *tobacco* or the *music and sound recording* clusters, each of which had less than 1,000 jobs and made up less than 0.03 percent of the region's total jobs in 2010.

Source: Delaware Valley Regional Planning Commission, April 2014.

The six basic clusters whose relative importance has either remained stable (but not grown) or declined include *education and knowledge creation*; *business services*; *distribution and electronic commerce*; *financial services*; *media, publishing, and design services*; and *printing services*. Table 3 indicated that two of these declining basic clusters (the *education and knowledge creation* and *distribution and electronic commerce* clusters) gained basic jobs between 2000 and 2010. Table 4 indicates, however, that their regional gains fell short of the rate of growth at the industry-wide level, and that these clusters had the potential to realize an even greater magnitude of growth.

Shift-Share Analysis

Location quotient analysis has provided a snapshot picture of the regional economy, indicating the presence of vital clusters in the region and tracking how each of these basic clusters has performed over the years. However, the analysis does not show how much of each basic cluster's growth or decline is due specifically to regional factors. Shift-share analysis is one method of answering this question. Shift-share analysis attempts to determine how much of the regional job growth or decline is attributable to unique regional factors by splitting regional job change into three components:

- The **national growth share**, equal to the macroeconomic change that affects all industries across the board. The national growth share for all clusters is -1.8 percent, equaling the overall percent change in jobs nationally across all industries between 2000 and 2010.
- The **nationwide industrial mix share**, equal to the share of the cluster's growth attributable to the growth or decline of each cluster's component industries nationwide.
- The **regional growth share** (or regional competitiveness effect), which represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors.

Table 6 ranks the region's 11 basic clusters by the number of basic jobs and provides their corresponding shift-share components. Two additional clusters (*energy generation and distribution* and *medical devices*) are also included, because they had basic jobs in 2000 but not in 2010.

Three clusters gained jobs between 2000 and 2010: *education and knowledge creation*, *distribution and electronic commerce*, and *biopharmaceuticals*. The shift-share analysis indicates that the job gains in these three clusters are primarily due to growth of the cluster at the national or industry-wide level. The *education and knowledge creation* and the *distribution and electronic commerce* clusters have expanded substantially at the national level, with 44 percent and 26 percent gains, respectively, while the *biopharmaceuticals* cluster's three percent gain at the national level was enough to offset the macroeconomic loss of almost two percent. None of the job growth in these clusters in the region is directly due to unique regional factors. Rather, much of the growth is in line with the industry's overall growth at the national level.

On the other hand, some of the declines in the region have been partially mitigated by regional competitiveness. *Downstream chemical products* and *information technology and analytical instruments* both experienced national declines of approximately 30 percent. Their declines have been reduced by approximately 17 and 16 percent, respectively, however, due to regional competitiveness. These two clusters may therefore have the potential for future growth.

The rest of the region's basic clusters have unfortunately seen accelerated declines greater than the national decline due to a lack of regional competitiveness. The troubling signs for the *financial services* and *business services* clusters that were revealed through the location quotient analysis are exacerbated by the fact that the decline in jobs in these clusters is primarily due to the lack of regional competitiveness. For *business services*, in particular, the regional decline of over four percent occurred despite the 17 percent growth in the cluster nationally.

Table 6: Job Change Attributable to National, Industrial, or Regional Factors

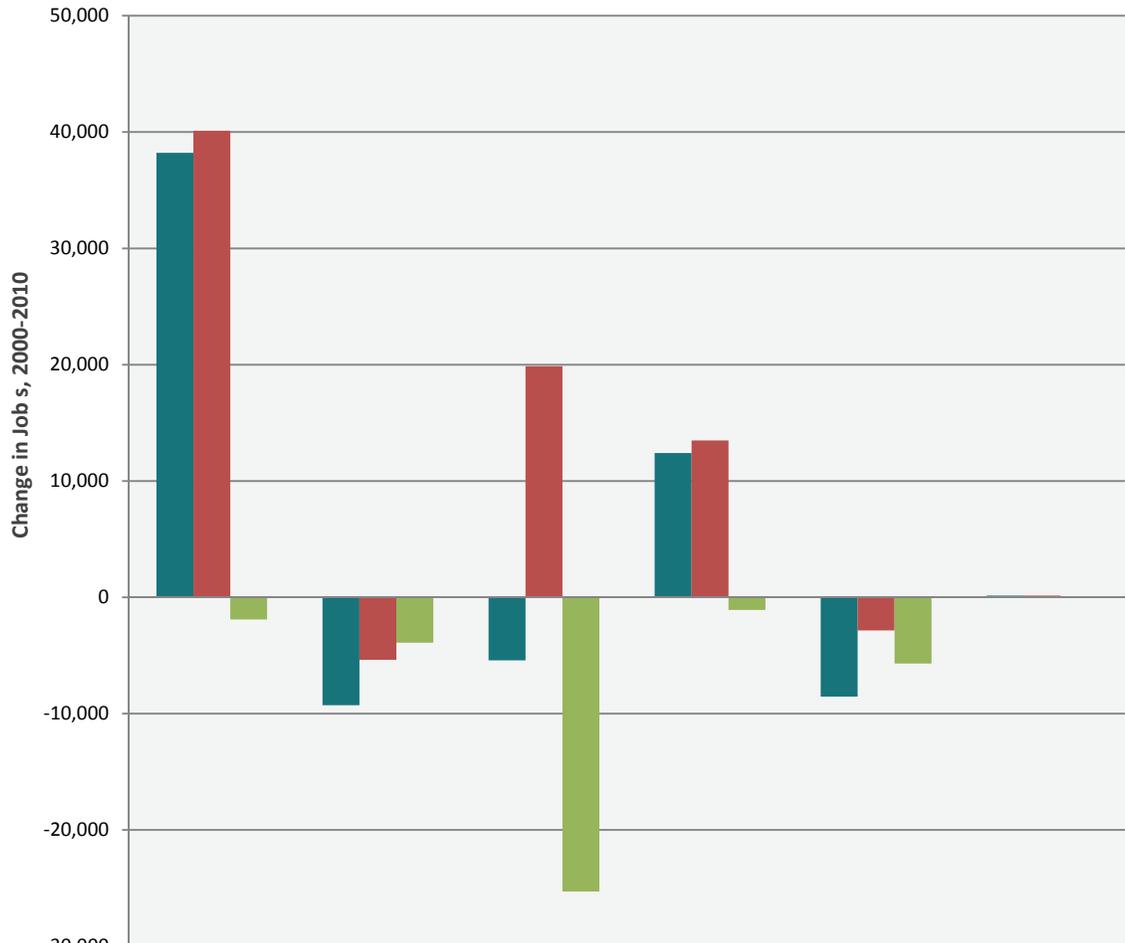
Cluster	Basic Jobs, 2010	Total Jobs		Percent Change in Total Jobs, 2000-2010		National Growth Share	Nationwide Industrial Mix Share	Regional Growth Share
		2000	2010	Greater Philadelphia	United States			
Education and Knowledge Creation	74,781	94,813	133,030	40.3%	42.3%	-1.8%	44.1%	-2.0%
Financial Services	26,862	76,668	67,409	-12.1%	-7.0%	-1.8%	-5.2%	-5.1%
Business Services	12,345	128,189	122,771	-4.2%	15.5%	-1.8%	17.3%	-19.7%
Distribution and Electronic Commerce	8,752	56,086	68,491	22.1%	24.0%	-1.8%	25.8%	-1.9%
Media, Publishing, and Design Services	5,232	29,223	20,681	-29.2%	-9.8%	-1.8%	-8.0%	-19.4%
Biopharmaceuticals	5,194	9,794	9,940	1.5%	1.6%	-1.8%	3.5%	-0.1%
Printing Services	983	11,957	6,337	-47.0%	32.3%	-1.8%	-30.5%	-14.7%
Downstream Chemical Products	918	6,540	5,770	-11.8%	28.6%	-1.8%	-26.8%	16.8%
Information Technology and Analytical Instruments	860	26,447	21,788	-17.6%	33.5%	-1.8%	-31.7%	15.9%
Aerospace Vehicles and Defense	332	13,276	11,213	-15.5%	14.9%	-1.8%	-13.1%	-0.6%
Paper and Packaging	212	11,519	7,573	-34.3%	34.1%	-1.8%	-32.3%	-0.2%
Energy Generation and Distribution	0	7,215	3,032	-58.0%	-6.4%	-1.8%	-4.6%	-51.6%
Medical Devices	0	5,439	4,690	-13.8%	-1.5%	-1.8%	0.3%	-12.3%

Note: The national growth share is the overall change in the number of jobs nationally across all industries between 2000 and 2010 (-1.8 percent). The nationwide industrial mix share represents the change in jobs in the component industries in each cluster at the national level. The regional growth share represents growth or decline in the cluster that cannot be explained by national trends and is instead attributable to unique regional factors. **Source:** County Business Patterns, 2000 and 2010.

Table 6 indicates that none of the region’s top six basic clusters, which together comprise about 98 percent of the total basic jobs in the region, gained jobs due to regional competitiveness. Figure 6 illustrates actual job change, expected change, and competitive effect for each of these top six clusters. Actual job change is the number of jobs gained or lost during the 10-year period from 2000 to 2010. Expected job change is the number of jobs that would have been gained or lost if the national rate of growth or decline was applied to the region’s base job figures from 2000, in the absence of any regional factors. The competitive effect illustrates the change that occurred due to unique regional factors. This is the most interesting of the three for the region, as it indicates how the region is performing in these clusters.

Figure 6 indicates that none of the top six clusters shows a positive regional competitive effect. In other words, whatever gains the region might have realized given national trends have been reduced, and whatever losses the region might have experienced have been accelerated, because of regional factors.

Figure 6: Job Change in Greater Philadelphia's Top Six Basic Clusters, 2000-2010



	Education and Knowledge Creation	Financial Services	Business Services	Distribution and Electronic Commerce	Media, Publishing, and Design Services	Biopharmaceuticals
Actual Job Change	38,217	-9,279	-5,418	12,405	-8,542	146
Expected Job Change	40,117	-5,378	19,876	13,487	-2,850	153
Competitive Effect	-1,900	-3,901	-25,294	-1,082	-5,692	-7

Note: Expected job change is the number of jobs that would have been gained or lost if the national and industrial mix rates of growth or decline were applied to the region's base job figures from 2000, in the absence of any regional factors. The competitive effect illustrates the difference between the actual and the expected change, and represents the change that occurred due to regional competitiveness. **Source:** Delaware Valley Regional Planning Commission, April 2014.

Basic Clusters in Greater Philadelphia

Based on the analysis so far, it is evident that the region has a few large clusters vital to the regional economy. However, regional competitiveness can be greatly enhanced by fostering stronger ties within clusters, especially those clusters that are related. The next step in understanding and improving the regional clusters is to dissect each of these vital clusters and determine where strong ties already exist and how such ties could be formed where they don't exist. In order to compete with the surrounding regions, it is imperative that the region focus on developing strong ties among clusters and building a diverse portfolio of strong clusters.

This section provides information on the jobs, by subcategory, in each of the 13 basic clusters identified in Table 6, accompanied by a map illustrating the location and relative scale of employers in each of the individual clusters. Summaries are provided in the order of the number of basic jobs in the cluster in 2010, provided in Table 6 (on page 18).

Data for these tables and maps is from the NETS database. As noted earlier in the report, the NETS database is a revised version of the Dun and Bradstreet database which uses each company's unique DUNS number to create a time series for each business. Unlike government sources of employment data, the NETS database includes sole proprietors, part-time jobs, and farm operations, and has been found to be more accurate in reporting data for small, privately owned firms and public sector employers such as post offices and public schools.

While CBP data is used to compare the region's economy to that of the nation, the NETS database provides location-specific information for individual employers throughout the region, by sector. The NETS database used by DVRPC includes the street address and the most current latitude-longitude for each establishment, and the origin and destination latitude-longitudes for all significant moves, at the four-decimal-place level. The database provides information on the number of employees working at each specific location and treats each separate location as an individual employment site, rather than providing the aggregated total of employees for those companies that operate in several locations throughout the region.

Table 7: Education and Knowledge Creation

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	2000 Location Quotient	2010 Location Quotient
Education and Knowledge Creation	94,813	133,030	40%	-2%	44%	-2%	2.29	2.28
Training Programs	5,392	6,918	28%	-2%	70%	-40%	1.46	1.12
Colleges, Universities, Professional Schools	75,921	103,776	37%	-2%	32%	7%	2.51	2.67
Research Organizations	13,500	22,336	65%	-2%	82%	-15%	1.81	1.68

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster’s growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

Figure 7 illustrates the locations of employers in the *education and knowledge creation* cluster, by size and type. The cluster includes employees of all education and training institutions as well as R&D institutions focused on biotechnology, physical sciences, engineering, life sciences, and social sciences. Also included are employees working in health care education at the region’s six teaching hospitals and three pharmacy schools.

Education and knowledge creation employers include colleges, universities, and professional schools, which tend to locate in centers and along major transportation routes. The region’s largest employers in the cluster include the University of Pennsylvania (the region’s largest traded industry employer), Drexel, Temple, and Villanova universities, all located in Philadelphia; Princeton University and Educational Testing Services (ETS), both in Princeton, Mercer County; Rowan University, in Glassboro Borough, Gloucester County; and NAVSEA, the naval research facility located at the Navy Yard in Philadelphia.

In 2010, the cluster had the highest location quotient (2.28) in the region and employed the greatest share of workers. There are approximately 74,800 basic jobs in the cluster, again the highest of any of the region’s clusters. From 2000 to 2010, the *education and knowledge creation* cluster gained 38,000 jobs. The location quotient of this cluster, however, declined slightly, from 2.29 to 2.28, meaning that although the cluster gained jobs in Greater Philadelphia, employment grew at a slower rate here than elsewhere in the country. Much of the growth in the cluster during the decade was due to cluster-specific factors. In fact, local factors reduced the growth potential by two percent.

The *education and knowledge creation* cluster consists of three subcategories: (1) *training programs*; (2) *colleges, universities, and professional schools*; and (3) *research organizations*. While all three gained employees from 2000 to 2010, only *colleges, universities, and professional schools* realized an increase in its location quotient, from 2.51 to 2.67. The cluster’s other two subcategories showed a substantial decline in location quotient, indicating that their employment growth was not as significant as it was in other regions.

Shift-share analysis also shows that these two subcategories, *training programs* and *research organizations*, lost their growth potential due primarily to local factors. Although training programs experienced 70 percent growth at the industry level, they grew by only 28 percent regionally.

Similarly, *research organizations* saw a substantial growth of 82 percent at the industry level, while growing by only 65 percent regionally. An Economy League of Greater Philadelphia report on the region's colleges and universities reached similar conclusions, finding that region lags the nation not only in growth in employment in higher education but also in growth in the number of students who attend these higher education institutions.⁸ The report concluded that although the region's knowledge industry is significant, it could be even larger, if its growth had kept pace with that in other regions.

The fact that the region has gained employment in *colleges, universities, and professionals schools* and that the location quotient has also increased for this subcluster bodes well for the region's economic future. However, the decline in the location quotient for *research organizations* coupled with the fact that local factors played the major role for the drop is troubling in light of the potential benefits they can bring to the regional economy. As of 2006, the Mid-Atlantic region ranked second in the nation among all regions in nanotechnology-related patents granted for the prior 10 years.⁹ Nanotechnology is increasingly considered to become an integral part of a wide variety of industry sectors. In 2003, the greater Philadelphia region was also recognized as a national nanotechnology niche leader by *Small Times Magazine*.¹⁰

The benefits of R&D go beyond the ideas and products that are produced. During the Economy League of Greater Philadelphia's 2009 roundtable on the regional economy, it was noted that approximately 50 percent of Philadelphia's conventions are related to life science industries. It is clear that the region is already positioned to reap benefits from *research organizations*. The declining concentration of *research organizations* in the region, however, reveals certain weaknesses that must be addressed in order to bolster the already strong cluster.

⁸ www.economyleague.org/files/File/reports/KIP%202000%20exec%20summ.pdf.

⁹ www.midatlanticnano.org/pdfs/Getting_To_The_Future_First.pdf.

¹⁰ *Connecting the Greater Philadelphia Innovation Economy: A Road Map for Regional Growth* (www.innovationphiladelphia.com/).

**Figure 7:
Education and Knowledge Creation**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Colleges, Universities, and Professional Schools
- Research Organizations
- Training Programs

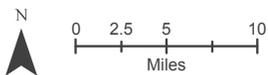
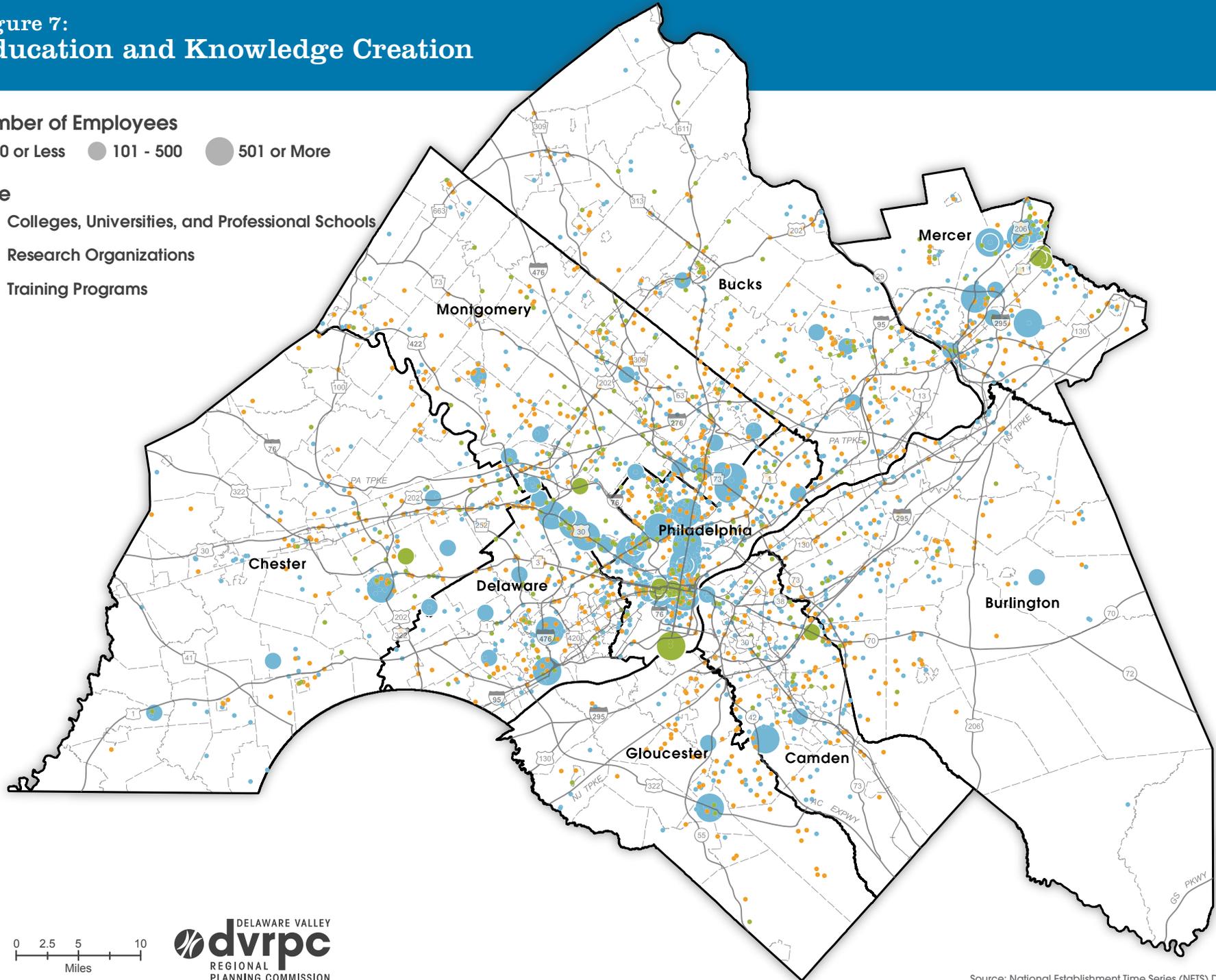


Table 8: Financial Services

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Financial Services	76,688	67,409	-12%	-2%	-5%	-5%	1.74	1.66
Financial Investment Activities	20,133	25,686	28%	-2%	35%	-5%	2.79	2.74
Credit Intermediation	15,158	14,243	-6%	-2%	-2%	-2%	1.09	1.08
Insurance	29,134	11,006	-62%	-2%	-20%	-40%	2.52	1.24
Securities Brokers, Dealers, and Exchanges	12,263	16,474	34%	-2%	-17%	53%	1.08	1.82

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

The *financial services* cluster includes establishments that support the transaction, growth, and protection of financial assets for businesses and individuals. Figure 8 illustrates the location and relative size of employers in this cluster. Large *financial services* employers include the Vanguard Group (in Malvern), ING (in West Chester), Planco Financial Services (Wayne), and Nationwide Life Insurance (Berwyn), all in Chester County; Merrill Lynch, in Pennington, Mercer County; and SEI Investments (Oaks) and the Harleysville Mutual Insurance Company (Harleysville), both in Montgomery County. This cluster boasts the region's second highest number of basic jobs (26,862) and third highest location quotient (1.66), indicating that it is one of the region's vital clusters. However, from 2000 to 2010, *financial services* lost 9,279 jobs, including 5,762 basic jobs.

The subcategories for this cluster include *financial investment activities*; *credit intermediation*; *insurance*; and *securities brokers, dealers and exchanges*. All but *financial investment activities* lost jobs at the national industrial level from 2000 to 2010, primarily due to the ongoing economic recession. These losses were exacerbated by regional factors that resulted in additional losses in the region, with the exception of *securities brokers, dealers, and exchanges*, which gained 54 percent due to regional factors. The decreasing location quotient of this cluster may be partially explained by the national trend of the *financial services* cluster dispersing across regions.¹¹ A 2008 study by Michael Porter on the economic performance of regions indicated that *financial services* is one of the 12 clusters that showed a decreasing level of concentration across regions nationally.¹²

Financial services and products support businesses, which in turn produce and export manufactured goods. In 2012, at least 132 of *Fortune's* Global 500 companies located their headquarters in the United States, to leverage its competitive and comprehensive financial services sector. Of the 132 *Fortune* Global 500 companies located in the U.S., only 11 call Greater Philadelphia their home. A robust *financial services* cluster can attract other businesses, which in turn bring direct and indirect economic benefits to the region. On the other hand, a weak *financial services* cluster can deter businesses from coming to the region and forgo potential benefits to the region.

¹¹ www.clustermapping.us/resources/research-and-methodology/?art_widemode=details&art_wideid=24&d-set=db_mode:close.

¹² Porter, M. E. *On Competition*. Updated and Expanded Edition. Boston: Harvard Business School Publishing, 2008.

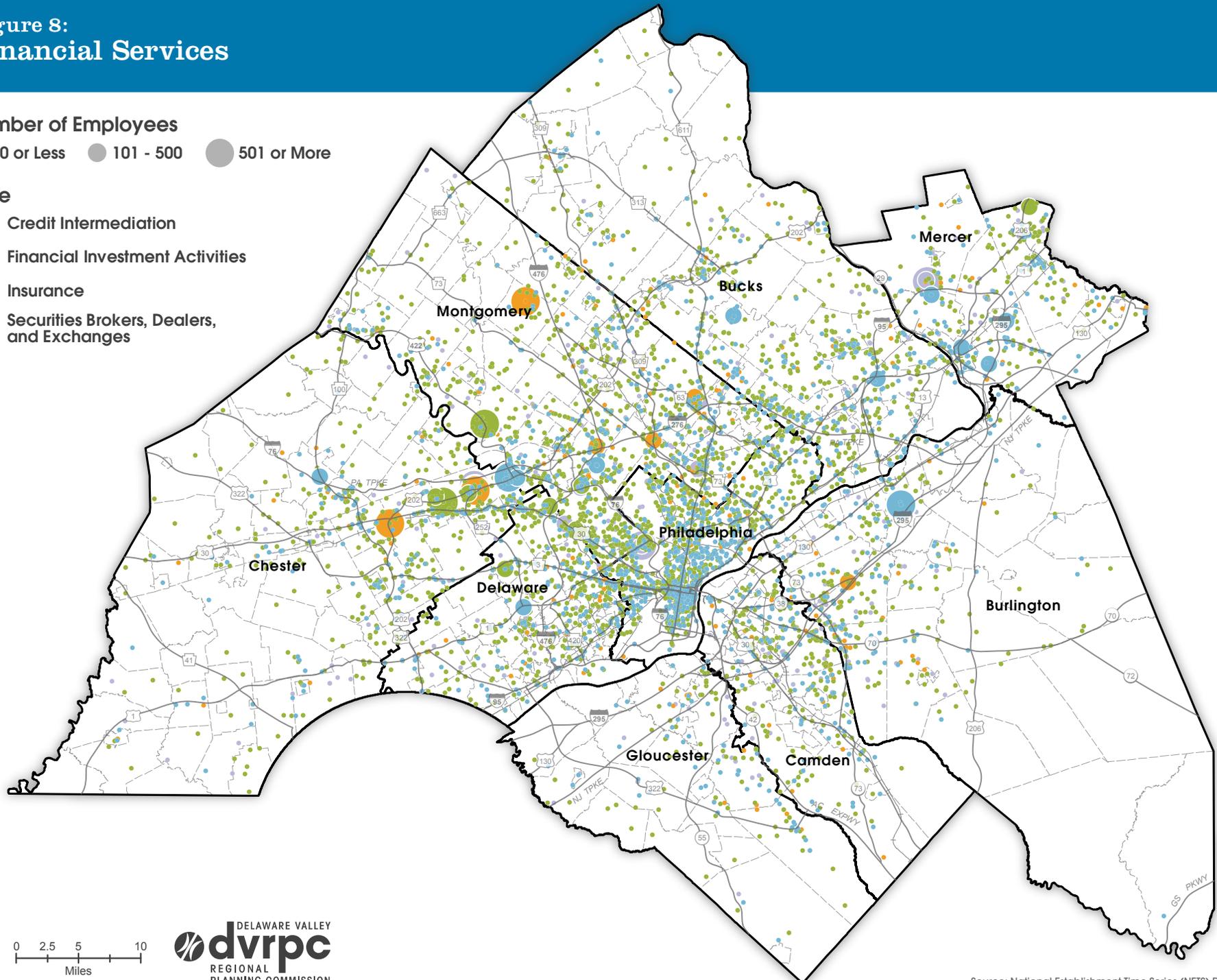
**Figure 8:
Financial Services**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Credit Intermediation
- Financial Investment Activities
- Insurance
- Securities Brokers, Dealers, and Exchanges



Source: National Establishment Time Series (NETS) Database, 2010

Table 9: Business Services

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Business Services	128,189	122,771	-4%	-2%	17%	-19%	1.33	1.11
Consulting Services	25,230	23,881	-5%	-2%	27%	-30%	1.71	1.31
Business Support Services	24,001	24,878	4%	-2%	22%	-16%	0.86	0.76
Computer Services	42,671	47,673	12%	-2%	25%	-11%	1.40	1.28
Engineering Services	34,101	19,484	-43%	-2%	13%	-54%	1.88	0.98
Holding Companies	2,186	6,855	214%	-2%	-36%	252%	0.57	2.94

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors.

Source: County Business Patterns, 2010.

The *business services* cluster includes companies that provide services primarily intended to assist other businesses, such as consulting, computer services, engineering, job placement, and other professional services. As illustrated in Figure 9, smaller companies providing business services are dispersed throughout the region, while numerous larger companies are located along the region's major highways. The largest employers in this cluster include Unisys in Blue Bell and the Lockheed Martin Corporation's Integrated Systems Solutions in King of Prussia, both in Montgomery County; Propoco Professional Services, in Wayne, Chester County; SAP Software and Solutions, in Newtown Square, Delaware County; L-3 Communications Systems-East, in Camden City, and Information Network Systems, in Cherry Hill Township (both in Camden County); MTS Systems Corporation, in Williamstown, Gloucester County; and ADP Financial Services, in Mt. Laurel, Burlington County.

The *business services* cluster has the second highest number of employees, and its location quotient of 1.11 is the eighth largest in the region. The cluster has 12,345 basic jobs, third to only *education and knowledge creation* and *financial services*. However, the cluster lost almost 5,000 jobs overall and 19,000 basic jobs between 2000 and 2010, indicating that many of the basic jobs either left the region or transformed into non-basic jobs. This four percent loss of employment in the *business services* cluster occurred despite a 17 percent increase in employment in the cluster nationally.

The subcategories for this cluster include *consulting services*, *business support services*, *computer services*, *engineering services*, and *holding companies*. With the exception of *holding companies*, the location quotients of the other subcategories, which have bigger presences in the region, declined during the decade. The growth or decline of these subcategories was mainly due to local factors that either promoted growth, despite the national industrial level decline, or reduced the growth potential due to local weaknesses.

Nationally, the *business services* cluster is the largest cluster with a steady growth rate, and is also dispersing across regions. These trends indicate that *business services* jobs are leaving our region to relocate somewhere else. The current trend of dispersion also indicates that the *business services* cluster in our region could experience a further decline and could potentially become a non-basic cluster as other regions experience growth.

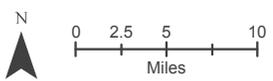
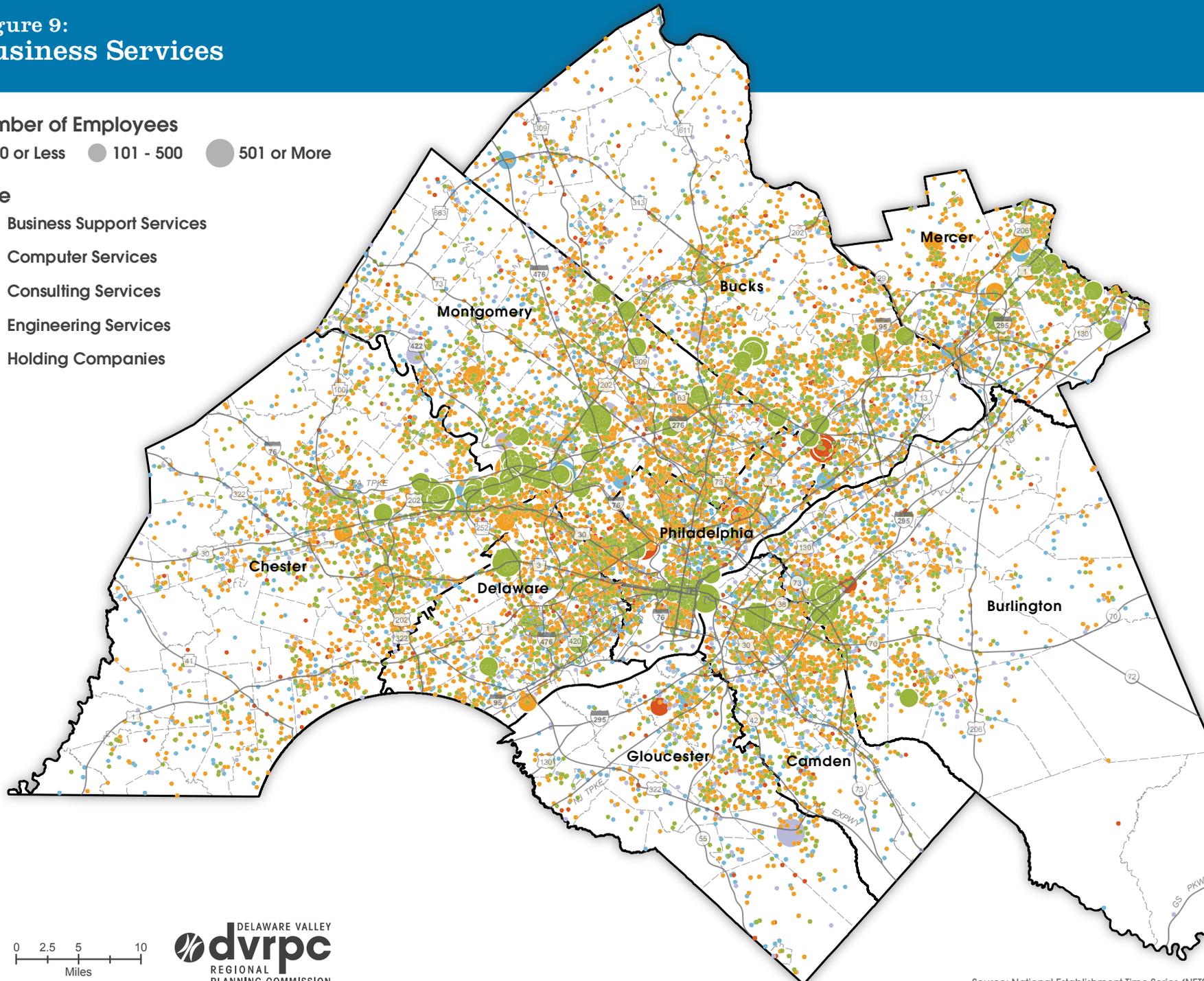
**Figure 9:
Business Services**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Business Support Services
- Computer Services
- Consulting Services
- Engineering Services
- Holding Companies



Source: National Establishment Time Series (NETS) Database, 2010

Table 10: Distribution and Electronic Commerce

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Distribution and Electronic Commerce	56,086	68,491	22%	-2%	26%	-2%	1.15	1.15
Warehousing and Storage	3,557	10,909	207%	-2%	395%	-188%	1.31	0.82
Electronic and Catalog Shopping	10,338	12,356	20%	-2%	16%	6%	1.80	1.91
Wholesaling of Agricultural and Construction Machinery	1,524	1,201	-21%	-2%	-7%	-12%	0.38	0.33
Wholesaling of Apparel and Accessories	4,611	3,384	-27%	-2%	-14%	-11%	1.04	0.91
Wholesaling of Farm Material and Supplies	1,387	1,165	-16%	-2%	-30%	16%	0.49	0.61
Wholesaling of Food Products	4,628	3,171	-31%	-2%	-31%	2%	1.15	1.18
Wholesaling of Other Merchandise	27,324	34,599	27%	-2%	21%	8%	1.24	1.34
Distribution of Transportation Equipment and Supplies	939	931	-1%	-2%	-12%	13%	0.78	0.91
Rental and Leasing	1,778	775	-56%	-2%	-22%	-32%	1.07	0.62

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

Figure 10 illustrates the location and relative size of employers in the *distribution and electronic commerce* cluster. This cluster is comprised primarily of wholesale establishments that buy, inventory, and/or distribute apparel, farm materials, machinery, and other merchandise (including pharmaceuticals), as well as traditional wholesalers, mail order houses, and electronic merchants. Major employers include Merck, Sharpe, and Dohme (in Upper Gwynedd), Iron Mountain and Wyeth Pharmaceuticals (both in Collegeville), and Honeywell International (in Fort Washington), all in Montgomery County; TJ Maxx, Procacci Brothers, and Cherokee Pharmaceuticals, all in Philadelphia; and Shire Pharmaceuticals and Wyeth-Ayerst International (both in Wayne) and Softmart Product Services (in Downingtown), all in Chester County. Also shown on Figure 10 is Sony Entertainment in Pitman Borough, Gloucester County, which had over 500 employees in 2010 but closed in 2011.

In 2010, this cluster had the third highest number of jobs (68,491); the seventh highest location quotient (1.15); and over 8,700 basic jobs, fourth most in the region. Overall, the cluster's location quotient remained the same from 2000 to 2010, despite a 22 percent increase in the number of jobs in the region. The majority of the cluster's employees work in three of the cluster's nine subcategories (*wholesaling of other merchandise, electronic and catalog shopping, and warehousing and storage*). With the exception of *warehousing and storage, wholesaling of agricultural and construction machinery, and rental and leasing*, most of the subcategories have been strong, with mostly positive local growth shares and increasing location quotients.

The *distribution and electronic commerce* cluster is the second largest cluster nationally (second to only the *business services* cluster) and is growing, with its concentration of jobs generally dispersing across regions. Greater Philadelphia fared relatively well in terms of maintaining the relative concentration between 2000 and 2010. The fact that the region's *distribution and electronic commerce* cluster saw 22 percent job growth while maintaining a location quotient of 1.15 indicates that the region has competed well against other regions and retained these jobs, even as more and more *distribution and electronic commerce* jobs are being dispersed across regions.

**Figure 10:
Distribution and Electronic Commerce**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Distribution of Transportation Equipment and Supplies
- Electronic and Catalog Shopping
- Rental and Leasing
- Warehousing and Storage
- Wholesale: Agricultural and Construction Machinery
- Wholesale: Apparel and Accessories
- Wholesale: Farm Material and Supplies
- Wholesale: Food Products
- Wholesale: Other Merchandise

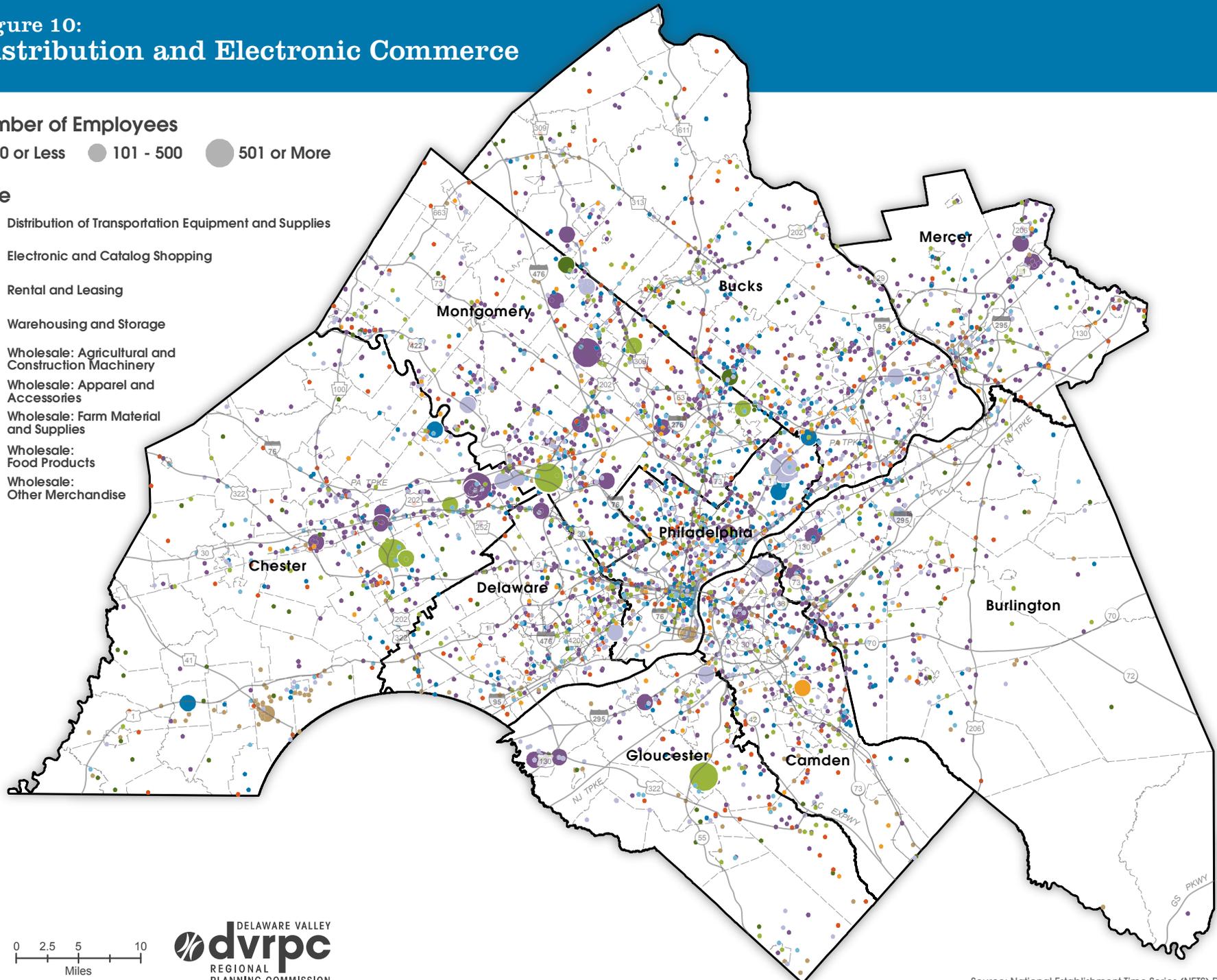


Table 11: Media, Publishing, and Design Services

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Media, Publishing, and Design Services	29,223	20,681	-29%	-2%	-8%	-19%	1.69	1.34
Media Representatives	1,153	604	-48%	-2%	-36%	-10%	1.21	1.03
Design Services	4,356	2,328	-47%	-2%	-22%	-23%	1.5	1.07
Marketing-Related Services	10,879	7,415	-32%	-2%	-20%	-10%	1.91	1.69
Publishing	12,835	10,334	-19%	-2%	10%	-27%	1.65	1.24

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

Figure 11 illustrates the location and relative size of employers in the *media, publishing, and design services* cluster, which includes establishments involved in media services such as publishing (online and offline), design services, and marketing. The region's largest employers in this cluster include the Free Library of Philadelphia and Thomson Reuters Scientific, in Philadelphia; the Trenton Times Publishing Company and the Hibbert Company (both in the City of Trenton) and McGraw-Hill and UBM Global Trade, Inc. (both in Hightstown), all in Mercer County; Vertex, Inc., in Berwyn, Chester County; and Direct Group, LLC, in Swedesboro, Gloucester County.

This cluster has the seventh largest number of jobs (20,681) and the fourth largest location quotient (1.34) in the region. The *media, publishing, and design services* cluster lost about 8,500 jobs and 6,600 basic jobs between 2000 and 2010, and its location quotient also declined from 1.69 during this period. While the cluster lost 10 percent of its jobs at the national industrial level, regional factors increased these losses by an additional 19 percent.

The subcategories for this cluster include *media representatives, design services, marketing-related services, and publishing*. These subcategories tell a similar story of declining location quotients and job losses caused by regional factors. For example, the largest subcategory in the cluster, *publishing*, saw its location quotient decline from 1.65 to 1.24, and the national industrial level growth of 10 percent for publishing was hampered by the 27 percent loss caused by regional factors.

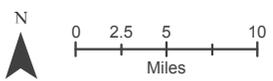
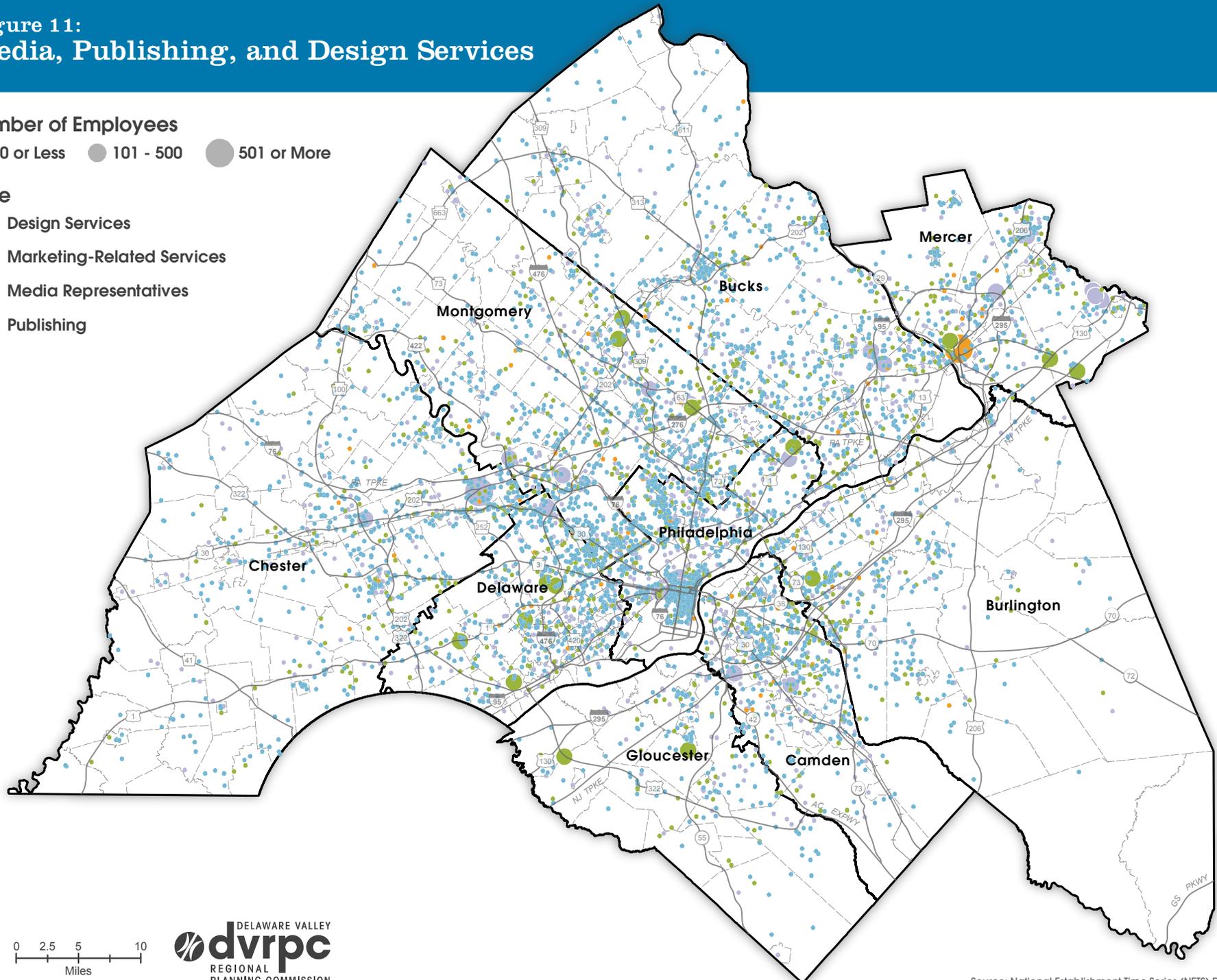
**Figure 11:
Media, Publishing, and Design Services**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Design Services
- Marketing-Related Services
- Media Representatives
- Publishing



Source: National Establishment Time Series (NETS) Database, 2010

Table 12: Biopharmaceuticals

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Biopharmaceuticals	9,794	9,940	1%	-2%	3%	0%	2.07	2.09
Biopharmaceutical Products	9,159	5,554	-39%	-2%	4%	-41%	2.69	1.62
Biological Products	200	4,256	2,028%	-2%	10%	2,020%	0.41	8.14
Diagnostic Substances	435	130	-70%	-2%	-1%	-67%	0.53	0.16

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

The *biopharmaceuticals* cluster, illustrated in Figure 12, includes establishments that produce complex chemical and biological substances used in medications, vaccines, diagnostic tests, and similar medical applications. Although the cluster had the 14th largest number of jobs in the region (9,940), its location quotient of 2.09 was second to only *education and knowledge creation*. The region's largest biopharmaceutical employers include Ortho-McNeil-Janssen Pharmaceuticals in Hopewell Township and Eon Labs in Princeton, both in Mercer County; Cephalon, Inc., in Malvern, Chester County; Centocor USA (in Horsham), Merck (in Blue Bell), Wyeth (in Paoli), CSL Bering (in King of Prussia), Colorcon (in Upper Gwynedd Township), and Teva Pharmaceuticals (in North Wales), all in Montgomery County; and Pharmaceutical Holdings Corporation, in Philadelphia.

This cluster is one of the few clusters in the region that gained both overall jobs and basic jobs between 2000 and 2010. During this period, *biopharmaceuticals* gained 146 jobs and 122 basic jobs, and its location quotient increased from 2.07 to 2.09. The growth of this cluster is due primarily to the industrial mix growth of three percent. Unlike most of the region's clusters, regional factors did not hinder the growth potential of this cluster.

The cluster's subcategories include *biopharmaceutical products*, *biological products*, and *diagnostic substances*. It is important to note that the seemingly exponential regional growth of biological products (2,020 percent) might be due to changes in classification conventions from 2000 to 2010 between *biopharmaceutical products* and *biological products* in the region. The fact that *biopharmaceutical products* lost about 3,600 jobs while *biological products* gained about 4,000 jobs in the region supports this hypothesis. Combined, these two categories display a growth pattern that is similar to the national industrial growth.

Nationally, the *biopharmaceuticals* cluster realized a slight decline in jobs from 2000 to 2010 while becoming more dispersed across regions. Against this trend, Greater Philadelphia's *biopharmaceuticals* cluster has seen a modest growth both in jobs and location quotient. This attests to the region's competitive advantage and strengths in the *biopharmaceuticals* cluster.

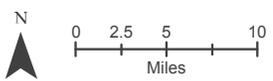
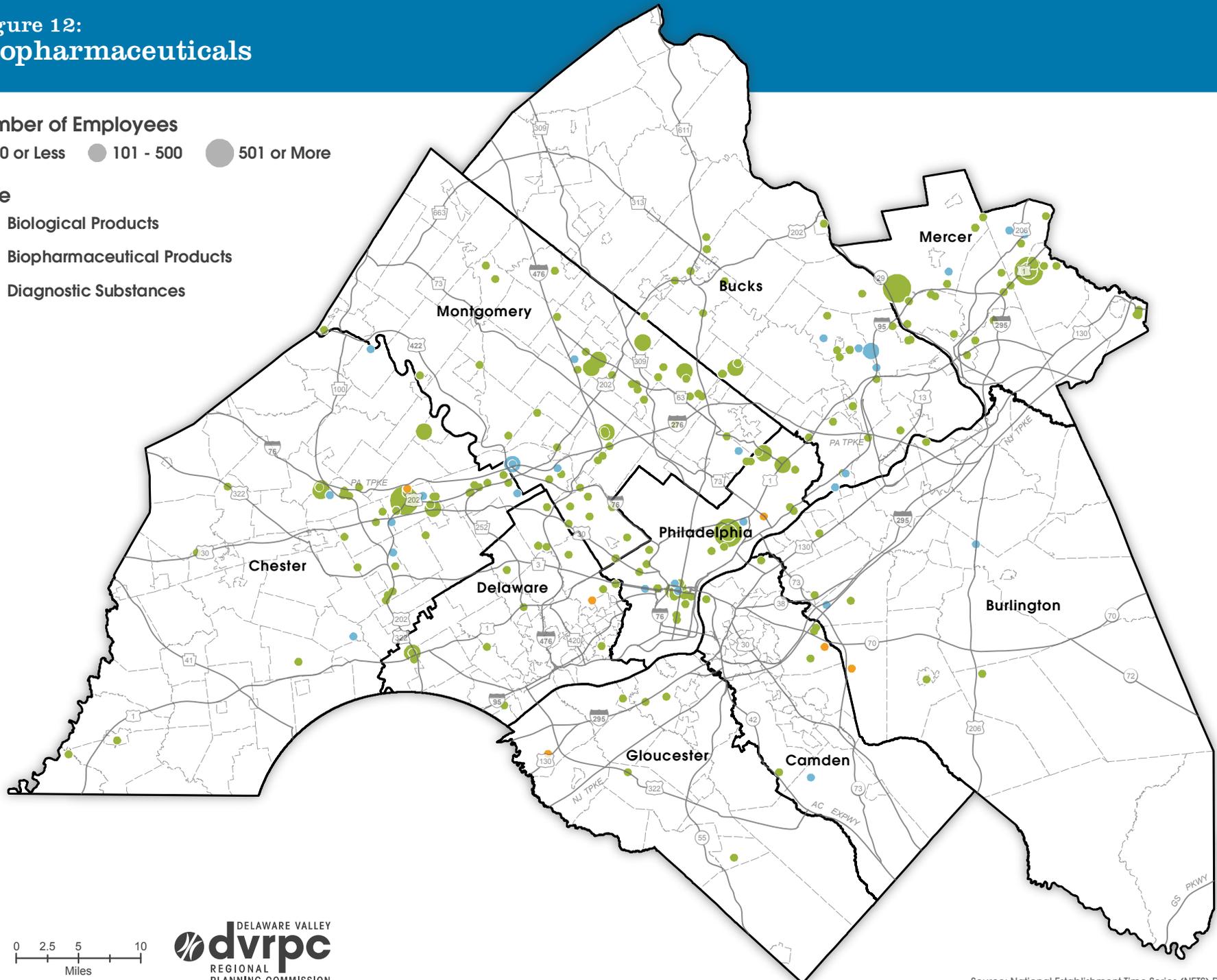
**Figure 12:
Biopharmaceuticals**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Biological Products
- Biopharmaceutical Products
- Diagnostic Substances



Source: National Establishment Time Series (NETS) Database, 2010

Table 13: Printing Services

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Printing Services	11,957	6,337	-47%	-2%	-30%	-15%	1.50	1.18
Support Activities for Printing	4,221	1,816	-57%	-2%	-55%	0%	2.68	2.69
Printing Services	6,951	3,959	-43%	-2%	-25%	-16%	1.20	0.95
Greeting Card Printing and Publishing	410	245	-40%	-2%	-40%	2%	1.11	1.16
Printing Inputs	375	317	-15%	-2%	7%	-20%	1.38	1.12

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors.

Source: County Business Patterns, 2010.

Figure 13 illustrates the location and relative size of employers in the *printing services* cluster, which includes establishments primarily engaged in commercial printing, digital printing, and binding. The cluster includes businesses that produce and supply upstream products and services necessary for printing (such as ink and typesetting services) as well as printed end products, such as books, journals, photo albums, greeting cards, and related goods. *Printing services* is the only one of Greater Philadelphia's clusters of basic traded industries that does not include a single business with over 500 employees. The region's largest employers in this cluster include Sancoa International and Celebration/US, both located in Lumberton, Burlington County; Reed Technical and Information Services, in Horsham, Montgomery County; World Color/USA, LLC, in Atglen, Chester County; and Bartash Printing, Inc., in Philadelphia.

The printing services cluster ranks 18th in terms of employment size while its location quotient of 1.18 ranks sixth in the region, just above *distribution and electronic commerce* and *business services*. However, the *printing services* cluster lost 5,620 jobs (47 percent) and 2,980 basic jobs between 2000 and 2010, and the cluster's location quotient shrank from 1.50 to 1.18. Of the 47 percent job loss in the *printing services* cluster, 32 percent was due to the national industrial decline and the remaining 15 percent was due to regional factors.

The cluster's subcategories include *support activities for printing*, *printing services*, *greeting card printing and publishing*, and *printing inputs*. The location quotient of 2.69 for the *support activities for printing* subcategory despite the location quotient of only 0.95 for the *printing services* subcategory indicates that the support activities export their services beyond the region.

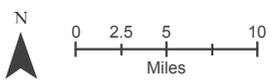
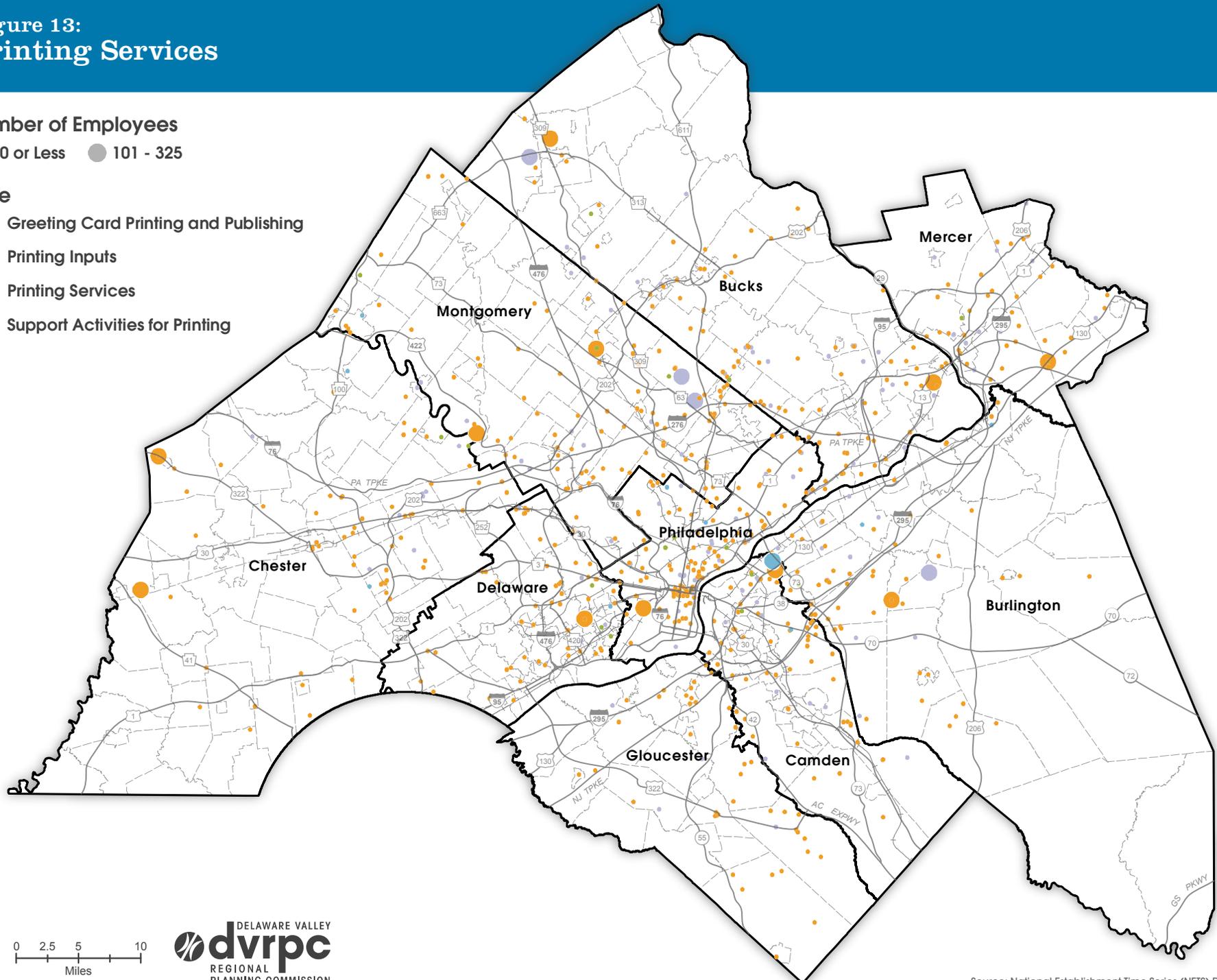
**Figure 13:
Printing Services**

Number of Employees

- 100 or Less
- 101 - 325

Type

- Greeting Card Printing and Publishing
- Printing Inputs
- Printing Services
- Support Activities for Printing



Source: National Establishment Time Series (NETS) Database, 2010

Table 14: Downstream Chemical Products

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Downstream Chemical Products	6,540	5,770	-12%	-2%	-27%	17%	0.95	1.19
Personal Care and Cleaning Products	1,512	2,884	91%	-2%	-23%	116%	0.58	1.50
Processed Chemical Products	2,593	1,425	-45%	-2%	-27%	-16%	1.06	0.82
Dye, Pigment, and Coating	1,730	1,058	-39%	-2%	-36%	-1%	1.20	1.20
Explosives	0	75	---	-2%	-15%	NA	0.00	0.59
Lubricating Oils and Greases	705	328	-53%	-2%	-13%	-38%	3.13	1.74

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors.

Source: County Business Patterns, 2010.

Figure 14 illustrates the location and relative size of employers in the *downstream chemical products* cluster, which includes establishments that manufacture complex chemical products for end users such as adhesives, beauty products, soaps, cleaners, film processing chemicals, dyes, paints, and explosives. Large *downstream chemical products* employers include Armkel, LLC (a manufacturer of personal care and cleaning products) and the Xerox Corporation, both located in Princeton, Mercer County; the Quaker Chemical Corporation, in Conshohocken, Montgomery County; Betz Laboratories (in Langhorne) and Northtec, Inc. (in Bristol), both in Bucks County; and Haas Total Chemical Management, LLC, in West Chester, Chester County.

This cluster has the 12th largest number of jobs (5,770), while its location quotient of 1.19 ranks it fifth in the region. Overall, the *downstream chemical products* cluster lost 12 percent or 770 jobs and 918 basic jobs, indicating that some of the basic jobs became non-basic jobs. However, its location quotient increased from 0.95 to 1.19. At the national industrial level, *downstream chemical products* experienced a loss of 29 percent of jobs while the growth of 17 percent due to regional factors helped contain the regional decline to 12 percent.

The subcategories for this cluster include *personal care and cleaning products*; *processed chemical products*; *dye, pigment, and coating*; *explosives*; and *lubricating oils and greases*. The cluster's largest subcategory is *personal care and cleaning products*, which declined nationally but grew by 91 percent regionally (to 2,884 jobs), with its growth caused entirely by regional influences. The other subcategories all lost jobs due to both national factors and regional factors. Jobs in *explosives* are the only exception, as the region had no employment in the subcategory in 2000.

The *downstream chemical products* cluster realized a decline in jobs nationally between 2000 and 2010, and it became more concentrated in a few regions. The decline in *downstream chemical products* jobs in Greater Philadelphia is in keeping with the national trend, while the increase in location quotient from 0.95 to 1.19 indicates that the region is one of the few regions in the country that have seen growth in the relative concentration of this cluster.

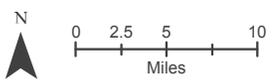
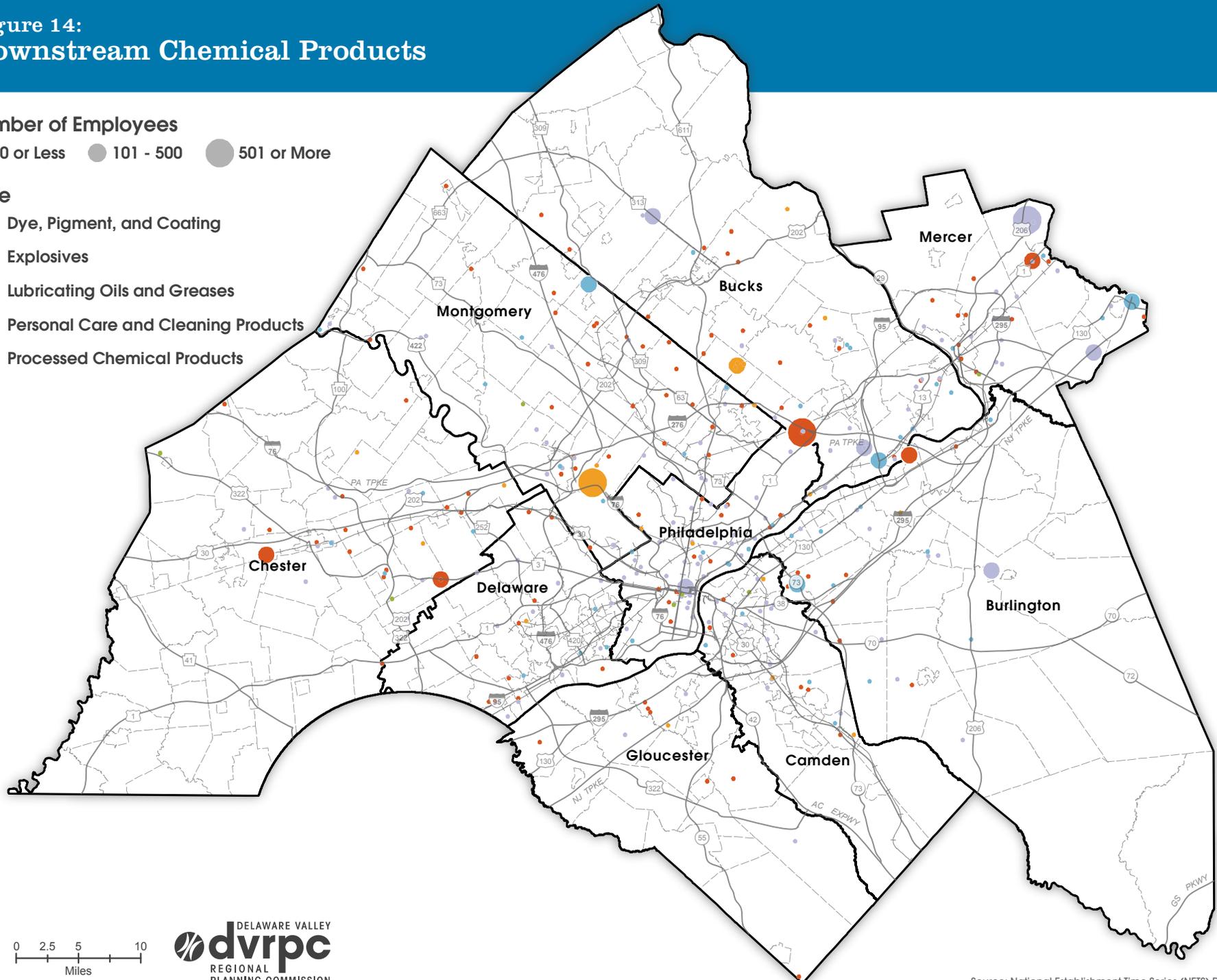
**Figure 14:
Downstream Chemical Products**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Dye, Pigment, and Coating
- Explosives
- Lubricating Oils and Greases
- Personal Care and Cleaning Products
- Processed Chemical Products



Source: National Establishment Time Series (NETS) Database, 2010

Table 15: Information Technology and Analytical Instruments

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Information Technology and Analytical Instruments	26,447	21,788	-18%	-2%	-32%	16%	0.83	1.04
Electronic Components	3,878	2,176	-44%	-2%	-48%	7%	0.51	0.58
Computers and Peripherals	2,727	960	-65%	-2%	-61%	-2%	0.68	0.36
Semiconductors	2,957	591	-80%	-2%	-51%	-27%	0.58	0.21
Software Publishers	9,649	13,406	39%	-2%	12%	29%	1.40	1.43
Software Reproducing	335	93	-72%	-2%	-64%	-6%	0.91	0.29
Process and Laboratory Instruments	5,578	3,541	-37%	-2%	-30%	-5%	0.96	0.65
Medical Equipment	1,270	920	-28%	-2%	21%	-47%	0.91	0.75
Audio and Video Equipment	53	101	91%	-2%	-69%	162%	0.08	1.96

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

Figure 15 illustrates the location and relative size of employers in the *information technology and analytical instruments* cluster, which includes information technology products such as computers, software, and audiovisual equipment as well as analytical instruments. The cluster also includes standard and precision electronics, such as circuit boards and semiconductor devices. Large employers include Lockheed Martin's semiconductor manufacturing facility, in Hightstown, Mercer County; Unisys and Vishay Americas (both in Malvern), and Bentley Systems, Inc., and Automated Financial Systems (both in Exton), all in Chester County; First Quality Retail Services (in King of Prussia) and Brooks Instruments (in Hatfield), both in Montgomery County; Metrologic Instruments, in Blackwood, Camden County; Pitney Bowes, in Delran, Burlington County, and the Oracle Corporation, in Chester, Delaware County.

This cluster is sixth largest in terms of employment and has the ninth largest location quotient. Despite the loss of over 4,600 jobs between 2000 and 2010, the cluster's location quotient increased from 0.83 to 1.04, changing this cluster from non-basic to basic. The 18 percent decline overall resulted from a 34 percent decline at the national industrial level coupled with 16 percent growth at the regional level. The cluster's largest subcategory in the region, by a wide margin, is *software publishers*, which added almost 4,000 jobs, representing a 39 percent increase. The growth of *software publishers* is encouraging, as the category grew by an extra 29 percent due to regional factors in addition to the national industrial growth of 10 percent.

Nationally, the *information technology and analytical instruments* cluster lost jobs between 2000 and 2010, and the cluster has become increasingly concentrated in a few regions. In Greater Philadelphia, the *information technology and analytical instruments* cluster lost jobs, yet its location quotient increased from 0.83 to 1.04. This indicates that our region is one of the few regions where the relative concentration of *information technology and analytical instruments* jobs has increased.

Figure 15: Information Technology and Analytical Instruments

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Audio and Video Equipment
- Computers and Peripherals
- Electronic Components
- Medical Equipment
- Process and Laboratory Instruments
- Semiconductors
- Software Publishers
- Software Reproducing

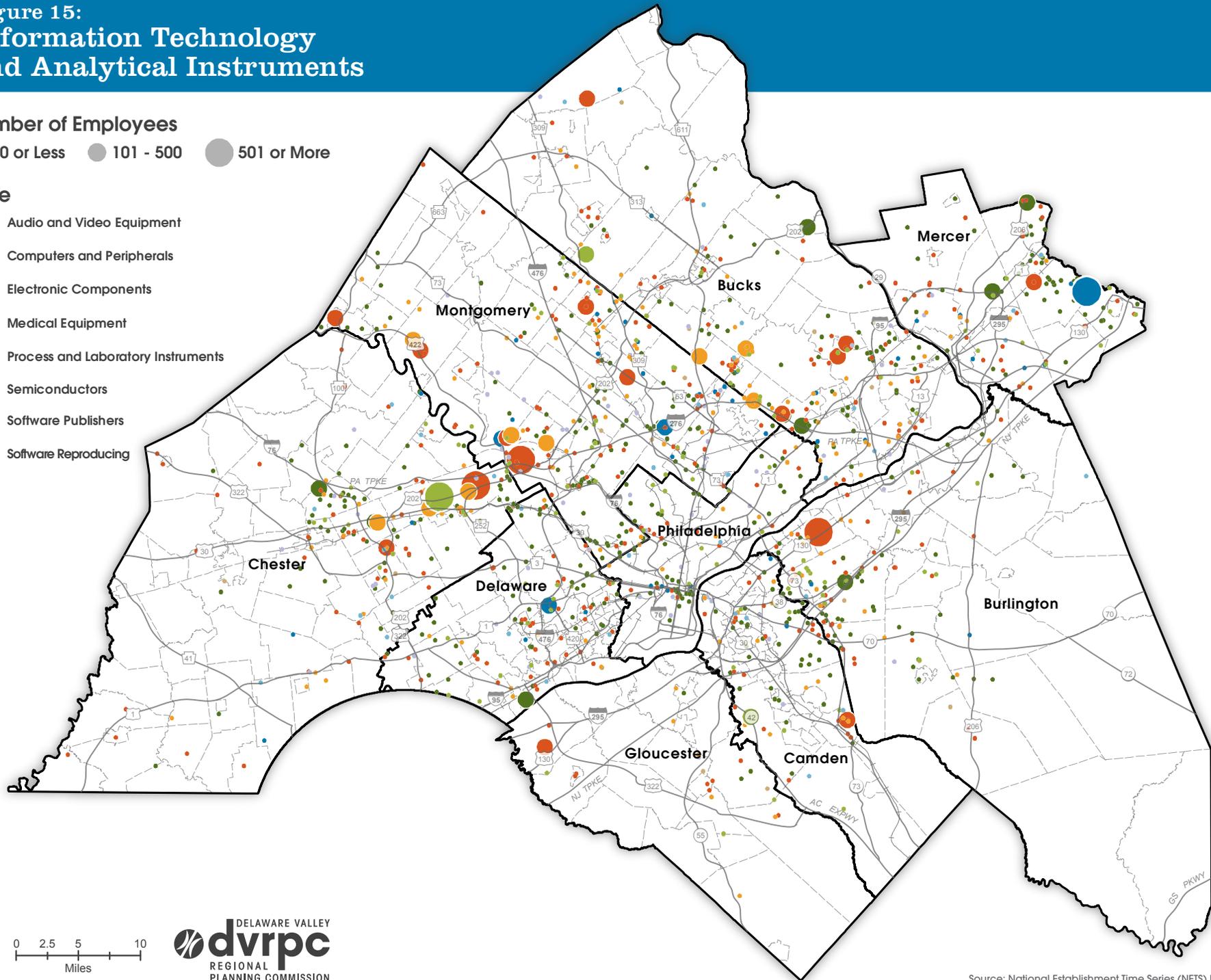


Table 16: Aerospace Vehicles and Defense

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Aerospace Vehicles and Defense	13,276	11,213	-16%	-2%	-13%	-1%	1.03	1.03
Aircraft	8,370	4,653	-44%	-2%	-12%	-30%	1.07	0.70
Missiles and Space Vehicles	0	429	--	-2%	-15%	NA	0.00	0.36
Search and Navigation Equipment	4,906	6,131	25%	-2%	-15%	42%	1.34	2.04

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster’s growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

Figure 16 illustrates the location and relative size of employers in the *aerospace vehicles and defenses* cluster, which includes establishments that manufacture aircraft, space vehicles, guided missiles, and related parts. This cluster also includes firms that manufacture the necessary search and navigation equipment used by these products. In 2010, the region’s largest *aerospace vehicles and defense* employers included the Lockheed Martin Corporation, with locations in Moorestown, Burlington County and Newtown, Bucks County¹³; MSSC, Inc., in Glenside, Montgomery County; and Boeing, in Ridley Park, Delaware County.

Since 2010, Sikorsky Global Helicopters, in Sadsbury Township (Chester County), has expanded and gained over 1,200 employees, making it the region’s largest aircraft manufacturer and the 3rd largest aerospace vehicles and defense employer. Although the current employment at Sikorsky is not reflected in this report’s data analysis (which compares 2000 and 2010 data), Figure 16 has been revised to reflect the growth in Sikorsky’s workforce since 2010.

In 2010, the *aerospace vehicles and defenses* cluster is the 12th largest in terms of employment size (11,213) and had the 10th highest location quotient (1.03). The cluster lost 2,063 jobs (16 percent) between 2000 and 2010, although its location quotient remained stable. The 16 percent decline in jobs was the result of a 15 percent decline at the national industrial level coupled with an additional one percent decline regionally, although the growth of Sikorsky Global Helicopters in Chester County has undoubtedly had a significant impact on the relative strength of the industry here in Greater Philadelphia.

The subcategories for this cluster include *aircraft, missiles and space vehicles, and search and navigation equipment*. The cluster’s largest subcategory is *search and navigation equipment*, with 6,131 jobs (after growing by 25 percent between 2000 and 2010) and a location quotient of 2.04. This growth occurred despite the subcategory’s 17 percent decline at the national industrial level.

¹³ The Lockheed Martin facility located in Bucks County is expected to close in early 2015.

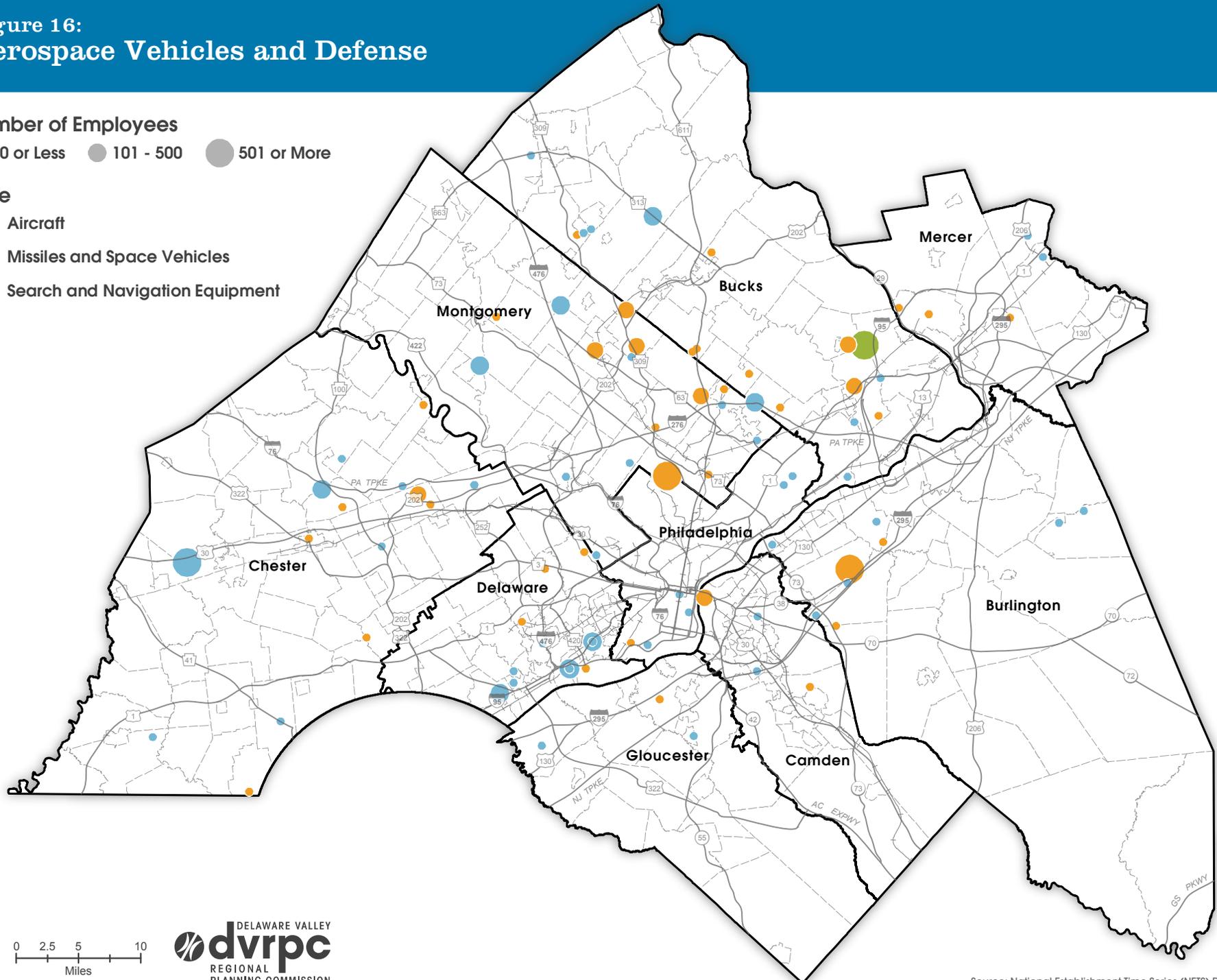
**Figure 16:
Aerospace Vehicles and Defense**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Aircraft
- Missiles and Space Vehicles
- Search and Navigation Equipment



Source: National Establishment Time Series (NETS) Database, 2010

Table 17: Paper and Packaging

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Paper and Packaging	11,519	7,573	-34%	-2%	-32%	0%	1.02	1.03
Paper Mills	1,535	1,338	-13%	-2%	-35%	24%	0.44	0.62
Packaging	5,347	3,783	-29%	-2%	-30%	3%	1.10	1.16
Paper Products	4,637	2,452	-47%	-2%	-32%	-13%	1.56	1.26

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

Figure 17 illustrates the location and relative size of employers in the *paper and packaging* cluster, which includes the paper mills and manufacturers of paper products used for shipping, packaging, containers, office supplies, personal products, and similar products. The region's largest employers in this cluster include Kimberley Clark, located in Marcus Hook, Delaware County (the only business in the cluster with over 500 employees); the Sharp Corporation (in Conshohocken) and National Label Company (in Lafayette Hill), both in Montgomery County; the International Paper Company, with locations in West Deptford (Gloucester County), Barrington (Camden County), and Lawrenceville (Mercer County); the Smurfit-Stone Container Corporation, in Aston, Delaware County; Graphic Packaging International, in Phoenixville, Chester County; SCA Americas, in Philadelphia; and M&C Specialties Company (in Southampton) and Fibermark Holdings, LLC (in Quakertown), both in Bucks County.

This cluster ranks 15th in employment size (7,573) and 11th in location quotient (1.03). From 2000 to 2010, this cluster lost 34 percent of its employment (3,946 jobs) while its location quotient increased slightly from 1.02 to 1.03. The decline was entirely due to the national industrial loss of 34 percent. The subcategories for this cluster include *paper mills*, *packaging*, and *paper products*. All of the sub-categories lost jobs during this period, although two of the subcategories, *paper mills* and *packaging*, gained in location quotient.

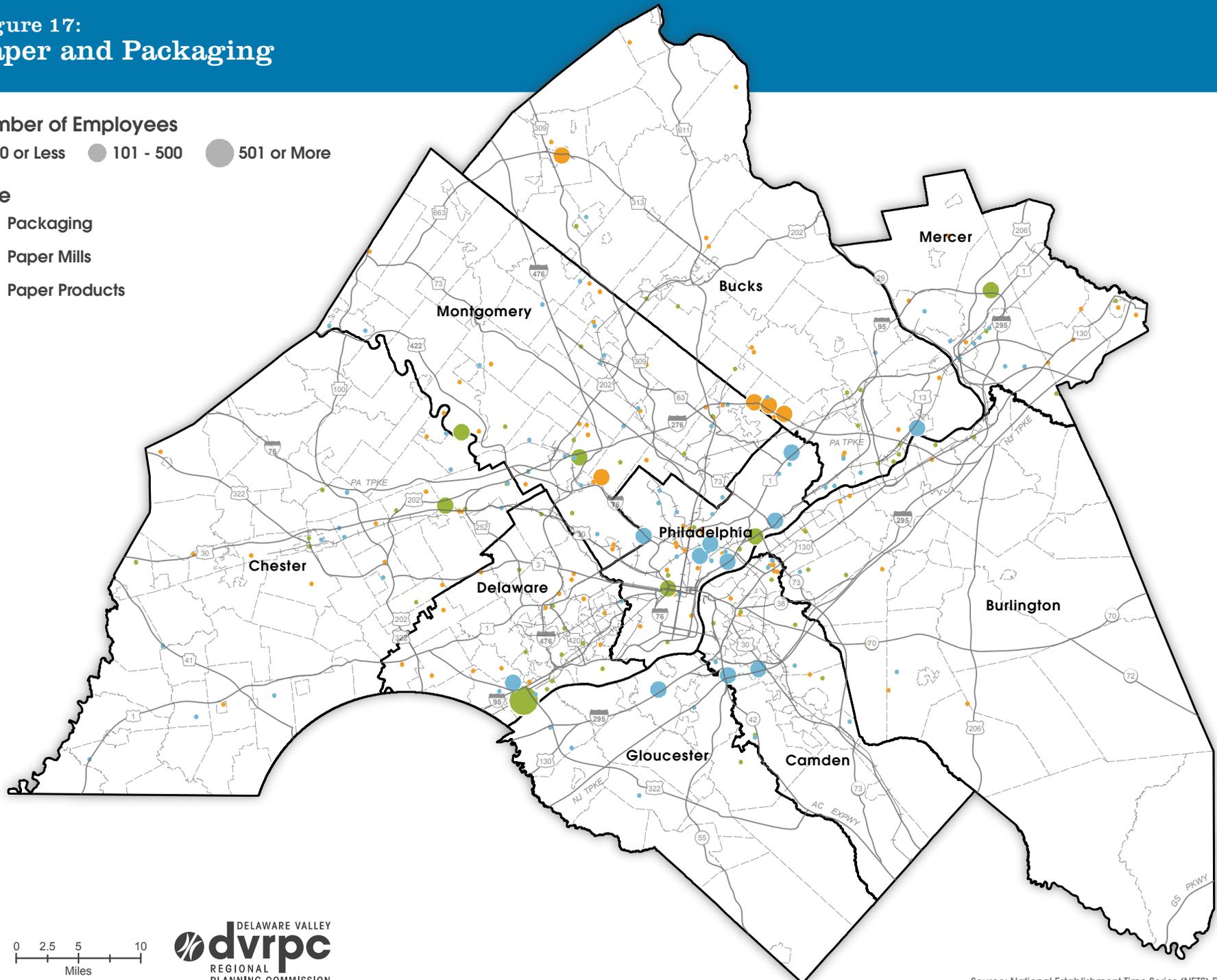
**Figure 17:
Paper and Packaging**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Packaging
- Paper Mills
- Paper Products



Source: National Establishment Time Series (NETS) Database, 2010

Table 18: Energy Generation and Distribution

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	Location Quotient 2000	Location Quotient 2010
Energy Generation and Distribution	7,215	3,032	-58%	-2%	-5%	-51%	1.72	0.78
Electric Services	5,875	2,619	-55%	-2%	-2%	-51%	1.89	0.89
Pipeline Transportation	1,340	413	-69%	-2%	-10%	-57%	1.22	0.43

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

Figure 18 illustrates the location and relative size of employers in the *energy generation and distribution* cluster, which includes establishments primarily responsible for generating and/or distributing electric power, oil, gas, and petroleum. Major employers in this cluster in 2010 included Exelon, located in Limerick Township, Montgomery County; the Amergen Energy Corporation, in Kennett Square, Chester County; Sunoco and the Sun Pipeline Company, both in Philadelphia; and PECO Energy, with locations in Coatesville, Chester County, and Plymouth Meeting, Montgomery County. It should be noted, however, that significant changes have occurred since 2010, including the re-purposing of Sunoco as Philadelphia Energy Solutions in 2012.

This cluster ranks 29th in employment size (3,032) and 21st in location quotient (0.78). The cluster lost 4,183 or 59 percent of jobs from 2000 to 2010, and its location quotient also decreased dramatically (from 1.72 to 0.78), as the cluster shifted from a basic to a non-basic cluster. This 59 percent decline was unique to this region, as the national industrial decline was a comparatively meager seven percent.

The subcategories for this cluster include *electric services* and *pipeline transportation*. Both of these subcategories realized declines in both employment size and location quotient between 2000 and 2010, and regional factors contributed to a greater magnitude of decline than was seen nationally. Given the potential impact of Pennsylvania's Marcellus Shale natural gas generation, however, this cluster has the potential for growth in the future. Future DVRPC research efforts will consider the more recent regional significance of the *energy generation and distribution* cluster.

**Figure 18:
Energy Generation and Distribution**

Number of Employees

- 100 or Less
- 101 or More

Type

- Electric Services
- Pipeline Transportation

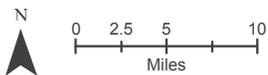
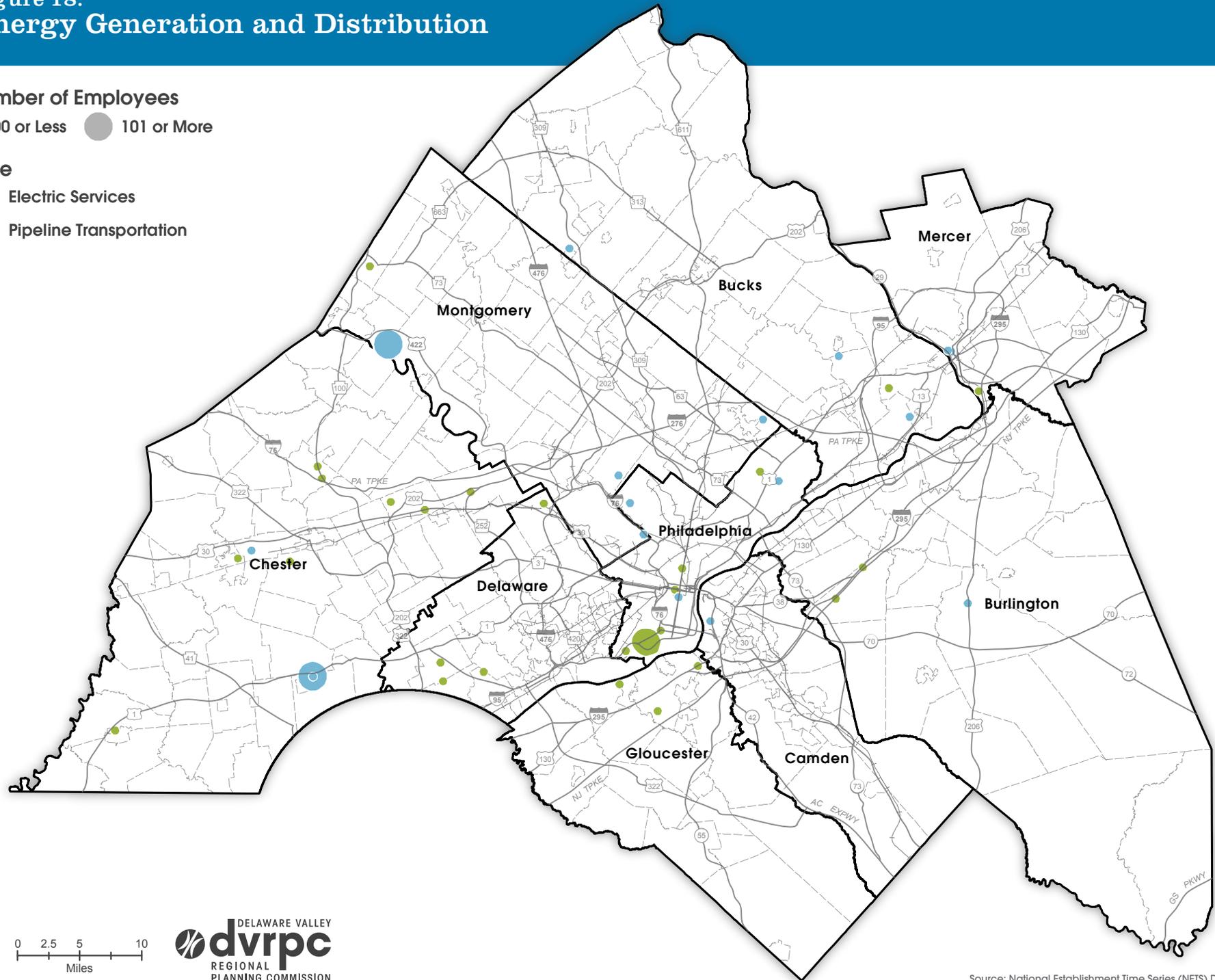


Table 19: Medical Devices

Cluster/Subcategory	Total Jobs 2000	Total Jobs 2010	Change in Jobs	National Growth Share	Industrial Mix Share	Local Share	2000 Location Quotient	2010 Location Quotient
Medical Devices	5,439	4,690	-14%	-2%	0%	-12%	1.00	0.89
Optical Instruments and Ophthalmic Goods	736	1,274	73%	-2%	-19%	94%	0.73	1.62
Surgical and Dental Instruments and Supplies	4,703	3,416	-27%	-2%	5%	-30%	1.07	0.76

Note: The national growth share (-2.0 percent) is equal to the national macroeconomic change that affected all industries in all clusters. The industrial mix share is equal to the share of the cluster's growth attributable to the growth of the cluster at the national level. The local growth share represents how much of the regional growth or decline of a cluster cannot be explained simply by growth of the economy overall or by changes in the cluster that occurred nationwide and is instead due to unique regional factors. **Source:** County Business Patterns, 2010.

Figure 19 illustrates the locations and relative size of employers in the *medical devices* cluster, which includes establishments that primarily manufacture surgical, dental, and optical instruments and supplies. This cluster ranks 23rd in employment size (4,690) and 15th in location quotient (0.89). The region's largest *medical devices* employers include Siemens Medical Solutions, located in Malvern, Montgomery County; Johnson and Johnson, located in Philadelphia; Synthes USA Sales, Inc., and the Animas Corporation (both in West Chester, Chester County) and West Pharmaceutical Services (in Exton), all located in Chester County; Porter Instruments, in Hatfield, Montgomery County; and Edmund Optics, in Barrington, Camden County.

The *medical devices* cluster lost 749 (14 percent) jobs from 2000 to 2010, and its location quotient decreased from 1.00 to 0.89, indicating the *medical devices* cluster shifted from a basic cluster to a non-basic cluster. The 14 percent decline in jobs is primarily due to regional factors, as the two percent decline at the national level was accelerated by regional factors with an additional 12 percent decline. The cluster's subcategories include *optical instruments and ophthalmic goods* (which lost jobs nationally but experienced a 73 percent increase in jobs regionally) and *surgical and dental instruments and supplies* (

Nationally, the *medical devices* cluster lost jobs from 2000 to 2010, as the concentration of jobs has dispersed across regions. Similarly, the Greater Philadelphia region's *medical devices* cluster has declined in the number of jobs as well as in terms of location quotient. The fact that these jobs are becoming fewer and dispersed indicates a continuation of a weakening cluster.

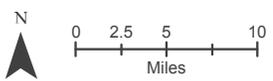
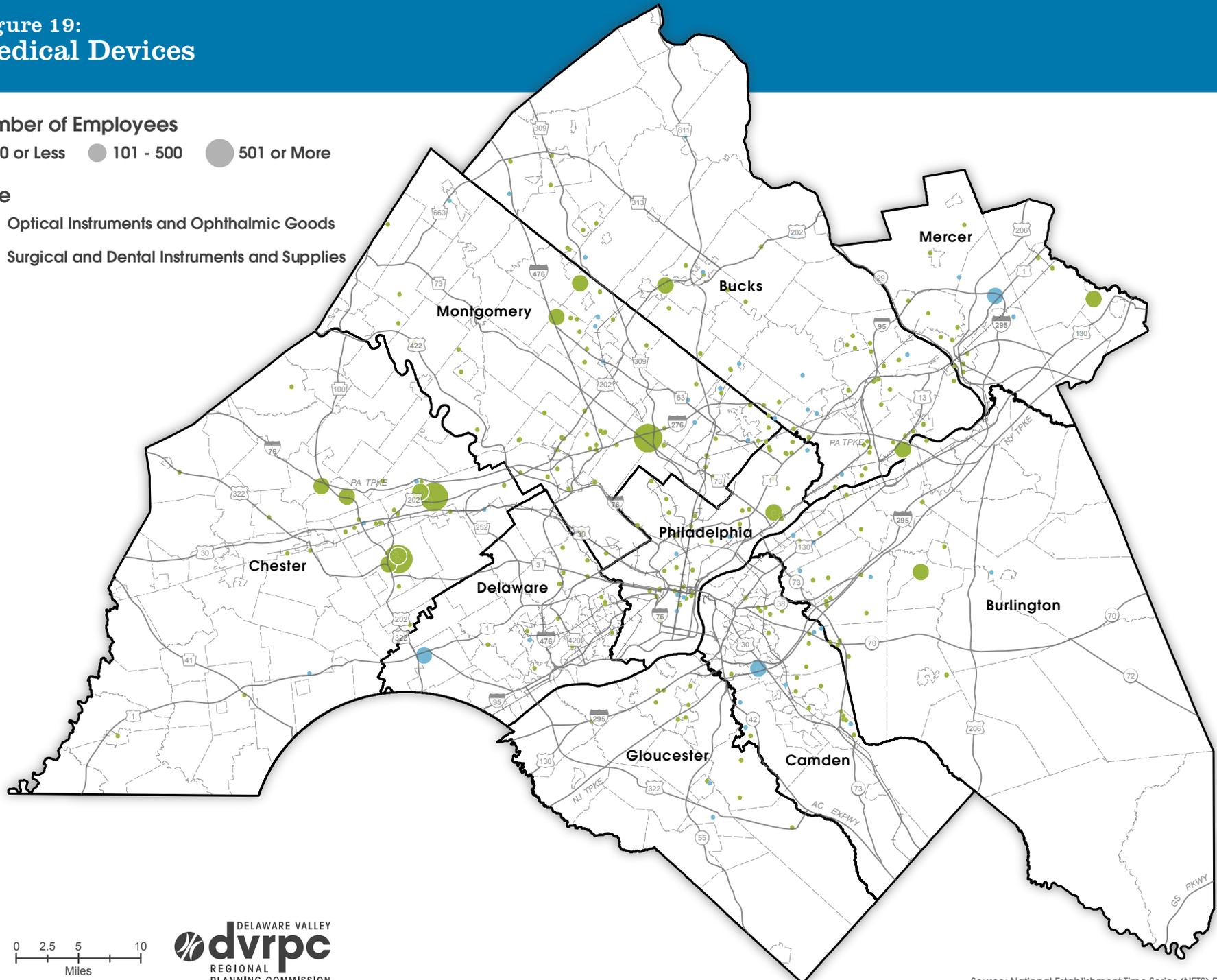
**Figure 19:
Medical Devices**

Number of Employees

- 100 or Less
- 101 - 500
- 501 or More

Type

- Optical Instruments and Ophthalmic Goods
- Surgical and Dental Instruments and Supplies



Source: National Establishment Time Series (NETS) Database, 2010

Summary

This report evaluates the importance and vitality of key regional clusters by considering total employment, location quotients, and the number of basic jobs for clusters of traded industries, as defined by the U.S. Cluster Mapping Project. Research has shown that the synergy effects between clusters result in higher productivity, encourage knowledge spillover and innovation, and facilitate the formation of new businesses. The report also provides a shift-share analysis to identify how much of the regional employment change in each cluster was the result of regional competitiveness rather than national or industry-specific trends, which can shed light on the strengths and weaknesses of specific industries.

The largest traded industry cluster in Greater Philadelphia is the *education and knowledge creation* cluster, with over 133,000 employees. The ideas and services provided by the *education and knowledge creation* cluster, which includes the region's numerous health education facilities, attract money and talent into the region, and create and support synergies with other clusters. Based on total employment, other top clusters include *business services*, *distribution and electronic commerce*, *financial services*, and *hospitality and tourism*.

In addition to the total number of jobs, the report also considers regional economic activity compared to the nation as a whole. Using location quotient analysis, the report identifies 11 basic clusters, defined as clusters that are more heavily concentrated in the regional economy than in the national economy. These basic industries export goods and services and bring in wealth from outside the region. Anchored by *education and knowledge creation*, the region's top six basic clusters, which represent almost 96 percent of the region's basic jobs, are related to one another through the services and products they provide. *Financial services* and *business services* provide financial and capital infrastructure to *biopharmaceuticals* and other manufacturers and enterprises. The symbiotic relationship between R&D and biopharmaceuticals facilitates and enhances the synergy effect between the *education and knowledge creation* and *biopharmaceuticals* clusters.

Two of the region's largest clusters, *education and knowledge creation* and *distribution and electronic commerce*, both gained basic jobs between 2000 and 2010. Job losses in the *financial services* and *business services* clusters, however, easily erased these gains, with a combined loss of almost 25,000 basic jobs during the 10-year period. These two clusters play a vital role in supporting other top clusters, making the need to address the declining number of basic jobs even more urgent.

Five of the region's 11 basic clusters are characterized as strong and growing, being more concentrated in this region than in the nation as a whole and gaining in concentration: *information technology and analytical instruments*, *aerospace vehicles and defense*, *biopharmaceuticals*, *paper and packaging*, and *downstream chemical products*. These strong and growing clusters represent a potential for economic growth and development in the region. An additional six basic clusters are more concentrated in this region, yet stable or declining in relative importance, having either lost jobs between 2000 and 2010 at a faster rate than the nation, or having grown but at a slower rate than the nation. These clusters include *education and knowledge creation*, *business services*; *distribution and electronic commerce*; *financial services*; *media, publishing, and design services*; and *printing services*.

Although three of the region's basic clusters gained jobs between 2000 and 2010 (*education and knowledge creation, distribution and electronic commerce, and biopharmaceuticals*), the shift-share analysis indicates that the job gains in these clusters was primarily due to the growth of each cluster at the national level, rather than to unique regional factors. On the other hand, some of the declines in the region have been partially mitigated by regional competitiveness. Although the *downstream chemical products* and *information technology and analytical instruments* clusters both experienced national declines of approximately 30 percent, for example, their declines were reduced by approximately 17 and 16 percent, respectively, due to regional competitiveness. These clusters may therefore have future growth potential.

This report identifies economic strengths, trends, and opportunities in Greater Philadelphia through an analysis of clusters of traded industries. The report's characterization of industry clusters as strong or weak, and growing or stable, can help identify clusters most vital to the regional economy and guide policy-makers as they decide which industries present the best opportunities for economic growth.

In addition to the key economic clusters identified in this report, Greater Philadelphia has long been known as a leader in life sciences, a broader categorization of related industries that include health care, pharmaceuticals, biotechnology, and all of their related support services. Because many of the industries and services that together make up the life sciences are considered as separate parts of other traded clusters, or are considered to be local industries and are therefore not considered at all in the current report, the full combined extent and impact of life sciences on the regional economy is not readily apparent.

Similarly, the broader categorization of manufacturing includes several economic sectors that are considered herein as individual components of separate traded clusters. Future DVRPC research will explore the regional significance and impact of the broader categorizations of life sciences and manufacturing.



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