What Will It Take to Support New Jersey’s Industry Clusters?

April 2013

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PlanSmart NJ is an independent, non-profit planning and research organization committed to improving the quality of community life through the advancement of sound land use planning and regional cooperation. With over four decades of experience shaping land use policy in the state, PlanSmart NJ balances expertise and real-world contexts in framing issues to find constructive solutions, create innovative tools and strategies to better inform land-use decision-making in NJ. PlanSmartNJ believes that our state's challenges in the areas of economic development, transportation, housing, regional equity, and the environment are linked -- and most holistically addressed -- through the common nexus of land use. Through more sensible land use planning, we can mobilize and build upon our tremendous assets. PlanSmartNJ adopts a regional planning approach to foster balance between environmental and economic interests, with the goal of creating a sustainable future for all New Jersey residents.

The New Jersey Chamber of Commerce

Created in 1911, the New Jersey Chamber of Commerce is a business advocacy organization based in Trenton that works for and is funded solely by members ranging from solo proprietors to Fortune 500 companies. Members of the New Jersey Chamber represent every industry doing business in the state and include New Jersey's most prestigious and innovative companies. New Jersey Chamber lobbyists interact daily with key legislators in Trenton to discuss ways to ease the tax burden, reduce burdensome regulation and generate economic growth. Located across the street from the State House enables staff to react and mobilize quickly to the rapid events that unfold in the state's capital. The New Jersey Chamber's reach extends to Washington, where members are represented in the halls of Congress and at the White House. Whether you own a business, represent one, lead a corporate office, or manage an association, the New Jersey Chamber of Commerce provides members with a voice of experience and influence in Trenton. The Chamber also provides members with networking events that offer access to decision makers in Trenton as well as top business leaders across the state. From the Chamber's inception – Thomas Edison was a founding member in 1911 – the organization's talented leaders have provided the guidance necessary to develop solutions to the important and tough issues of the day with the singular goal of creating a prosperous economy for New Jersey.
Authors

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What Will It Take to Support New Jersey’s Industry Clusters?
Executive Summary

This report, What Will It Take To Support New Jersey’s Regional Innovation Clusters (RICs), provides the results and interpretation of a collaborative research project completed by the New Jersey State Chamber of Commerce and PlanSmart New Jersey. The Chamber and PlanSmart NJ conducted this project to explore the concept of Regional Innovation Clusters (RICs), a theory that is explicitly promoted as a means to achieve targeted economic growth in various state level economic development initiatives. This report documents the relationship between New Jersey’s industry clusters and the state’s existing infrastructure to evaluate how infrastructure investment and economic development align on the ground.

The report generated the following findings:

- All eight industries exhibit a clustering pattern which is supported by the Nearest Neighbor Ratio statistic and visual map observations.
- The Life Sciences, Healthcare, Finance, Technology, and Transportation, Logistics, and Distribution industries are more concentrated in New Jersey than the rest of the country.
- The Life Sciences and Healthcare industries are considered strong and growing industries within the state.
- Research shows that both hard infrastructure and soft infrastructure, such as higher education institutions, play a critical role in the development and prosperity of industry clusters.
- A relationship exists between the location of employment density and the state’s existing infrastructure as evidenced by the report’s eight unique cluster maps.
Section 1 of this report explains industry cluster theory and lists examples of successful RIC initiatives implemented around the country. Section 2 records the methodology used to complete this report. Section 3 analyzes eight industry clusters identified through the advisory board feedback process: life sciences; healthcare; advanced manufacturing; finance; technology; transportation, and logistics, and distribution; aerospace and defense; and tourism. Following this list, in section 4 is an overview of the hard and soft infrastructure needed to support the state’s eight industry clusters including: transportation, water and sewer, power, telecommunications, business parks and industrial facilities, higher education institutions, hospitals, institutions for collaboration, and quality of life. Section 5 utilizes mapping to visually demonstrate the linkages between the eight key industries described in Section 3 and infrastructure described in Section 4. Section 6 concludes future initiatives that are planned as a result of this study. The appendix contains two case studies that will examine the clustering of the life sciences industry in Princeton and the effects of Superstorm Sandy on the tourism industry and infrastructure at the Jersey Shore.

This report is meant to serve as a starting point to spur further research on the relationship between industry and infrastructure in New Jersey. We hope that the knowledge gained from these analyses can spark meaningful discussion and policy ideas that can further the goals of state level initiatives concerned with but not limited to regional innovation clusters, economic development incentives and future state planning efforts.
What Will It Take To Support New Jersey’s Regional Innovation Clusters (RICs)?

Introduction

In October 2011, the Christie/Guadagno Administration released the New Jersey’s Draft State Strategic Plan for Development and Redevelopment, which established four goals to prioritize the themes of smart growth, preservation, sustainability, and good governance within the state’s planning process. To differentiate itself from the existing statewide planning framework, the Draft State Strategic Plan identified specific industries that prove valuable to New Jersey and advocated for strategic investment in the physical and cultural infrastructure that enable these industries to thrive in the Garden State.

Additionally, top tier state level initiatives have been created with the intention of supporting economic and workforce development for New Jersey’s top industries. Choose New Jersey, through marketing, business attraction and lead generation, markets New Jersey as an ideal location for businesses to take advantage of extensive infrastructure and a highly educated workforce. The New Jersey Talent Network’s helps connect businesses in New Jersey’s top industry clusters with education institutions, workforce development agencies, government and community groups to identify the skills and training Garden State employers require to remain competitive in the global market.

By way of their backgrounds, the New Jersey State Chamber of Commerce, an independent voice representing a broad base of small, medium and large businesses, and PlanSmart New Jersey, a planning and research organization committed to improving the quality of community life through the advancement of sound land use planning and regional cooperation, found the plan’s discussion of balanced economic growth and environmental preservation to be a useful framework. The two organizations formed a partnership in late 2011 to investigate the relationship between New Jersey’s industry clusters and its existing infrastructure to evaluate how the state’s goals of strategic investment and economic development align on the ground. This report, “What Will It Take To Support New Jersey’s Regional Innovation Clusters (RICs)” provides the results and interpretation of the collaborative research undertaken by the New Jersey State Chamber of Commerce and PlanSmart New Jersey.

INTRODUCTION
Regional Innovation Clusters (RICs)

The State of New Jersey, as a means to achieve “targeted economic growth,” explicitly promotes the development and expansion of Regional Industry Clusters (RICs). Cluster theory, the foundation of RICs, anchors its origins to the nineteenth century economist, Alfred Marshall, and his book, *The Economics of Industry*. In this publication, Marshall explained that social and political conditions impact market forces such as supply and demand, cost of production, and marginal utility, which in turn influence industrial location. In contemporary times, cluster theory experienced resurgence when Harvard Professor Michael Porter tied the theory to his well-known writings on competition, business strategies, and globalization. Porter’s work defines industry clusters as geographic assemblages of related companies that simultaneously compete and cooperate with each other (Porter, 1998: 197). According to Porter, clusters take on various forms, but they typically include:

“…end-product or services companies; suppliers of specialized inputs, components, machinery, and services; financial institutions; and firms in related industries…firms in downstream industries (that is, channels or customers); producers of complementary products; specialized infrastructure providers; government and other institutions providing specialized training, education, information, research and technical support (such as universities, think tanks, vocations training providers); and standards-setting agencies,” (1998: 199).

RICs demonstrate the characteristics associated with cluster theory while also including the principles of regional development and business innovation to provide a holistic approach to industrial growth.

RICs offer a number of benefits that make them a vital element in the restructuring and revitalization of local economies. According to Porter, RICs increase an area’s competitive edge because companies located in clusters prove more productive, highly innovative, and better able to create spinoffs or closely associated business activities that boost local employment (Porter, 1998). The proximity between businesses within a cluster enables companies to access
high quality research and development information, build stronger relationships with their suppliers and customers, and network beyond their internal employment base. Additionally, the interconnectedness of clusters and supportive infrastructure and/or institutions within RICs allows companies to speed up the creation and distribution of goods and services. It also provides businesses with an opportunity to unite together and advocate for policies that foster strong business communities.

Dr. John Lechleiter, the Chairman, President and CEO of Eli Lilly believes that “federal policy plays a key role in the success of regional economic clusters at both the micro and the macro level” (Lechleiter, 2010). In line with this logic, the Federal Government put forth several initiatives to support RICs. In 2010, the Small Business Administration established two programs within its Regional Cluster Initiative that offered a total of $600,000 in funding to support the growth of 15 different RICs throughout the country (Byrne, 2012). In the 2011 budget, two line items sought to financially support the development of RICs: a provision of monies to encourage gathering of information on successful regional economic clusters and a line item for grants to help foster the expansion of emerging RICs. In May 2012, fourteen federal agencies launched the $26 million Advanced Manufacturing Jobs and Innovation Accelerator Challenge. This program awards financial and technical assistance to applicant enterprises that retain jobs, create jobs, and/or provide training to prepare job seekers for careers in the field of advanced manufacturing (Atwood, 2012).

The Brookings Institution, a Washington D.C. based policy and research think tank, confirms that well-designed policies, especially those at the state level, prove instrumental to the formation and growth of successful RICs. According to an article published by Brookings, RICs offer state and local leaders a vision for prosperity that includes stakeholders. Cluster strategy also unites all of the various state and federal resources for encouraging economic growth under one guiding theme of Local Economic Development (LED). While gridlock in Congress and recessionary economic trends negatively impact growth at the state level, Governors can deflect these impediments if they “leverage clusters to drive their economic competitiveness efforts” (Muro and Fikri, 2011). The Brookings Institution adds that effective cluster strategies typically involve: the application of rigorous data analysis to determine clusters; the provision of grants, disbursed in amounts proportional to cluster performance; and the reorganization of existing
programs into one cohesive set of pro-growth policies. The RIC initiatives found in California, Maine, and Ohio described below exemplify other statewide strategies for promoting industry clusters:

- **California Innovation Hub (iHub) Initiative**: The State of California’s iHub initiative looks to designate certain regions in the state as iHubs (another iteration of RICs) and then leverages those area’s assets, which may include industry parks, university campuses, federal laboratories, and trade groups, to bolster its economic competitiveness and encourage local investment. In total, California designated 12 regions as iHubs and most of them contain industries associated with “clean and green” technologies. For instance, the Sacramento iHub specializes in clean and medical technologies, while the North State iHub deals with renewable energy, biofuels, and advanced material manufacturing (Governor’s Office of Business and Economic Development, 2012).

To date, the iHub program engendered two projects that advance its goals for local economic development. One development, Sonoma Mountain Village, exists as a zero waste and zero carbon community built on a former factory site. The Village, which functions as a business incubator, contains “green,” sustainable features. One of the companies locating at the village, a modular steel framing manufacturing facility, obtains 100 percent of its operating power from solar energy and produces zero waste. There is also a water plant that uses green infrastructure to treat and manage water at the site, an exemplary model for new development in California. This project demonstrates the strength and attractiveness of the emerging green economy. Companies like DC Power, Comcast, and AT&T signed on to lease space and the project is expected to generate about 4,000 jobs at full buildout. Another project, the March LifeCare Campus, is being constructed in Riverside as a self-contained healthcare facility that offers high-quality healthcare facilities, nursing services, and treatment centers along with amenities not typically found in a hospital like a spa, retail shops, and entertainment places. March LifeCare will replace the former March Air Force Base, creating about 12,000 construction jobs and 7,000 permanent jobs in the
health care industry at this previously abandoned and underutilized site.

• **The Maine Technology Institute (MTI):** Funded by the state of Maine, MTI is a non-profit corporation that provides start-up capital and other resources to promote the development of new technologies, products, and enterprises that eventually grow into profitable RICs for the state of Maine. Similar to New Jersey’s very own EDA and Choose NJ, a Board of Directors consisting of industry leaders from across the state governs the organization (Maine Technology Institute, 2010). Since its creation in 1999, MTI successfully facilitated the development and expansion of several clusters including: biotechnology; composites and advanced materials; environmental technologies; forest and agriculture products; information technology; marine technology and aquaculture; and precision manufacturing. In the past decade, MTI awarded over $100 million in funding to support growth in these industries and according to MTI, every $1 they award to fund business innovation leverages about $14 in additional investment. Moreover, MTI partners with the University of Southern Maine to conduct a biannual thorough, independent review of its operations and transactions to ensure the organization keeps in step with its mission of advancing Maine’s RICs (Muro and Fikri, 2011: 5).

• **Ohio’s Hubs of Innovation and Opportunity:** This statewide program directs grants, brownfield redevelopment incentives, and tax credits to specifically designated hubs or geographically confined areas in Ohio that house RICs. Some Ohio Hubs include: the Solar Energy Innovation Hub in Toledo, the Aerospace Hub in Dayton, and the Biomaterials Commercialization Hub in Akron. Ohio’s Hubs program demonstrates that cluster strategy should seek to align existing state programs for redevelopment and growth. In addition, regions seeking these designations must put together an application that identifies a research or higher education institution that will facilitate programs for local economic development. This is a powerful element of Ohio’s RIC strategy because it requires regions to secure commitments from local actors, ensuring regional buy-in and cooperation (Ohio Office of Redevelopment, 2011).
Methodology

Using both qualitative and quantitative data, this project seeks to analyze New Jersey’s industry clusters and the infrastructure necessary to support industry cluster development. Research on basic industry cluster theory, cluster development, and examples from other states was completed to establish a conceptual foundation for this work. The analysis section of this report is supported by further research on the composition of the eight specific clusters, and a review of the various types of infrastructure necessary for industry development in New Jersey. In addition to basic research, the analysis is also informed by expert opinions from industry leaders participating in the project's Advisory Committee. Finally, GIS mapping technology was used to map the location of New Jersey’s physical infrastructure, including: hard infrastructure such as roads, port, airports, freight rail, public transit systems; utilities such as electricity lines and sewer service areas; and soft infrastructure or institutions such as hospitals, places of education and public amenities like parks and recreational areas. Together, the research, expert opinions from local leaders and mapping analysis offer an extensive analysis of the relationship between industry and infrastructure in New Jersey. The following is an overview of the data inputs and quantitative methods used in this project.

Put simply, the definition, measurement, and depiction of industry clusters in a spatial environment is a complicated endeavor. Methods can range from simply showing point locations of firms to mapping location quotient values, statistical cluster analysis (Moran's I, Getis Ords Gi*), and other density analyses. Some studies have also examined the distribution of patent citations to identify clusters of innovation. Hofe & Chen (2006) address the confusion over the different methods used to identify clusters. They assert that the varying concepts of agglomeration economies and industrial clusters lead to a “tremendous number of methods” to identify clusters. Quantitative methods used in this project include an analysis of statewide Location Quotient Values and the use of the Nearest Neighbor Index and the Kernel Density function in ArcGIS.

*Location Quotient*

Location Quotient Value was obtained from the U.S. Department of Labor Bureau of Labor Statistics Location Quotient Calculator for each of our regional industry clusters.
According to EMSI Economic Modeling Specialists Intl. we can use Location Quotient to quantify how “concentrated an industry is in a region compared to a larger geographic area, such as the state or nation.”

Industry LQs are calculated by comparing the industry’s share of regional employment with its share of national employment. Our LQ calculation is augmented by two other pieces of information: size of industry/cluster/occupation in terms of jobs, and percent change in LQ over a given time period (Economic Modeling).

| LQ = 1 | Industry has the same share employment in New Jersey as it does in the USA. |
| LQ > 1 | Indicates an industry with a greater share of employment in New Jersey than the USA. This industry makes up the “economic base” and exports services and products out of state. |
| LQ < 1 | Indicates an industry has less share of the employment in New Jersey than the USA. |

As promoted by Harvard Professor Michael Porter, the calculations of the LQ as well as looking at the historical change over time can help to target efforts of economic development. Keeping in mind the goal of investing developing policies to support New Jersey’s Regional Innovation Clusters, there are four potential combinations (Location Quotients)

- If the industry has a LQ of less than one and is declining over time, this industry is considered to be “weak and declining” and generally should not be considered a potential cluster.
- If the industry has a LQ of less than one but is increasing over time, the industry is considered “weak and growing” and may be a potential industry to focus economic policy efforts.
• If the industry has a LQ of greater than one but is declining over time, it is considered “strong and declining.” In this case, policy makers should determine if the decline of this industry presents a potential risk to the state economy. If so, focused policies to revitalize the industry may be appropriate.

• If the LQ is greater than one and growing over time, it is considered “strong and growing.” These are potential clusters for economic growth and development should be a focus of policy efforts. Additionally, these industries have a competitive advantage over other regions and may have further growth potential.

<table>
<thead>
<tr>
<th>Identification of Clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weak and Growing</strong></td>
</tr>
<tr>
<td>Location Quotient &lt; 1</td>
</tr>
<tr>
<td>Location Quotient Increases Over Time</td>
</tr>
</tbody>
</table>

| **Weak and Declining**     | **Strong and Declining** |
| Location Quotient < 1      | Location Quotient > 1 |
| Location Quotient Decreases Over Time | Location Quotient Decreases Over Time |

Location Quotient values will be used to reinforce and highlight the industries that have been chosen for the study. First, we calculated the Location Quotient using the BLS calculator. Then, in an attempt to show how each of the industry clusters fared through the recession of 2007 the time series starts in 2005. The time series ends in 2011, which represented the most up to date Bureau of Labor Statistics employment data sets at the time of retrieval. Then, we charted the change of the LQ values from 2005 to 2011 to show change over time. We also included a trend line that overlays the data points. The trend line’s R-squared value explains how well the
trend line matches the original data points based on a zero to one scale. The line represents the ability of the model to project data points forward based on the data already in the model.

After that, we have provided an analysis of where each industry cluster fits into the “Identification of Clusters” graphic. For each industry we have provided a close examination of location quotient. From that categorization and examination we can then recommend what levels of economic development policy are appropriate for that industry cluster. The evaluative criteria used to determine if an industry was growing or declining was based on the change in that Industry’s Location Quotient Value from 2010 to 2011. The evaluative Criteria used to determine if an industry is strong or weak is based on if that industry’s Location Quotient value is more or less than 1.

**Nearest Neighbor and Kernel Density**

The Nearest Neighbor and Kernel Density surface calculations are based on firm-level data obtained from ReferenceUSA, a continuously updated database of U.S. businesses. Data for Advanced Manufacturing, Finance, Healthcare, Life Sciences, TLD, and Technology industries was downloaded in March 2012. Data for the Defense and Tourism industries was downloaded in March 2013. To establish whether or not such clusters were statistically significant, a nearest neighbor ratio was computed for each of the eight industry clusters. This index measures spatial clustering by calculating the average distance from one point to that point’s closest neighbor. The nearest neighbor ratio evaluates the existence of clustering on a scale between less than one, indicating clustering, and greater than one, implying dispersion. The nearest neighbor ratio for all eight industry types measured less than one and supported the visual observation that firms in the same sector locate close to one another.

The ReferenceUSA database, which is used by the NJ Department of Labor and Workforce Development, allowed us to display and analyze individual firms with 2 or more employees within each industry cluster using the latitude and longitude of each firm. The decision to use Kernel Density as a means of depicting clusters was based on a review of the available methods and the type of data inputs used in this project. Examples of other studies that implement Kernel Density include *Spatial Analysis of Knowledge-based Occupation Clusters* (Kumar & Nolan, 2010), *Geography of Opportunity: Poverty, Place, and Educational Outcomes* (Tate, 2008), and
Transportation infrastructure impacts on firm location: the effect of a metro line in the suburbs of Madrid (Mejia-Dorantes, Paez & Vassallo, 2011).

After downloading descriptive data about firms, the data points were transformed using the Kernel Density function to create a smooth density map that depicts clusters using the density of firms and their respective employment values. It is important to note that we used the location size (actual number of employees) for the population field to weigh each data point. Therefore, those firms with large amounts of employees represent more jobs within the cluster and result in great density. Furthermore, we utilized the default search radius generated by ArcGIS and the raster cell size to produce a detailed map of RICs. The search radius can be made smaller or larger, though changing the radius does not significantly change the density values. Larger search radius values produce a smoother, more generalized density raster, while smaller values produce a raster that shows more detail (ESRI, 2011). The kernel density application produced a raster surface showing locations of industry clusters, with each cell displaying a value of employees per square mile (ESRI, 2012). These density maps were then juxtaposed with vector data showing key infrastructure obtained from the NJ Geographic Information Network, NJ Transit, NJTPA Geoportal, PASDA, and NJ OGIS.

Limitations

The methodology of this project faces a number of limitations in both data and procedure. Firstly, many of the desired infrastructure data points were unavailable or outdated. Future analysis could include more detailed data regarding capacity, as well as power facilities, updated sewer service areas, housing, and other desirable infrastructure such as corporate parks and distribution centers. Secondly, there is also a great deal of subjective judgment involved in defining clusters in a GIS environment. There are many available methods and lack of consensus among professionals on which are most appropriate. Finally, the kernel density function uses certain parameters, including weights, search radius and cell size, which are user-defined and depend on individual needs. For example, the kernel density could be calculated based on purely the clustering of firms, or it can be weighted with employment numbers. There is a lack on consensus in the literature as to which method (establishments or employment) best indicates clustering of economic activity (Sweeney & Feser, 2004). Future work using kernel density...
could examine the use of employment as an indicator or change the search radius to reflect the characteristics of each cluster and/or specific policy goals.
Targeted Regional Innovation Clusters in New Jersey

The following section contains industry descriptions, firm location maps and tables showing employment values for each of the eight following industries:

- Advanced Manufacturing
- Finance
- Healthcare
- Life Sciences
- Technology
- Transportation, Logistics, and Distribution
- Aerospace and Defense
- Tourism
What Will It Take to Support New Jersey’s Industry Clusters?
Advanced Manufacturing

Located between the natural, deep-water ports of the Hudson and Delaware Rivers, New Jersey has long existed as a strategic site for the location of business and industry. Beginning with the invention of the light bulb by the state's most famous innovator, Thomas Edison, and lasting until the mid-twentieth century, New Jersey served as a hotbed of manufacturing by producing “…pottery at Trenton; rubber at Trenton and Butler; leather and jewelry at Newark; ships, pen points, and condensed soup at Camden; antiseptic bandages at New Brunswick; textiles at Passaic and Paterson, and Famous Amos cookies in Nutley” (Johnson, 1987: 9). While the latter half of the twentieth century witnessed a decline in manufacturing activity in New Jersey and throughout the rest of the country, the new millennium has embraced the emerging sector of advanced manufacturing, which is differentiated from nineteenth and twentieth century manufacturing by the application of modern technologies and highly skilled workers to production lines.

New Jersey's industrial legacy, which left behind large commercial and manufacturing spaces and a vast transportation network, has supplied the state with a competitive advantage in capturing a share of the advanced manufacturing sector. The industry has a statewide location quotient of 0.80, with 3.86% of employment in New Jersey represented by this cluster. This location quotient suggests that advanced manufacturing has a lower percent share of employment than the greater U.S. Nevertheless, it has been recognized as an important industry for the state. (See Figure 1). Today, New Jersey’s advanced manufacturing cluster produces: chemical goods in the way of basic chemicals, pharmaceuticals, medicines, toiletries, cleaning supplies, paints, and adhesives; computers and electronics; and machinery and transportation equipment (Timian, 2011).
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>NJ Statewide Employment</th>
<th>US Total Employment</th>
<th>NJ Share of US Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3251</td>
<td>Basic chemical manufacturing</td>
<td>2,676</td>
<td>110,885</td>
<td>2.41%</td>
</tr>
<tr>
<td>3252</td>
<td>Resin, rubber, and artificial fibers mfg.</td>
<td>7,036</td>
<td>142,692</td>
<td>4.93%</td>
</tr>
<tr>
<td>3253</td>
<td>Agricultural chemical manufacturing</td>
<td>984</td>
<td>90,192</td>
<td>1.09%</td>
</tr>
<tr>
<td>3254</td>
<td>Pharmaceutical and medicine manufacturing</td>
<td>358</td>
<td>35,977</td>
<td>1.00%</td>
</tr>
<tr>
<td>3255</td>
<td>Paint, coating, and adhesive manufacturing</td>
<td>30,032</td>
<td>269,914</td>
<td>11.13%</td>
</tr>
<tr>
<td>3256</td>
<td>Soap, cleaning compound, and toiletry mfg.</td>
<td>2,427</td>
<td>57,199</td>
<td>4.24%</td>
</tr>
<tr>
<td>3259</td>
<td>Other chemical product and preparation mfg.</td>
<td>9,098</td>
<td>101,429</td>
<td>8.97%</td>
</tr>
<tr>
<td>3331</td>
<td>Ag., construction, and mining machinery mfg.</td>
<td>2,839</td>
<td>84,941</td>
<td>3.34%</td>
</tr>
<tr>
<td>3332</td>
<td>Industrial machinery manufacturing</td>
<td>4,708</td>
<td>79,382</td>
<td>5.93%</td>
</tr>
<tr>
<td>3333</td>
<td>Commercial and service industry machinery</td>
<td>180</td>
<td>225,511</td>
<td>0.08%</td>
</tr>
<tr>
<td>3334</td>
<td>VAC and commercial refrigeration equipment</td>
<td>2,834</td>
<td>102,699</td>
<td>2.76%</td>
</tr>
<tr>
<td>3335</td>
<td>Metalworking machinery manufacturing</td>
<td>1,426</td>
<td>91,625</td>
<td>1.56%</td>
</tr>
<tr>
<td>3336</td>
<td>Turbine and power transmission equipment mfg.</td>
<td>1,768</td>
<td>129,083</td>
<td>1.37%</td>
</tr>
<tr>
<td>3339</td>
<td>Other general purpose machinery manufacturing</td>
<td>2,235</td>
<td>166,648</td>
<td>1.34%</td>
</tr>
<tr>
<td>3341</td>
<td>Computer and peripheral equipment mfg.</td>
<td>1,066</td>
<td>98,675</td>
<td>1.08%</td>
</tr>
<tr>
<td>3342</td>
<td>Communications equipment manufacturing</td>
<td>4,537</td>
<td>239,609</td>
<td>1.89%</td>
</tr>
<tr>
<td>3343</td>
<td>Audio and video equipment manufacturing</td>
<td>636</td>
<td>157,642</td>
<td>0.40%</td>
</tr>
<tr>
<td>3344</td>
<td>Semiconductor and electronic component mfg.</td>
<td>2,945</td>
<td>115,379</td>
<td>2.55%</td>
</tr>
<tr>
<td>3345</td>
<td>Electronic instrument manufacturing</td>
<td>205</td>
<td>19,789</td>
<td>1.04%</td>
</tr>
<tr>
<td>3346</td>
<td>Magnetic media manufacturing and reproducing</td>
<td>8,033</td>
<td>383,523</td>
<td>2.09%</td>
</tr>
<tr>
<td>3361</td>
<td>Motor vehicle manufacturing</td>
<td>13,977</td>
<td>404,922</td>
<td>3.45%</td>
</tr>
<tr>
<td>3362</td>
<td>Motor vehicle body and trailer manufacturing</td>
<td>595</td>
<td>22,435</td>
<td>2.65%</td>
</tr>
<tr>
<td>3363</td>
<td>Motor vehicle parts manufacturing</td>
<td>1,636</td>
<td>45,202</td>
<td>3.62%</td>
</tr>
<tr>
<td>3364</td>
<td>Aerospace product and parts manufacturing</td>
<td>1,983</td>
<td>138,472</td>
<td>1.43%</td>
</tr>
<tr>
<td>3365</td>
<td>Railroad rolling stock manufacturing</td>
<td>N/A</td>
<td>161,284</td>
<td>N/A</td>
</tr>
<tr>
<td>3366</td>
<td>Ship and boat building</td>
<td>321</td>
<td>115,574</td>
<td>0.28%</td>
</tr>
<tr>
<td>3369</td>
<td>Other transportation equipment manufacturing</td>
<td>1,251</td>
<td>446,843</td>
<td>0.28%</td>
</tr>
<tr>
<td>3241</td>
<td>Petroleum and coal products manufacturing</td>
<td>1,558</td>
<td>485,363</td>
<td>0.32%</td>
</tr>
<tr>
<td>3272</td>
<td>Glass and glass product manufacturing</td>
<td>N/A</td>
<td>21,149</td>
<td>N/A</td>
</tr>
<tr>
<td>3351</td>
<td>Electric lighting equipment manufacturing</td>
<td>1,012</td>
<td>122,730</td>
<td>0.82%</td>
</tr>
<tr>
<td>3353</td>
<td>Electrical equipment manufacturing</td>
<td>97</td>
<td>33,229</td>
<td>0.29%</td>
</tr>
<tr>
<td>3391</td>
<td>Medical equipment and supplies manufacturing</td>
<td>12,344</td>
<td>305,393</td>
<td>4.04%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>120,797</strong></td>
<td><strong>5,005,390</strong></td>
<td><strong>2.41%</strong></td>
</tr>
</tbody>
</table>

*Data Source: U.S. Bureau of Labor Statistics 2011*
Finance

New Jersey’s finance cluster contains businesses that deal with banking, securities, and commodities and insurance sectors. New Jersey provides a welcoming environment for these types of companies. New Jersey’s real estate, which is competitively priced when compared to office space in New York City, attracts many of the “back office” functions that are needed to support the financial industry in NYC as well as businesses that want to be near Manhattan without paying Manhattan rents (Office for Planning Advocacy, 2011). As of 2011, Jersey City contained 15 percent of the financial services industry in New Jersey, in part because of its proximity to Manhattan’s Wall Street and financial district (Valeriano, 2011).

Aside from competitively priced office space, New Jersey also contains the technological infrastructure that financial institutions rely on to quickly obtain information and data necessary to their daily operations. In fact, "New Jersey has the second largest concentration of data centers in the US after California," (New Jersey Department of Labor and Workforce Development, 2011). In addition, Prudential Financial and Chubb Insurance, two of the financial industry’s fortune 500 companies, are headquartered in the state and companies like Goldman Sachs, Bank of America, and Merrill Lynch have offices in New Jersey. The finance industry has a location quotient of 1.15 indicating that this industry is a basic, exporting industry for the state. 5.83% of the population is employed in finance, while 5.12% of U.S. employment is found in this industry (See Figure 1).
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>NJ Statewide Employment</th>
<th>US Total Employment</th>
<th>NJ Share of US Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>5211</td>
<td>Monetary authorities - central bank</td>
<td>168</td>
<td>18,522</td>
<td>0.91%</td>
</tr>
<tr>
<td>5221</td>
<td>Depository credit intermediation</td>
<td>50,034</td>
<td>1,729,805</td>
<td>2.89%</td>
</tr>
<tr>
<td>5222</td>
<td>Non-depository credit intermediation</td>
<td>12,145</td>
<td>557,720</td>
<td>2.18%</td>
</tr>
<tr>
<td>5223</td>
<td>Activities related to credit intermediation</td>
<td>5,244</td>
<td>260,479</td>
<td>2.01%</td>
</tr>
<tr>
<td>5231</td>
<td>Securities and commodity contracts brokerage</td>
<td>34,174</td>
<td>460,529</td>
<td>7.42%</td>
</tr>
<tr>
<td>5232</td>
<td>Securities and commodity exchanges</td>
<td>66</td>
<td>7,566</td>
<td>0.87%</td>
</tr>
<tr>
<td>5239</td>
<td>Other financial investment activities</td>
<td>12,342</td>
<td>347,141</td>
<td>3.56%</td>
</tr>
<tr>
<td>5241</td>
<td>Insurance carriers</td>
<td>40,044</td>
<td>1,160,742</td>
<td>3.45%</td>
</tr>
<tr>
<td>5242</td>
<td>Insurance agencies, brokerages, and related</td>
<td>28,510</td>
<td>877,461</td>
<td>3.25%</td>
</tr>
<tr>
<td>5251</td>
<td>Insurance and employee benefit funds</td>
<td>831</td>
<td>47,098</td>
<td>1.76%</td>
</tr>
<tr>
<td>5259</td>
<td>Other investment pools and funds</td>
<td>182</td>
<td>39,571</td>
<td>0.46%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>183,740</td>
<td>5,506,634</td>
<td>3.34%</td>
</tr>
</tbody>
</table>

*Data Source: U.S. Bureau of Labor Statistics 2011 Employment Data*
What Will It Take to Support New Jersey's Industry Clusters?
Health Care

New Jersey’s healthcare cluster contains three industry sectors: hospitals and healthcare providing institutions; ambulatory services such as doctors’ offices, outpatient centers, freestanding clinics, and laboratories; and nursing and residential care services. An estimated 21,300 establishments make up this cluster and provide healthcare for residents across the state. According to a study completed by the New Jersey Department of Labor and Workforce Development, “Healthcare is the only industry that has added jobs in the state every year from 1990 through 2010,” (Timian, 2011). In addition, that study found Healthcare employs about 421,000 people, whom the Department of Labor and Workforce Development characterizes as one of the most diverse workforce populations made up of people that differ in age, race, and educational attainment. The employment outlook for this sector appears bright as experts anticipate the demand for healthcare to increase in the coming years. The Department of Labor and Workforce Development predicts this cluster will see a growth rate of 1.3 percent annually as the baby boomer population continues to age and the millennial population enters its child bearing and rearing phases (New Jersey Department of Labor and Workforce Development, 2011). In fact, healthcare represents the greatest New Jersey employment share of all six industries, with 13.49% of the population employed in the industry (See Figure 1).

The statewide location quotient is 1.04, but since the Healthcare industry primarily supports local residents this industry is thought to serve as a non-basic industry. However, the central location of New Jersey and the existence of world renowned institutions like the Cancer Institute of New Jersey (CINJ), one of 41 National Cancer Institute-designated Comprehensive Cancer Centers in the country, may support an argument that the state’s Healthcare industry does indeed provide goods and services to those living outside of New Jersey’s borders.
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>NJ Statewide Employment</th>
<th>US Total Employment</th>
<th>NJ Share of US Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>6211</td>
<td>Offices of physicians</td>
<td>70,488</td>
<td>2,347,665</td>
<td>3.00%</td>
</tr>
<tr>
<td>6212</td>
<td>Offices of dentists</td>
<td>28,122</td>
<td>838,505</td>
<td>3.35%</td>
</tr>
<tr>
<td>6213</td>
<td>Offices of other health practitioners</td>
<td>21,841</td>
<td>695,835</td>
<td>3.14%</td>
</tr>
<tr>
<td>6214</td>
<td>Outpatient care centers</td>
<td>16,748</td>
<td>620,792</td>
<td>2.70%</td>
</tr>
<tr>
<td>6215</td>
<td>Medical and diagnostic laboratories</td>
<td>12,735</td>
<td>231,701</td>
<td>5.50%</td>
</tr>
<tr>
<td>6216</td>
<td>Home health care services</td>
<td>36,694</td>
<td>1,138,814</td>
<td>3.22%</td>
</tr>
<tr>
<td>6219</td>
<td>Other ambulatory health care services</td>
<td>7,944</td>
<td>257,514</td>
<td>3.08%</td>
</tr>
<tr>
<td>6221</td>
<td>General medical and surgical hospitals</td>
<td>134,016</td>
<td>4,364,438</td>
<td>3.07%</td>
</tr>
<tr>
<td>6222</td>
<td>Psychiatric and substance abuse hospitals</td>
<td>1,747</td>
<td>102,533</td>
<td>1.70%</td>
</tr>
<tr>
<td>6223</td>
<td>Other hospitals</td>
<td>6,811</td>
<td>211,123</td>
<td>3.23%</td>
</tr>
<tr>
<td>6231</td>
<td>Nursing care facilities</td>
<td>50,350</td>
<td>1,666,972</td>
<td>3.02%</td>
</tr>
<tr>
<td>6232</td>
<td>Residential mental health facilities</td>
<td>16,050</td>
<td>569,400</td>
<td>2.82%</td>
</tr>
<tr>
<td>6233</td>
<td>Community care facilities for the elderly</td>
<td>19,654</td>
<td>765,893</td>
<td>2.57%</td>
</tr>
<tr>
<td>6239</td>
<td>Other residential care facilities</td>
<td>3,084</td>
<td>159,270</td>
<td>1.94%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>426,284</strong></td>
<td><strong>13,970,455</strong></td>
<td><strong>3.05%</strong></td>
</tr>
</tbody>
</table>

*Data Source: U.S. Bureau of Labor Statistics 2011 Employment Data*
What Will It Take to Support New Jersey’s Industry Clusters?
Life Sciences

According to the Office for Planning Advocacy, New Jersey is “the world’s medicine chest,” and is “home to 17 of the 20 largest pharmaceutical companies, ranked 3rd in bioscience venture capital investments and is home to over 300 biotech companies,” (Office for Planning Advocacy, 2011). The life sciences cluster includes companies that: produce medicinal products; make medical devices, equipment or supplies; and participate in research and development (R&D) or analytic and diagnostics. New Jersey has long been home to life sciences companies, dating back to 1866 when three brothers founded Johnson & Johnson along the Raritan River in New Brunswick. Since then, the state has maintained a well-established presence of companies in the life sciences industry such as Merck, Celgene, Novartis, Bayer, Sanofi, Becton Dickenson, and C.R. Bard. Experts suggest a bright future for the life sciences industry as well, with recent promising entrants such as Allergan and Ipsen.

In January 2012, the New York Times reported that biotechnology companies and research laboratories occupy 6.5 million square feet of office space within the central counties of Hunterdon, Mercer, Middlesex, Monmouth, and Somerset, taking up 5 percent of the entire commercial and industrial real estate in that market (Gregor, 2012). Real estate forecasters believe this number will grow as new developments like SciPark in East Windsor and the redevelopment of Novo Nordisk's office in the Princeton Forrestal Center come to fruition.

In addition, data from the U.S. Bureau of Labor Statistics show a location quotient of 1.96 for New Jersey’s Life Sciences industry in 2011. With a location quotient of 1.96, the state's Life Sciences industry appears as a strong sector that exports goods and services beyond New Jersey’s jurisdictions. Figure 1 at the end of this section, paints a bright picture for the life sciences industry in New Jersey, as 3.85% of the New Jersey population is employed in the industry while the employment share for the entire U.S. is only 1.95%. For a closer look at the Life Sciences Industry please refer to the case study examining Route 1 Corridor.
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>NJ Statewide Employment</th>
<th>US Total Employment</th>
<th>NJ Share of US Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3254</td>
<td>Pharmaceutical and medicine manufacturing</td>
<td>30,032</td>
<td>269,914</td>
<td>11.13%</td>
</tr>
<tr>
<td>3256</td>
<td>Soap, cleaning compound, and toiletry mfg.</td>
<td>9,098</td>
<td>101,429</td>
<td>8.97%</td>
</tr>
<tr>
<td>3345</td>
<td>Electronic instrument manufacturing</td>
<td>13,977</td>
<td>404,922</td>
<td>3.45%</td>
</tr>
<tr>
<td>3391</td>
<td>Medical equipment and supplies manufacturing</td>
<td>12,344</td>
<td>305,393</td>
<td>4.04%</td>
</tr>
<tr>
<td>4242</td>
<td>Druggists' goods merchant wholesalers</td>
<td>13,036</td>
<td>187,606</td>
<td>6.95%</td>
</tr>
<tr>
<td>5417</td>
<td>Scientific research and development services</td>
<td>30,675</td>
<td>630,375</td>
<td>4.87%</td>
</tr>
<tr>
<td>6215</td>
<td>Medical and diagnostic laboratories</td>
<td>12,735</td>
<td>231,701</td>
<td>5.50%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>121,897</td>
<td>2,131,340</td>
<td>5.72%</td>
</tr>
</tbody>
</table>

*Data Source: U.S. Bureau of Labor Statistics 2011 Employment Data*
What Will It Take to Support New Jersey’s Industry Clusters?
Technology

The Technology cluster includes those companies that are typically associated with the twenty-first century information and knowledge economy such as: data providers, processors and hosts; internet servicers; telecommunications; information technology; and IT research and development. Location quotient analysis reveals a statewide statistic of 1.14, suggesting that technology is a significant industry cluster in the state. This is indeed true, as New Jersey has the fourth fastest growing technology industry and is ranked first nationally in broadband communications (Office for Planning Advocacy, 2011). Moreover, the share of technology employment is the state is 8.04%, with only 6.96% in the U.S. as a whole (see Figure 1). A number of firms that operate within the technology industry have their headquarters in the state, two of which, Avaya and Cognizant Technology Solutions, are Fortune 500 companies. There are, however, a very large number of smaller technology firms that contribute to this cluster, as evidenced in the map above.
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>NJ STATEWIDE EMPLOYMENT</th>
<th>US TOTAL EMPLOYMENT</th>
<th>Percentage of US Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3341</td>
<td>Computer and peripheral equipment mfg.</td>
<td>636</td>
<td>157,642</td>
<td>0.40%</td>
</tr>
<tr>
<td>3342</td>
<td>Communications equipment manufacturing</td>
<td>2,945</td>
<td>115,379</td>
<td>2.55%</td>
</tr>
<tr>
<td>3344</td>
<td>Semiconductor and electronic component mfg.</td>
<td>8,033</td>
<td>383,523</td>
<td>2.09%</td>
</tr>
<tr>
<td>3345</td>
<td>Electronic instrument manufacturing</td>
<td>13,977</td>
<td>404,922</td>
<td>3.45%</td>
</tr>
<tr>
<td>3346</td>
<td>Magnetic media manufacturing and reproducing</td>
<td>595</td>
<td>22,435</td>
<td>2.65%</td>
</tr>
<tr>
<td>3359</td>
<td>Other electrical equipment and component mfg.</td>
<td>2,315</td>
<td>124,843</td>
<td>1.85%</td>
</tr>
<tr>
<td>3391</td>
<td>Medical equipment and supplies manufacturing</td>
<td>12,344</td>
<td>305,393</td>
<td>4.04%</td>
</tr>
<tr>
<td>5112</td>
<td>Software publishers</td>
<td>4,198</td>
<td>270,236</td>
<td>1.55%</td>
</tr>
<tr>
<td>5171</td>
<td>Wired telecommunications carriers</td>
<td>25,887</td>
<td>587,681</td>
<td>4.40%</td>
</tr>
<tr>
<td>5172</td>
<td>Wireless telecommunications carriers</td>
<td>2,529</td>
<td>168,507</td>
<td>1.50%</td>
</tr>
<tr>
<td>5174</td>
<td>Satellite telecommunications</td>
<td>207</td>
<td>10,907</td>
<td>1.90%</td>
</tr>
<tr>
<td>5179</td>
<td>Other telecommunications</td>
<td>2,537</td>
<td>113,097</td>
<td>2.24%</td>
</tr>
<tr>
<td>5182</td>
<td>Data processing and related services</td>
<td>7,900</td>
<td>245,100</td>
<td>3.22%</td>
</tr>
<tr>
<td>5413</td>
<td>Architectural and engineering services</td>
<td>35,504</td>
<td>1,290,565</td>
<td>2.75%</td>
</tr>
<tr>
<td>5415</td>
<td>Computer systems design and related services</td>
<td>63,647</td>
<td>1,540,038</td>
<td>4.13%</td>
</tr>
<tr>
<td>5416</td>
<td>Management and technical consulting services</td>
<td>37,269</td>
<td>1,075,405</td>
<td>3.47%</td>
</tr>
<tr>
<td>5417</td>
<td>Scientific research and development services</td>
<td>30,675</td>
<td>630,375</td>
<td>4.87%</td>
</tr>
<tr>
<td>8112</td>
<td>Electronic equipment repair and maintenance</td>
<td>3,019</td>
<td>98,430</td>
<td>3.07%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>254,217</strong></td>
<td><strong>7,544,474</strong></td>
<td><strong>3.37%</strong></td>
</tr>
</tbody>
</table>

*Data Source: U.S. Bureau of Labor Statistics 2011 Employment Data*
What Will It Take to Support New Jersey’s Industry Clusters?
New Jersey has long proved a pacesetter in the Transportation, Logistics and Distribution (TLD) industry, which facilitates the movement of goods and people from origin to destination by air, water, roadways, light or passenger rail, heavy freight rail and pipeline. According to the New Jersey Department of Labor and Workforce Development, New Jersey is within a 24-hour drive of 40 percent of the US population, making it a natural node within supply chains and distribution networks that circulate goods and people throughout the eastern seaboard and into the Midwest (2012). There is a strong relationship between infrastructure and the TLD industry, which is why this cluster is a natural fit for New Jersey, a state that has: about 38,000 miles of roadway; 628 miles of passenger rail; 225 miles of commercial navigation channels; 3 commercial airports and 46 general airports (NJ DOT, 2008). In addition, the Port of New York and New Jersey ranks third in the US in terms of commerce statistics calculated by the US Army Corps of Engineers and New Jersey has more than 585 million square feet of warehousing space, which helps the state catch a large share of the logistics and distribution business within this cluster (Office for Planning Advocacy, 2011). It is vital that this infrastructure is constantly maintained and upgraded to ensure that the transportation industry can continue to operate in New Jersey with confidence.

As a result, the TLD industry shows a statewide location quotient of 1.28 in 2011, indicating that it serves as an important basic industry. This industry even shows the greatest difference between New Jersey and U.S. employment shares of all of the six industries. That is, 11.36% of New Jersey’s population is employed in the TLD cluster while 8.87% of the U.S. is represented in this industry, showing quite a large difference of 2.5% (see figure 1).
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>Employment</th>
<th>Total Payroll</th>
<th>Annual Payroll</th>
</tr>
</thead>
<tbody>
<tr>
<td>4239</td>
<td>Misc. durable goods merchant wholesalers</td>
<td>13,453</td>
<td>290,482</td>
<td>4.63%</td>
</tr>
<tr>
<td>4241</td>
<td>Paper and product merchant wholesalers</td>
<td>5,311</td>
<td>121,588</td>
<td>4.37%</td>
</tr>
<tr>
<td>4242</td>
<td>Druggists’ goods merchant wholesalers</td>
<td>13,036</td>
<td>187,606</td>
<td>6.95%</td>
</tr>
<tr>
<td>4243</td>
<td>Apparel and piece goods merchant wholesalers</td>
<td>9,008</td>
<td>139,159</td>
<td>6.47%</td>
</tr>
<tr>
<td>4244</td>
<td>Grocery and Related Product Wholesalers</td>
<td>28,070</td>
<td>714,559</td>
<td>3.93%</td>
</tr>
<tr>
<td>4245</td>
<td>Farm product raw material merch. whls.</td>
<td>197</td>
<td>73,835</td>
<td>0.27%</td>
</tr>
<tr>
<td>4246</td>
<td>Chemical merchant wholesalers</td>
<td>7,166</td>
<td>122,707</td>
<td>5.84%</td>
</tr>
<tr>
<td>4247</td>
<td>Petroleum merchant wholesalers</td>
<td>2,439</td>
<td>92,963</td>
<td>2.62%</td>
</tr>
<tr>
<td>4248</td>
<td>Alcoholic beverage merchant wholesalers</td>
<td>4,708</td>
<td>165,695</td>
<td>2.84%</td>
</tr>
<tr>
<td>4249</td>
<td>Misc. nondurable goods merchant wholesalers</td>
<td>12,764</td>
<td>321,933</td>
<td>3.96%</td>
</tr>
<tr>
<td>4251</td>
<td>Electronic markets and agents and brokers</td>
<td>24,613</td>
<td>841,812</td>
<td>2.92%</td>
</tr>
<tr>
<td>4811</td>
<td>Scheduled air transportation</td>
<td>16,265</td>
<td>414,258</td>
<td>3.93%</td>
</tr>
<tr>
<td>4812</td>
<td>Nonscheduled air transportation</td>
<td>838</td>
<td>40,865</td>
<td>2.05%</td>
</tr>
<tr>
<td>4821</td>
<td>Rail transportation</td>
<td>23</td>
<td>673</td>
<td>3.42%</td>
</tr>
<tr>
<td>4831</td>
<td>Sea, coastal, and Great Lakes transportation</td>
<td>934</td>
<td>38,262</td>
<td>2.44%</td>
</tr>
<tr>
<td>4832</td>
<td>Inland water transportation</td>
<td>24,609</td>
<td>901,864</td>
<td>2.73%</td>
</tr>
<tr>
<td>4841</td>
<td>General freight trucking</td>
<td>8,095</td>
<td>398,604</td>
<td>2.03%</td>
</tr>
<tr>
<td>4842</td>
<td>Specialized freight trucking</td>
<td>1,584</td>
<td>41,382</td>
<td>3.83%</td>
</tr>
<tr>
<td>4851</td>
<td>Urban transit systems</td>
<td>1,854</td>
<td>18,398</td>
<td>10.08%</td>
</tr>
<tr>
<td>4852</td>
<td>Interurban and rural bus transportation</td>
<td>5,023</td>
<td>71,320</td>
<td>7.04%</td>
</tr>
<tr>
<td>4853</td>
<td>Taxi and limousine service</td>
<td>14,060</td>
<td>183,687</td>
<td>7.65%</td>
</tr>
<tr>
<td>4854</td>
<td>School and employee bus transportation</td>
<td>1,804</td>
<td>30,285</td>
<td>5.96%</td>
</tr>
<tr>
<td>4855</td>
<td>Charter bus industry</td>
<td>2,355</td>
<td>84,776</td>
<td>2.78%</td>
</tr>
<tr>
<td>4859</td>
<td>Other ground passenger transportation</td>
<td>N/A</td>
<td>8,948</td>
<td>N/A</td>
</tr>
<tr>
<td>4861</td>
<td>Pipeline transportation of crude oil</td>
<td>N/A</td>
<td>27,319</td>
<td>N/A</td>
</tr>
<tr>
<td>4862</td>
<td>Pipeline transportation of natural gas</td>
<td>175</td>
<td>6,731</td>
<td>2.60%</td>
</tr>
<tr>
<td>4869</td>
<td>Other pipeline transportation</td>
<td>N/A</td>
<td>10,952</td>
<td>N/A</td>
</tr>
<tr>
<td>4871</td>
<td>Scenic and sightseeing transportation, land</td>
<td>369</td>
<td>13,826</td>
<td>2.67%</td>
</tr>
<tr>
<td>4872</td>
<td>Scenic and sightseeing transportation, water</td>
<td>N/A</td>
<td>2,539</td>
<td>N/A</td>
</tr>
<tr>
<td>4879</td>
<td>Scenic and sightseeing transportation, other</td>
<td>3,148</td>
<td>159,818</td>
<td>1.97%</td>
</tr>
<tr>
<td>4881</td>
<td>Support activities for air transportation</td>
<td>451</td>
<td>23,909</td>
<td>1.89%</td>
</tr>
<tr>
<td>4882</td>
<td>Support activities for rail transportation</td>
<td>4,565</td>
<td>89,745</td>
<td>5.09%</td>
</tr>
<tr>
<td>4883</td>
<td>Support activities for water transportation</td>
<td>2,202</td>
<td>83,281</td>
<td>2.64%</td>
</tr>
<tr>
<td>4884</td>
<td>Support activities for road transportation</td>
<td>8,543</td>
<td>177,824</td>
<td>4.80%</td>
</tr>
<tr>
<td>4885</td>
<td>Freight transportation arrangement</td>
<td>939</td>
<td>27,446</td>
<td>3.42%</td>
</tr>
<tr>
<td>4889</td>
<td>Other support activities for transportation</td>
<td>35</td>
<td>4,678</td>
<td>0.75%</td>
</tr>
<tr>
<td>4911</td>
<td>Postal service</td>
<td>19,889</td>
<td>474,999</td>
<td>4.19%</td>
</tr>
<tr>
<td>4921</td>
<td>Couriers</td>
<td>1,548</td>
<td>46,177</td>
<td>3.35%</td>
</tr>
<tr>
<td>4922</td>
<td>Local messengers and local delivery</td>
<td>26,445</td>
<td>647,579</td>
<td>4.08%</td>
</tr>
<tr>
<td>4931</td>
<td>Warehousing and storage</td>
<td>9,543</td>
<td>312,559</td>
<td>3.05%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>354,545</td>
<td>9,574,937</td>
<td>3.70%</td>
</tr>
</tbody>
</table>

*Data Source: U.S. Bureau of Labor Statistics 2011 Employment Data*
What Will It Take to Support New Jersey’s Industry Clusters?
Aerospace and Defense

The Aerospace and Defense industry cluster takes advantage of the highly educated workforce that New Jersey has to offer. The state’s military facilities serve as a catalyst for technological advancement, which reaches beyond the requirements of general defense to homeland security and other areas of the economy as well. Within its boundaries, New Jersey has seven major military bases and one major contracting facility: the Lockheed Martin's Naval Electronics & Surveillance Systems-Surface Systems plant near Moorestown, NJ. Despite the closure and realignment of the activities of Fort Monmouth in 2011, the industry that supports these military bases still has a significant presence in the New Jersey economy.

The Aerospace & Defense Industry is made up of businesses manufacturing weapons, guidance systems, and military armored and aeronautical craft. According to the Bureau of Labor Statistics, the New Jersey Aerospace & Defense industry employed 11,957 workers outside of military installations in 2011. It should be noted that the location quotient calculated for the purposes of this report, .47, reflects only those non-military employees. Separate Department of Defense data is available regarding military installation employment for 2009, which states that there are 21,890 DOD personnel in New Jersey.

A financial and economic impact study of the Aerospace and Defense Industry in the U.S. done by Deloitte in March 2012 estimated that 70,797 workers make up the total of the direct, indirect, and induced employment in the A&D industry in New Jersey. When compared to the rest of the nation, New Jersey ranks 16th in volume of direct employment in this industry cluster. However, New Jersey ranks 6th in the nation with the average wage of a worker directly employed in this industry cluster making $93,120. The approximately $5.4 billion in revenues within this industry cluster in 2010 generated nearly $28.5 million in business income and gross receipts taxes as well as $50.7 million in state individual income tax. Finally, in 2010 the Aerospace and Defense industry cluster contributed 1.12% to the state GDP, creating $1.5 billion in exports and $1.2 billion in imports.
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>NJ Statewide Employment</th>
<th>US Total Employment</th>
<th>NJ Share of US Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>332992</td>
<td>Small arms ammunition manufacturing</td>
<td>N/A</td>
<td>10,252</td>
<td>N/A</td>
</tr>
<tr>
<td>332993</td>
<td>Ammunition, except small arms, manufacturing</td>
<td>N/A</td>
<td>16,013</td>
<td>N/A</td>
</tr>
<tr>
<td>332994</td>
<td>Small arms and ordnance manufacturing</td>
<td>N/A</td>
<td>14,751</td>
<td>N/A</td>
</tr>
<tr>
<td>332995</td>
<td>Other ordnance and accessories manufacturing</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>33422</td>
<td>Broadcast and wireless communications equip.</td>
<td>1,956</td>
<td>64,430</td>
<td>3.04%</td>
</tr>
<tr>
<td>334511</td>
<td>Search, detection, and navigation instruments</td>
<td>7,431</td>
<td>138,691</td>
<td>5.36%</td>
</tr>
<tr>
<td>33641</td>
<td>Aerospace products and parts manufacturing</td>
<td>1,558</td>
<td>485,310</td>
<td>0.32%</td>
</tr>
<tr>
<td>33661</td>
<td>Ship and boat building</td>
<td>1,012</td>
<td>122,718</td>
<td>0.82%</td>
</tr>
<tr>
<td>336992</td>
<td>Military armored vehicles and tank parts mfg.</td>
<td>N/A</td>
<td>9,613</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>11,957</td>
<td>861,778</td>
<td>1.39%</td>
</tr>
</tbody>
</table>

*Data Source: U.S. Bureau of Labor Statistics 2011 Employment Data*
Tourism

The tourism industry cluster is a $40 billion dollar industry, with a total of approximately $19 billion in sales originating from the Jersey Shore in Monmouth, Ocean, Atlantic, and Cape May Counties (NJ Tourism Study 2012). This significant economic activity is a result of New Jersey’s accessible location between the major metropolitan areas of New York and Philadelphia, and quantity of high quality tourism destinations. NJ Transit’s North Jersey Coast and Atlantic City commuter train lines provide easy trips from residents of the northern part of the state as well as the Philadelphia area. In Jersey Shore communities, it is not uncommon to see large groups get off the train and walk right to the beach or engage in other tourist activities.

New Jersey Tourism extends beyond just the shore areas and exists in all corners of the state. In the northern region, tourists can ski and snowboard or go white water rafting on the Delaware River. The Meadowlands boasts the site of the 2014 NFL Super Bowl. The NJPAC Newark is just one of many arts venues located in cities such as Morristown, New Brunswick, and Red Bank. Throughout the state, the wine tourism industry is growing, especially in the coastal plains of Atlantic and Cape May counties where soils and climate have made vineyards a successful venture.

Tourism spending directly supports 318,500 jobs in New Jersey and 500,000 jobs including indirect and induced impacts. Tourism jobs represent 10% of total employment or 1 in 10 jobs in New Jersey. The tourism sector directly represented $34.7 billion of state GDP in 2012, 7.0% of the entire state economy. Including indirect and induced impacts, tourism in New Jersey generated $4.5 billion in state and local taxes and $5.1 billion in Federal taxes last year (NJ Tourism Study 2012).

The tourism industry cluster in New Jersey experienced a lull from 2008 to 2010. Only recently, as of 2012, did the state surpass its prior peak achieved in 2007. In 2012, Superstorm Sandy dealt a significant blow to the New Jersey Tourism industry cluster, undoing much of the progress made in recent years. The entire 127 mile coast line, which generates $19 billion in economy activity, sustained damage from the storm. The 2012 NJ Tourism Economic Impact Study claimed that in the absence of the state and local taxes generated by all tourism, each NJ household would need to pay $1,420 to maintain governmental revenues. With the storm
recovery in effect, it will be critically important to rebuild the shore and work towards returning the tourism industry cluster to pre-storm economic levels.

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>NJ Statewide Employment</th>
<th>US Total Employment</th>
<th>NJ Share of US Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>483112</td>
<td>Deep Sea Passenger Transportation</td>
<td>11</td>
<td>8,376</td>
<td>0.13%</td>
</tr>
<tr>
<td></td>
<td>Coastal and Great Lakes Passenger Transportation</td>
<td>20</td>
<td>7,117</td>
<td>0.28%</td>
</tr>
<tr>
<td>483212</td>
<td>Inland Water Passenger Transportation</td>
<td>411</td>
<td>4,263</td>
<td>9.64%</td>
</tr>
<tr>
<td>4871</td>
<td>Scenic and Sightseeing Transportation, Land</td>
<td>N/A</td>
<td>10,955</td>
<td>N/A</td>
</tr>
<tr>
<td>4872</td>
<td>Scenic and Sightseeing Transportation, Water</td>
<td>365</td>
<td>13,824</td>
<td>2.64%</td>
</tr>
<tr>
<td>4879</td>
<td>Scenic and Sightseeing Transportation, Other</td>
<td>N/A</td>
<td>2,534</td>
<td>N/A</td>
</tr>
<tr>
<td>488990</td>
<td>All Other Support Activities for Transportation</td>
<td>939</td>
<td>27,448</td>
<td>3.42%</td>
</tr>
<tr>
<td>561510</td>
<td>Travel Agencies</td>
<td>3,346</td>
<td>82,787</td>
<td>4.04%</td>
</tr>
<tr>
<td>561520</td>
<td>Tour Operators</td>
<td>362</td>
<td>24,707</td>
<td>1.47%</td>
</tr>
<tr>
<td>561591</td>
<td>Convention and Visitors Bureaus</td>
<td>202</td>
<td>7,835</td>
<td>2.58%</td>
</tr>
<tr>
<td>561599</td>
<td>All other Travel Arrangement/Reservation</td>
<td>2,185</td>
<td>74,302</td>
<td>2.94%</td>
</tr>
<tr>
<td>7111</td>
<td>Performing arts companies</td>
<td>2,342</td>
<td>110,444</td>
<td>2.12%</td>
</tr>
<tr>
<td>7112</td>
<td>Spectator Sports</td>
<td>2,153</td>
<td>124,921</td>
<td>1.72%</td>
</tr>
<tr>
<td>712</td>
<td>Museums, historical sites, zoos, and parks</td>
<td>1,734</td>
<td>131,258</td>
<td>1.32%</td>
</tr>
<tr>
<td>713</td>
<td>Amusement, gambling, and recreation</td>
<td>42,647</td>
<td>1,392,394</td>
<td>3.06%</td>
</tr>
<tr>
<td>7211</td>
<td>Traveler Accommodation</td>
<td>55,385</td>
<td>1,720,082</td>
<td>3.22%</td>
</tr>
<tr>
<td>7212</td>
<td>RV parks and recreational camps</td>
<td>1,478</td>
<td>53,417</td>
<td>2.77%</td>
</tr>
<tr>
<td>722</td>
<td>Food Services and Drinking Places</td>
<td>223,744</td>
<td>9,587,402</td>
<td>2.33%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>337,324</td>
<td>13,384,066</td>
<td>2.52%</td>
</tr>
</tbody>
</table>

*Data Source: U.S. Bureau of Labor Statistics 2011 Employment Data*
New Jersey’s Industry Clusters: Location Quotient Analysis

Figure 1. This chart shows the percentage of employment for each industry cluster. For the NJ percentages, employment in the cluster is compared to total statewide employment. For the US statistics, employment in the cluster is compared to overall national employment.

*Data obtained from the US Department of Labor, Bureau of Labor Statistics Calculator.
Figure 2. This graph shows the change in location quotient from 2005 to 2011 for all eight of the industry clusters this study is examining. *Data obtained from the US Department of Labor, Bureau of Labor Statistics Calculator.*
Location Quotient is a significant analysis because it shows the actual physical presence of business in terms of employment in the state compared to the nation. The time series data from 2005 to 2011 reveals that all of the industries retracted in terms of employment numbers due to the recession. When examined in the most recent available years (2010 - 2011) the Healthcare and Life Sciences industries have shown growth. The data shows that the most concentrated industry examined in the study is the Life Science industry with an increasing location quotient of 1.95 in 2011. The other strong and growing industry in the state is Healthcare with an increasing location quotient of 1.04. The least concentrated industry is the Aerospace and Defense industry with a location quotient of .47 in 2011, which can be considered misrepresentative due to the fact that military employment is not factored into the calculated.

Overall, the complexity of the New Jersey Economy as a whole and its ability to incorporate many industries into the economic system allows for a highly diversified economy. It is important to note that the industries focused on in this study do not exist independently of each other. Multipliers, when calculated, summarize the total impact that can be expected from change in a given economic activity. The changes produce direct, indirect, and induced effects on the economy. Direct effects occur to the firm that exports additional goods or services as a result of the change in economic activity. Indirect effects occur to industries in the backward linked industries that supply the exporting firm. Induced effects are concerned with the spending of households in the local economy (Miller 2012).

Finally, the diversified economy and industries of New Jersey are physically linked together through the infrastructure of the state. The next part of the study focuses on thorough geospatial analysis examining the relationship between each industry cluster and the state infrastructure as well as an in depth look at each industry’s Location Quotient Values.
What Will It Take to Support New Jersey’s Industry Clusters?
INFRASTRUCTION
Infrastructure Needs for New Jersey’s Regional Innovation Clusters

Not only does infrastructure perform necessary services for individuals, firms, and communities, but it also establishes a certain quality of life that attracts the people and firms to communities. Due to these important roles, our roads, sewers, and other public facilities play a powerful role in guiding the State’s physical and economic growth.

The New Jersey State Planning Commission takes a comprehensive view of the infrastructure conditions necessary to spur cluster development. “The preferred location for RICs is at or in close proximity to assets such as commuter transit hubs, freight lines, nautical ports, airports, higher education facilities and existing corporate campuses where adequate infrastructure exists. Studies have documented that high-technology businesses, research and development firms, and corporate headquarters rely on “knowledge” or “talent” workers who strongly consider quality of life, and recreational resources in particular, when making employment decisions” (State Planning Commission, 2011).

The following research describes the ways in which the various types of infrastructure impact the development of regional innovation clusters, with an emphasis on New Jersey’s unique assets and the industries.
Transportation

Transportation infrastructure has an important relationship with industry clusters due to the inherent transport cost savings derived from clustering. The adequate capacity and proper maintenance of both passenger and freight transportation networks is essential for the movement of people and goods in all industries. By investing in transportation infrastructure, New Jersey and its localities can attract workers and firms to foster industry cluster development.

Traditional theory states that as firms cluster to form agglomeration economies, they benefit from lower transport costs that facilitate an easier exchange of goods, people, and ideas. Interestingly, however, the cost of moving goods has greatly declined over time but industries still exhibit the desire to cluster. This is due in part to the steadily rising cost of moving people. Industry clusters allow for greater labor market pooling in which employees have access to more jobs, and employers have access to more workers. Furthermore, research shows that service industries who must deliver face-to-face services to customers concentrate in more urban areas, while manufacturing tends to concentrate in more rural areas as their goods are cheaper to deliver (Glaeser, 2010).

Thus, the accessibility and efficiency of transportation facilities is important for businesses to transport their workers, customers, and goods. For example, a new road could decrease travel time with a connection to a hub within a transport network, while a well-designed street could drive more foot traffic to businesses. The travel costs of moving goods is also important for the many modern businesses relying on “just-in-time” delivery, in which product inventory is constantly in circulation to avoid warehousing costs. An efficient transportation system is necessary for firms that practice “just-in-time” to distribute products to markets in the most economical manner (Hague, Hague & Breitbach, 2011).

While transportation is a key concern for almost every business, New Jersey’s various industries certainly have different transportation needs. As a densely populated state with a large number of retail and service establishments, New Jersey exhibits a significant demand
for products that rely on freight transportation. For example, businesses in the advanced manufacturing industry rely on steady shipments of raw materials. Corporate offices may require special pick-up/delivery of time-sensitive materials. New Jersey is also home to a manufacturing industry that produces goods moved by freight on major highways and rail lines. Freight requirements also vary depending on the type of manufacturing activity, as some firms rely on bulk deliveries of raw materials and others bring in smaller, more varied shipments before sending out finished goods. The demand for freight transport, on behalf of both consumers and producers, changes as New Jersey’s economy changes over time. Therefore, it is important that we continue to analyze the trends in the freight industry, as put forth in the New Jersey Comprehensive Statewide Freight Plan, when developing economic development strategies (Parsons Brinckerhoff Quade & Douglas, Inc., 2007). The South Jersey Freight Transportation and Economic Development Assessment, prepared in 2010 by Parsons Brinkerhoff for the NJDOT, is an excellent example of efforts to make vital connections between transportation and New Jersey’s economy (NJDOT, 2010).

In addition to freight needs of the State’s industry clusters, there are also transportation considerations for the movement of workers and customers. For example, many firms in the healthcare, life sciences, finance, and technology industries employing members of the “creative class” rely on public transit for employees to reach the workplace. These types of workers were found to be positively associated with the percentage of people that take public transit, walk, or bike to work (Florida, 2011). Based on these trends, clusters employing creative class workers in New Jersey might benefit from public transport investment.

Transportation networks are also vital to New Jersey’s tourism industry, and some suggest that that there is still room for improvement. For example, industry leaders at the 2011 Governor’s Conference on Tourism suggested that the lack of transportation options from New York City to Atlantic City discourage many from visiting (Fletcher, 2011). The seasonal ACES train, a train that took passengers from New York City to Atlantic City via Philadelphia, was suspended in March 2012 after a three year trial. The initiative was ultimately unprofitable, but the train did boast around 90% ridership in summer months signaling a demand for this type of transportation.
(Wittkowski, 2012).

Moreover, research has shown that public transportation can play a significant role in fostering the development of industry clusters. As mentioned above, reduced travel time is an important factor for agglomeration economies. An improvement in public transport can lower transport costs, thereby increasing connectivity between firms and workers and increasing firm productivity. This occurs as a larger labor pool within commuting distance allows for more employees to access jobs, and there is better job matching and less worker turnover. Public transport improvements could also encourage a more economically productive use of land through higher occupancy and denser development. If these positive effects of agglomeration are to occur, development regulations should allow densification around public transport facilities (Chatman).

Finally, the conditions and capacity of our transportation networks have direct economic impacts on businesses. Deteriorated conditions damage vehicles and increase operating costs for trucks, cars, and rail vehicles. Additionally, transportation facilities in poor condition may lead to greater miles traveled and time wasted, as routes are unusable or congested. Such costs reduce the productivity and competitiveness of New Jersey businesses. For example, a truck traveling on deficient pavement could face higher operating costs, lower safe travel speeds, detours due to weight restrictions, and even damaged goods. Moreover, deficiencies in capacity result in congestion and stop-and-go conditions that generate additional travel time, higher operating costs, and unpredictable business operations. In the Mid-Atlantic region, such pavement deficiencies affect 44% of vehicle miles traveled and capacity deficient routes affect 23% of vehicle miles traveled. As a state in the more urbanized Mid-Atlantic region, New Jersey is also more susceptible to the costs of congestion and deficient transit than other areas of the country (Economic Development Research Group, 2011).

Transportation - The New Jersey Context

Every worker and customer must arrive at their destination, whether by personal or public transportation. New Jersey is quite unique in that 10.6% of its population uses public
transportation to commute to work, according to 2010 American Community Survey 5-year estimates. Moreover, about 12% of households do not have access to a vehicle (U.S. Census Bureau, 2010). Many of New Jersey’s industries could benefit from locating near public transportation facilities in order to reach these segments of the population.

Without doubt, New Jersey has an extensive freight transportation network that plays a significant role in our economy. For example, the State Strategic Plan cites that we hold the world’s 3rd largest port, in addition to a number of ports along the Delaware River with growth potential. An estimated 620 million tons of freight valued at over $850 billion pass through such ports each year. Furthermore, our regional air network represents almost 25% of all U.S. International air cargo (State Planning Commission, 2011). The Army Corps of Engineers Waterborne Statistics Center estimates that in 2010 the Port of New York and New Jersey ranked third among the top 50 water ports by tonnage at 139.2 million short tons. The Paulsboro, New Jersey port ranks 40 on this list, with 17.5 million short tons (Mindy, Bailey & William, 2011). According to the Association of American Railroads 2010 data, the top commodity by weight terminating in New Jersey by rail shipment was chemicals, while intermodal shipments were the top rail shipments originating in the state (Mindy, Bailey & William, 2011).

As mentioned above, the success of many of New Jersey’s industries is dependant on the condition and capacity of our transportation network. While slightly dated, the 2007 Report Card for New Jersey’s Infrastructure highlights major trends in the state’s transportation network that are still relevant into 2013. Aviation received a grade “D,” considering the size and air traffic control capacities of airports, largely Newark Airport, to handle greater volumes of service and newer, larger airliners. New Jersey’s roads received a “D” due to our high levels of pavement deficiency, congestion, and old roadway drainage systems. Bridges also received a “D” based on the condition of bridges. Finally, Ports and Navigable Waterways received a grade “C”, with South Jersey lacking in capital investment on their waterways and rail, and North Jersey exhibiting issues with the channel depth, bridge clearance, and intermodal connectors. It is important to note that the recent Port Authority effort to raise the Bayonne Bridge will significantly enhance the capacity of North Jersey’s ports which will coincide with the expansion of the Panama Canal
The issues associated with New Jersey’s transportation network are reflected in more current data as well. According to the National Air Traffic Controllers Association, Newark Airport exhibited the most delayed arrivals with 33.75% of flights delayed and the second most delayed departures of all major U.S. airports in September 2011 with 23.05% of flights delayed (National Air Traffic Controllers Association, 2011). Recent reports from the Federal Highway Administration Highway Statistics on the 2009 pavement condition of the State’s interstates, other principal arterials, rural minor arterials, and the National Highway System use the International Roughness Index. Of these roads, it is estimated that only 45% had acceptable or good ride quality. According to the 2011 National Bridge Inventory, 10.1% of road bridges are structurally deficient, signifying that they are either closed, restricted to light vehicles, or require immediate rehab to remain open. New Jersey’s road bridge conditions are worse in terms of lane widths, load carrying capacities, clearances, and approach roadway alignments, with 25.1% being functionally obsolete and no longer meeting the criteria for the system of which the bridge is a part (Mindy, Bailey & William, 2011).

The destruction from Superstorm Sandy confronted state transportation agencies with the challenge of restoring service as quickly as possible to return the region’s transportation commuting capacity. Immediately after the storm, the Port Authority of New York and New Jersey worked quickly to restore container terminals to accommodate shipping. PATH train service returned gradually as well with the most effort focused on the Hoboken Terminal. NJTransit’s North Jersey Coast Line and the Montclair-Boonton Line were damaged by falling trees, washout, and other debris from the storm. Additionally, NJTransit and Amtrak worked together to remove water from the underground Hudson River train tunnels. Many alternative transportation options were developed for commuters including trans-Hudson ferry access and expanded NJTransit Bus routes. For approximately about a week after the storm a gasoline shortage severely limited vehicular travel as well.

This unique and unprecedented event has caused officials to realize the vulnerabilities
of the state’s transportation infrastructure. Moving forward, efforts will need to be made to make the system more resilient. For example, when the Kearny rail yards flooded a significant portion of NJTransit’s rolling stock was damaged. The implausibility of moving the rail yard and maintenance facility will require installation of key resiliency infrastructure to mitigate damage from a future storm. Other resiliency projects will be required to protect transportation infrastructure along the Jersey Shore and in urban areas such as Hoboken and Jersey City.
It is important that communities understand the water needs and desires of businesses to effectively promote economic development. Businesses commonly take a community’s water and wastewater into account when involved in site selection. Industrial firms evaluate the capacity of wastewater facilities to decide whether or not they treat on-site or use a community facility. Both the availability and quality of water are also considerations in the site selection process. Some firms even look to utilize different “types” of water to increase efficiency, such as using reclaimed water for irrigation and cooling (Bruns, 2008).

There are a number of highly water-intensive and water-dependant industries that use both publicly and self-supplied water. Automobile manufacturing, biotechnology/pharmaceuticals, and electronics are considered to be the most dependant on a clean, reliable water supply in the U.S. economy. On the other hand, certain industries are more water-intensive. These include agriculture, mining, and power generation (which mostly self-supply) and manufacturing sectors such as paint & coating manufacturing, alkalis & chlorine manufacturing, paperboard mills, and food processing (which mostly use public water infrastructure) (Economic Development Research Group, 2011). Therefore, water and wastewater is a particularly important infrastructure consideration for New Jersey’s life sciences, manufacturing, and tourism industries.

As the majority of water infrastructure resides out of sight underground, conditions often go unnoticed. The consequences of ignoring old and degraded pipes should not be overlooked, however, as they can cause disruptions in service, slowed emergency response, damages to other types of infrastructure, and unsanitary conditions. Businesses and households with undependable water delivery and inadequate water treatment face costs associated with higher water rates, moving, purchasing/operating equipment, and medical issues (Economic Development Research Group, 2011).

While water and sewer infrastructure is widely recognized as a fundamental component of economic development, the development of such infrastructure can have large impacts on
What Will It Take to Support New Jersey’s Industry Clusters?

communities, especially those under growth pressures. Entities responsible for the provision of water and sanitation can face overloading, maintenance issues, and collapse without an adequate tax base. It is recommended that a life-cycle cost approach be used when financing infrastructure to ensure that the system is sustainable (Hague, Hague & Breitbach, 2011).

**Water and Sewer Infrastructure - The New Jersey Context**

The make-up of New Jersey’s water infrastructure varies greatly by scale and ownership. As of late 2010, there are 31 investor-owned water utilities that serve over 40% of NJ’s businesses and households. There are also 620 public community water supply systems, 75% of which serve less than 3,000 accounts. Finally, there are more than 260 community wastewater systems, 60% of which are publicly owned. On the other hand, stormwater infrastructure is not operated as a utility operation at all, but is managed by local and county public works departments (NJ Clean Water Council, 2010).

While New Jersey has a competitive advantage over much drier states in the West and South, New Jersey has many older cities and towns with drinking water infrastructure systems that are aged and prone to failure. The majority of the water distribution piping dating from the late 1800’s through the late 1960’s is cast-iron with a life of about 120 years and in need of replacement. Different types of piping from the 1920’s and the post WWII boom have average life spans of 100 and 75 years respectively. Similarly, the majority of the sewerage collection systems in Jersey were put in over 70 years ago, while expected useful life of pipe is just 50 years. The quality of pipes may be prolonged past this 50 year mark, however maintenance neglect is common. It is important to note that age is not the only factor in the degradation of piping, as temperature, corrosion, and hydraulic surges are all factors (ASCE New Jersey Section, 2007).

In 2007, the American Society of Civil Engineers released a report card for New Jersey’s infrastructure that highlighted the fact that critical repairs are needed for our existing infrastructure. The wastewater utilities received a grade of “D” and drinking water utilities were given a “C”. Subsequently, the New Jersey Clean Water Council put forth a number of recommendations in 2010 that suggest infrastructure should be maintained at the lowest life-
cycle cost in order to avoid wasting resources/money and maintain a viable economy. That is, utilities should implement asset-management principles and standardized approaches to utility accounting, as well as receive sufficient institutional support (“Recommendations for water,” 2010).

There are also considerable concerns related to New Jersey’s wastewater systems due to a large number of combined sewer and wastewater systems throughout the state. Such systems, which were constructed in early cities to transport sewage, industrial wastewater, and rainwater runoff in the same pipes, pose serious environmental and public health risks when water is discharged into water bodies during periods of heavy rain. In addition to health concerns, combined sewer overflows (CSOs) also create financial burdens related to cleanup expenses, lost tourism revenue, emergency repairs, lost productivity, and medical costs. New Jersey has 20 permit holders for CSOs and 254 outfalls (U.S. Environmental Protection Agency, 2011). Combined sewer overflows and dilapidated pipes that result in the discharge of raw sewage are of particular concern for the tourism industry. Pollution often occurs in older urban areas near bodies of water, as well as coastal areas. A polluted shore environment is simply detrimental to the Jersey Shore tourism industry (NJDEP Division of Water Quality, 2012).

Finally, the effects of severe weather and other climate change impacts on water and sewer infrastructure should not be underestimated. It is estimated that Superstorm Sandy damaged over 100 facilities that supply drinking water and treat sewage in the New Jersey. This translates to about $2.6 billion to repair systems and make them more resilient. The rebuilding needs are only exacerbated by the fact that the state’s water and sewer infrastructure was already in poor condition, as evidenced in the above discussion. Not only do the impacts cause disruptions in daily life, there are considerable health concerns. For example, the Passaic Valley Sewerage Commission, which is the fifth-largest wastewater plan in the country, suffered from flooding that resulted in millions of gallons of sewage dumped into waterways (Johnson, 2013). Tackling these issues will not be an easy task, as current funding levels are insufficient.

The U.S. EPA features an initiative known as “Climate Ready Water Utilities,” which
provides a number of valuable resources to help utility owners and operators adapt to the impacts of climate change. According to the initiative’s Adaptation Guide for Water Utilities, the northeast region of the U.S. should expect temperature rise, shifts in precipitation patterns, and altered hydrologic cycles as a result of climate change. As such, they suggest that water utilities should incorporate climate adaption plans into their long-range planning efforts. These plans can incorporate sustainability aspects such as energy management and green infrastructure into their adaptation strategies. Therefore, it is imperative that the state’s water utilities work to both rebuild damaged and decayed infrastructure in the short term and adopt climate adaptation measures for the long term.
Power Infrastructure

The electricity system is made up of three basic components that vary by age, capacity, and condition: generation facilities, high-voltage transmission lines, and local distribution systems. The sufficiency and reliability of this system depend on the age, capacity, and spatial pattern of the infrastructure. The age of equipment is often related to reduced power quality and availability, while equipment capacity is also associated with bottlenecks in the electricity grid that cause brownouts and blackouts (Economic Development Research Group, 2011). Electricity transmission congestion is a notable issue for the State, as New Jersey lies directly within a Critical Congestion Area designated by the U.S. Department of Energy that runs from south of Washington D.C. to north of New York City (U.S. Department of Energy, 2009).

Reduced reliability of electricity supply due to equipment failures, voltage surges, irregular power quality, and blackouts/brownouts can have several negative economic effects. These effects include damaged electronic equipment, spoilage of food and items kept in controlled conditions, unproductive time for workers, and costs related to backup and monitoring/conditioning equipment. By failing to invest in electricity infrastructure, such effects could negatively impact the development of New Jersey’s industry clusters. For example, a 2004 study by the U.S. Department of Energy Office of Science national laboratory found that industrial firms lost around $2,000 to $5,000 and commercial firms lost around $700 to $1,300 per power interruption. In addition to costs related by electricity interruption, there are also economic impacts related to higher electric costs, costs associated with unreliability, and more expensive industrial processes. Such expenses translate to reduced competitiveness and job loss. Because electricity is generated, transmitted, and distributed by private companies under public oversight, investment in electricity infrastructure cannot be accomplished by purely increasing public expenditure. In addition to public policy, private investments rely on the private capital loan and bond markets and perceptions of economic risk. Nevertheless, public policies can regulate the pace, siting, and nature of electricity infrastructure investment (Economic Development Research Group, 2011).
While most industries depend on electricity, there are certain sectors that are more dependent on a reliable source of electricity. Industries that use higher than average portion of their revenue for electricity include (in descending order) primary metals, non-metal minerals, paper, accommodation & food, education, chemical products, agriculture & forestry, food & beverage manufacturing, wood products, plastics, mining, textiles and apparel, leasing, printing, petroleum & coal products, and fabricated metals (Economic Development Research Group, 2011). Within the technology industry, data center facilities have specific power infrastructure concerns. The number of data centers is growing rapidly in New Jersey, which has doubled to almost 40 since 2005. These facilities need high quantities of power for constant operation and back up. For example, the world’s largest data center was opened last year in Edison, NJ, and can support enough electricity to power about 80,000 homes (Portlock, 2011). The emergence of a “Green Economy” cluster also prompts some power infrastructure concerns as solar power facilities become increasingly common. With large solar and wind energy facilities on the horizon, it will be necessary for infrastructure to have the capacity to accommodate these new power sources.

**Power Infrastructure - The New Jersey Context**

There are four energy distribution companies that span different areas of the State, including Atlantic City Electric Company in South Jersey, Jersey Central Power and Light and Public Service Electric and Gas Company in North/Central Jersey, and Rockland Electric Company serving a small portion of North Jersey. All of these companies are controlled by PJM, a regional transmission organization that coordinates the flow, reliability, and security of the electric power system (“New Jersey energy,” 2011). In late 2011, the State adopted an Energy Master Plan (EMP) that sets forth a number of initiatives to expand in-state electricity resources, promote cost-effective renewable resources and conservation/energy efficiency programs, and support the development of innovative energy technologies. The theme of economic development is woven into the EMP, highlighting the various benefits businesses may receive from the implementation of the stated goals (“New Jersey energy,” 2011).

The commercial and industrial sector uses 65% of overall electric power in New Jersey.
Because energy costs are the second greatest expense for most New Jersey businesses, reducing energy costs would directly contribute to business success. Moreover, our electricity prices are relatively high compared to other states, which may discourage certain industries from locating in New Jersey. In addition to reducing energy cost for existing industries, the EMP also recognizes the potential for new business creation in the emerging renewable energy industry. The State Strategic Plan identifies the “Green Economy” as an emerging industry cluster. As such, collaboration between universities, research institutions, and businesses is key to spurring innovation and developing this industry cluster (“New Jersey energy,” 2011).

The 2007 Report Card for New Jersey’s Infrastructure assigned the state a “C+” energy grade which was above the national average. Our diversified energy sources, commitment to and exploration of new energy sources, and PJM’s investment in transmission position New Jersey as a leader in energy infrastructure (ASCE New Jersey Section, 2007). Under new circumstances, New Jersey has the opportunity to be a leader in the context of a post Superstorm Sandy power system.

On 9:00AM on October 31, 2012, two days after Superstorm Sandy made landfall 2,040,195 or 51% of customers were without power in New Jersey. Salem Unit 1, a 1,174 megawatt nuclear generation facility was manually shut down safely on October 30th due to four of the station’s six circulating water pumps being no longer available due to weather impacts. Petroleum and natural gas refineries in Port Reading and Linden were such down as well (Hurricane Sandy Situation Report #6). The impacts of flooding damaged substations and high winds led to trees falling on transmission lines. With the lack of power gas stations were unable to pump gasoline, further exacerbating the impact to transportation. Immediately after the storm passed energy companies mobilized a massive multi-state force of technicians, workers and equipment to begin repairs to the severely damaged power infrastructure.

To move forward and mitigate the impacts of future storms it will take a combination of common sense initiatives and strategic investment into our power delivery system. First, substations in areas venerable to flooding should be raised above the flood plain. Next, at facilities such as hospitals, other healthcare institutions and community centers on site power generation
should be examined. For transportation infrastructure such as gas stations, having generator hook up ports installed into the site will allow for easy connection of emergency generators. Finally, underground power lines in new developments will reduce exposure to falling trees while regular tree grooming will help maintain existing lines. Ultimately, without power the economy cannot function. The state should place priority in the technology that exists to improve the power system and make it less open to future storm impacts.
Telecommunications Infrastructure

Broadband access is an increasingly important economic consideration for individuals, businesses, and communities. For example, 62% of workers in the US depend on the Internet for their occupation. Businesses can use the internet to improve their operating process and access new, larger markets. The Internet is also a valuable workforce development tool, allowing individuals to learn new skills and find employment. Finally, communities can attract new industries and workers through the development of telecommunications infrastructure. Therefore, the National Broadband Plan recommends the development of broadband programs that support entrepreneurship and small/medium businesses, deliver job training and placement services, promote telework, and enable local/regional economic development. A great example of such recommendations that represent the spirit of this report is recommendation 13.8, that “The federal government should develop regional and community broadband benchmarks for use as a central component within economic development planning and programs” (“National broadband plan,” 2010).

In addition to helping firms operate on a daily basis, technology also plays a great role in the development of industry clusters. Put simply, technology enables innovation. Fast and dependable broadband and wireless allow various industries to use digital tools that propel them forward with a competitive edge. This includes the opportunity for healthcare institutions to share x-rays and other digital images, as well as practice “telemedicine.” Educational institutions also benefit from the ability to better engage students distance learning and real-time assessment. More generally, better technology such as video conferencing allows for better communication and opportunities for collaboration (West, 2011).

Telecommunications also enable the tourism industry to provide innovative smartphone maps and mobile-friendly websites to help guide visitors to new activities and experiences. For example, Asbury Park is considered a leader in its development of an interactive phone application that helps tourists explore the city. Industry leaders suggest that these technologies are becoming increasingly important ways to stay competitive in tourism (Fletcher, 2011).
The technology industry is especially impacted by the quality and availability of broadband access. For example, a 2003 study found that cities with greater telecommunications capacity are more likely to have positive growth in the high-tech industry (Hackler). In his article in the Journal of Urban Technology, Wieman accurately illustrates the importance of telecommunications infrastructure when he states “Broadband information infrastructure is now as important to a growing array of high-tech firms as railroads were to nineteenth-century steel and textiles mills” (1998).

**Telecommunications - The New Jersey Context**

Not only are telecommunications an essential feature of our economy and daily life, they are also critical in emergency situations. We rely on this infrastructure to call 911, get in touch with family and friends, obtain news, and so on. This was painfully clear for New Jersey during the events of Superstorm Sandy. Telecommunications infrastructure suffered substantial impacts as a result of Superstorm Sandy, with one of every four cell towers out of service in the 10 state region affected by the storm according to the FCC. Moreover, there is a vital relationship between telecommunications and power infrastructure, as we rely on electricity to power the antenna towers, central offices, individual devices, and other equipment necessary for the function of the network. Therefore, as the state lost power during Superstorm Sandy, telecommunications suffered as well (Beeson).

Similar to all other types of infrastructure, the telecommunications industry must pursue greater resiliency in the face of severe weather events and other climate change effects. The Federal Communications Commission held a series of field hearings in the months following the storm to discuss failures of the telecommunications system and explore ways to increase resiliency. Some suggested that infrastructure be hardened to protect from flooding and ensure that there is sufficient back-up power at cell tower sites. Other ideas include co-locating towers with each other to create redundancy in the system and greater cooperation among mobile carriers (Beeson).

Overall, New Jersey is a national leader in broadband access (State Planning Commission, 2011). Broadband is provided through DSL, cable, fiber, or wireless systems by various providers.
As of December 2011, the majority of New Jersey’s population (64.3%) had access to 3 wireline providers, while 74.1% had access to 4 wireless providers. Moreover, 58.2% of the population had access to fiber technology, while DSL, cable, and wireless were available to 93.9%, 95.1%, and 99.8% respectively. Broadband speeds also tend to vary by type of user. For example, homes tended to have the highest speeds, followed by medium/large businesses, schools/libraries/community centers, and small businesses (NTIA, 2011).

Finally, The National Telecommunications and Information Administration’s State Broadband Data and Development Grant Program recently funded the New Jersey Office of Information Technology to map the availability and utilization of broadband in New Jersey. The mapping efforts will allow the state to better understand the current and future demand for broadband. For the purposes of this report, fiber-optic service areas from this broadband mapping initiative were mapped to depict the latest fast and reliable technology sought by broadband users.
What Will It Take to Support New Jersey’s Industry Clusters?
Corporate Parks, Centers, and other Industrial Facilities

Science and technology parks have become an integral part of industry clusters, especially for the technology, life science, and advanced manufacturing industries. These parks assist in the development of industry clusters in many ways due to their ability to bring together firms that foster creativity and innovation. In spurring innovation, they can further jump start the economy by cultivating and attracting talent and creating new jobs. Successful science and technology parks tend to have a specialized management team, value-added services, quality facilities, efforts for new business creation and business attraction, networks, and positive effects on the surrounding geography (Bellavista & Sanz, 2009). Some of the major science and technology parks in New Jersey include the University Heights Science Park, Technology Center of New Jersey, South Jersey Technology Park, and the Waterfront Technology Center at Camden.

Warehousing and distribution centers are common sights clustered at highway interchanges, ports, and airports in New Jersey. Many of the facilities function as “value-added warehouses,” in which employees assemble, customize, and/or prepare products before shipping to their final destination. The 2007 Comprehensive Statewide Freight Plan states that such facilities are “the intersection of the freight transportation system and economic development.” These facilities, which naturally tend to cluster due to their logistical needs, are often the site of the state’s transportation, logistics, and warehousing industry cluster, as well as many firms involved in manufacturing processes. Many of New Jersey’s companies benefit from operating within one of the five foreign trade zones located across the state. Within these zones, products that are processed and re-exported receive duty-free treatment (State of New Jersey). According to the Statewide Freight Plan, warehouse and distribution centers tend to take three forms in the state, either as 500,000+ square feet facilities that serve the northeast and national markets, 100,000-500,000 square foot facilities that serve the regional market or those that must be on-site or adjacent to ports and airports. In New Jersey, the Port of Newark/Elizabeth is significant, as products can be shipped in from overseas and prepared in the state’s warehouse and distribution centers. Exit 8A on the New Jersey Turnpike is considered the “epicenter” of distribution center activity, while exit 7A is also developing as a prominent center. Issues facing the development and
success of these centers include truck traffic, competition with I-78 and I-80 sites in Pennsylvania, and a shortage of suitable land area (Parsons Brinckerhoff Quade & Douglas, Inc., 2007).

“Freight villages” are becoming an increasing popular framework for fostering clusters of logistics, warehousing, and distribution facilities and other support activities. The Delaware Valley Regional Planning Commission Long-Range Vision for Freight promotes the development of freight villages as a means to enhance the link between freight transportation and land use. A typical freight village would be located around a highway interchange and/or intermodal facilities and include light manufacturing, warehouse/distribution, and office, retail, and hotels that support the industry. Pureland Industrial Complex in Swedesboro, NJ is a shining example of a freight village with over 15 million square feet of facilities adjacent to a highway and served by rail (DVRPC, 2010).
Higher Education Institutions

Both community colleges and universities have a vital role to play in New Jersey’s Regional Innovation Clusters. Universities impact their local economies in three major ways. Traditionally, they generate jobs and wealth through purchasing and procurement, and enhance human capital through education. Most importantly, however, universities are often central components of industry clusters because they produce research that fuels innovation. This occurs during the process of “technology transfer,” in which the results of basic and applied research are used in the commercialization of products, services, or processes. This includes patenting, licensing, research consortia, technical assistance programs, spin-off business, start-up incubators, research parks, venture-capital funds, consultant services, and other less formal interactions between the university and the industry.

In a report produced by Carnegie Mellon University for the U.S. Department of Commerce Economic Development Administration, the authors suggest that universities with high engagement, a strong base of research and development, and alignment with the greater region are more likely to successfully contribute to industry cluster development. It is also important to note that the nature and organization of a specific cluster affects the ability of a university to make significant impacts. For example, the de-concentration of production and a general resistance to accepting new technology and innovations could negatively impact a university’s ability to contribute to an industry cluster (Paytas, Gradeck, & Andrews, 2004).

While universities are the primary producers of innovative research, community colleges play a more localized workforce and economic development role. They serve as workforce intermediaries to assist in the job-matching process, improve the quality of the labor supply, and enhance the capacity of employers (Velluzzi, 2010). For example, in a study of four community colleges, Rosenfeld (2000) found that colleges embedded within a cluster had the social resources to incorporate cluster influenced curricula, match students to jobs, and further the development of the cluster by supplying trained labor.
Research shows that certain industries benefit greatly from university programs and partnerships, including technology, life sciences, and advanced manufacturing. For example, a 2011 report from the Brookings-Rockefeller Project on State and Metropolitan Innovation suggests that states should actively promote the advanced manufacturing industry by creating research and education centers to develop new, relevant technologies, as well as provide education to assist businesses in applying such technologies (Halper & Wiel).

**Higher Education Institutions- The New Jersey Context**

The Draft State Strategic Plan states that New Jersey is in the top ten states for bachelor degree attainment for people ages 25-44, as well as 6th in the country for residents holding an advanced degree (State Planning Commission, 2011). It should be noted that although New Jersey’s workforce is well-educated, these numbers should not overshadow the significant “brain drain” that New Jersey experiences. According to the National Center for Education Statistics Fall 2010 data, New Jersey has the 6th lowest ratio of in-state students to residents enrolled in any state (.65) compared to all other states, which means New Jersey is losing the opportunity to educate its own residents in state. Moreover, 34,995 students migrated out of state, while only 5,451 migrated into New Jersey, representing a net out-migration of -29,544 students (U.S. Department of Education, 2011). Coupled with the high amount of unmet demand is a low capacity to serve college-bound students. For example, New Jersey ranks 46th in the nation in public four-year college/university enrollment per capita (New Jersey Association of State Colleges and Universities, 2012). These trends indicate that there is a significant gap between the real and potential enrollment in New Jersey’s colleges and universities. By investing in New Jersey’s educational institutions, we could retain more of our bright students and fuel innovation for our industry clusters.

Moreover, further development of research institutes, training programs, etc. in colleges and universities tailored to industry cluster needs would be beneficial to New Jersey’s economic development efforts. For example, the New Jersey Advanced Manufacturing Institute at the Rutgers University School of Engineering seeks to foster business partnerships, attract investment, and do research and development for the advanced manufacturing industry. Another
example is the Stem Cell Institute of New Jersey out of the UMDNJ-Robert Wood Johnson Medical School and Rutgers, which benefits the state's life sciences industry by engaging in research, training, and clinical studies to attract pharmaceutical and biotechnology companies. Finally, the pending merger of Rutgers University and UMDNJ presents an opportunity for New Jersey to have greater capacity to attract more research grants and corporate partnerships for the healthcare industry. The merger, which is set for July 1, 2013, will also allow the state to provide greater educational opportunities and attract more talent.
What Will It Take to Support New Jersey’s Industry Clusters?
Hospitals

Like colleges and universities, hospitals often serve as community anchor institutions that employ residents and generate significant economic activity through local spending. It should be noted, however, that hospitals are not a panacea for ailing economies. Rather, significant opportunities exist when hospitals and other healthcare institutions work within industry clusters that involve higher education institutions, businesses, and economic development efforts. This is especially true within the healthcare and life sciences industry. In order to sustain these clusters, it is imperative that the greater community fosters conditions in which workforce development is prioritized, there is a high quality of life, and significant opportunity for entrepreneurs. State and local governments can play a major role in encouraging such conditions. For example, the Indiana Department of Commerce designated central Indianapolis as a Certified Technology Park, qualifying the area to receive state funding for location incentives and infrastructure improvements. The BioCrossroads Initiative has now developed a successful life sciences center made up of hospitals, medical device companies, drug manufacturers, and research labs in the Indianapolis area (Krohe, 2012).

Hospitals - The New Jersey Context

Containing around 34% of all healthcare employment, hospitals are clearly a key component of New Jersey’s healthcare cluster. As such, general medical and surgical hospitals represent the largest type of healthcare employer (Ehert, 2011). Hospitals contribute to the healthcare cluster by teaching future medical professionals and supporting smaller businesses that provide support products and services. Hospitals are also particularly important to New Jersey’s life science cluster because they often conduct research and clinical trials that assist pharmaceutical and biotechnology companies. For more on the role in hospitals in the Life Sciences industry refer to the Route 1 Corridor case study.
Institutions for Collaboration

While physical infrastructure, government regulation, companies, and universities are recognized as basic components that affect business competitiveness and industry cluster development, there are other types of entities that play an integral role as well. Michael Porter identified such organizations as “institutions for collaboration,” which include chambers of commerce, industry and professional organizations, quality centers, think tanks, technology transfer organizations, university alumni associations, and more. By fostering relationships, doing shared activities, and setting standards, institutions for collaboration can affect productivity and competitiveness. Porter suggests that as the number of institutions for collaboration is increasing, the knowledge and skills of competition are increasing as well (Porter, 2003).

Institutions for Collaboration - The New Jersey Context

New Jersey has an abundance of institutions for collaboration dedicated to the advancement of New Jersey’s industries. There are chambers of commerce on the statewide, regional, and local level. Statewide chambers include the New Jersey Chamber of Commerce, Statewide Hispanic Chamber of Commerce of New Jersey, African American Chamber of Commerce of NJ, NJ Chinese American Chamber of Commerce, and the Asian Indian Chamber of Commerce. There are also a large number of associations that focus on certain trades and professions in New Jersey. Each of the state’s industry clusters can benefit from trade organizations including the HealthCare Institute of New Jersey, New Jersey Hospital Association, the New Jersey Bankers Association, BioNJ, the New Jersey Technology Council, the New Jersey Tooling and Manufacturing Association, Material Handling Society of New Jersey, and the New Jersey Motor Truck Association.

New Jersey’s Department of Labor and Workforce Development has recently introduced a number of Talent Networks that focus on the six industry clusters put forth in the Draft State Strategic Plan. The Talent Networks are a shining example of Michael Porter’s Institutions for Collaboration in that they bring together a number of partners for workforce development in
their respective industries. They consist of colleges and universities, workforce investment boards, trade associations, chambers of commerce, funding groups, employers, and others. Together, these companies and organizations can make a powerful difference in the advancement of their industries.
Quality of life infrastructure

Many well-established industry cluster theories are based in the idea that firms cluster to reap benefits of efficiency, knowledge spillovers, and face-to-face contact. Many experts are now expanding such theories to include a firm’s desire to access a talented workforce concentrated in a particular place. To this end, there are clear arguments that human capital is a major driver of regional economic growth because businesses cluster to benefit from common labor pools.

In an expansion of this concept, Richard Florida identifies the “creative class” as a specific type of worker that seeks to locate in places with a certain quality of life. The creative class includes super-creative people that create useful new forms or designs such as scientists, engineers, artists, architects, professors, writers, analysts, and others; and creative professionals that work in knowledge-based fields such as technology, finance, healthcare, law, and business. His research shows that these highly-educated workers look for inclusive and diverse places when deciding where to live, thereby attracting firms and driving economic growth in those regions. These places offer high-quality experiences and an inclusive atmosphere in which creative people can flourish. The theory, he asserts, is that innovation and growth are correlated to the three T’s, or technology, talent, and tolerance (Florida, 2003).

Such “human capital” and “creative capital” theories of economic development establish a case for promoting an attractive quality of life in places that want to attract workers and firms. In addition to attracting workers, quality of life is also important to firms for other business reasons. Companies often have to pay higher salaries as a form of “disamenity compensation” in places with lower quality of life in order to attract employees. Moreover, quality of life is also a consideration for companies looking to retain employees and avoid recruitment costs (Compton, 2007).

Quality of Life - The New Jersey Context

The Draft State Strategic Plan recognizes that although New Jersey boasts an ideal location, abundant recreational opportunities, preserved landscapes, and rich culture and
history, the state is also home to underperforming urban centers that hurt our ability to compete economically. Nevertheless, the Plan highlights the growing preference toward more walkable, mixed-use, and urban communities with transportation options and access to recreation and other amenities that make for better quality of life. To achieve such places, New Jersey’s transit hubs can be developed and redeveloped as desirable places to live and recreate, as well as promote economic activity. Moreover, preservation and park development is highlighted as a viable means to increase quality of life infrastructure by encouraging both denser development and open space for healthier lifestyles (State Planning Commission, 2011).

The availability of open space and recreational opportunities has been recognized as a major attractor of businesses and workers, particularly for footloose companies and highly educated employees. For example, Richard Florida found that high-technology workers chose environmental quality as the most important factor in their location decisions (Crompton, 2007). The most recent New Jersey Statewide Comprehensive Outdoor Recreation Plan (SCORP) released in 2008 highlights the State’s commitment to open space preservation. Goal 2 of the SCORP, “To provide close to home park and recreation opportunities for residents statewide and promote the development of parks in New Jersey’s urban and suburban centers to support revitalization efforts,” would directly support the development of quality of life infrastructure for industry clusters (New Jersey Department of Environmental Protection, 2007). Using funds from the Garden State Preservation Trust, Land and Water Conservation Fund, Forest Legacy Program, Pinelands Section 502 Program and other sources, the NJDEP Green Acres Program has preserved almost 640,000 acres of open space. However, as of 2013, Green Acres funding has run dry and no new sources of funding have been identified. While New Jersey is considered a leader in open space preservation, the 2007 Report Card for New Jersey’s Infrastructure assigned a grade of “C-” to the state’s public parks and recreation due to development pressures and unmet funding (ASCE New Jersey Section, 2007).

New Jersey’s open space can also serve as an important type of infrastructure for the tourism industry. Eco-tourism is an increasingly popular type of travel that features resources such as the Pinelands. Nevertheless, a disconnect remains between our natural resources and
availability of tourist facilities such as hotels and restaurants. For example, the Pinelands have 20 million people living within 60 miles of his boundaries, presenting quite a market for ecotourism activities (Fletcher, 2011). While communities certainly benefit from the economic activity associated with the tourism industry, there are also impacts on local infrastructure that should be considered. For example, the State Heritage Tourism Plan suggests that communities should “Understand carrying capacity for heritage sites and towns so that visitation does not negatively impact resources or infrastructure.” Moreover, the plan puts forth a strategy to develop heritage products and infrastructure such as building a strong network of historic sites, supporting the Wayfinding Master Plan, and developing a historical marker program. Such initiatives would enhance the quality of life in New Jersey and contribute to a healthy tourism industry (State Heritage Tourism Plan).

In addition to parks and recreational opportunities, housing costs are a major consideration for places looking to foster industry cluster growth. New Jersey, notorious for its high housing costs, faces competition with states that have more affordable housing such as Virginia, North Carolina, and Georgia. Such places have succeeded at attracting knowledge-based jobs and talented workers in recent years. Moreover, New Jersey also faces an outmigration of population as workers seek cheaper housing elsewhere (Hughes, 2007). In fact, the state ranks as the 3rd most expensive state in the latest National Low Income Housing Coalition report Out of Reach (2012). For example, the report shows that a worker would have to earn $25.04 an hour to afford a 2 bedroom fair market rent apartment.

Finally, arts and cultural amenities can be considered a type of “quality of life infrastructure” that attracts workers and firms to communities. New Jersey’s latest Arts Plan recognizes the community and economic development value of the arts, stating that “A strong cultural landscape in New Jersey attracts both businesses and a highly skilled and creative workforce.” For example, the plan seeks to “grow thriving and vibrant communities” by aligning with public policies that encourage innovation and the creative economy, promoting inclusion, connecting with the business community, promoting cultural tourism, and doing further research on the impact of the arts (“Arts plan New Jersey,” 2008). Future research and mapping of New
Jersey cultural amenities would help inform further analysis on quality of life infrastructure and the development of industry clusters in New Jersey.
Business and Infrastructure Mapping Analysis

The previous sections describe New Jersey’s industry clusters and infrastructure needs. A GIS analysis was also performed to better understand the relationships across the state’s landscape. Maps of the eight industry categories visually show that firms are in fact concentrated in certain areas of the state. The maps depicting employment density (as described in the methodology section) were overlaid with infrastructure data to show the relationship between industry and infrastructure in New Jersey. The GIS analysis, informed by the research put forth in the previous sections of this report, generated the following observations:
The image shows a map of New Jersey with various markers indicating employment density and infrastructure related to the Advanced Manufacturing Industry. The map includes labeled cities such as Newark, Jersey City, Trenton, and Atlantic City. The infrastructure markers include ports in use, general hospitals, colleges and universities, public airports, sewer service areas, state and county owned open space, roads (interstate, US, state, toll routes), active freight rail, passenger rail (NJ Transit, PATH, PATCO), and passenger rail stations. The employment density is computed using the ArcGIS Kernel Density tool, with a high density of 469 and a low of 0. The data sources include NJGIN, NJTPA, NJ Transit, PASDA, ReferenceUSA, NJ OGIS, ESRI. The map was produced on April 9, 2013, by Kayla Malsbury. The map also includes logos for PlanSmart NJ and the New Jersey Chamber of Commerce.
The advanced manufacturing industry cluster exhibited a nearest neighbor ratio of 0.44, which suggests that New Jersey’s advanced manufacturing firms are clustered, yet not as strongly as some of the other industry types in the report. The advanced manufacturing clusters with the highest employment densities as depicted on the map are largely located in areas near transportation facilities. Advanced manufacturing tends to cluster in the northern portion of the state within the counties of Bergen, Essex, Somerset, Union, Morris, and Middlesex; along the NJ Turnpike; and around the NY/NJ port area. The state’s network of transportation, logistics and distribution facilities, as well as its location between two major cities, New York City and Philadelphia, provide the ability to receive and send freight shipments to areas of high demand. Moreover, these firms tend to congregate in suburban locations because goods are relatively cheap to transport, as opposed to firms that rely more on the movement of people.

The map also shows that advanced manufacturing employment is largely located within the state’s sewer service areas. Advanced manufacturing firms, especially those that make electronics, depend on a clean supply of water. In addition, companies that make paint, chemical products, and certain paper goods are water intensive, necessitating a reliable and large supply of water for manufacturing processes. Finally, the relationship between higher education and the advanced manufacturing cluster serves as another important consideration. Universities, such as Rutgers’ Advanced Manufacturing Institute located near one of the clusters, provide research and development that assists firms in crafting new technologies and using them to refine production processes. Further, places of higher education along with their counterparts like trade schools and community colleges provide training and professional development that produces a 21st century workforce for the advanced manufacturing cluster. Another initiative known as the Manufacture NJ – New Jersey’s Manufacturing Talent Network will work to build capacity of employers, help develop a 21st Century workforce, and encourage expanding firms in the manufacturing sector in New Jersey’s regional economies (Manufacture NJ, 2013).
The Location Quotient analysis reveals that the Advanced Manufacturing Industry in New Jersey is weak and declining. A Location Quotient value less than one, indicates the industry has less of a share of the employment in New Jersey than the United States. From 1990 to 2011 Manufacturing has shed 275,000 jobs at a 3.4% annual decline (New Jersey Department of Labor and Workforce Development, 2012). More recently the recession of 2007 has had strong effects on the industry lowering the Location Quotient value by nearly .05 from 2007 to 2011. Additionally, there is considerable debate as to whether there is a skills gap resulting in the stagnation and decline of the advanced manufacturing industry (Boston Consulting Group, 2012). Through realizing the linkages between infrastructure and Advanced Manufacturing as described above as well as collaboration with institutions the industry is increasingly becoming a focus of state level initiatives.
**Recommendations:**

- Continue to promote industry through Talent Networks initiative and increase partnerships between trade schools, community colleges, and higher education.
- Continue investment in water and sewer infrastructure in strategic locations to support Advanced Manufacturing activities.
- Develop usage of freight rail and other non-vehicular logistical options.
PlanSmart NJ & New Jersey Chamber of Commerce

New Jersey Finance Industry
Employment Density and Infrastructure

Finance Industry Employment Density per Square Mile

- High: 2040
- Low: 0

*Computed using ArcGIS Kernel Density tool

Map Produced 4/9/2013 by Kayla Malsbury
Data Sources: NJ DEDR, NJTPA, NJOGIS, ESRI

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PlanSmart NJ & New Jersey Chamber of Commerce
The finance cluster revealed a rather low nearest neighbor ratio of 0.24, verifying the fact that finance firms are significantly clustered in the New Jersey. From the maps produced, it appears that firms within the finance sector cluster near the urbanized north and around central New Jersey, with a few clusters occurring in the southern part of the state near the Philadelphia market.

Finance firms may choose to locate in these areas for the following reasons. First, cities like Jersey City and Newark simultaneously offer close proximity to New York City and competitively cheaper rents, which attracts the back office establishments of large financial firms. Secondly, workers in the finance industry are considered members of Richard Florida’s “creative class” and research shows that these types of employees prefer urban settings that offer mixed uses and a variety of transportation options. Finally, the finance industry may also tend to cluster near New Jersey’s urban areas because these places offer easy and convenient opportunities for face-to-face interaction, a necessity for firms in service-oriented industries such as finance.
New Jersey’s Finance industry is considered strong and declining from 2010 to 2011. With a Location Quotient value of greater than 1, the industry has a greater share of employment in New Jersey than in the United States. The Finance industry has been in decline from 2008 to 2011 as a result of the recession, investment bank failures, the subprime mortgage crisis and other macro economic factors. Regulation and policy making guiding the finance industry, in particular investment banking, originates at the federal level with the Security and Exchange Commission. The impact of state level policy to this industry would originate from the New Jersey Department of Banking and Insurance.

**Recommendations:**
- Encourage residential development and mixed use projects at transit hubs to attract creative class workers.
- Improve mass transit links between financial hubs within the state making commuting and business travel more efficient and effective.
- Ease commuting times to high density areas with financial sector jobs.
New Jersey Healthcare Industry
Employment Density and Infrastructure

Data Sources: NJGIN, NJTPA, NJ Transit, PASDA, ReferenceUSA, NJ OGIS, ESRI

Map Produced 4/9/2013 by Kayla Malsbury

Healthcare Industry
Employment Density per Square Mile*

High: 1592
Low: 0

*Computed using ArcGIS Kernel Density tool

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Healthcare Industry Analysis

The healthcare cluster indicated a nearest neighbor ratio of 0.13, signifying that this sector is the second most clustered within the state after the tourism industry. The maps produced for this report show a strong relationship between the healthcare industry and New Jersey’s hospital systems because many of the firms in the healthcare industry support the large hospitals by providing lab testing, ambulatory services, and additional patient care. In addition, employment density in this industry appears close to places of higher education. For instance, healthcare clusters can be found near the UMDNJ campuses in New Brunswick, Camden, and Newark. Colleges and universities can respond to the needs of healthcare firms and foster cluster development by providing research and workforce training.
The Healthcare industry in New Jersey has been categorized as strong and growing with a location quotient value of 1.04 signifying that the industry is a cluster of economic growth and has a higher share of employment than the nation. While sustaining job loss as a result of the recession after 2007, the Healthcare Industry appears to be on the rebound carrying growth through 2011. The trend line indicates that growth was likely to continue into 2012. The Department of Labor and Workforce has identified the trends of an aging population and obesity as factors that will increase healthcare demand. Recent policy decisions such as the Rutgers University merger with the University of Medicine and Dentistry of NJ will bring together two of the state’s largest institutions. The merger will enhance education opportunities in healthcare by strengthening recruitment, attracting increased research funds, and improving partnerships between higher education and the healthcare industry furthering the clustering of this industry.

**Recommendations:**
- Continue to fund programs aimed at addressing nursing shortage within the state.
- Increase incentives for construction and improvement to hospitals.
- Increase transit links to make healthcare more accessible.
- Incentivize on-site power generation at critical hospitals and facilities.
What Will It Take to Support New Jersey’s Industry Clusters?
New Jersey Life Sciences Industry Employment Density and Infrastructure

Life Sciences Industry Employment Density per Square Mile*

- High: 841
- Low: 0

*Computed using ArcGIS Kernel Density tool

Map Produced 4/9/2013 by Kayla Malsbury

Data Sources: NJGIN, NJTPA, NJ Transit, PASDA, ReferenceUSA, NJ OGIS, ESRI

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Life Sciences Industry Analysis

This cluster revealed a nearest neighbor ratio of 0.38, indicating significant clustering yet slightly more dispersion than some of the others explored in this report. Central New Jersey, in particular, helps to attract and retain several of the state’s life science companies because the area serves as a halfway point between New York and Pennsylvania, contains a talented labor pool, and hosts major hospital networks and universities that boast reputations as quality research institutions. The central part of the state also provides large tracts of land on which life sciences firms can build their research and production facilities.

Like the healthcare industry, clusters of life sciences firms show a relationship with the state’s hospital networks. Life sciences firms provide research and development for hospitals, while hospitals facilitate clinical trials and purchase biomedical goods produced by the life sciences industry. Life sciences firms also have associations with higher education facilities through research and development partnerships. Educational institutions provide the education and training that produces a strong and highly skilled labor pool for life sciences firms. Lastly, life sciences firms, particularly pharmaceutical manufacturers, need the highest quality of water for developing and making their products. Therefore, these firms are located within the state’s sewer service areas that enable them to access water supplies that prove necessary to their daily operations.
The Life Sciences industry in New Jersey has been categorized as strong and growing with a location quotient value of approximately 1.96 in 2011 signifying that the industry is a strong cluster of economic growth and a has a higher share of employment than the nation. The industry reached a high point in 2007 and declined for three straight years closely tracking the recession. With growth from 2010 to 2011 the Life Sciences industry is set to continue growth as more companies continue to expand within the state’s borders. Higher education institutions such as Montclair State University, Rutgers University in Piscataway, Fairleigh Dickinson University and Monmouth University identified areas of life sciences, chemistry, biology, and lab space as top areas in need of priority investment (NJ Presidents Council, 2011).

**Recommendations:**

- Continued investment to maintain and improve existing water and sewer infrastructure service areas.
- Consider InnovationNJ/NJPRO “Building Bridges II” report on encouraging academia, industry and the state to work together to leverage research and development assets to build New Jersey’s “Innovation Economy”.
- Develop laboratory space specialized for biotechnology companies in areas with high access to transit and quality water and sewer infrastructure.
- Prioritize investment of New Jersey higher education “Building Our Future Bond Act” to align with industry cluster needs.
What Will It Take to Support New Jersey’s Industry Clusters?
Case Study: Route 1 Corridor Life Sciences Industry Cluster

Between 1980 and 2000, the Route 1 Corridor, from New Brunswick to Trenton, also known as “Einstein’s Alley” gained nearly 100,000 jobs (Route 1 Regional Growth Strategy). Within this period of economic growth, employment in high value industries of biotechnology, pharmaceuticals, and other industries grew to form the Life Sciences industry cluster. The map shows that a variety of hard and soft infrastructure supports the corridor which has allowed the region to gain a geographic competitive advantage.

The region’s location within the global and national economy is bolstered by its transportation systems. The Northeast Corridor train line extends through multiple states and contains 17% of the US population, 20% of the US GDP and 37% of Fortune 100 companies (NEC Commission). With unparalleled access, the life sciences industry is prominently positioned at major transportation hubs such as New Brunswick and Princeton through a short connection line at Princeton Junction. Adding to the transportation capacity is Route 1 which provides commuters access to corporate office parks which houses life science companies of a variety of sizes.

Another factor leading to a competitive advantage is the constant supply of a highly educated workforce from education institutions. Within the corridor, Princeton and Rutgers Universities produce graduates within science, technology, engineering, and math (STEM) career tracks. Additionally, the private corporations within this region benefit from the knowledge and research generated at these institutions. The third factor that drives this industry is the close proximity of leading hospitals in both New Brunswick, Princeton, and Hopewell. Having hospitals close by allows pharmaceutical companies access to venues for clinical trials. As of April 23 2013 there were 2,200 active clinical trials occurring in New Jersey highlighting this linkage (Choose New Jersey).

The result of this critical mass of institutions creates a knowledge “spillover” effect in which the natural collaboration occurs from geographic proximity and leads to innovation within the life science field. Finally, the geographic scale allows labor to flow freely between educational institutions and private firms, giving more opportunities for career advancement, furthering the attractiveness of the region.
**Future Challenges**

In order for the Route 1 corridor to maintain its competitive advantage as a geographic location over other regions, future challenges need to be addressed. Stakeholders such as the New Jersey Department of Transportation, PlanSmartNJ, The Vorhees Transportation Center and others have issued recommendations for improvements to the corridor. The New Jersey Department of Transportation predicts that traffic will increase by as much as 55 percent by 2020. Without improvements this will lead to traffic gridlock and a significant increase in commuter traffic time (Route 1 Regional Smart Growth Strategy). Projects such as installing Bus Rapid Transit and the North Brunswick Station and loop project are critically important. In addition, ideas that have been presented such as closing jug handles, highway widening, traffic circles, and new bypasses need to be fully analyzed for impact and feasibility. Finally, stakeholders have also identified a mismatch between housing availability and predicted job increase. A zoning-based build-out analysis, completed in 2010, calculated an increase of over 480,000 new jobs, compared to an increase of only 37,000 new housing units (Route 1 Regional Growth Strategy). This analysis reinforces the jobs-to-housing imbalance as well as the need for municipalities to collaborate and adjust their zoning regulations to meet the future regional needs.
New Jersey Technology Industry Employment Density and Infrastructure

Data Sources: NJGIN, NJTPA, NJ Transit, PASDA, ReferenceUSA, NJ OGIS, ESRI

Map Produced 4/9/2013 by Kayla Malsbury

Technology Industry Employment Density per Square Mile*

High: 1451
Low: 0

*Computed using ArcGIS Kernel Density tool

Map Produced 4/9/2013 by Kayla Malsbury
Data Sources: NJGIN, NJTPA, NJ Transit, PASDA, ReferenceUSA, NJ OGIS, ESRI

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This cluster revealed a nearest neighbor ratio of 0.3447, once again establishing the industry’s tendency to cluster. Firstly, much of the technology employment density tends to locate where fast broadband and fiber-optic communication systems exist. There is a correlation between the growth of the technology industry and the expansion of fast and reliable telecommunications infrastructure. Technology clusters may have a close relationship with public transportation infrastructure because the creative class employees in this industry enjoy having modal choices when commuting to and from work. Finally, although the authors lacked access to data that would illustrate the location of New Jersey’s power lines on the maps produced for this report, the relationship between power infrastructure and the technology is important to consider. The technology industry has a strong association with this type of infrastructure because data centers and technology operators in this sector need consistent, high-quality, and cost-effective sources of power.
The Technology Industry in New Jersey with a Location Quotient value of 1.15 is considered strong. However, the industry has been declining each year since 2007. Despite the downturn a vibrant start up tech community known as NJ Tech Meet up has developed to enhance networking, collaboration, and showcase informative speakers in the field. Similar goals exist for the NJ Technology Talent Network. Also, understanding the potential of this industry, Stevens Institute of Technology identified a Center for Engineering & Science Innovation as a top investment priority (NJ Presidents Council, 2012). The revitalization of the technology industry may come from start up companies as they seek locations close to venture capital and technology resources.

**Recommendations:**

- State level agencies such as the Economic Development Authority should continue funding technology incubator space for start up companies.
- Provide infrastructure and support systems to start up technology companies.
- Monitor Angel Investment and Venture Capital activity as an economic indicator of this industry.
Transportation, Logistics and Distribution (TLD) Industry Analysis

With a nearest neighbor ratio of 0.32, the transportation, logistics, and distribution industry is clustered within the state. TLD firms are inherently dependent on New Jersey’s transportation infrastructure, which is clearly evident in the map above. This relationship is especially important due to “just in time” supply chain management practices that utilize tight schedules to deliver goods and services in the least amount of time, requiring reliable and expedient transportation routes. Much of the TLD employment density is located near the state’s deep-water ports and airports, which enable companies to serve regional, national, and international markets. Clusters also appear along highway interchanges that provide access to local and regional transportation networks. Finally, TLD also exhibits clustering around freight rail facilities.
The Transportation, Logistics, and Distribution industry in New Jersey with a 2011 Location Quotient of 1.26 is strong and declining. However, the decline is not nearly as dramatic as the chart would lead to believe. From 2005 to 2011, the TLD Industry only had an average location quotient value change of -.0057. The total change from 2005 to 2011 was negative .0343. Other industries experienced a much more dramatic change through the same years of the recession. The TLD industry is a part of the New Jersey Talent Networks initiative. The TLD Talent Network is set up to bridge gaps between industry employer’s needs and the education and training of current and future TLD employees (NJ TLD Network).

Recommendations:

- Push for fast track completion of the Port Authority of New York and New Jersey’s raising the Bayonne Bridge Project.
- Implement planned freight rail capital improvements to improve distribution network.
- Integrate ports and freight rail system to lessen reliance on vehicular movement of goods.
New Jersey Defense Industry
Employment Density and Infrastructure

Defense Industry
Employment Density per Square Mile*

- High: 721
- Low: 0

*Computed using ArcGIS Kernel Density tool

Infrastructure
- Ports in Use
- General Hospitals
- Colleges and Universities
- Public Airports
- Sewer Service Areas
- Fiber Optic Service Areas
- State and County Owned Open Space
- Roads (Interstate, US, State, Toll Routes)
- Active Freight Rail
- Passenger Rail (NJ Transit, PATH, PATCO)
- Passenger Rail Stations

Map Produced 4/9/2013 by Kayla Malsbury
Data Sources: NJGIN, NJTPA, NJ Transit, PASDA, ReferenceUSA, NJ OGIS, ESRI

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Aerospace and Defense Industry Analysis

With a nearest neighbor ratio of 0.6843, the Aerospace and Defense firms in New Jersey are statistically the least clustered in the state. However, the mapping reveals Aerospace and Defense firms in New Jersey have a geographic relationship with the military installations in the state, which is not captured with the Nearest Neighbor Ratio Statistic. Clustering around military facilities provides opportunities for weapons and systems testing, exploring maintenance procedures and provides a space for the firms to carry out contracts with the military. The military bases have relationships with open space areas within the state. The open space creates a defendable buffer between the activities on the base which may entail high intensity land use and noise pollution and citizen activity.
The Aerospace & Defense industry in New Jersey has been categorized as weak and declining by consideration of a location quotient of .4755 and context. A Location Quotient value less than one, indicates the industry has less of a share of the employment in New Jersey than the United States. Overall, the Location Quotient of the A&D industry has declined and appears to have leveled off from 2010 to 2011. The decline could be explained by the Base Defense Closure and Realignment Commission (BRAC) closing of Fort Monmouth and relocating the facilities’ operations to Aberdeen, Maryland.

As the Aerospace & Defense industry continues to operate in the state it will be important that the state’s selected and elected officials and agencies identify the key players in the industry and work to establish policies that keep this $5.4 billion dollar industry. This strategy is exemplified by New Jersey Economic Development Authority’s efforts to help Lockheed Martin secure a $100 million dollar contract with the Navy. The $40 million Grow New Jersey Grant in 2012 was for new machinery and equipment, and modifications to the Lockheed facility, which employs about 4,000. A condition of the EDA award was Lockheed winning the Navy contract (Arney 2013).

Recommendations:

- Utilize the Fort Monmouth Redevelopment Authority to create suitable land use plans that brings reuse, business development and employment to the former Fort Monmouth site that will benefit the local economy.
- Continue to support businesses seeking military contracts through incentives and business development initiatives.
- Support a new updated study that examines the economic contribution of military and Coast Guard installations in New Jersey.
What Will It Take to Support New Jersey’s Industry Clusters?
New Jersey Tourism Industry
Employment Density and Infrastructure

Infrastructure
- Ports in Use
- General Hospitals
- Colleges and Universities
- Public Airports
- Sewer Service Areas
- Fiber Optic Service Areas
- State and County Owned Open Space
- Roads (Interstate, US, State, Toll Routes)
- Active Freight Rail
- Passenger Rail (NJ Transit, PATH, PATCO)
- Passenger Rail Stations

Tourism Industry
Employment Density per Square Mile*
- High: 5485
- Low: 0

*Computed using ArcGIS Kernel Density tool

Map Produced 4/9/2013 by Kayla Malsbury
Data Sources: NJ GIN, NJ TPA, NJ Transit, PASDA, ReferenceUSA, NJ OGIS, ESRI

PlanSmart NJ & New Jersey Chamber of Commerce
Tourism Industry Analysis

The Tourism industry, with a Nearest Neighbor Ratio of .108, is statistically the most clustered in New Jersey. While Atlantic City exhibits the highest concentration of tourism employment by far, the above map also shows the clustering of the Tourism industry at the Jersey Shore and other tourist locations such as Six Flags Great Adventure. New Jersey regularly hosts professional sporting events at Metlife Stadium in the Meadowlands and the Prudential Center in Newark. In 2014, the state will capitalize on the NFL Superbowl which will provide increased tourism revenue and opportunity to showcase the state's hospitality to visitors to this large event. Similar to most industries, employment in tourism tends to follow the patterns of infrastructure and development. It is important to note, however, that there is a lack of tourism industry employment near open space. New Jersey's natural resources can serve as a key “quality of life” infrastructure that attracts tourists for outdoor activities and ecotourism.
The Tourism Industry in New Jersey has been categorized as weak and declining by consideration of a location quotient of .86 and context. A location quotient value of less than one indicates the industry has less of a share of the employment in New Jersey than the United States. The location quotient of the Tourism industry appears to be in constant flux, however when examined more closely the variation ranges by only approximately .01 from its highest point in 2006, to its lowest point in 2011. This indicates that the Tourism industry, which may experience fluctuation in revenues, is relatively stable in terms of employment numbers from year to year.

Much of the damaged infrastructure caused by Superstorm Sandy will have lasting effects on New Jersey’s tourism industry, particularly in the shore locations. In addition to real impacts, there may be perceived damages that can deter tourists from visiting the shore. Such misperceptions can last months after infrastructure has been restored (Sandy Action Plan). Therefore, the future outlook of the Tourism industry at the shore remains a large question as efforts to recover from Superstorm Sandy will be the driving force of this endeavor. Various state agencies and the federal government are offering a host of services available to businesses impacted by the storm. It will be critically important that recovery effort does not become a patchwork of initiatives up and down the coastline but rather a strategic longer term planning efforts that produces outcomes that will allow recovery and future growth of the tourism industry.

**Recommendations:**

- Encourage the rebuilding of infrastructure in a sustainable and resilient way that balances environmental concerns with common sense.
- Aggressively market and promote recovery efforts to enhance perceptions and patronage of areas ready to receive tourists.
- Continue to look towards innovative transportation solutions to move tourists to New Jersey destinations, such as a regional fare card during the Super Bowl.
- The industry should explore mobile technology that helps guide tourists to new experiences and activities.
What Will It Take to Support New Jersey’s Industry Clusters?

Atlantic City Tourism Industry Cluster

Infrastructure
- Ports in Use
- General Hospitals
- Colleges and Universities
- Public Airports
- Sewer Service Areas
- Fiber Optic Service Areas
- State and County Owned Open Space
- Roads (Interstate, US, State, Toll Routes)
- Active Freight Rail
- Passenger Rail (NJ Transit, PATH, PATCO)
- Passenger Rail Stations

Tourism Firms
Number of Employees
- 0 - 6
- 7 - 250
- 251 - 500
- 501 - 1000
- 1001 - 6500

Data Sources: NJGIN, NJTPA, NJ Transit, PASDA, ReferenceUSA, NJ OGIS, ESRI

Map Produced 4/9/2013 by Kayla Malbury

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Case Study: Atlantic City Tourism

Although New Jersey boasts an extensive list of tourist attractions, the Shore region certainly takes the top spot as an extremely popular destination among residents and visitors. This case study focuses specifically on the Atlantic City area, as it plays a particularly important role in New Jersey’s economy. Moreover, Atlantic City has a number of challenges and opportunities that present a rather complex, yet compelling example for this report.

About 30 million visitors come to Atlantic City every year to take advantage of its casino gambling, luxury hotels, beaches, top restaurants, attractions, spas, entertainment, and shopping (New Jersey Division of Travel and Tourism). Therefore, the city serves as a major revenue generator and employment center for the state. Unfortunately, Atlantic County faced a negative 2.1% change in tourism direct sales in 2012, mostly attributed to declining gambling wins. Nevertheless, there is a 4.6% positive change in direct employment in Atlantic County for this same period, with 69,429 employees in 2012. Atlantic County contains the most tourism sector jobs in New Jersey by far. The total share of total employment in Atlantic County attributed to tourism is an astonishing 52.8%. This statistic underlies the importance of planning for resiliency in this heavily tourism-dependent area. While the Atlantic City tourism market did not suffer impacts as large as the northern shore, Superstorm Sandy did close the casinos for up to a week and cause significant damage (Tourism Economics, 2012). Future planning for tourism in the Shore area should consider resiliency as a major goal to help manage impacts from future weather events.

As evidenced by the above map, Atlantic City is served by a rather robust transportation infrastructure, with air, rail, and major road access. The Atlantic City airport attracts major airlines such as Spirit and AirTran, which provide service to places such as Boston, Orlando, and Atlanta (New Jersey Division of Travel and Tourism). Despite its high capacity, the airport is relatively under-utilized. The Port Authority of New York and New Jersey has recently been approved to take over the airport in the hopes that it can increase usage (Potter, 2013). There is also rail access to Atlantic City via the Atlantic City Line, which runs from Philadelphia to a train station adjacent to the Atlantic City Convention Center. Nevertheless, rail is the least common form of transportation for Atlantic City visitors. In 2011, according to the South
Jersey Transportation Authority, there were just 205,000 visitor-trips via rail, while there were 24,293,000 trips via automobile, 3,223,000 via casino bus, 449,000 via franchise bus, and 282,000 via air travel (The Atlantic City Convention and Visitors Authority, 2013.) Bus and automobile travel are particularly popular because the city attracts the majority of its visitors from New Jersey and nearby urban areas.

While Atlantic City’s location is close to major urban areas (one hour from Philadelphia and two and half hours from New York City), its location is proving to be less appealing in recent years. Gaming revenue in New Jersey has fallen from a high of $5.6 billion in 2006 to a little over 3 billion in 2012, whereas the casino industry in other nearby states has become increasingly profitable, most notably Pennsylvania. Experts attribute Atlantic City’s decline to the availability of new casinos in locations that are more convenient to residents of the New York and Philadelphia metro areas (Lattanzio, 2013).

To combat these trends, some suggest that that Atlantic City should seek to decrease its reliance on casino gambling by attracting a broader crowd with events and other attractions (Lattanzio, 2013). For example, the Atlantic City Arts Commission and the Noyes Museum of Art at Richard Stockton College of New Jersey are actively marketing Atlantic City as an arts and culture destination. The organizations have planned a boardwalk art show, and an art-retail space has been recently leased out to serve as an anchor for an Arts District that is planned for the city (Bogdan, 2013). The Arts District is part of a greater Tourism District Master Plan that is overseen by the Casino Reinvestment Development Authority. The plan “offers a strategic framework for near-term, mid-term and long-term project and policy initiatives that will enhance the visitor experience, stimulate private investment and improve the financial stability of Atlantic City.” Moreover, it places importance on infrastructure components, as an assessment of the existing infrastructure revealed insufficient roadway capacity, need for alternative forms of transportation, and aging water, sewer, and stormwater infrastructure (Casino Reinvestment Development Authority).
Policy Conclusions

This report emphasizes the importance of:

- **STEM Education** – A workforce educated in the fields of science, technology, engineering, and math is critical to the success of several if not all of the industries mentioned in this report.

- **Redevelopment** - Careful evaluations of appropriate redevelopment sites must take place so that commercial and residential projects can capitalize on infrastructure already in place, minimizing the cost and impact of creating additional infrastructure to support new development.

- **Transportation and Utility Investment** – When workers, goods, and services can move to deliver products in a timely fashion economic activity and output is greatly increased.

- **High Quality Places** – Companies and workers are increasingly seeking locations that have cultural amenities, are open to diversity, have quality housing and retail options, accessible open space, and easy access to public transportation.

- **Talent Networks** – This state level initiative helps to generate employment in the industry clusters that were examined in this report. It will be critically important to continue to develop New Jersey’s workforce.

- **Technology** - The influence of technological change on regional industry cluster growth will be maximized when industries are clustered together geographically. Innovation in one business or industry will lead to advancement in others.
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