State of Delaware Cluster Analysis: Final Report

Prepared for the State of Delaware Economic Development Office:

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# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
<td>3-6</td>
</tr>
<tr>
<td>Preface</td>
<td>7</td>
</tr>
<tr>
<td><strong>Part I: State Context for Health Science Cluster Analysis</strong></td>
<td>8-19</td>
</tr>
<tr>
<td><strong>Part II: Delaware’s Bioscience Cluster - A Model for Health Science Cluster Development</strong></td>
<td>20-22</td>
</tr>
<tr>
<td><strong>Part III: Health Science Cluster Analysis</strong></td>
<td>23-45</td>
</tr>
<tr>
<td>Section One: Introduction and Cluster Definition</td>
<td>23-27</td>
</tr>
<tr>
<td>Section Two: Industry Context for the Health Science Cluster</td>
<td>28-39</td>
</tr>
<tr>
<td>Section Three: Cluster Strategy and Recommendations</td>
<td>40-45</td>
</tr>
<tr>
<td><strong>Appendix: Diagnosis Detail and Methodology</strong></td>
<td>46-54</td>
</tr>
<tr>
<td><strong>Sources</strong></td>
<td>55-56</td>
</tr>
</tbody>
</table>
Executive Summary

Delaware’s economic picture over the last decade shows a state that is diversifying, and one in which many of its stalwart businesses sectors have been losing ground. Financial institutions, chemical manufacturers, and automotive manufacturers have all shed jobs. These job declines have been met with increases in service sector and non-basic employment, which generally pay lower wages. Thus, it is of paramount importance that Delaware attract and retain high paying workers that can create other jobs in the local economy.

Delaware is very advanced in its cluster development. The Delaware Economic Development Office (DEDO) and its six official clusters put Delaware in a very good economic position versus other states in the US. Consequentially, this report focuses on DEDO’s newest cluster, Health Sciences, which was first implemented in 2007. Considering demographic and labor statistics examined in this report, there are four avenues for Health Science cluster development in Delaware:

1) Utilizing the Bioscience Cluster as a model, 2) Nurturing the connection between Health Science and Bioscience, 3) Reforming state tort laws and liability legislation, and 4) Developing export industries within the Health Sciences.

Utilizing the Bioscience Cluster as a model

Using the Bioscience cluster as a model, the Health Science cluster can further develop by replicating the following characteristics of the Bioscience cluster:

- **The Delaware Bioscience Association** - the Health Science cluster must form an organization akin to the Delaware Bioscience Association to increase the cohesion of the cluster as well as promote it and lobby for its interests. The University of Delaware’s Health Sciences Department should be highly visible in this organization, collaborating on research and development, as well as on creative ways to export knowledge in their field.

- **Collaboration (i.e. through the Delaware Biotechnology Institute)** – the Health Science cluster should help fledgling businesses become viable by providing inexpensive laboratory space for those doing Health Science research, and by directly connecting the Health Science cluster with government funding (similar to the Biotechnology Institute). This would significantly contribute to the development of specialized products and to potential advancements in technology that can be exported.
**Outreach** - the Health Science cluster’s outreach efforts should be modeled after the Bioscience Association’s university outreach programs, networking opportunities, and industry organization. Outreach efforts should emphasize the growing demand for Health Science related employment over the next fifty years, as well as the high pay that these jobs offer.

**Nuturing the Connection between the Bioscience and Health Science Cluster**

There is considerable overlap between the Bioscience and Health Science clusters. This overlap occurs in industries such as Drugs and Pharmacueticals, Research and Testing, and Medical Devices and Equipment. According to Wobbekind (2004):

> The interrelationships of bioscience with other emerging technologies will be a significant growth trend in the future. New products and applications will be made possible through the convergence of biotechnology with devices, information technologies, photonics, and nanotechnology...The future also involves the convergence of devices with other technology advances in information technology, biotechnology, drugs, and medical imaging (p. 146-147 – emphasis added).

If the connection between these two clusters is fostered, there is the potential that growth in Health Science could bolster growth in Bioscience and vice-versa. An example of the reciprocal relationship between the two is medical devices enhanced by biotechnology. When the Health Science cluster uses this new Bioscience technology, it may attract individuals seeking cutting-edge treatment to Delaware. This results in the need for more facilities, doctors, nurses, and other health care workers. Additionally, the increase in demand may help promote the context for local Bioscience firm strategy and rivalry - thus creating a supportive environment for innovation. When these new Health care related innovations become available to patients, the cycle can start all over again.

**Reform state tort laws and liability legislation**

Tort reform needs to be considered to enable the state to attract top medical professionals. Increasing the number of doctors in the state, including highly sought after specialists, can go a
long way towards increasing the amount of medical research in the state. Capping the amount that plaintiffs can win in medical malpractice suits, as well as other medical related lawsuits, will greatly increase the number of doctors in the state. These changes, coupled with a business friendly environment, can make the state very attractive to high-end doctors, specialists, and researchers.

Developing export industries within the Health Sciences

Research of demographic statistics shows that Delaware will have the 9th highest proportion of over-65 individuals in the United States by 2030. In addition analysis of labor statistics shows that two of Delaware’s fastest growing sectors (between 2001 and 2006) include nursing and residential care facilities and ambulatory health care services (doctor’s offices, dental offices, etc.). As the population continues to rapidly age it is foreseeable that these industries will continue to grow – and as the sectors develop, there is the potential for them (and others in health science) to contribute to the development of Health Sciences as a traded cluster.

By its definition, the Health Science cluster is a mix of traded and non-traded industries. Because traded industries drive the economy, it is important to identify ways to nurture this area of Delaware’s economy. The issue is that Delaware’s fastest growing Health Science sectors (Nursing and residential care facilities and Ambulatory health care services) are not traded industries. However, this does not mean there are not ways for these fast growing non-traded Health Science industries to spawn traded industries. The combination of over-65 age growth and rapid expansion of health care related sectors could spawn traded industries in the following areas:

- **Old-age Health Care**

  Delaware’s projected high concentration of individuals over-65 will enable health care providers (i.e. nursing and residential care facilities to specialize on specific demographics like never before (i.e. elderly aged 80-82 with multiple health problems). By focusing so intently on specific demographics, health care providers in Delaware may develop health care expertise that can be patented or copyrighted (much like Michael Porter’s industry cluster course) and exported.

  Another way to capitalize on over-65 health care is for Delaware to become a regional
health care center. Much like the Mayo Clinic does for Minnesota, Delaware’s specialized over-65/elderly health care system could attract individuals from outside the state – thus creating a regional export product.

- **Clinical Trials**

  Delaware’s projected high concentration of individual over-65 (often with health complications) and small geographic area will provide a good environment for clinical testing. If Delaware promotes in-state clinical testing, it could attract research from companies outside the state. Ideas on how to market and attract clinical trials include emphasizing the connection between research and the health industry, promoting the adequacy of facilities, and creating a one-stop shop for signing up for clinical trials in Delaware.

  In addition to focusing on development of export industries thought these means, an additional strategy is to develop Delaware’s reputation for sports medicine:

- **Sports Treatment**

  In the same manner as attracting individuals over-65 for health care, Delaware could attract athletes from across the country (and perhaps beyond) to receive sports medicine treatment. According to Simon Condliffe, Ph.D. (facilitator of DEDO’s Health Science Cluster report), various members from US national teams receive sports medicine treatment at the University of Delaware\(^1\). If this relationship is publicized, perhaps Delaware can become a center for sports medicine and attract individuals and money from outside the state.

  Overall, consideration of the Heath Science cluster development opportunities mentioned above will support the Delaware’s already competitive position in the United States and in the global marketplace.

\(^1\) S. Condliffe (personal communication, April 9, 2008).
Preface

This report examines Health Sciences\(^2\) to provide ideas about how to develop the cluster in Delaware. The challenge is that Health Sciences is a mix of traded and non-traded industries, and is considered by most to be a non-traded sector (thus it is of secondary importance to traded sectors such as Bioscience and Automotive Manufacturing). However, according to DEDO Health Science Market Leader, Patty Cannon (2007), “Health care was identified as Delaware’s number one untraded cluster, We’ve proven this [cluster development] works in traded clusters. Health Science wanted a voice too” (as quoted by Grasso, p.30). Since late 2007, the Health Science Cluster has held several meetings, produced a report on the cluster’s current state, and become an officially recognized DEDO cluster. The goal of Health Science cluster development is to “keep the money in Delaware...[and] to work on keeping it in and get[ing] new money into the state” (Cannon, as quoted by Grasso, 2007). This report does just that - identifies ways for Health Science cluster development that will attract and retain money in Delaware.

The development strategy for the largely un-traded Health Science cluster is unique because “An untraded cluster does not focus on exporting a product or service, but rather on identifying what it will take from the local population to make the cluster’s businesses grow and thrive” (Kempner, as quoted by Grasso, 2007). Accordingly, this report focuses on strategies that will help the Health Science cluster’s businesses to grow and thrive: namely through utilizing the Bioscience Cluster as a model for cluster development, nuturing the connection between Health Science and Bioscience, and reforming state tort laws and liability legislation. However, this paper also details potential ways to enhanced the Health Science cluster’s capacity to offer traded services. Although this is un-traditional, the authors propose it as an innovative way to develop a non-traded cluster, and to attract and retain money in Delaware.

This report utilizes three parts and an appendix to provide background context, propose a model, analyze the Heath Science cluster, and give recommendations for the cluster’s development in Delaware.

\(^2\) DEDO’s Official “Health Science and Medical Devices” cluster is referred to as “Health Science/s” throughout this paper. The same is true for “Biotechnology and Life Sciences” - which is referred to as “Bioscience/s.”
Part I: State Context for Health Science Cluster Analysis

Introduction

Delaware was one of the early states to implement a cluster strategy of economic development, and currently has employed several strategies for the six distinct industry clusters within its program. Part one assesses the state’s current economic situation, details its changing economy over the last seven years, looks at demographic trends, describes its current cluster strategy, and describes its emerging industries to provide a state context for Health Science cluster development strategies.

Overall Economic Situation

During the period of 2001 and 2006, Delaware saw a drop in the share of national employment in many of its most prominent industries (i.e. chemical manufacturing and pharmaceutical manufacturing - see appendix).\(^3\) Although many prominent industries lost jobs, enough new jobs emerged to nearly maintain Delaware’s national share of employment (.32% in 2006 vs. .33% in 2001).

These changes reflect a statewide industry trend towards diversification. As of 2007, traditionally large and prominent industries such as chemical manufacturing and finance/insurance were shedding jobs; at the same time, smaller industries such as educational services, transportation and warehousing, and leisure and hospitality were also contributing to the increase of employment.

However, while adding jobs, these smaller industries pay substantially less on average than Delaware’s traditionally prominent industries. For example, the 2005 average wage for the hospitality and tourism cluster was $21,051, and the average wage for the educational services industry in 2006 was $36,012. This is compared to the finance and insurance industry which had an average 2006 wage of $84,603. Job growth through 2014 is expected to occur along the same lines (slow growth in high-paying industries and fast growth in low-paying industries),

\(^3\) 2006 is the most recent source of BLS data. This study uses BLS data for the time period between 2001 and 2006 to advance Michael Porter’s analysis which included data up to 2001.

Delaware’s public polices, laws, and tax systems are structured to create a very business friendly environment; this strategy has been very successful, as the state has managed to attract a high concentration of corporate headquarters. Businesses that drive Delaware’s economy, such as DuPont, Bank of America, and Christiana Care, enjoy no sales tax, business use tax, real estate tax, inventory tax, occupancy tax, or ad-valorem tax (New Castle Airport, 2007). In fact, the Tax Foundation ranks Delaware as having the 3rd lowest tax burden in the United States (Delaware Department of Finance, 2008). Additionally, Delaware’s corporate law encourages companies to incorporate and operate in Delaware through a number of efficient regulatory stipulations. According to Black (2007), companies in Delaware benefit from:

A modern and nationally recognized corporation statute and a well-developed case law that facilitates business planning; the respected Court of Chancery to deal with corporation law issues should they arise; an efficient and user-friendly Secretary of State’s Office; and a legislature that puts a high priority on corporation law matters and is committed to keeping Delaware’s business laws current (p. 10).

Overall, these regulations help Delaware to attract new businesses and retain their operations in the state.
Most Specialized Sectors

The following tables show the diversification that Delaware’s economy underwent between 2001 and 2006. They show that the location quotients of nearly all of the state’s top traded industries fell during this time period. This underscores the need for Delaware to create higher paying jobs in traded sectors.

In the years between 2001 and 2006, Delaware saw its specialization in many key industries fall or remain stagnant. This period saw a drop in super-specialized sectors (sectors with a location quotient above 2.0), from a total of five in 2001 to three in 2006 (Figures 1 and 2 - bolded). Additionally, the range of location quotients for the top five sectors in each period fell from 2.26-3.64 in 2001 to 1.62-2.80 in 2006 (Figures 1 and 2 - numbered).

Some top industries including Managing of companies and enterprises (LQ dropped from 3.64 to 2.08) and Performing arts and spectator sports (2.44 to .97) fell dramatically between 2001 and 2006. However, one of Delaware’s most successful sectors, Credit activities, slightly increased over this period (2.72 to 2.8). This could show that although the economies in Delaware and the nation are struggling, people and businesses are still borrowing at a high rate.

Figure 1: Top 10 Specialized Sectors, 2001

<table>
<thead>
<tr>
<th>Industry</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAICS 551 Management of companies and enterprises</td>
<td>3.64</td>
</tr>
<tr>
<td>NAICS 522 Credit intermediation and related activities</td>
<td>2.72</td>
</tr>
<tr>
<td>NAICS 712 Museums, historical sites, zoos, and parks</td>
<td>2.52</td>
</tr>
<tr>
<td>NAICS 711 Performing arts and spectator sports</td>
<td>2.44</td>
</tr>
<tr>
<td>NAICS 324 Petroleum and coal products manufacturing</td>
<td>2.26</td>
</tr>
<tr>
<td>NAICS 311 Food manufacturing</td>
<td>1.8</td>
</tr>
<tr>
<td>NAICS 518 Data processing, hosting and related services</td>
<td>1.67</td>
</tr>
<tr>
<td>NAICS 325 Chemical manufacturing</td>
<td>1.66</td>
</tr>
<tr>
<td>NAICS 442 Furniture and home furnishings stores</td>
<td>1.46</td>
</tr>
<tr>
<td>NAICS 485 Transit and ground passenger transportation</td>
<td>1.39</td>
</tr>
<tr>
<td>NAICS 515 Broadcasting, except Internet</td>
<td>1.31</td>
</tr>
</tbody>
</table>


Figure 2: Top 10 Specialized Sectors, 2006

<table>
<thead>
<tr>
<th>Industry</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAICS 522 Credit intermediation and related activities</td>
<td>2.80</td>
</tr>
<tr>
<td>NAICS 712 Museums, historical sites, zoos, and parks</td>
<td>2.22</td>
</tr>
<tr>
<td>NAICS 551 Management of companies and enterprises</td>
<td>2.08</td>
</tr>
<tr>
<td>NAICS 311 Food manufacturing</td>
<td>1.95</td>
</tr>
<tr>
<td>NAICS 325 Chemical manufacturing</td>
<td>1.62</td>
</tr>
<tr>
<td>NAICS 442 Furniture and home furnishings stores</td>
<td>1.62</td>
</tr>
<tr>
<td>NAICS 515 Broadcasting, except Internet</td>
<td>1.58</td>
</tr>
<tr>
<td>NAICS 519 Other information services</td>
<td>1.5</td>
</tr>
<tr>
<td>NAICS 713 Amusements, gambling, and recreation</td>
<td>1.49</td>
</tr>
<tr>
<td>NAICS 523 Securities, commodity contracts, investments</td>
<td>1.41</td>
</tr>
<tr>
<td>NAICS 236 Construction of buildings</td>
<td>1.38</td>
</tr>
</tbody>
</table>

The table below shows Delaware’s top ten employment sectors. These sectors are dominated by business and finance related activities (Credit Intermediation, Administrative and Support Services, Professional and Technical Services, and Management of Companies and Enterprises) as well as the service sector (Food Services and Drinking Places, Food and Beverage Stores, and General Merchandise Stores). These top ten job producing sectors employ 51% of Delaware’s labor force. The lack of traded sectors in this table shows the need to develop new traded industries in Delaware.

**Figure 3: Top Ten Employers by Sector, 2006**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAICS 722 Food services and drinking places</td>
<td>29,258</td>
</tr>
<tr>
<td>NAICS 541 Professional and Technical Services</td>
<td>26,500</td>
</tr>
<tr>
<td>NAICS 522 Credit intermediation and related activities</td>
<td>26,470</td>
</tr>
<tr>
<td>NAICS 561 Administrative and support services</td>
<td>22,918</td>
</tr>
<tr>
<td>NAICS 238 Specialty trade contractors</td>
<td>17,818</td>
</tr>
<tr>
<td>NAICS 622 Hospitals</td>
<td>16,562</td>
</tr>
<tr>
<td>NAICS 621 Ambulatory health care services</td>
<td>15,682</td>
</tr>
<tr>
<td>NAICS 551 Management of companies and enterprises</td>
<td>12,017</td>
</tr>
<tr>
<td>NAICS 452 General merchandise stores</td>
<td>9,523</td>
</tr>
<tr>
<td>NAICS 311 Food manufacturing</td>
<td>9,272</td>
</tr>
</tbody>
</table>

Demographic Trends

Important demographic trends are a population that is growing, aging, becoming more diverse, and shifting to new locations in the state. These trends – from the Delaware State Treasurer’s “Facing Forward, a Look at Delaware’s Demographic Future” report (2005) are described below:

Growing Population

Delaware’s population is expected to increase 30.3% (from 783,600 to 1.013 million) between 2000 and 2030. This growth rate is akin to the nation’s population increase during the same period of time (29.2%); is greater than New York, Pennsylvania, and New Jersey; and is less than Maryland and Virginia. The increase in population will be supplemented by a significant in-migration pattern which is expected to continue for the next two decades (p. 4). Overall, the State Treasurer’s report comments that:

“Delaware’s pace of growth is expected to be significant but manageable, in contrast to states like West Virginia and North Dakota, which will face declines in their populations, or Nevada and Arizona, which will confront problems that arise from explosive growth (their populations more than doubling by 2030)” (p. 3).

Aging Population

As the baby-boomers begin to retire, Delaware’s population will grow older on average at a faster rate than the rest of the nation. Between 2000 and 2030, Delaware’s population of those aged 65 and older is expected to increase by 133.8% (from just over 100,000 to just over 230,000) while the nation’s 65 and older population is expected to increase 104.2% (p.7). According to the 2005 report:

In the 2000 Census, Delaware was tied for 21st among the states and the District of Columbia in the share of its population age 65 and older (13 percent). That percentage is projected to balloon by 2030, vaulting Delaware into the top 10 states, at number 9. Delaware is projected to surpass even neighboring Pennsylvania, which ranked second behind Florida in 2000 (p.10).
This pattern means that the same pressures the nation faces with an aging population (i.e. increasing demands on public transit, an increase of demand on the health system, and an overall smaller amount of workers supporting non-workers) will be even more pronounced in Delaware.

Diversifying Population

Delaware’s population is expected to become more diverse between 2000 and 2030, with African Americans and Hispanics leading the increase in minority population. In particular, the African American population is expected to increase by 57.2% (approximately 90,266 people), and the Hispanic population\(^4\) is expected to increase by 107% (approximately 16,454 people). The diversifying population presents many opportunities for Delaware, but also presents challenges because of disparities in education and public health (p.39).

Shifting Population

Between 2000 and 2030 Delaware’s population is expected to continue shifting into Delaware’s two southern counties (Kent and Sussex) and into suburban, ex-urban, and rural locations. Delaware’s population center has long been shifting south from traditional population concentrations surrounding Wilmington (in New Castle County) since World War II. Between 2000 and 2030 New Castle’s proportion of the state’s population is projected to decrease by 6.2%, while Kent and Sussex’s proportions are expected to increase by 2% and 4.3% respectively (p. 17 - see figure 4 on next page). This shift to the southern part of the state will be augmented by retiree’s settling into one-time vacation homes and increasing numbers of retirees moving to Delaware from other states for the low-cost of living and relatively high quality of life (p.21). An increase in population outside of urban areas is expected statewide, but will be most pronounced in Kent and Sussex counties. These changes mean that Kent and Sussex Counties (in particular) will require additional housing, infrastructure,

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\(^4\) The Delaware Population Consortium’s “All other Race/Ethnic Group” designation stands for Hispanics because it is mostly composed of those with Hispanic or Latino origins or backgrounds.
and roads investments – while also creating the potential for increased sprawl, more traffic, and greater congestion (p.1).

**Figure 4: Population Growth by County**

<table>
<thead>
<tr>
<th>Years</th>
<th>Delaware # of Persons</th>
<th>New Castle County # of Persons</th>
<th>% of Population</th>
<th>Kent County # of Persons</th>
<th>% of Population</th>
<th>Sussex County # of Persons</th>
<th>% of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>786,418</td>
<td>501,856</td>
<td>63.8%</td>
<td>127,103</td>
<td>16.2%</td>
<td>157,459</td>
<td>20.0%</td>
</tr>
<tr>
<td>2005</td>
<td>843,540</td>
<td>523,016</td>
<td>62.0%</td>
<td>143,969</td>
<td>17.1%</td>
<td>176,555</td>
<td>20.9%</td>
</tr>
<tr>
<td>2015</td>
<td>939,185</td>
<td>560,980</td>
<td>59.7%</td>
<td>167,094</td>
<td>17.8%</td>
<td>211,111</td>
<td>22.5%</td>
</tr>
<tr>
<td>2030</td>
<td>1,044,105</td>
<td>601,343</td>
<td>57.6%</td>
<td>189,536</td>
<td>18.2%</td>
<td>253,226</td>
<td>24.3%</td>
</tr>
</tbody>
</table>

Source: Facing Forward, a Look at Delaware’s Demographic Future, p. 17.

**Cluster Promotion**

The Delaware Economic Development Office, active since 1981, currently manages six industry clusters: Financial Services, Automotive Manufacturing, Chemistry and Advanced Materials, Biotechnology and Life Sciences, Health Sciences and Medical Devices, and Tourism Industry. DEDO provides various services to promote the development of these clusters within Delaware. The current situations of these clusters - paraphrased from communication with Ross Tyler, DEDO’s Market Development Director⁵ - are described below:

**Financial Services**

- Delaware’s historically strong base in finance and banking has largely maintained its fiscal health in spite of recent sub-prime issues because very few of the state’s banks are involved in mortgages.
- There is particular strength in credit card companies with a recent surge in start-up of small niche market credit and debit card companies.
- Trust companies are continuing rapid expansion.
- Delaware has reviewed some of its laws and is well situated to compete for captive

⁵ R. Tyler (personal communication, February 26, 2008).
insurance markets in an attempt to increase its competitiveness compared to Vermont – the national leader in captive insurance markets⁶.

- Delaware is on the cusp of passing a new progressive tax law designed to attract ultra high wealth asset management investment companies.
- A limited in-state labor pool will be an important challenge for this sector as firms are forced to recruit from outside Delaware to fill employment needs.

Automotive Manufacturing

- Delaware’s automotive industry has witnessed positive growth in the past 12 months. The growth is the result of increased efficiency and growth in plastics. Any negative GDP indicators were the results of layoff that have come and gone.
- The future of Chrysler’s assembly plant in Newark is in question, but DEDO is working to fill underutilized space on-site in an effort to reduce overhead/costs.
- GM is focused on alternative fuel vehicles, with Delaware’s assembly plants competing for the new technology instead of new model types. Delaware’s main competition comes from southern states with less expensive power costs. However, Delaware’s competitive advantage comes from its location in the northeast corridor (Delaware to New York) - which has 135 million inhabitants and would provide a good return on investment on new vehicles produced in-state.
- The automotive companies have a strong relationship with associated plastics suppliers. DEDO’s primary function in this relationship is providing specialized training support or assisting with new site location.

Chemistry and Advanced Materials

- The traditional bulk chemical companies are moving out of Delaware – following national trends.
- The advanced materials sub-cluster is very dynamic and is attracting firms and workers from outside Delaware. The new workers are attracted by Delaware’s low cost of living compared to surrounding states and a high quality of life (i.e. close to beach and ocean).

⁶ Captive insurance markets are primarily composed of captive insurance companies. Captive insurance companies are specialized insurers that provide insurance at lower rates than traditional insurers because they essentially have better knowledge of individual industries.
New firms are attracted by the high intellectual capacity in Delaware and in surrounding areas.

**Biotechnology and Life Sciences**

- DEDO is developing biotechnology at a slower rate than other cluster because of the tendency for emerging companies to be acquired by larger firms outside the state – diminishing the financial return to Delaware.
- The main challenges in this cluster often relate to firm size: large firms function relatively well, medium-sized companies are limited by an inability to pay the high salaries required by the cluster’s workers, and small companies are in need of substantial financing to begin operations.

**Health Sciences and Medical Devices**

- The health science cluster was recently created in 2007. Three cluster meetings have taken place, and the firms have show support of ‘simulation’ as a way to reduce the training and certification process for certain positions. Most firms are in the growth phase and are in common need of recruiting qualified personnel from outside Delaware.

**Tourism Industry**

- Delaware’s tourism cluster is focused on business and weekend business in the northern part of the state and summer vacation-based tourism in the south. Opportunity exists to expand winter tourism in the south.
- The industry is expanding with DEDO’s support of state-wide marketing initiatives.
- The smallness of Delaware facilitates communication between cluster stakeholders including associations, advisory boards, and representative legislators.
Up-and-Coming Industries

In our analysis of the most recent (2001-2006) NAICS data (see appendix), we identified the following subsectors as up-and-coming:

- **Nursing and residential care facilities** – nursing homes, assisted care facilities, etc.
- **Ambulatory health care services** - doctors and dentists’ offices, imaging centers, etc.
- **Food services and drinking places** – restaurants, bars, etc.
- **Merchant wholesalers, nondurable goods** – merchants that sell goods with an average life expectancy of less than three years to other businesses.
- **Nonmetallic mineral product manufacturing** – granite cutters/finishers, brick-makers, ceramic-makers
- **Educational services** - elementary and secondary schools, colleges and universities, and business and trade schools.
- **Air transportation** – industries that provide air transportation of passengers and/or cargo using aircraft such as airplanes or helicopters.

*Up-and-coming* refers to subsectors that represent a proportionally small share of statewide employment, but are growing relatively fast. Considering the context of industry diversification, demographic change, and cluster development by DEDO described above, below are some insights into why a few of these industries are growing so quickly:

**Nursing and residential care facilities and Ambulatory health care services**

The industries in this subsector may be seeing a boost from Delaware’s rapidly aging population and influx of retirees from other parts of the region/country. Between 2001 and 2006 Nursing and residential care facilities added 866 jobs (20.1% growth), and ambulatory health care services added 2,628 jobs (12.8% growth). According to Mullin, Lonergran & Associates (2007), “jobs in these professions (health care and social assistance) are projected to grow the fastest through 2014 in total number of jobs and on a percentage basis” (p. 21).

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7 Without local knowledge it is difficult to postulate reasons behind changes in Merchant wholesalers, nondurable goods and Nonmetallic mineral product manufacturing.
Food services and drinking places

Food services and drinking places may be growing in-part because of Delaware’s shifting population – residents continuing to move to the suburbs and retiree in-migrants locating in Delaware (Sussex County in particular) may be the driving force behind the demand for new restaurants and drinking places. According to Mullin, Lonergran & Associates (2007), “this category (accommodation and food services) is expected to add almost 5,000 jobs by 2014... with almost all of the gain expected in food services” (p. 21).

Educational services

Educational services may also be growing because of increased educational demands placed on the workforce. According to Mullin, Lonergran & Associates (2007), “...it is common for some jobholders to have more than the required level of education and for some employers to give preference to candidates with more education, even when it is not necessarily required” (p. 8). Additionally, clusters like Financial Services and Health Science require high levels of education and are being forced to recruit from outside Delaware. Consequently, there has been increased demand for educational services from workers seeking to compete in the job market. However, Mullin, Lonergran & Associates (2007) caution that “education is projected to grow only about half as fast as it did in the past ten years (1997-2007) – [this] reflects the projected slower increase in Delaware’s school age population over the next ten years” (p. 22).

Air transportation

Delaware’s air transportation subsector is small (153 employed) due to the absence of an international airport or commercial air service out of its smaller airports. The growth in the industry between 2001 and 2006 was most likely due to increased service at one or more of Delaware’s airports. Nonetheless, the opportunity remains for expansion in this industry as Delaware is the only state in the nation without regularly scheduled airline service.
Traded Versus Non-Traded Industries

The industries listed above, with the exception of merchant wholesalers and nonmetallic mineral production, are non-traded (non-basic) industries that respond to changes in traded (basic) employment. As such, it is important for economic development initiatives to focus on basic employment because it is the driver of the local economy. However, the importance of the non-basic economy should not be overlooked. According to Joseph Cortright of Impresa Inc. (a business consulting service), non-basic economic activity often spurs the development of traded clusters. An example is the Oregon microbrew cluster which was spawned by the concentration of independent restaurants in Portland that agreed to carry micro-brewery beer – thus popularizing a product that would not have a competitive chance in chain/franchised restaurants. As a result, non-basic sector restaurants served as an incubator for local microbrewery products that were sold out of state - thus becoming a traded industry which eventually evolved into a traded cluster. Therefore, while the growth in the above non-basic industries may not drive Delaware’s economy, the potential that they may be sources of future traded clusters is worthy of consideration.

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8 J. Cortright (personal communication, April 27, 2008).
Part II: Delaware’s Bioscience Cluster - A Model for Health Science Cluster Development

Introduction

In order to fully understand Delaware’s Health Sciences cluster, it is important to understand how its related Bioscience cluster developed. Part two discusses the steps that the state, its universities, and private firms have taken to grow this cluster because the Health Sciences cluster’s development strategy can partially be modeled on the Bioscience cluster.

Bioscience Cluster Development

Delaware’s Bioscience Cluster, with help from the state and its universities, has become a very successful cluster. The founding of the Delaware Bioscience Association and the Biotechnology Institute are major achievements, and go a long way towards creating a regional and national center for bioscience in Delaware.

Delaware’s current Bioscience cluster is dynamic and includes the following industries: drugs and pharmaceutical firms; agri-biotech and chemicals companies; research and testing companies; medical institutions; and university research departments. The Bioscience cluster accounts for 2.5 percent of total private sector employment and 4.5 percent of all employment. Delaware’s competitive edge is enhanced by: an experienced and skilled workforce, especially within pharmaceuticals; access to state of the art research institutions both in Delaware and surrounding states; the availability of lab space; a supportive business environment; and a high quality of life for employees in the sector. The success of the Bioscience cluster is due to strategic efforts of the various stakeholders through the following measures:

State Efforts

The first step towards developing the Bioscience cluster began when the state, firms, and academic leaders came together to form a Bioscience Task Force, where they identified changes and goals to enhance the cluster. They developed a strategic plan to position Delaware...
to grow the sector. The legislative leaders and policymakers from the state created a state-funded industry/university matching grant program. They also set aside seed money, which was matched by private sector contributions, to set up a statewide bioscience industry organization.

The above steps led to the inception of the Delaware Bioscience Association, with leaders from Astra Zeneca, the Delaware Technology Park, Tapestry Pharmaceuticals, and DEDO. This group primarily helped raise initial funds for the organization, and DEDO continues to provide staff support by developing cluster reports and identifying resources that can fill gaps in the cluster. During the cluster’s early stages, the state analyzed the cluster’s gaps with an industry led working group and suggested the following areas of improvement:

- Academic industry relations;
- Linking bench and clinical research;
- Identifying strategic focus areas for Delaware; and
- Increasing the scale and intensity of networking amongst Delaware bioscience companies and between companies and academic and medical institutions.

The Delaware Bioscience Association

Delaware Bioscience Association has since addressed the above issues. As a non-profit trade association, dedicated to promoting and expanding Delaware’s bioscience industry, it has taken the following steps in response to the issues cited above through:

- **Establishing a unified voice** for the bioscience community in order to accelerate the growth of human, animal, plant, and industrial bioscience

- **Engaging in a collaborative dynamic** amongst firms by:
  - Offering cost saving programs to researchers and firms
  - Creating meaningful networking opportunities,
  - Helping educate and attract a qualified workforce,
  - Communicating information vital to the growth of the bioscience industry
  - Advocating on behalf of the industry in support of public policies that advance bioscience in the state
- **Supporting initiatives that help attract bioscience talent and enterprises** to the State, as well as supporting their retention and growth

- **Developing and implementing communications programs** that build regional, national, and international recognition of and support for Delaware’s vibrant bioscience industry

- **Creating an informative website** detailing the work and accomplishments of the cluster. It also provides news, updates, and a newsletter focusing on new research and various issues pertaining to the cluster

**The Delaware Biotechnology Institute**

The Delaware Biotechnology Institute is a partnership created by the University of Delaware’s Bioscience Department in conjunction with the Bioscience Association and Delaware’s state government. Its mission is to facilitate a biotechnology network. It includes 15,000 square feet of lab space for academic and for profit research, and has garnered $9 million in grants and matching funds from the state and the National Science Foundation. The institutes’ goals include: enhance existing academic and private sector research; catalyze cross-disciplinary researchers and education initiatives; and foster entrepreneurship that creates high-quality jobs. These goals, especially those of engendering cross-disciplinary research, feed directly into the needs of the burgeoning and related Health Sciences cluster.
Part III: Health Science Cluster Analysis and State Strategy for Development

This part of the report discusses the Health Sciences Cluster in Delaware and makes recommendations for its development. This portion of the paper is divided into three sections. Section one is the introduction and defines the Health Sciences cluster. Section two explains the make-up of the cluster. This section details the Health Science’s connection to the Bioscience cluster, as well as models for greater understanding the cluster. These models include a SWOT (Strengths, Weaknesses, Opportunities, and Threats) Analysis, a Value Chain, a cluster map, a Diamond Chart, and a Location Quotient Chart. Section three shows strategies and recommendations for cluster development and provides a conclusion.

Section One: Introduction and Cluster Definition

The Health Sciences cluster is the least developed of the state’s six designated clusters. It is comprised of a mix of traded and non-traded industries. While other clusters are more developed and better understood, Delaware’s economy and demographic trends show a need for an advanced Health Sciences cluster. Jobs in this cluster are high paying, and can cater to a growing population of elderly residents. Delaware has a competitive advantage in this sector due to its location; its demographic characteristics, including an influx of elderly persons as well as a makeup that reflects the nation’s demographic trends; already established anchor businesses including Dupont and Dade-Behring; the highly developed and related bioscience cluster; and its strong research and development subsectors, which include renowned research hospitals and universities.

The largest traded industries in this cluster are medical devices and pharmaceuticals. Delaware contains a very high concentration of medical device firms and employees; this industry employs 3,600 people in the state and is the 28th highest concentration of medical device employees in the nation. This is no small feat considering that Delaware is the 45th smallest state by population. Pharmaceuticals has long been one of Delaware’s strongest industries; however, in the past decade, many firms have moved out of the state. Despite this restructuring, the industry still holds a strong presence in the state. Additional sectors of this cluster that can become traded in coming years include: elderly care; clinical trials; sports training; and research.
Cluster Definition

As defined by DEDO, the Health Sciences cluster contains firms which represent industries such as traditional healthcare service providers, diagnostic and analytical equipment manufacturers, technology products and services, and medical device and instrumentation firms (2008). The Health Sciences cluster is primarily concerned with the development and delivery of health care products, from medical devices to doctor’s visits. In 2006, the Health Science cluster comprised 45,227 jobs and $3.1 billion in Delaware. According to DEDO, the Delaware’s Health Science cluster contains the following industries:

- **Medical Equipment and Supplies Manufacturing (Traded)** – i.e. production of laboratory apparatus and furniture, surgical and dental equipment and supplies

- **Medical, Dental & Hospital Equipment Merchant Wholesalers (Non-traded)** – i.e. distributors of professional medical equipment, instruments and supplies

- **Pharmacies and Drug Stores (Non-traded)** – i.e. establishments retailing prescription or nonprescription drugs and medicines

- **Drugs and Pharmaceuticals Development and Manufacturing (Traded)** - i.e. medical and diagnostic substances

- **Research and Development in Physical, Engineering & Life Sciences (Traded)** – i.e. research in agriculture, computers, and pharmacy

- **Offices of Physicians and Mental Health Specialists (Non-traded)** – i.e. health practitioners with M.D. (Doctor of medicine) or D.O. (Doctor of osteopathy) degrees

- **Offices of Dentists (Non-traded)** – i.e. practitioners with D.D.S. (Doctor of dental surgery) or D.M.D. (Doctor of dental medicine) degrees

- **Offices of Health Practitioners (Non-traded)** – i.e. independent health practitioners (except physicians and dentists)

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9 Sources: Condliffe, 2007, p. 3; Census 2002 NAICS Definitions
• **Outpatient Care Centers (Non-traded)** – i.e. mental health centers or addiction treatment centers

• **Medical and Diagnostic Laboratories (Non-traded)** – i.e. body fluid analysis and/or diagnostic imaging

• **Home Health Care Services (Non-traded)** – i.e. hospice care

• **Ambulatory Services (Non-traded)** – i.e. doctors offices, outpatient care – health services to individuals that are not bedridden

• **Hospitals (Non-traded)** – i.e. facilities that provide medical, diagnostic, treatment services, and research

• **Nursing and Residential Care Facilities (Non-traded and Potentially Traded)** – i.e. nursing and assisted care facilities

**Connection with Delaware’s Bioscience Cluster**

There are many overlaps between the Health Science cluster and the Bioscience cluster in terms of *firms* (i.e. Christiana Care), *operations* (i.e. bioscience research often takes place in research hospitals), and *technology* (i.e. biotechnology used in health care applications)\(^\text{10}\). However, DEDO separates Biotechnology and Life Sciences from Bioscience, and differentiates between the Biotechnology and Life Sciences and Health Science clusters – with Biotechnology and Life Sciences centered around *molecular and cellular processes* and Health Science focused around *medical devices and healthcare delivery*.

\(^{10}\) The Bioscience cluster is comprised of firms that employ life science technologies to develop and commercialize new therapeutics and diagnostics, instruments and devices, services, and products, for improving human health, food production, and the environment. The Bioscience cluster encompasses the firms classified as “biotechnology” - those that use cells and biological molecules for applications in medicine, pharmaceuticals, research and testing, industry, environment, and agriculture (Wobbekind, 2004).

**Although DEDO explicitly separates Biotechnology and Life Sciences from Bioscience, the Bioscience Association does not.** References to the Bioscience cluster in this paper represent the umbrella cluster defined by the Bioscience Association - which includes DEDO’s Biotechnology and Life Sciences cluster.
The Health Sciences and Bioscience clusters overlap in many important industries. Precise areas of overlap between the two clusters are as follows:

1. **Drugs & Pharmaceuticals**: Bioscience research feeds directly into the development of these health care products, which the Health Sciences cluster distributes. This field includes firms that develop and produce medicinal and diagnostic substances. Delaware companies that are part of this subsector include: AstraZeneca, Incyte Corporation, Intervet, Noramco, Schering Plough and SPI Pharma.

2. **Research & Testing**: Biological research is used and conducted by both the Bioscience and the Health Sciences clusters. This field includes firms that are highly research-oriented and seek to commercially advance technologies in drug discovery and delivery systems. Delaware companies that are part of this subsector include: Accugenix, Analytical Biological Services, ANP Technologies, AstraZeneca, Avantix Laboratories, C B Research & Development, Fraunhofer Center for Molecular Biotechnology, Quest Pharmaceutical Services, Stereochemical, Strategic Diagnostics Inc. and TimTec.

3. **Academic Medical Centers and Research Hospitals**: Both clusters benefit and work with these institutions to develop state of the art products. These institutions are characterized as health systems that encourage high standards of quality and have access to the most up-to-date treatments because of affiliation with top-rated medical schools.

4. **Medical Devices & Equipment**: Although included as part of the Health Sciences cluster, the medical devices and equipment industry is closely tied to the Bioscience field. Research conducted in the Biosciences leads directly to the development of medical devices. It includes firms that develop and produce physical products for diagnostics, therapeutics, surgical applications, and supplies and equipment for health care delivery. Delaware companies that are part of this subsector include, Agilent, Dade Behring, Dentsply Caulk, DirectRadiography (Hologic), MIDI, Metler-Toledo (Berger SFC Instruments) and TA Instruments (Waters Corporation).

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11 Battelle (2007) identifies Medical Devices and Equipment as part of the Bioscience cluster while DEDO identifies it as part of the Health Science cluster. This inconsistency is the result of the overlap between the Health Science cluster and the Bioscience cluster.
Because there is so much overlap, growth (even non-traded growth) in the Health Science cluster can produce growth in the Bioscience cluster. Additionally, advancements in the Bioscience cluster can reciprocally benefit the development of the Health Science Cluster (see Section Three: Cluster Strategy and Recommendations).
Section Two: Industry Context for the Health Science Cluster

In 2006, Delaware was aligned with the nation in its share of employment for Health Sciences (LQ of 1). Delaware was specialized in just two out of the 13 Health Science industries (see table below), but had six industries at or above the national share of employment. Nationally, the healthcare jobs that make up the cluster are projected to compromise 12 of the 20 fastest growing occupations through 2014 (Condliffe, 2007, p. 2). These location quotients show a cluster that has many industries at or around the national average in employment. These numbers show a need for these industries to work together to increase their competitive advantage and attract employment to the state.

Delaware Health Science Industry Specialization 2002-2006

<table>
<thead>
<tr>
<th>Industry</th>
<th>2002 LQ</th>
<th>2006 LQ</th>
<th>LQ Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAICS 54171 Physical, engineering and biological research</td>
<td>4.08</td>
<td>2.5</td>
<td>-1.58</td>
</tr>
<tr>
<td>NAICS 44611 Pharmacies and drug stores</td>
<td>1.33</td>
<td>1.4</td>
<td>.07</td>
</tr>
<tr>
<td>NAICS 622 Hospitals</td>
<td>1.12</td>
<td>1.17</td>
<td>.05</td>
</tr>
<tr>
<td>NAICS 6213 Offices and other health care practitioners</td>
<td>1.01</td>
<td>1.07</td>
<td>.06</td>
</tr>
<tr>
<td>NAICS 6211 Offices of physicians</td>
<td>1.02</td>
<td>1.05</td>
<td>.03</td>
</tr>
<tr>
<td>NAICS 3391 Medical equipment and supplies manufacturing</td>
<td>1.07</td>
<td>1</td>
<td>-.07</td>
</tr>
<tr>
<td>NAICS 6219 Ambulatory health care services</td>
<td>.63</td>
<td>.91</td>
<td>.28</td>
</tr>
<tr>
<td>NAICS 6212 Offices of dentists</td>
<td>.87</td>
<td>.88</td>
<td>.01</td>
</tr>
<tr>
<td>NAICS 6216 Nursing and residential care facilities</td>
<td>.70</td>
<td>.82</td>
<td>.12</td>
</tr>
<tr>
<td>NAICS 6216 Home health care services</td>
<td>.93</td>
<td>.76</td>
<td>-.17</td>
</tr>
<tr>
<td>NAICS 6215 Medical and diagnostic laboratories</td>
<td>.53</td>
<td>.68</td>
<td>.15</td>
</tr>
<tr>
<td>NAICS 6214 Outpatient care centers</td>
<td>.67</td>
<td>.59</td>
<td>-.08</td>
</tr>
<tr>
<td>NAICS 4235 Metal and mineral merchant wholesalers</td>
<td>.27</td>
<td>.19</td>
<td>-.08</td>
</tr>
</tbody>
</table>

### Health Sciences SWOT Analysis

#### Strengths
- Delaware’s small size allows for opportunities for partnerships and collaborations, especially with the established bioscience cluster
- Strong demographic trends (aging population, increasing worldwide demand for high quality health care products)
- Favorable business environment
- High quality research institutions (University of Delaware’s Health Sciences Department)
- Highly developed, and related, Bioscience Cluster
- Strong research environment with strong anchor businesses

#### Weaknesses
- Lack of collaboration with universities and publicly funded research (medical devices)
- Shortage of high skilled labor
- Medical liability/tort system makes some research and care risky
- Fewer export industries than most clusters

#### Opportunities
- Lots of opportunity for collaboration with the state, its universities, and the Biosciences cluster
- Increasing investment in research and technology
- Opportunity to lobby for innovative change in tort and liability system
- The development of the Delaware Health Information Network
- Increasing age of population offers opportunities for innovative research, care, and products
- Delaware’s emergence as a center for sports medicine

#### Threats
- Competition with more established health sciences clusters, such as Massachusetts, Connecticut, and Minnesota
- Recruitment and retention of firms and highly skilled workers
- Increasing health care costs
- Over-regulation of the health sciences industry
SWOT Analysis Explanation

Delaware’s Health Sciences cluster has many strengths that should allow for further development. These include the highly developed and related Bioscience cluster, which can offer support to and a model for the Health Sciences cluster (See Section Three: Cluster Strategy and Recommendations). Moreover, a highly developed research industry, which includes international firms such as Dupont, creates good factor conditions for development of new products. The state’s demographic trends, which show a diversifying and aging population can lead to the creation of health sciences research and products. Additionally, the state’s business-friendly environment makes it a great place to locate or start a business.

Weaknesses of the state’s Health Sciences cluster include a lack of export industries; as discussed above, most of the industries not traded. This creates difficulties in growing Delaware’s economy through this cluster. Moreover, employers complain about the lack of highly skilled labor in the state, and the changing makeup of the state’s economy reflects this weakness. The tort and liability laws in the state create barriers for attracting the high quality specialists, who can create the context for ground-breaking research and attract patients from around the nation and the world. Currently, there is a lack of collaboration between the Health Sciences cluster and the research universities; this is a serious weakness for a developing cluster.

There are many opportunities for the development of this cluster. These include the rapidly changing demographics which show an aging population in DE as well as an influx of retirees. This creates the setting for the development of research, products, and care that focuses on this population, which is growing across the country. The state’s powerful Economic Development Organization has the clout to lobby for tort reform legislation that can attract and retain highly skilled employees. Finally, with the U.S. Olympic team training in Delaware, they have an excellent opportunity to develop a strong sports medicine and training center (See Section Three: Cluster Strategy and Recommendations for more detail on opportunities).

The biggest threats to the Health Sciences cluster are the highly developed clusters in Minnesota, Massachusetts, and Connecticut. These clusters are nationally and internationally known, and create barriers to establishing a strong cluster in the same field. Additionally, the Health Sciences field is considered over-regulated at the national level, which also increases barriers to development.
### Health Sciences Value Chain: A Source of Competitive Advantage

#### Firm Infrastructure:
- Economy with 45,000 jobs in Health Sciences (leader in medical technology jobs)
- Revenue of $1.2 billion as of October 2007
- $3.1 billion in gross state product annually
- Established presence of companies such as Dupont and Integrated Biopharma
- Demand created by demographics of the State
- Small State with a strategic location
- Health Care occupations comprise 12 of 20 fastest growing occupations. (BLS)

#### Human Resource Management:
- Concentration of PhDs
- State Loan Repayment Program
- Highest concentration of workers in medical device industry
- Education and training in Delaware Schools (promoting science, math, and tech)

#### Technology Development:
- Research and development through partnerships with Universities within the State
- Analyze other states’ health science clusters
- Medical Institutions such as Delaware Biotechnology Institute
- Strong Industry Investment in R&D

#### Procurement:
- Medical Devices and Instruments
- Buildings
- Machineries

<table>
<thead>
<tr>
<th>Inbound Logistics:</th>
<th>Operations:</th>
<th>Outbound Logistics:</th>
<th>Marketing &amp; Sales:</th>
<th>After-Sales Service:</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Transportation: Port of Wilmington; interstate and local secondary roads</td>
<td>-Hospitals, Ancillary Services</td>
<td>-Transportation: easy distribution within and outside of state due to size and easy flow of products -Disposition of bio-waste</td>
<td>-Advertising, Promotional, Video</td>
<td>-Manufacturing companies, medical supply companies</td>
</tr>
</tbody>
</table>
Health Sciences Value Chain Explanation

The value chain is a tool developed to analyze and create an industry’s competitive advantage by looking at its firm infrastructure, human resource management, technology development, procurement and other specific activities such as its operations, logistics and others.

The firm infrastructure for the Health Sciences Cluster shows the business environment in which the cluster operates. The firm’s infrastructure in this value chain provides a strong base for the Health Science as a strong developing cluster. This value chain provides exposition of how the economy of Delaware supports the Health Science cluster. For example, the Human Resource Management link explains current structures in place for recruitment and training in order to attract new workers; and the technology development link introduces research and development through investment and research by medical and academic institutions. Overall, this value chain shows clearly how the different support activities in Delaware are already in place to help the Health Science develop and blossom similar to its Bioscience counterpart.
Health Science Cluster Map Explanation

The Health Science cluster map is a cross tabulation of various industries. Medical offices, medical services and medical centers, and hospitals are strong local industries which serve local needs and provide a platform for the traded industries. Other important components of the cluster are medical equipments and supply manufacturing, drugs and pharmaceuticals, and research and development - all of which have the potential to be strong traded industries.

Offices of health practitioners, offices of dentists, offices of physicians, and offices of mental health specialists compose the medical office component. This component is important in Health Science cluster because as the aged population continues to grow there is a growing need for medical specialists. Similarly medical services play an important role in the health science cluster. Nursing and residential care facilities, ambulatory services, outpatient care centers and home health care centers compose the medical services component. If Delaware can strengthen medical services, this industry can contribute to the state’s economic development.

A possible traded industry in the Health Science cluster is research and development - which consists of medical research and education and training. This is because Delaware has research institutions and university and medical laboratories that provide facilities for research, an already disproportionately high level of research that has the potential for spin off production, and a high concentration of PhDs that contribute to research and development.

One strength of health science cluster is medical devices and equipments. Medical supplies, information technology, and diagnostic and surgical applications are part of the medical devices industry. Medical devices is a traded industry; and Delaware’s small size contributes to the state’s ability to create the partnerships and collaboration needed to bolster device exports at the international level.

The drugs and pharmaceutical industry is another component of Health Science cluster. The proportionately large number of drug stores is important in supporting medical services. Medical and diagnostic substances, another component of drug and pharmaceutical industry, could potentially be a traded industry because diagnostic substances have worldwide importance in the medical field.
Health Sciences Diamond Chart

**Strategy, Structure, Rivalry**
- Enhance viability by working with firms, the state, and
- Develop a cluster organization with representatives from all firms, as well as universities and state officials
  - Lobby for favorable laws
  - Lobby for grants and funds
  - Up to date information and research sharing
  - Aid to start up firms
  - Community outreach
    - Work with college and high school students to increase visibility
- Work with Bio Science Association and Institute to develop linkages and use overlapping research for innovation
- Work with Universities to increase the workforce’s human capital
- Develop new export industries within the cluster
  - Sports Treatment
  - Elderly Care Research
  - Clinical Trials

**Factor Conditions**
- U. Delaware- Department of Health Sciences
- Business Friendly Tax Laws
- Advanced Bio Sciences Cluster
  - Bio Science Insitute
  - Delaware Bioscience Association

**Demand Conditions**
- Rapidly increasing worldwide demand for medical devices
- Aging population leads to increased demand locally
  - Large influx of retired peoples
- Increasing health and income in developing nations increases export demand
- Need to create and retain highly skilled labor

**Related and Supporting Industries**
- Biological Research
- Plastics and Chemical Manufacturing
- Medical Research
- Health Care Delivery
Health Sciences Diamond Chart Explanation

**Strategy, Structure, Rivalry**

The strategy of the Health Sciences cluster, from the perspective of the state, should be to increase the strength and visibility of the cluster through collaborative work with private firms, the state, and its universities. This collaboration should result in the development of a trade association that can perform the following functions: organize businesses, academics, and state policymakers; lobby for favorable laws; garner grants and funds; share information and increase transparency amongst firms; perform community outreach to raise awareness of the cluster and attract highly skilled employees. This organization should also work with the Delaware Bioscience Association and the Bioscience Institute to develop linkages and use overlapping research for innovation. They should also work with universities by offering internships and training seminars to increase the visibility and attractiveness of the cluster as a career path. This organization should also work to take advantage of growing opportunities in the field related to demographic changes and emerging specialties. These include: sports treatment and medicine, already supported by the training of various US national teams in Delaware; elderly care research, as Delaware’s strong Health Sciences research centers can work with the rapidly growing elderly population to create innovative products and services; clinical trials, as the state has a population makeup that mirrors that of the nation; and the overlap of the Health Science and Bioscience clusters.

**Demand Conditions**

Demand conditions for the Health Sciences cluster include increasing local and worldwide demand for medical devices and health products as the U.S. and local population ages and the international population grows wealthier. The state needs to create and retain highly skilled jobs. With high average wages and high levels of spin-off, jobs in this growing sector should meet this demand.

**Factor Conditions**

The University of Delaware boasts a very strong Health Sciences department with which collaboration is crucial for the success of this cluster. Also, the state’s “business friendly”
environment includes favorable tax rates and support from DEDO to help fledgling businesses and clusters. Additionally, the already present and advanced Bioscience cluster offers a great resource and creates the context for the development of the Health Sciences cluster.

**Related and Supporting Industries**

Biological research, conducted both by the Bioscience cluster as well as the Health Sciences, creates the foundation for Health Sciences products. Plastics and chemical manufacturers create the parts that help make these products; with many chemical manufacturers in Delaware, this creates a large opportunity for collaboration. Medical research, conducted by private firms, research hospitals, and universities, contributes heavily to the delivery of health care products such as medical devices.
1) Metal and mineral merchant wholesalers  
2) Outpatient care centers  
3) Medical and diagnostic laboratories  
4) Home health care services  
5) Nursing and residential care services  
6) Office of dentists  
7) Other ambulatory health care services  
8) Medical equipment and supplies manufacturing  
9) Offices of physicians  
10) Offices of other health practitioners  
11) Hospitals  
12) Pharmacies and drug stores  
13) Physical, engineering and biological research
Health Sciences Location Quotient Chart Explanation

The Health Science location quotient chart can be explained according to the four quadrants shown:

**Quadrant one** shows particularly strong Delaware Health Science industries that are growing - albeit very slowly. These industries are: Offices of physicians, Offices of other health practitioners, Hospitals, and Pharmacies and drug stores. In general, as the population ages and increasing numbers of retirees move into the state and Delaware continues to have a high proportion of older individuals, these industries will continue to grow.

**Quadrant two** shows emerging industries - those that are not yet specialized but have positive growth rates. The industries in this sector are: Medical and diagnostic laboratories, Nursing and residential care services, Office of dentists, and Other ambulatory health care services. Nursing and residential care services and Other ambulatory health care services are the fastest growing Health Science industries; and have been identified as up-and-coming (see appendix).

**Quadrant three** shows non-specialized shrinking industries. The industries in this sector are: Metal and mineral merchant wholesalers, Outpatient care centers, and Home health care services. These industries are the least influential Health Science industries in Delaware.

**Quadrant four** shows specialized industries that are in decline. The industries in this sector are Medical equipment and supplies manufacturing, and Physical, engineering and biological research. Although Medical equipment and supplies manufacturing saw only a small decrease in specialization; Physical, engineering, and biological research saw a precipitous decline - probably the result of a major company or companies relocating out of Delaware. The precipitous decline of this industry in the face of other smaller and growing industries again evidences Delaware’s diversification trend.
Section Three: Cluster Strategy and Recommendations

The health science cluster is in a developmental state compared to the more mature bioscience cluster. Many of the recommendations below are drawn from the current structure of the Bioscience cluster as detailed above, as well as from the development of health sciences clusters in Minnesota, Connecticut, and Massachusetts.

Utilize the Bioscience Cluster as a model

Delaware’s Bioscience cluster is highly developed. This is due to strong collaboration between the state, its universities, and private firms. Since the Health Science and Bioscience clusters overlap in research, there is a lot of information that can be shared. We recommend that the state works with both clusters and the university system to develop a strong cluster organization and facilitate collaboration between the three entities. This is especially needed for the traded industry of medical devices.

The Bioscience cluster’s development is due in large part to the creation of the Delaware Bioscience Association, which serves to: organize firms and increase the viability of startups and small firms; collaborate with the state and universities; lobby state and federal policymakers for favorable laws; and perform outreach in the community through education efforts to increase its visibility and capabilities. The Health Sciences cluster must form such an organization to increase the cohesion of the cluster as well as promote it and lobby for its interests. The University of Delaware’s Health Sciences Department should be highly visible in this organization, collaborating on research and development, as well as on creative ways to export knowledge in their field.

There is an especially strong opportunity to grow the already highly concentrated medical device industry. This industry, along with biological research, overlaps with bioscience in many ways. The umbrella Health Sciences organization should encourage collaboration between these entities and the Bioscience Association to increase markets and inputs for their products; gain leverage in the industry; to gain inexpensive lab space for those doing Health Sciences Research; and help fledgling businesses become viable. The organization can create work to greater transparency in research, leading to an increase in specialized products and advancements in technology.
Nuture the Connection between the Bioscience and Health Science Cluster

As described above, because there is so much overlap, growth (even non-traded growth) in the Health Science cluster can produce growth in the Bioscience cluster and vice-versa. An example of the benefits which stem from nuturing the reciprocal relationship between these clusters is the potential for old age nursing facilities that utilize biotechnologically enhanced medical devices produced in Delaware. According to Wobbekind (2004):

The interrelationships of bioscience with other emerging technologies will be a significant growth trend in the future. New products and applications will be made possible through the convergence of biotechnology with devices, information technologies, photonics, and nanotechnology...The future also involves the convergence of devices with other technology advances in information technology, biotechnology, drugs, and medical imaging (p. 146-147 – emphasis added).

The predicted proliferation of individuals over-65 in Delaware means more old age nursing facilities will be built in the near future. When these facilities use biotechnologically enhanced medical devices, they will benefit the Bioscience cluster by:

- **Increasing local demand conditions** – which enhance the product's local customer base and provides an ideal testing ground for new technology. Because Delaware will have a concentration of over-65 individuals, there is a good opportunity for Delaware bioscience companies to conduct local clinical research (see below). The ability for Delaware companies to conduct local research helps promote the context for firm strategy and rivalry.

- **Supporting the context for firm strategy and rivalry** – compared to other Bioscience firms which produce biotechnologically enhanced medical devices and must research out-of-state, Delaware will have the advantage of testing cutting-edge technologies with local over-65 populations. Because Delaware will have such a high proportion of individuals over-65, they may be able to conduct the tests more efficiently on a representative population.

- **Enhancing the interconnectivity of related and supporting industries** – connections
to the proliferation of old age nursing facilities in Delaware strengthen the relationship between the Bioscience industry and the facilities in the Health Science cluster that utilize biotechnologically enhanced devices. As a result, growth in health care facilities can influence growth in the Biotechnology cluster and the larger Bioscience cluster.

Overall, growth in the Health Science sector creates a more competitive environment for biotechnologically enhanced medical devices. This competitive environment may help produce new technologies in the bioscience sector which can be exported to other parts of the country and the world. Thus, the growth of the largely non-traded Health Science cluster can influence the development of the largely traded Bioscience cluster.

Conversely, development of the bioscience cluster may produce development of the Health Science cluster. If the health science cluster is focused on exporting a specialized environment for the most cutting edge treatments (see Cluster Strategy and Recommendations section below), Delaware’s care facilities that utilize cutting edge technology will be very attractive to out-of-state individuals. When the out-of-state individuals visits Delaware facilities for cutting edge treatment, they spend money that benefits the local economy – more individuals seeking treatment equals an increased demand for facilities, nurses, doctors, and a whole plethora of supporting industries. Thus, not only does an expanding/cutting edge bioscience cluster induce growth in the health science cluster, it can also benefit other industries in Delaware (i.e. the construction industry, the security industry, and/or office/residential furniture manufacturers/wholesalers).12

Reform State Tort Laws and Liability Legislation

The reformation of tort reform laws in Delaware should help stabilize the Health Science cluster from shocks due to medical malpractice suits against lawyers, doctors, and researchers. It will also go a long way towards attracting the “creative class” of doctors and researchers, creating higher paying jobs and greater job creation in supporting sectors.

The best way to accomplish these goals is to work with lawmakers to cap the potential amount of money rewarded to plaintiffs in lawsuits. This cap, implemented in a handful of states including Texas, will make the state more attractive to young doctors graduating from medical school. Moreover, once this tort reform is accomplished, Delaware can advertise to medical schools and specialists across the country to attract these high demand employees.

12 Without first-hand industry knowledge it is difficult to define specific ways to nurture the overlap between Health Science and Bioscience - although medical devices may be a good starting point.
Thus, tort reform coupled with the state’s pro-business environment and favorable tax rates will go a long way towards attracting an educated workforce.

An influx of high concentration of doctors and specialists can reverberate across the Health Sciences Sector, making the area more attractive for research and development. Additionally, it can make the state a regional center for certain doctors, who export their specialties to patients from across the region and the nation.

**Develop Export Industries within the Health Sciences**

As shown above, the Health Science cluster is a mixture of traded industry sectors (i.e. medical equipment and supplies manufacturing) and non-traded industry sectors (i.e. drug stores and physicians offices). However, the majority of activities in the cluster are non-traded. Three ways to develop the traded capacity of the cluster are by focusing on old-age health care for Delaware’s pending large proportion of individuals over-65 (9th highest in the nation by 2030), promoting US National Team sports treatment at the University of Delaware, and promoting Delaware as an ideal location for clinical trials.

**Old-age Health Care**

Delaware’s projected high concentration of individuals over-65 will create a unique situation that hospitals, dentists, and other service providers can capitalize on. Because those over-65 will be such a large proportion of the population, service providers will be able to specialize on specific demographics like never before (i.e. elderly aged 80-82 with multiple health problems). By focusing so intently on specific demographics, health care providers in Delaware may develop particular expertise in health care niches that can be marketed to other parts of the nation and other parts of the world. If this expertise is patented or copyrighted (much like Michael Porter’s industry cluster course) perhaps expertise in elderly care can be sold. Outside of the United States, potential short-term customers are rapidly aging industrialized countries, and potential long-term customers are developing countries that currently have grossly disproportionate numbers of young persons (i.e. Mexico).

Another way to capitalize on over-65 health care is for Delaware to become a regional health care center. Much like the Mayo clinic does for Minnesota, Delaware’s elderly health care system could attract individuals from outside the state – thus creating a regional export product. An example is an elderly individual from New York that is attracted to Delaware because of
better health care service (lower health-care provider to patient ratios) and lower costs. The family from New York would pay for this individual to stay (or receive temporary care) in Delaware – thus creating new health care provider jobs and boosting the state’s economy.

Sports Treatment

In the same manner as attracting over-65 individuals for health care, Delaware could attract athletes from across the country (and perhaps beyond) to receive sports medicine treatment. According to Simon Condliffe Ph.D., various members from US national teams receive sports medicine treatment at the University of Delaware. If this relationship is publicized and developed, perhaps Delaware can become a center for sports medicine. In the same manner as becoming a regional health care center (above), Delaware could attract individuals and money from outside the state. By attracting money and patients from outside, Delaware’s in-house sport treatment export activity would help develop the Health Science cluster in the following two ways:

- **Increasing employment** – the inflow of money created by a specialization in sport medicine will support additional employment in other Health Science industries such as Offices of health practitioners, Medical equipment and supplies manufacturing, and Ambulatory services.

- **Creating an environment or new products and innovation** – the specialization around sports medicine may create the perfect factor conditions for new medical products and innovation. Similar to the health care strategy describe above, specialization has the ability to create the unique environment required for innovation that will help the Health Science cluster move toward advanced stages of development.

Clinical Trials

Delaware’s projected high concentration of individuals over-65 and small geographic area will provide a good environment for clinical testing. This is because clinical testing is based on disease/health problem concentrations, and a projected high proportion of individuals aged

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13 S. Condliffe (personal communication, April 9, 2008).
14 P. Cannon (personal communication, April 23, 2008).
over 65 means a significant portion of the population may be facing similar health complications. If Delaware were to promote itself as an ideal place for clinical testing, it could attract research from companies outside the state – thus exporting a characteristic of the over-65 population. The challenge comes in how to market clinical testing because it is controversial to promote the concentration of a disease or health problem. Ideas on how to market and attract clinical trials include emphasizing the connection between research and the health industry, promoting the adequacy of facilities, and creating a one-stop shop for signing up for clinical trials in Delaware. Attracting clinical trials to Delaware would help develop the Health Science cluster in the following two ways:

- **Supporting research and development** – Delaware Health Science companies that currently conduct clinical trials outside Delaware can save time and money by conducting them in-state. This contributes to the context for firm strategy and rivalry by allowing Delaware companies access to greater efficiency and productivity.

- **Enhancing the link between hospitals and research** – the hospital or health care facility is where the Health Science cluster interacts with the Bioscience cluster. Additional Health Science and Bioscience research bolstered by additional clinical trials in Delaware contributes to the state’s potential for technological innovation.

**Conclusion**

The development of the Health Sciences cluster is especially important to Delaware. Delaware’s share of employment in high paying sectors has declined over the past decade, and has been replaced by lower paying service sector jobs. Jobs in the health sciences cluster, from nursing positions to medical device manufacturers, are higher paying than service sector jobs and create spin-off jobs at a high rate. Specifically, Delaware wishes to attract the “Creative Class,” and our recommendations, which include outreach efforts, collaboration to strengthen the cluster, and tort reform, can go a long way towards attracting highly skilled employers to the state.

A strong Health Sciences cluster is necessary for Delaware to keep up with rapidly changing demographics and job losses in established sectors. While many of the industries in the Health Sciences cluster are non-traded, at the very least they support crucial, high paying Health Sciences and Biosciences jobs; at most, innovative work between the state, universities, and private firms can grow the Health Science cluster’s traded capacity.
Appendix: Diagnosis Detail and Methodology

I. Methodology

We used the Location Quotient technique and updated Michael Porter’s 2002 specialized cluster report for our analysis. The most current (2001-2006) BLS information provided the data for this report. First, we examined the top 10 specialized sectors for 2001 to 2006. This gave us a good snapshot of Delaware’s economy based on the most recent information. Examining the data further, we found that Electronics sector was the fastest growing, and thus chose it for further analysis. Next, we examined complete employment data from the years 2001-2006 (79 out of 93 sectors) to identify and chart particularly strong and up-and-coming industries in Delaware.

II. Specialization of the Delaware Economy – Location Quotient Results

In the years between 2001 and 2006, Delaware saw its specialization in many key industries fall or remain stagnant. This period saw a drop in super-specialized sectors (sectors with a location quotient above 2.0), from a total of five in 2001 to three in 2006 (Figures 1 and 2 - bolded on next page). Additionally, the range of location quotients for the top five sectors in each period fell from 2.26-3.64 in 2001 to 1.62-2.80 in 2006 (Figures 1 and 2 - numbered on next page). This demonstrates that Delaware’s economy has been in rapid fluctuation over this period compared to the national economy.

15 Location Quotients taken at the 3-Digit NAICS Level
### Figure 1: Top 10 Specialized Sectors, 2001

<table>
<thead>
<tr>
<th>Industry</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAICS 551 Management of companies and enterprises</td>
<td>1)</td>
</tr>
<tr>
<td>NAICS 522 Credit intermediation and related activities</td>
<td>2)</td>
</tr>
<tr>
<td>NAICS 712 Museums, historical sites, zoos, and parks</td>
<td>3)</td>
</tr>
<tr>
<td>NAICS 711 Performing arts and spectator sports</td>
<td>4)</td>
</tr>
<tr>
<td>NAICS 324 Petroleum and coal products manufacturing</td>
<td>5)</td>
</tr>
<tr>
<td>NAICS 311 Food manufacturing</td>
<td></td>
</tr>
<tr>
<td>NAICS 518 Data processing, hosting and related services</td>
<td></td>
</tr>
<tr>
<td>NAICS 325 Chemical manufacturing</td>
<td></td>
</tr>
<tr>
<td>NAICS 442 Furniture and home furnishings stores</td>
<td></td>
</tr>
<tr>
<td>NAICS 485 Transit and ground passenger transportation</td>
<td></td>
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<tr>
<td>NAICS 515 Broadcasting, except Internet</td>
<td></td>
</tr>
</tbody>
</table>


### Figure 2: Top 10 Specialized Sectors, 2006

<table>
<thead>
<tr>
<th>Industry</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAICS 522 Credit intermediation and related activities</td>
<td>1)</td>
</tr>
<tr>
<td>NAICS 712 Museums, historical sites, zoos, and parks</td>
<td>2)</td>
</tr>
<tr>
<td>NAICS 551 Management of companies and enterprises</td>
<td>3)</td>
</tr>
<tr>
<td>NAICS 311 Food manufacturing</td>
<td>4)</td>
</tr>
<tr>
<td>NAICS 325 Chemical manufacturing</td>
<td>5)</td>
</tr>
<tr>
<td>NAICS 442 Furniture and home furnishings stores</td>
<td></td>
</tr>
<tr>
<td>NAICS 515 Broadcasting, except Internet</td>
<td></td>
</tr>
<tr>
<td>NAICS 519 Other information services</td>
<td></td>
</tr>
<tr>
<td>NAICS 713 Amusements, gambling, and recreation</td>
<td></td>
</tr>
<tr>
<td>NAICS 523 Securities, commodity contracts, investments</td>
<td></td>
</tr>
<tr>
<td>NAICS 236 Construction of buildings</td>
<td></td>
</tr>
</tbody>
</table>


Some top industries including Managing of Companies and Enterprises (LQ dropped from 3.64 to 2.08) and Performing Arts and Spectator Sports (2.44 to .97) fell dramatically between 2001 and 2006. However, one of Delaware’s most successful sectors, Credit Activities, slightly increased over this period (2.72 to 2.8). This could show that although the economies in
Delaware and the nation are struggling, people and businesses are still borrowing at a high rate. Although many industries lost or at most maintained their economic activities between 2001 and 2006, four industries among others showed dramatic growth that pushed them into specialized territory (Figure 3). These emerging sectors include Electronic markets and agents and brokers, which saw its location quotient grow 166% from .42 to 1.12.

**Figure 3: Fastest Growing Sectors by Location Quotient**

<table>
<thead>
<tr>
<th>Industry</th>
<th>2001 LQ</th>
<th>2006 LQ</th>
<th>% LQ Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAICS 425 Electronic markets and agents and brokers</td>
<td>0.42</td>
<td>1.12</td>
<td>166.67</td>
</tr>
<tr>
<td>NAICS 713 Amusements, gambling, and recreation</td>
<td>0.85</td>
<td>1.49</td>
<td>75.29</td>
</tr>
<tr>
<td>NAICS 493 Warehousing and storage</td>
<td>0.74</td>
<td>1.22</td>
<td>64.86</td>
</tr>
<tr>
<td>NAICS 525 Funds, trusts, and other financial vehicles</td>
<td>0.68</td>
<td>1.04</td>
<td>52.94</td>
</tr>
</tbody>
</table>


Overall, though 2001-2006 saw a fall in the range of the top five industries’ location quotients, the number of specialized industries grew over this period. In 2001, Delaware had 28 specialized industries, and in 2006 this number rose to 32 – a positive occurrence for Delaware’s competitive outlook.

**III. Specialization of the Delaware Economy – Update of Michael Porter’s 2002 Analysis of Specialization by Traded Cluster**

The graph below is from Michael Porter’s 2002 analysis of the Delaware state economy. It identifies the leading clusters in Delaware for the years 1990-1999. The industries labeled on the upper right represent Delaware’s strongest, most dynamic clusters - they have a proportionally large share of national cluster employment and are gaining ground. The industries on the lower right represent potential future opportunities – they have a proportionally small share, but are growing relatively fast. The y-axis of the graph shows Delaware’s percentage share of the national employment in each cluster in 1999, while the x-axis shows percentage of change in employment over time.
The next graph updates Porter’s traded cluster analysis with data from 2001-2006. The classification scheme (2-5-digit NAICS codes) may not directly align with Porter’s cluster definition, but gives a general idea of Delaware’s prominent traded clusters.
Comparison between the 2002 Porter report and 2001-2006 data

- Despite many industries declining over between 2001 and 2006, Delaware maintained its share of the national employment (.33% in the 2002 report vs. .32% in 2006, Figures 5 and 6). This shows that despite many industries losing employment relative to the nation, there are enough emerging industries to maintain their overall national share of employment.

- Credit/finance related services are still Delaware’s strongest industries.
Presumably, real estate related industries were particularly strong between 2001 and 2006 (building material and garden supply stores, construction of buildings, and furniture and home furnishings stores).

IV. Specialization of the Delaware Economy – Delaware’s Strongest/Most Dynamic Industries

Figure 6: Delaware’s Strongest/Most Dynamic Industries

Delaware’s strongest/most dynamic industries are located in the upper right hand corner of the chart below (closest to the chart’s extremities). They represent industries with higher than average location quotients and positive growth rates.

Delaware’s Strongest/Most Dynamic Industries with Employment Figures:

1) NAICS 522 Credit intermediation and related activities (total employment: 26,470)\(^{16}\)
2) NAICS 311 Food manufacturing 9,272
3) NAICS 515 Broadcasting, except Internet 1,674
4) NAICS 442 Furniture and home furnishings stores 3,060
5) NAICS 523 Securities, commodity contracts, investments 3,756
6) NAICS 444 Building material and garden supply stores 4,981
7) NAICS 236 Construction of buildings 7,985
8) NAICS 525 Funds, trusts, and other financial vehicles 309
9) NAICS 713 Amusements, gambling, and recreation 6,674

Notable omissions from the graph include:

- NAICS 425: Wholesale electronic markets and agents and brokers
  - .36% share of national employment in 2006
  - 240% percent change in employment (2001-2006)
  - 2,833 employed statewide in 2006

- NAICS 493: Warehousing and storage
  - .39% share of national employment in 2006
  - 102% percent change in employment (2001-2006)
  - 2,475 employed statewide in 2006

\(^{16}\) Industries chosen by visual assessment. Numbers (1-9) are only for identification purposes - they do not represent rank.
Figure 7: Delaware’s Potentially Up-and-Coming Industries

Delaware’s potentially *up-and-coming* industries are located in the lower right hand corner of the chart below. The numbered industries are those that are very close to achieving above average location quotients and that have fast growth rates.

**Delaware’s Potentially Up-and-Coming Industries with Employment Figures:**

1) NAICS 623 Nursing and residential care facilities 7,652
2) NAICS 722 Food services and drinking places 29,258
3) NAICS 424 Merchant wholesalers, nondurable goods 6,479
4) NAICS 531 Real estate 4,737
5) NAICS 621 Ambulatory health care services 15,682
6) NAICS 327 Nonmetallic mineral product manufacturing 1,024
7) NAICS 611 Educational services 4,225
8) NAICS 481 Air transportation 153

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17 Industries have average shares lower than the state’s (.32%) and 2001-2006 employment growth greater than 10%. Numbers (1-8) are only for identification purposes - they do not represent rank. Number 4 (real estate) is based on 2001-2006 data, and does not take into account the recent downturn in the housing market.
Sources


