

# LONG ISLAND INNOVATION INDEX

Prepared for the Long Island Index  
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Dear Friends,

For more than a decade, the Rauch Foundation has published the *Long Island Index* which tracks progress on key regional economic and community indicators. One of the critical challenges identified by the *Long Island Index* has been how to create a vital economy that will generate high paying jobs for residents of Long Island through new businesses and the expansion of existing business.

In 2010, a group of leaders from Long Island's research institutions, businesses and local government began working together to identify ways to better connect our region's innovation assets to stimulate entrepreneurship and job creation. The result of this collaborative effort was the formation of Accelerate Long Island, regional initiative to promote innovation through collaboration.

To establish an objective baseline of information about the relative strength and weaknesses of our current innovation system and measure our progress over time, the Rauch Foundation is pleased to support the *Long Island Innovation Index*. Working with an advisory group representing the region's major research organizations, Collaborative Economics has developed this inaugural Index to help the region better understand where we currently stand and what needs to be done to move our innovation system forward.

The Index is based on a framework that demonstrates how innovation assets of research and talent are translated into important outcomes of new firms and good jobs through a commercialization process that involves dynamic interaction between researchers, entrepreneurs, financers within an innovation habitat. While investing in critical assets is necessary, they are not sufficient for success. The Innovation Index tells the story of how well Long Island is doing in sustaining an innovation habitat that has proven so important in other leading innovation regions.

This Index suggests that while our region has many strengths and assets to build on, we can take a number of important steps to create a stronger innovation system.

As Accelerate Long Island is implemented, the *Long Island Innovation Index* will provide an important tool for tracking our progress over time as well as comparing ourselves to other regions. What matters most is building our strengths and addressing our weaknesses by collaborating to promote our unique opportunities so that we can achieve the economic promise of our region.

With this spirit of collaboration, Long Island can have a strong future as a leading innovation region that generates opportunity for its people and businesses.

Sincerely,

Nancy Rauch Douzinas  
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**Special thanks to the distinguished group of advisors who contributed valuably to the development of this document.**

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## EXECUTIVE SUMMARY

A major finding of the inaugural Innovation Index is the discovery that **Long Island has more innovation strengths than is often recognized** and that the region has the potential to become a leading innovator if it uses its assets more effectively.

- ✓ Long Island is **home to world class research centers** at its nationally recognized laboratories and research universities. The region's science and engineering talent base is growing, and its research and development funding has been rising.
- ✓ Several **innovative companies have been founded** in Long Island with roots in the region's research institutions, especially in the areas of biosciences, information technology and clean energy.
- ✓ A key measure of economic vitality is entrepreneurship, and Long Island has been **creating new establishments**, with a high percentage in business services, especially in scientific and technical services.

However, **Long Island's regional innovation system is not yet fully developed compared to other leading innovation regions**, and there are several key areas in need of improvement.

- ✓ While **venture financing and patenting has been on the rise, both lag** the level of other leading regions, indicating greater opportunities for commercialization of the region's technologies.
- ✓ There are **positive signs that the region's innovation system is moving toward greater commercialization** as technology licensing from research institutions, direct technology commercialization by institutions, contract research with the private sector and collaborative and cooperative research initiatives have all been recently on the rise.
- ✓ **Key areas for improvement** involve continued investments in the region's talent and R&D assets while taking steps to create greater linkages between the region's research universities and labs and market driven commercial opportunities focused on growing industries.

**Implications of the Long Island Innovation Index** include:

- ✓ In five years, **Long Island could be a leading region** not only in science and engineering talent and research and development funding but also in attracting venture financing, increasing patenting and licensing, and the creation of innovative companies based on these relationships.
- ✓ Initiatives such as **Accelerate Long Island can play a key role** in helping to connect Long Island's innovation assets and promote commercialization by building closer relationships among the region's research institutions and private sector.
- ✓ This will generate **greater entrepreneurship and business innovation** in the region's leading industries of bioscience, information technology and clean energy.
- ✓ Sustaining a **vital cycle**, wealth created by this increasing economic innovation can help support investments in the region's quality of life including education, housing and transportation that will benefit residents and attract and grow high value businesses.
- ✓ The timing is right for acting now. In addition to the momentum building behind Accelerate Long Island, Governor Cuomo has launched an effort to redefine the state's approach to economic development to focus on the regional level. **Long Island is one of the ten Regional Economic Development Councils** created – public-private partnerships composed of local experts and stakeholders from business, academia, local government, and non-governmental organizations. This effort will allow Long Island to develop its own strategic plan tailored to its own strengths and unique assets.

## HIGHLIGHTS

**LONG ISLAND HAS MANY STRENGTHS AND ASSETS.** Assets, such as a talented workforce, research and development capacity, and investment capital, contribute to the foundation of an innovation system. These assets fuel the innovation process and create economic opportunities in the global economy.

While slightly less than the national average and below other leading technology regions, Long Island's Science & Engineering (S&E) talent base is growing, driven primarily by growth in foreign-born talent.

- Long Island's S&E talent expanded by ten percent between 2000 and 2009.
- In 2009, one-fifth of S&E degrees conferred on Long Island were earned by foreign students compared to one in seven, nationally.
- Looking at the region's broader talent base, 32 percent of adults on Long Island have a Bachelor's Degree or higher. While exceeding the national average of 26 percent, Long Island lags other innovation centers and no progress has been made since 2005.
- Long Island's population growth picked up in 2009. Driven by foreign migration, for the first time since 2001, more people moved to Long Island than left.

Federal Research & Development funding is rising on Long Island driven in large part by the Department of Health and Human Services (HHS) and the Department of Energy (DOE).

- Federal R&D funding on Long Island increased 25 percent from 2009 to 2010, jumping from \$243 million to \$304 million. Accounting for 62 percent of total federal R&D in the region in 2010, funding from HHS rose 15 percent to reach \$189 million. DOE funding more than tripled in 2010, reaching \$67 million, primarily due to new funding related to smart grid and energy efficiency research.
- Since 2005 growth in federal R&D funding in the region rose 54 percent between 2005 and 2010 while it dropped by 12 percent nationally.

Long Island attracts modest flows of venture capital investment when compared to other U.S. innovation regions; however, investment has been picking up in recent years.

- Venture funding on Long Island increased nearly threefold from 2009 to 2010 to \$21.4 million, surpassing investment levels of the preceding three years.
- Most recently, Software, Media and Entertainment, Biotechnology and Financial Services are attracting the strongest investment flows.

**THE PROCESSES AND REGIONAL INTERCONNECTIONS ARE WHAT GENERATE VALUE FROM A REGION'S INNOVATION ASSETS.** Innovation processes include the generation and commercialization of new products and ideas, entrepreneurship and business innovation.

Patenting is on the rise on Long Island but at a slower rate than other innovation centers.

- In 2010, patent registrations increased 26 percent over 2009, representing the peak of activity over the last two decades.
- Over the last decade, patents in Communications surged 113 percent and in Computers, Data Processing & Information Storage, by 73 percent.
- Though building from a smaller base, patent activity related to biotechnology increased 38 percent in the most recent period 2008-10, outpacing other regions.
- Collaboration with researchers based abroad increased from two percent in 1990 to eight percent in 2009. Co-patenting has significantly increased with researchers in Canada, United Kingdom, and Israel.

Long Island's labs and universities are engaging with the business community to drive innovation and commercialization in the region.

- Technology licensing from research institutions increased 31 percent in 2010.
- Direct technology commercialization by institutions increased from 19 to 31 in 2010.
- Contract research with the private sector in 2010 jumped 73 percent in number of agreements and 94 percent in value.
- The number of collaborative and cooperative research initiatives has increased by 203 percent since 2005.

Entrepreneurship is alive on Long Island.

- From 2008 to 2009, 11,200 new establishments were created and Business Services led the way accounting for 24 percent.
- Growth in small business innovation awards on Long Island is outpacing the state, nation, and other innovation centers, increasing 120 percent to \$38 million in 2009. Statewide, SBIR funding increased 55 percent and nationally by 12 percent over the same year.

### **THE OUTCOMES OF INVESTING IN LONG ISLAND'S SCIENCE AND TECHNOLOGY ASSETS AND FACILITATING THE INNOVATION PROCESSES IN THE REGION WILL BE RISING ECONOMIC COMPETITIVENESS AND REGIONAL PROSPERITY.**

Earnings and productivity are rising and the number of new firms is growing.

- Earnings and the regional cost of living remain relatively high on Long Island, and after declining in 2008, average annual earnings on Long Island have recovered their climb.
- Regional productivity falls above the national average but below the state average and has increased at a slower rate.
- Productivity growth varies by industry, and the strongest growth in productivity between 2001 and 2011 was reported in Natural Gas Extraction (79%) and Information (72%).
- Increasing 34 percent over the prior year, 2009 represents the fourth straight year of growth in new establishments on Long Island with 19,200 net new firms. Newly opened firms make up 98 percent of the 31,200 new establishments founded in 2009.

The region's overall employment has outpaced state growth by 0.7 percent at an average annual rate. Biological Sciences, Information Technology, and Clean Energy represent Long Island's key industry clusters of opportunity.

- Since 2000, Biological Sciences is highly concentrated and has grown at an annual rate of 9.5.
- IT is large and concentrated, and though employment has declined, it remains an important and diverse industry on Long Island.
- Although still small, Clean Energy has grown annually 4.7 percent since 2001 and continued growth is expected.

### **QUALITY OF LIFE OF INDIVIDUALS AND SOCIETIES CAN BE MEASURED BY THE LIVABILITY AND VIBRANCY OF A REGION. Proximity of the workplace to attractive and affordable living options and local offerings of leisure time activities contribute to general well-being, spur creativity and attract and retain talent.**

Compared to other regions, Long Island's housing cost burden is second only to San Diego for renters and owners; however, housing costs appear to have stabilized since 2007.

Although Long Island's number of artists and entertainers per capita is not as high as other innovation centers, the number of arts and entertainment establishments has increased 57 percent from 1995 to 2009, and two percent between 2008 and 2009.

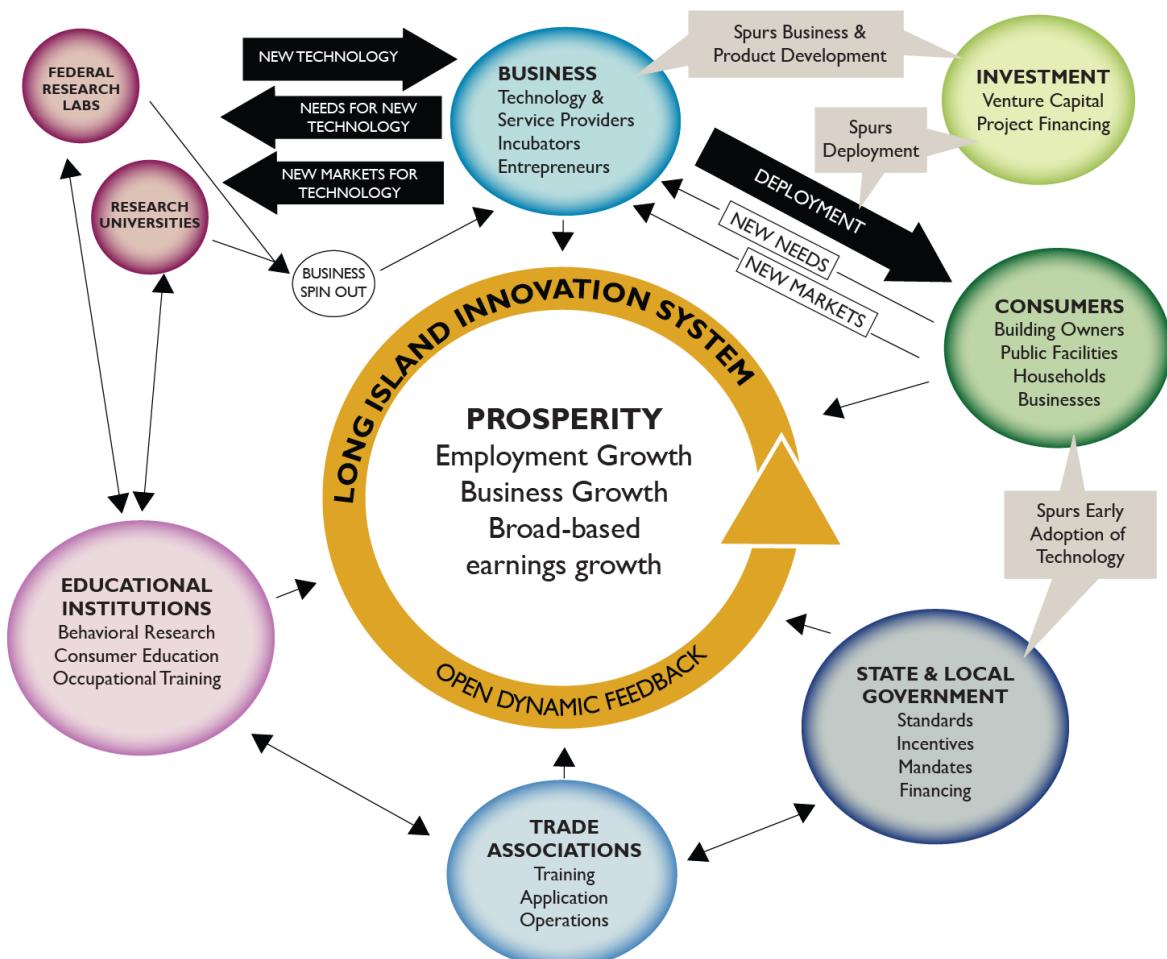
# THE LONG ISLAND INNOVATION INDEX

## The Elements of a Vital Regional Innovation System

A vital regional innovation system is driven by a diverse mix of world-class economic actors in an environment which supports the flow of information between actors and across different types of actors such as businesses, researchers, consumers, investors, educators and policymakers. It is the open flow of interaction between these different actors that create the vital feedback loops that speed adaptation and creation in the commercialization process which results in economic growth and prosperity.

The image below illustrates the participants in the region's innovation system and the dynamics which generate added value beyond the sum of the individual elements. New investment in Long Island's innovation system will stimulate the dynamics already in place, speed the broad deployment of technology already under development and result in gains in employment and regional prosperity. Related to clean energy technology, the local deployment of products that conserve energy or leverage clean energy sources will also support environmental improvement as the region lowers its reliance on carbon-based energy. Further, as the speed of development and deployment quickens in Long Island, the deployment of these important technologies will quicken nationally.

### ASSETS AND DYNAMICS OF A REGIONAL INNOVATION SYSTEM



While Long Island benefits from its **universities and federal labs**, an innovation system is primarily driven by the information flowing through the many feedback loops of the system. While much valuable technology originates in the labs and other research centers, an open dynamic model spurs the flow of information about new market needs to help drive research and development. This means that more complete information about the needs of consumers reaches **businesses** (e.g. the product and service providers) and labs (scientific and technical researchers). This also means that where rich communication flows exist, dollars spent on research and development can go further and result in a broader impact in the community. **Venture capital** investment of cash and business development assistance serves to accelerate the commercialization of viable technology.

**Innovative public policy** can support the growth of new markets and new technology. Policy makers can create a supportive environment for start-up companies by supporting the development of seed funding and creative financing mechanisms that support commercialization, facilitating low-cost space and offering other incentives for entrepreneurs to grow their companies in the region. Policy makers can also help grow demand for new technology. Without picking specific technologies, policy makers can align consumer incentives and public procurement to encourage the adoption of new technology. Specifically in the area of clean energy, setting standards for building and appliance efficiency can not only improve the region's energy efficiency but also increase the demand for the required products and services. A region that can develop a culture of early technology adoption creates rich feedback loops which speed the forward advancement of technology.

For technology related to clean energy, **trade associations** play a critical role in the application and operations of clean energy generation systems and building efficiency products as well as in the related training activities. They generate important feedback to product providers and developers as well as to policymakers especially in the area of operations and the proper functioning of systems.

Long Island's **educational institutions** including universities, community colleges and other occupational training centers contribute meaningfully to the region's highly skilled talent pool. When linked directly with other elements of the system, educational institutions contribute to the development of technology, business, public policy and consumer education in addition to occupational and professional training.

## Long Island's Research Assets

Long Island is home to world-class research centers in its two national laboratories and three universities. These institutions are contributing to advances in science and technology through fundamental and applied research. With different fields of expertise and types of facilities, each institution contributes valuably and uniquely to the region's diverse talent base in science and engineering as well as business and law. In addition to talent, these institutions offer unique capacity, through technology and equipment, for supporting the technology development efforts of the region's innovative companies.

Long Island's laboratories and universities are briefly presented below.

### Cold Spring Harbor Laboratory

Established in 1890 and located in Laurel Hollow, New York, Cold Spring Harbor Laboratory (CSHL) is a private, non-profit research and educational institution with programs focusing on cancer, neurobiology, plant genetics, genomics, and bioinformatics. CSHL is a renowned leader of the biotechnology movement and further is distinguished by its emphasis on collaboration and early stage research and careers. The Laboratory has been home to eight Nobel Prize

winners, including its president of 40 years, President James D. Watson, who discovered the structure of DNA.

C冷 Spring Harbor Laboratory is primarily a research institution focused on the study of the fields of Cancer, Neuroscience, and Plant Biology. Since 1987, C冷 Spring Harbor Laboratory has been a National Cancer Center. Its scientists use a multidisciplinary approach to explore the molecular basis of human cancer with the goal of improving diagnosis and treatment of all forms of the disease. This approach has led to the discovery of the first human cancer gene and many of the underpinnings of cancer genetics in 1981, the development of DNA profiling technology in 2004, and the advancement of drugs that target and treat childhood leukemia in 2011. In the field of neuroscience, C冷 Spring Harbor Laboratory scientists use genetic, molecular, physiological, and imaging tools to study attention, memory, and decision making. Their research has been beneficial in the understanding the causes of disruptions in diseases including autism, schizophrenia, and Alzheimer's. Finally, C冷 Spring Harbor Laboratory has a reputation as one of the foremost leaders in the field of plant biology. Barbara McClintock, the first women to independently win the Nobel Prize for Medicine in 1983, was the first to discover that gene sequences could be transposed and she became one of the most well-known scientists working with the hybridization of maize and rice. More recently, C冷 Spring Harbor Laboratory has been working with the U.S. Department of Energy to develop aquatic plants for biofuel production.

Today, Cold Spring Harbor Laboratory maintains a reputation as one of the world's premier hubs of activity in biology and genetics. It employs a staff of over 400 scientists and maintains a budget of over \$140 million. The recently opened Watson School of Biological Sciences at C冷 Spring Harbor Laboratory was ranked 3<sup>rd</sup> in the nation for graduate schools of biology and biomedical studies by the National Research Council.

Over the past 20 years, C冷 Spring Harbor Laboratory has spun off 20 start-ups from research performed at its labs and, as a result of its success, the lab is running out of research space to house new companies. To continue providing facilities for start-ups and for its most successful start-up, OSI Pharmaceuticals, Cold Spring Harbor recently completed an addition of six new laboratory buildings to its campus and will begin work on expanding the Broad Hollow Bioscience Research Park to 38.5 acres, collaboration between C冷 Spring Harbor Laboratory and Farmingdale State College.<sup>1</sup>

### **Brookhaven National Laboratory**

Located in Upton, New York, Brookhaven National Laboratory (BNL) is a United States national laboratory operated by the Brookhaven Science Associates under contract by the U.S. Department of Energy. Brookhaven was originally conceived as just a nuclear research facility in 1947. Today, its mission has expanded to include nuclear and high-energy physics, physics and chemistry of materials, environmental and energy research, nonproliferation, neurosciences, medical imaging, and structural biology. Recently, Brookhaven has been working on ways to commercialize its technologies in order to foster entrepreneurship in the Long Island region.

Brookhaven National Laboratory's Office of Technology Commercialization and Partnerships (TCP) contributes to building a vibrant entrepreneurial community focused on commercialization and technology based enterprises. BNL engages inventors, entrepreneurs, business leaders, investors, service providers, large corporations and small businesses through a range of programs and support services. These programs include:

**The Entrepreneurs' Foundation Workshop Series:** A quarterly program that brings together entrepreneurs, technology transfer and business experts to discuss topics relevant to start-up technology companies.

**The Next Top Energy Innovator:** A program that aims to increase the number of start-up companies arising from the National Laboratories offering its patented technologies with simplified commercial license options available at reduced costs.

**The New York Innovation Marketplace:** A web-based resource for companies and entrepreneurs looking to bring new technologies to the marketplace.

In partnership with Accelerate Long Island, BNL hosted a workshop in August for scientists, entrepreneurs and investors to discuss early-stage technologies invented by BNL researchers. This represents an important step towards commercializing research from Long Island's labs. Jointly, under the federal Start-Up America initiative, BNL will offer start-up companies the option to license one of BNL's 300 available technologies for a discounted fee of \$1,000 until the end of the year. BNL has taken a leadership role in this federal initiative, and other DOE laboratories have adopted their agreement template for commercializing technologies from their own labs.<sup>2</sup>

With a staff of approximately 3,000 scientists, engineers, technicians and more than 4,000 guest investigators hosted every year, Brookhaven is a integral part of both the science and innovation communities on Long Island. Brookhaven's facilities are free to use by researchers who publish their findings in open literature and maintains a strong connection with the institutions of higher learning nearby by offering internships for graduate students and programs for students and professors alike.

### **Stony Brook University**

Stony Brook University is a public research university founded in 1957 and located in Stony Brook, New York. Considered the flagship university of the State University of New York (SUNY) system, Stony Brook is a haven for innovation and research in the fields of science, medicine, and engineering. Stony Brook is also noted for numerous scientific discoveries made at the university including the dating system used to determine the age of the Moon, the first MRI imaging machine, and the first virtual colonoscopy machine.

Stony Brook has also worked with the Long Island region to encourage entrepreneurship and provide areas for companies to innovate and develop their industries. These locations include the New York State Center of Excellence in Wireless and Information Technology (CEWIT) and the Long Island High Technology Incubator (LIHTI). CEWIT has leveraged a \$50 million state construction award to attract more than \$150 million in support for almost 100 industry partners, and \$100 million in competitive federal grants, to keep Long Island and New York at the forefront of the ongoing information technology revolution. They have produced 117 invention disclosures and 43 issued patents; 19 of these have been licensed to industry. LIHTI is a premier hub for early-stage, high-tech companies to enhance their opportunity for development and growth. Since the incubator opened 16 years ago, it has housed over 70 companies, most of which have had a high rate of survival upon graduating from the program. These graduated companies earned more than \$100 million in revenues last year and employ hundreds of Long Islanders. The university's economic development programs, which assist companies of all sizes and stages of development, have supported the creation or retention of more than 17,000 jobs.

Stony Brook University is one of the premier public research institutions of higher education in the country. It educates almost 25,000 students, undergraduates and postgraduates, every year and employs an academic staff of almost 2,000. Stony Brook maintains a strong connection to

the community it serves and encourages its students and staff to get involved with the locally owned companies it has helped create over the years.

### **Feinstein Institute**

Located in Manhasset, New York, The Feinstein Institute for Medical Research is a private, non-profit institution with research programs focusing on immunology, inflammation, neuroscience, and behavioral medicine. The Institute was founded in 1995 to support the research operations of the North Shore-Long Island Jewish Health System. The North Shore-LIJ is the largest integrated health system in New York State and second largest secular healthcare system in the country based on patients served. Feinstein Institute, as part of the North Shore-LIJ Health System, has transformative and ever-expanding influence on the healthcare industry on Long Island.

Working in collaboration with other universities worldwide, Feinstein scientists study the molecular biology and pathophysiology of immunity, autoimmune diseases, cancer, neurodegenerative diseases, and neuropsychiatric conditions. Feinstein Institute sees itself as a bridge between biomedical research and patient care, through its connection with the North Shore-LIJ's 15 hospitals. Patients can participate in clinical trials related to the use of experimental drugs in various stages of clinical and preclinical testing for cancer, cardiac disease, diabetes, sepsis, shock, trauma, arthritis, and other inflammatory conditions. Over 90 percent of the research can be characterized as "patient-oriented," some 65 percent of which is supported by federal grants. The Feinstein Institute is also home to the Federal Clinical Research Center that offers state-of-the-art facilities for designing, implementing, and conducting clinical research in a central location, an Early-Phase Schizophrenia Center, the Laboratory of Medicinal Biochemistry, and the Litwin-Zucker Center for Alzheimer's disease.

Feinstein Institute is one of the premier institutions for biomedical research in the country. With a staff of over 800 employees and an endowment of more than \$45 million in federal funding from the National Institutes of Health, The Feinstein Institute is a growing force in research innovation, education, and progress.

### **Hofstra University**

Founded in 1935 as an extension of New York University (NYU), Hofstra University is a private undergraduate and post-graduate institution of higher learning located in Hempstead, New York. It is the largest private university in New York and one of the few in the country that holds full accreditation in 19 academic areas. Hofstra University has several programs and centers that interact with the business community, providing training and research support. These include the Scott Skodnek Business Development Center, the Wilbur F. Breslin Center for Real Estate Studies, and the Frank G. Zarb School of Business.

The Scott Skodnek Business Development Center (BDC) offers an array of programs that support business and entrepreneurs whether the goal is to start a business, expand and/or diversify an existing business, develop or improve management skills or train workers in new skills. By combining Hofstra's faculty and student body with Long Island's business community and governmental agencies, the BDC provides a comprehensive package of expertise and service designed to promote economic development and workforce development on Long Island and throughout New York.

The Wilbur F. Breslin Center for Real Estate Studies at Hofstra University is an interdisciplinary center for the study of real estate that brings together the expertise of Hofstra's School of Business, Hofstra's School of Law, and the Institute of Real Estate at Hofstra. The Center

provides real estate professionals, municipal officials, developers, and the public with information, education, and scholarly analysis about complex issues important in the real estate field. The Center also provides training for other officials in the real estate industry and has become a trusted source for real estate education, mentoring, information, and networking.

The Frank G. Zarb School of Business is a comprehensive business school offering Bachelor of Business Administration, Master of Business Administration, Executive Master of Business Administration, and Master of Science degrees. It is noted for being one of the few schools in the nation to hold dual accreditations from the Association to Advance Collegiate Schools of Business (AACSB) in both business and accounting. Students are offered the opportunity to participate in scholarly activities like The Merrill Lynch Center. This center was established to promote and facilitate faculty and student study in the field of international financial services and markets, and to communicate knowledge and information in the business field.

In new developments, the new North Shore-LIJ School of Medicine at Hofstra University has just welcomed its first entering class, and the University has announced the establishment of a new School of Engineering and Applied Science. Both new initiatives will significantly increase the involvement of Hofstra University with Long Island's research community and businesses in the areas of science, health, technology, and engineering.

### **Farmingdale State College**

Farmingdale State College (FSC), also referred to as State University of New York at Farmingdale, is a public university located in East Farmingdale, New York. FSC has played a critical role in supporting regional economy, providing the education and training for the future workforce and developing the academic curriculum to prepare students to meet industry needs. The college has also been instrumental in the area of research. According to a 2009 study by the Long Island Association, the college has a \$1.1 billion impact and was responsible for the creation of more than 10,000 jobs.

Farmingdale State has developed partnerships with industries in the region propelling the college into a leading role in economic development. The Small Business Development Center at FSC, one of the largest in the state, has worked with more than 23,000 clients who, in turn, have invested \$260 million in the Long Island economy. Farmingdale also prides itself on permitting its students to engage in a variety of internship, clinical, and guided research activities. In 2008, the College reported that 536 students participated in such learning. Farmingdale has also involved itself in the innovation of alternative energy technologies. The Institute for Research and Technology Transfer at FSC pioneered developments in fuel cell technology and its Solar Energy Center was the first of its kind to be established in the Northeast. The college's contributions to industrial efficiency were recognized by SUNY Chancellor Nancy Zimpher.

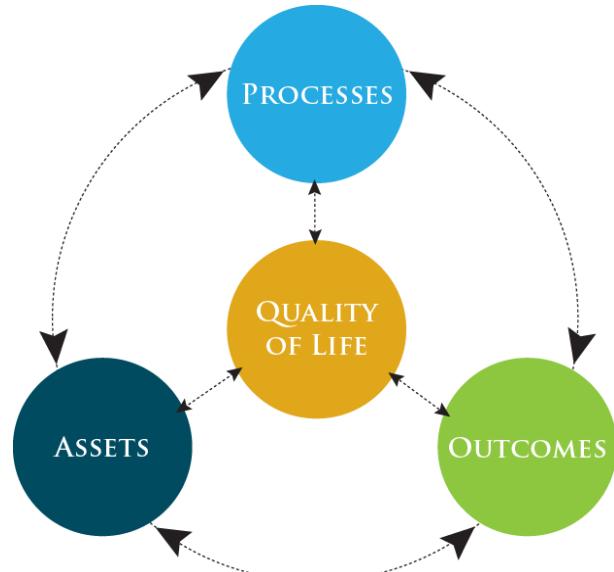
Farmingdale is still one of the best public universities in New York. The U.S. News and World Report ranked Farmingdale as one of the best colleges in the North in its 2011 rankings.

Farmingdale State College remains committed to the community it serves. The vast majority of the student body is recruited from the Long Island area and many of its graduates opt to stay, live, and work in the region. The Long Island Press ranked Farmingdale 88<sup>th</sup> in the country in terms of highest earning power among graduates of public universities.

## Framework for the Long Island Innovation Index

The *Long Island Innovation Index* provides an assessment and tool for tracking the region's progress in growing its assets, improving its processes of innovation, and producing better outcomes for its communities. The *Index* examines Long Island's key science and technology infrastructure and base for innovation. This framework provides important information required for the development of an innovation-based economic strategy. In addition, it offers valuable information to policy makers, administrators and the business community for making informed decisions regarding investment, training and program development. Further, the *Index* provides residents with accessible information about Long Island's strengths and areas for development as well as how the region's economy is evolving.

The framework for the *Index* is organized into four parts: Innovation Assets, Innovation Processes, Innovation Outcomes, and Quality of Life. Each part includes multiple facets, and unique indicators based on local primary data collection which serve to track the dynamics between the region's innovation assets.



### ASSETS:

Long Island has many strengths and assets. Assets, such as a talented workforce, research and development capacity, and investment capital, contribute to a fundamental foundation for innovation. These assets fuel the innovation process and create economic opportunities in the global economy. However, assets alone are insufficient for developing a vibrant regional innovation system.

### PROCESSES:

While examining Long Island's assets provides a measure of its innovation capacity, observing the region's innovation processes provides a measure of how well assets are translating into innovations and economic benefit. Processes include the generation of new products and ideas, the commercialization of these, and the propensity of both entrepreneurship and business innovation.

### OUTCOMES:

Valuing and investing in Long Island's science and technology assets and facilitating the innovation processes in the region will yield positive results for the region's economy and the prosperity of its communities. Measuring outcomes from innovation, such as competitiveness, business performance, and economic opportunity, captures Long Island's economic benefits that result from translating assets into innovations.

### QUALITY OF LIFE:

The general well-being of individuals and societies can be measured by the livability of a given city or region. Arts and culture are integral to Long Island's economic and civic future. Participation in arts and cultural activities spurs creativity and increases exposure to diverse people, ideas and perspectives.

Creative expression is also important to an economy based on innovation. How well the region supports its arts and cultural organizations is an important measure of its overall vitality. A vital arts community is also a factor in a region's attraction and retention of talent.

In some cases, comparisons with other places can be useful when tracking regional progress. The analysis that follows provides regional comparisons for many of the indicators across the four parts of the *Index*. The regions included for comparison represent a mix of places with varying degrees of similarity with Long Island. For the most part, regional definitions are based on the U.S. Bureau of Census defined Metropolitan Statistical Areas (MSAs); however, definitions vary slightly by data source.

<b>LONG ISLAND:</b>	Nassau and Suffolk Counties, New York
<b>BOSTON:</b>	Boston-Cambridge-Quincy, MA-NH Metro Area
<b>GREATER WASHINGTON, D.C.:</b>	Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area
<b>RESEARCH TRIANGLE:</b>	Dunn, NC Micro Area; Durham, NC Metro Area; Raleigh-Cary, NC Metro Area
<b>SAN DIEGO:</b>	San Diego County, California
<b>SILICON VALLEY:</b>	Santa Clara and San Mateo Counties, California
<b>ST. LOUIS:</b>	St. Louis, MO-IL Metro Area

Throughout this document, twelve examples of companies which were founded on Long Island over the years are spotlighted. Many of these companies have roots in the region's research institutions through their founders or the development of their technology. These brief descriptions help illustrate the history and scope of technological and business innovation on Long Island particularly in the areas of biosciences, information technology and clean energy. Given Long Island's assets and track record, the region has a solid foundation upon which to grow and develop its regional innovation system.

## ASSETS

Long Island has many strengths and assets. Assets, however, are a necessary but insufficient condition for success. Assets, such as a talented workforce, research and development (R&D) capacity, and investment capital, contribute to a fundamental foundation for innovation. These assets fuel the innovation process and create economic opportunities in the global economy.

### Talent: Development & Attraction

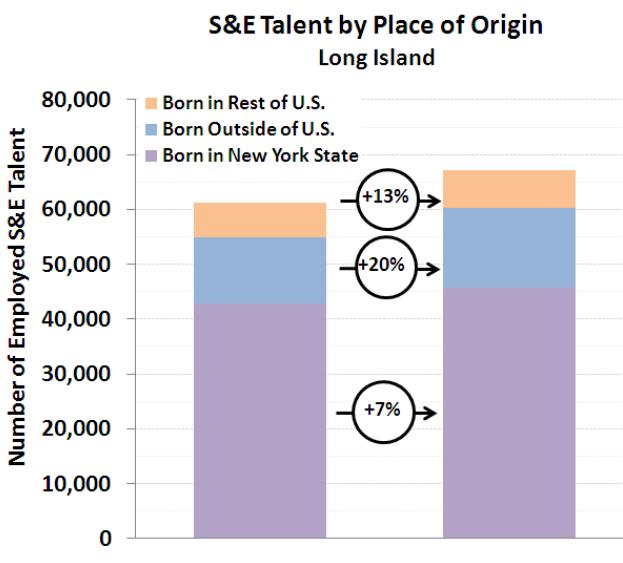
A vital regional innovation system can attract talent from around the world and also grow it at home. Tracking progress in talent development and talent attraction provides some indication of how well the region's companies and research institutions will be able to source the talent they need to remain competitive.

Producing talent takes place at the university level but begins in the early years of education. Universities can be a vital port of entry for foreign talent who often stay in the region to start businesses. Not only do these students provide important skills and often entrepreneurial zeal, they help develop global linkages between their adopted region and their home countries.

Although not large by national standards, Long Island's Science & Engineering (S&E) talent base is growing driven primarily by growth in foreign-born talent. Long Island's S&E talent represents 4.8 percent of the region's total employment. This sets the region below the national average of 5.7 percent. Over nine percent of employment in Boston and Research Triangle are in science and engineering. With its highly diverse technology industry mix, Silicon Valley's S&E talent represents 15.5 percent of total employment.

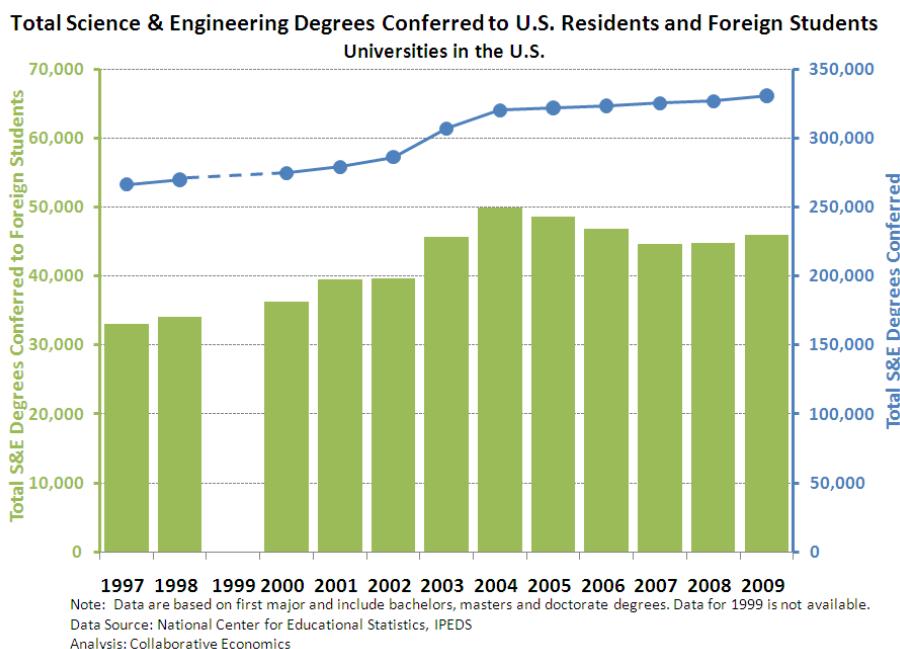
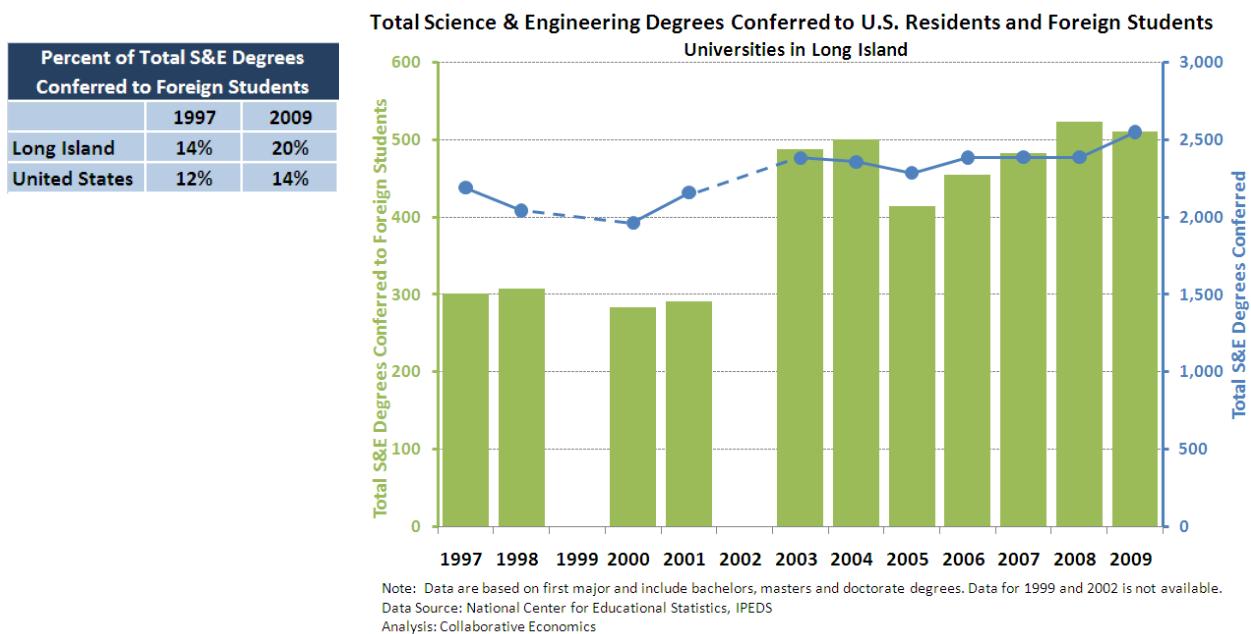
Long Island's S&E talent is growing. Between 2000 and 2009, S&E talent in the region expanded by 10 percent. During that same time frame the share of foreign-born S&E talent employed increased by 20 percent. Representing the two largest groups of foreign-born talent in Long Island, China accounted for 20 percent and India, ten percent, of all foreign-born S&E talent employed on Long Island. Meanwhile, the share of Long Island's employed S&E talent that was born in a state other than New York increased by 13 percent, and talent born in New York State increased by seven percent.

Region	Total Number of Employed Talent		Percentage of Total Employed
	S&E Jobs	All Jobs	
Long Island	67,253	1,396,064	4.8%
U.S.	8,046,347	140,637,710	5.7%
St. Louis	86,237	1,468,180	5.9%
San Diego	115,489	1,353,975	8.5%
Research Triangle	96,051	1,048,983	9.2%
Boston	244,988	2,605,994	9.4%
Greater Washington DC	352,548	2,748,664	12.8%
Silicon Valley	186,516	1,205,352	15.5%



Long Island is training foreign and domestic S&E talent. The total number of S&E degrees conferred on Long Island has grown 16 percent since 1997 and 24 percent nationally. Although remaining relatively steady since 2003, S&E degrees conferred in the region increased by seven percent from 2008 to 2009.

One-fifth of Science & Engineering (S&E) degrees conferred on Long Island are earned by foreign students. This rate has held relatively steady since 2003 while it has dropped nationally. Nationally, one in seven S&E degrees were conferred to foreign students in 2009, down from the peak in 2004 of one in five.



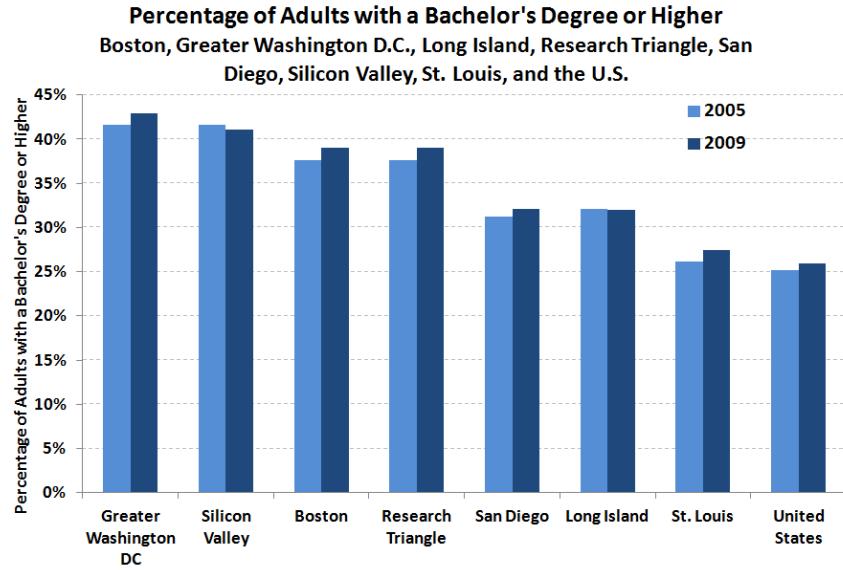
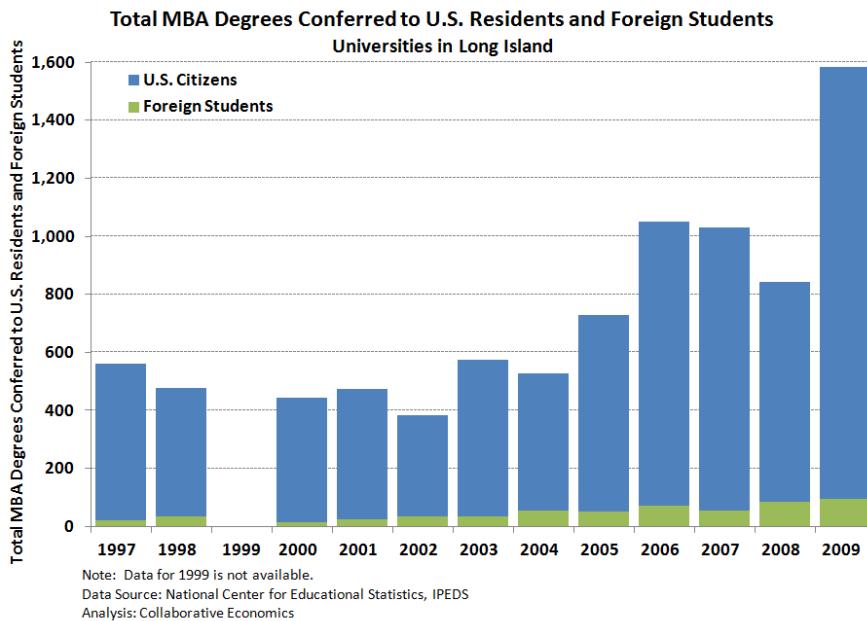
Tracking MBA degrees conferred on Long Island helps to illustrate the development of business skills in the region. As a hub for innovative research and development, Long Island must continue to educate individuals in business management in order to support technology-based start-up companies in the region.

Long Island is educating increasing numbers of individuals in business management. The number of MBAs conferred on Long Island has grown nearly three-fold since 1997 to a high of roughly 1,580 in 2009. In just one year, from 2008 to 2009, the number of MBA degrees conferred nearly doubled, due largely to a jump in MBAs conferred from New York Institute of Technology's Old Westbury Campus.

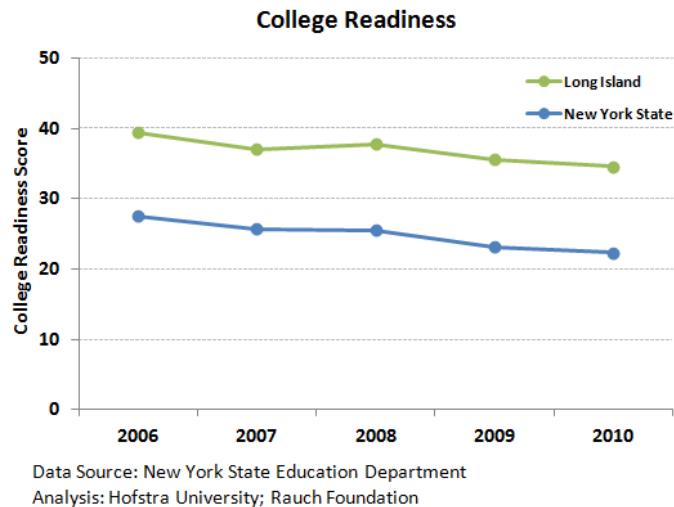
MBA degrees conferred to foreign students made up ten percent of total MBAs conferred in 2008. While total numbers remained constant just below 100 graduates, foreign students represented six percent of MBA degrees conferred in 2009.

Looking more broadly at the region's talent base, 32 percent of adults on Long Island have a Bachelor's Degree or higher. This is similar to San Diego, but nationwide, this is the case for only 26 percent of adults. Some regions witnessed modest improvement over the four-year period, but there was no change on Long Island.

Standing out with the highest percentage of adults with at least a four-year degree are Washington, DC with 43 percent and Silicon Valley with 41 percent. While Washington's share increased one percent from 2005 to 2009, Silicon Valley's share dropped slightly by one half of a percent. Tracking each other closely, adults with at least a four-year degree increased from 38 percent to 39 percent over the period in both Boston and Research Triangle.



Preparing youth for university education is a vital step for growing Long Island's talent base. Hofstra's measure of college readiness reflects mastery of the New York State High School Curriculum. It indicates the percentage of scores in a school at 85 percent or better across numerous statewide Regent's examinations, including English, Chemistry, Physics, U.S. History, Global History, and the two highest-level Mathematics exams. Broad-based superior performance reflects that graduates are prepared for the rigors of higher education.



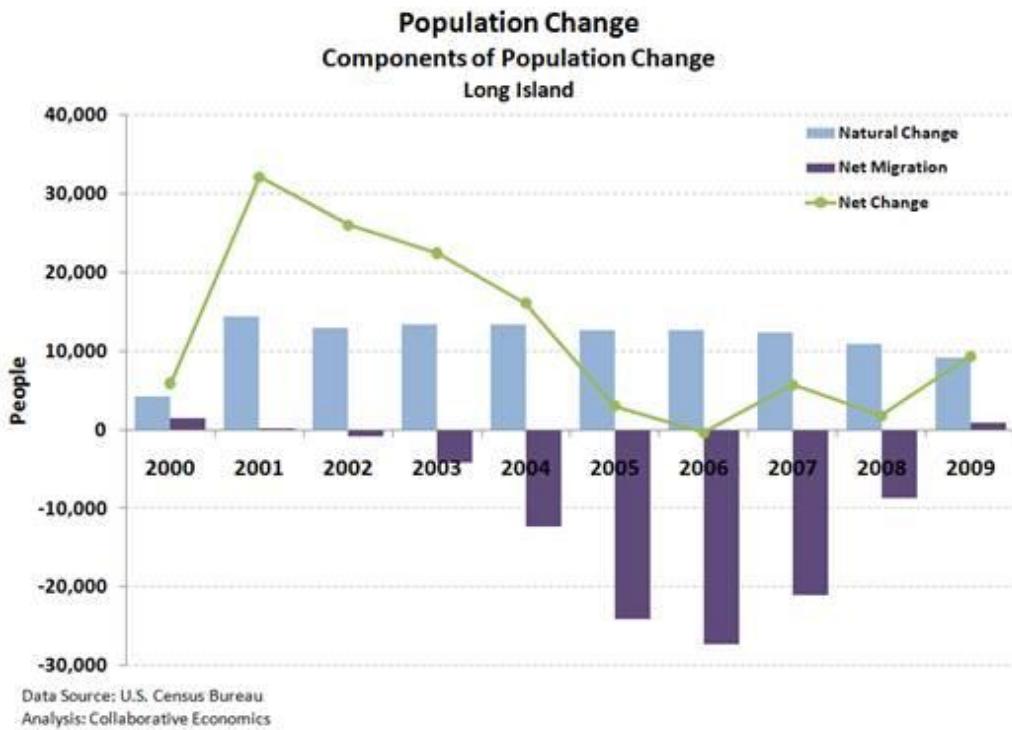
Compared to the state as a whole, Long Island high schools continue to prepare more of its students for college. Since 2005, Long Island has maintained an approximate eleven percentage point advantage over the state in the number of students scoring over 85 percent on the aforementioned Regent's exams. While the Long Island advantage is consistent, there has been a downward trend for both the state and the region over the five years. In 2006, Long Island schools averaged a college readiness score of 39 which by 2010 had decreased to 35. The state saw a slightly larger decline from 28 in 2006 to 22 in 2010.

## SYMBOL TECHNOLOGIES

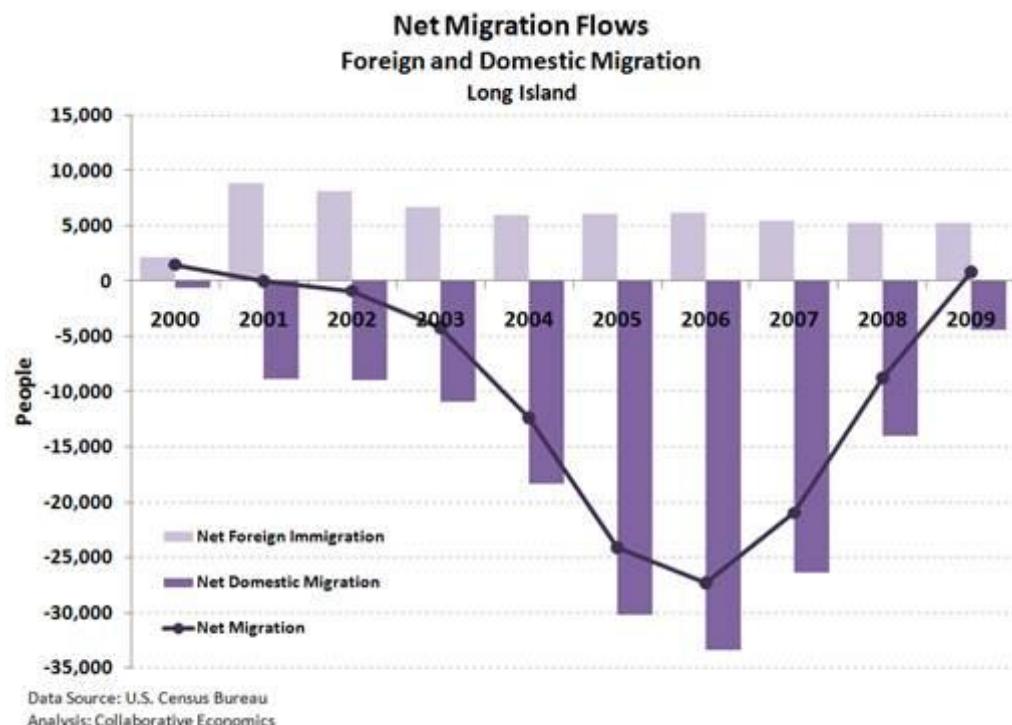
Known for inventing the first handheld laser scanner, Symbol Technologies is a leading innovator and manufacturer of mobile data capture and delivery equipment. The company specializes in barcode scanners, mobile computers, RFID systems, and Wireless LAN infrastructure. The company was founded in 1973 by Dr. Jerome Swartz, who came up with the concept of how to illuminate a target with a laser, decode the physical return of the light and thus take photons and make data available to the computer systems it serves. This idea evolved into the handheld barcode scanners iconic at nearly every sales register in the country.

Symbol first went public in 1979 and brought in total yearly revenues of \$5 million. By the end of the 1980s, Symbol increased sales to an annual total of \$222.3 million, and grew almost 1,500 percent over a four-year span. The workforce at Symbol increased drastically as well. After reporting total employment of 152 through 1985, Symbol now employs over 1,800 individuals worldwide. Throughout the past 20 years, Symbol has dominated the bar code scanner market, selling millions of scanners and other portable data devices to Fortune 500 companies and federal and state governments.

Since its incorporation, Symbol has been strongly committed to their employees and their community. Former Vice President of Marketing Rich Bravman stated that a motivated and happy workplace was the "number one principle" because this directly kept productivity and sales at high levels. In addition, Symbol has maintained a strong relationship with neighboring SUNY Stony Brook since the company's inception. Symbol founder Dr. Jerome Swartz, now a professor of electrical engineering at Stony Brook, believes in higher education and wishes to form a strong relationship with the university. He contributed funds for grants and research and recruited students for internships and part time positions.



Long Island's population growth picked up in 2009. Although natural change (births minus deaths) decreased by 16 percent from 2008 to 2009, for the first time since 2001, more people moved to Long Island than left. This growth has been driven by foreign migration which outpaced domestic out-migration in 2009 as the flows of people leaving the region slowed. Since 2001, foreign population flows have slowed 41 percent.

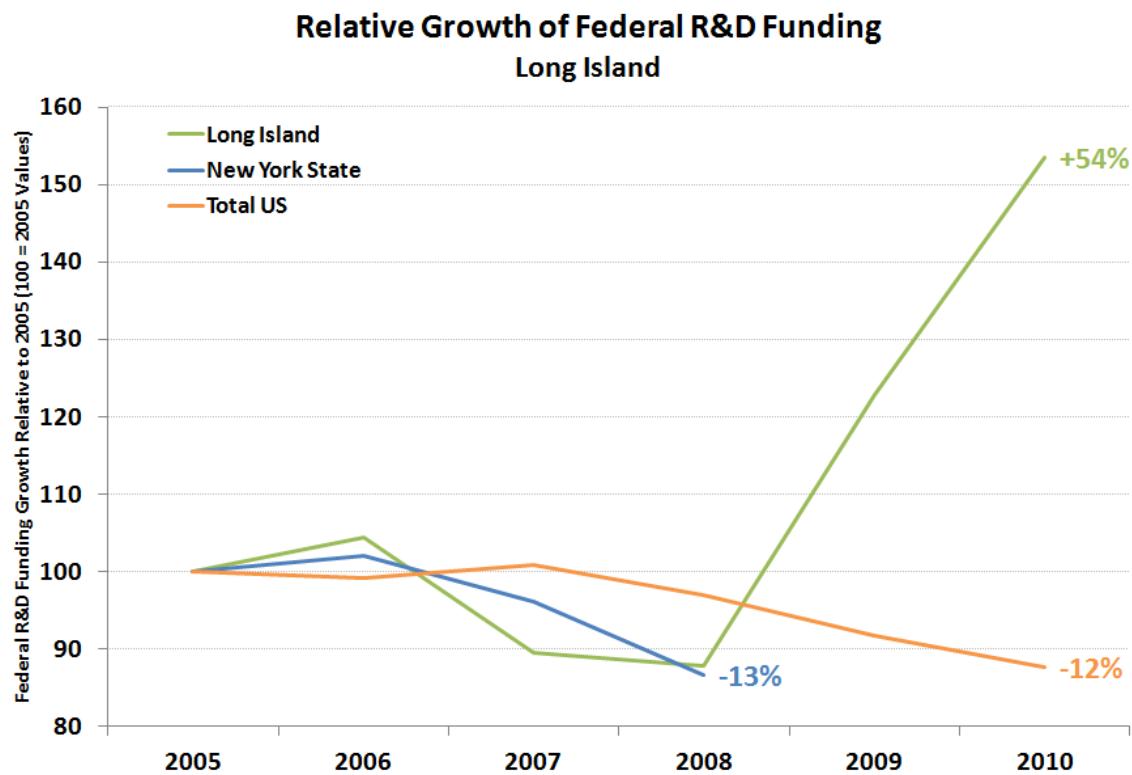


## Technology Research & Development

The ability of producing technological breakthroughs represents a foundational asset for a regional innovation system. New technology has the potential of creating new markets, products, and business models and can also enable significant productivity gains. A strong representation of research talent in a region can be an attractor of world-class talent. Research assets can also be leveraged outside of the individual institutions to help support the region's business community.

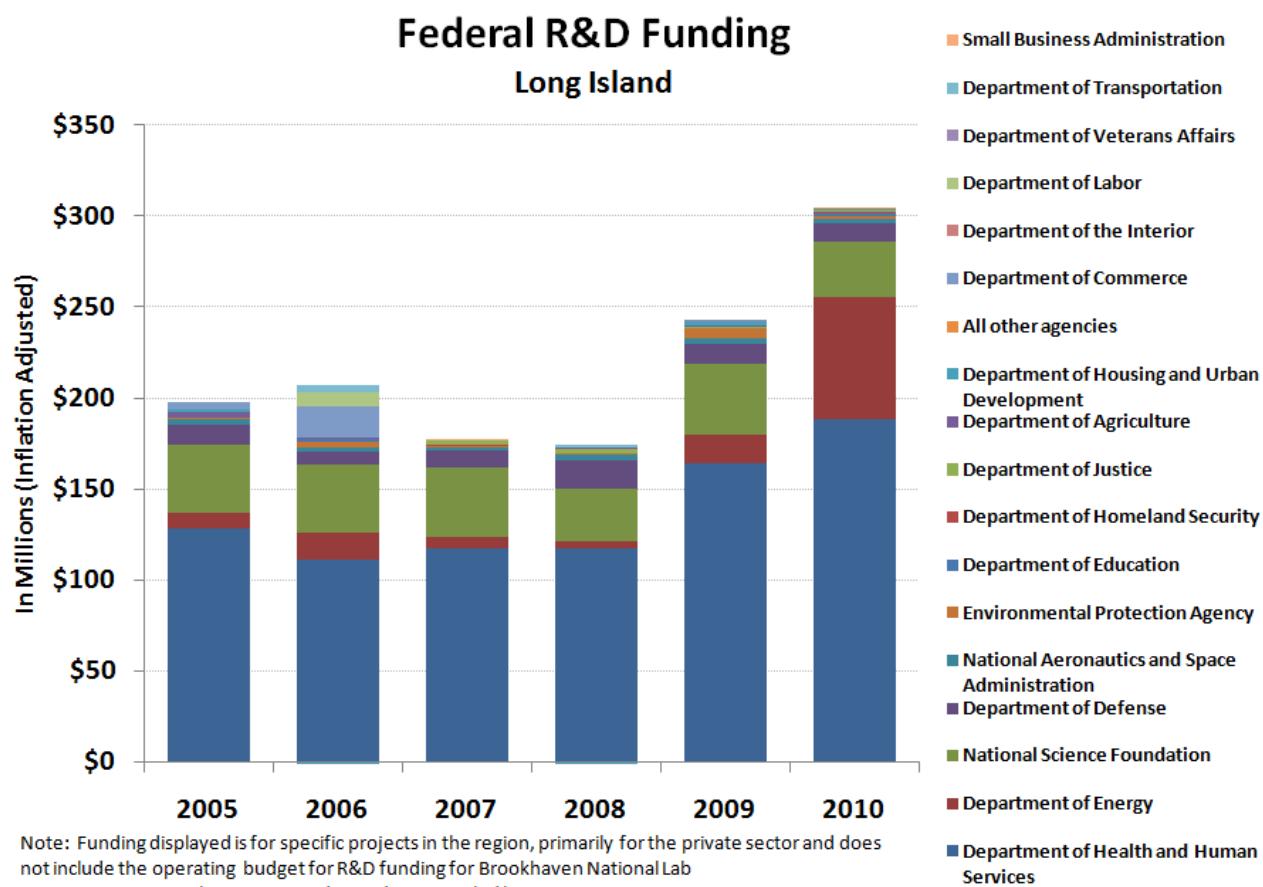
As the nation continues to recover from the recent global financial crisis, government spending at both the state and federal levels will continue to be increasingly constrained. In the coming years, tightened budgets will directly reduce federal research funds. Long Island investors, businesspeople and scientists will need to work together to attract funding from other sources in order to maintain the level of innovation that continues to define and strengthen the region.

Since 2005 growth in federal R&D funding has outpaced national and statewide trends. Funding in the region rose 54 percent between 2005 and 2010 while it dropped by 12 percent nationally. Statewide data is only available up to 2008 (2009 will be released fall 2011), and a drop of 13 percent was reported for both the region and the state.



Federal Research & Development (R&D) funding on Long Island increased 25 percent from 2009 to 2010. This jump from \$243 million to \$304 million was driven in large part by the Department of Health and Human Services (HHS) and the Department of Energy (DOE). Rising by 15 percent over the prior year, funding from HHS reached \$189 million, accounting for 62 percent of total federal R&D in the region in 2010. Federal R&D funding from DOE surged by more than a factor of three in 2010, reaching \$67 million. This increase is primarily due to a \$25 million grant to Long Island Power Authority for an R&D project related to smart grid. In addition, funding worth \$8 million went to Veeco Process Equipment Inc. for the development of building efficiency technologies.

The third largest source of federal R&D funding on Long Island in 2010 was the National Science Foundation with \$31 million, accounting for eleven percent of total federal R&D that year. Funding from the Department of Commerce in 2006 was for a \$13 million Sea Grant study on invasive marine species in the Long Island region.



Brookhaven National Laboratory is the largest research institution on Long Island, and its research funding is not reflected in the project-based data presented about. In addition to its research funding, BNL administers a sizable operating budget over its research facilities and staff. The economic impact of these activities alone is significant to Long Island. For fiscal year 2009, BNL employed over 2,890 employees, 98 percent of whom lived on Long Island. Between the fiscal years 2006 to 2009, employment at the lab grew by 12 percent.

BNL is one of six multi-program national labs funded by the Department of Energy's (DOE) Office of Science. In fiscal year 2010, DOE funding represented 88 percent of the lab's total operating and R&D budget.

BNL's DOE research and development budget grew 53 percent from fiscal year 2000 to a peak of \$451 million in 2010, while non-DOE R&D funding increased eight percent over the same timeframe. The Nuclear Physics Program received the largest percentage of total R&D funding in 2010 (37%) equivalent to \$165 million.

Between 2000 and 2010, Major Facilities/Equipment funding jumped 314 percent due largely to the construction of the new world class National Synchrotron Light Source II (NSLS-II). It is estimated that Brookhaven National Lab generated \$647 million in economic output and created 5,190 full time jobs in fiscal year 2009 since construction of NSLS-II began.<sup>3</sup> Recently, BNL contracted Global Partners in Shielding, a New Jersey based company to build steel-encapsulated lead enclosures that will contain high powered X-rays under NSLS-II. This \$912 million project will be operational in 2015.<sup>4</sup>

## Brookhaven National Laboratory

### Department of Energy and Other Sources of Funding

	FY 2000	FY 2009	FY 2010	Percent Change 00-10	Percent Change 09-10
<b>Research and Development</b>	\$ 295	\$ 449	\$ 451	53%	1%
<b>Major Facilities/Equipment</b>	\$ 52	\$ 347	\$ 214	314%	-38%
<b>Non-DOE Research and Development</b>	\$ 82	\$ 84	\$ 88	8%	5%
<b>Total Funding</b>	<b>\$ 429</b>	<b>\$ 880</b>	<b>\$ 753</b>	<b>76%</b>	<b>-14%</b>

### Department Of Energy Research & Development Funding

Nuclear Physics	\$ 112	\$ 160	\$ 165	47%	4%
Basic Energy Sciences	\$ 71	\$ 100	\$ 101	43%	2%
Particle Physics	\$ 24	\$ 53	\$ 56	131%	4%
Biological & Environmental Res	\$ 20	\$ 23	\$ 21	3%	-9%
Safeguards & Security	\$ -	\$ 12	\$ 11	-	-4%
Environmental Rest & Waste Mgmt.	\$ 31	\$ 42	\$ 43	41%	2%
Defense Nuclear Non-Proliferation	\$ 23	\$ 37	\$ 29	24%	-22%
Other DOE Programs	\$ 14	\$ 22	\$ 25	83%	14%
<b>Total R&amp;D Funding</b>	<b>\$ 295</b>	<b>\$ 449</b>	<b>\$ 451</b>	<b>53%</b>	<b>1%</b>

Note: Data As of September 20, 2010. Dollars in Millions

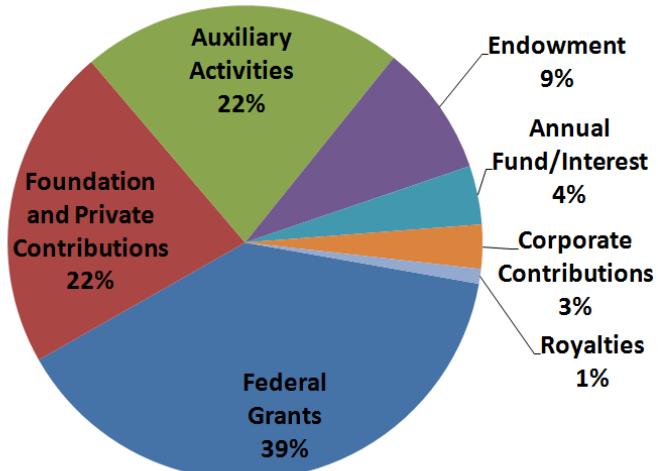
Data Source: Brookhaven National Laboratory

Cold Spring Harbor Laboratory (CSHL) is a private, non-profit research and educational institution. Similar to BNL, its funding is not represented in the region's trends in R&D funding reported above. CSHL's budget for fiscal year 2011 was \$137 million.

CSHL's largest source of funding is through federal grants. Funding from federal grants represented 39 percent of total revenues in 2010, and nine percent of which was awarded under the American Recovery and Reinvestment Act. The second largest revenue source is from private foundations, contributing 22 percent of total 2010 revenues. CSHL also raises revenues through commercial research which represented three percent of total funding in fiscal year 2010.<sup>5</sup>

## Cold Spring Harbor Laboratory

### 2010 Sources of Revenue



Data Source: Cold Spring Harbor Laboratory 2010 Annual Report Executive Summary

## APPLIED DNA SCIENCES

Applied DNA Sciences, Inc. was founded in 1983 as Datalink Systems and is one of many biotech oriented companies at the Long Island Incubator in Stony Brook, New York. Applied DNA Sciences provides DNA anti-counterfeiting products used to mark and authenticate originality. Their products have been used to help protect products, brands and intellectual property of companies, governments, and consumers from theft, counterfeiting, fraud, and diversion. Having the ability to authenticate and identify counterfeit versions of such items enables companies and governments to detect, deter, interdict and prosecute counterfeiting enterprises and individuals.

Applied DNA Sciences offers two primary products used as DNA solutions to protect products in various industries, including cash-in-transit, homeland security, textiles and apparel, identity cards, and secure documents. The first product, SigNature DNA, uses the DNA from plants to mark and authenticate products in a unique manner that cannot be copied. What is unique about SigNature DNA is that while the products provides a clear and indistinguishable mark on a product needed for tracking, the solution does not alter the quality of the product nor require any major changes to the manufacturing process due to the solution's natural makeup. Applied DNA Sciences' other primary product is BioMaterial GenoTyping. This solution refers to the development of genetic assays to distinguish between varieties or strains of biomaterials, such as cotton, wool, tobacco, fermented beverages, natural drugs, and foods that contain their own source DNA. Applied DNA Sciences has developed two proprietary genetic tests to tract American Pima cotton from the field to finished garments. These provide the textile industry with authentication tools that can be applied worldwide.

With its headquarters located at the Long Island High Technology Incubator in Stony Brook, Applied DNA Sciences maintains a strong relationship with neighboring SUNY Stony Brook. Current President, Chairman, and CEO Dr. James Hayward is a graduate of SUNY Stony Brook's graduate school and Applied DNA Sciences offers full and part time positions to students studying at the university and provides its employees access to the array of programs offered at the university.

## Investment Capital

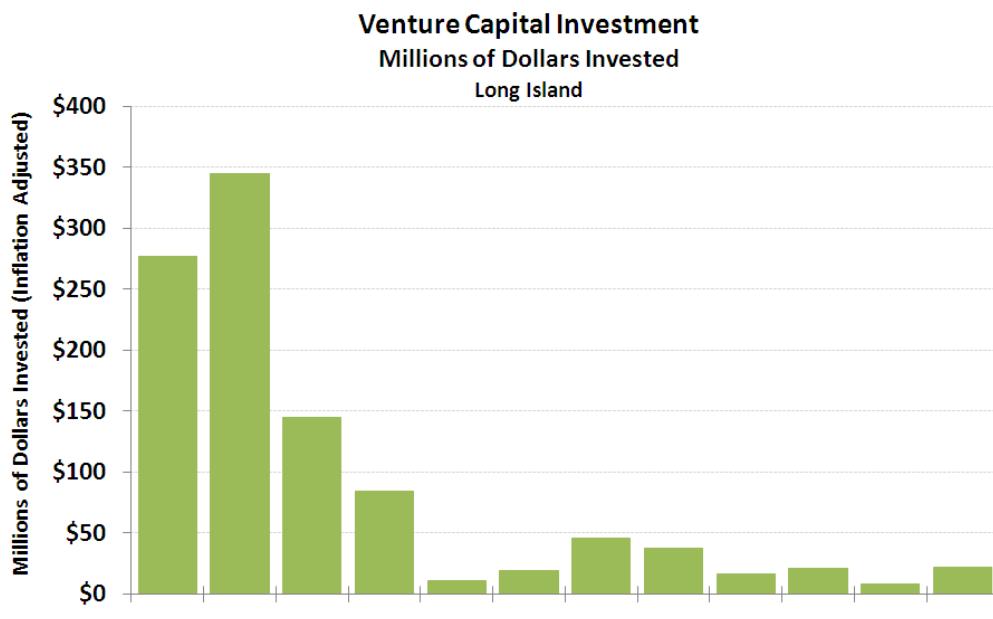
An innovation system is not just about technology. Turning a technology into a viable product with market potential requires business savvy and often investment. Investment in early-stage technology or established companies can take different forms from different sources. These include private individual investors, angel investment groups as well as venture capital.

Long Island is home to a growing number of science based investor groups that dedicate funds to early stage start up ventures and innovation breakthroughs. In addition to their active support of Accelerate Long Island, each company takes a hands-on approach to Long Island investments by directing locally based funds to locally based innovation companies from their inception. Topspin Partners, a \$213 million venture capital and private equity firm, has worked alongside Renaissance Technologies to develop and generate returns on Long Island companies since 2000. Canrock Ventures is an early stage technology venture capital fund, founded in 2010, that focuses on turning good technology ideas into great technology businesses. Long Island Angel Network's mission is to provide its members with exposure to, and access to funding for early stage technology and innovation-focused companies in the region.

Not all forms of investment activity are easy to track; however, data on venture capital (VC) has been collected for many years. Tracking VC investment represents trends in cash flows into the region for potentially high-value business opportunities. In addition to capital, these flows represent access to talent and other forms of support.

VC investment in Long Island increased nearly threefold from 2009 to 2010 to \$21.4 million, surpassing investment levels of the preceding three years. But first half 2011 figures were 80 percent below those of 2010 at \$4.5 million. As of July 2011, Long Island has attracted \$5 million in VC funding in the first half of 2011 which lags the \$21 million garnered in the first two quarters of 2010.

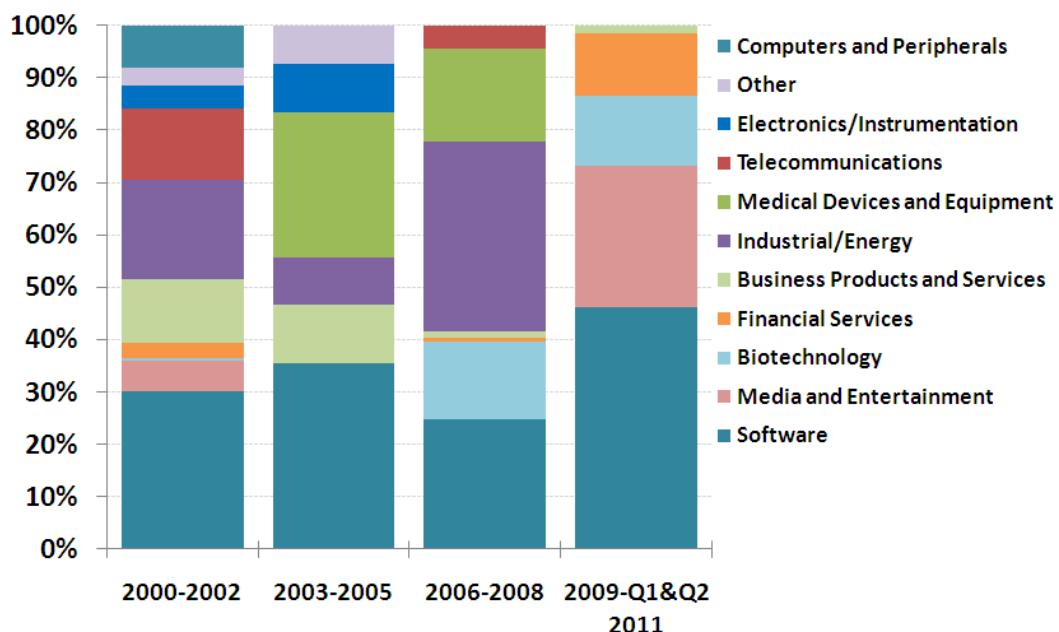
The year 2000 marked the peak of the information technology-driven economic bubble and also the peak of national VC investment. In most places, VC investment has not recovered to those levels in the overheated economic context and therefore comparisons are not very useful.



Data Source: Pricewaterhouse Coopers/National Venture Capital Association MoneyTree™ Report, Data: Thomson Reuters  
Analysis: Collaborative Economics

## Venture Capital Investment by Industry

### Percentage of Total Long Island Venture Capital Investment by Industry



Note: Other includes Consumer Products & Services, IT Services, Retailing/Distribution, Healthcare and Other Industries.

Data Source: Pricewaterhouse Coopers/National Venture Capital Association MoneyTree™ Report, Data: Thomson Reuters

Analysis: Collaborative Economics

Over time, the distribution of investment shifts across industries as technology advances and regional strengths change. The software industry continues to comprise a large portion of venture capital investments on Long Island, accounting for 46 percent of total investment in the most recent period. Media and Entertainment followed with 27 percent after a dearth of investment between 2003 and 2008.

Biotechnology remains a vital sector attracting 13 percent of investment. Financial Services accounted for 12 percent of the region's VC, a jump from earlier periods.

Over the past decade VC investment has fluctuated nationwide. The year 2000 marked a boom in investment followed by a drastic bust. While investment is not likely to return to boom-time levels, regions are eager to see signs of progress in the attraction of VC Dollars. From 2005 to 2010, nationwide investment fell eight percent while some regions enjoyed gains. The San Francisco region witnessed growth of 23 percent while New York State and Research Triangle witnessed growth of 13 and 16 percent respectively. VC investments fell 87 percent from 2000 to 2005 in Long Island and dropped 54 percent between 2005 and 2010.

Venture Capital Investment (Millions of Dollars)				
	2005	2010	2011 Q1-2	% Change 2005-2010
Long Island	\$ 46	\$ 21	\$ 5	-54%
St. Louis	\$ 44	\$ 39	\$ 19	-12%
Greater Washington DC	\$ 887	\$ 630	\$ 189	-29%
Research Triangle	\$ 302	\$ 350	\$ 205	+16%
San Diego	\$ 1,260	\$ 866	\$ 322	-31%
New York State	\$ 1,235	\$ 1,401	\$ 1,010	+13%
Boston	\$ 2,502	\$ 2,062	\$ 1,504	-18%
San Francisco	\$ 3,314	\$ 4,063	\$ 2,104	+23%
San Jose	\$ 4,455	\$ 3,731	\$ 2,350	-16%
United States	\$ 25,161	\$ 23,201	\$ 12,980	-8%

Note: Data current as of July 2011.

Data Source: Pricewaterhouse Coopers/National Venture Capital Association MoneyTree™ Report, Data: Thomson Reuters

Analysis: Collaborative Economics

## VIATRONIX

Viatronix, Inc. is a clinical software provider in the field of radiology. The company was founded in Stony Brook, New York in 2000 and has since then become the nation's foremost innovator of diagnostic medical imaging and treatment. Viatronix has achieved this reputation through development of 3-D imaging technologies. Primary 3-D imaging products include five different tools specifically designed for imaging and examining different parts of the body including the colon, heart, muscles and ligaments, and vascular structures.

Viatronix first launched its V3D scanning system in 2000. As the company's leading product, the V3D-Colon allows physicians to interactively view the colon by providing a visualization of its inner surface. The computer-based, volumetric rendering toll can display a patient's anatomy as a virtual computer model. The system uses digital data generated by existing imaging equipment, such as Computed Tomography (CT) scans, to create the high-resolution image models displayed on a computer screen. Using these reconstructed image models, physicians have a more accurate view to check for signs of colon cancer. Viatronix also developed the V3D-Calcium Scoring to facilitate cardiac analysis and aid physicians in determining the amount of calcium plaque accumulation in the coronary arteries. Viatronix is in the final stages of developing the V3D-Cardiac, which is software used for detecting, visualizing, quantifying coronary and left ventricle structures and functions, diagnosing heart diseases, and reporting based on CT images.

Viatronix is located at the Long Island Incubator and does the majority of its testing at the Stony Brook Institute. In fact, the SUNY Stony Brook Department of Computer Science, under the leadership of Ari Kaufman, led the team that developed the Virtual Colonoscopy technology.

## PROCESSES

While examining Long Island's assets provides a measure of its innovation capacity, observing the region's innovation processes provides a measure of how well assets are translating into innovations and economic benefit. Processes include the generation of new products and ideas, the commercialization of these, and the propensity of both entrepreneurship and business innovation on Long Island.

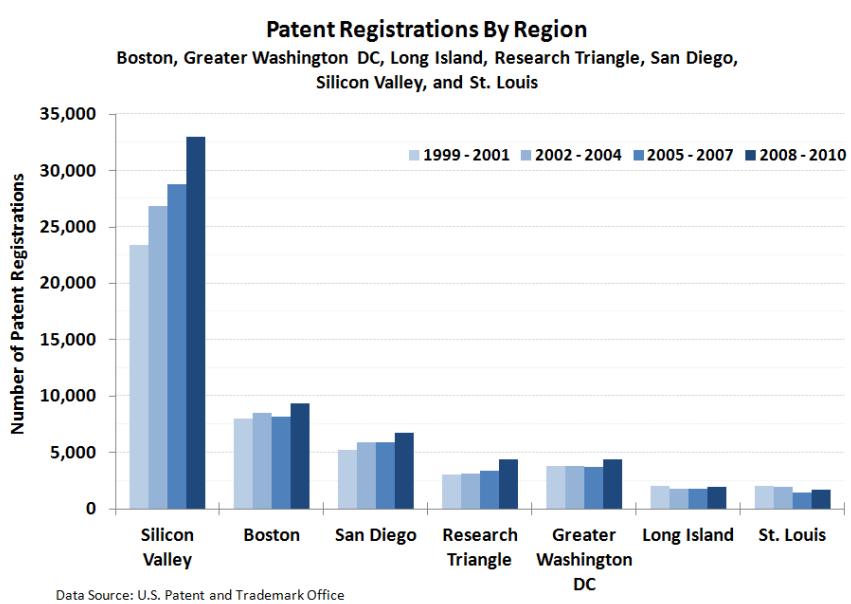
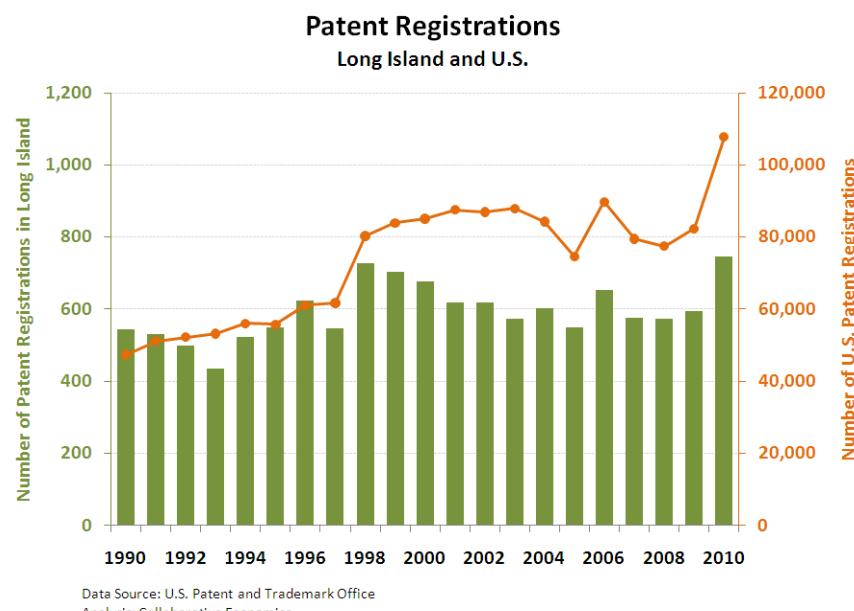
### Idea Generation

The registration of a patent represents the recording of a new idea, technology, or process that has the potential for bearing monetary value for the patent holder. Patent activity in a region can be an indicator of innovative activity as individuals and companies aim to protect potential sources of future income and market competitiveness.

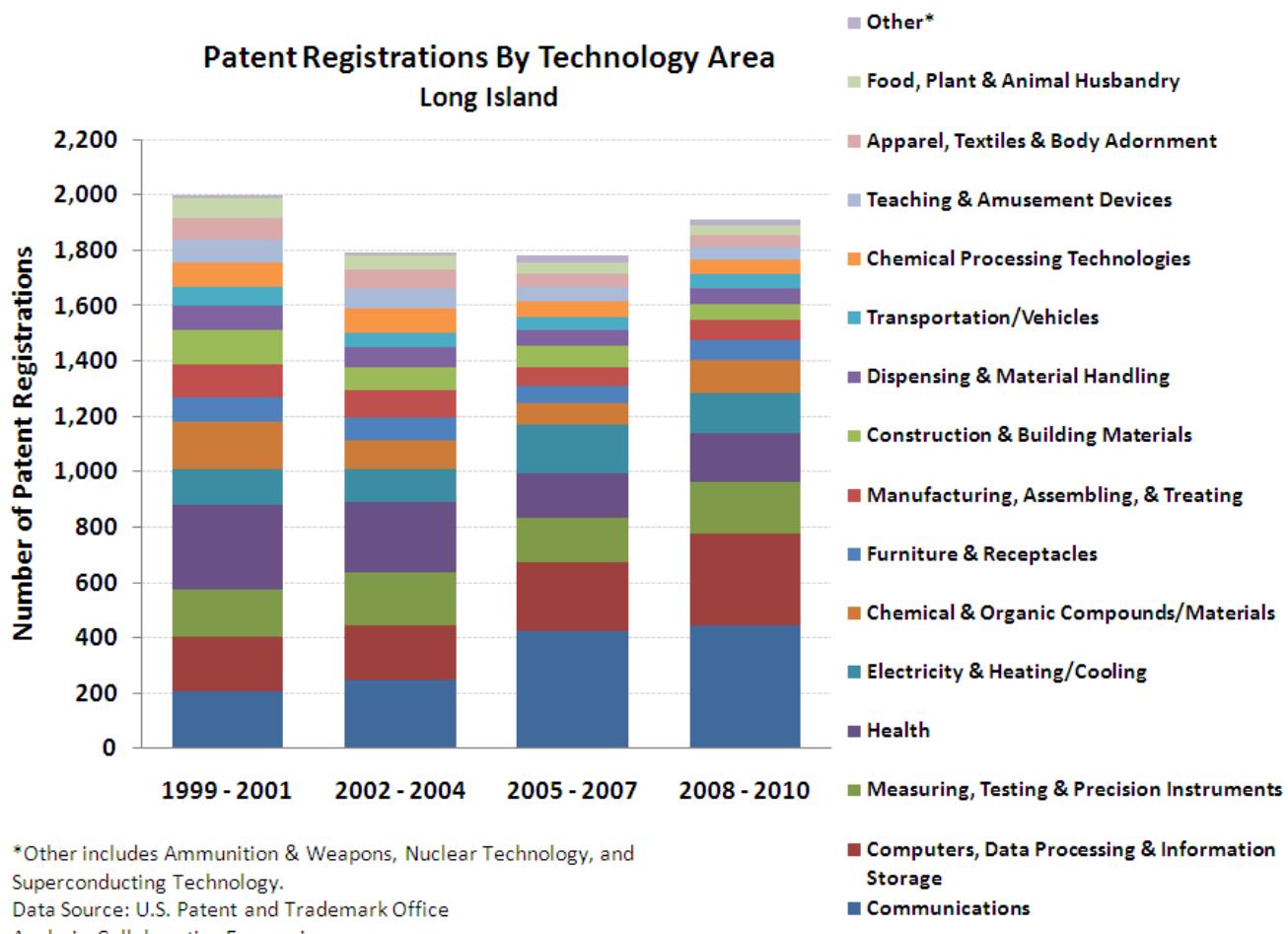
In 2010, 746 patents were registered on Long Island, representing the highest level of activity over the last two decades. Registrations increased 26 percent over 2009.

In view of trends by region, patent activity picked up during the 2008-10 period. Registrations expanded seven percent on Long Island in the most recent period, but still represented a decline of four percent from the earliest period 1999-2001.

Compared to the other regions, Silicon Valley generates the largest number of patents, and registrations have increased 41 percent since the 1999-2001 period. While U.S. patent activity increased by four percent over the decade, activity jumped 45 percent in Research Triangle, 29 percent in San Diego, 17 percent in Boston, and 15 percent in the Greater Washington DC area. Patents dropped by 16 percent in St. Louis.

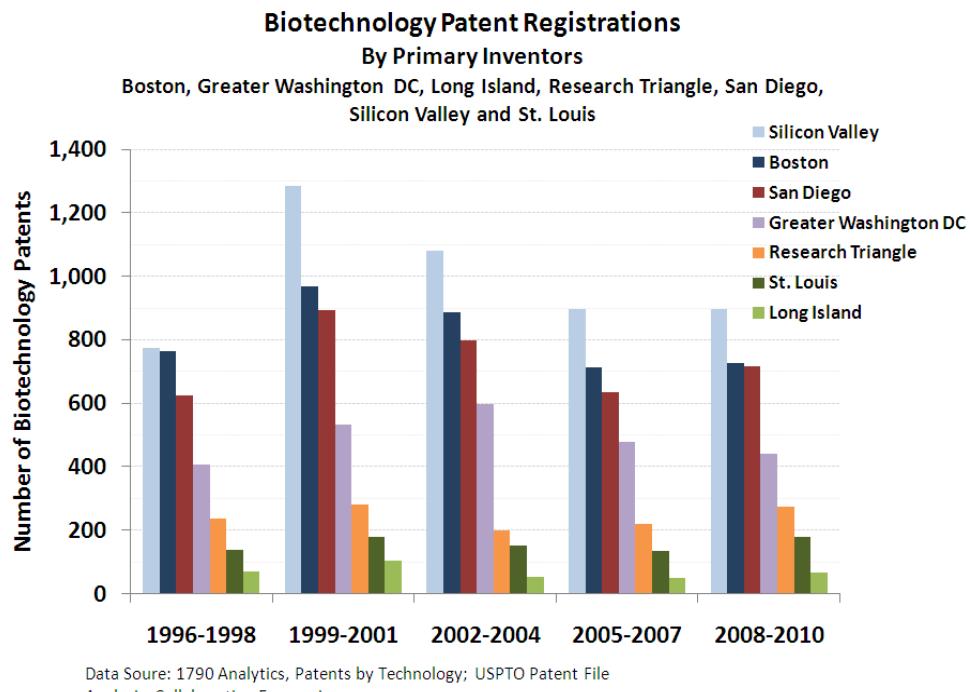


As technology advances and regions develop new areas of expertise, patenting activity by technology area shifts. Since 1999, the area of Communications has represented a growing source of patent registrations on Long Island. Communications represents 23 percent of total patents in Long Island in the 2008-10 period, expanding by 113 percent over the decade. Representing the largest area of activity in the 1999-2001 period, Health has since been displaced by information technology and precision instruments. Computers, Data Processing & Information Storage increased by 73 percent over the earliest period. Patents in precision instruments increased six percent over the decade, and Electricity & Heating/Cooling registrations expanded 13 percent.



Increasing 38 percent in the most recent period 2008-10, patent activity in biotechnology on Long Island surpassed that of other regions. Biotechnology patents increased 33 percent in St. Louis, 25 percent in Research Triangle, 13 percent in San Diego, and two percent in Boston. Activity remained stagnant in Silicon Valley, and decreased eight percent in Greater Washington DC.

Tracking activity in biotechnology requires a different examination of patent data than displayed above. This is because patent registrations related to biotechnology are listed under multiple patent classes (categories displayed above) such as: Chemical & Organic Compounds/Materials, Chemical Processing Technologies, Computers, Data Processing & Information Storage, Food, Plant & Animal Husbandry, Health, and Measuring, Testing & Precision Instruments.



## DEL PHARMACEUTICALS

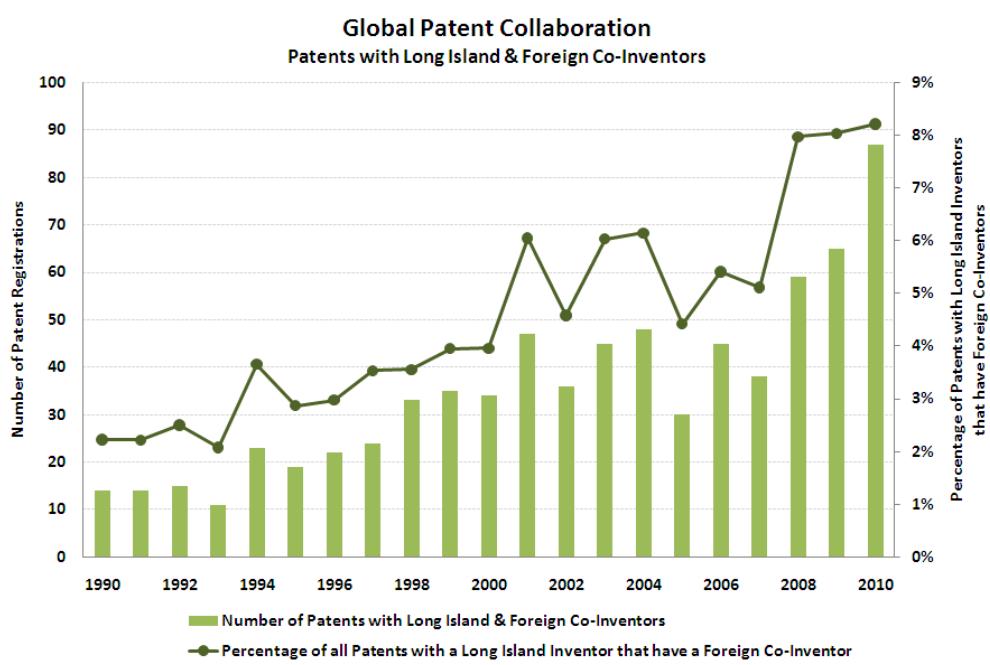
Founded in 1962 in Uniondale, New York as Commerce Drug Company, Del Pharmaceuticals, Inc. manufactures and markets cosmetics and over-the-counter pharmaceuticals. Del Pharmaceuticals products have become staples in drug stores nationwide. Their product line includes ointments and creams for skin ailments such as psoriasis and eczema and for skin irritations caused by bug bites and sunburns. Additionally, Del Pharmaceuticals produces cosmetic products that strengthen nails and rejuvenate skin.

Del Pharmaceuticals' most well known product is Orajel. Orajel was developed as the first over the counter gel that soothes the gums of teething babies. Benzocaine as it is medically known, works as a numbing medication that blocks nerve signals from the area it is applied thereby reducing pain. Del Pharmaceuticals was able to create a Benzocaine ointment in a low enough dosage for use on infants. Today, Orajel is one of the most trusted brands in oral hygiene not only for its gels but also toothpaste and toothbrushes made specifically for children.

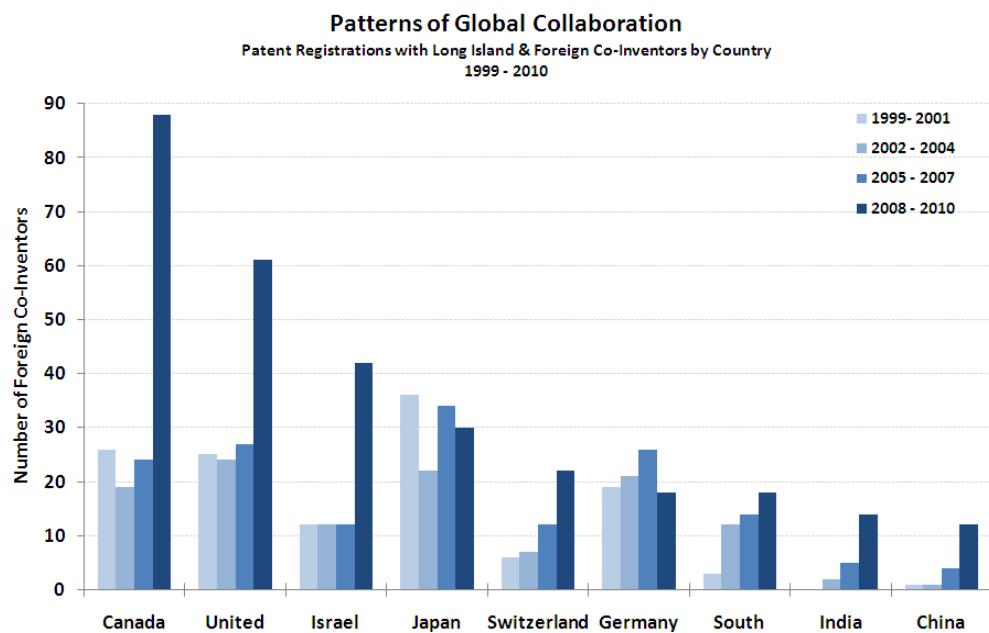
Del Pharmaceuticals is a wholly owned subsidy of Church & Dwight Company. It remains one of the nation's foremost manufacturers in over the counter pharmaceuticals and cosmetics, and its products can be found on drug store shelves across the country.

The strength of collaboration with inventors outside the region and abroad illustrates how well the region is connected to other talent centers. Since, 2007, there has been a steady increase in collaboration between inventors and researchers located in Long Island and inventors located in other countries. The percentage of patents with Long Island and foreign inventors expanded from two percent in 1990 to eight percent in 2010.

Over the years, collaboration has primarily been with researchers in Canada, United Kingdom, Israel, and Japan. Recently patenting activity has significantly increased in Canada, United Kingdom, and Israel.



Note: Patent counts reported here refer to all patents with an inventor from Long Island, regardless of inventor number.  
 Data Source: U.S. Patent and Trademarks Office  
 Analysis: Collaborative Economics



Data Source: U.S. Patent and Trademarks Office  
 Analysis: Collaborative Economics

## Commercialization

Many regions are highly adept at attracting R&D funding and generating patent registrations but struggle at turning new technology and ideas into viable products with growing markets. The commercialization process typically requires the collaboration of technically-minded people with people who understand how to get a new product to market.

The commercialization of new medical devices can be tracked by observing approvals from the U.S. Food and Drug Administration (FDA) which determines when a drug or device is ready for market. Tracking other technologies can be difficult because of the lack of reliable data. In order to uncover progress taking place on Long Island, the Rauch Foundation carried out a survey of the region's labs and higher education institutions. The Long Island Regional Innovation Partner Survey specifically examines the different forms of interaction between the institutions and the region's business community.

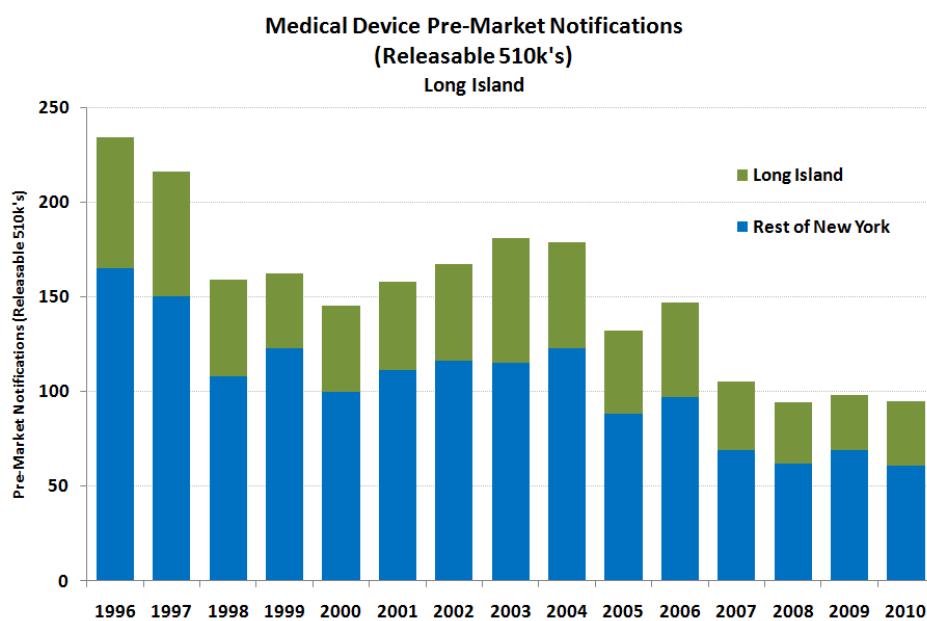
The FDA issues two classes of approvals for new medical devices: pre-market approvals (PMAs) and pre-market notifications (PMNs), known as 510(k)s. Pre-market approvals apply to more sophisticated devices and require design review that is analogous to the clinical trials of pharmaceutical drug, while pre-market notifications tend to address less sophisticated products or improvements on existing products.

For the more elaborate approval class, Long Island accounts for three percent of total PMAs granted in New York State. The region has received nine pre-market approvals from 1996 to 2010. The latest approval was granted to Avery Laboratories Inc in 2003, which accounts for five of the nine approvals granted in the region.

In terms of Pre-Market Notifications, Long Island accounted for 36 percent of PMNs in the state in 2010, up from 29 percent in 1996. In total number, the region was granted 34 PMNs in 2010, an increase over 29 in the prior year. As of June 2011, Long Island had acquired five PMNs, placing it at 15 percent of its 2010 total.

Applicant	Long Island Pre-Market Approvals (PMAs)															Total		
	PMAs Received																	
	1980	1982	1984	1985	1986	1987	1988	1989	1990	1991	1992	1994	1996	1997	1998	2000	2001	Total
ALLERGAN OPTICAL							1			2	1						4	
AVERY BIOMEDICAL DEVICES		1					1											2
AVERY LABORATORIES, INC.								1	1	1			1		1	1	1	8
DEKNATEL, INC.							9	4	5									18
FLOW LABORATORIES, INC.	1	1																2
FONAR CORP.				2	1	8												11
HOWMEDICA CORP.										1								1
INTL. HYDRON CORP.			1	2	14	18	6	3										44
LASER MEDIA		2		1														3
OCULUS CONTACT LENS CO.				3														3
OCUMED, INC.												1						1
PHARMAFAIR, INC.												3						3
RYNCO SCIENTIFIC CORP.										1								1
<b>Grand Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>20</b>	<b>36</b>	<b>11</b>	<b>10</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>101</b>	

Data Source: US Food and Drug Administration, Center for Devices and Radiological Health (CDRH)  
Analysis: Collaborative Economics

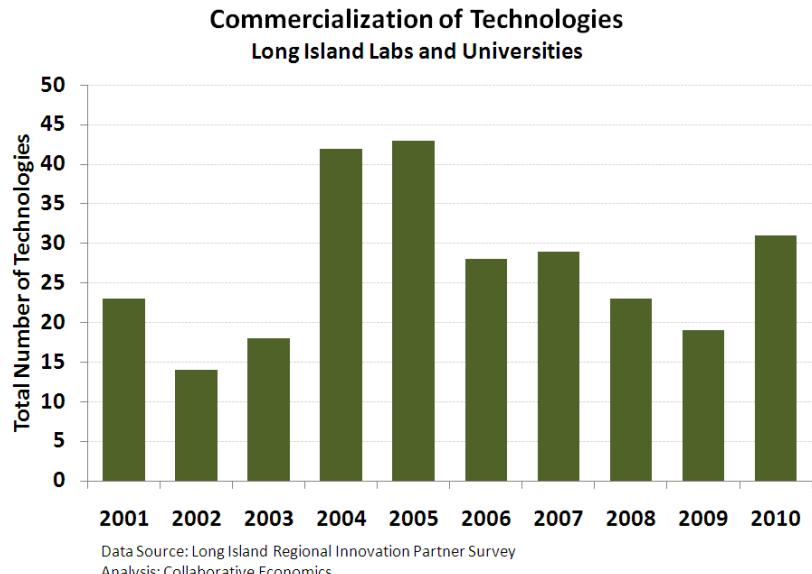
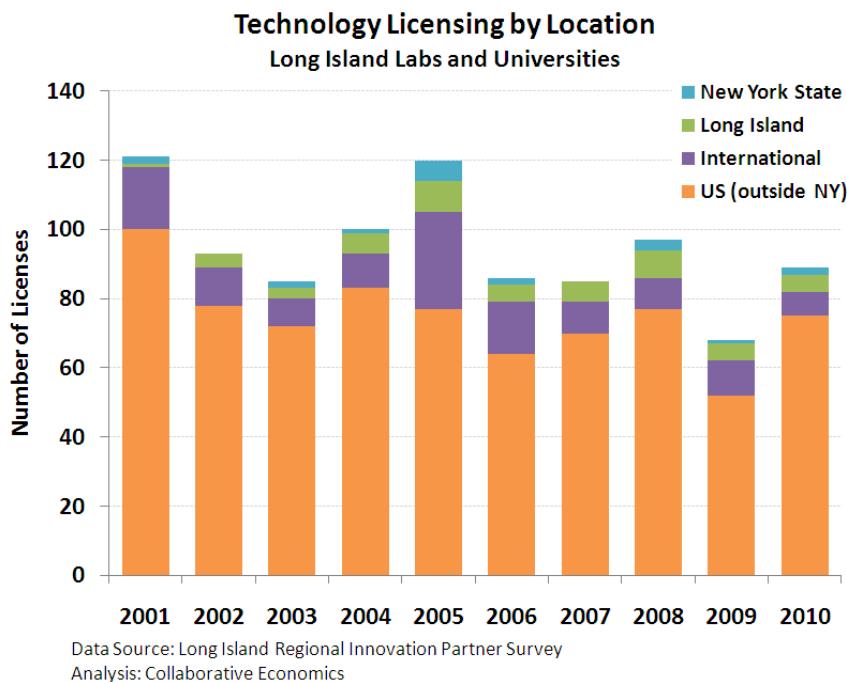


Long Island's research institutions engage with the business community through different means. When a technology is developed inside a research facility, it can be brought to market by the institution itself or through a formal licensing agreement with a company allowing it to use or commercialize the technology.

In other instances, a company may have an idea for specific research or testing based on their understanding of market demand. In this case, the company and research institution may embark on contract research. In addition to specifically defined contract research, there are also other forms of collaborative and cooperation research efforts. This type of cooperation not only meets the immediate research aims, but also represents an important flow of information between the business and research communities. The two groups of individuals broaden their perspectives through the exchange of competencies in technology and product markets and they also help to build linkages of cooperation between their domains.

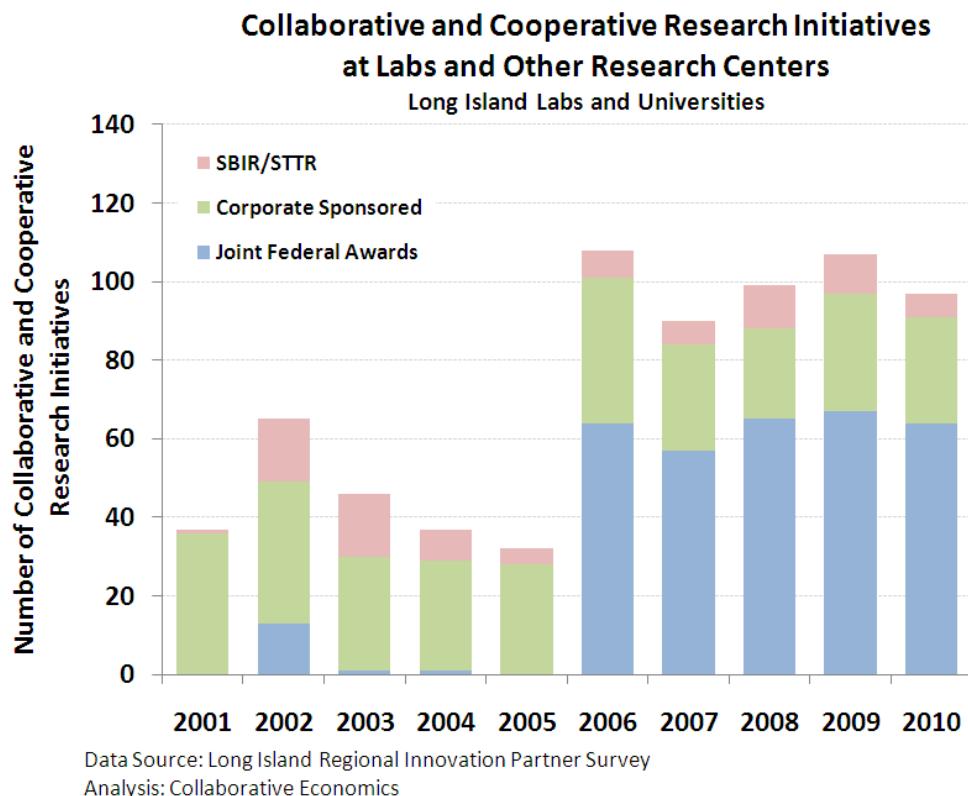
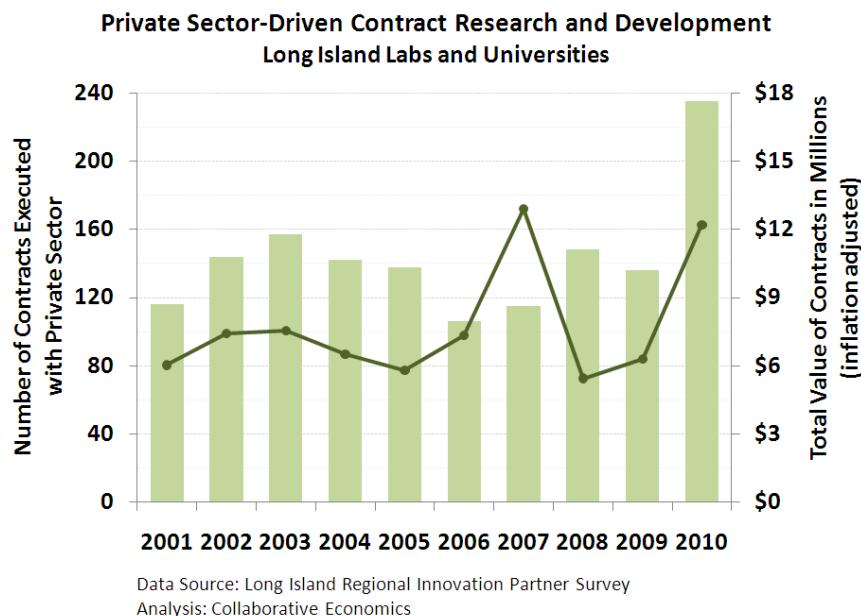
Technology licensing from Long Island's research institutions increased 31 percent in 2010. Licensing is primarily with U.S.-based companies located outside of New York State which represented 84 percent of licensing in 2010. Licensing with Long Island-based companies accounted for six percent. The year 2005 was the peak in the region's licensing activity in the last decade, and this was driven by foreign-based companies, which accounted for 23 percent of licenses that year.

Direct technology commercialization by the region's institutions increased from 19 to 31 in 2010. In 2005, the peak year, the region's institutions commercialized 43 technologies.



Contract research with the private sector in 2010 jumped 73 percent in number of agreements and 94 percent in value. Over the decade, contract research has increased 103 percent in number and 102 percent in value to the institutions. In 2010, the 235 contracts were valued at a total of \$12.2 million.

The number of collaborative and cooperative research initiatives at Long Island's research centers has increased by 203 percent since 2005. This growth has been driven by an increase in joint federal awards. Other types of cooperative research include corporate sponsored efforts, federal SBIR/STTR awards, and state funded research. In 2010, 28 percent of the research initiatives were corporate and non-federal sponsored.



## Entrepreneurship

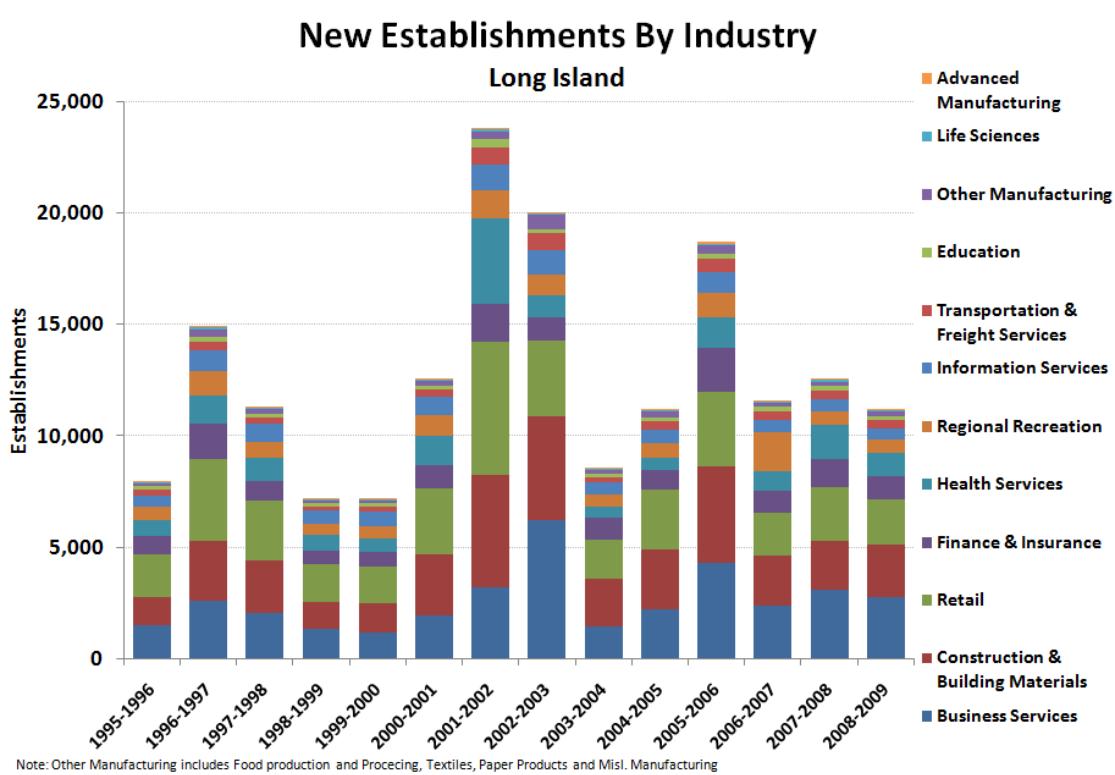
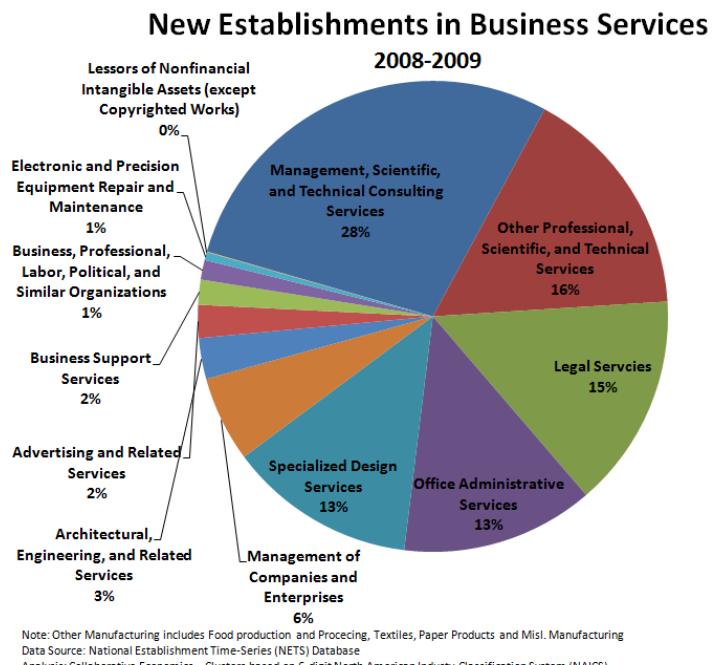
Entrepreneurship is a vital part of an innovation system. Entrepreneurs are creative risk takers who produce new value and new markets through the commercialization of novel and existing technology, products and services. A region with a thriving innovation habitat supports a vibrant ecosystem for businesses to start up and to grow.

Even during the recent economic downturn, the opening of new business establishments has taken place on Long Island. From 2008 to 2009, 11,200 new establishments were created.

Business Services led the way accounting for 24 percent of new establishments. Forty-four percent of new establishments in Business Services are in different forms of scientific and technical services. The largest category, Management, Scientific, and Technical Consulting Services, increased by 12 percent over the prior year. Various professional and administrative services are also strongly represented.

Construction & Building Materials made up 21 percent of new establishments increasing in number by seven percent over the prior year.

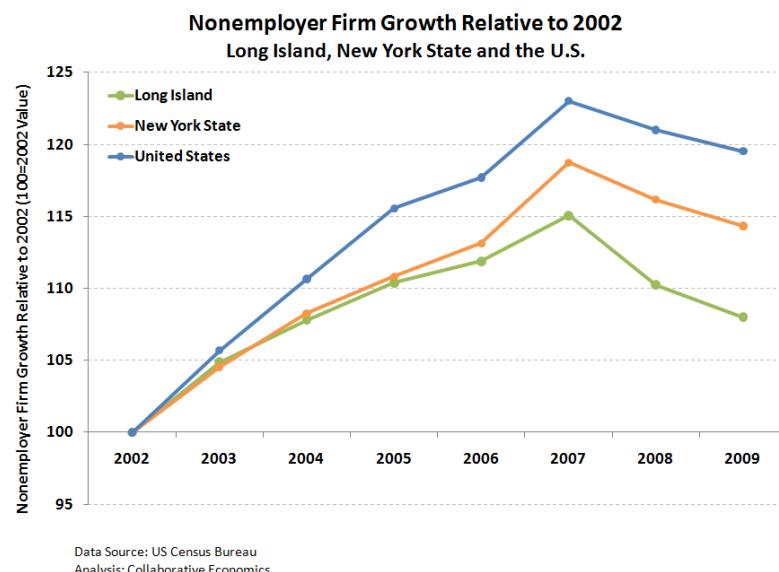
Retail followed making up 18 percent of all new firms.



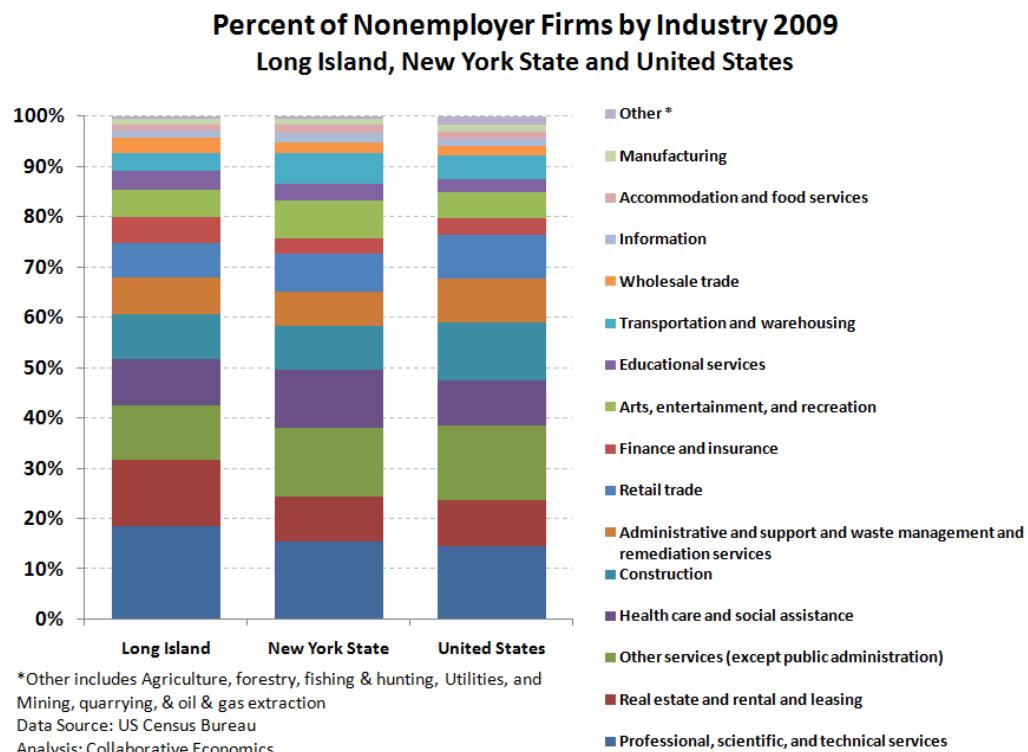
Business formations can occur in different forms. Some emerge as spinouts from other companies or research centers while others emerge through different avenues. According to the Long Island Regional Innovation Partner Survey, 49 new companies have been formed by individuals associated with the region's five major research institutions over the past decade. Forty-seven of these were formed just in the last four years and benefited from direct assistance from the labs and universities such as, office space, investing equity, provide training, consultancy services or equipment.

Some people start businesses with no intention of hiring employees. In some cases, people go into business for themselves when hiring slows. Nationally, the growth in nonemployer firms (firms with no employees) has outpaced overall employment trends.

Growth in Long Island's nonemployer firms has trailed statewide and national trends in recent years. While these firms have increased in number since 2002 by eight percent on Long Island, they have expanded by 14 percent statewide and 20 percent nationally. Since 2007, growth has slowed but numbers remain above 2002 levels. Long Island's nonemployer firms declined two percent in 2009. Nonemployers dropped two percent statewide and one percent nationally.



The largest category of nonemployer firms, Professional, Scientific & Technical Services represents 18 percent of nonemployer firms on Long Island. In contrast, this category represents 15 percent in New York State and 14 percent nationally.



## Business Innovation

The Small Business Research and Innovation (SBIR) program and the Small Business Technology Transfer (STTR) program provide funding to small innovative companies to spur development and the commercialization of ideas into products and services. There are two phases of awards, with the second phase depending up on the success of the first phase and also providing a larger amount of funding. The STTR program focuses on facilitating joint ventures between small businesses and non-profit research institutions in the nation.

Small business innovation awards on Long Island more than doubled from \$17 million in 2008 to \$38 million in 2009. Statewide, SBIR funding increased 55 percent and nationally by 12 percent over the same year. Over the last two decades, Long Island reports gains in SBIR/STTR funding of 580 percent, far outpacing the state's gains of 237 percent and national growth of 192 percent. Recent and long-term growth in SBIR/STTR funding on Long Island has been driven primarily by increasing awards from the Department of Health and Human Services, Department of Defense and Department of Energy. Angion Biomedica Corporation was awarded the vast majority of SBIR/STTR grants by the Department of Health & Human Services Agency in 2009.

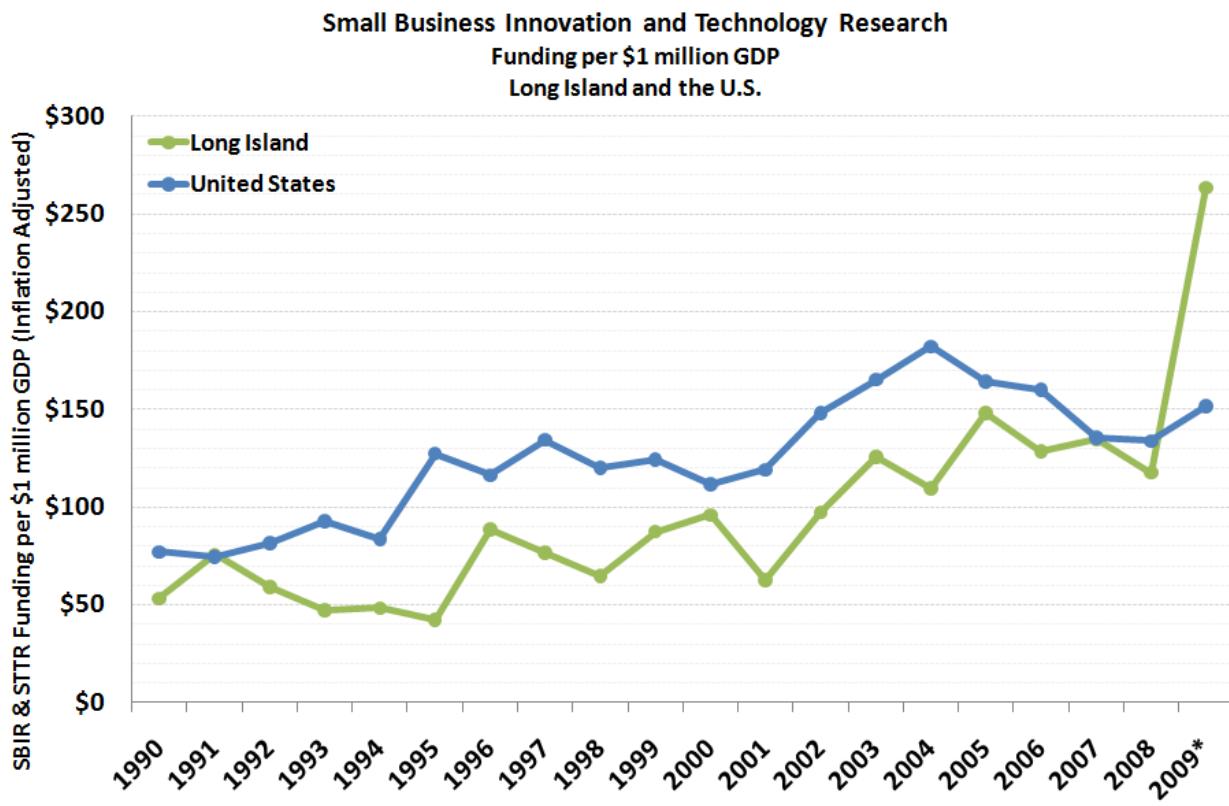
Long Island SBIR & STTR Award Values					
		1990	2009	% Change 1990-2009	
Value of Awards	Long Island	\$5.6M	\$38.0M	+580%	
	New York State	\$41.1M	\$138.6M	+237%	
	United States	\$0.7B	\$2.2B	+192%	
Long Island Share of Total	New York State	14%	27%	--	
	United States	0.7%	1.7%	--	

Observing SBIR/STTR funding relative to the size of a regional economy as measured by regional gross product, offers a clearer comparison across different regions. SBIR/STTR funding per one million dollars of GDP has trailed the national average over the last two decades until 2009. In 2009, funding surged in Health and Human Services in Long Island, five 1990 levels and 32 percent above the national average.

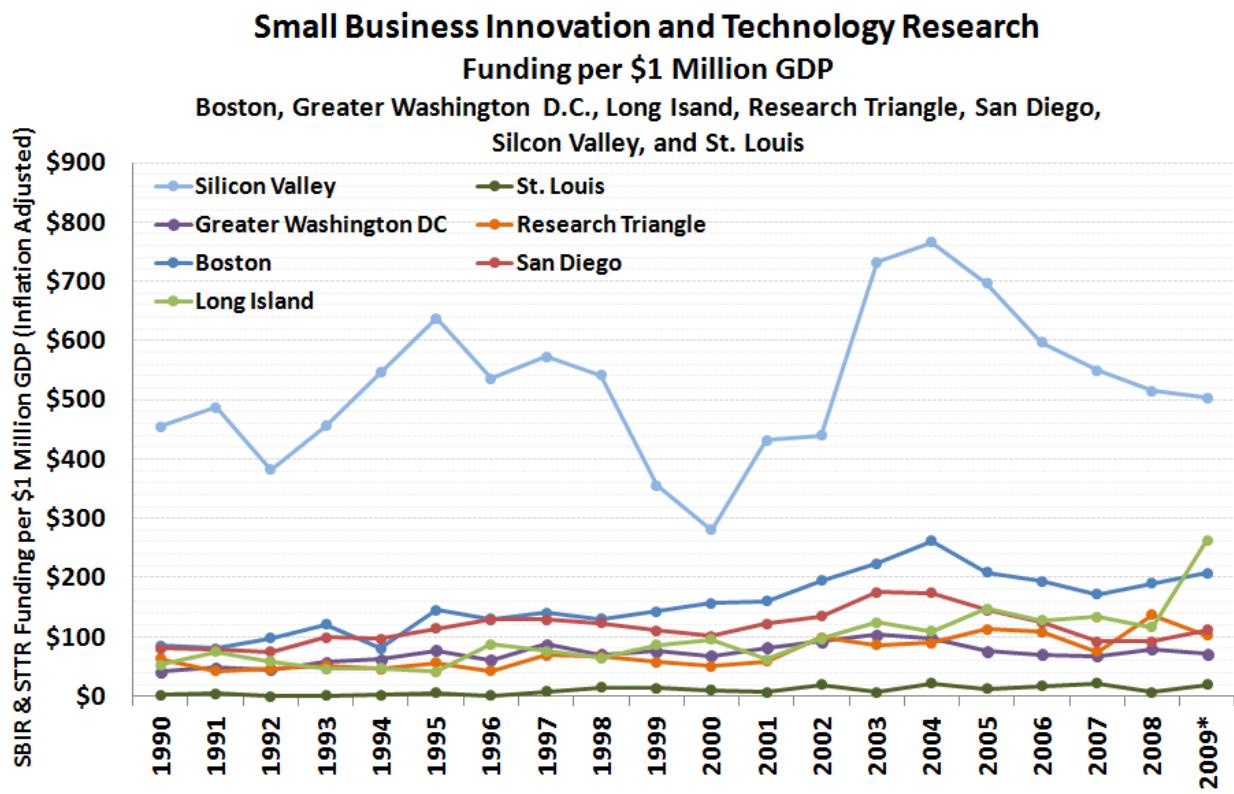
## FATWIRE

FatWire, headquartered in Mineola, New York, is a software company that provides web experience management solutions for optimizing the online experience for customers. FatWire's software supports the efforts of some of the world's largest corporations spanning media, technology, financial services, and healthcare. The company architects, designs, develops and deploys content-centric applications and websites through their four step methodology. This approach produces web experience management tools that afford companies a channel for communication, marketing, customer engagement and commerce, all of which foster customer retention and loyalty. Specific products offered include: the Content Optimizer, which tracks and reports individual assets, promotions, and visitor segments for use by editors and marketers to determine what web content is most effective; the Mobility Server, which offers centralized management of mobile web presence across thousands of mobile device types; the Community Server, which enables user-generated content capabilities so visitors can communicate and share their thoughts.

Attributed to their focus on customer satisfaction and an innovative approach to web content management, FatWire, posted strong revenue growth in the first half of 2010. Additionally, FatWire achieved a 98 percent renewal rate for annual maintenance for three years straight. FatWire was recently acquired by Oracle, to complement the technology and applications already offered by the software giant.



In 2009, SBIR/STTR funding relative to regional product on Long Island was second only to Silicon Valley. Long Island (+174%) and Research Triangle (+100%) witnessed the strongest growth in SBIR/STTR funding from 2000 to 2009. While funding relative to regional product in Long Island grew by 124 percent between 2008 and 2009, the comparison regions experienced declines or only modest growth.



## FONAR CORPORATION

Fonar Corporation was founded in 1978 by Dr. Raymond Damadian. Damadian discovered that tumors and damaged tissue can be distinguished from healthy tissue by observing their relaxation patterns, which are altered when the tissue is damaged. This technology led to the invention of the first Magnetic Resonance Imaging (MRI) scanner and the subsequent production of the first commercial scanner in 1980. FONAR has remained the unquestioned leader in magnetic resonance innovation and production.

Through the 1980s, FONAR developed and introduced more advanced forms of magnetic resonance scanning. This included the introduction of Oblique Imaging, which provides the means to produce multiple images at any angle. This provided a platform for the creation of the first mobile MR scanner in 1985 and the first MRI scanner to perform interventional radiology procedures in 1986. FONAR achieved further fame in 1996 with the invention of the Upright MRI machine, which allowed patients to be scanned in practically any position and identified pathologies that previously went undetected. FONAR has grown from a small workforce of scientists back in 1978 to a team of over 400 employees today. FONAR has installed over 300 MRI scanners worldwide and the future looks bright for this Long Island innovator.

## SBIR & STTR Awards in Long Island in 2009

### 2009 Phase I Awards

Agency	Firm Name	Amount	Awards
Department of Defense	Afco Systems Development, Inc.	\$101,241	Real-time Adversarial Characterization and Adaptive Software Protection Countermeasures
	Energy Research Co.	\$101,008	Cancer Progenitor Cell Markers
	Enogetek, Inc.	\$167,170	3 to 15 Covalent Gold for High Resolution Electron Microscopy
	Eta, LLC	\$71,048	Acoustic Intercept Receiver for Naval Special Warfare Undersea Vehicles
		\$101,640	High-Temperature Environmental Barrier Coating for Silicon Carbide Composites
		\$81,312	Innovation in Strain Sensing and Damage Detection in Composite Repairs using Printed Gages
	Mesoscribe Technologies, Inc.	\$101,640	Ceramic Materials Optimization and Thermocouple Fabrication
		\$101,640	Aware Composite Structures
		\$101,640	Integration of Direct-Write Sensors and Interconnects for Sounding Rocket Payload Test Platforms
		\$101,640	Ultra-High Range Thermocouples for Turbine Applications
	Mohawk Innovative Technology, Inc.	\$101,640	Reconfigurable Materials for Photonic Systems
	Ocean & Atmospheric Science In	\$101,640	High Efficiency Flexible Thin Multi-Junction Solar Cells
	Power Photonic	\$101,598	Minority carrier lifetime measurements in Strained Layer Superlattices (SLS)
	Thin Film Concepts Inc	\$711,425	Serial Blockface SEM Labels for Assessing Nervous System Plasticity
Department of Health & Human Services		\$332,640	Novel therapeutic for Alcoholic Liver Disease
	Angion Biomedica Corporation	\$203,795	Novel Therapeutic for Duchenne Muscular Dystrophy (DMD)
		\$295,336	Phase I Study of BB3 in Dialysis Patients
		\$101,222	A High Efficiency Integrated Syngas Purification and Hydrogen Separation and Storage System
	Biolife Solutions, Inc.	\$100,834	Software Assurance Analysis and Visual Analytics
	Therapyx, Inc.	\$101,637	Common Gravity Dropped Small Weapon Electronic Safe Arm Fuze (ESAF)
Department of Energy	Thermal Gradient, Inc.	\$118,129	A Filter to Remove HMGB1
	Triage Pharmaceuticals, LLC	\$101,640	Identifying and Interpreting Trends through News/Blog Analysis
	Advanced Energy Systems, Inc	\$101,308	Advanced High-Brightness Electron Source
National Science Foundation	Mesoscribe Technologies, Inc.	\$101,593	Prototype 800MHz Crab Cavity Development
	Astraion LLC	\$101,640	Development of Packaging and Integration of Sensors for On-Line Use in Harsh Environments
	Energy Research Company	\$101,875	Data acquisition system for multiplex analysis of color encoded particles
National Institute of Science & Technology	Isoflux Incorporated	\$406,407	A Novel Therapeutic Approach for Liver Injury
National Institute of Science & Technology	Ad Harmony	\$173,865	Sustained Drug Release for Antifibrosis

### 2009 Phase II Awards

Agency	Firm Name	Awards
Department of Health & Human Services	Angion Biomedica Corporation	\$3,028,013 Safety and PK Study in Hepatic Impairment Patients \$1,691,586 Pilot Clinical Study in Renal Transplantation \$2,334,932 Novel Neuroprotective/Restorative Therapy for Ischemic Stroke \$1,967,177 Small Molecule Therapeutics for Renal Disease \$2,123,757 Therapeutic use of small-molecule HGF-mimetic for emphysema \$2,212,273 Novel Neuroprotective/Anti-inflammatory Therapy for Ischemic Stroke \$1,476,239 Novel Therapy for Amyotrophic Lateral Sclerosis
	Applied Biophysics Inc.	\$762,212 Outbreak detection: combinatorial tests for small samples
	Breomics, Inc.	\$762,194 Graphical Trace Object (GTO) Tool
	Butler Farms Usa, Inc.	\$608,993 Low Noise Millimeter Wave LNA
	Lam Design Management, LLC	\$447,818 Dynamic Modeling of Safe Routes
	Nanoprobe, Inc.	\$300,238 Molecular Mammography of Her-2 Cancers using Gold Nanoparticles
	Oncogene Science Inc.	\$757,348 A Novel Low Cost, High Efficiency, Algal Biomass Harvest and Dewatering Technology for Biodiesel Production
	STS Duotex Inc.	\$1,625,871 A Novel Therapy for Septic Shock
	Therex, LLC	\$741,947 Structurally Integrated Position and Orientation Sensor and Seeker Technologies
	Virmatics, LLC	\$741,929 Novel High Control-Authority Impulse Based Micro-Actuation Technologies for Steering Guided Munitions
	X-Ray Optical Systems, Inc.	\$2,100,171 Multi-antigen peptide assay for the serodiagnosis of Lyme disease
Department of Defense	Mesoscribe Technologies, Inc.	\$762,300 An Integrated Approach to Sensor Materials Synthesis, Design and Fabrication for Extreme Temperature Applications \$762,302 Novel Design and Fabrication of Conformal GPS & Communications Antenna for UAV
	Stiefvater Consultants	\$2,887,941 Rapid test for leptospirosis
	TTC Technologies, Inc.	\$762,968 Exhaust Jet Noise Reduction for Tactical Aircraft \$761,376 Computational Fluid Dynamics Enhancements for Scramjet Flow Simulations
		\$760,134 Improved Superconducting Accelerator System for Next Generation Light Sources
Department of Energy	Advanced Energy Systems, Inc	\$762,115 High Power Fundamental Power Coupler for Next Generation Light Sources \$709,677 Development of Alternative Reduced-Cost Helium Vessels for ILC Cavities
National Science Foundation	Medicine Rules Corporation	\$355,725 Forest pest risk analysis in dynamic landscapes
Department of Homeland Security	Power Engineering Assoc	\$751,616 Digital Beamforming (DBF) for Satellite Operations (SATOPS) Support
Department of Homeland Security	Aymont Technology, Inc	\$524,464 The Scientific Media Concise Message Routing System

Note: Award amounts are inflation adjusted to 2010 dollars

Data Source: U.S. Small Business Administration, Office of Technology

Analysis: Collaborative Economics

# OUTCOMES

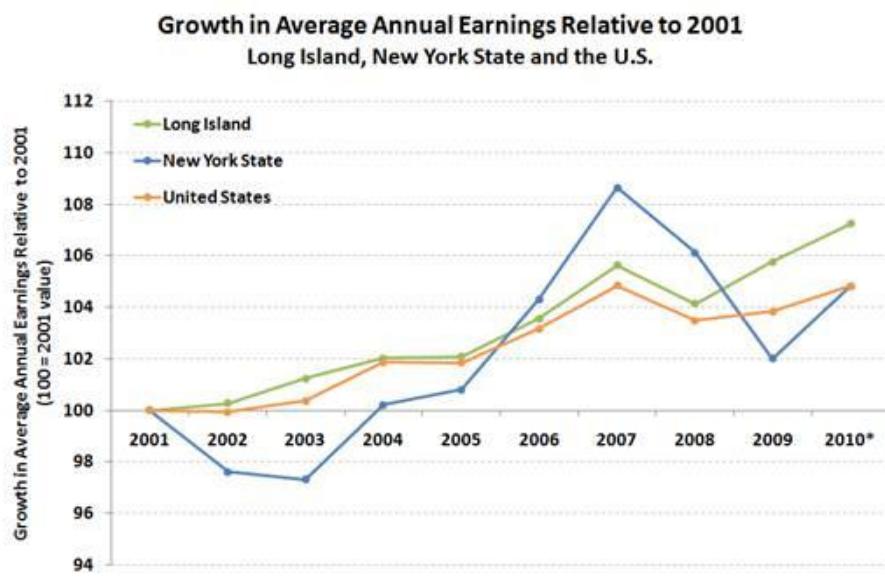
Valuing and investing in Long Island's science and technology assets and facilitating the innovation processes in the region will yield positive results for the region's economy and the prosperity of its communities. Measuring outcomes from innovation, such as competitiveness, business performance, and economic opportunity, captures Long Island's economic benefits that result from translating assets into innovations.

## Opportunity

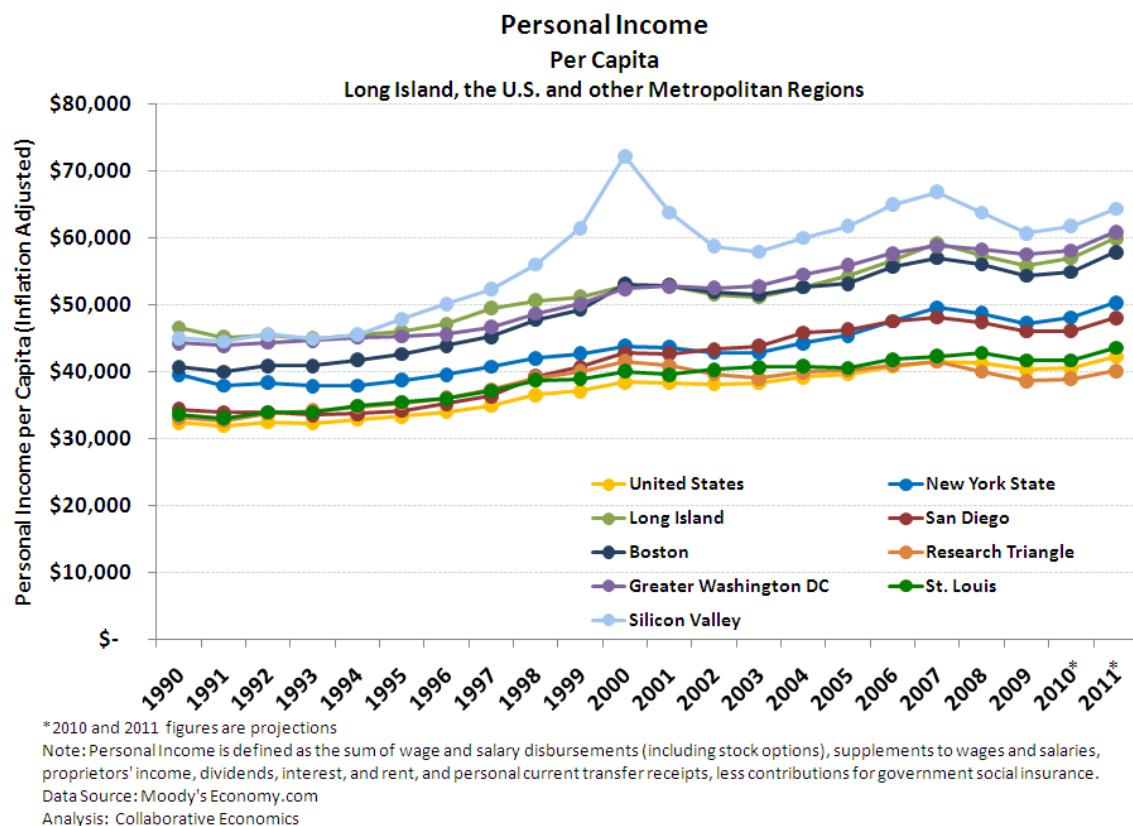
Earnings growth is an important measure of economic vitality in a regional innovation system as employment growth. A variety of income measures presented together provides an indication of regional prosperity and the distribution of prosperity. Average annual earnings illustrate trends in aggregate earned income in the region. Real per capita income rises when a region generates wealth faster than its population increases. The median household income is the income value at the middle of all income values. In addition to typical earnings, the cost of living varies by region.

After declining in 2008, average annual earnings on Long Island have recovered their climb. Average annual earnings on Long Island reached \$52,371 in 2010. This represents a one percent increase over the prior year and seven percent over 2001.

Relative to 2001, earnings growth on Long Island of seven percent outpaced statewide and national gains of five percent. New York State earnings have been more volatile over the decade.



Long Island's 2011 per capita income of \$46,600 is relatively high following Silicon Valley (\$69,900) and Greater Washington DC (\$64,300). After dropping significantly in 2008 and 2009, per capita income gained momentum in 2010 and increased in all regions. Between 2009 and 2011, income growth was strongest in Long Island, jumping 7.4 percent, followed by Boston at 6.5 percent and New York State at 6.4 percent. Over the past two decades, income growth was strongest in Silicon Valley (+43%), Boston (+42%) and San Diego (+40%).

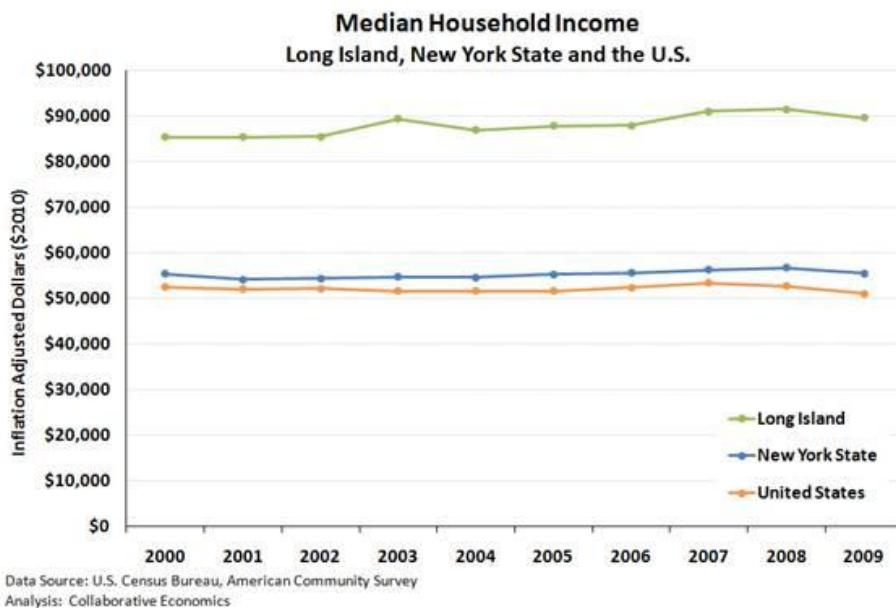


## COMPUTER ASSOCIATES

Founded in 1976 in Islandia, New York as Computer Associates, Inc., CA Technologies is one of the largest independent software corporations in the world. The company's software supports mainframe, distributed, virtualized, and cloud environments for companies all over the world. It sells anti-virus and internet security programs for both personal and business use, but is primarily known for its mainframe computer and distributed computing applications and solutions used by business.

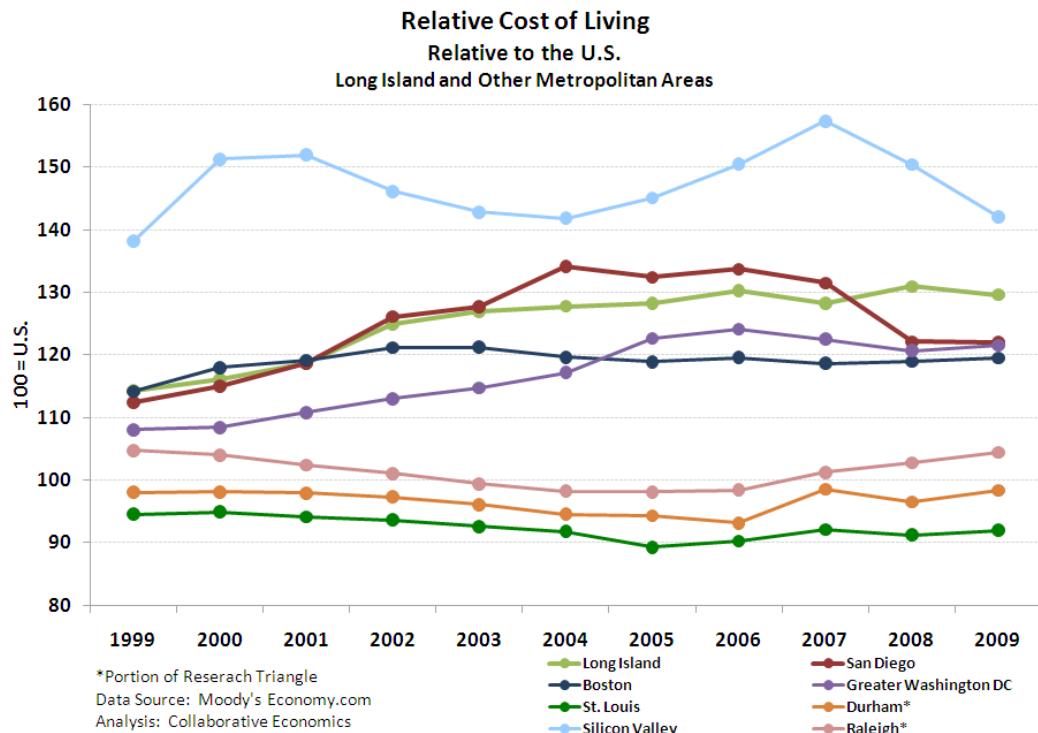
CA Technologies grew substantially through the 1980s evolving from a primarily system utility based company into one competing in the applications and software markets with firms such as Microsoft and Lotus Development Corporation. CA Technologies grew with the acquisition of companies that provided spreadsheet, word processor, and graphics. By the end of the decade, CA Technologies became only the second software company ever to exceed \$1 billion in sales. CA Technologies focused on ensuring efficiency and customer satisfaction during the 1990s as well as expanding further into the global market. Recently, CA Technologies has become a leader in the Cloud Strategy by launching the concept of an IT Supply Chain, which allows a company to manage and dynamically secure both the physical and virtual environments and to deliver more flexible IT services.

Today, CA Technologies remains one of the largest software companies in the world with over 150 offices and more than 13,200 employees around the globe. Additionally, CA Technologies was ranked among the nation's greenest companies by Newsweek Magazine.



The median household income on Long Island is 61 percent higher than in the state and 76 percent higher than in the country as a whole. In 2009, the median income was \$89,645 in Long Island, \$56,749 in the state, and \$51,045 in the country. From 2000 to 2009, incomes grew by five percent in Long Island, while remaining stable in New York State, and declining by three percent in the United States. In the most recently reported year, median household incomes in all three geographies decreased, falling farther nationally.

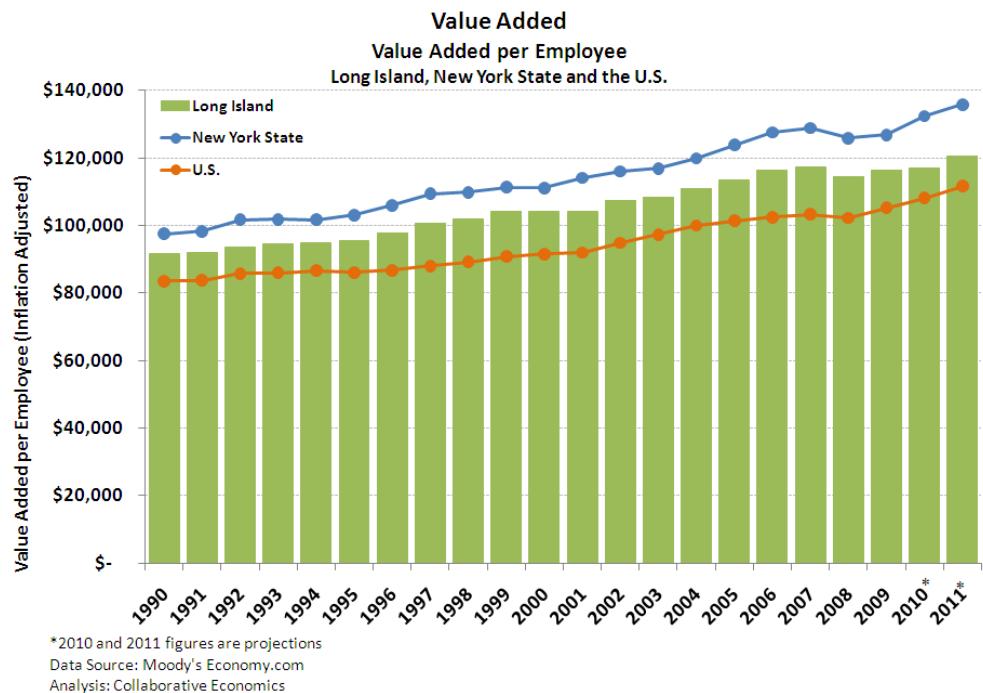
While incomes are higher on Long Island, living costs are also higher. Long Island's cost of living has remained relatively stable in recent years compared to other regions. In 2009, Long Island's cost of living was 30 percent higher than the national average and second only to Silicon Valley.



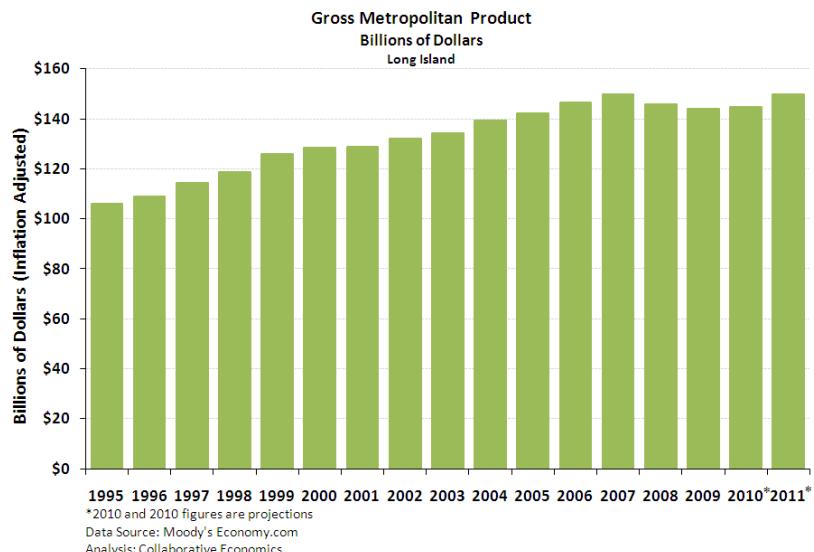
## Competitiveness

Economic competitiveness drives success of a regional economy. An indicator for competitiveness and the overall health of the region's economy is productivity. Value added per employee reports the value generated (gross metropolitan product) per employee in the region.

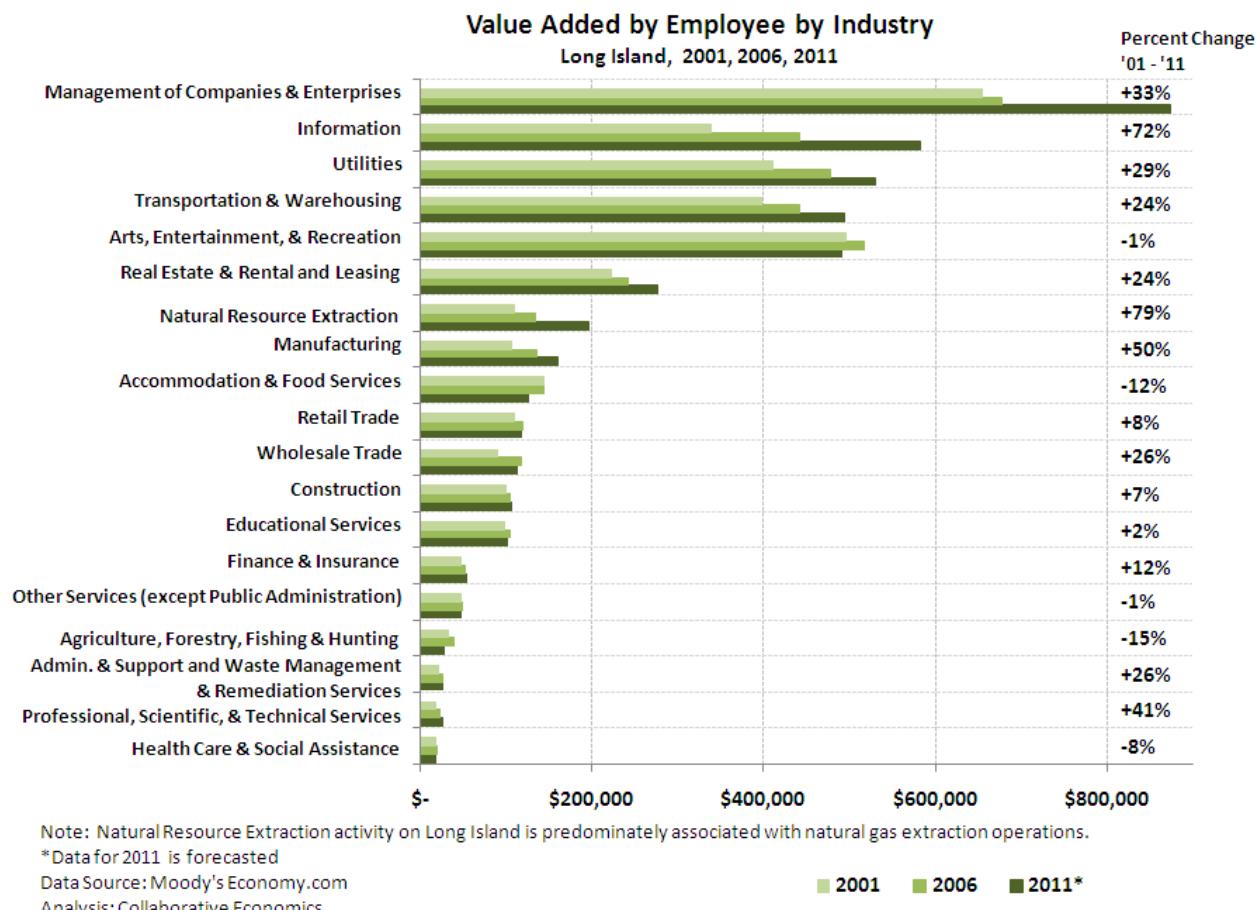
Regional value added per employee on Long Island falls above the national average but below the state average. In 2011, value added was \$120,500 on Long Island compared to \$136,000 in New York State and \$111,500 in the United States. Over the past two decades, the value added increased at a slower pace on Long Island, expanding 31 percent. Over this time period productivity increased 34 percent in the United States and 39 percent in New York State.



A factor of productivity and competitiveness, Long Island's regional product is on the rise. After dropping during the recent economic downturn, Long Island's gross metropolitan product peaked just under \$150 billion in 2011. Since 1995, Long Island's economic product has increased 42 percent.



Productivity growth varies by industry. The Management of Companies & Enterprises sector represents Long Island's highest value-added industry with roughly \$873,000 GDP added per employee in 2011. Other industries reporting high value added per employee in 2011 include Information (\$582,000), Utilities (\$530,000), and Transportation & Warehousing (\$494,000). The strongest growth in productivity between 2001 and 2011 was reported in Natural Resource Extraction (79%) and Information (72%).



## GRAPHENE LABORATORIES, INC.

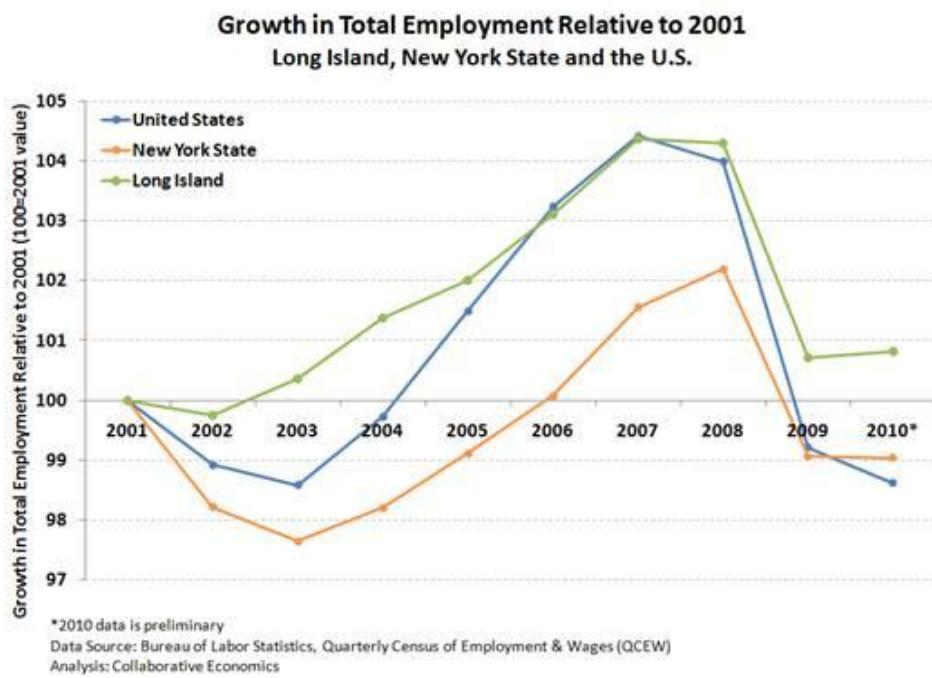
Graphene Laboratories, Inc., a nanotechnology start-up company specializing in bringing functional graphene materials and devices to market, recently relocated to the Calverton Business Incubator at Stony Brook University from one of the nation's top innovation hubs, Boston. The move south has put Graphene close to its industrial partner, Long Island-based CVD Equipment Corporation and to Brookhaven National Laboratory, whose Center for Functional Nanomaterials supports Graphene Laboratories' research projects. Not only will this draw more science & engineering jobs to the region, but according to CEO Elena Polyakova, the proximity of the sales and manufacturing divisions will allow the company to better meet customers' needs.

Graphene, a carbon-based material, was discovered less than seven years ago and has been coined a "miracle material" by the 2010 Nobel Prize Committee. Its applications range from flexible touch screens for smart phones to ultrasensitive biosensors. Graphene Supermarket™, managed by Graphene Laboratories, is a leading supplier of nanocarbon and graphene products including CVD grown graphene on foils and wafers, Q-Graphene™, graphene nanopowder and graphene oxide to customers worldwide. Other services offered by Graphene Laboratories include analytical services, prototype development and consulting.

## Business Performance

Tracking employment gains and losses is a basic measure of economic health. Shifts in employment across industries suggest structural changes in Long Island's economic composition. Over the course of the business cycle, employment growth and decline across industries can be cyclical, but the permanent changes reflect how the region's industrial mix is changing.

In 2010, total employment in Long Island increased less than one percent over the previous year, stabilizing from the dramatic losses in 2009. Relative to 2001, employment in the region was one percent higher in 2010. By contrast, in New York State and the United States, employment fell below 2001 levels in 2009. New York State employment stabilized in 2010 while losses slowed nationwide.



## CHYRON CORPORATION

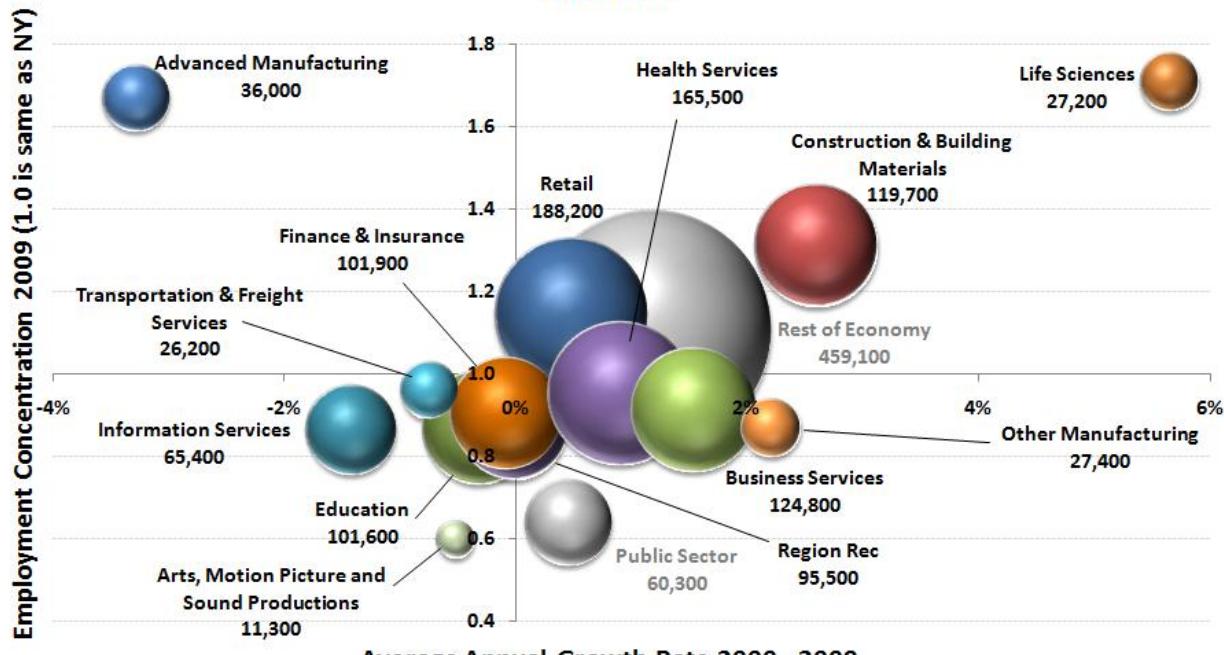
Founded as Digitronics in 1966, Chyron Corporation is a Melville, New York-based company that develops and manufactures on-screen graphics for the broadcasting industry. The company develops, manufactures, markets and supports hardware and software solutions that enhance the production values of live and pre-recorded television programs. It is estimated that almost 60 percent of U.S. broadcasters use Chyron products to display news titles, sports scores, weather information, election results and news and finance tickers.

During the company's early years, Chyron manufactured dot-matrix character generators (CG) for airport arrival time displays as well as Chyron I, a clean-looking fixed-font CG. Chyron I was able to record and retrieve lower thirds and full page text displays for news departments of TV stations as an alternative to art cards, slides, or scrolling black felt. Chyron followed with an ambitious CG project that featured up to six loadable fonts with very high resolution video. The project was named Chyron II and aimed to achieve a feat that was unheard-of at the time. The capability of Chyron II was too sophisticated for smaller markets so, Chyron developed the less complex Chyron III system and later the first mobile graphics systems which became Chyron IV. Chyron became a staple in the development of graphics for sports programming as Chyron IV was the primary supplier of graphic designing for sports broadcasting nationwide including the networks NBC, ABC, CBS, ESPN, and TNT.

Today, Chyron Corporation is the leading hardware manufacturer and software designer for 2D and 3D broadcast generators in North America. Chyron's graphics products are used by thousands of broadcasters in the US and around the world including ABC, FOX, CBS, ESPN, Turner Entertainment Networks, The Golf Channel, Home Shopping Network, Korean Broadcasting, Germany's BR and NDR networks, and the BBC, plus local stations in every television market. The name of this Long Island company is so well known that the graphics generated by character generators (CG), are typically referred to in the United States as "Chyrons."

## Long Island's Industry Clusters

2000-2009



### Average Annual Growth Rate 2000 - 2009

Note: Other Manufacturing includes Food Production and Processing, Textiles, Paper Products and Misl. Manufacturing  
 Data Source: National Establishment Time Series

Size of bubble represents employment size in 2009.

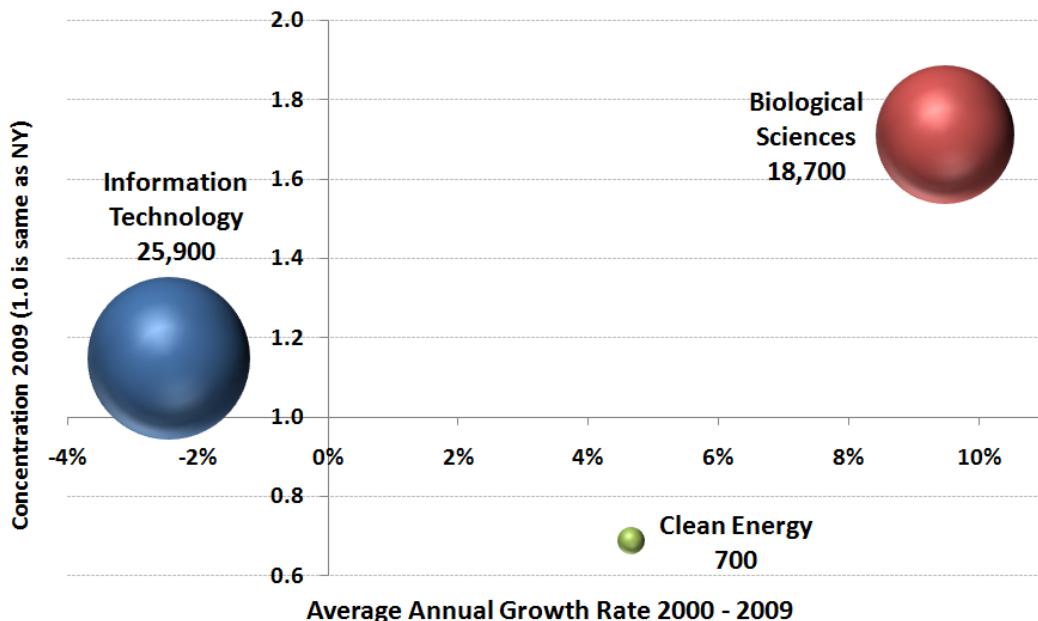
Analysis: Collaborative Economics, Clusters based on 6-digit North American Industry Classification System (NAICS)

Long Island hosts a diverse industry base in which key industries are growing while others continue to wane. The region's overall employment has outpaced state growth by 0.7 percent at an average annual rate. Life Sciences reports the strongest average annual growth of 5.6 percent from 2000 to 2009. With employment of 27,200, the region boasts an employment concentration in Life Sciences 71 percent higher than the state.

The y-axis displays the employment concentration of each industry cluster and its ratio to New York's employment in a cluster. A concentration greater than one indicates Long Island has relatively more employment in that cluster as compared to the state's economy as a whole. Construction & Building Materials is 31 percent more concentrated than the state and has continued to grow over this period by 2.6 percent at an average annual rate. Although Advanced Manufacturing has declined in employment, it remains a highly concentrated cluster, 67 percent more concentrated than the state.

Information Technology (IT), Biological Sciences and Clean Energy represent Long Island's key industry clusters of opportunity. Since 2000, Biological Sciences is highly concentrated and has grown at an annual rate of 9.5. Although still small, Clean Energy has grown annually 4.7 percent since 2001 and continued growth is expected. IT is large and concentrated, and though employment has declined, it remains an important and diverse industry on Long Island.

## Long Island's Key Clusters



Data Source: Green Establishment Database and National Establishment Time-Series Database  
Analysis: Collaborative Economics, Clusters based on 8-digit Standard Industry Classification (SIC) System, which are significantly more detailed than the 6-digit North American Industry Classification Systems (NAICS)

### BALFOUR TECHNOLOGIES

Headquartered in Bethpage, New York, Balfour Technologies has been a leading developer of four dimensional, integrated visualization technology for a variety of markets since 1999. Balfour primarily began as a consulting firm focusing on simulation and training but opted to develop their own software program to offer to others. Balfour Technologies provides customers with consultants that have over 60 years of combined real-time simulation and visualization technology experience. This includes high-fidelity aircraft flight and full-mission simulators, electronic systems, maintenance trainers, and operational simulators for advanced transportation systems.

Balfour's primary software product is their patented *fourDscape*. The *fourDscape* is a four-dimensional browser that enables automated situational awareness for human interaction, analysis and response through a fully integrated four dimensional landscape. The information displayed in a *fourDscape* browser effectively presents the data in a single visual scene or common operating picture, providing automated situational awareness for emergency or law enforcement personnel. The *fourDscape* technology has been used in significant events including the September 11, 2001 Attacks, the 2004 Tsunami in Southeast Asia, Hurricanes Katrina and Rita, the 2004 Republican National Convention in New York, and the 2005 Presidential Inauguration in Washington, DC. The technology is also utilized by the U.S. Army Corps of Engineers, the U.S. Air Force, the U.S. Border Patrol, and police departments across the country.

Starting out from a small team of employees at its inception in 1999 with annual revenues of less than \$200,000, Balfour Technologies now generates more than \$1 million in services and sales each year. The company was awarded the Long Island Software Award (LISA) for Technology Innovation in its first year of existence and in 2006; Balfour was awarded two Phase I Small Business Innovation Research (SBIR) contracts from the Department of Homeland Security.

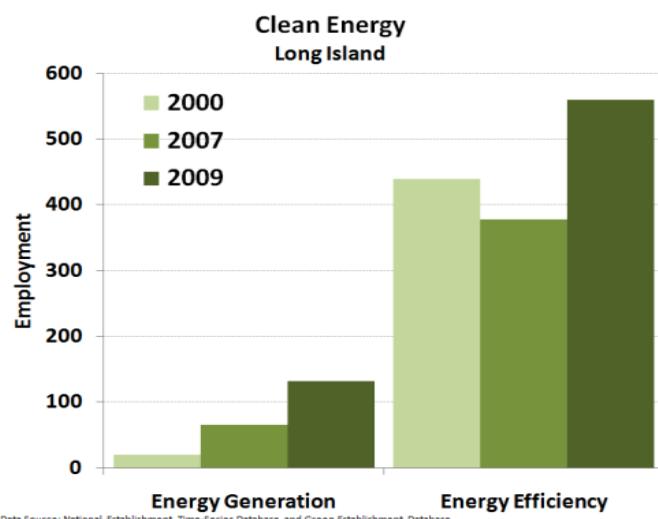
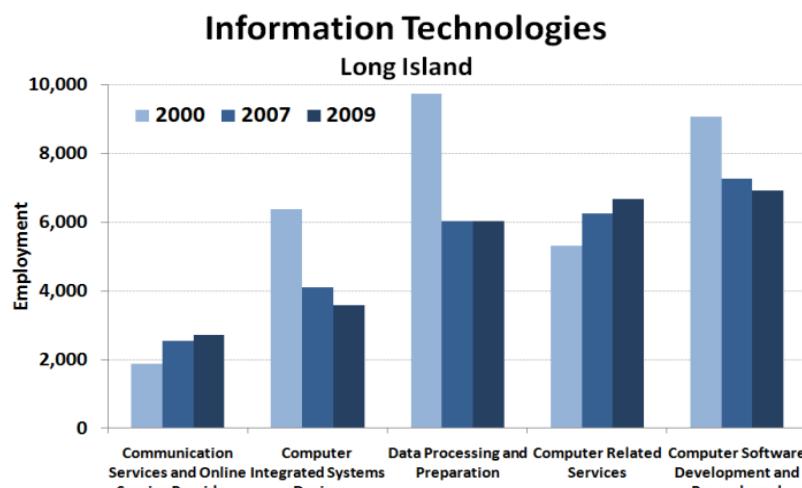
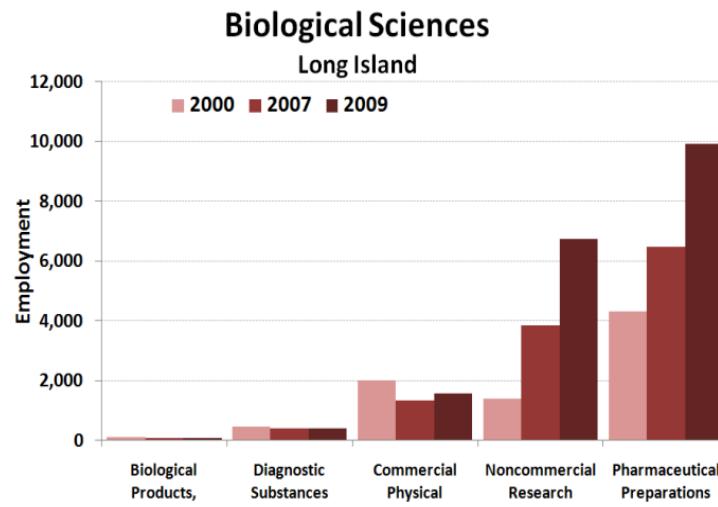
### Within Biological Sciences, Noncommercial Research

Organizations expanded 19 percent annually from 2000 to 2009. With 6,735 employees, Noncommercial Research Organizations represents the fastest growing sector of Biological Sciences. Forty-three percent of these jobs are located at Brookhaven National Laboratory and 35 percent are at Stony Brook University.

Pharmaceutical Preparations is the largest subgroup of Biological Sciences on Long Island and is 2.5 times more concentrated than the state. With 9,925 employees, this sector grew at an annual rate of ten percent over the same time period.

Information Technology is a diverse field that spans several sectors. While some sectors have declined since 2000, two IT sectors have grown. Computer Related Services employment increased 26 percent from 2000 to 2009. Communication Services & Online Service Providers grew four percent annually over the period. Although declining from 2000, employment in Data Processing & Preparation has remained steady since 2007 and is twice as concentrated as statewide.

Clean Energy consists of Energy Generation and Energy Efficiency. Energy Generation expanded by 23 percent annually from 2000 to 2009. Three times the state average, Energy Efficiency is highly concentrated in the Long Island region and has increased 28 percent since 2000.



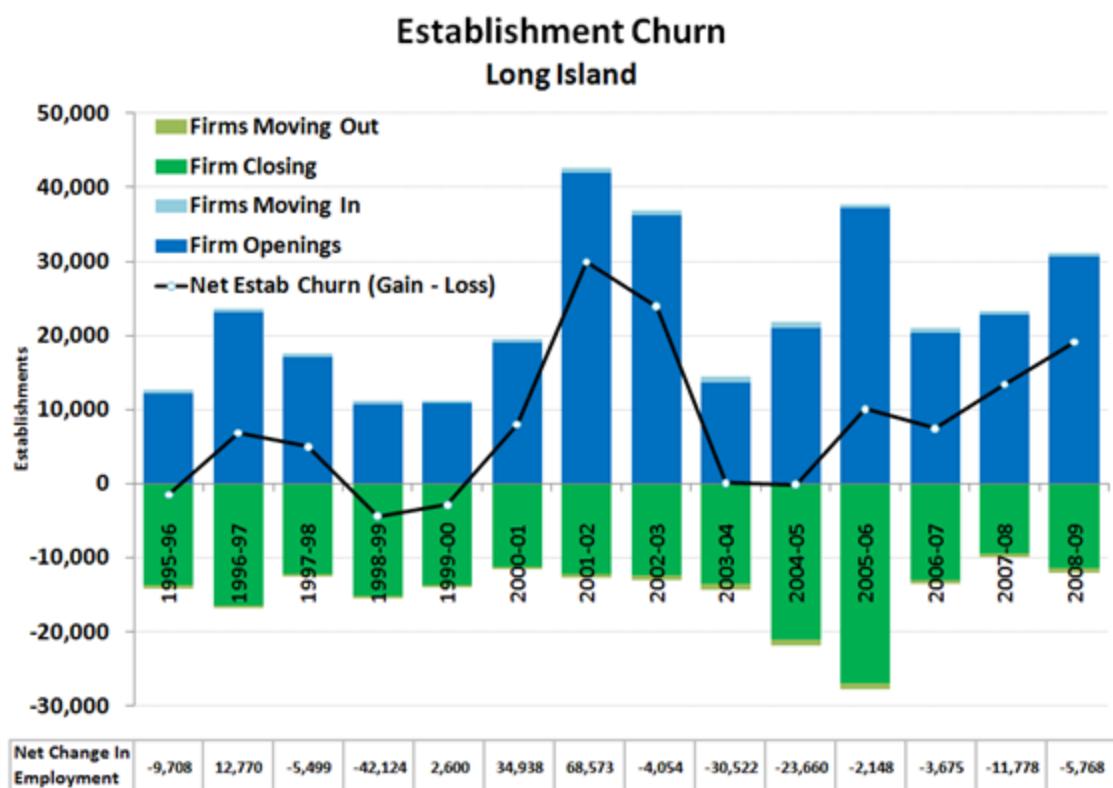
In any given year, new business establishments will open their doors and old establishments will close. This “churn” is the result of start-ups, expansions, closures, mergers and businesses moving locations. The movement of business establishments to and from the region provides some insight into the continued attractiveness of the region for business.

Increasing 34 percent over the prior year, 2009 represents the fourth straight year of growth in new establishments on Long Island with 19,200 net new firms. Newly opened firms make up 98 percent of the 31,200 new establishments founded in 2009. Firm closings also increased, ticking 20 percent from 2008 but were significantly over shadowed by openings.

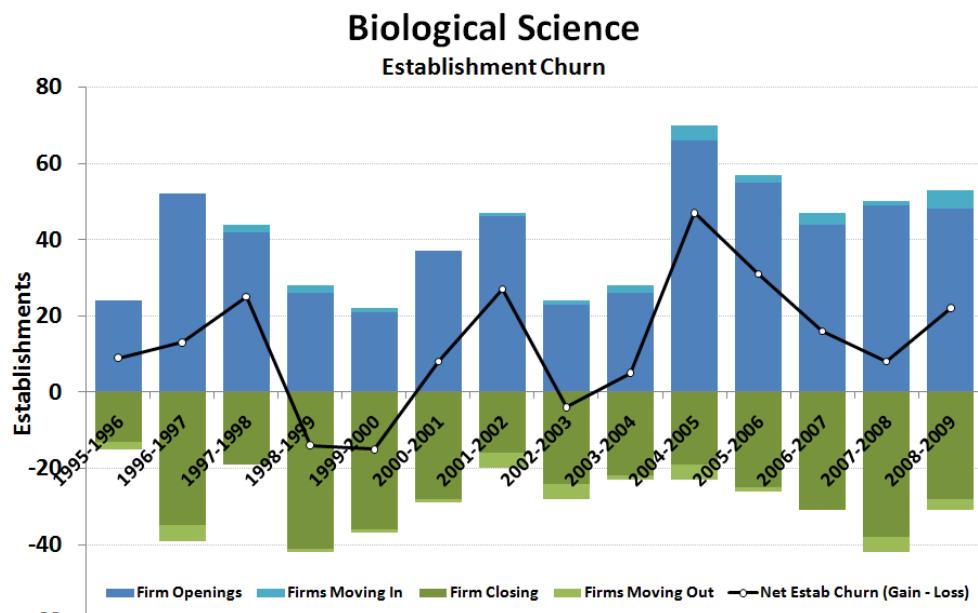
The percentage of companies moving into the Long Island region from outside New York State has increased from 13 percent in 1995-96 to 32 percent in 2008-09 of all incoming establishments. In terms of firms leaving Long Island, the destination tends to be outside the state more so than in earlier periods. However, for larger firms, movement tends to remain within the state.

Percent of Total Long Island Business Establishments			
	1995-1996	2008-2009	
ENTERED Long Island	From Rest of NY	87%	68%
	From Rest of US	13%	32%
EXITED Long Island	To Rest of NY	55%	28%
	To Rest of US	45%	72%

From 2002 to 2009, Long Island witnessed a net loss in employment. However, the net employment churn has been trending towards neutrality from 2006 to 2009, with net employment loss just under 6,000 in 2008 compared to 35,000 in 2003.



Data Source: National Establishment Time Series (NETS) Database  
Analysis: Collaborative Economics



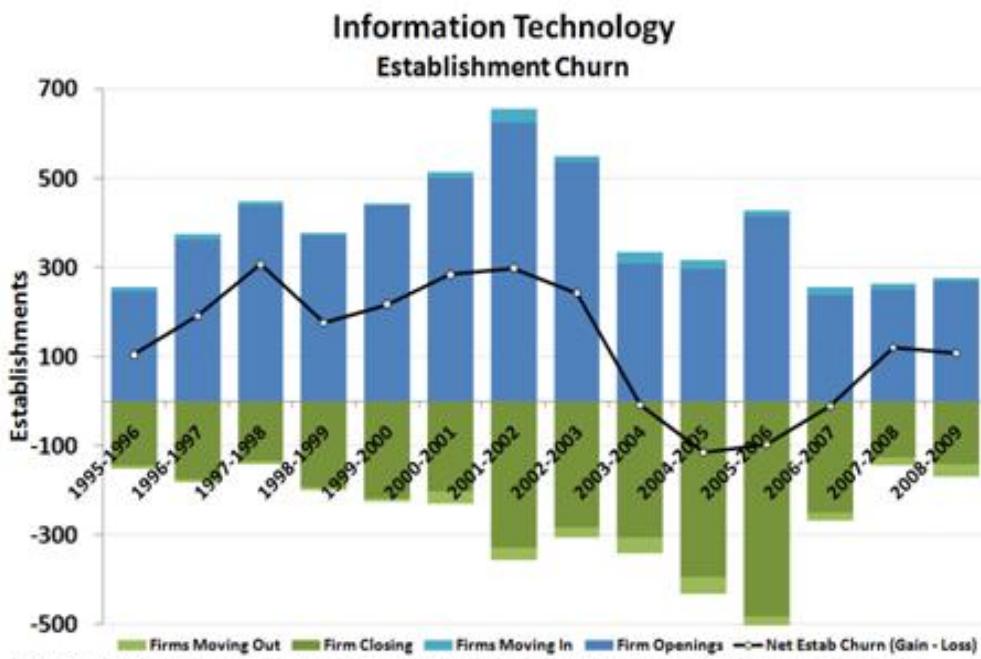
Note: Biological Science is defined using 8-Digit Standard Industry Classification (SIC) System. This Definition is more detailed than the industry cluster definition, which are based on 6-digit North American Industry Classification Systems (NAICS).

Data Source: National Establishment Time Series (NETS) Database

Analysis: Collaborative Economics

Establishment churn can vary by industry. In **Biological Science**, Long Island witnessed a net gain of over 20 new establishments in the most recent observable year, tripling over the prior year. From 2008 to 2009, 48 new establishments opened and 28 closed. Firm closings dropped 26 percent and exits slowed by 25 percent over this period.

In **Information Technology**, Long Island witnessed a net gain of nearly 120 new Information Technology establishments in the most recent period. Total openings in IT increased by eight percent from 2007-08 to 2008-09, adding 270 new establishments. Closings and exits also increased over this period, causing a slight decrease in the net growth.

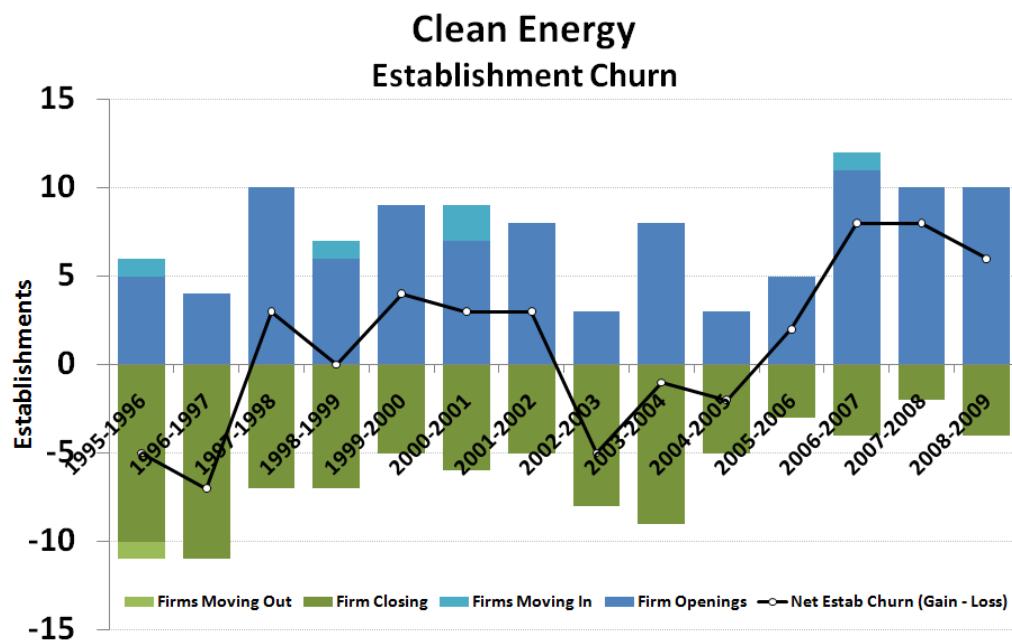


Note: Information Technologies is defined using 8-Digit Standard Industry Classification (SIC) System. This Definition is more detailed than the industry cluster definition, which are based on 6-digit North American Industry Classification Systems (NAICS).

Data Source: National Establishment Time Series (NETS) Database

Analysis: Collaborative Economics

In **Clean Energy**, Long Island reported a net gain of six new Clean Energy firms between 2008 and 2009. The region has witnessed net gains in Clean Energy establishments since 2005-06. No establishments have exited the region since 1996, and four new establishments have relocated to Long Island in the same time period.



Note: Clean Energy is defined using 8-Digit Standard Industry Classification (SIC) System. Clean Energy consists primarily of Energy Efficiency and Energy Generation establishments as defined in Next10's Many Shades of Green Report.

Data Source: National Establishment Time Series (NETS) Database, Green Establishment Database

Analysis: Collaborative Economics

## AGRIPOWER, INC.

Agripower, Inc. is a Great Neck, New York-based start-up company founded in 2004 that specializes in the conversion of biomass and plastic waste to be used as an inexpensive and low-cost electricity and heat. The company produces Combined Heat and Power (CHP) Systems to generate thermal energy for heating and air-conditioning buildings, heating water, refrigeration, water desalination, water purification, and making ice in an environmentally friendly manner.

Agripower seeks to address a common problem for enterprises worldwide, waste. Tens of thousands of enterprises generate biomass and plastic waste that is expensive to dispose of and is subject to restrictions imposed by environmental laws. Their operations require a great deal of expensive energy which hinders their ability to expand due to restrictions imposed by environmental laws. Agripower has developed a solution to address all these problems with one solution. Agripower created and now manufactures Combined Heat and Power (CHP) Systems that utilize Waste-to-energy technology. This technology enables readily available Biomass and plastic waste generated by enterprises to be efficiently converted into low-cost, "carbon neutral" electricity and thermal energy. The CHP systems are modular and portable and can be placed on the chassis of tractor-trailers for easy and inexpensive movement. While a company may have paid for the removal of their waste in addition to their electricity and fuel costs, the CHP system allows businesses and enterprises to convert their biomass and plastic waste into clean, environmentally friendly fuel and electricity at little to no cost.

Agripower, Inc. is currently in the pre-revenue stage, but recently secured their first purchase and expects the purchased CHP system to be fully operational by October 2011. The company is currently working to partner with one of Long Island's six research institutes and provide a CHP system at a reduced rate to demonstrate their product and how it can be used by a research facility.

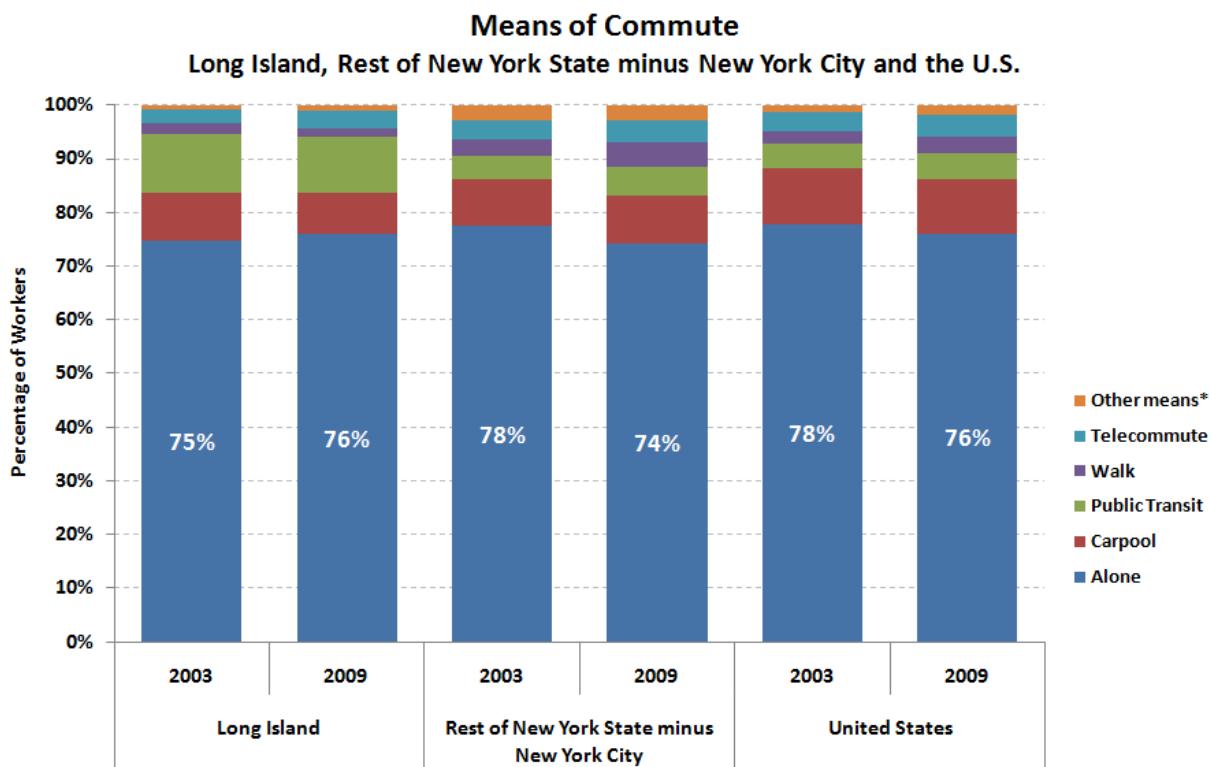
## QUALITY OF LIFE

The general well-being of individuals and societies can be measured by the livability of a region. Quality of life relates to the pleasant character of the surroundings, the proximity of the workplace to attractive and affordable living options, and the local offerings of leisure time activities. Arts and culture are integral to Long Island's innovation system in spurring creativity and attracting and retaining talent.

### Livability

The affordability of housing affects a region's ability to maintain a viable economy and high quality of life. Lack of affordable housing in a region encourages longer commutes, which diminish productivity, curtail family time and increase traffic congestion. Lack of affordable housing can make a region less attractive to new talent and also restricts the ability of crucial service providers—such as teachers, registered nurses and police officers—to live in the communities in which they work. The current financial crisis has greatly added to housing pressures across the country.

In 2009, 1.4 million Long Islanders commuted to work. Of these, 76 percent drove alone to work in a truck, van or car, one percent more than in 2003. Public transit use as well as carpooling on Long Island dropped by one percent over this period. In New York State, excluding Long Island and New York City, commuters driving alone dropped from 78 percent to 74 percent while public transit use increased by one percent, and walkers increased by two percent between 2003 and 2009. National patterns resemble Long Island although more progress can be observed. Commuters driving alone dropped from 78 percent to 76 percent. Walkers and Telecommuters increased by one percent each over this period. Public transit use and carpooling remained unchanged over this period.



\*Other means includes taxicab, motorcycle, bicycle, and other means not identified separately within the data distribution.

Note: The category Walk is included in Other means for the year 2005.

Data Source: U.S. Census Bureau, American Community Survey

Analysis: Collaborative Economics

In 2009, ridership on both the Long Island Rail Road (LIRR) and Long Island Bus declined by six percent, and Suffolk County Transit declined by three percent. This follows four years of ridership growth from 2005-2008. The recession that began in 2008 is the primary cause as job losses both on Long Island and in New York City decreased the number of people traveling to work. However, both Metro North and New Jersey Transit had smaller declines than LIRR, and the Westchester Bus system had a smaller drop-off than either Long Island Bus or Suffolk Transit. This is similar to previous years when transit systems in other New York, New Jersey and Connecticut suburbs grew faster than on Long Island. Faster growth in housing in these places and more rapid growth in “reverse commutation” from New York City to suburban job centers are part of the reason for these differences.

In comparison to surrounding suburban communities, since 2000, Long Island Rail Road has declined by two percent while Metro North and New Jersey Transit have grown by eleven percent and nineteen percent, respectively. The Long Island Bus, which has experienced a two percent gain in ridership since 2000, has grown significantly more than the Long Island Railroad. Long Island’s Suffolk County Transit has grown by 40 percent over the same time period, a much more robust growth than other commuter bus systems in the region. This is due in part to population growth in Suffolk and in part to services that were added earlier in the decade.

Compared to surrounding regional suburbs, Long Island offers fewer affordable housing options. Over the past decade, Long Island has issued 3.3 multi-family building permits per 1,000 residents, fewer permits than comparable northeastern regions. SW Connecticut and Northern New Jersey issued 6.8 and 13.2 permits per 1,000 residents over the same time frame. Single-family home permits issued on Long Island neared the level of surrounding regions, but remained the lowest at 12.1 permits per 1,000 residents from 2000 to 2009. New York region excluding New York City issued 16.1 permits, Northern New Jersey 16.9 permits, SW Connecticut 17.3 permits and Hudson Valley 17.9 permits per 1,000 residents over the decade. In 2009, fewer than one in five Long Island homes were occupied by renters compared to roughly a third of homes in surrounding regions.

Transportation Ridership Trends: Long Island and Surrounding Suburban Communities		
Regions	Percent Change in Ridership	
	2008-2009	2000-2009
Long Island Railroad	-6%	-2%
Long Island Bus	-6%	+2%
New Jersey Transit, Bus	-4%	+5%
New Jersey Transit, Commuter Railroad	-5%	+19%
Westchester County Bee Line	-1%	+8%
Suffolk County Transit* (Bus)	-3%	+40%
Metro-North Railroad	-4%	+11%

\*Suffolk County data includes Huntington Area Rapid Transit

Data Source: MTA, NJ Transit, Suffolk County, and

Westchester County Bee Line

Analysis: Rauch Foundation

Housing Statistics: Long Island and Surrounding Regions			
Regions	Building Permits Issued per 1,000 Residents, 2000-2009		Share of Renter-Occupied Units 2009
	Single-Family	Multi-Family	
Long Island	12.1	3.3	18.1%
New York City	1.3	26.3	66.4%
Hudson Valley	17.9	7.8	32.6%
SW Connecticut	17.3	6.8	31.7%
Northern New Jersey	16.9	13.2	36.3%
NY region excluding NYC	16.1	9.4	31.6%

Data Source: Census Bureau Building Permits Survey; ACS (2009

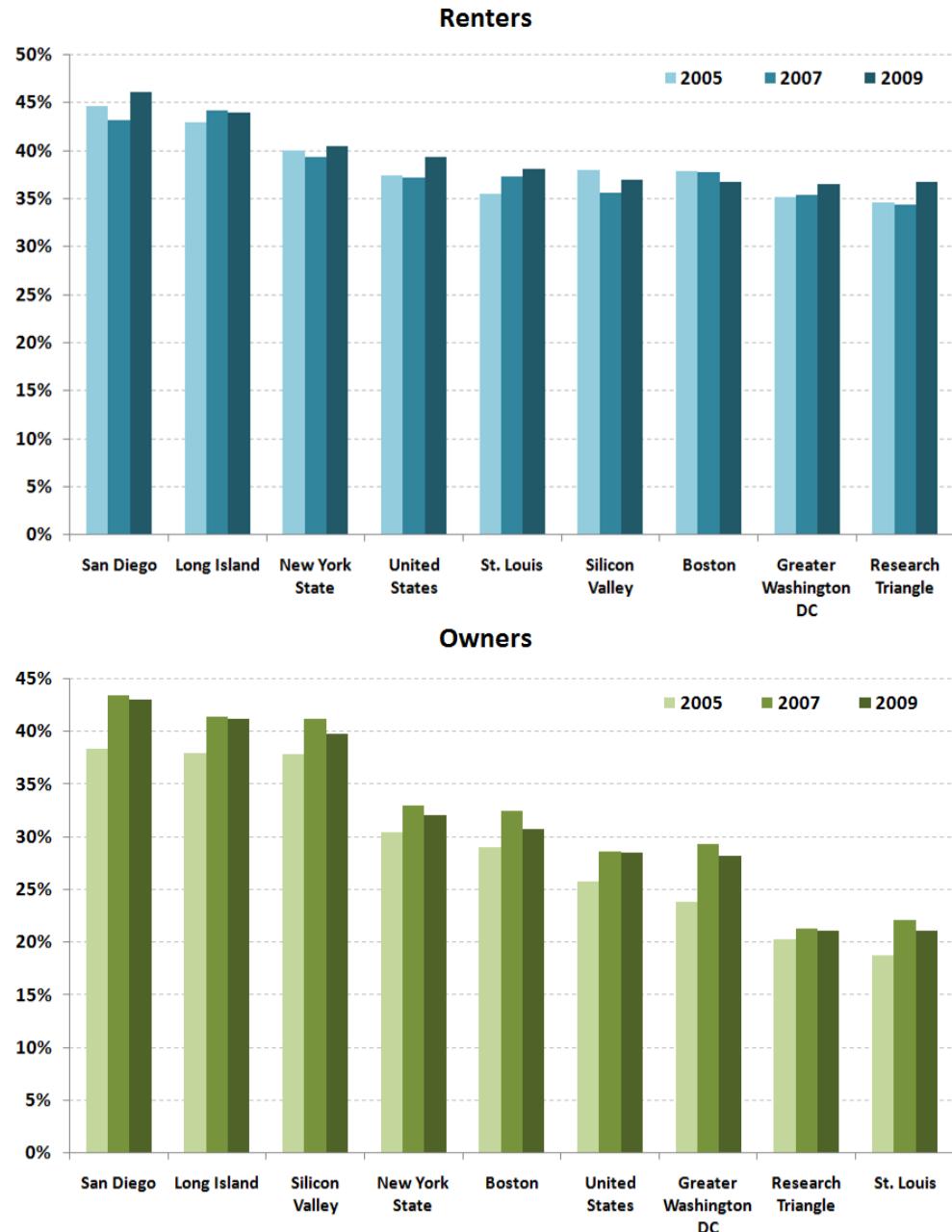
American Community Survey 1-Year Estimates), data compiled by RPA.

Analysis: Rauch Foundation

Long Island's housing costs are typically higher than other places, but for both renters and owners, costs appear to have stabilized since 2007. For the last three years, 44 percent of renters and 41 percent of homeowners spent more than 35 percent of their income on housing costs. Statewide, up two percent from 2007, 41 percent of renters spent more than 35 percent of their income on housing in 2009. For 32 percent of New York State homeowners, housing costs exceeded 35 percent of household income in 2009.

Compared to other regions, Long Island's housing cost burden is second only to San Diego for renters and owners. Nationally, 39 percent of renters and 29 percent of owners face high housing costs. Since 2005, the housing cost burden has increased across all regions for home owners. The strongest increase in the housing cost burden was felt in San Diego (+5%) and the Greater Washington DC area (+4%). For renters, the cost burden increased in every region except Silicon Valley and Boston which both witnessed a one-percent drop over the five-year period.

**Percent of Households with Housing Costs Greater than 35% of Income**  
Boston, Greater Washington DC, Long Island, New York State, Research Triangle, San Diego, Silicon Valley, St. Louis, and the U.S.



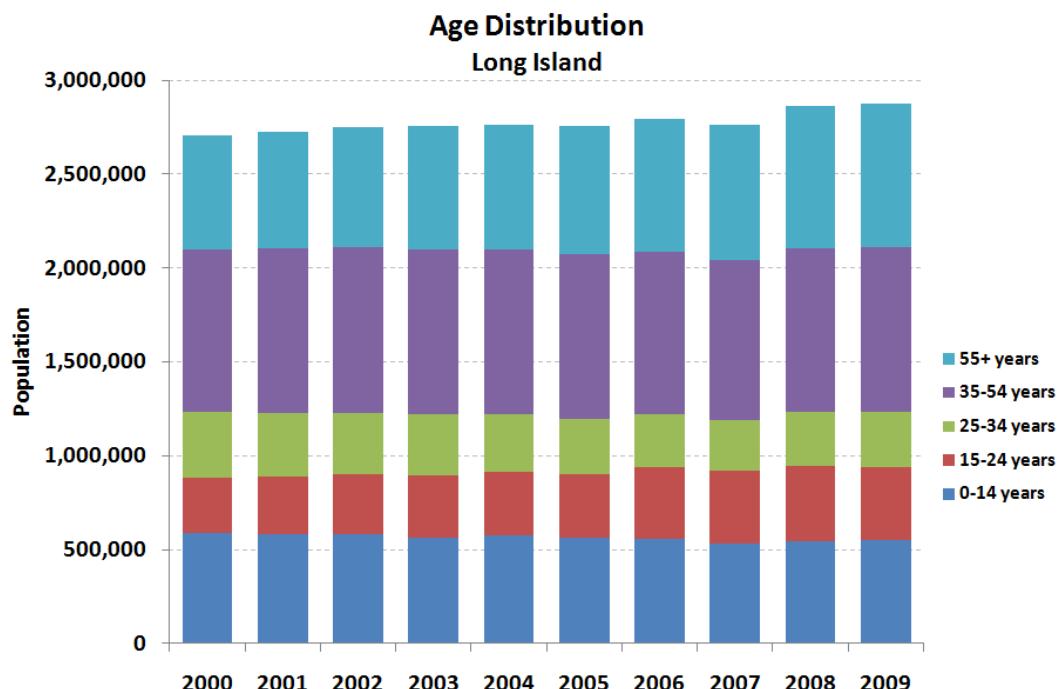
Data Source: U.S. Census Bureau, American Community Survey  
Analysis: Collaborative Economics

## Vibrancy

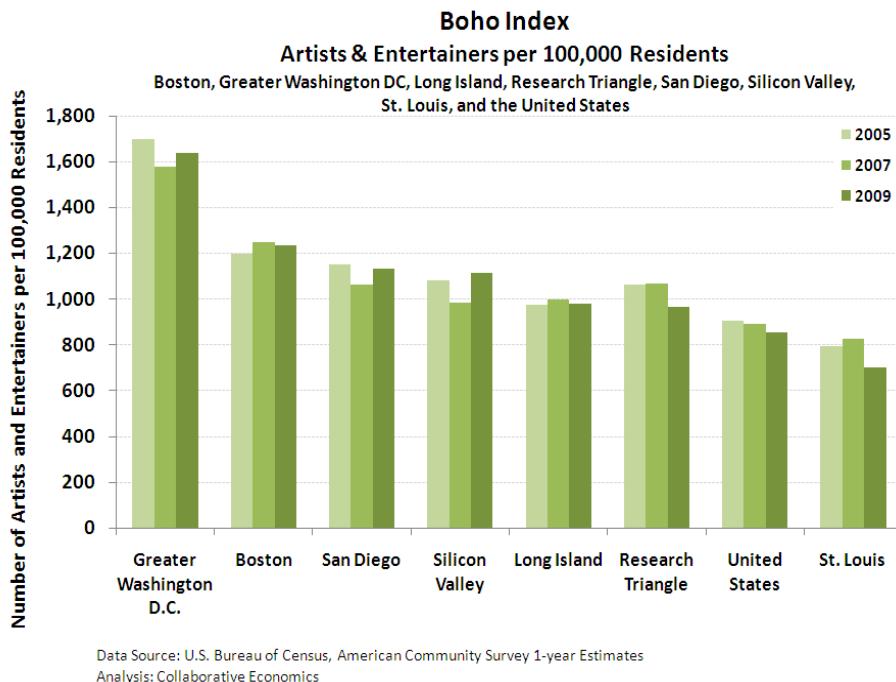
Art and culture are integral to a regional innovation system. Participation in arts and cultural activities spurs creativity and increases exposure to diverse people, ideas and perspectives. Creative expression is also important to an economy based on innovation. How well the region supports its arts and cultural organizations—especially in relation to household income—is an important measure of our overall vitality. A vital arts community is also a factor in a region's attraction and retention of talent.

Examining a region's population breakdown by age distribution can provide some indication for a region's vitality in that it helps to illustrate whether the region is attracting young talent. An influx of young adults moving to the region can indicate greater innovative potential as start-ups often rely on young talent, while a growing number of baby boomers and lack of affordable housing options can make a region less attractive to young adults.

Individuals aged 35-54 make up 30 percent of Long Island's population. Although this age group represents the largest segment of the population, it dropped from 32 percent in 2000. Residents aged 55 and older make up 27 percent of the region's population and increased four percent since 2000. Children and youth under 24 years combined account for 33 percent of the region's population, the same as in 2000 but now with a larger portion of those younger than 14. Individuals aged 24-34 represent ten percent of the population, down from 13 percent in 2000.



The Boho Index illustrates the concentration of artists and performers in a community and represents the number of artists and entertainers per 100,000 residents. In 2009, Long Island's Boho Index was 979, a two percent decrease from 2007 and little change from 2005. Regions with higher scores on the Boho Index in 2009 include: Greater Washington DC (1,639), Boston (1,237), San Diego (1,131), and Silicon Valley (1,113).



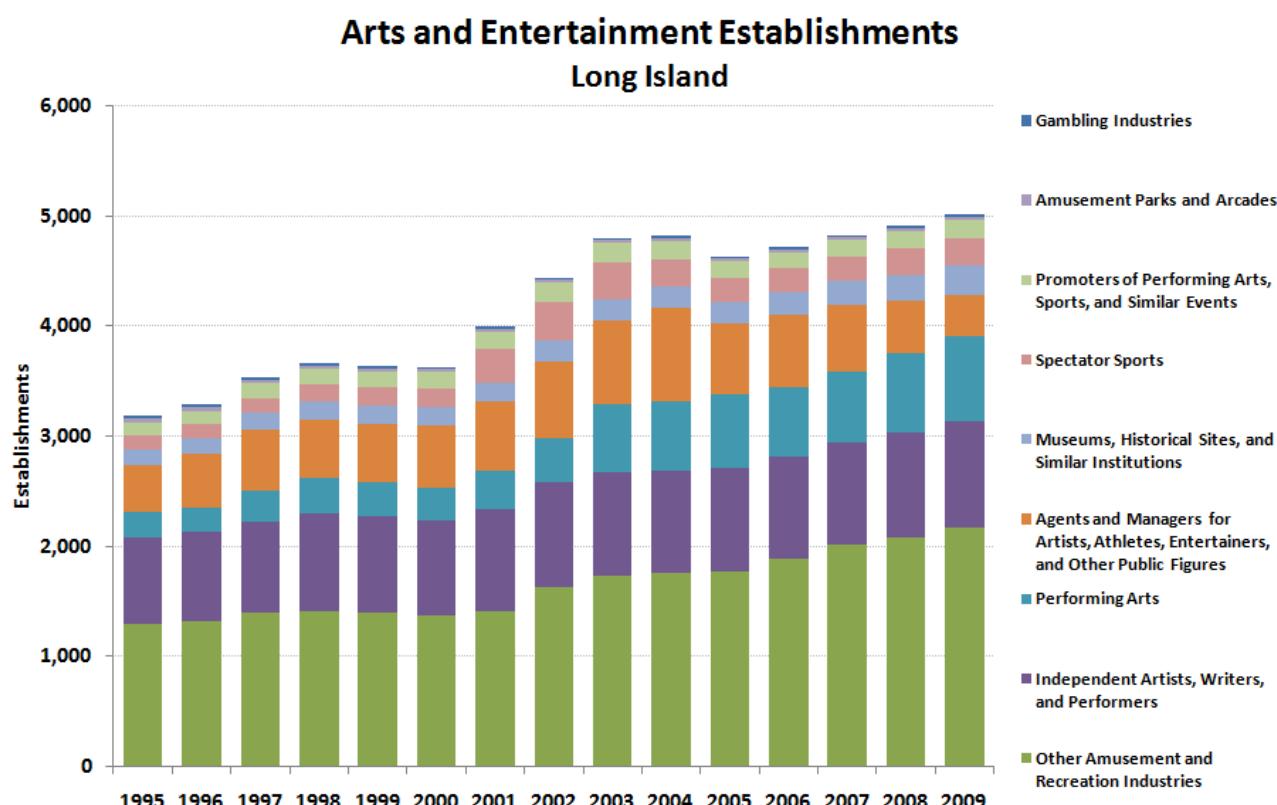
## SPECTRONICS CORPORATION

Founded in Westbury, New York in 1955, Spectronics Corporation engages in the research, development and manufacturing of fluorescent leak detection, ultraviolet dyes, and inspection lamps for various industrial and automotive markets. Spectronics became a well-known institution after it invented fluorescent leak detection in 1955 and is still the leader in this field.

Fluorescent tracer dyes are still Spectronics' primary product and are used by companies all over the world. These dyes are utilized to check for leaks in nuclear reactors, power plants, liquid storage tanks, and oil pipelines. Additionally, Spectronics has supplied NASA with tracer dyes to check for leaks on the space shuttle. The ability to quickly pinpoint the exact source of a leak, whether it be oil based, water, transmission fluid, or refrigerant, allows companies to save time and labor by ensuring the safety and upkeep of their equipment. Spectronics has grown to encompass production of trans-illuminators and UV lamps widely used by medical professionals for diagnosis and treatment. Spectronics also manufactures the world's most extensive line of UV EPROM erasers. An EPROM is a memory chip that retains data even when the power supply is cut off. The only way to erase the data on the chip is to expose it to a strong ultraviolet light from a mercury-vapor light source. Spectronics has been credited with providing the highest quality editions of these UV erasers and is acknowledged as a leader in the field. More recently, Spectronics has developed counterfeit currency detectors to uncover imitation money and phony U.S. Treasury checks. These detectors are used by banks, retailers, and government agencies nationwide.

Spectronics was founded on Long Island and has remained there for their entire fifty year history. Spectronics partners with Cold Spring Harbor Laboratory in Laurel Hollow to test products still in development. Recently at the Cold Spring Harbor Laboratory, Spectronics tested one of its products to determine what effect different binding methods have on DNA retention. Starting out over fifty years ago as a small team of innovators with an idea, Spectronics Corporation has grown to more than 200 employees and remains a leader in UV light production worldwide.

Long Island is currently home to over 5,000 arts and entertainment establishments. These firms and organizations increased in number by 57 percent from 1995 to 2009 and by two percent just from 2008 to 2009. Golf courses, skiing facilities, fitness centers and other facilities are grouped together under "Other Amusement and Recreation" and combined, make up 43 percent of all establishments and expanded by four percent from 2008 to 2009. There are 970 Independent Artists, Writers, and Performers residing on Long Island, and their numbers have grown by 25 percent over the long term and by one percent most recently. Performing Arts establishments have reported the most robust growth over the long term, expanding 235 percent from 1995 to 2009 and by seven percent recently. Representing less than one percent of the total, the strongest growth in the most recent year has been in gambling establishments which increased in number by 14 percent.



Note: Other Amusement and Recreation Industries include golf courses, country clubs, skiing facilities, and fitness centers, among others.

Data Source: National Establishment Time-Series (NETS) Database, Classifications based on 6-digit North American

Industry Classification System (NAICS)

Analysis: Collaborative Economics

## IMPLICATIONS: WHAT DOES THIS MEAN FOR LONG ISLAND AND WHAT ARE THE CRITICAL NEXT STEPS

Long Island (LI) has many of the assets that are necessary for an innovation region, but it lacks a culture of collaboration that is essential to becoming a world-class innovator. In short, it's not just the ingredients (talent, capital and technology) but the recipe (networking, commercialization and entrepreneurship) that is the secret to regional success.

Why have Silicon Valley, Research Triangle and more recently San Diego achieved recognition as top tier innovation regions? Each has great universities and research centers that have attracted talent and investment from both business and the federal government. However, more important are the dense networks of relationships that have been established as part of the innovation habitat that connect researchers, venture capitalists, lawyers, accountants and marketing specialists in an ongoing commercialization process.

Innovative regions go through different stages of development over time. After an initial build-up phase, often driven by federal investment and institution building, they reach a take-off phase where technology push is replaced by market pull driven more by private investment and network building. This leads to expansion of technology clusters based on a vital cycle where the innovation habitat reinforces dynamic industry development. When new technologies emerge, there is usually a convergence at the intersection of these technologies and the process begins again.

*Long Island may be standing at a critical point between the build-up and take-off phases where federal investments have created institutions which now need to network in order to attract private investment.*

### Stages of Transition in Innovation Regions

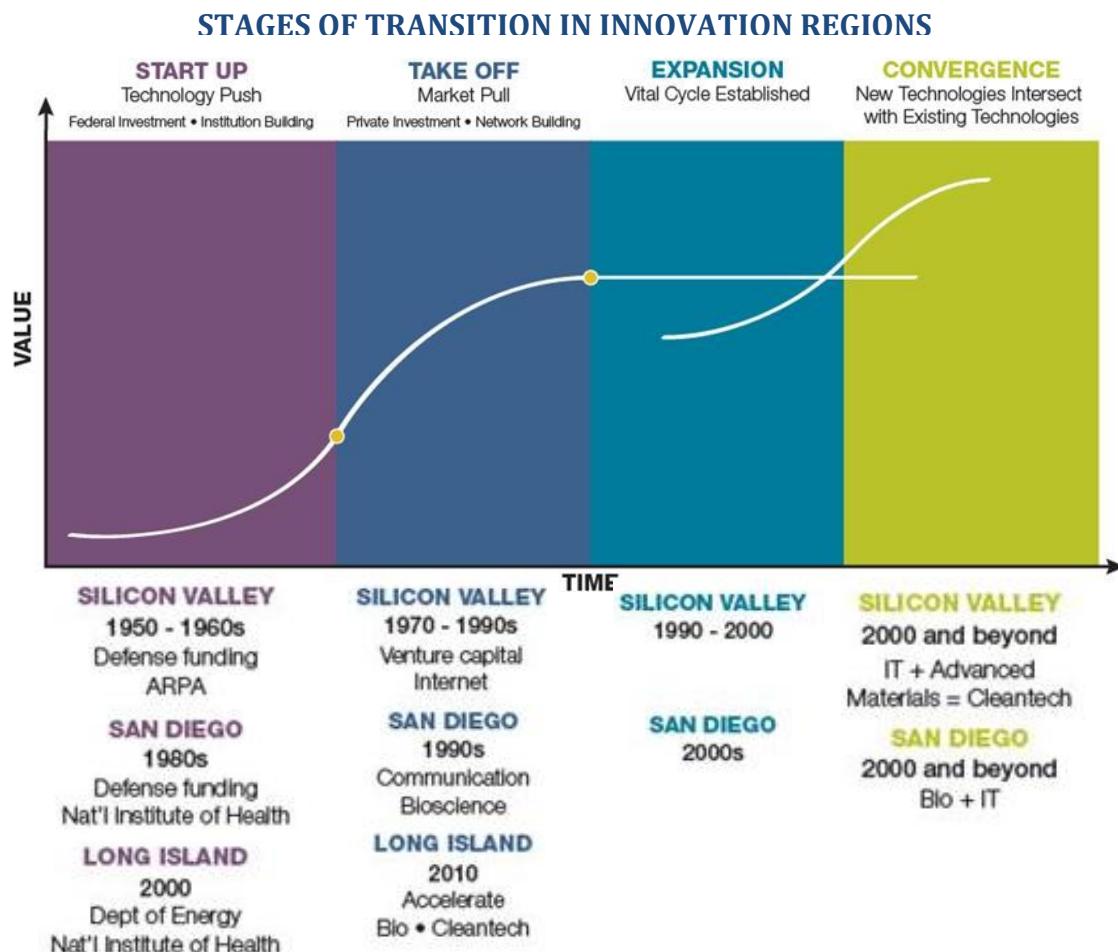
For example, Silicon Valley in the Cold War period of the 1950s and 1960s was driven mainly by defense spending and investments by the Advanced Research Projects Agency (ARPA). The early development of the semiconductor and computer industries was supported by the Department of Defense and NASA to develop missile and space technologies to compete with the Soviet Union. However, in the mid 1960s and 1970s, commercial applications of these defense funded technologies were identified and growing markets for integrated circuits and computers led to the rapid growth of entrepreneurial firms in what is now known as Silicon Valley. This transition from federal to private investment was critical to the "take off" of the region as it began to create technology jobs and dramatically increase its productivity.

Likewise, defense funding of communications technologies in San Diego along with National Institute of Health funding of biotechnology research at the University of California at San Diego in the 1980s created a foundation for a transition from technology push to market pull led by private sector investments in leading digital communications firms (e.g. Qualcomm) as well as a large number of venture funded biomedical firms. A critical transition was achieved as a result of regional efforts to actively connect university research to local industry and attract venture capital to support entrepreneurial firms.

After achieving this private-sector led take-off phase based on networking, innovation regions begin to see the expansion of technology clusters based on a vital cycle where the innovation habitat reinforces dynamic industry development. In Silicon Valley, computing, software as well as the internet based on earlier defense investments in ARPANET, led to the emergence of world class information technology clusters in the 1990s. In San Diego, communications and biosciences clusters expanded rapidly in the 1990s and into the decade of the 2000s.

However, when new technologies emerge, innovation usually occurs at the intersection of these technologies and a process of renewal begins again. In Silicon Valley, after the dot com bust in the early 2000s, information technology began to converge with both biotechnology and advanced materials to give rise to new developments in areas such as personalized medicine, bioinformatics and clean energy. Furthermore, digital communications, software and the internet converged into new breakthroughs in mobile communications and social media in the late 2000s and early decade of 2010. In San Diego, biotechnology and communications have also converged into new developments in health IT while biotechnology and advanced materials has led to the emergence of new biofuels industries in the region.

The figure below illustrates this process and how it played out in Silicon Valley and San Diego during the past decades. S curves, displayed in the below figure, are used to illustrate the diffusion process of an innovation through its life cycle. At the end of an S curve, there can be a transition or “tipping point” which sets off the next S curve. These stages of transition could also take place in Long Island as it moves from its current phase of primarily federally funding research in energy and biotechnology at Brookhaven Lab, Stony Brook and Cold Spring Harbor labs towards greater networking and industry connections. This will lead to private sector commercialization and entrepreneurship as it reaches a critical take off phase led more by market pull. Accelerate Long Island can be an important spark to achieve this tipping point.



### **Long Island's Transition**

A major finding of the inaugural Innovation Index is the discovery that Long Island has more innovation strengths than is often recognized and that the region has the potential to become a leading innovator if it uses its assets more effectively. Its assets include world-class research centers at its nationally recognized laboratories and research universities. Its science and engineering talent base is growing, and its research and development funding has been rising.

However, Long Island's regional innovation system is not fully developed compared to other leading innovation regions. These regions have come together and over time pursued focused and common economic development strategies. In contrast, Long Island has been unable to collaborate and pursue a common regional agenda. Since 2004 the *Long Island Index* has tracked year after year of continuing patterns of governmental fragmentation with an accompanying social and geographical separation of Long Islanders by socio-economic class, age and race. It has been an extremely difficult task for LIers and their leaders to raise their sights to have a larger regional vision.

This pattern of fragmentation is also reflected in how business is conducted with mostly small companies and a few large ones. This same pattern exists with regard to innovation with each research institution and entrepreneur often pursuing its own separate goals. In general, each entity - public, private or nonprofit - does not scale up easily, and it would seem that this challenge must be addressed for the region to become a more significant center of innovation.

Interestingly, individual Long Island school districts and the Long Island region as a whole produce more high school Intel scholars than the rest of the U.S., but Long Island lags, even the U.S. average, in the percent of the population who are scientists and engineers. Added to this is the continuing and painful loss of young talent that LI schools pay to educate and then export. Since 2000 Long Island has continued to lose its 18-35 population at double the national rate.

A lagging innovation indicator is venture capital - money that seeks to go where the best ideas and talent are. In 2010 Long Island received 0.5 percent of the U.S. venture capital. Given the institutional assets and skilled population that the region possesses, this fact should be shocking but is unfortunately not widely known or understood.

However, the lesson from leading innovation regions is that venture capital is attracted to innovation habitats that create a strong environment for business start ups and expansions. Without the strong habitat, capital by itself will not be enough to sustain innovation and entrepreneurship.

One noteworthy point that the *Innovation Index* suggests is increased federal investment through direct research and collaborative grants to institutions. This together with growing small business research grants to LI companies (second only to Silicon Valley in 2011) also indicates that, at least at the federal level, there is more understanding and investment in LI's regional innovation assets. In contrast, private venture capital and corporate investment have increased but at a much slower rate. This definitely seems to be an area that LI regional economic strategy should target and, thereby, leverage its federal investment. Addressing these issues with a concerted campaign is imperative if the region wishes to improve its innovation indicators and its place as a center of innovation.

Initiatives such as Accelerate Long Island and the New York State recent LI Regional Council's task force can play a key role in helping to connect Long Island's innovation assets and promote commercialization by promoting closer relationships among the region's research institutions and private sector.

Other leading innovation regions have reached a "tipping point" when initial federal investments have provided the seed capital for private investment and commercialization. This was clearly the case in Silicon Valley with early defense investment in integrated circuits, advanced materials and the ARPANET

led to the explosive private investment in semiconductors, the internet and now clean energy. This was also the case in San Diego with defense investments in communications and NIH investments in biotechnology that led to the growth of digital communications and bioscience clusters.

Here then the challenge for Long Island: How do we build on Long Island's extensive research assets and talent base within its major institutions to generate strong connections with the private sector? The *Index* documents Long Island's strengths. What is required is a culture of collaboration led by the private sector in cooperation with government.

Other possible policy implications include:

- Innovative policy by the state, building on the regional economic strategy as well as major state initiatives such as those driven by NYSERDA focused on alternative energy. The example of state and regional policy to attract and grow major investments in nanotechnology in the Albany region is an example of what can be done with concerted public-private efforts.
- Education reforms including STEM (Science, Technology, Engineering, and Mathematics) magnet schools to support the essential science and technology based for the region.
- Housing options including development of critical transit downtown to help tech centers such as Hicksville attract and retain creative talent.

Where would we first expect to see change if we are improving in innovation – growing number of professionals, growing number of students in tech and science, increasing private investment, growing entrepreneurship and increasing productivity.

Our first step involves creating a culture of working together to achieve the critical transition from the current building-up phase to our take-off phase driven by private investment and networking.

## APPENDIX A

### ASSETS

#### **Talent: Development & Attraction**

##### **Science & Engineering Talent by Place of Origin**

Data provided by the United States Census Bureau, 2000 Decennial Census and 2009 American Community Survey Public Use Microdata Samples (PUMS). The category of foreign-born includes people born in U.S. territories/territorial areas, residents, and naturalized citizens. Data based on Public Use Microdata Area Codes for Nassau and Suffolk Counties. Regional comparison data are for San Diego County, Silicon Valley (Santa Clara County and San Mateo County), Boston-Cambridge-Quincy, MA-NH Metro Area, and St. Louis, MO-IL Metro Area, Research Triangle (Dunn, NC Micro Area, Durham-Chapel Hill, NC Metro Area, Raleigh-Cary, NC Metro Area) and Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area from the United States Census Bureau, American Community Survey based on Public Use Microdata Area Codes.

[http://www2.census.gov/census\\_2000/datasets/PUMS/FivePercent/](http://www2.census.gov/census_2000/datasets/PUMS/FivePercent/)

##### **Science & Engineering Degrees Conferred; and to Foreign Students**

National and regional data for 1997-2009 are from the National Center for Education Statistics. Regional data for Long Island includes the following post secondary institutions: Adelphi University, Dowling College, Hofstra University, Long Island University C W Post Campus, Long Island University Southampton Campus, Molloy College, New York Institute of Technology, All Campuses, New York Institute of Technology, Main Campus, St. Joseph's College, Suffolk Campus, SUNY College at Old Westbury, SUNY at Farmingdale, SUNY at Stony Brook, All Campuses, United States Merchant Marine Academy, Webb Institute. Data from Polytechnic University graduate campus in Suffolk County data could not be separated from the main Brooklyn campus data and therefore was not included. The academic disciplines include: computer and information sciences, engineering, engineering-related technologies, biological sciences/life sciences, mathematics, physical sciences and science technologies. Data were analyzed based on 1st major, citizenship, and level of degree (bachelors, masters or doctorate). 2002 Long Island data is unavailable due to incomplete data.

##### **MBA Degrees Conferred to U.S. Residents and Foreign Students**

Regional data for 1997-2009 are from the National Center for Education Statistics and includes the following post secondary institutions: Adelphi University, Dowling College, Hofstra University, Long Island University C W Post Campus, Molloy College, New York Institute of Technology, All Campuses, New York Institute of Technology, Main Campus, St. Joseph's College, SUNY at Stony Brook, All Campuses. MBA is defined as a Master's degree in Business, Administration and Management, General.

##### **Percent of Adults with a Bachelor's Degree or Higher**

Data for educational attainment are for Nassau and Suffolk Counties are from the United States Census Bureau, American Community Survey. The percentage of adults with a Bachelor's Degree or higher is for the population 25 years and over. Regional comparison data are for San Diego County, Silicon Valley (Santa Clara County and San Mateo County), Boston-Cambridge-Quincy, MA-NH Metro Area, and St. Louis, MO-IL Metro Area, Research Triangle (Dunn, NC Micro Area, Durham-Chapel Hill, NC Metro Area, Raleigh-Cary, NC Metro Area) and Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area from the United States Census Bureau, American Community Survey.

##### **College Readiness**

Chart and data provided by the Rauch Foundation. Original analysis by Hofstra University on data from the New York State Education Department.

##### **Population Growth & Migration**

Data for Population Change and Net Migration Flows are from the U.S. Census Bureau. Data for Nassau and Suffolk Counties are from April 1, 2000 to July 1, 2009.

## Technology R&D

### Federal Research & Development Funding & Relative Growth

Data was compiled by Decision Data Resources. In 2011, Decision Data Resources redesigned its database, and due to a break in the data series, federal funding information is only available from fiscal year 2005 onward. From this data, Research and Development projects were identified through the detailed review of total federally funded projects for the Long Island Region. Long Island is defined as Nassau and Suffolk Counties. Values are inflation-adjusted and reported in 2010 dollars, using the CPI for the U.S. City Average from the Bureau of Labor Statistics.

### Brookhaven National Laboratory R&D Funding

Data provided by the Brookhaven National Laboratory. Original analysis was performed by the BNL operations team; Collaborative Economics presented only relevant years and data summaries.

### Cold Spring Harbor Laboratory Sources of Revenue

Data was gathered from Cold Spring Harbor Laboratory's 2010 annual report. The sources of revenue were highlighted in the executive summary of the report. Information about ARRA funding and percentages was gathered from the Chief Operating Officer's letter in the same report.

## Investment Capital

### Venture Capital by Industry

Data are provided by The MoneyTree™ Report from PricewaterhouseCoopers and the National Venture Capital Association based on data from Thomson Reuters. Long Island includes Nassau-Suffolk, NY Metropolitan Division. Boston includes Boston MA-NH MSA. Greater Washington DC includes Washington DC-VA-MD-WV MSA. San Francisco includes San Francisco, CA MSA. San Jose includes San Jose, CA MSA. San Diego includes San Diego, CA MSA. Research Triangle includes Raleigh-Durham-Chapel Hill, NC MSA. St. Louis includes St. Louis MO-IL MSA. Data updated as of July 2011. 2011 venture capital funding level is based on quarters 1 and 2 data. Values are inflation-adjusted and reported in 2010 dollars, using the CPI for the U.S. City Average from the Bureau of Labor Statistics.

## PROCESSES

### Idea Generation

#### Patent Registrations and Patents by Technology Area

Patent data provided by the U.S. Patent and Trademark Office, and consists of only Utility patents. Geographic designation is given by the location of the first inventor named on the patent application. Patents include only those patents filed by residents of each region. Regions are defined by the cities, towns, Census Designated Places (CDPs), and communities located within, Boston (Boston-Cambridge-Quincy, MA-NH Metro Area), Greater Washington D.C. (Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area), Long Island (Nassau County, NY and Suffolk County, NY), Research Triangle (Durham, NC Metro Area and Raleigh-Cary, NC Metro Area), San Diego County, CA, and St Louis (St. Louis, MO-IL Metro Area). Silicon Valley is defined by the Joint Venture Silicon Valley Network's city definition for the region. Technology Areas are based on the United States Patent Classification System (USPCS) and grouped according to certain technologies and/or classes.

#### Biotechnology Patent Registrations by Primary Inventors

1790 Analytics developed and performed the search of detailed U.S. Patent data from the U.S. Patent & Trade Office based on search criteria defined by Collaborative Economics for the biotechnology technology area. Geographic designation is given by the location of the first inventor named on the patent application. Patents include only those patents filed by residents of each region. Regions are defined by the cities, towns, CDPs, and communities located within, Boston (Boston-Cambridge-Quincy, MA-NH Metro Area), Greater Washington D.C. (Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area), Long Island (Nassau County, NY and Suffolk County, NY), Research Triangle (Durham, NC Metro Area and Raleigh-Cary, NC Metro Area), San Diego County, CA, and St Louis (St. Louis, MO-IL Metro Area). Silicon Valley is defined by the Joint Venture Silicon Valley Network's city definition for the region.

#### Global Co-Patenting

Patent data provided by the U.S. Patent and Trademark Office, and consists of only Utility patents. Analysis includes all patents with an inventor from Long Island, regardless of inventor number. Geographic designation is

given by the location of the first inventor named on the patent application. Patents include only those patents filed by residents of each region. Long Island region are defined by the cities, towns, CDPs, and communities located within Nassau and Suffolk counties.

## **Commercialization**

### **Pre-market Approvals and Pre-market Notifications, FDA**

Data was collected from U.S. Food and Drug Administration Center for Device and Radiological Health (CDRH). Information was gathered on pre-market approvals and pre-market notifications, also known as released 510K's, on medical devices to be sold in the US market. The Long Island region is defined as Nassau and Suffolk Counties.

### **University Technology Licensing; Commercialized Technologies; Private Sector-Driven Contract Research; and Collaborative and Cooperative Research**

Data from the Long Island Regional Innovation Partner Survey. The following labs and universities were surveyed: Brookhaven National Laboratory, Cold Spring Harbor Laboratory, Farmingdale State College, Feinstein Institute for Medical Research, and Stony Brook University. All of the collected information has been aggregated for display in the charts.

## **Entrepreneurship**

### **New Business (Establishments) Starts by Industry, By Multi-Establishment or Stand Alone Firm**

Clusters are derived using data from the National Establishment Time-Series Database (NETS), prepared by Walls & Associates using Dun & Bradstreet establishment data. Clusters are based on the North American Industry Classification System (NAICS) classification. Data is for Nassau and Suffolk Counties representing new establishments between 1995 and 2009. Contract values are inflation adjusted into 2010 dollars using the U.S. city average Consumer Price Index (CPI) of all urban consumers, published by the Bureau of Labor Statistics.

### **Nonemployers Firms by Industry, Average Earnings**

Data for Nonemployers is from the U.S. Census Bureau. Nonemployer statistics originate from tax return information of the Internal Revenue Service. The data are subject to nonsampling error such as errors of self-classification by industry on tax forms, as well as errors of response, nonreporting and coverage. Values provided by each firm are slightly modified to protect the respondent's confidentiality.

## **Business Innovation**

### **Small Business Innovation Research (SBIR) Awards**

U.S. Small Business Administration, Office of Technology Small Business Innovation Research Program (SBIR). Small businesses must be American-owned and independently operated, for-profit, principal researcher employed by business, and company size limited to 500 employees to participate in the program.

### **SBIR Funding per \$1 million GDP**

Data is from the U.S. Small Business Administration, Office of Technology Small Business Innovation Research Program (SBIR). Small businesses must be American-owned and independently operated, for-profit, principal researcher employed by business, and company size limited to 500 employees to participate in the program. Data for phase 1 and phase 2 awards are included in totals. Gross Domestic Product (GDP) estimates the market value of all final goods and services. GDP data is from Moody's Economy.com. Award values and GDP are inflation adjusted into 2010 dollars using the U.S. city average Consumer Price Index (CPI) of all urban consumers, published by the Bureau of Labor Statistics.

### **SBIR Funding per \$1 million GDP by Region**

Data for Small Business Innovation Research (SBIR) and Small Business Technology Transfer awards come from the U.S. Small Business Administration. Data include Phase 1 and Phase 2 awards for all agencies and branches for the years 1990-2009. Data for GDP are from Moody's economy.com and are inflation adjusted to 2010 dollars. Regional comparison GDP data are for the following regions: Long Island (Suffolk and Nassau Counties), St. Louis (St. Louis, MO-IL MSA), Greater Washington DC (Washington-Arlington-Alexandria, DC-VA-MD-WV MSA), Research Triangle (Hartnett County, Raleigh-Cary, NC MSA and Durham-Chapel Hill, NC MSA), Boston (Boston-Cambridge-Quincy, MA-NH MSA), San Diego (San Diego-Carlsbad-San Marcos, CA MSA) and Silicon Valley (Definition used for Joint Venture Index of Silicon Valley). SBIR & STTR data for the regional comparisons were determined by the zip codes associated with counties under each of the region's MSA or county definition.

## OUTCOMES

### Opportunity

#### Average Annual Earnings

Average annual earnings are calculated as total wages in the region per employees in the region. Wage and Employment data are from the Quarterly Census of Wages and Employment. The data set counts jobs in the region and uses data from the Quarterly Census of Wages and Employment program that produces a comprehensive tabulation of employment and wage information for workers covered by State unemployment insurance (UI) laws and Federal workers covered by the Unemployment Compensation for Federal Employees (UCFE) program. Employment data exclude members of the armed forces, the self-employed, proprietors, domestic workers, unpaid family workers, and railroad workers covered by the railroad unemployment insurance system. Covered workers may live outside of the Long Island region. Multiple jobholders (i.e., individuals who hold more than one job) may be counted more than once. Data for the year 2010 are preliminary. Data is for Nassau and Suffolk Counties, New York, and the United States.

#### Personal Income per Capita

Total personal income and population data are from Moody's Economy.com. Personal Income is defined as the sum of wage and salary disbursements (including stock options), supplements to wages and salaries, proprietors' income, dividends, interest, and rent, and personal current transfer receipts, less contributions for government social insurance. Income values are inflation adjusted into 2010 dollars using U.S. city average Consumer Price Index (CPI) of all urban consumers, published by the Bureau of Labor Statistics. Long Island includes Nassau-Suffolk, NY Metropolitan Division. Boston includes Boston-Cambridge-Quincy, MA-NH Metropolitan Statistical Area (MSA). Greater Washington DC includes Washington-Arlington-Alexandria, DC-VA-MD-WV MSA. Silicon Valley includes San Mateo and Santa Clara Counties. San Diego includes San Diego-Carlsbad-San Marcos, CA MSA. Research Triangle includes Durham-Chapel Hill, NC MSA, Raleigh-Cary, NC MSA, Dunn Micropolitan Statistical Area. St. Louis includes St. Louis MO-IL MSA. Data updated as of May 2011. Income data for New York and the U.S. is historical through Q4 2010. Income data for the remaining regions and population data is historical through Q4 2009.

#### Median Household Income

Data for Distribution of Income and Median Household Income are from the American Community Survey from the U.S. Census Bureau. All income values are adjusted into 2010 U.S. dollars, using CPI for the U.S. City Average from the Bureau of Labor Statistics. Long Island data includes Nassau and Suffolk counties.

#### Relative Cost of Living

The Regional Cost of Living index was provided by Moody's Economy.com. Long Island includes Nassau-Suffolk, NY Metropolitan Division. Boston includes Boston-Quincy, MA Metropolitan Division. Greater Washington DC includes Washington-Arlington-Alexandria, DC-VA-MD-WV MSA. Silicon Valley includes San Jose-Sunnyvale-Santa Clara, CA MSA. San Diego includes San Diego-Carlsbad-San Marcos, CA MSA. Research Triangle includes Durham-Chapel Hill, NC MSA and Raleigh-Cary, NC MSA. St. Louis includes St. Louis MO-IL MSA.

#### Competitiveness

##### Regional Value Added

Value added per employee is calculated as regional gross domestic product (GDP) divided by the total employment. GDP estimates the market value of all final goods and services. GDP and employment data are from Moody's Economy.com. All GDP values are inflation-adjusted and reported in 2010 dollars, using CPI for the U.S. City Average from the Bureau of Labor Statistics. Data updated as of May 2011. GDP is historical through Q4 2009 for the Nassau-Suffolk, NY Metropolitan Division and New York and historical through Q4 2010 for the U.S. All employment data and GDP data for the U.S. is historical through Q4 2010. GDP for New York and Nassau-Suffolk, NY Metropolitan Division is historical through Q4 2009.

##### Gross Metropolitan Product

Gross metropolitan product is equivalent to a region's gross domestic product (GDP). GDP estimates the market value of all final goods and services. GDP is from Moody's Economy.com. All GDP values are inflation-adjusted and reported in 2010 dollars, using CPI for the U.S. City Average from the Bureau of Labor Statistics. Data updated as of May 2011. GDP data is historical through Q4 2009.

## Value Added by Industry

Value added by industry is calculated as regional gross domestic product (GDP) by industry divided by the total employment by industry. GDP and employment data are from Moody's Economy.com. The industry category "Natural Resource Extraction" refers to the 21A.DMNAS category "Mining, Quarrying, & Oil & Gas Extraction." All GDP values are inflation-adjusted and reported in 2010 dollars, using CPI for the U.S. City Average from the Bureau of Labor Statistics. Data updated as of May 2011. GDP data is historical through Q4 2009 and employment is historical through Q4 2010.

## Business Performance

### Annual Employment

The data set counts jobs in the region and uses data from the Quarterly Census of Wages and Employment program that produces a comprehensive tabulation of employment and wage information for workers covered by State unemployment insurance (UI) laws and Federal workers covered by the Unemployment Compensation for Federal Employees (UCFE) program. Employment data exclude members of the armed forces, the self-employed, proprietors, domestic workers, unpaid family workers, and railroad workers covered by the railroad unemployment insurance system. Covered workers may live outside of the Long Island region. Multiple jobholders (i.e., individuals who hold more than one job) may be counted more than once. Data for the year 2010 are preliminary. Data is for Nassau and Suffolk counties, New York, and the United States.

### Employment Growth by Industry, by Multi-Establishment or Stand Alone Firm

Clusters of Opportunity are derived using data from the National Establishment Time-Series Database (NETS), prepared by Walls & Associates using Dun & Bradstreet establishment data. Clusters are based on the North American Industry Classification System (NAICS) classification. Data is for Nassau and Suffolk counties and the changes in employment of the counties between 1995 and 2009. See Appendix B for SIC code definitions of Information Technologies, Biological Sciences and Clean Energy industry definitions.

### Business Establishment Churn

The National Establishment Time Series (NETS) Database, prepared by Walls & Associates using Dun & Bradstreet establishment data, was sourced for jobs data and establishment counts. Long Island is defined as Nassau and Suffolk Counties in this analysis. See Appendix B for SIC code definitions of Information Technologies, Biological Sciences and Clean Energy industry definitions.

Long Island Churn Distribution by Size

	NEW FIRMS OPENING		FIRMS CLOSING		FIRMS MOVING IN		FIRMS MOVING OUT	
	Establishments	Employment	Establishments	Employment	Establishments	Employment	Establishments	Employment
Total Establishments	30,680	57,821	11,329	63,690	477	8,191	671	4,585
<b>By Size:</b>								
Less than 5	30,146	44,551	9,539	18,314	330	709	538	968
5 to 10	341	2,281	941	6,507	66	438	66	436
11 to 25	100	1,656	539	8,509	43	763	33	530
26 to 50	39	1,397	167	6,425	20	805	20	762
51 to 100	35	2,968	83	6,065	11	773	9	588
More than 100	19	4,968	60	17,870	7	4,703	5	1,301

## QUALITY OF LIFE

### Livability

#### Means of Commute

Data on the means of commute to work are from the United States Census Bureau, 2000-2009 American Community Survey. Data are for workers 16 years old and over residing in Nassau and Suffolk Counties, New York State minus New York City and Long Island, and the United States commuting to the geographic location at which workers carried out their occupational activities during the reference week whether or not the location was inside or outside the county limits. The data on employment status and journey to work relate to the reference week; that is, the calendar week proceeding the date on which the respondents completed their questionnaires or were interviewed. This week is not the same for all respondents since the interviewing was conducted over a 12-month period. The occurrence of holidays during the relative reference week could affect the data on actual hours

worked during the reference week, but probably had no effect on overall measurement of employment status. People who used different means of transportation on different days of the week were asked to specify the one they used most often, that is, the greatest number of days. People who used more than one means of transportation to get to work each day were asked to report the one used for the longest distance during the work trip. The category, "Car, truck, or van," includes workers using a car (including company cars but excluding taxicabs), a truck of one-ton capacity or less, or a van. The category, "Public transportation," includes workers who used a bus or trolley bus, streetcar or trolley car, subway or elevated, railroad, or ferryboat, even if each mode is not shown separately in the tabulation. The category "Other Means" includes taxicab, motorcycle, bicycle and other means that are not identified separately within the data distribution.

#### **Transportation Ridership Trends: Long Island and Surrounding Suburban Communities**

Chart and data provided by the Rauch Foundation. Original data from MTA, NJ Transit, Suffolk County and Westchester County Bee Line.

#### **Housing Statistics: Long Island and Surrounding Regions**

Chart and data provided by the Rauch Foundation. Original data from Census Bureau Building Permits Survey; ACS (2009 American Community Survey 1-Year Estimates), data compiled by RPA.

#### **Percent of Households with Housing Costs Greater than 35% of Income**

Data for owners and renters housing costs are from the United States Census Bureau, American Community Survey. This indicator measures the share of owners and renters spending 35% or more of their monthly household income on housing costs. Renter data are calculated percentages of gross rent to household income in the past 12 months. Owner data are calculated percentages of selected monthly owner costs to household income in the past 12 months. Owner's data are solely based on housing units with a mortgage. According to the U.S. Department of Housing and Urban Development, housing costs greater than 30% of household income pose moderate to severe financial burdens.

### **Vibrancy**

#### **Age Distribution**

Data for age distribution are for the United States, New York, and Nassau and Suffolk Counties and are derived from the United States Census Bureau, American Community Survey for the years 2000 through 2009.

#### **Boho Index (Artists and Entertainers per Capita)**

Data for Boho Index (number of artists and entertainers per 100,000 residents) provided by U.S. Bureau of Census, American Community Survey 1 - year estimates (2005, 2007 and 2009). The number of artists and entertainers is based on the Census definition of Arts, design, entertainment, sports, and media occupations. The population is also based on total population by region. The regions are Boston (Boston-Cambridge-Quincy, MA-NH Metro Area), Greater Washington D.C. (Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area), Long Island (Nassau County, NY and Suffolk County, NY), Research Triangle (Durham, NC Metro Area and Raleigh-Cary, NC Metro Area), San Diego County, CA, Silicon Valley (San Mateo and Santa Clara Counties) and St Louis (St. Louis, MO-IL Metro Area).

#### **Arts and Entertainment Establishments**

Arts and Entertainment Industries are based on the North American Industry Classification System (NAICS) classification at the four digit level. National Establishment-Time Series (NETS) database, prepared by Walls & Associates using Dun & Bradstreet establishment data, was used to source the establishment counts. Nassau and Suffolk Counties were used for the analysis.

## APPENDIX B

Biological Sciences		Clean Energy		Information Technologies	
SIC Codes	SIC Names	SIC Codes	SIC Names	SIC Codes	SIC Names
28340000	Pharmaceutical preparations	17310202	Energy management controls	48130200	Online service providers
28340100	Drugs affecting neoplasms and endocrine systems	17420204	Solar reflecting insulation film	48130201	Internet connectivity services
28340400	Drugs acting on the respiratory system	17990210	Weather stripping	48130202	Internet host services
28340600	Dermatologicals	32110302	Insulating glass, sealed units	48130203	Proprietary online service networks
28340700	Vitamin, nutrient, and hematinic preparations for human use	32310401	Insulating glass: made from purchased glass	48990000	Communication services, nec
28340701	Intravenous solutions	34339904	Solar heaters and collectors	48999901	Data communication services
28340702	Vitamin preparations	34430304	Economizers (boilers)	48999905	Satellite earth stations
28340800	Drugs affecting parasitic and infective diseases	38220206	Temperature controls, automatic	48999907	Communication signal enhancement network services
28349902	Druggists' preparations (pharmaceuticals)	38220300	Thermostats and other environmental sensors	73710300	Computer software development and applications
28349904	Extracts of botanicals: powdered, pilular, solid, or fluid	38229905	Energy cutoff controls, residential or commercial types	73710301	Computer software development
28349905	Medicines, capsule or ampuled	87489904	Energy conservation consultant	73710302	Software programming applications
28349906	Pills, pharmaceutical	13110201	Coal gasification	73720000	Repackaged software
28349907	Powders, pharmaceutical	13110203	Coal pyrolysis	73729901	Application computer software
28349908	Proprietary drug products	17110403	Solar energy contractor	73729902	Business oriented computer software
28349909	Solutions, pharmaceutical	17819901	Geothermal drilling	73729903	Educational computer software
28349910	Tablets, pharmaceutical	35110207	Wheels, water	73729905	Operating systems computer software
28349911	Veterinary pharmaceutical preparations	35239906	Windmills for pumping water, agricultural	73729906	Publisher's computer software
28350000	Diagnostic substances	36219909	Windmills, electric generating	73730000	Computer integrated systems design
28359901	Barium diagnostic agents	36740305	Photovoltaic devices, solid state	73730100	Systems software development services
28360000	Biological products, except diagnostic	36740306	Solar cells	73730101	Computer systems analysis and design
28361000	Blood derivatives	38290218	Solarimeters	73730102	Systems engineering, computer related
28361001	Coagulation products	87119906	Energy conservation engineering	73730200	Systems integration services
28362001	Allergens, allergenic extracts	50740208	Heating equipment and panels, solar	73730201	Local area network (LAN) systems integrator
87310000	Commercial physical research	52110300	Insulation and energy conservation products	73730202	Office computer automation systems integration
87310100	Biological research	52110301	Energy conservation products	73730300	Computer system selling services
87310101	Agricultural research	52110303	Solar heating equipment	73730301	Turnkey vendors, computer systems
87310102	Biotechnical research, commercial	76990304	Thermostat repair	73730302	Value-added resellers, computer systems
87310103	Food research	87110403	Heating and ventilation engineering	73730400	Computer-aided system services
87310200	Commercial physical research	49119908	Hydro electric power generation	73730401	Computer-aided design (CAD) systems service
87310201	Chemical laboratory, except testing	73899931	Meter readers, remote	73730402	Computer-aided engineering (CAE) systems service
87310202	Commercial research laboratory	36290102	Electrochemical generators (fuel cells)	73730403	Computer-aided manufacturing (CAM) systems service
87310203	Computer (hardware) development	36749901	Fuel cells, solid state	73790000	Computer related services, nec
87310204	Engineering laboratory, except testing			73760000	Computer facilities management
87310205	Industrial laboratory, except testing			73790100	Computer related maintenance services
87310300	Natural resource research			73740000	Data processing and preparation
87310301	Energy research			73740100	Computer processing services
87310302	Environmental research			73740102	Computer graphics service
87319901	Electronic research			73740103	Computer time-sharing
87319902	Medical research, commercial			73740104	Service bureau, computer
87330000	Noncommercial research organizations			73749901	Data entry service
87330100	Noncommercial biological research organization			73749902	Data processing service
87330101	Bacteriological research			73749903	Data verification service
87330102	Biotechnical research, noncommercial			73749905	Optical scanning data service
87330103	Medical research			73790101	Disk and diskette conversion service
28360402	Bacteriological media			73790102	Disk and diskette recertification service
				73790105	Computer data escrow service
				73790200	Computer related consulting services
				73790201	Computer hardware requirements analysis
				73790202	Data processing consultant
				73790203	Online services technology consultants
				73799901	Diskette duplication service

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## ENDNOTES

<sup>1</sup> Callegari, John. *Cold Spring Harbor lab running low on space*. Long Island Business News, 19 Aug. 2011. Web.

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<sup>3</sup> *Brookhaven National Laboratory Economic Impact Report: Meeting National Needs, Creating Opportunities for Growth*. Web.

<sup>4</sup> Callegari, John. *BNL awards \$5.2M contract to N.J. company*. Long Island Business News, 6 Sept. 2011. Web.

<sup>5</sup> *Cold Spring Harbor Laboratory 2010 Annual Report Executive Summary*. Web.