Long Island Regional Planning Council

Leadership on Regional Issues

SC IDA Suffolk County Industrial Development Agency

UPSKILLED:
PREPARING LONG ISLAND'S WORKFORCE FOR THE FUTURE

Opportunities and strategies for the next chapter of workforce training and development, Long Island, New York

2020

Report prepared by

jamesLIMA Planning + Development

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ABOUT THE LONG ISLAND REGIONAL PLANNING COUNCIL

The Long Island Regional Planning Council (LIRPC) is established to build productive linkages between communities, provide focus on issues best handled on a broad geographic scale and foster the development of regional comprehensive planning. In furtherance of these goals, the LIRPC conducts research, surveys and studies which address regional needs, issues and opportunities. It serves as a forum for discourse and debate and focuses on Long Island's economy, equity, tax and governance, environment and infrastructure. The LIRPC uses its inherent powers to effectuate positive change and implement the Region's long range planning goals and strategies.

ABOUT THE SUFFOLK COUNTY INDUSTRIAL DEVELOPMENT AGENCY

The mission of the Suffolk County Industrial Development Agency (IDA) is to promote economic development in the county by helping businesses expand and grow, increase employment opportunities and add to the quality of life for the residents of Suffolk County. The Suffolk IDA is the lead agency attracting new investment in Suffolk County and driving the region's innovation economy and job expansion. Carrying out the work of the Suffolk County IDA is a team of experienced, highly skilled economic development professionals. They focus on attracting new business, supporting the expansion of existing industry, and mobilizing local and regional assets supporting regional long-term growth and economic development.

Image credit Jakub Skafiriak

The world entered a new era with the outbreak of COVID-19. The voluntary shutdown of a previously strong economy drastically impacted all sectors of the economy and its labor force.

Responding to the realities of the post-pandemic world has required careful planning and analysis. Moreover, the pandemic exacerbated the region's existing social and economic inequalities that need solutions. Fortunately, prior to the outbreak, Long Island's public, private, and civic leadership was already focusing on the pressing need to ensure that the skills of all sectors of the population match future job needs, hence this report.

Investing in **workforce development**, in an environment of unprecedented joblessness and vast business disruptions, is now an even greater imperative than before. As global and regional economies reopen and recover, governments, industries, individuals who remain in the workforce, and those who lost employment are better prepared for the new realities with this plan to guide their individual and collective pursuits of livelihood and recovery.

While this report's data analyses and qualitative research were conducted just prior to the outbreak, the fundamentals for achieving equitable economic growth still apply. The strategic focus on industries and occupations with long-term growth potentials given Long Island's particular attributes, the demonstrated need to increase access to economic opportunities for all Long Islanders, and the emphasis on the regional commitment to collaboration are crucial to an economic recovery that is equitable and resilient.

As organizations and communities continue to adapt to the social and economic implications of COVID-19, the insights and recommendations in this report can inform regional efforts to protect, prepare, grow, and upskill the region's workforce, one of the most important assets of Long Island's economy.

ACKNOWLEDGEMENT

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For more information please go to:
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EXECUTIVE SUMMARY

New York State has rightfully recognized human capital as a critical input for economic growth, providing capacity-building support to innovative programs that address local and regional workforce challenges. Long Island possesses many assets that offer opportunities for more robust and sustained economic growth. To unlock their potential, **Long Island needs a better trained workforce and, in order to make it so, a regional commitment to collaboration.**

Tradable sectors, which consist of industries that export goods and services to other regions, are critical "engines" of Long Island's economic development. Tradable sectors bring new dollars into the region, provide better-paying jobs, and define a place's competitive advantages. As Long Island seeks to pursue long-term growth led by the tradable sectors, the region's current workforce, the vast majority of which is employed in local services, must be retrained in order to build a sufficient pipeline for these key industries. Moreover, as Long Island becomes an increasingly diverse place, workforce development can offer a solution for equitable economic development, preparing all Long Islanders for career trajectories with good earnings potential, regardless of age and ethnic or educational backgrounds.

This report envisions **economic and workforce development as a unified strategy that thrives on multi-institution, cross-sector, and bi-county collaborations**. The report begins to outline the next chapter of workforce development on Long Island, setting forth foundational **principles** that can guide programmatic and policy decisions, **opportunities** of actionable next steps, and **components** that illustrate potential, productive configurations of the regional workforce development system.

Four Principles:

Bottom-Up
Effective workforce development programs are often shaped by the region's collective wisdom and enabled by partnerships. Long Island communities, employers, workers, and institutions would need to better collaborate and relay local data, insights, and resources to decision-makers.

Equity
Long Island is an increasingly diverse region. Equitable workforce development strives to help those of all backgrounds, including job seekers without a Bachelor's degree or from disadvantaged communities, to find pathways to quality career opportunities.

Flexibility
To help grow the priority sectors, Long Island's workforce development would need to be nimble and adaptive to shifts in global and regional competition, demographics, technological advancement, and the emerging industries that present unknown opportunities and challenges.

Creativity
Workforce development need not stay in the status quo. Long Island could enable and incentivize entities across the region to test out new programs to better respond to changes in the economy, labor market, and policy priorities, emphasizing data, innovation, and collaboration.

Eight Opportunities:

Across Long Island, many organizations and stakeholders are already advancing workforce training in diverse settings, with various capacities and approaches. The next chapter of workforce development requires a regional commitment to a more collaborative ecosystem, where successful mechanisms can be shared and individual resources can be pooled to maximize effect.

1. ***Foster the coevolution of workforce and industry clusters.*** Leverage workforce development strategies to grow Long Island's priority sectors and motivate firms to collectively assess their strengths, move higher up the value chain, and create jobs that attract and retain talent.
2. ***Target selected sets of skills for customized training.*** Tailor training programs to address specific skill sets that are highly-demanded in key industry clusters and are in short supply among Long Island's workforce.
3. ***Address soft skills in workforce development.*** Integrate soft skill instruction into technical skill training programs to cultivate a well-rounded and dynamic workforce.

4. ***Form partnerships for industry-led programs.*** Coordinate between industry, academic institutions, and other training entities across the region. Allow employers to help shape the curriculum and let training providers access industry resources.
5. ***Capitalize on new industries and major players in the region.*** Implement a regional system for evaluating the capacity of Long Island's workforce upon the introduction of a new industry or large employer. Develop retraining strategies accordingly.
6. ***Seek to link academic research and innovation to workforce development.*** Forge partnerships between academic and research institutions and workforce development organizations. Identify roles where innovative entities and sectors require, or can provide, various types of training support.
7. ***Create a Long Island workforce development "consortium".*** Create formal and informal channels for collaboration that promote inter-organizational cooperation and strengthen the Long Island workforce development ecosystem as a whole.
8. ***Enhance the capacity of existing efforts.*** Use collaboration and resource sharing as a means to help Long Island's training program operators resolve deficits (in space, staff, funding, etc.). Grant effective programs the capacity to expand geographically and sectorally.

Three Components:*

The Training Center

One potential element of regional workforce development initiative is a state-of-the-art facility that provides instruction, event, and office space to multiple stakeholders across the public, private, and nonprofit sectors. The Center's objective is to centralize workforce development activity on Long Island and reap the benefits of co-location. Existing training programs on Long Island will be complemented by new customized training modules as well as courses on soft skills.

The Incubator

Another element of the initiative is to establish an organization to promote the development, adoption, and scaling of new and innovative training programs that both anticipate and respond to changes in the Long Island economy. Local and regional experts make up the board of this organization. Instead of providing direct training, this organization helps existing training entities and enhance their connections with industry.

The Connector

The third element of the regional workforce development initiative is a digital data system and a public facing website. It serves as the "front door" of the Long Island workforce development system to collect, organize, and distribute data from employers, job-seekers, and training program operators. Better information and data-driven insights could improve the workforce development system's effectiveness and navigability.

**These components can coexist as one comprehensive regional initiative or be implemented in different phases.*

Why Now?

The importance of a healthy pipeline of skilled workers for economic growth and competitiveness cannot be overstated. This report seeks to outline a vision for the next chapter of workforce development for Long Island that is:

- Tailored to the unique assets of Long Island and built upon cross-sector, region-wide collaboration to grow the priority sectors and promote equity;
- Aligned with regional economic development priorities as assessed by the Governor's Office, Long Island Regional Economic Development Council, and the County Executives; and
- Capable of leveraging the future employment potential generated by new investment and redevelopment on Long Island.

Preparing an entire region's workforce and its economy for the future is no small task. It requires **regional commitment to collaboration, clear vision**, **leadership**, and **resources** to bring about a system of new infrastructure - both physical and relational - that can upskill the talent base, lead to higher growth trajectories for industries, and achieve shared prosperity in the region.

What the Stakeholders Said:

Many organizations and stakeholders on Long Island are actively working to implement workforce training programs in diverse communities. The following topics are summarized based on insights shared during the interviews. For more discussion and a list of stakeholders, see the Key Findings and Opportunities section and Appendix 1.

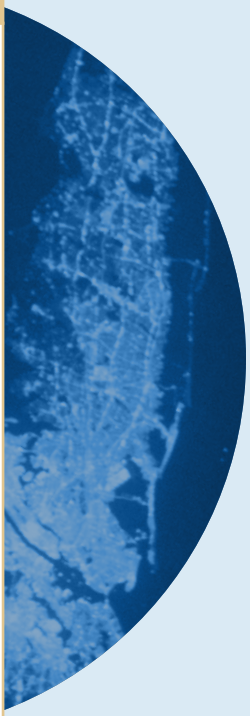
STAKEHOLDER GROUP: ACADEMIC & RESEARCH INSTITUTION

- Most institutions sought to develop new partnerships with local employers as well as to expand the scope of their relationships with existing partners.
- A number of institutions conducted regular "scans" of the regional economy to identify emerging jobs and industries to build new programs around.
- Many experienced capacity issues that prevented them from increasing program enrollment.
- Multiple institutions emphasized the need to focus on "non-traditional learners" who require different models of instruction and module delivery.
- Several were interested in exploring new opportunities to better link academic research to broader economic activity in the region.
- One in particular expressed the need for training programs that could generate a talent pipeline for specific middle-skill positions on their campus.
- Another felt that Long Island needed more training for entrepreneurial and commercialization-related skills (such as business development) in order to fully harness the capacity of the region's research institutions.

STAKEHOLDER GROUP: NONPROFIT/COMMUNITY GROUP

- All of the nonprofit groups interviewed believed in the virtues of collaboration and leveraging the combined strengths of the Long Island workforce development stakeholders.
- Multiple nonprofits also wanted to use emerging industries on Long Island as an opportunity to galvanize renewed workforce development efforts.
- Many organizations stated that the companies they worked with were struggling to fill key positions due to skill gaps.
- One felt that the new workforce development initiative needed to focus on making more people aware of alternative career pathways (such as occupations and job opportunities that do not require a Bachelor's degree).

STAKEHOLDER GROUP: PUBLIC AGENCY



- All of the public agencies interviewed identified a number of regional and local stakeholders already working in the communities who could be involved in the potential new initiative.
- One emphasized the need to view Long Island's workforce challenges with an equity lens given changes in the region's population.
- Several felt that buy-in from existing training operators, educational institutions, and industry would be imperative for the success of any new initiatives for the region.
- Most offered examples of successful workforce development initiatives elsewhere that could serve as models for Long Island.
- A number of organizations explained the local, state, and federal funding streams available for workforce development as well as the uses and limitations of each.
- One reported that workforce challenges made it more difficult for the organization to attract and retain companies into the region.

STAKEHOLDER GROUP: CORPORATE/PRIVATE SECTOR

- Most companies reported that Long Island's talent development and retention efforts should begin earlier on in a worker's career during their education.
- One company was primarily focused on conducting talent development in-house.
- Another company believed in the utility of on-the-job training but felt that certain things, such as soft skills, required instruction elsewhere before new recruits begin working in the company.
- Multiple private sector stakeholders felt that Long Island lacked some of the amenities and lifestyle options that attract top talent to other places in the country.

What the Data Shows:

Despite the high level of average educational attainment on Long Island, the current skill palettes of the region's workforce might be insufficient in matching the specific needs of strategic industries in the tradable sector.

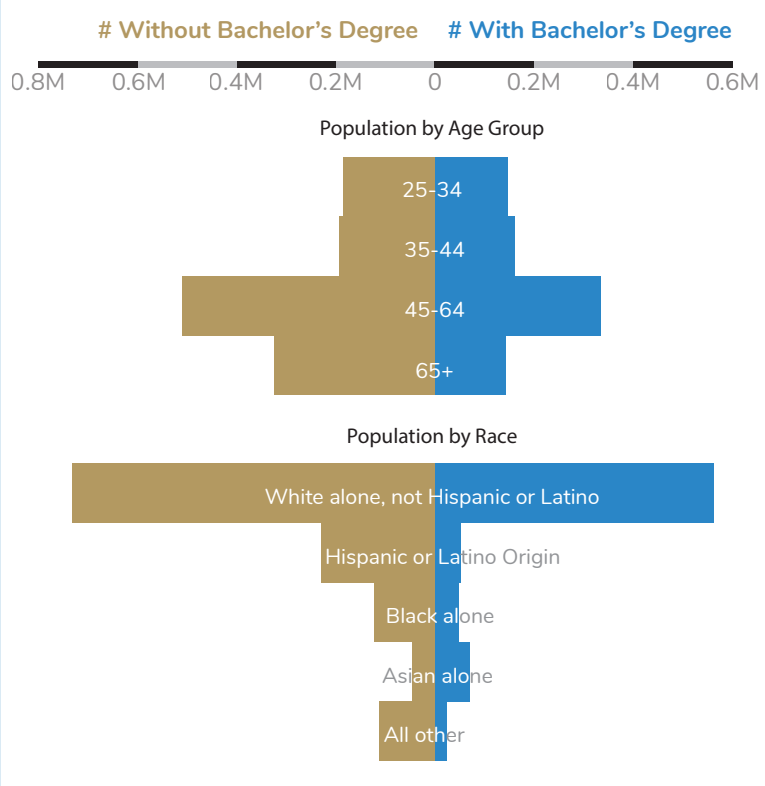
Key tradable industry clusters, such as biopharmaceuticals and IT, are crucial for the region's long-term economic growth. Data shows that jobs in these industries require different skill sets compared to those in local service industries. As the vast majority (77%) of Long Island's workers are employed in local services, the region needs to provide training of new skills in order to fuel the growth of tradable sectors.

Distribution of Long Island Employment by Tradable and Local Industries (Data: U.S. Bureau of Labor Statistics - Quarterly Census of Employment and Wages. Definition of Tradable and Local Industry Clusters: Harvard Business School - U.S. Cluster Mapping)

Long Island needs to provide workforce development programs for a population of diverse skill levels, career paths, and training needs.

Approximately 55% of Long Island's prime working-age population (ages 25-44) does not hold a Bachelor's degree. Educational attainment is lower for the older age group (45 and over) and for the region's black, Hispanic and Latino populations.

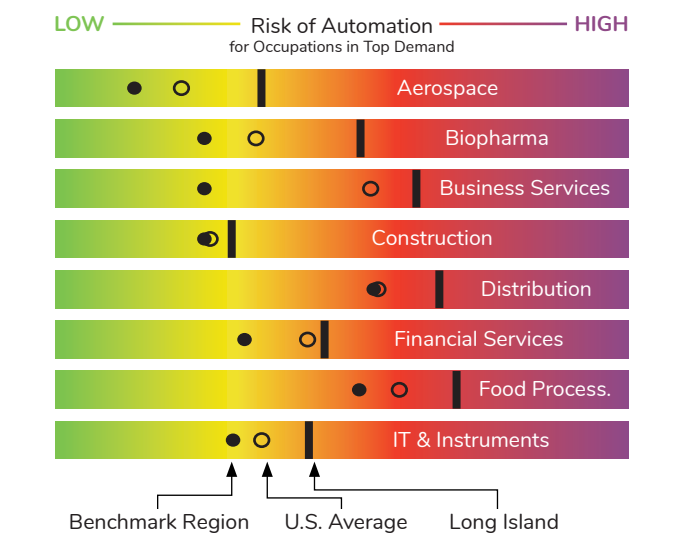
For people without a Bachelor's degree, quality career paths in key tradable industries do exist. Workforce development would need to recognize those opportunities, design and provide programs around them, and help Long Island's diverse job seekers to maximize their productive and earnings potential.



Distribution of Long Island Population by Educational Attainment and Age/Race (Data: American Community Survey)

Industries should climb up the value chain and create jobs with promising career potentials that can attract and retain upskilled talent on Long Island.

By comparing the patterns of job postings on Long Island with those in the national top-performing regions, the data indicates that Long Island jobs might be less prepared for the future of work. For several key industry clusters, such as business services and food processing, the jobs being posted on Long Island are facing relatively high risks of automation (the risk of human occupations being replaced by technology). Workforce development would need to prepare the trainees for careers that can survive automation, with the goal of achieving long-term economic wellbeing in a changing economy.



Average Risk of Automation for Occupations With Most Job Postings by Industry Cluster and Region (Data: Burning Glass Labor Insight)

Skill gap and employment trend analyses can provide insights for Long Island to design a data-driven training curriculum.

Combining employment data, job posting data, and occupational skill data, where more than 4,000 types of specialized knowledge and skills are matched to specific occupations, Long Island's economic development organizations and the many stakeholders of workforce development can identify specific training needs that are in high demand and in short supply.

According to the data, some skills are demanded across a wide range of key industries (analytical/scientific software is an example of such a widely used skill that Long Island has short supply for). Other skills are unique to a narrower range of industries, and they should be trained in more customized models. Jobs of differential educational requirements also exhibit various needs for training.

The Quantitative Data Analysis section of the report provides a summary of training needs for general technical skills; knowledge; software skills; and tools. They are all listed by industry cluster and the occupation's preferred level of education. Appendix 2 provides detailed accounts by industry cluster, each with a description of the trending occupations and Long Island's skill gap assessment.

Recommended Training by Industry Cluster:

Based on data analysis, JLP+D identified the skills that are in high demand and low supply for Long Island's key tradable clusters. Policy makers and stakeholders of workforce development across the region are encouraged to use this list as a baseline assessment to inform the design of targeted training modules for the region's diverse populations. The full list, as well as detailed documentation of occupations and research methodology, is available in Appendix 2.

Aerospace and Defense

Educational Requirement for Occupation

Less Than Bachelor's	Bachelor's or Above
GENERAL TECH.	**GENERAL TECH.**
Operations Analysis Quality Control Analysis	Troubleshooting Technology Design Programming + 3 other
SOFTWARE	**SOFTWARE**
Project management Presentation Enterprise resource planning Analytical or scientific	Requirements analysis and system architecture Operating system Map creation + 10 other
TOOL	**TOOL**
Torque wrenches Reflectometers Notebook computers + 11 other	Portable data input Oscilloscopes Integrated circuit testers + 5 other
KNOWLEDGE	**KNOWLEDGE**
Engineering & Technology Computers & Electronics Personnel & HR + 2 other	Engineering & Technology Design Computers & Electronics

Biopharmaceutical

Educational Requirement for Occupation

Less Than Bachelor's	Bachelor's or Above
GENERAL TECH.	**GENERAL TECH.**
N/A*	Operations Analysis
SOFTWARE	**SOFTWARE**
Presentation Analytical or scientific Enterprise resource planning	Analytical or scientific Data base management system Graphics/photo imaging + 2 other
TOOL	**TOOL**
Desktop computers Liquid crystal display projector Safety glasses + 5 other	Mainframe computers Portable data input Soil core sampling apparatus + 5 other
KNOWLEDGE	**KNOWLEDGE**
Administration & Management Production & Processing	Biology Chemistry Engineering & Technology Production & Processing

Business Services

Educational Requirement for Occupation

Less Than Bachelor's	Bachelor's or Above
GENERAL TECH.	**GENERAL TECH.**
N/A*	Troubleshooting Technology Design Quality Control Analysis + 3 other
SOFTWARE	**SOFTWARE**
Project management Presentation Operating system + 15 other	Web platform developm't Video creation & editing Transaction server + 37 other
TOOL	**TOOL**
Desktop computers Laser printers Notebook computers + 2 other	Mainframe computers Integrated circuit testers Computer servers
KNOWLEDGE	**KNOWLEDGE**
Computers & Electronics Clerical	Engineering & Technology Design Computers & Electronics

Construction

Educational Requirement for Occupation

Less Than Bachelor's	Bachelor's or Above
GENERAL TECH.	**GENERAL TECH.**
Quality Control Analysis Operations Analysis	Quality Control Analysis Operations Analysis
SOFTWARE	**SOFTWARE**
Project management Presentation CAD + 5 other	Human resources CAD Accounting + 9 other
TOOL	**TOOL**
Lasers Personal computers Level sensors or transmitters + 9 other	Radarbased surveillance Level sensors/transmitters Infrared camera + 6 other
KNOWLEDGE	**KNOWLEDGE**
Personnel & HR Mechanical English Language + 9 other	Engineering & Technology Design Building & Construction + 2 other

Distribution and E-Commerce

Educational Requirement for Occupation

Less Than Bachelor's	Bachelor's or Above
GENERAL TECH.	**GENERAL TECH.**
N/A*	Technology Design Programming Operations Analysis
SOFTWARE	**SOFTWARE**
N/A*	Web page creation and editing Map creation Financial analysis + 13 other
TOOL	**TOOL**
Workshop cranes Shears Claw hammer + 8 other	Mainframe computers Integrated circuit testers Computer servers
KNOWLEDGE	**KNOWLEDGE**
Sales and Marketing	Engineering & Technology Design

Financial Services

Educational Requirement for Occupation

Less Than Bachelor's	Bachelor's or Above
GENERAL TECH.	**GENERAL TECH.**
N/A*	N/A*
SOFTWARE	**SOFTWARE**
Presentation Financial analysis Accounting + 3 other	Financial analysis Customer relationship management Business intelligence and data analysis + 3 other
TOOL	**TOOL**
Scanners Photocopiers Personal computers + 6 other	Tablet computers Personal digital assistant or organizers
KNOWLEDGE	**KNOWLEDGE**
Mathematics Customer & Personal Service Clerical + 4 other	Sales & Marketing Mathematics Economics & Accounting Computers & Electronics

Food Processing and Manufacturing

Educational Requirement for Occupation

Less Than Bachelor's	Bachelor's or Above
GENERAL TECH.	**GENERAL TECH.**
N/A*	N/A*
SOFTWARE	**SOFTWARE**
N/A*	Financial analysis Enterprise resource planning Data base reporting + 6 other
TOOL	**TOOL**
Utility knives Ladders	N/A*
KNOWLEDGE	**KNOWLEDGE**
Sales & Marketing	Sales & Marketing Production & Processing Administration & Management

IT and Analytical Instrument

Educational Requirement for Occupation

Less Than Bachelor's	Bachelor's or Above
GENERAL TECH.	**GENERAL TECH.**
N/A*	Technology Design Programming Operations Analysis
SOFTWARE	**SOFTWARE**
Project management Presentation Operating system + 14 other	Operating system Data mining Business intelligence and data analysis + 20 other
TOOL	**TOOL**
Notebook computers Liquid crystal display projector Laser printers Desktop computers	Mainframe computers Integrated circuit testers Computer servers
KNOWLEDGE	**KNOWLEDGE**
Sales & Marketing Computers & Electronics Administration & Management + 2 other	Sales & Marketing Engineering & Technology Design Computers & Electronics

The scope of this report focuses on the tradable sectors that export goods and services to other regions. Separate studies would be needed to analyze the skill gaps and training needs of other large and important industries on Long Island, such as healthcare and local education.

**N/A: The data indicates that the priority skills in this category are relatively well supplied by the existing workforce.*

For the definition and examples of the listed skills, see Appendix 3.

SYNOPSIS

"New York must continue to invest in its workforce and make certain that our workers have the necessary skills to work in a rapidly-changing economy."

New York State Governor Andrew M. Cuomo

SYNOPSIS

Introduction

Businesses, places, and regions achieve greater economic growth when talent is developed and deployed in such a way that targets opportunity-rich sectors, benefits the broad spectrum of diverse populations, and maximizes people's productive potential.[1]

Since the turn of the 21st century, the divergent trajectories of regional economies within the United States has become the subject of much debate and study. A number of theories emerged to explain these observed differences in economic performance, citing factors such as a region's level of taxation, regulatory environment, and industrial legacy, among others.[2] In recent years, economists have increasingly asserted that "human capital stock" is the primary source of any region's economic prosperity.[3] As Governor Andrew M. Cuomo said in his 2020 State of the State, "With private sector employment at an all-time high, New York must continue to invest in its workforce and make certain that our workers have the necessary skills to work in a rapidly-changing economy."

The maintenance of high-quality human capital stock requires consistent investment in workforce development systems. Previously, the federal government led the way, establishing and funding large-scale employment and training programs that aimed to "upskill" the workforce and keep joblessness rates low. However, federal workforce spending has sharply fallen, down more than 70% from its 1979 peak.[4] The decline has shifted the onus of human capital stock investment onto local and regional entities in the public, private, and nonprofit sectors.

This transition has strained resources and left many regions unable to resolve the gap between the skills demanded by employers and those possessed by their workforce. Yet, it also presents regions with an opportunity to focus their efforts on local nuances, create new programs that are specifically designed to provide the most utility for their workers and employers, and try tailored workforce development initiatives that anticipate changes in the economy and respond to them.

Quotes from Long Island workforce development stakeholders

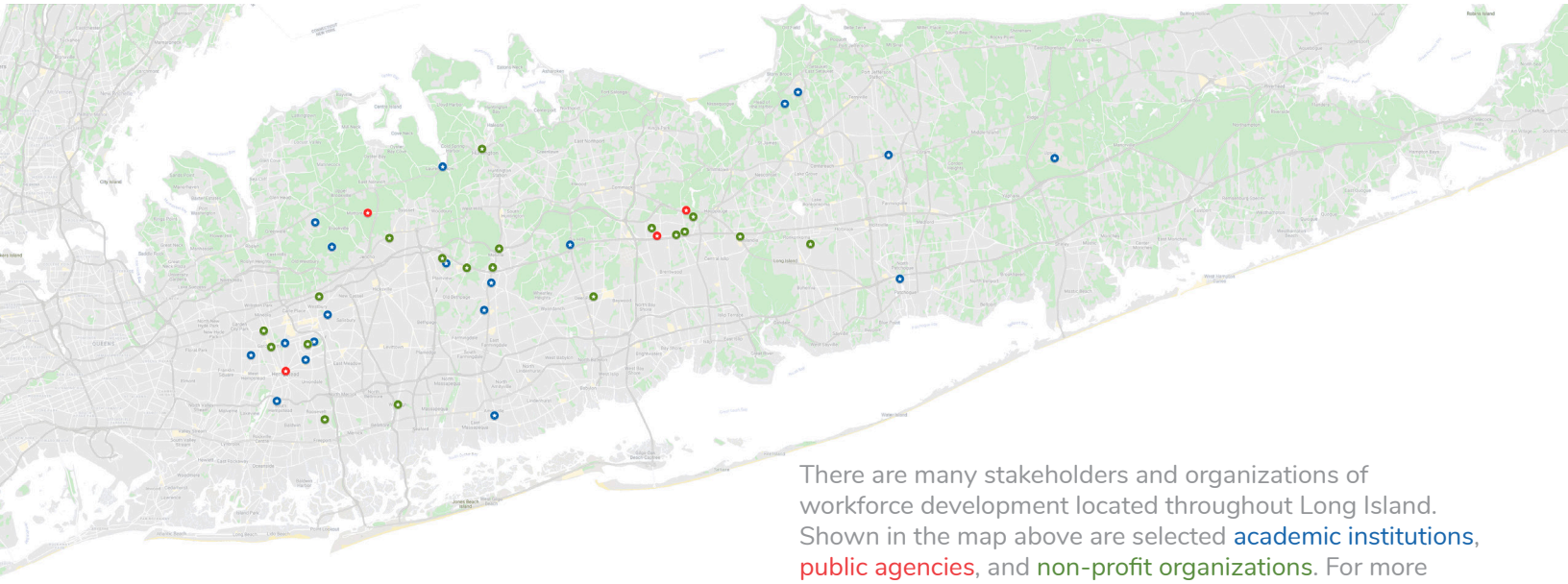
New York State rightfully recognizes human capital as a critical input for long-term economic growth in key sectors, providing capacity-building support to innovative programs that address local and regional workforce challenges. Governor Cuomo's sizable investments in the historic Workforce Development Initiative and New York's network of career and technical education providers have made the state a national leader in increasing access to high-quality jobs. These efforts have also helped regional workforce development systems resolve resource gaps and generate new strategies for enhancing their talent pipelines.

On Long Island, workforce training and employment pipeline development are of paramount importance for the regional economy. In this region (Nassau County and Suffolk County, New York), workforce development is complicated by a variety of socioeconomic and industry factors, including the following:

- As unemployment rates on Long Island remain low, many companies that are growing in business find it increasingly difficult to fill vacancies.
- While the average educational attainment of Long Island's residents is considerably high, this region is also home to new immigrants, families in poverty, and other underserved populations, who find it difficult to access or take on quality career opportunities without proper preparation.
- The skills demanded by new and strategically important industries, such as advanced manufacturing and biopharmaceuticals, can be intrinsically different from those possessed by the region's current workforce, the vast majority of which is employed in local service industries.

Tailoring a place's workforce development strategy to the nuances of its socioeconomic and industry composition is not easy, but imperative. Only by linking the agglomeration of high-potential industry clusters and the adaptive deployment of diverse workforce, can Long Island compete in today and tomorrow's economy.

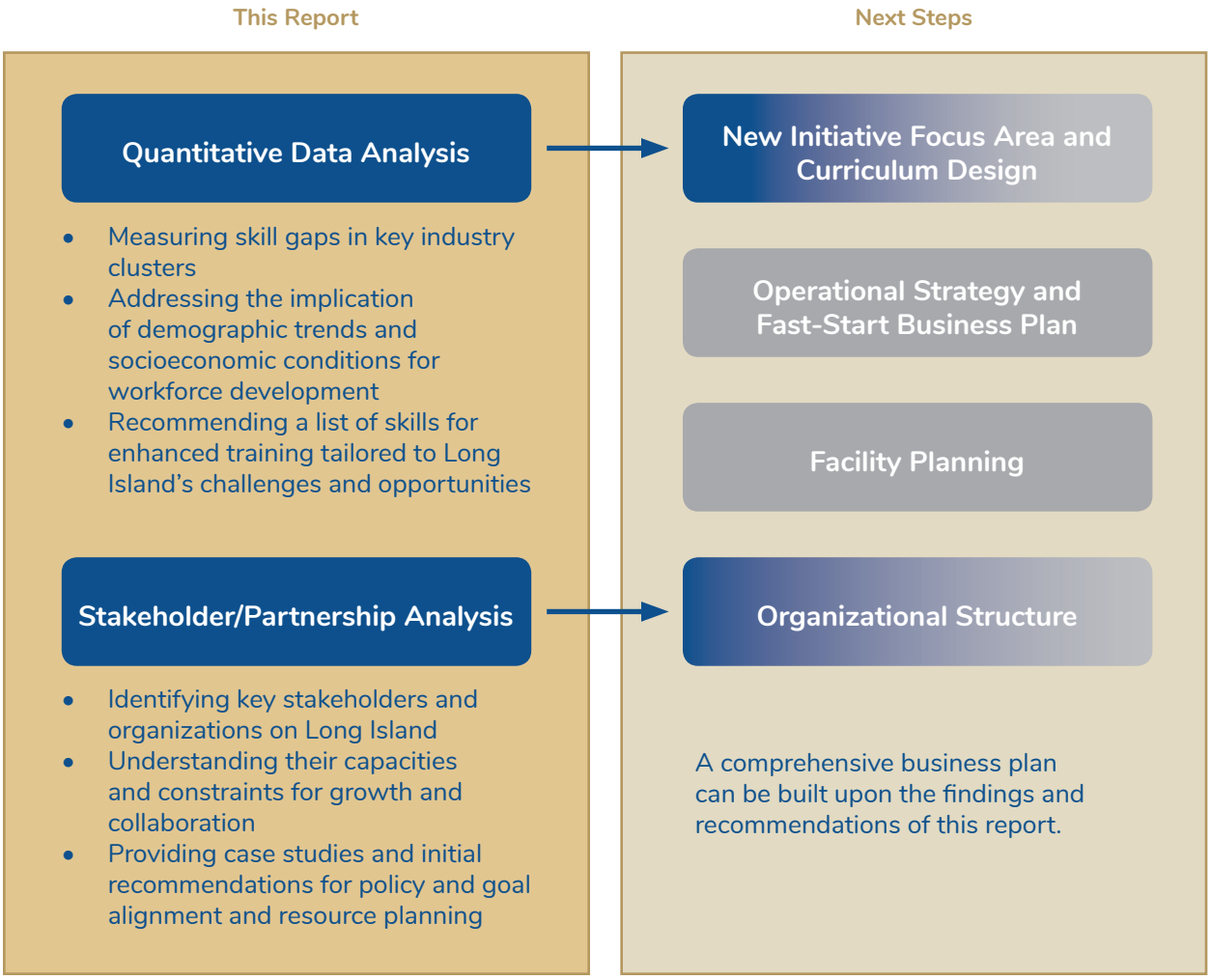
James Lima Planning + Development (JLP+D) was contracted by the Long Island Regional Planning Council (LIRPC) to advance the planning and development of the next chapter



There are many stakeholders and organizations of workforce development located throughout Long Island. Shown in the map above are selected academic institutions, public agencies, and non-profit organizations. For more details, including private-sector partners, see Appendix 1.

of workforce development initiative that would strengthen the region's employment pipeline, foster the agglomeration of key competitive industries, and promote collaboration across sectors.

In this report, JLP+D's task was to conduct a qualitative and quantitative scan of Long Island's labor market and workforce training ecosystem, and to identify opportunities and strategies to enhance and build upon the work of regional stakeholders. This report presents information and insights that can help Long Island stakeholders evaluate existing workforce training resources, pursue data-driven program design (this report includes the list of recommended skills for training by industry and educational level), and build out a new workforce development initiative that addresses its current workforce challenges and enables it to tackle those that may arise in the future. The findings and recommendations of this report build the foundation for Long Island's economic development organizations, policymakers, and other stakeholders to continue the planning and development of regional workforce training initiatives.

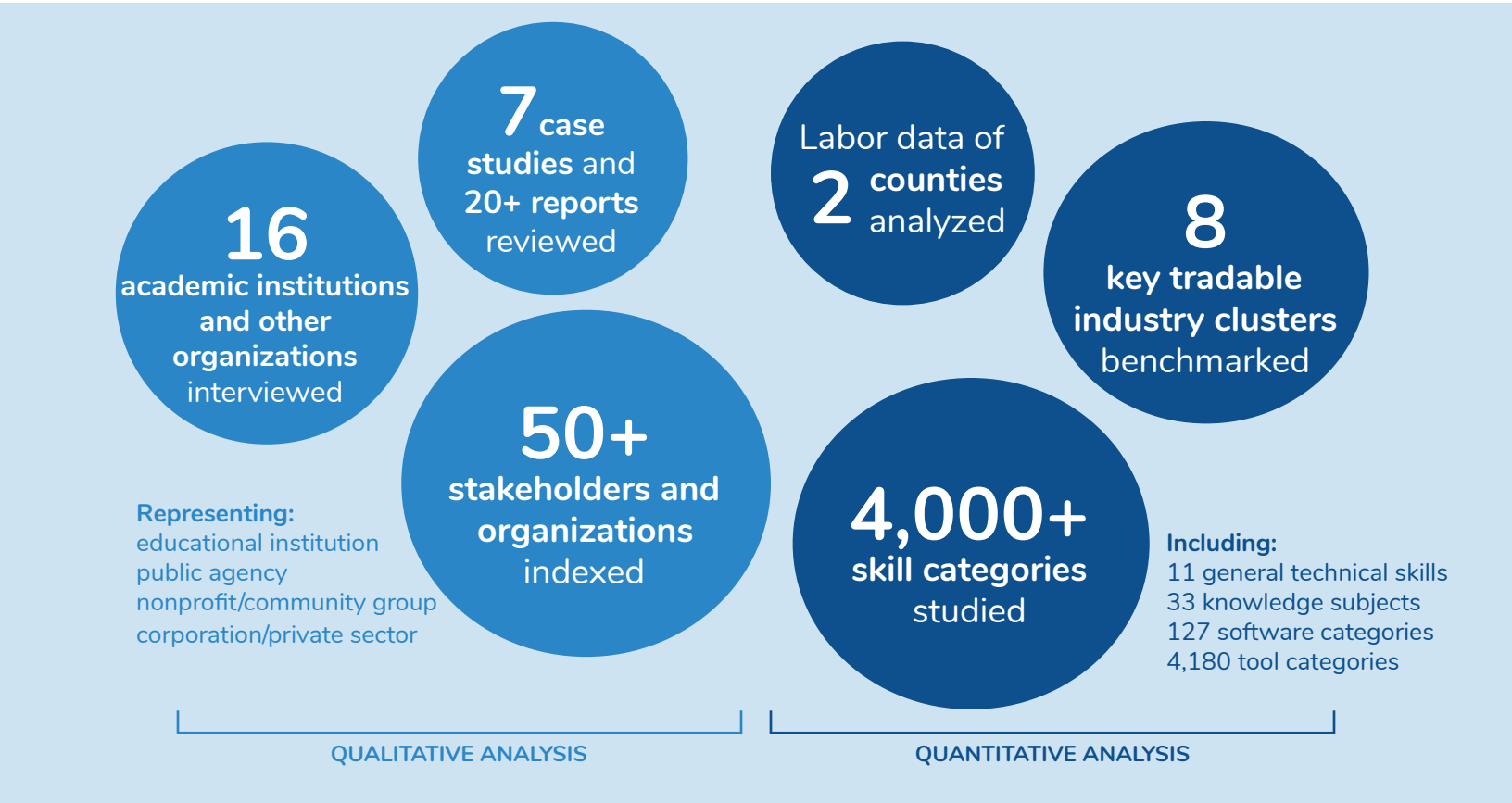


Methodology

Workforce development is a broad concept of economic development, consisting of diverse elements ranging from degree-based education to career counseling and placement. In the scope of this analysis, JLP+D has focused on programs that train practical, occupational skills and their related needs and resources. Key questions that we asked include:

1. How do industry trends and socioeconomic realities present challenges and opportunities to workforce development on Long Island?
2. What are the measurable skill gaps? Which occupational skills are the most in need of training?
3. What training programs already exist on Long Island?
4. How can the different groups of stakeholders on Long Island better collaborate to deliver a new and truly comprehensive workforce development program? What are the possibilities?

In answering these questions, JLP+D adopted a multi-pronged research method that includes literature and case study review, quantitative data analysis, and interviews with institutions, public agencies, nonprofits, and private-sector actors involved in Long Island's workforce training and development. Based on the findings of the quantitative and qualitative analyses, JLP+D describes Long Island's skill gaps, provides a list of identified training needs, indexes the key stakeholders in the regional workforce development landscape, and offers recommendations to reshape the next chapter of workforce development on Long Island.



The Next Chapter of Workforce Development

The following four foundational principles could guide the programmatic and policy decisions for a regional workforce development initiative.

BOTTOM-UP

Workforce development initiatives are most effective when they actively respond to the needs of local employers and job-seekers alike. This receptivity can be absent in top-down programs that do not sufficiently consult and involve training operators, businesses, and community organizations during the curriculum design and operation process. The diverse stakeholders of workforce development are critical sources of labor market intelligence, and their perspectives should inform programming decisions to a great extent. Moreover, it is important that all workforce development stakeholders feel heard and valued, which increases their willingness to collaborate, contribute resources (human, financial, networks, and facilities), and participate within the framework of a broader regional system.

As part of the larger local economic development effort on Long Island, workforce development initiatives need to be "bottom-up", leveraging existing resources and assets to restore or build new infrastructure that can promote further collaboration among local actors. There are a number of approaches and benefits to interorganizational cooperation. They include pooling resources to invest in mutually beneficial assets (equipment, space, etc.), creating knowledge-sharing routines and joint knowledge, leveraging complementary resources and capabilities, lowering transaction costs, and promoting effective system governance.[5]

Specifically, "bottom-up" workforce development initiatives thrive on an information collection infrastructure that can efficiently relay data and insights from local employers and organizations to institutional decision-makers. These systems typically consist of both uniform metrics and more informal feedback loops. The former includes skill gap reporting requirements for local employers and standardized skill evaluations for training participants upon program entry and exit. The latter can be accomplished through regular convenings (not unlike Long Island's existing "workforce development boards") and periodic surveys. The findings and recommendations within this report are meant to help stakeholders identify strategies for cultivating a larger and more strategically bottom-up workforce development system on Long Island.

Image credit: The Engineer

FLEXIBILITY

While it is important for workforce training programs to accurately reflect and be tailored to industry needs, smart talent development also adopts a panoramic view of the broader economic landscape and balances customization with flexibility.

Long Island is a diverse economy with multiple sectors of strategic importance. Economic development organizations and workforce development stakeholders need to understand which skills are in common demand across the different sectors and which skills are unique to specific industries. Only with such a holistic view of skill needs, can stakeholders design and deliver programs that pack the right training agenda to match resources, priorities, and industry growth patterns.

Furthermore, with the ongoing and anticipated shifts in global and regional trade, demographics, and technological development, new industry trends are emerging on Long Island. This requires workforce training initiatives to stay flexible and adaptive to unfamiliar and even unknown growth trajectories and prioritize the identification of occupational skills that are transferable from traditional industries to new ones.

Lastly, successful local workforce development is mindful of, and prepared for, the territorial competition for talent. Ultimately, the goal of workforce development is more than just filling the existing job vacancies of incumbent businesses. Talent development boosts productivity and promotes regional growth by empowering the labor force, helping them to pursue the best career opportunities offered in the economy, and if such opportunities are located in other regions, the upskilled workers can choose to relocate. This dynamic should be clearly understood by workforce development stakeholders, and it requires training programs to prepare workers for the highest and best opportunities in tomorrow's economy. Hence it is of critical importance to incentivize greater collaboration between industries, policymakers, and the broader economic development sector to link talent development with regional competitiveness assessment, industry upgrades, and sector growth strategies.

Image credit: MANTEC

EQUITY

Highly successful workforce development programs are inclusive and strive for greater equity in training and talent deployment. Traditional metrics narrowly focused on four-year degrees tend to paint an incomplete picture for economic development organizations and private businesses to view and address the region's workforce development needs. According to the Brookings Institute, the majority of the U.S. corporate investment in training goes to highly educated workers, leaving significant gaps in talent development for alternative career pathways. Furthermore, degree inflation, lack of information access and outreach, and outright discrimination have made the system even more difficult for the underserved population[6] to navigate (who might already be suffering from racial and economic inequalities).

Long Island is an increasingly diverse region home to workers of both high and low educational attainment. To complement academic degree programs, occupational skill-based workforce training needs to help people navigate alternative pathways to quality career opportunities that do not require a Bachelor's degree or higher - these positions do exist in many strategically important sectors, such as advanced manufacturing and food processing. On the one hand, this requires workforce development organizations to provide services and networks that can break down existing geographic, demographic, and language barriers to advertise job openings, guide job search, and provide career support. On the other hand, this requires workforce training curriculum to be multi-tracked by design: in addition to courses and programs targeting the highly educated workforce, Long Island needs to run a parallel and equally well-resourced track that can teach vital occupational skills to qualify workers and job seekers for quality positions that do not require a Bachelor's degree.

Image credit: GRI

CREATIVITY

Job training need not stay in the status quo. A willingness to innovate and try new things is imperative to the success of workforce development initiatives. Teaching methods in traditional educational settings have been advanced through pedagogical experimentation, often in response to broader structural changes. Workforce development systems must adopt a similar ethos in order to remain dynamic, particularly under conditions of rapid economic and technological transformation.

Workforce development experiments can be methodological, testing out on and off-site training options, different levels of technological integration, instructor-led sessions versus collaborative group work, and a number of other potential program designs. They can also include different configurations of and connections between workforce training assets, unlocking more value from existing resources. Lastly, they can explore new vocations and disciplines, learning from other places and anticipating emerging occupations or industries within the region and preparing the workforce accordingly.

A number of structures must be in place in order to facilitate this experimentation and to measure the degree to which it is having a positive impact on workforce and economic development outcomes. Many training operators' resources are strained enough by existing program loads, making it difficult for them to explore and pilot new ones. The formation of new types of workforce development alliances, spaces, and/or programs could provide existing organizations with the capacity needed to foster innovative programs. The effectiveness of these new programs can be determined using the growing trough of available economic and labor market data. This will help make the Long Island workforce development system become a more data-driven ecosystem able to adapt to change through experimentation and subsequent evaluation.

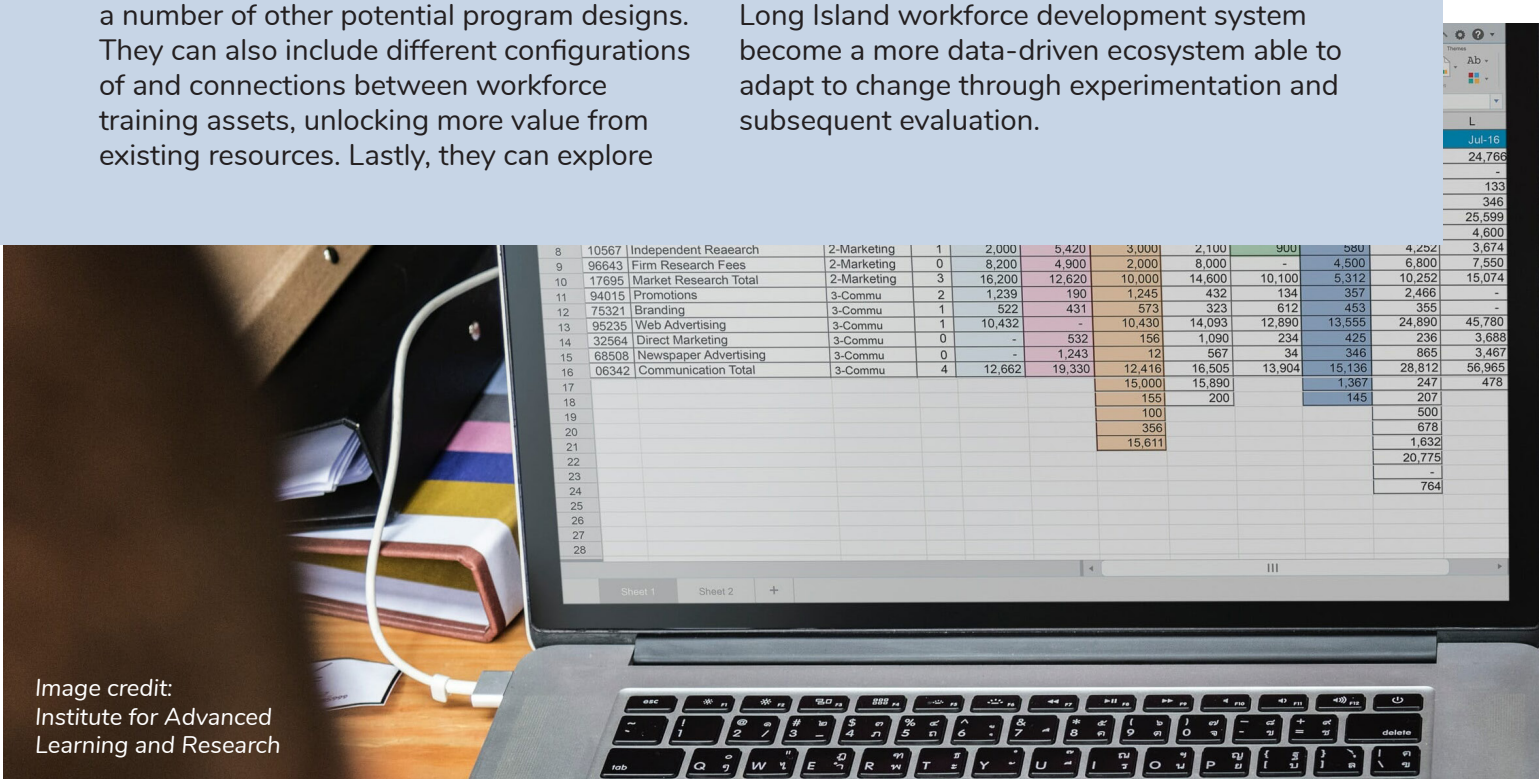


Image credit: Institute for Advanced Learning and Research

Opportunities

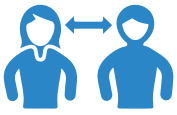
Many organizations and stakeholders are already advancing workforce training. The following opportunities illustrate elements for more collaboration to address the challenges facing Long Island.

Action 1: Foster the Coevolution of Workforce and Industry Clusters

Workforce development is of strategic importance to the broader goal of achieving long-term economic growth on Long Island. In addition to matching the labor force's skills with existing industry demand and helping companies fill vacancies, workforce training also offers an opportunity for companies and industries to coevolve with the workforce, assess their competitions, climb up the value chain, and create job opportunities that can keep and attract the upskilled labor force. This requires actors and stakeholders both in the industry and in other sectors to work together to examine latent risks, anticipate skill demands beyond the immediate local situation, and create employment and training opportunities that can prepare the region for future growth.

Action 2: Target Selected Sets of Skills for Customized Training

For the diverse population of Long Island, and for job opportunities in various industry clusters, skill training needs to be differentiated and customized in order to have a high impact. Stakeholders of workforce training should design a highly targeted workforce development program. This can be achieved with the help of a data-driven process, where quantitative analyses of industry trends and skill gaps, for high and low educational levels, can help inform the selection of skills that are 1) highly demanded by the key industry clusters, anticipating potential changes in future needs, 2) currently in short supply from Long Island's workforce, and 3) responsive of the diverse socioeconomic backgrounds of prospective trainees.



Action 3: Address Soft Skills in Workforce Development

As expressed by most employers in the U.S., soft skills are crucial for success and can be hard to train in an active workplace environment. Therefore, in addition to technical skills, which have been featured extensively in workforce development initiatives both on Long Island and elsewhere around the country, teaching soft skills is an equally critical component. Stakeholders should construct holistic workforce development programs and curricula that incorporate both technical skills and "soft" skills (communication, social and emotional intelligence, critical thinking, etc.).

Action 4: Form Partnerships for Industry-Led Programs

A gap exists between what the current training and academic programs are offering and what the businesses are demanding for their new hires. In fact, many such in-demand skills are better trained outside of classroom settings, and training organizations need access to technical equipment and expertise in order to properly prepare trainees for on-the-job responsibilities. Stakeholders on Long Island need to form stronger partnerships between industries and other stakeholders of workforce training to address this challenge. In addition to basing the curriculum design on the skill gap analysis, training programs should grant industry partners a chance to shape the development of training programs and provide further input to the curriculum. In exchange for developing tailored programs, businesses can offer access to equipment, staff, or on-site training space that would otherwise be unavailable to trainers.

The close coordination between industry and training entities will maximize the efficiency of workforce development expenditures by minimizing skill mismatches between candidates and employers.

Action 5: Capitalize on New Industries and Major Players in the Region

As Long Island's economy changes and incumbent businesses and industries are supplemented by new ones, the region's workforce development system must adapt to capture the opportunities they present. The workforce development and job training initiative can serve as an organizing impetus, helping Long Island identify strategies for how to anticipate and capitalize on the introduction of new players and industries such as offshore wind.

Image credit: Wikimedia

Action 6: Seek to Link Academic Research and Innovation to Workforce Development

Long Island is home to a number of innovative research institutions. However, academic innovation appears to be detached from many of the business operations and workforce development activities in the region. The new initiative should seek to forge a partnership between research institutions and workforce development entities and make this partnership a key component of training programs. Stakeholders should facilitate cross-sector dialogues to generate ideas of how the research institutions' unique needs, resources, and talent pool can be linked to the growth of key industry clusters and inform workforce development.

Long Island's relatively small but engaged group of workforce development stakeholders can become an asset if better channels for collaboration, both formal and informal, are established.

Action 7: Create a Long Island Workforce Development "Consortium"

Long Island's relatively small group of workforce development stakeholders can make coordination easier in the implementation of new initiatives, pursuing a more collaborative regional effort. Stakeholders should use the new workforce training and development initiative to develop a job training "consortium", breaking down barriers to collaboration and maximizing the utility and reach of each organization's strengths. Specifically, stakeholders should create a centralized location and/or shared physical space that could help build community around the shared goal of preparing the Long Island workforce for the future.

Image credit: Christopher Furlong /Getty Images

Action 8: Enhance the Capacity of Existing Efforts

Several workforce development entities on Long Island run programs that are in high demand, acutely responding to the needs of both employers and job-seekers. However, they report lacking the space, staff, and general resources to be able to scale-up. A new workforce training and development initiative that is regional and collaborative would enhance the capacity of these successful existing programs. The initiative can either directly provide or connect organizations to affordable space, staff, and technical expertise.

Looking Ahead:

Many of Long Island's companies, schools, and nonprofit organizations are actively seeking to develop new training programs that presciently respond to changes in the economy. However, they lack the opportunity to experiment with these new ideas and curricula. This new initiative for workforce development should create spaces, both physical and organizational, where Long Island workforce development entities can test out new programs. This can help ensure that the new initiative remains responsive to changes in the economy, labor market, and policy priorities.

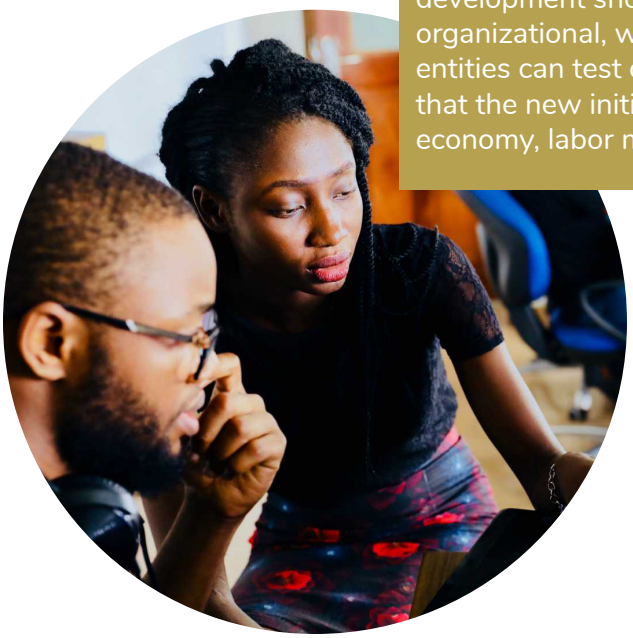
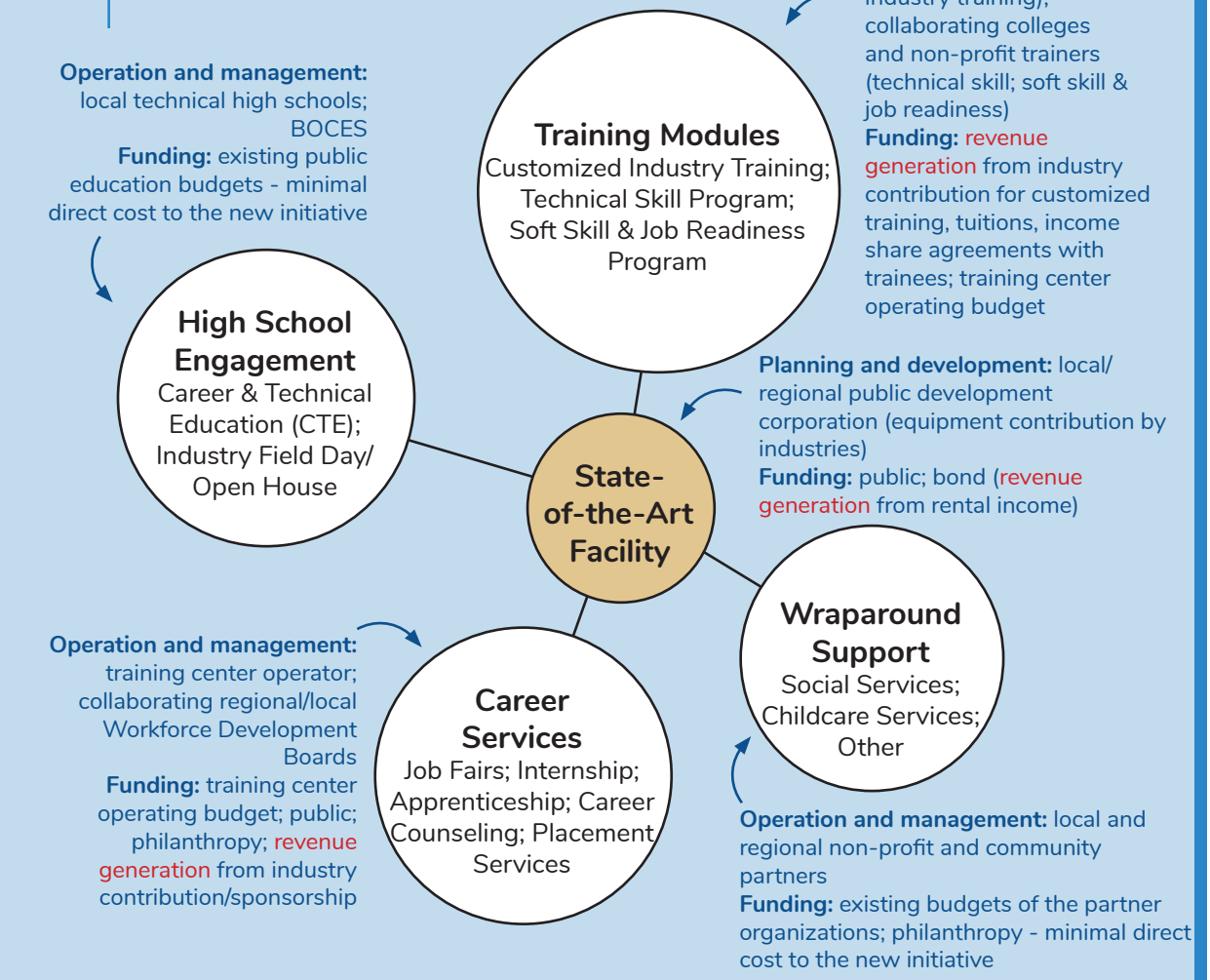


Image credit: Training Industry

Potential Components
for Regional Workforce Development Initiatives

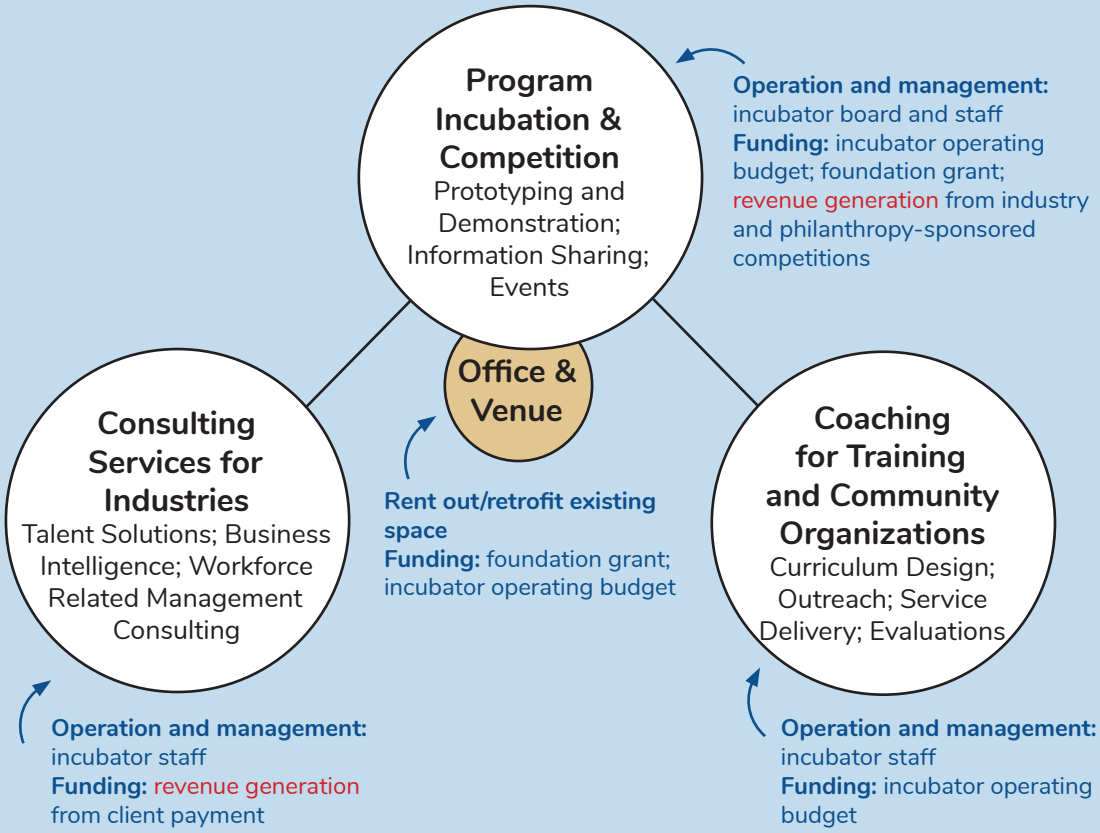
JLP+D identified three potential components of workforce development at a regional scale that could address the challenges facing Long Island. They could be pursued in combination or in phases. With different structures, sizes, funding requirements, and revenue generation opportunities, these components illustrate the potential collaborative configurations of existing stakeholders, based on their aligned interests, capacities, and needs.

A | The Training Center



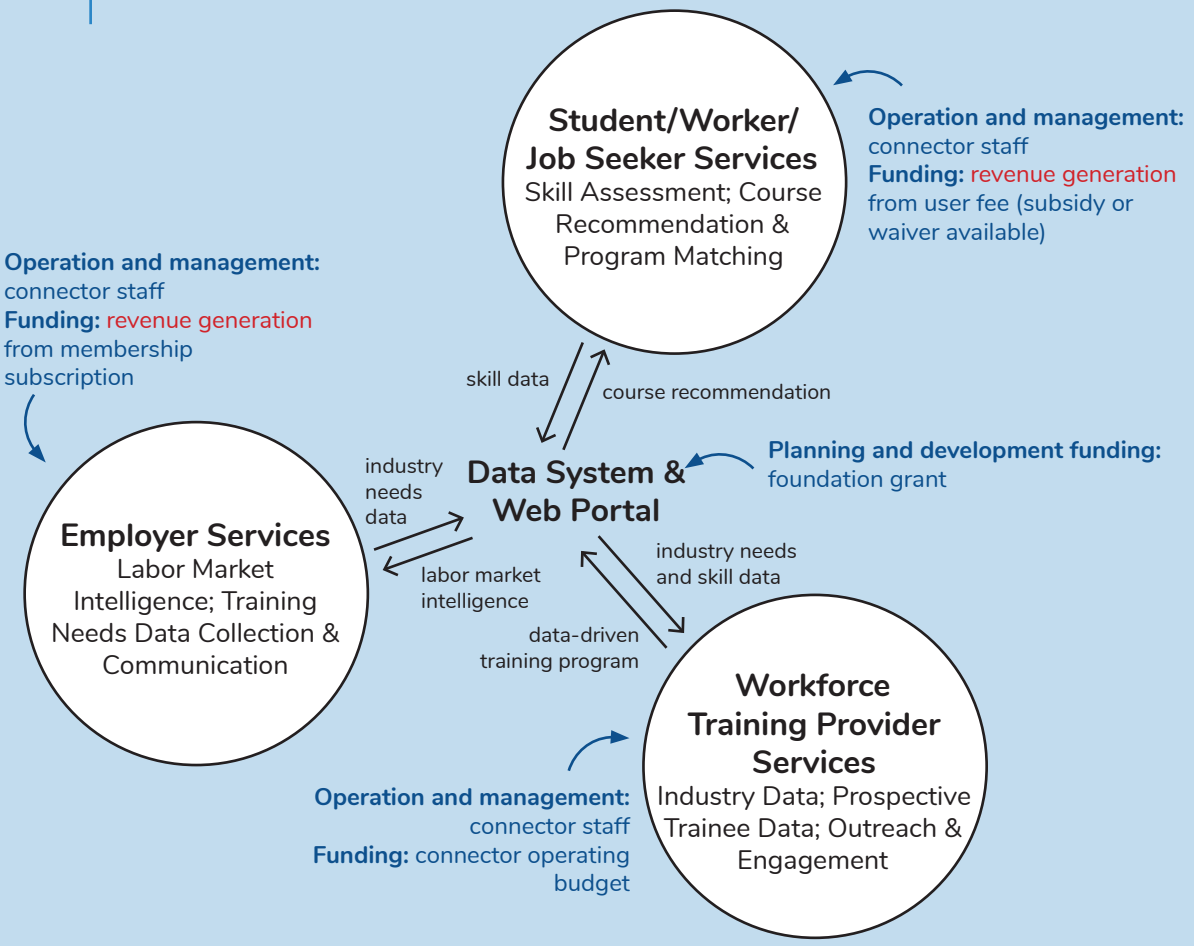
The "Training Center" component seeks to provide training and support programs and build connections among industries, students/job seekers, and existing training organizations. The entity managing the facility will design and operate flagship training programs that are customized to industry needs. The other parts of the operation, from technical and soft skill training and high school CTE to wraparound and career services, will be provided by collaborating local and regional organizations.

B The Incubator



The "Incubator" component seeks to promote stronger connections between industries and workforce training organizations and incentivize them to collaboratively develop, pursue, and adopt more innovative training programs. The board of the incubator consists of industry experts, educational administrators, and representatives from public and community sectors. While full-scale teaching and training will not take place or be administered at the incubator, it supports and provides resources for the prototyping, grant application, and scaling of new training programs in the region. It also directly manages regional competitions of talent development programs that address policy priorities and/or specific industry goals, potentially sponsored by businesses or philanthropies. The incubator generates consulting revenue by providing direct, customized technical workforce solutions to businesses. The revenue is redirected to provide subsidized coaching services to help existing institutional and non-profit training organizations roll out new and better programs that address industry needs.

C The Connector



The "Connector" component seeks to serve as the "front door" for industries, trainees, and workforce training organizations to navigate and collectively improve the workforce training system in the region. It facilitates better communication and data collection from industries and trainees, and provides data-driven insights to all parties, which helps the training organizations to design and roll out more targeted and effective programs that respond to changing industry needs and labor force characteristics. The capital requirement is lower than Components A and B and mainly related to the development of informational and digital, instead of physical, infrastructure. Revenue can be generated from the industry side and the trainee side, the former subscribing for periodic updates of labor market insights and an effective outlet for reporting skill needs, the latter paying user fees for customized industry-based skill assessment and training program recommendations (fees subsidized or waived for low-income individuals).

Conclusion

To achieve its potential long-term economic growth, revitalization, and inclusive development that benefits all people, Long Island needs to adopt new thinking and approaches to regional workforce training and development.

The need for talent development on Long Island is pressing. As the region seeks to pursue long-term economic growth led by tradable sector development, Long Island's workforce, the vast majority of which is currently employed in local services, needs to be upskilled in order to build a sufficient pipeline for key industries. Moreover, as Long Island becomes an increasingly diverse place, workforce development also offers a solution for equitable economic development, preparing a sizable portion of the region's population, primarily those lacking a bachelor's degree or coming from disadvantaged backgrounds, for alternative career trajectories with good earnings potential.

The next chapter of workforce development should rely on the bottom-up collaboration of stakeholders across sectors, closely monitoring industries' and workers' needs while remaining flexible and anticipatory of future challenges, design training and offer opportunities to people of diverse educational and skill backgrounds, and innovate past the status quo to adopt better curriculum design, partnership building, project delivery, and program operations.

The actions recommended in this report, with the potential components of regional-scale initiatives, constitute potential strategies tailored to Long Island's unique situation and built to complement the region's existing assets. Addressing challenges related to the capacity of training programs (both new and existing), barriers to system-wide collaboration, and navigability of the workforce development landscape - both for employers and for job-seekers, the recommendations offer possible directions for Long Island stakeholders to reconfigure, reinvest in, and revolutionize its workforce training system.

Furthermore, building a flexible, equitable, creative, and bottom-up regional workforce development infrastructure is a smart investment. The recommendations aim to bring about a system that is capable of self-evolution. Proactively equipping Long Island with such an adaptable workforce training system today will further hone the region's competitive advantage and help prevent skill gaps and other labor market challenges from becoming obstacles to economic and industrial growth in the future.

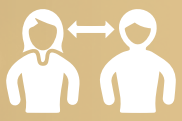
The importance of a healthy pipeline of skilled workers for economic development cannot be overstated. Preparing Long Island's workforce and its economy for the future is no small task. It requires a clear vision, leadership, and resources to bring about a system of new infrastructure - both physical and relational - that can upskill the talent base, lead to higher growth trajectories, and achieve shared prosperity in the region.

1. Brookings Institute. Talent-driven economic development: A new vision and agenda for regional and state economies. 2019.
2. Jennifer Vey and Richard McGahey. Retooling for Growth: Building a 21st Century Economy in America's Older Industrial Areas. Brookings Institution Press. 2008.
3. Michael Chrisitian. Net Investment and Stocks of Human Capital in the United States, 1975-2013. Bureau of Economic Analysis. 2016. World Economic Forum. The Human Capital Report. 2013.
4. Urban Institute. Workforce Development as Anti-Poverty Strategy. 2008.
5. Federal Reserve Bank of Atlanta. Fragmentation in Workforce Development and Efforts to Coordinate Regional Workforce Development Systems. 2015.
6. Brookings Institute. Talent-driven economic development: A new vision and agenda for regional and state economies. 2019.

Preparing Long Island's workforce and its economy for the future requires a clear vision, leadership, and resources to bring about a system of new infrastructure.

Coevolution of workforce and industry clusters

Customized Training



Soft Skills

Industry Partnerships

New Industries

Innovation

Regional Consortium

Capacity Enhancement

KEY FINDINGS AND OPPORTUNITIES

Foster the Coevolution of Workforce and Industry Clusters
Target Selected Sets of Skills for Customized Training
Address Soft Skills in Workforce Development
Form Partnerships for Industry-Led Programs
Capitalize on New Industries and Major Players in the Region
Seek to Link Academic Research and Innovation to Workforce Development
Create a Long Island Workforce Development "Consortium"
Enhance the Capacity of Existing Efforts
Looking Ahead: The Next Chapter of Regional Workforce Development

To achieve long-term economic growth, revitalization, and inclusive development that benefits all people, Long Island needs to adopt new thinking and approaches to regional workforce training and development.

KEY FINDINGS AND OPPORTUNITIES

Based on quantitative and qualitative analyses of workforce development trends, challenges, and opportunities, JLP+D identified the following findings and recommendations to strengthen Long Island's workforce development. The findings address core themes to prepare Long Island to implement the next chapter of its workforce development initiative, from the identification of skill gaps and recommended training areas, to the assessment of stakeholder capacity and potential new solutions.

Foster the Coevolution of Workforce and Industry Clusters

CHALLENGE

Long Island's $194 billion economy is expanding. However, tradable sectors in the region, such as advanced manufacturing and renewable energy, are relatively small - they can bring new dollars to Long Island and should be better fostered for the long-term economic growth of the region.

OPPORTUNITY

Treat workforce development as a program of broader strategic importance for the growth of Long Island's tradable clusters. In the short-term, training the labor force can better match the workers' skill sets with the industries' demand, thus helping companies fill vacancies. More importantly and in the long-term, upskilling the workforce is also a process that requires companies and industries to coevolve with the workforce, climb up the value chain, and create job opportunities that can keep and attract skilled labor.

Tradable clusters are crucial for a region's long-term prosperity and economic resilience. Depending on a place's unique history, resources, and policies, the tradable industry clusters, such as aerospace, software engineering, and medical devices, often define the region's competitive advantage, which attracts investment, entrepreneurs, and talent to the region.

In the U.S., 36% of all private-sector employment is in tradable clusters. On Long Island, the number is 23%.[7] Long Island's tradable clusters, such as business services, distribution, and IT,

[7] Data source: U.S. Bureau of Labor Statistics (Quarterly Census of Employment and Wages). Cluster definition: Harvard Business School (U.S. Cluster Mapping Project).

are relatively small and have experienced slow growth due to various factors, workforce and talent pipeline being a major one. For companies, the difficulty in filling vacancies and the threat of a large number of the retiring workforce have put many at risk. This is particularly true for tradable clusters such as IT, aerospace, and biopharmaceuticals, and, to a lesser extent, business services and finance.

Therefore, workforce development is an important initiative to ensure a healthy pipeline of skilled workers with skill sets that meet the industries' demand, and ultimately help companies in the tradable clusters grow. However, besides training the workers, the industries themselves should also seek to evolve and climb up the value chain, design and make new products and services, and create jobs that the upskilled Long Island workers will be willing to take and pursue as their careers.

The pressure for Long Island's incumbent tradable industries to evolve comes from greater competition nationally and even globally. With the reduction in transportation costs, and when the factors of production - money and labor - are increasingly mobile, Long Island's existing firms cannot afford to stay in the comfort zone and must provide opportunities that can keep the region's workforce that is highly educated and will be even more skilled and specialized with enhanced training.

Regional Comparison: The biopharmaceutical cluster is a major economic asset for Long Island. However, when compared with other national centers, it is evident that Long Island's cluster still has the potential for growth, upgrades, and more innovation.

According to quantitative analysis of job posting patterns, biopharma companies on Long Island have been hiring a great number of inspectors. In comparison, companies in San Francisco, which is a major hub of this industry cluster, no longer have inspectors as their top in-demand job; instead, San Francisco companies hire natural science managers and medical scientists, which are better-paying occupations that face less risk of automation and replacement. Long Island firms and San Francisco firms, although classified as in the same industry cluster, are actually driven by work of different nature and growing on different trajectories (More details and data points are available in the Quantitative Data Analysis section and in Appendix 2).

According to an interviewee at a research institution on Long Island, the majority of its post-doctoral scientists who are interested in industry careers do not stay in pharmaceutical companies on Long Island due to the dearth of appropriate opportunity and the companies' lack of focus on research and development (R&D).

Without Long Island's firms taking a long-term view for strategic business transformations and upgrades, the region's upskilled workforce might choose to relocate themselves elsewhere to pursue promising careers. It is hence important for policymakers and businesses to

understand that workforce development should not only aim to achieve the successful filling of current vacancies on Long Island but that ultimately, workforce development is about the future. Workforce development is a chance for the workers and the industries to coevolve, where the workers are learning to equip themselves with new skill sets, and the industries are learning to capture market opportunities and stay competitive to attract the upskilled labor force.

Workforce development is a chance for the workers and the industries to coevolve, where the workers are learning to equip themselves with new skill sets, and the industries are learning to capture market opportunities and stay competitive to attract the upskilled labor force.

Target Selected Sets of Skills for Customized Training

CHALLENGE

Despite the high level of average educational attainment, Long Island's workforce consists of diverse population segments. Preparing people of different skill levels, educational attainments, and socioeconomic backgrounds for successful careers in key tradable clusters requires the identification of a specific set of skills that needs training and would have a high impact.

OPPORTUNITY

Design a highly targeted workforce development program and tailor to local situations. Analyses of industry trends and skill gaps can help inform the selection of skills that are 1) highly demanded by the key industry clusters and 2) currently in short supply among Long Island's workforce. Provide different packages for prospective trainees of diverse backgrounds.

Currently, the majority of Long Island's workforce is employed in local service industries. The skill sets associated with service occupations are different from the skills desired and required by tradable sector companies. The gap between what industries demand and what the local workforce can supply should be studied, and the curriculum design of Long Island's workforce development initiative should be based on such understanding.

JLP+D conducted analyses of industry demands and local skill gaps. The lists of skills recommended for training, as well as detailed documentation of methodology and analytical process, are provided in the Quantitative Data Analysis and Appendix 2.

According to the analysis, training needs tend to vary across industry clusters and by the educational requirement of occupations, although some skills are cross-cutting. An example of such a skill with broad training significance is enterprise resource planning (ERP) software. It is a highly demanded skill for a variety of industry clusters that are important to Long Island; it is used in occupations of both high and low educational requirements; and, according to the current employment composition of Long Island, it is a type of software that the current workforce is not well prepared to command.

In the analysis of skill gap and training needs, different educational attainments, which can be associated with different socioeconomic backgrounds of the population, should be addressed. More details are included in the Quantitative Data Analysis section. It is recommended that policymakers, industry, educational and institutional partners, and other stakeholders use the lists provided in the report as the basis to design training programs that fit the region's policy priorities.

Address Soft Skills in Workforce Development

In addition to technical skills, which have been featured extensively in workforce development initiatives both on Long Island and elsewhere around the country, teaching soft skills is an equally critical component of cultivating a dynamic workforce.

Develop holistic workforce development programs and curricula that incorporate both technical skills and "soft" skills (communication, social and emotional intelligence, critical thinking, etc.).

"Soft skills" are emerging as a highly in-demand skill set in the modern workplace. In a 2014 survey, 77% of employers in the U.S. rated soft skills as being of equal importance to cognitive or technical skills.[8] Soft skills are non-industry specific abilities such as professional

[8] U.S. Chamber of Commerce - Center for Education and the Workforce. "Bridging the Soft Skills Gap". 2017.

communication, critical thinking, collaboration, and time management, among others. While workers at any stage of their career can benefit from soft skills training, the soft skill "gap" is most pronounced among younger candidates and employees.

Soft skills are often tough or somewhat awkward to teach in an active workplace environment. As a result, companies generally choose to collaborate with educational institutions or nonprofit organizations to conduct soft skill training sessions off-site or infuse them into their orientation process. Recognizing the desirability of candidates who are well-versed in a suite of soft skills, some regions have even begun to incorporate them into K-12 and community college curricula.[9]

Several of the Long Island stakeholders that JLP+D interviewed reported that soft skills were a challenge that they faced with their employees or students, particularly among the younger generation. One business owner stated that many of his entry-level positions are customer facing and a lack of social skills among candidates has made those roles difficult to fill. Responding to this issue, two of the educational institutions JLP+D spoke with have introduced soft skill seminar offerings in many of their academic programs.

> *"Soft skills" are emerging as a highly in-demand skill set in the modern workplace.*

A new workforce development or job training initiative on Long Island would need to seek to provide workers with transferable soft skills as well as industry-specific technical skills. A potential strategy for achieving this is to make the inclusion of soft skill training a precondition for receiving resources (space, staff, funding, etc.). This will enable Long Island's workforce to gain a set of skills that will be ever-relevant, even as the nature of work continues to evolve.

Case Study: The West Philadelphia Skills Initiative targets specific positions that a given employer needs to fill and uses a cohort model to recruit, assess, and train candidates on the employer's behalf. Their program has a strong professional development component, covering topics such as critical problem solving, basic management skills, and mindfulness. Graduates from the program have been placed in some of the region's top employers, including the Children's Hospital of Philadelphia and the University of Pennsylvania.

[9] Houghton, Tony and Proscio, Tony. Hard Work on Soft Skills: Creating a "Culture of Work" in Workforce Development. 2001

The West Philadelphia Skills Initiative puts soft skills as the foundation of every cohort's experience. Image Credit: Generocity.org and West Philadelphia Skills Initiative

Form Partnerships for Industry-Led Programs

CHALLENGE

A gap exists between what current training and academic programs are offering and what the businesses are demanding in their hires. Many in-demand skills are better trained outside of classroom settings, and training organizations need access to technical equipment and expertise in order to properly prepare trainees for on-the-job responsibilities.

OPPORTUNITY

Form strong partnerships between industries and other stakeholders of workforce training. In addition to basing the curriculum design on the skill gap analysis, give industry partners a chance to shape the development of training programs and provide further input to the curriculum. In exchange for developing tailored programs, businesses can offer access to equipment, staff, or on-site training space that would otherwise be unavailable to trainers.

Workers and companies both benefit when training curricula are specifically designed to meet employer needs. Job seekers want assurance that the skills they are spending time and money to learn can earn them a livelihood upon graduation. Firms require a steady supply of qualified workers who will not require extensive onboarding in order to become job-ready.[10] A natural

[10] Third Way. The 7 Habits of Highly Effective Workforce Programs. 2014

solution is to establish workforce development partnerships between industry and educational institutions or nonprofit training organizations.

Effectively, this removes unnecessary barriers between jobs and job seekers, ensuring that the talent being invested in is actually deployed. Moreover, companies often do not want to train potential and new employees on-site (as it stretches staff bandwidth and presents safety hazards). Off-site industry-led programming is capable of closely simulating actual work conditions and exposing trainees to the people, equipment, and situations they are likely to encounter on the job.[11]

A number of the Long Island stakeholders that JLP+D has interviewed reported that the private sector would like to increase its role in workforce development. Interestingly, companies themselves offered mixed responses when asked whether they would prefer to conduct training programs on or off-site. One was concerned that dedicating a manufacturing line to on-site training would harm their productivity. By contrast, another felt that off-site training would compromise their intellectual property. A third expressed a willingness to potentially donate equipment to a satellite training program that could make candidates proficient in the machinery and tools used in their facilities.

> *The close coordination between industry and training entities will maximize the efficiency of workforce development expenditures by minimizing skill mismatches between candidates and employers.*

A new workforce development or job training initiative on Long Island presents an opportunity to create bespoke programs for major regional employers facing talent shortages, enabling them to select the venue (on or off-site), format, and other program design decisions. With an overall balance and flexibility of the regional program administration, the companies can provide the input, staff expertise or specialized equipment required to operate such programs while the initiative can offer space (for those seeking off-site options) and take the lead on recruiting participants. This close coordination between industry and training entities will maximize the efficiency of workforce development expenditures by minimizing skill mismatches between candidates and employers.

[11] Brookings Institution. Talent-Driven Economic Development. 2019

Case Study: The Northland Workforce Training Center in Buffalo is an industry-driven, public-private partnership between employers, educational institutions, community organizations, and government focused on closing skills gaps. Northland receives funding, in-kind and advisory support from major employers in the Lake Erie region, including energy companies and advanced manufacturers. Its training programs seek to prepare participants for careers in these fast-growing sectors while providing wraparound services as well.

A training area at the Northland Workforce Training Center. Image Credit: Northland Workforce Training Center

Capitalize on New Industries and Major Players in the Region

CHALLENGE

As Long Island's economy changes and incumbent businesses and industries are supplemented or supplanted by new ones, the region's workforce development system must adapt to capture the opportunities they present.

OPPORTUNITY

The workforce development and job training initiative can serve as an organizing impetus, helping Long Island identify strategies for how to capitalize on the introduction of new players and industries such as offshore wind.

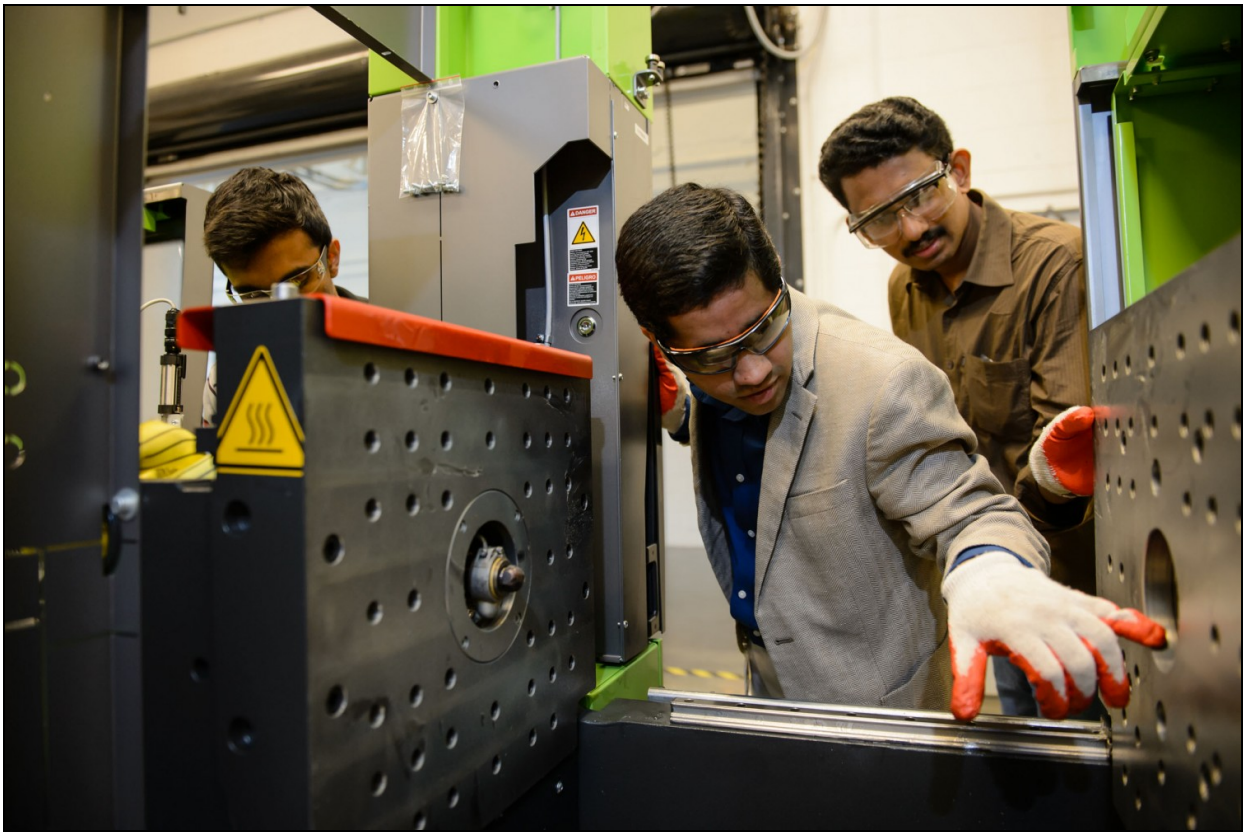
Upon the introduction of a new major business or industry, regions generally take stock of their existing workforce, seeking to understand the extent to which there is a skills alignment. After conducting this preliminary analysis, they evaluate their workforce development capacity, figuring out whether current programs can address any skill gaps or if they need to be refashioned or scaled up. In some cases, the creation of new programs may also be necessary. This exercise can enable the new business or industry cluster to expand rapidly and increase the likelihood of the region retaining it.[12]

The State of New York is seeking to cultivate such a new industry cluster on Long Island: offshore wind. New York recently committed to supporting the development of 9,000 megawatts of offshore wind energy by 2035, enough to power up to 6 million homes.[13] Preliminary estimates have projected that offshore wind can create nearly 5,000 jobs, roughly half of which are in operations and maintenance.[14] Studies of other offshore wind energy projects in the United States have found that a diverse technical workforce is required, spanning over 70 different occupations including electricians, welders, and vessel operators.

Work has already begun to identify the available workforce for offshore wind in New York State and to measure the number and capacity of relevant training programs.[15] This has involved looking at sectors with a comparable occupational composition, offshore wind's intermediate inputs, and understanding their respective talent pipelines. Long Island should use the workforce development and job training initiative as an impetus to undertake a similar process for the region, developing a standard set of practices that can be used when subsequent new industries and businesses come about. This will position Long Island's workforce development system to be adaptable, reshaping to seize the opportunities presented by any new industry or major player.

Case Study: In 1992, BMW selected Spartanburg, South Carolina as the location for a significant new assembly plant. Recognizing the region's shortage in automotive engineers, Clemson University launched the International Center for Automotive Research, which offers a range of degree and certificate programs in vehicle dynamics and automotive systems. The program developed such a significant pool of talent that Michelin and Timken chose to expand to locations in Upstate South Carolina, forming a highly specialized cluster.

[12] Brookings Institution. Rethinking Cluster Initiatives. 2018
[13] The New York State Energy Research and Development Authority (NYSERDA). Offshore Wind Master Plan. 2016.
[14] The New York State Energy Research and Development Authority (NYSERDA). The Workforce Opportunity of Offshore Wind in New York. 2017
[15] Workforce Development Institute. New York State and the Jobs of Offshore Wind Energy. 2017



At the International Center for Automotive Research, students in the state-of-the-art labs and shops help design and build prototypes that are transforming the traditional classroom into a model original equipment manufacturer and supplier. Image credit: Clemson University

Seek to Link Academic Research and Innovation to Workforce Development

CHALLENGE

Long Island is home to a number of innovative research institutions. However, academic innovation appears to be detached from most of the business operations and workforce development activities in the region.

OPPORTUNITY

Forge a partnership between research institutions and workforce development entities, and make this partnership a key component of any new regional job training initiative. Facilitate cross-sector dialogues to generate ideas of how the research institutions' unique needs, resources,

and talent pool can be linked to the growth of key industry clusters and inform workforce development.

A growing body of empirical studies have established a strong causal link between increased research and development (R&D) and long-term regional economic growth.[16] However, businesses and workers outside of a region's innovative sectors and organizations do not always experience the spillover benefits that research activity brings about. This is arguably due to the fact that workforce development systems often struggle to identify and train for the accessible jobs that research-oriented entities have the capacity to create.[17] The first step in cultivating an inclusive knowledge-intensive economy requires workforce development practitioners to directly engage innovative firms and organizations during their program design process.

This will enable training curricula to be tailored to the "middle-skill" STEM jobs that exist in many research and development-heavy sectors (particularly bioscience and energy) and are available to candidates with a sub-baccalaureate education.[18] These occupations generally include process and maintenance technicians and computer network architects and support specialists, among others.[19] Moreover, companies have recently experienced difficulty filling these "middle-skill" positions. A National Skills Coalition report found that 53% of all US jobs were "middle-skill", yet only 43% of workers possessed the necessary skills to meet the role demands.[20]

Long Island has a significant concentration of research institutions, ranging from the national laboratories to universities. A number of the stakeholders JLP+D interviewed from these organizations reported concerns over the middle-skill workforce pipeline. Specifically, they worried about their ability to replace facility and equipment maintenance staff as their current workers approach retirement. As a result, several expressed an interest in partnering with community colleges or other training organizations to develop the next generation of technicians. One interviewee felt that middle-skill employment opportunities would arise as site upgrades and new construction on campuses becomes increasingly necessary in the near future.

In order to connect research and development activity on Long Island to workforce development objectives, the middle-skill employment needs of the region's innovative entities must be incorporated into training initiatives. Growing the supply of middle-skill labor on Long

[16] Blanco et al. The Impact of Research and Development on Economic Growth and Productivity in the United States. Southern Economic Journal. 2016.
[17] Lowe, Nicholas. Job Creation and the Knowledge Economy: Lessons From North Carolina's Life Science Manufacturing Initiative. Economic Development Quarterly. 2007
[18] Lowe, Nicholas. Job Creation and the Knowledge Economy: Lessons From North Carolina's Life Science Manufacturing Initiative. Economic Development Quarterly. 2007
[19] Urban Institute. America's Forgotten Middle-Skill Jobs. 2007
[20] RAND Corporation. Supporting Middle-Skills STEM Workforce Development. 2019

Island could also facilitate the expansion of research and development-focused companies (or even attract new ones), improving Long Island's innovative output. This could be accomplished by assigning an intermediary who can bring together program operators and research administrators, ensuring that the pipeline generates candidates who meet their requirements and standards.

Training for and increasing the availability of middle-skill STEM jobs should not be the only strategy for creating stronger linkages between Long Island's innovative institutions and the regional economy. One stakeholder JLP+D interviewed felt that Long Island's industries lacked an innovative orientation and asserted that the region's difficulty in cultivating a cluster of research and development-focused companies was due to the lack of entrepreneurial talent. Equipping more people in the region with business development skills and an entrepreneurial mindset could form a class of workers who are adept at identifying opportunities for scientific research to be commercialized and spun off into job-creating startup ventures. It should be noted, however, that many regions are struggling to develop effective strategies for leveraging scientific institutions in order to create shared value for workers, industry and the broader economy.

Case Study: The North Carolina Biotechnology Center connects life sciences companies to workforce development resources and monitors changes in the industry's employment needs. Through its long-standing partnership with the North Carolina community college system, the center developed BioWork, a 128-hour certificate course that provides students with entry-level technician skills for both bio-manufacturing and chemical-based pharmaceutical manufacturing. Enrollment in the program increased by 241 percent in its first five years. The Center also funds internships for high-caliber business students who can help companies become more entrepreneurial in their product and business development activities.

The North Carolina Pharmaceutical Services Network (PSN) is a one-of-a-kind partnership between industry and academia that provides a continuum of pharmaceutical education and training to new and existing companies in North Carolina and beyond. The PSN program at East Carolina University (PSN@ECU) provides laboratory-based education and the PSN program at Pitt Community College (PSN@PCC) teaches oral solid dosage theory and manufacturing techniques in a real-world environment. Image credit: North Carolina Biotechnology Center and North Carolina Pharmaceutical Services Network.

Create a Long Island Workforce Development "Consortium"

CHALLENGE

In terms of implementing the new workforce development initiative, while Long Island fortunately has a relatively small group of workforce development stakeholders, which can make coordination easier, their activities and efforts can be more collaborative.

OPPORTUNITY

Use the new workforce training and development initiative to develop a job training "consortium", breaking down barriers to collaboration and maximizing the utility and reach of each organization's strengths. Specifically, create a centralized location and/or shared physical space that could help build community around the shared goal of preparing the Long Island workforce for the future.

As human capital has become rightfully recognized as a central component of economic development strategy and the public resources available for training programs have shrunk, new players have entered into or increased their presence in regional workforce development systems across the country. While it is encouraging that entities outside the public sector are responding to the shifting needs of businesses and the labor force, the proliferation of localized programmatic responses might yield fragmentation. This results in a less coherent and coordinated workforce development system that can be confusing for workers who are seeking training, contain duplicative services among providers, and discourage meaningful outcome measurement and program evaluation.[21]

In addition, stakeholders often find themselves competing with one another in a saturated workforce development environment, creating inefficiencies and conflicts where there should be collaboration that seeks to propel the regional economy as a whole. There are a number of benefits to interorganizational cooperation for workforce development. They include pooling resources to invest in mutually beneficial assets, creating knowledge-sharing routines and joint knowledge, leveraging complementary resources and capabilities, lowering transaction costs and promoting effective governance. Yet, building such partnerships is time and resource-intensive, which is why this sort of coordination is generally led by an independent umbrella organization.[22]

[21] Federal Reserve Bank of Atlanta. Fragmentation in Workforce Development and Efforts to Coordinate Regional Workforce Development Systems. 2015.
[22] Federal Reserve Bank of Atlanta. Fragmentation in Workforce Development and Efforts to Coordinate Regional Workforce Development Systems. 2015.

On Long Island, both educational and industry stakeholders reported to JLP+D that there were barriers to Island-wide workforce development collaboration created by the boundaries between Nassau and Suffolk Counties as well as the sense that each workforce development entity has its own distinct "fiefdom". Fortunately, Long Island appears to have fewer actors than many of the regions where workforce development system fragmentation is a significant issue, making widespread and holistic coordination a more readily attainable goal.

Long Island's relatively small but engaged group of workforce development stakeholders can become a greater asset if better channels for collaboration, both formal and informal, are established. This may include the creation of a new entity to manage the network of training providers, to serve as a liaison between Long Island's labor force, business community, and workforce development system, and monitor training programs for effectiveness and responsiveness to economic needs and opportunities. Other options include co-locating different training programs and workforce development resources in a centralized place, facilitating the formation of a consortium-like community of individuals and institutions who share the goal of preparing Long Island's workforce and economy for the future.

Case Study: While there are not yet any workforce development entities that explicitly refer to themselves as "consortiums", there are many organizations that serve as conduits between all of the workforce development stakeholders within their respective regions. Sacramento Works is one such nonprofit who manages a network of employment and training centers that provide resources and services to both employers and job-seekers in Sacramento County. The organization also directly offers training programs as well as help designing sector and business-specific workforce development strategies in coordination with over 40 public, private, and nonprofit partners. Sacramento Works presents a potential model for the sort of "umbrella organization" that oversees the coordination of a regional workforce development system.

The Crossroads Job Center is one of the largest members of Sacramento Works' network. With the help of Sacramento Works, Crossroads has served over 6,000 workers with job placement and training services, many of whom are disadvantaged. Image Credit: Crossroads Job Center

Long Island's relatively small but engaged group of workforce development stakeholders can become an asset if better channels for collaboration, both formal and informal, are established.

Enhance the Capacity of Existing Efforts

Several workforce development entities on Long Island run programs that are in high demand, acutely responding to the needs of both employers and job-seekers. However, they report lacking the space, staff, and general resources to be able to scale-up.

Leverage the new workforce training and development initiative to enhance the capacity of these successful existing programs. The initiative can either directly provide or connect organizations to affordable space, staff, and technical expertise.

In 1973, only 28% of jobs in the US economy required post-secondary education or training. By 2020, this share is projected to rise to 65%.[23] The labor market has largely responded to this shift in qualification standards, with the share of high school graduates enrolling in post-secondary degree or certificate-granting programs increasing from 26% in 1967 to 69% in 2019.[24]

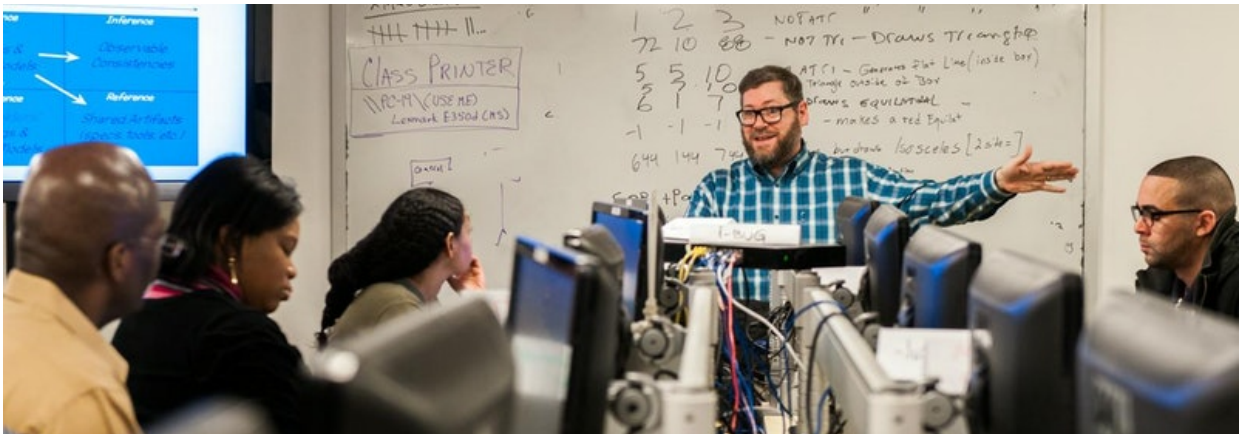
However, resources for higher-level training programs have not kept pace with the growth in demand for them. Department of Labor spending on workforce development has fallen by approximately 70% since the 1970s.[25] State and local governments have often struggled to come up with downstream funding alternatives, leaving resources for training and development disproportionately low compared to need.[26]

[23] Georgetown Center on Education and the Workforce. Recovery: Job Growth and Education Requirements Through 2020. 2013.
[24] National Academy of Science. Building America's Skilled Technical Workforce. Chapter 4: The Complex US System of Workforce Education and Training. 2017.
[25] Urban Institute. Workforce Development as an Anti-Poverty Strategy. 2008
[26] Urban Institute. Public Funding for Job Training at the State and Local Level. 2018

Long Island's leading workforce development entities are feeling the impact of this discrepancy between limited resources and heightened demand. This dynamic is obstructing organizations' ability to launch programs that target new skills and industries or increase the number of workers enrolled in their existing programs. A Long Island community college reported to JLP+D that their institution could double the number of participants in some of their vocational programs were it not for constraints on space, equipment, staff, and funding to address these shortages. This sentiment was echoed by other interviewees representing higher education, a nonprofit manufacturing training center, and the research sector.

The upshot is restricting the growth of Long Island's skilled workforce and diminishing the region's competitiveness in key industrial clusters. A new workforce development or job training initiative on Long Island should incorporate strategies for resolving resource deficits and granting effective programs the capacity to expand. Specifically, options may include providing auxiliary space and a cohort of industry experts that organizations can affordably tap as adjuncts. Such offerings could enable both companies and educators to easily offsite training activities and reduce the costs associated with program extension or increased enrollment.

Case Study: One of the primary ways to enhance the capacity of workforce development organizations is to provide low-cost space. The Link in Cambridge, Massachusetts offers a compelling model for this type of investment. Led by the Cambridge Redevelopment Authority, The Link is a workforce development center that connects job-seekers to training service providers as well as growing, innovative companies in the greater Boston area. It offers affordable classroom, cowork, and office space to nonprofit organizations who conduct training programs, such as Per Scholas, which operates some of its programming out of the facility.



Per Scholas is a nonprofit that provides free IT job training in cities across the country. The Link is home to Per Scholas' Greater Boston location. Image credit: Per Scholas

Looking Ahead: The Next Chapter of Regional Workforce Development

From work-based learning to online coursework, new strategies to improve education and training opportunities for American workers have been regularly developed over the past half-century. This is thanks to cities, states, and the federal government experimenting with innovative approaches to adapt workforce development (and the way it is delivered) to structural changes in the economy.[27] However, with the exception of the Workforce Innovation and Opportunity Act of 2014, public funding that encourages the creation and scaling of new policies and programs has largely stalled.

In recent years, the philanthropic sector has picked up the mantle and standardized a series of best practices for designing, implementing and assessing non-traditional workforce strategies. Their key component is shifting away from the "train and pray" model, where participants are taught a somewhat general range of skills in the hope that they find a job.[28] Instead, programs should develop data-driven curriculum that can respond to specific employment trends and skill gaps in opportunity-rich sectors, illustrated by available economic and workforce data. This approach is also conducive to effective monitoring and evaluation, establishing a clear understanding of "what works".[29]

Some of Long Island's workforce development stakeholders already appear to be operating in this manner. According to interviews JLP+D conducted over the course of the analysis, three colleges (one community and two 4-year) reported conducting periodic "environmental scans" and "needs assessments" to identify industry clusters on Long Island that could make use of specialized educational and vocational programs. These institutions stated that the exercise allows them to keep their offerings current and helps students secure jobs in their desired fields.

> *Cultivating a workforce development system that promotes experimentation is critical to ensuring that Long Island's workers have access to dynamic programs that address the changing skill demands of regional employers.*

[27] Upjohn Institute. Lessons Learned from Public Workforce Program Experiments. 2017
[28] Philadelphia Business Journal. Going Beyond 'Train and Pray' Jobs Initiatives. 2014
[29] Brookings Institution. Principles for Reforming Workforce Development and Human Capital Policies in the United States. 2013

Yet, they felt that resources were sometimes an obstacle to launching pilots and continuously improving services through experimentation. A new workforce development or job training initiative on Long Island could provide space or additional support for organizations seeking to test and build out new programs. Cultivating a workforce development system that promotes experimentation is critical to ensuring that Long Island's workers have access to dynamic programs that address the changing skill demands of regional employers.

The initiative itself can serve as a workforce development "incubator" that tests new methodological and pedagogical training approaches, partnerships and configurations of training assets, and talent development financing strategies.[30] Most importantly, it can allow training operators to explore programs for new vocations or disciplines in response to emerging occupations and industries. A number of states and regions around the country have been exemplary in developing and deploying experimental workforce training solutions of this sort:

- **The Alabama Department of Education** recently implemented "simulated workplace" requirements for all off-site training programs in order to promote the development of soft skills, familiarize workers with workplace procedures and protocols (safety, operations, etc.), and to generally reduce employees' on-the-job learning curves.[31]
- **Brooklyn Workforce Innovations (BWI)** revolutionized its partnerships model by working with business park managers such as the Brooklyn Navy Yard (BNY) rather than directly with employers. This improved the rate and quality of BWI's job placements post-training and helped BNY achieve its goal of increased local representation in its hiring pool, increasing the efficiency and positivity of outcomes for all parties.[32]
- **The Michigan New Jobs Training Program (MNJTP)** authorized community colleges to provide training services to employers who are creating net new jobs that pay at least 175 percent of state median wage at no cost. The training is paid for by bonding against then capturing the future state income tax associated with each new employee's wages. Since its inception in 2008, the program has served 194 employers and supported over 20,000 new jobs.[33]

[30] Brookings Institution. Talent-Driven Economic Development. 2019
[31] Alabama Department of Education. Simulated Workplace Operation Manual. 2019
[32] Aspen Institute. Investing in Workforce Program Innovation. 2018
[33] Brookings Institution. Talent-Driven Economic Development. 2019

- The **UpSkill Houston** initiative identified four rapidly-growing sectors in the metropolitan area, engaged nearly 100 employers within the sectors to identify their skills needs, and worked with local community colleges and training agencies to develop programs that prepare the workforce for the new job opportunities within these industries.[34]

Case Study: In 2012, the Aspen Institute and Capital One Foundation launched the Human Capital Innovation Fund (HCIF), which invested in building the capacity of five workforce development organizations pursuing experimental new strategies. The HCIF grant recipients not only developed and implemented new programs and partnerships but also increased the enrollment and effectiveness of their existing offerings. Extensive training and employment outcome data was collected from each participating organization.

Brooklyn Workforce Innovations (BWI) is a recipient of HCIF investment. BWI's "experiment" was to figure out how to connect long-time residents to new jobs created in the borough's rapidly expanding waterfront industrial parks. Image credit: Brooklyn Workforce Innovations

[34] Brookings Institution. Talent-Driven Economic Development. 2019

POTENTIAL COMPONENTS

FOR REGIONAL WORKFORCE DEVELOPMENT INITIATIVES

The Training Center
The Incubator
The Connector

Creating spaces, both physical and organizational, to test out new programs

POTENTIAL COMPONENTS

FOR REGIONAL WORKFORCE DEVELOPMENT INITIATIVES

Building on the findings from the analysis, JLP+D developed three prototypical components, asking how Long Island's workforce development stakeholders and assets can be reconfigured and supplemented in order to address reported challenges and prepare the region for its economic future. The components leverage the existing capacities and specialities of Long Island's industries, educational institutions, and public and nonprofit sectors and enhance them with the objective of cultivating a workforce development system that is flexible, equitable, creative, and bottom-up.

While each component is unique with different structures (both physical and organizational), sizes, funding requirements, and revenue generation opportunities, they are not mutually exclusive. All three could coexist and leverage the strengths of each other, or they could be phased as one large, comprehensive initiative. Moreover, these components are not intended to be prescriptive. Rather, they seek to help economic and workforce development administrators on Long Island develop new ways of strategic thinking that are grounded in Long Island-specific research as well as recommended best practices from other regions.

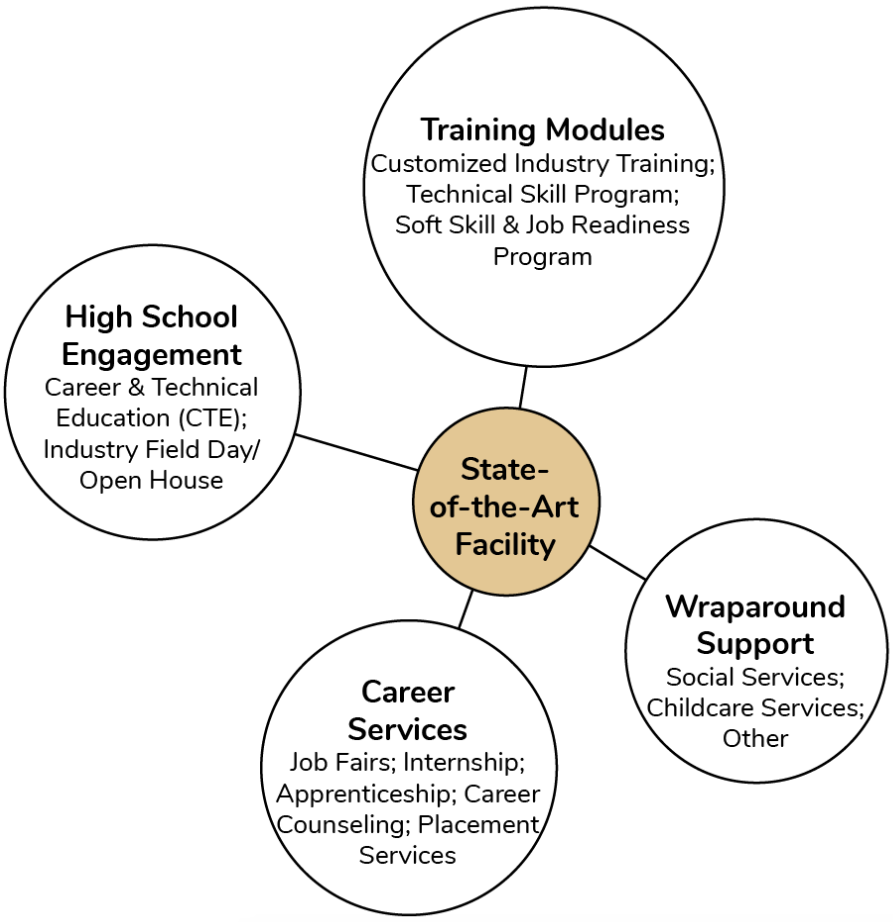
Component A: The Training Center

Rationale: Through interviews with workforce development stakeholders on Long Island, JLP+D identified three distinct yet related challenges: limited capacity due to resource constraints, geographic barriers to collaboration, and the lack of a clear, approachable "front door" for job-seekers, businesses and the public. Creating a centralized facility where different workforce training, education, and social support programs can co-locate and share resources may help resolve these issues. As mentioned in previous sections, co-location offers a number of benefits including the pooling of resources to invest in mutually beneficial assets (equipment, space, etc.), creating knowledge-sharing routines and joint knowledge, leveraging complementary resources and capabilities, lowering transaction costs, and promoting the effective governance of the workforce development system as a whole.

Description: The "Training Center" component seeks to develop an accessible, state-of-the-art facility that centralizes workforce development activity on Long Island and builds connections between industry, job-seekers, training organizations, and community groups. The Training Center's key feature is its provision of instruction, event, and office space where Long Island's existing workforce training stakeholders can maintain satellite locations,

securing affordable space to facilitate program expansion while reaping the benefits of co-location. The Training Center will also be home to, and/or contain a directory of, a number of support service providers including career counselors, case workers, and childcare. The majority of the facility's square footage, however, will be dedicated to three sections of training spaces, each allocated to a different set of stakeholders.

The first will be used as auxiliary technical instruction space for organizations who have a presence at the center, which can include two and four-year colleges and nonprofit training programs, among others. The second will house career and technical education (CTE) programming operated by local high schools and Long Island's BOCES, keeping the youth engaged in the Center's activities and industry presence. The third will be reserved for use in customized training modules that are developed for industry partners in the region who make financial contributions to the center. The curriculum for these bespoke programs will be designed by the same organization who will be created to manage the Center. All individuals enrolled in a program that operates out of the center will be required to take a soft skills ("job readiness") class and will have access to the career and wraparound services listed above.



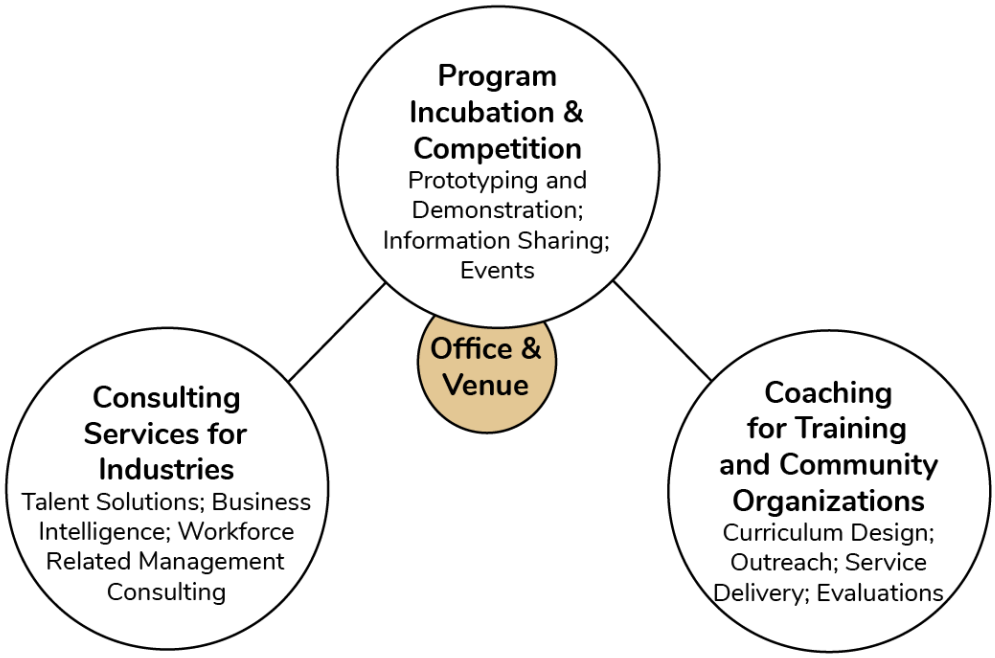
Elements		Stakeholder Roles	Funding Sources
State-of-the-Art Facility		- A local or regional public development corporation can coordinate the planning and development of the Training Center Facility. - Industry partners can make in-kind contributions of equipment.	Capital: Public; bond (backed by revenue generated through rental income)
Training Modules	**Technical Skill Programs**	- Organizations who operate existing vocational training programs (Suffolk County Community College, St. Joseph's College, Composite Prototyping Center, etc.) can locate some of their course offerings and maintain an office at the Center .	Operational: Revenue generation from tuitions; income share agreements with trainees; training center operating budget
	Soft Skill & Job Readiness Program	- Each of the training operators located within the facility will contribute an instructor to teach a session of the mandatory soft skills/job readiness course. This will distribute the burden of the course across all members of the center equally and minimize the budgetary constraints put upon the Center's managing entity.	
	Customized Industry Training Programs	- Establish a nonprofit organization who is charged with managing the Training Center and working with employers to design and execute customized training modules tailored to specific industry needs.	Operational: In addition to the above sources, revenue generation from industry contributions for customized training modules
High School Engagement	**Career & Technical Education**	- Long Island technical high schools and BOCES will be able to locate some of their coursework and other programming at the Center. - Industries provide access. - This will expose local students to alternative career pathways, provide them with soft skill instruction, and offer a number of readily accessible career planning resources.	Operational: Existing public education budgets - minimal direct costs to the new initiative or the Center's managing entity
	Industry Field Days & Open Houses		
Career Services	**Job Fairs**	- The Labor Departments of both Nassau and Suffolk Counties already appear to operate "one-stop" employment centers that offer career counseling and placement services. They can reallocate some of those resources and redirect some of those activities to the Center. - Industries provide access and participate in programs.	Operational: Training Center operating budget; public; philanthropy; revenue generation from industry contributions or sponsorship
	Internships		
	Apprenticeships		
	Career Counseling		
	Placement Services		
Wraparound Support	**Social Services**	- Local and regional nonprofits and community partners such as the United Way of Long Island and The Community Program Centers of Long Island can provide some of these services on-site.	Operational: Existing budgets of partner organizations supplemented by philanthropy - minimal direct costs to the new initiative or the Center's managing entity
	Childcare Services		

Component B: The Incubator

Rationale: Business incubators are typically designed to help entrepreneurs resolve some of the problems commonly associated with starting a new venture, securing expedited access to critical inputs such as workspace, preliminary funding, and a mentorship network. Workforce training organizations on Long Island have reported encountering the same obstacles when seeking to develop new programs that respond to emerging skill sets, occupations and industries. Creating an "incubator" that works with stakeholders to nurture and develop their initial needs and ideas into full-fledged programs can help the Long Island workforce training system remain dynamic and capable of regular evolution.

Description: The Workforce Development "Incubator" component is focused on increasing collaboration between industry and workforce training organizations in order to promote the development, adoption, and scaling of new and innovative programs that both anticipate and respond to changes in the Long Island economy. While the Incubator will require a modest physical space, the component's distinctive element is the expertise of its staff and board, which will be comprised of seasoned experts from Long Island's high-growth industries, educational administrators, and representatives from Long Island's public and nonprofit sectors. Both will play a critical role in accomplishing the Incubator's primary objective: helping workforce training organizations identify opportunities for new programs, design a curriculum for them, and test their effectiveness. This work will be conducted through an annual cohort-based program as well as pro-bono coaching projects on a case-by-case basis.

In addition, the Incubator will also manage regional competitions in which workforce training organizations are tasked with generating ideas for new programs that address policy priorities (such as offshore wind and related industries) and/or specific industry skill needs. These competitive processes will likely be sponsored by businesses or philanthropic partners and include grant-based funding for scaling up and dissemination. Much of the Incubator's activity will be funded using the revenue generated by its consulting service, where industry partners hire members of the Incubator's staff on a contractual basis and leverage their knowledge to develop customized talent development and deployment solutions for their business. No full-scale teaching or training will take place at the incubator (only pilot sessions for evaluative purposes).



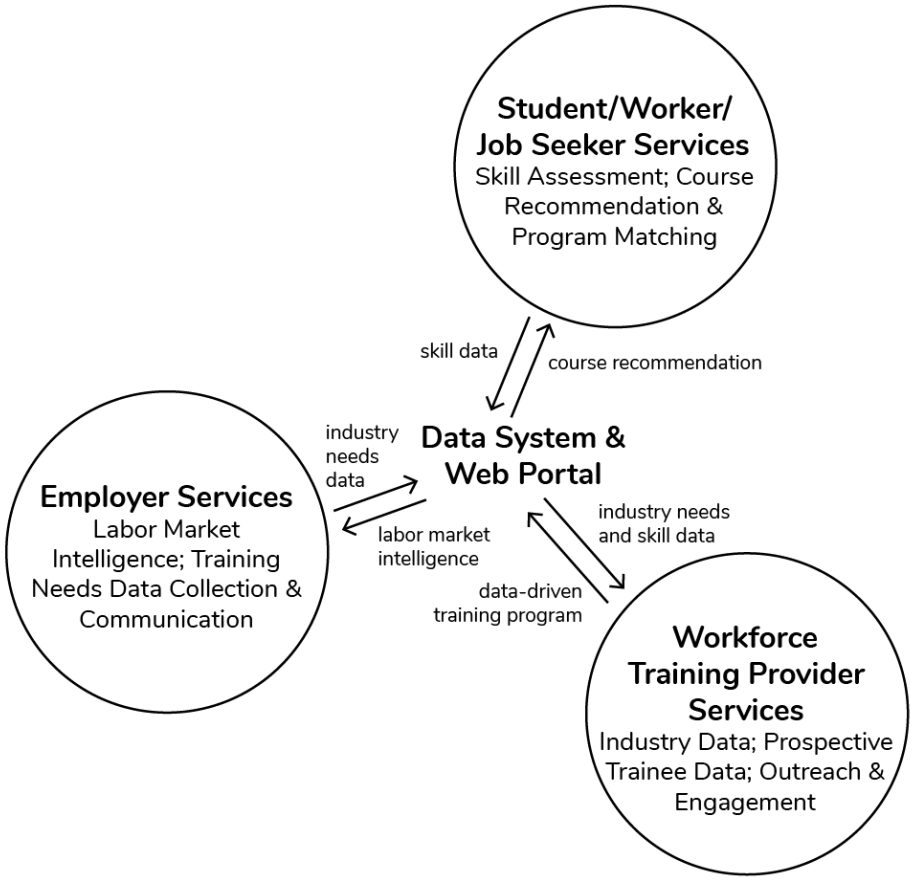
Elements		Stakeholder Roles	Funding Sources
Office & Venue		- Establish a nonprofit organization through which the Incubator can operate. Rent out or retrofit an existing office or multi-purpose space.	Operational: Incubator operating budget; foundation grant if capital investment is needed
Program Incubation & Competition	**Prototyping and Demonstration**	- Bring in an annual cohort of workforce training organizations who are seeking to develop new programs, help them design a curriculum, and test their effectiveness. - Host competitions in which workforce training organizations are tasked with generating ideas for new programs that address policy priorities (such as offshore wind) and/or specific industry skill needs.	Operational: Incubator operating budget; foundation grant; revenue generation from industry and philanthropy-sponsored competitions
	Information Sharing		
	Events		
Consulting Services for Industries	**Talent Solutions**	- Incubator staff is hired by industry partners to help them develop customized talent development and deployment solutions for their business, provide labor market intelligence, or offer broader workforce-related management consulting services.	Operational: Revenue generation from client payment
	Business Intelligence		
	Workforce Related Management Consulting		
Coaching for Training and Community Organizations	**Curriculum Design**	- Incubator staff works with training program operators (primarily educational institutions and nonprofits) to help them design curricula for new programs or improve the effectiveness and capacity of their existing programs via the introduction of data-driven monitoring and evaluation techniques, etc.	Operational: Incubator operating budget
	Outreach		
	Service Delivery		
	Evaluations		

Component C: The Connector

Rationale: Long Island has a number of highly capable workforce training organizations that seek to equip trainees with skills and place them in jobs in related fields. However, communication barriers between these organizations and industries appear to inhibit the development of training programs that address the most pressing skill needs, fill industry hiring gaps, and fulling incorporate future business and employment trends. Moreover, students and job seekers similarly lack proper information regarding their own skill gaps, training programs, and alternative career pathways. As a result, an entity is needed to collect and disseminate industry skill needs data, reports on the workforce's existing skill palette ("labor market intelligence"), and descriptions of available training program options, serving as a conduit between businesses, job-seekers, and training program operators.

Description: The "Connector" component creates a digital "front door" for the Long Island workforce development system, improving the quality and timeliness of the data that flows throughout it and increasing its navigability for job-seekers, industry partners, and training organizations alike. Effectively, the Connector is an ever-evolving live database that collects information on the labor market and workforce development system (skill and credential assessments from job-seekers; skill needs from employers; program registrars from training operators) and centralizes it all in a user-friendly web portal that can be easily accessed. The Connector's primary objective is to break down the information barriers that create inefficiencies within the Long Island workforce development system, helping training providers develop targeted, data-driven programs, employers articulate and address hiring gaps, and job-seekers understand the utility of their own skills identify training programs that can effectively place them on a desired career track.

The Connector has lower capital requirements than both Components A and B, requiring only the establishment of a small organization and staff who are tasked with the initial development of the web portal and monitoring to ensure the quality of all data and information reported through it. Revenue can be generated from both the industry and trainee sides, with the former subscribing for regular labor market intelligence insights and an effective outlet for reporting skill needs; the latter paying user fees for skill and credential assessment and training program recommendations (however, the fees can be subsidized or waived for low-income individuals and students).

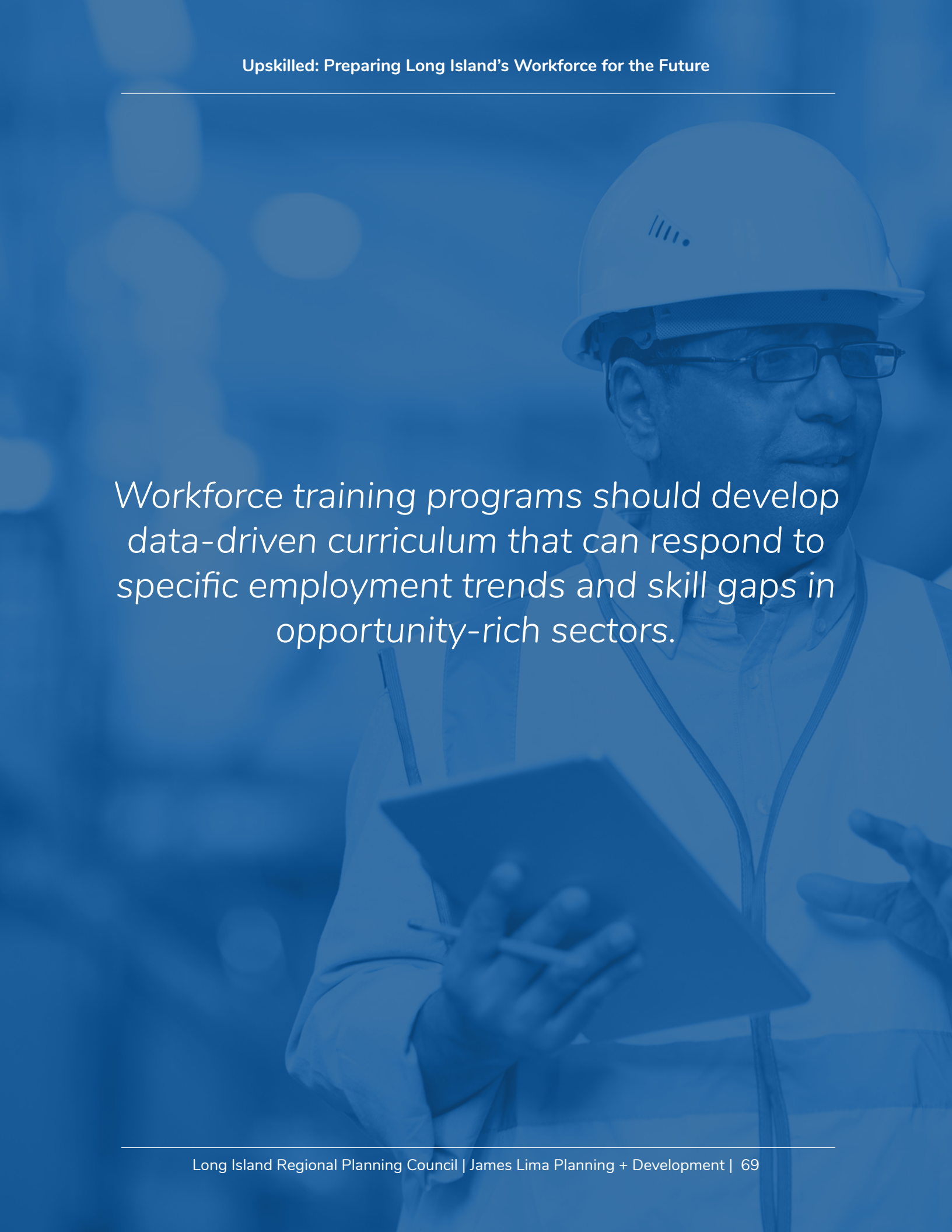


Elements		Stakeholder Roles	Funding Sources
Data System & Web Portal		- Hire a small staff consisting of web developers, data managers, and a handful of workforce development experts who can create and maintain the Connector.	Capital: Foundation grant
Student/Worker/Job Seeker Services	**Skill & Credential Assessment**	- Students, workers, and job-seekers use the Connector, inputting their existing skills, credentials, and industries of interest. - In return, prospective trainees receive a report that informs them what types of roles they are currently suited for and what available programs can help them prepare and attain qualification for a desired career path.	Operational: Revenue generation from user fee (subsidy or waiver available)
	Course Recommendation & Program Matching		

Employer Services	**Labor Market Intelligence** **Training Needs Data Collection & Communication**	- Employers subscribe to the Connector, reporting their hiring needs as well as the skill gaps that exist among candidates. - In return, employers gain access to the skill palette ("labor market intelligence") reports that are generated via the job-seeker assessments. This information can help employers develop more effective talent development and deployment strategies.	Operational: Revenue generation from membership subscription
Workforce Training Provider Services	**Industry Data** **Prospective Trainee Data** **Outreach & Engagement**	- Workforce training organizations can access both the industry and job seeker-generated data, using it to develop targeted programs that address gaps and increase placement efficiency, subsequently using the data to evaluate program effectiveness. The data can also signal industries and populations that training organizations need to reach out to and better engage with.	Operational: Connector operating budget

QUANTITATIVE DATA ANALYSIS

Key Industry Clusters
Diverse Skill Levels, Career Paths, and Training Needs
Regional Skill Palette
Benchmark Analysis
Identification of Training Needs



Workforce training programs should develop data-driven curriculum that can respond to specific employment trends and skill gaps in opportunity-rich sectors.

QUANTITATIVE DATA ANALYSIS

JLP+D conducted quantitative analyses of workforce characteristics and industry trends to understand the skill gaps that exist on Long Island and identify training needs for the region.

According to the analysis, the majority of Long Island's current workforce is employed in local services. Key tradable industry clusters, which are of strategic importance to the region's long-term economic growth, have skill requirements that are different from local services. The mismatch between Long Island's current skill palette and the demand for specialized workers is evident across tradable clusters and has implications for jobs of both high and low educational requirements. Workforce training should thus identify and target skills that are in demand by tradable clusters, provide quality career opportunities for the diverse population, and are in short supply from Long Island's current workforce.

The quantitative analysis processed a wide range of data to identify training needs for Long Island's key clusters. The results are summarized below. Appendix 2 provides the results of detailed analysis for each industry cluster and the documentation and explanation of respective data source and methodology.

Key Industry Clusters

JLP+D's quantitative analysis groups industries into "industry clusters" based on Harvard Business School's U.S. Cluster Mapping Project. Within each industry cluster, different industries and firms share inputs and supply chains, benefit from the labor pooling effect of specialized workforce, reduce transportation costs, and share the technology, knowledge, and information that boost productivity. For these reasons, industry clusters, as a lens to study local and regional economies, capture the dynamics of agglomeration and are instrumental in defining a region's competitive advantages.

This report focuses on the workforce training needs of eight key *tradable* clusters of Long Island. Tradable clusters, different from local clusters, are groups of industries that export goods and services to other regions. They are the subjects of this study because of their importance in a region's long-term economic growth. It is the tradable clusters that "bring outside money in", and a healthy mix of diverse export-oriented industry clusters can enhance the resilience of the regional economy.

The eight key clusters being analyzed in this report are: **aerospace and defense; biopharmaceuticals; business services; construction products and services; distribution and e-commerce; financial services; food processing and manufacturing; information technology and analytical instruments**.

These clusters are selected because they satisfy one or more of the following criteria: 1) providing large employment base on Long Island, 2) being highly specialized on Long Island; 3) experiencing substantial job growth; and 4) its rate of job growth outperforming the national average in the same time period.[35]

The table below summarizes the main statistics of the key clusters selected for the workforce training analysis.[36]

Characteristics of the Key Clusters				
Key Cluster	**Employment (2017)**	**Specialization (2017)**	**Regional Job Growth Rate (2013-2017)**	**National Job Growth Rate (2013-2017)**
Aerospace	4.4 thousand	Specialized within the State	-2%	-3%
Biopharma	10.1 thousand	Specialized in the U.S.	-1%	+5%
Business Services	51.2 thousand	Not specialized	+4%	+12%
Construction	3.3 thousand	Not specialized	+75%	+8%
Distribution	49.9 thousand	Specialized within the State	-1%	+10%
Finance	16.1 thousand	Similar to the U.S. average	+2%	+3%
Food Processing	1.2 thousand	Not specialized	+120%	+14%
IT	6.6 thousand	Not specialized	-6%	+7%

The scope of this report focuses on the tradable sectors that export goods and services to other regions. Separate studies would be needed to analyze the skill gaps and training needs of other large and important industries on Long Island, such as healthcare and local education.

[35] These criteria would also identify Education and Research as one of the key clusters for Long Island. It is not included in this report because the focus of the analysis is to identify workforce training needs faced by industry clusters. Education, on the contrary, is a provider of training services.
[36] Data source: U.S. Bureau of Labor Statistics (Quarterly Census of Employment and Wages).

Diverse Skill Levels, Career Paths, and Training Needs

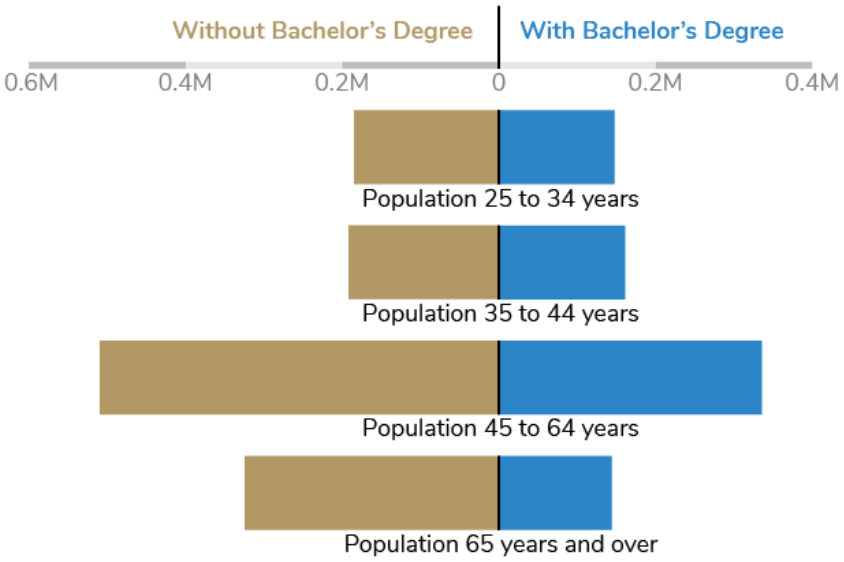
On the population side, Long Island's demographic and educational attainment composition provides both opportunities and challenges for the growth of key industry clusters. Long Island's population on average is highly educated, with approximately 45% of its prime working age population (ages 25-44) holding a bachelor's degree (approximately 50% higher than the national average).[37]

This finding often papers over the fact that the remaining 50%+ of Long Island's workers without a bachelor's degree are overwhelmingly separated from key tradable sector jobs that can provide an upward career trajectory and stable living in a high-cost environment like Long Island. The share of workers lacking a bachelor's is even higher among Long Island's growing minority communities. As the data suggests, approximately three-quarters of Long Island's black population does not hold a bachelor's degree. The figure is over 80% for Long Island's Hispanic and Latino population.[38]

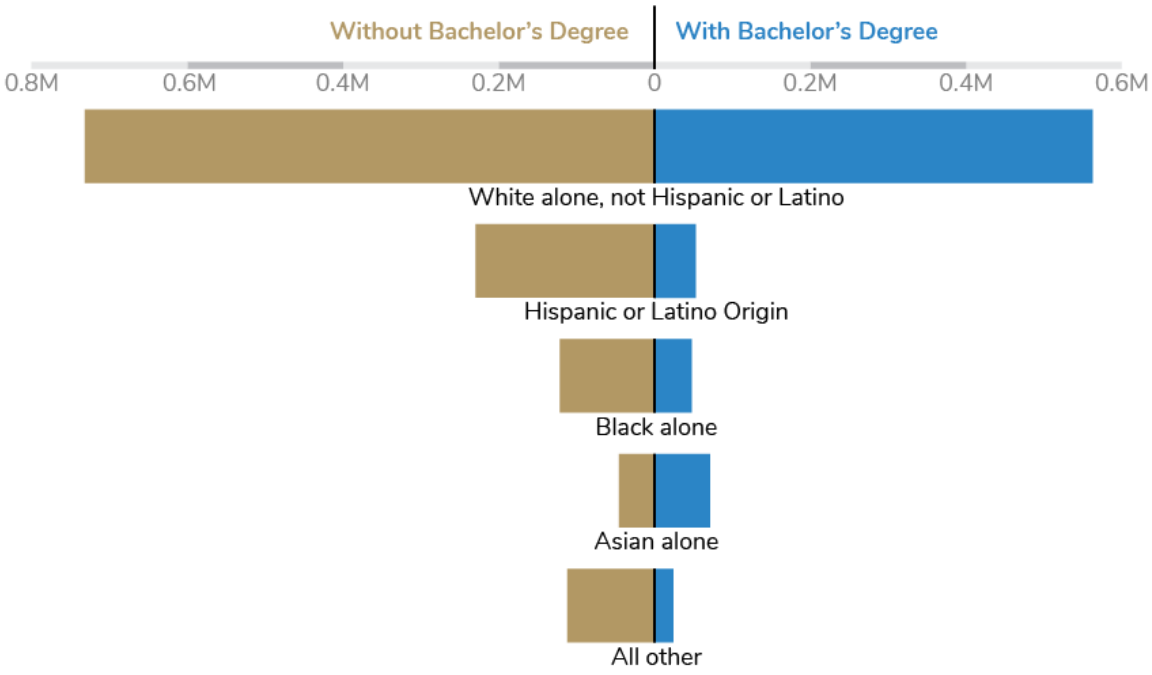
Effective workforce training and skill credential programs that prepare sub-baccalaureate workers for good-paying jobs in high-growth industries are a critical tool for both promoting equity and transitioning the Long Island economy into more tradable sectors. "Talent development" initiatives should be oriented around goals beyond the attraction and retention of "knowledge economy" workers. Recognizing the diverse population present on Long Island, the region should give proper focus on maximizing the productive and earnings potential of its sub-baccalaureate workers. In JLP+D's analysis, we analyze both jobs of higher educational requirement and those of lower requirement, and provide insights of skill gaps and training needs for both categories.

[37] National Science Foundation. Bachelor's Degree Holders Among Individuals 25-44 Years Old. 2019
[38] Data Source: American Community Survey (2013-2017)

Distribution of Long Island Population
By Age and Educational Attainment



Distribution of Long Island Population
By Race and Educational Attainment



Regional Skill Palette

The key clusters for Long Island, despite their importance for economic growth, do not represent the current majority of employment in the region. In fact, 77% of current jobs on Long Island are in the local, rather than tradable, part of the economy.[39] Specifically, most workers of Long Island are employed by local health services, local hospitality, local commercial services, and local real estate construction, among other local service industries.

It is in this context that workforce training, as a key component in the region's overall economic development toolkit, is a means to transform the regional economy and prepare Long Island's local service workers, who are the majority of the region's current workforce, to take up jobs in the growing tradable clusters that are of strategic importance.

Tradable cluster jobs require different skill sets compared with jobs in local services. In order to identify the greatest training needs for Long Island, one needs to first understand the existing skills palette of the region, by asking: Given the current employment and industry patterns of Long Island, what kind of skills are presumably possessed by the people? In order to foster the growth of Long Island's tradable clusters, which skills need to be augmented by training?

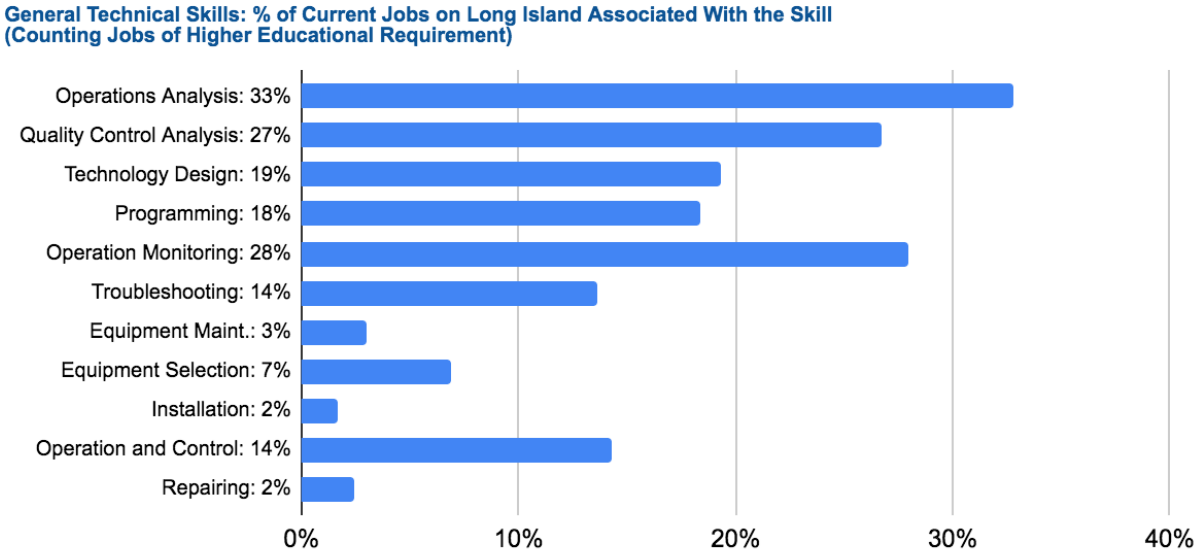
To answer the first question, JLP+D conducted quantitative data analysis to paint a snapshot of the current skill palettes of Long Island's workforce, utilizing employment data from New York State Department of Labor and skill data from O*NET (Occupational Information Network), the nation's primary source of occupational information. Included in the analysis are four types of skills: 1) general technical skills, 2) knowledge, 3) software skills, and 4) skills to use specialized tools. Soft skills are a very important aspect of the contemporary workplace; however, due to the lack of reliable quantitative data, they are not addressed in the quantitative section of the analysis. For all parts of the quantitative analysis, jobs are divided into two groups: 1) jobs that typically require a Bachelor's degree or above (hereby as "higher educational attainment"), and 2) jobs requiring less than a Bachelor's degree (hereby as "lower educational attainment").

[39] Data source: Data source: U.S. Bureau of Labor Statistics (Quarterly Census of Employment and Wages). Cluster definition: Harvard Business School (U.S. Cluster Mapping Project).

General Technical Skills

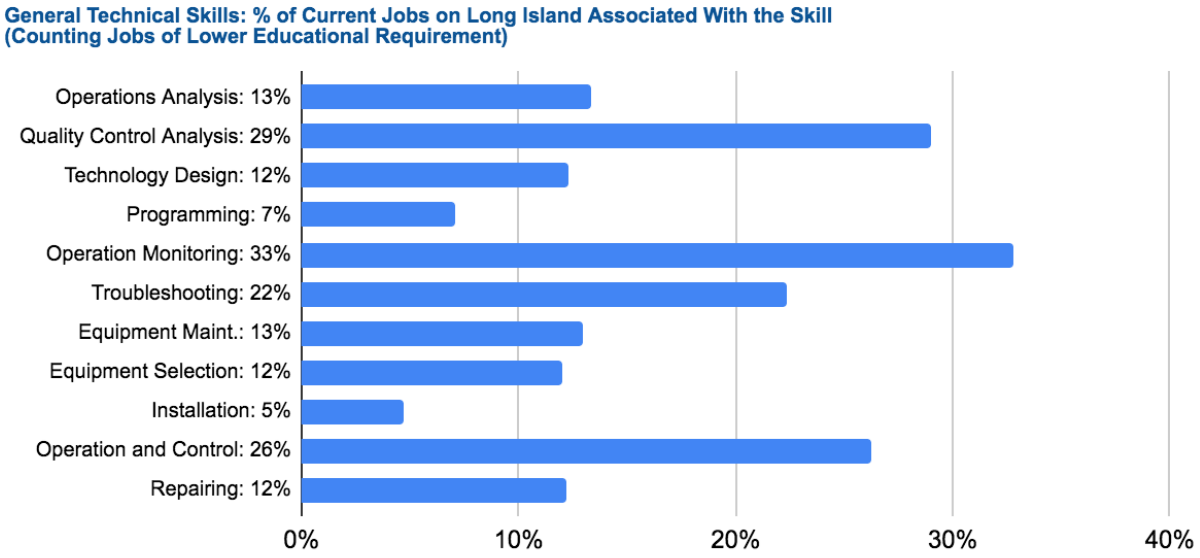
O*NET reports 11 categories of general technical skills, which refer to the general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.

According to the analysis, and as shown in the chart below, for jobs of higher educational requirement, 33% of Long Island's current workers in this group are likely to deploy the skill of operations analysis (with various degrees of proficiency) in their jobs.[40] Other prevalent general technical skills for jobs of higher educational requirement are operation monitoring and quality control analysis (these skills are each associated with more than 20% of Long Island's current job base in the higher educational requirement group).[41]



[40] This does not mean that 33% of workers have the particular skill. The data suggest that 33% of the current occupations are supposed to require its workers to use such a skill in the job.
[41] The percentages add up to more than 100% because a job can be associated with more than one skills. This applies to all categories.

Jobs of lower educational requirement are associated with the respective skill categories in different ways. Operations analysis, which is associated with 33% of current jobs of higher educational requirement, is only associated with 13% of current jobs of lower educational requirement. As shown in the chart below, the main skills for this group are: operation monitoring, quality control analysis, operation and control, and troubleshooting (these skills are each associated with more than 20% of Long Island's current job base in the lower educational requirement group).

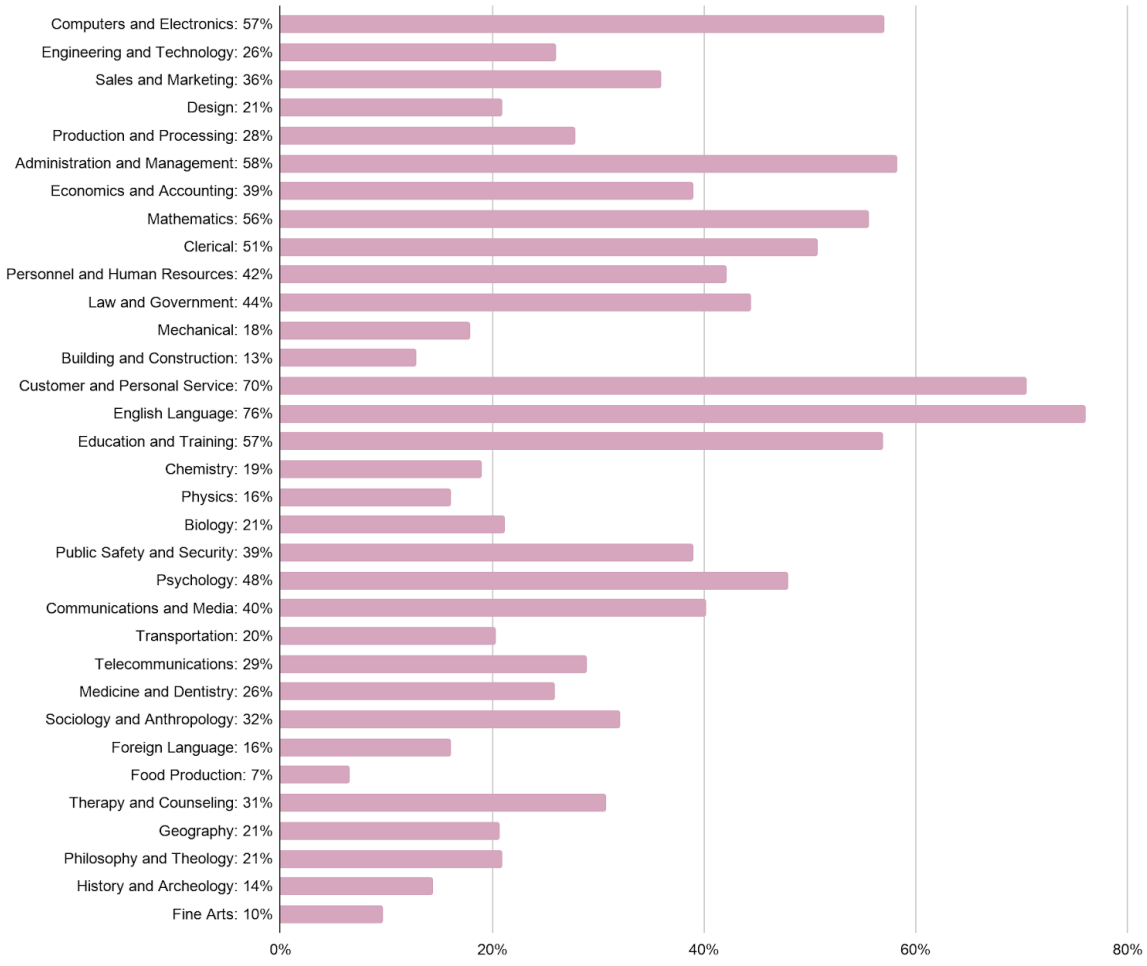


Knowledge

O*NET reports 33 categories of knowledge, which refer to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications. Detailed explanations of these subjects are available in Appendix 3.

According to the analysis, and as shown in the chart below, for jobs of higher educational requirement, the top 5 knowledge categories are: English; customer and personal service; administration and management; computer and electronics; and education and training (measured by the percentage of current jobs in this group that are associated with the skill).

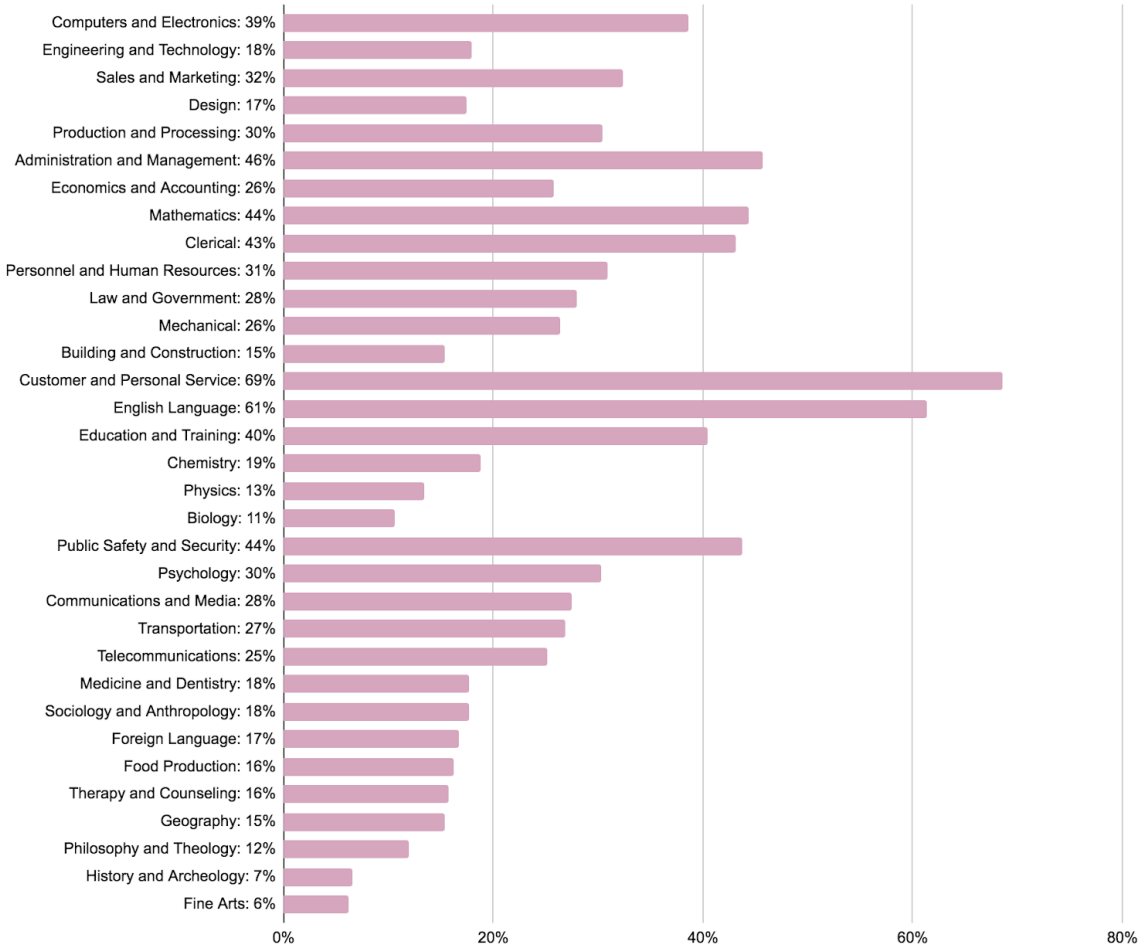
Knowledge: % of Current Jobs on Long Island Associated With the Knowledge (Counting Jobs of Higher Educational Requirement)



For jobs of lower educational requirement, according to the analysis, and as shown in the chart below, the top 5 knowledge categories are: customer and personal service; English; administration and management; mathematics; and public safety and security (measured by the percentage of current jobs in this group that are associated with the skill).

Though the categories do repeat from the previous group to this one, their statistics are different. Administration and management is associated with 58% of current jobs on Long Island that require a Bachelors' degree or above; it is associated with only 46% of all jobs of lower educational requirement. The biggest differences exist in the following subjects: computers and electronics (57% in the higher educational requirement group > 39% in the lower educational requirement group); psychology (48% in the higher educational requirement group > 30% in the lower educational requirement group); education and training (57% in the higher educational requirement group > 40% in the lower educational requirement group).

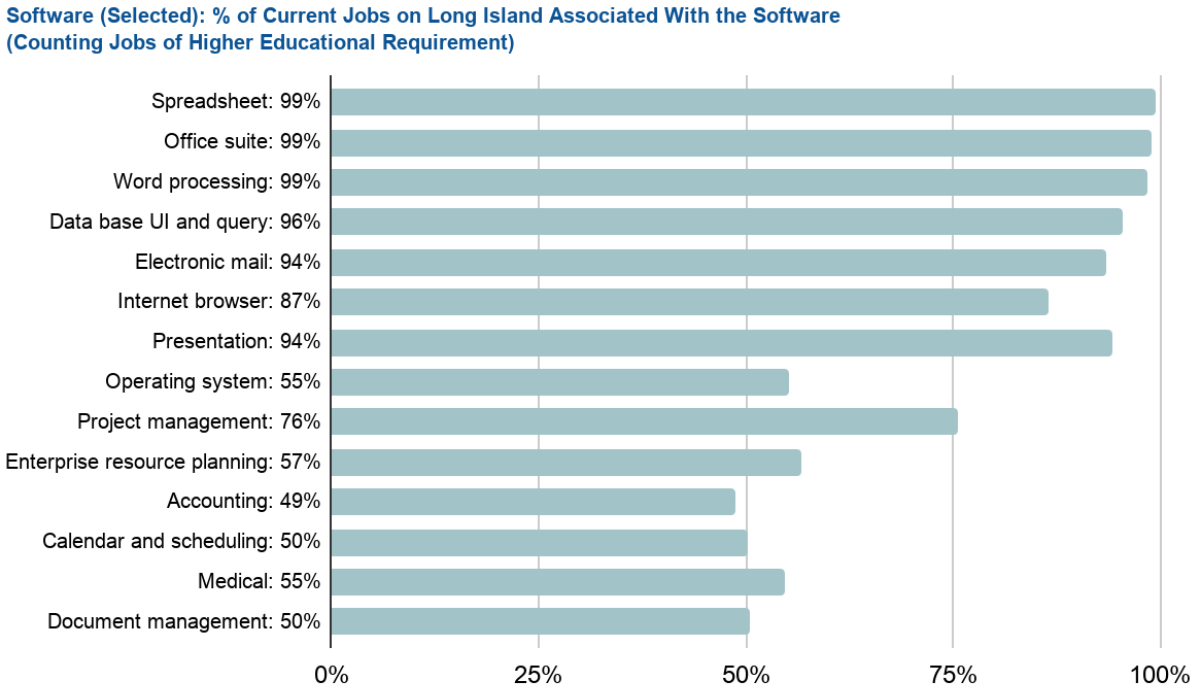
Knowledge: % of Current Jobs on Long Island Associated With the Knowledge (Counting Jobs of Lower Educational Requirement)



Software

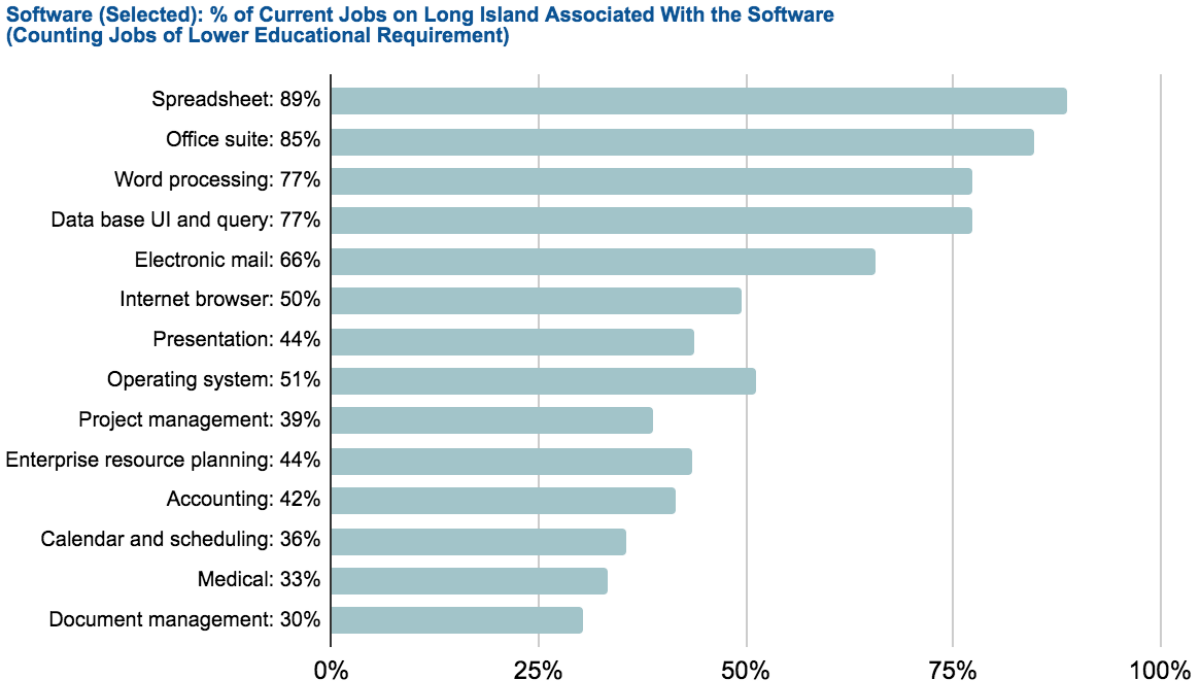
O*NET reports 127 types of software applications. A detailed list of examples is available in Appendix 3.

For jobs of higher educational requirement, according to the analysis, the top 5 software categories are: spreadsheet; office suite; word processing; data base user interface and query; and presentation (measured by the percentage of current jobs in this group that are associated with the skill). The chart below shows the statistics for 15 software categories most frequently associated with the overall employment base on Long Island (regardless of educational requirement); while all 127 software categories are analyzed, due to space limitation, not all of them are represented in the chart.



For jobs of lower educational requirement, software use is generally lower than for the other group. According to the analysis, the top 5 software categories are: spreadsheet; office suite; word processing; data base user interface and query; and email (measured by the percentage of current jobs in this group that are associated with the skill). The chart below shows the statistics for 15 software categories most frequently associated with the overall employment base on Long Island (regardless of educational requirement); while all 127 software categories are analyzed, due to space limitation, not all of them are represented in the chart.

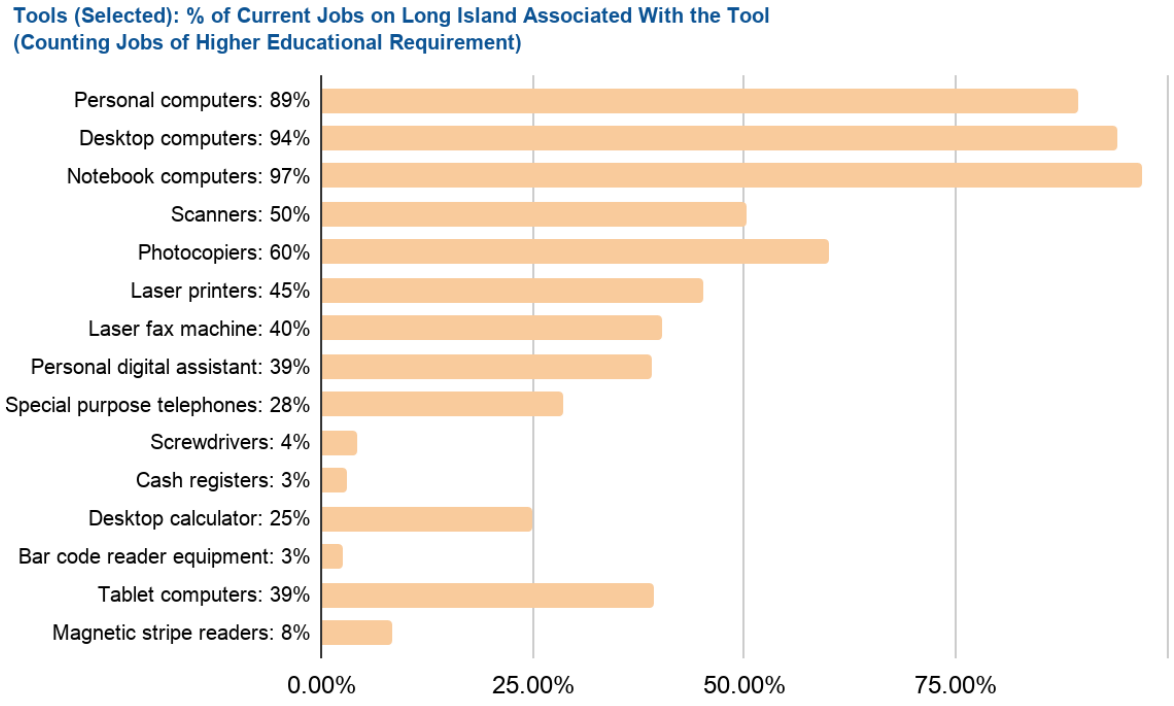
Though the categories do repeat from the previous group to this one, their statistics are different. Spreadsheet software is associated with 99% of current jobs on Long Island that require a Bachelors' degree or above; it is associated with 89% of jobs of lower educational requirement. The biggest differences exist in the following categories: presentation software (94% in the higher educational requirement group > 44% in the lower educational requirement group); analytical or scientific software (59% in the higher educational requirement group > 19% in the lower educational requirement group); information retrieval or search software (56% in the higher educational requirement group > 16% in the lower educational requirement group).



Tools

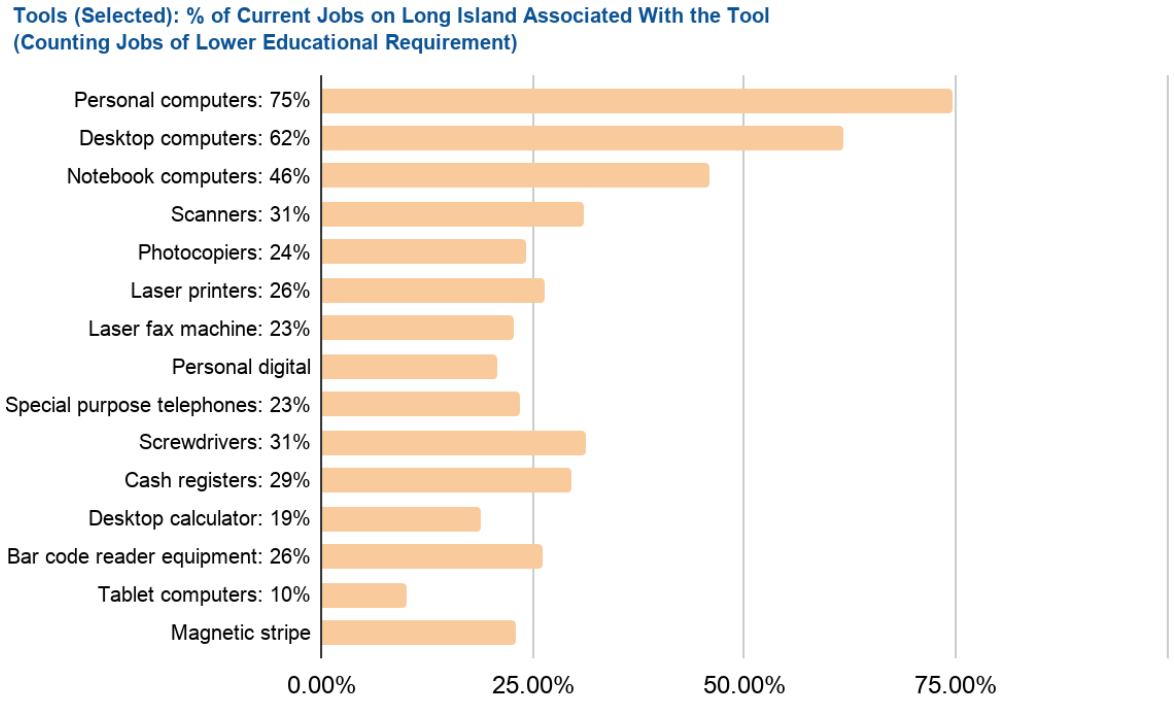
O*NET reports 4,180 types of machines and tools. A detailed list of examples is available in Appendix 3.

For jobs of higher educational requirement, according to the analysis, the top 5 tool categories are: computers, photocopiers, scanners, laser printers, and fax machine (measured by the percentage of current jobs in this group that are associated with the skill). The chart below shows the statistics for 15 tools most frequently associated with the overall employment base on Long Island (regardless of educational requirement); while all 4,180 categories are analyzed, due to space limitation, not all of them are represented in the chart.



For jobs of lower educational requirement, according to the analysis, the top 5 tool categories are: computers, screwdrivers, scanners, cash registers, and laser printers (measured by the percentage of current jobs in this group that are associated with the skill). The chart below shows the statistics for 15 categories most frequently associated with the overall employment base on Long Island (regardless of educational requirement); while all 4,180 software categories are analyzed, due to space limitation, not all of them are represented in the chart.

Though the categories do repeat from the previous group to this one, their statistics are different. Notebook computer is associated with 97% of current jobs on Long Island that require a Bachelors' degree or above; it is associated with only 46% of jobs of lower educational requirement. This type of difference exists in all the top 5 tools of the two groups.



The data of Long Island's existing skill palette provides a basis for the assessment of skill gaps and the identification of training needs.

Benchmark Analysis

For each industry cluster, a benchmark region is selected to compare job statistics with Long Island. The benchmark region satisfies one or more of the following criteria: 1) the size of the cluster is large (measured by employment); 2) it experienced substantial employment growth; and 3) it is a leader in innovation for the respective industry cluster. The selected benchmark regions are listed in the table below:

Benchmark Regions for Industry Clusters	
Cluster	Benchmark Region
Aerospace	St. Louis MO-IL MSA
Biopharma	San Francisco CA MSA
Business Services	San Jose CA MSA
Construction	Washington DC MSA
Distribution	Riverside CA MSA
Finance	San Francisco CA MSA
Food Processing	Los Angeles CA MSA
IT	San Francisco CA MSA

JLP+D analyzed job posting data in the benchmark region and compared them with the recent job postings of the same period on Long Island. This comparative analysis of hiring needs revealed key differences related to the industries' growth patterns, competitive advantages, and specialized labor skills.

For instance, on Long Island, in the biopharmaceutical cluster, inspectors are one of the most in-demand positions in the higher educational requirement group.[42] In the San Francisco CA MSA, postings for inspectors did not make the region's top 10 list; instead, biopharma companies are hiring a different set of specialized occupations, such as natural science managers (14% of postings in the region's top 10) and medical scientists (11% of postings in the region's top 10). This kind of difference in hiring needs is observable, to various degrees and with differential implications, across all the key industry clusters studied in this report. For more details, see findings in Appendix 2.

[42] Inspectors (including testers, sorters, samplers, and weighers) represent 13% of the top 10 occupations in the region's job postings (requiring a Bachelor's degree or above).

The difference in hiring needs between Long Island and the benchmark region is important and should inform the region's workforce development priorities. On the one hand, it essentially speaks to the difference in the kind of products and services produced and exported by firms, which relates to the region's position in the global value chain and the overall industry competitiveness.

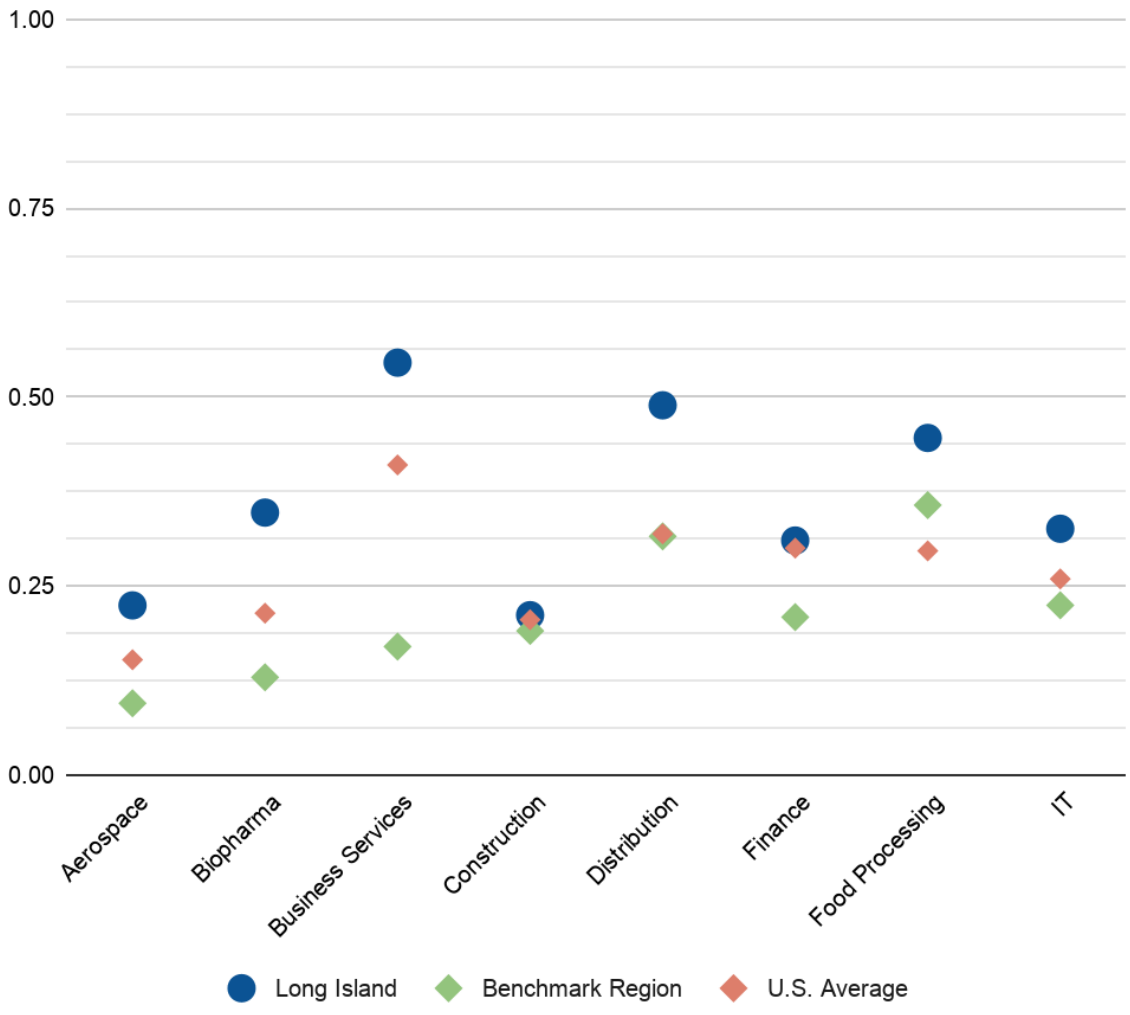
On the other hand, as computers, artificial intelligence, and robotic technology begin to replace a portion of the human workforce, some occupations face larger automation risks than others. For instance, according to the seminal Oxford University study on automation, "The Future of Employment: How Susceptible are Jobs to Computerisation?", the probability of automation in the next 20 years for inspectors is 0.98; the probabilities of automation for natural science managers and medical scientists are 0.018 and 0.0045, respectively. So it is appropriate to say that inspectors face high automation risks, while natural science managers and medical scientists face low automation risks.

This report gathered data for all the selected key clusters and analyzed the automation risks of their in-demand occupations. For each cluster, three geographies are compared: Long Island, the benchmark region, and the U.S. average. Two groups of occupations, those of higher educational requirement and those of lower requirement, are studied.

The chart below summarizes the automation risks of top 10 in-demand occupations that require a Bachelor's degree or above for Long Island's key clusters, with comparative statistics of the benchmark region and the national average.

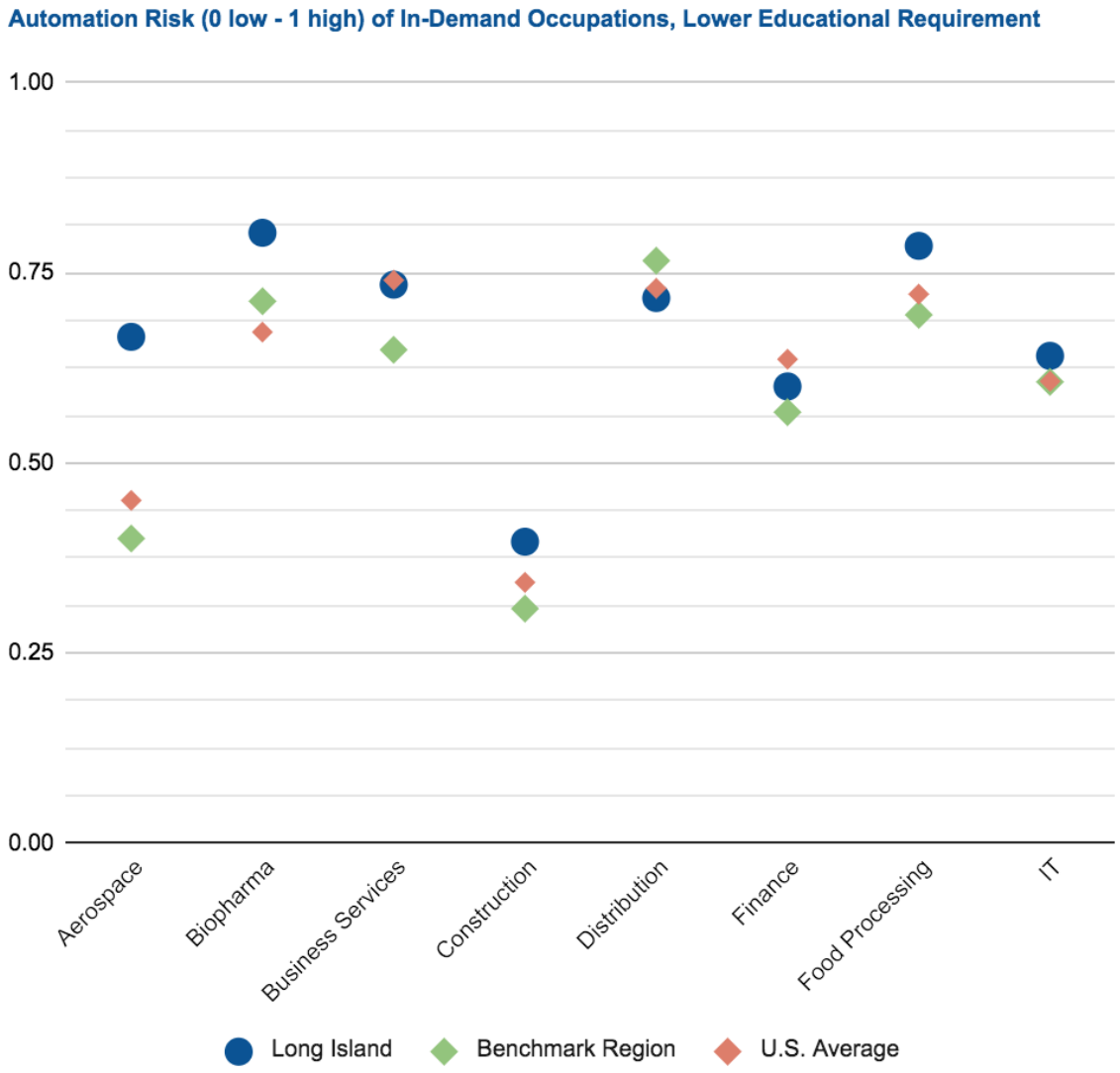
The data suggests that for all clusters included in the analysis, Long Island faces a higher risk of automation than the other geographies. The biggest difference occurs in business services, where the average automation probability of Long Island's in-demand occupations of higher educational requirement is 0.55, whereas the automation probabilities of in-demand occupations are 0.41 for the U.S. and 0.17 for the benchmark region. The smallest difference is observed in construction and financial services, where the Long Island statistics are similar to the respective U.S. averages.

Automation Risk (0 low - 1 high) of In-Demand Occupations, Higher Educational Requirement

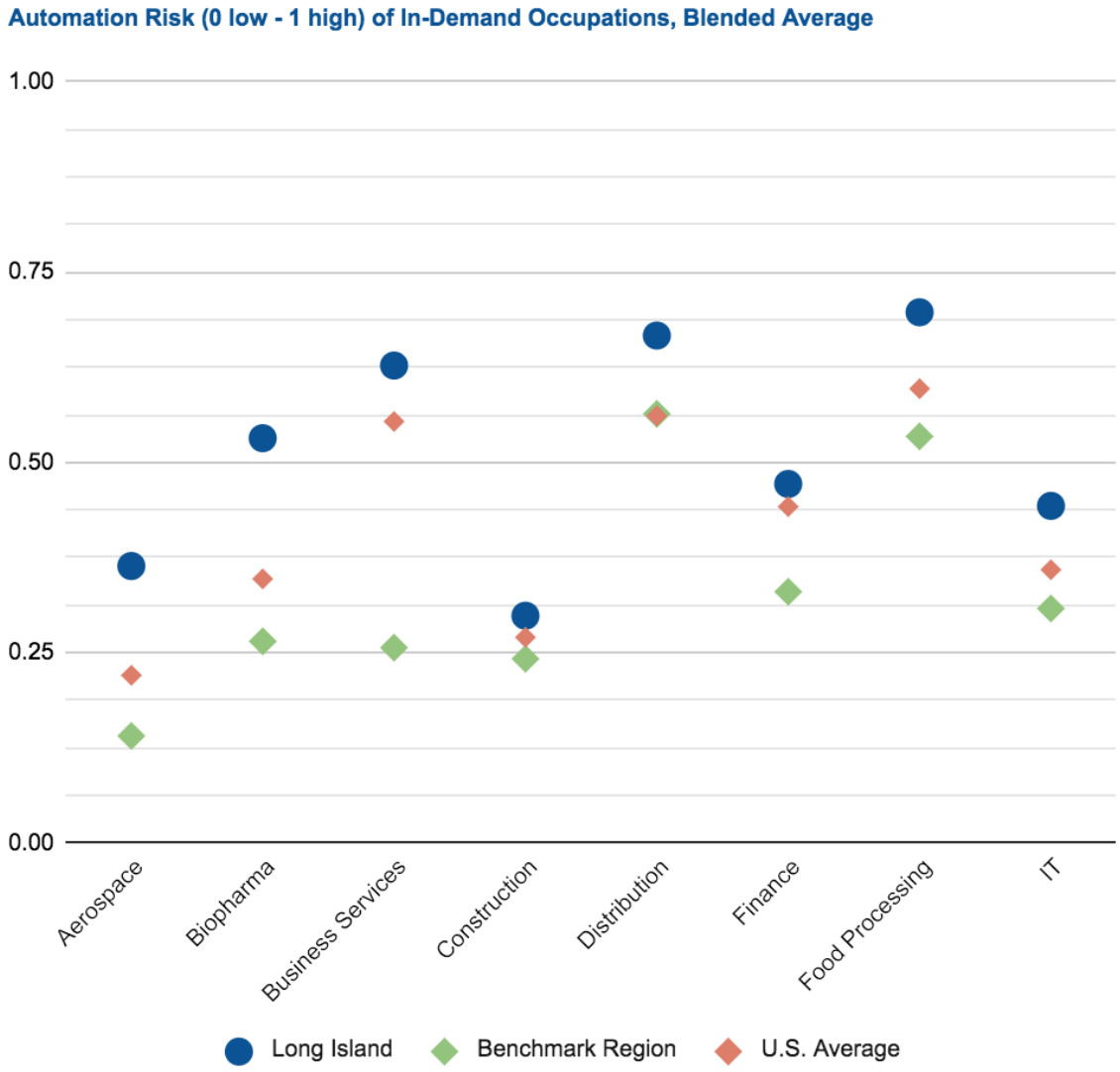


For jobs of lower educational requirement, the automation risks are generally higher than for jobs of higher educational requirement. As shown in the chart below, for most of the key industry clusters, Long Island faces a higher risk than both the U.S. average and the benchmark regions.

The exceptions are business services, distribution, and finance. For business services and finance, although Long Island's risk is still higher than the benchmark regions', the U.S. average risks are the highest out of the three geographies. For the distribution cluster, the automation probability for in-demand occupations of lower educational requirement on Long Island is smaller than those of the national average and the benchmark region.



The chart below depicts the blended average of automation risks (both educational requirements) for the three geographies. In general and observed in all the clusters, Long Island faces a larger risk of automation than the U.S. average and the benchmark region.



Identification of Training Needs

The need for workforce training originates from the mismatch between the skillsets of the current workforce on Long Island and the demand of key industry clusters. Given that the majority of the region's employment is in the local service industries, and that performing job duties in local services might require a different set of skills than in tradable clusters, it is imperative for the region's training program to target the specific set of skills that:

1. Is of strategic importance for the key industry clusters, which means that the clusters have demand for such skills, and
2. Has the biggest gap measured against Long Island's current workforce skill palettes, which means that Long Island is short in supply of such skills.

For each industry cluster, the report analyzed the supply and demand of skills by comparing the current skill palettes of Long Island's workers with the skills associated with in-demand occupations of the benchmark region. The demand patterns of benchmark regions are used, instead of those of Long Island's incumbent firms, because the cross-region analysis provides more useful insights for economic development stakeholders by illustrating *how far Long Island should go in order to catch up with the benchmark region, prepare its workforce for future opportunities, and enhance cluster competitiveness.*[43]

Detailed analysis for each industry cluster, as well as the documentation of data source and methodology, is provided in Appendix 2. The following tables summarize the "hot skills" that need training for and are of strategic importance for Long Island's tradable cluster development. They offer a global view of training needs across industries.

[43] The only exception is for jobs of lower educational requirement in the distribution cluster, where the analysis used in-demand occupations of Long Island's incumbent firms to measure the skill gap and identify training needs, because in this group, Long Island outperforms the benchmark region in terms of having lower risks of automation.

General Technical Skills

For general technical skills, the table below identifies skill categories that can benefit from targeted training, according to the data analysis. The skills are listed by industry cluster (the header row) and by educational requirement of the jobs (the second column). For instance, operations analysis is a training need for the growth of several clusters (aerospace, biopharma, business services, construction, distribution, food processing, and IT), but it is mostly for jobs of higher educational requirement.

The frequency of training needs is generally lower for jobs of lower educational requirement than for jobs of higher educational requirement, indicating that in this group, when Long Island's current workforce without a Bachelor's degree seeks to transition into employment opportunities in key tradable clusters that do not require a Bachelor's degree, they are likely to already possess some or most of the desired general technical skills. The greater need of training general technical skills is for Long Island's workforce with high educational attainment seeking transition, because the skill needs are vastly different.

General Technical Skills: Identifying Training Needs for Jobs in Key Clusters (Marked by "Yes")

Skill Category	Educational Req. for Jobs	Key Industry Clusters							
		Aerospace	Biopharm.	Business Services	Construct.	Distribut.	Finance	Food Process.	IT
Operations Analysis	Higher	Yes	Yes	Yes	Yes	Yes	No	No	Yes
	Lower	Yes	No	No	Yes	No	No	No	No
Quality Control Analysis	Higher	Yes	No	Yes	Yes	No	No	No	No
	Lower	Yes	No	No	Yes	No	No	No	No
Technology Design	Higher	Yes	No	Yes	No	Yes	No	No	Yes
	Lower	No	No	No	No	No	No	No	No
Programming	Higher	Yes	No	Yes	No	Yes	No	No	Yes
	Lower	No	No	No	No	No	No	No	No
Operation Monitoring	Higher	Yes	No	Yes	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Troubleshooting	Higher	Yes	No	Yes	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Equipment Maintenance	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Equipment Selection	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Installation	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Operation and Control	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Repairing	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No

Knowledge

The table below summarizes training needs for knowledge by subject, industry cluster, and educational requirement of the occupation.

Some subjects are in need of training for a multitude of industry clusters, such as computer and electronics, engineering and technology, sales and marketing, and design. Other subjects are mostly in need of training for the growth of one specific cluster, such as building and construction, mechanical, physics, and English language for the construction cluster.

Knowledge: Identifying Training Needs for Jobs in Key Clusters (Marked by "Yes")

Knowledge Category	Educational Req. for Jobs	Key Industry Clusters							
		Aerospace	Biopharm.	Business Services	Construct.	Distribut.	Finance	Food Process.	IT
Computers and Electronics	Higher	Yes	No	Yes	No	No	Yes	No	Yes
	Lower	Yes	No	Yes	Yes	No	Yes	No	Yes
Engineering and Technology	Higher	Yes	Yes	Yes	Yes	Yes	No	No	Yes
	Lower	Yes	No	No	Yes	No	No	No	No
Sales and Marketing	Higher	No	No	No	No	No	Yes	Yes	Yes
	Lower	No	No	No	No	Yes	Yes	Yes	Yes
Design	Higher	Yes	No	Yes	Yes	Yes	No	No	Yes
	Lower	No	No	No	Yes	No	No	No	No
Production and Processing	Higher	No	Yes	No	Yes	No	No	Yes	No
	Lower	Yes	Yes	No	No	No	No	No	No
Economics and Accounting	Higher	No	No	No	No	No	Yes	No	No
	Lower	No	No	No	Yes	No	Yes	No	Yes
Administration and Management	Higher	No	No	No	No	No	No	Yes	No
	Lower	No	Yes	No	Yes	No	No	No	Yes
Clerical	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	Yes	No	No	Yes	No	Yes
Mathematics	Higher	No	No	No	No	No	Yes	No	No
	Lower	No	No	No	Yes	No	Yes	No	No
Law and Government	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	Yes	No	Yes	No	No
Building and Construction	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Mechanical	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Personnel and Human Resources	Higher	No	No	No	No	No	No	No	No
	Lower	Yes	No	No	Yes	No	No	No	No
Customer and Personal Service	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	Yes	No	No
Biology	Higher	No	Yes	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No

Chemistry	Higher	No	Yes	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Education and Training	Higher	No	No	No	No	No	No	No	No
	Lower	Yes	No	No	No	No	No	No	No
English Language	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Physics	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Communications and Media	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Fine Arts	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Food Production	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Foreign Language	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Geography	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
History and Archeology	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Medicine and Dentistry	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Philosophy and Theology	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Psychology	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Public Safety and Security	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Sociology and Anthropology	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Telecommunications	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Therapy and Counseling	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Transportation	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No

Software

The table below summarizes training needs for software by category, industry cluster, and educational requirement of the occupation. While all 127 software categories reported by O*NET are analyzed, due to space limitation, only the top 15 software are included in the table (measured by the combined frequency of both educational requirements).

Training needs for software demonstrate a great level of inter-cluster variability. For instance, for jobs of higher educational requirement, while there are as many as 23 software categories that need training for the growth of the IT cluster, there are only 8 identified for the construction cluster.

The difference between jobs of higher educational requirement and those of lower requirement is also significant. For instance, presentation software is not identified as a training need for occupations of higher educational requirement in any of the industry clusters, because it is already associated with 94% of Long Island's existing jobs of higher educational requirement; however, for jobs of lower educational requirement, presentation software is a training need for six out of the eight clusters analyzed in this report.

Software Skills: Identifying Training Needs for Jobs in Key Clusters (Marked by "Yes")

Software Category (Top 20)	Educational Req. for Jobs	Key Industry Clusters							
		Aerospace	Biopharm.	Business Services	Construct.	Distribut.	Finance	Food Process.	IT
Analytical or scientific	Higher	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
	Lower	Yes	Yes	Yes	Yes	No	No	No	Yes
Enterprise resource planning	Higher	No	No	Yes	Yes	Yes	No	Yes	Yes
	Lower	Yes	Yes	Yes	Yes	No	Yes	No	Yes
Graphics or photo imaging	Higher	Yes	Yes	Yes	Yes	Yes	No	No	Yes
	Lower	No	No	Yes	Yes	No	No	No	Yes
Financial analysis	Higher	No	No	Yes	No	Yes	Yes	Yes	Yes
	Lower	No	No	Yes	No	No	Yes	No	Yes
Accounting	Higher	No	No	No	Yes	No	Yes	Yes	Yes
	Lower	No	No	Yes	Yes	No	Yes	No	Yes
Web page creation and editing	Higher	No	No	Yes	Yes	Yes	No	Yes	Yes
	Lower	No	No	Yes	No	No	No	No	Yes
Document management	Higher	No	No	Yes	Yes	Yes	No	No	Yes
	Lower	No	No	Yes	Yes	No	No	No	Yes
Business intelligence and data analysis	Higher	No	No	Yes	No	Yes	Yes	Yes	Yes
	Lower	No	No	Yes	No	No	No	No	Yes
Object oriented development	Higher	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

	Lower	No	No	No	No	No	No	No	No
Presentation	Higher	No	No	No	No	No	No	No	No
	Lower	Yes	Yes	Yes	Yes	No	Yes	No	Yes
Customer relation. management	Higher	No	No	Yes	No	No	Yes	No	Yes
	Lower	No	No	Yes	No	No	Yes	No	Yes
Computer aided design CAD	Higher	Yes	No	Yes	Yes	Yes	No	Yes	No
	Lower	No	No	No	Yes	No	No	No	No
Video creation and editing	Higher	No	No	Yes	No	Yes	No	No	Yes
	Lower	No	No	Yes	No	No	No	No	Yes
Operating system	Higher	Yes	No	Yes	No	No	No	No	Yes
	Lower	No	No	Yes	No	No	No	No	Yes
Desktop publishing	Higher	No	No	Yes	No	Yes	No	No	Yes
	Lower	No	No	Yes	No	No	No	No	Yes
Map creation	Higher	Yes	Yes	Yes	No	Yes	No	No	Yes
	Lower	No	No	No	No	No	No	No	No
Data base management system	Higher	Yes	Yes	Yes	No	Yes	No	No	Yes
	Lower	No	No	No	No	No	No	No	No
Project management	Higher	No	No	No	No	No	No	No	No
	Lower	Yes	No	Yes	Yes	No	No	No	Yes
Enterprise application integration	Higher	Yes	No	Yes	No	Yes	No	No	Yes
	Lower	No	No	No	No	No	No	No	No
Development environment	Higher	Yes	No	Yes	No	No	Yes	No	Yes
	Lower	No	No	No	No	No	No	No	No

Tools

The table below summarizes training needs for tools by category, industry cluster, and educational requirement of the occupation. While all 4,180 types of tools reported by O*NET are analyzed, due to space limitation, only the top 15 categories are included in the table (measured by the combined frequency of both educational requirements).

It is worth noticing that office equipment, such as computers, printers, and scanners, though considered to be widely in use for most contemporary workplaces, is still identified as training needs for occupations of lower educational requirement in several clusters. This is because 1) Long Island's current jobs of lower educational requirement might not require the workers to use these tools, and 2) the occupational landscape of key clusters is becoming increasingly white collar. For instance, human resource specialists, a white collar occupation, is the top in-demand occupation of lower educational requirement in the aerospace cluster of the St. Louis MO-IL MSA, which is the benchmark region for aerospace.

Tool Skills: Identifying Training Needs for Jobs in Key Clusters (Marked by "Yes")

Tool Category (Top 23)	Educational Req. for Jobs	Key Industry Clusters							
		Aerospace	Biopharm.	Business Services	Construct.	Distribut.	Finance	Food Process.	IT
Notebook computers	Higher	No	No	No	No	No	No	No	No
	Lower	Yes	Yes	Yes	Yes	No	Yes	No	Yes
Mainframe computers	Higher	Yes	Yes	Yes	No	Yes	No	No	Yes
	Lower	No	No	No	No	No	No	No	No
Desktop computers	Higher	No	No	No	No	No	No	No	No
	Lower	Yes	Yes	Yes	No	No	Yes	No	Yes
Liquid crystal display projector	Higher	No	No	No	No	No	No	No	No
	Lower	Yes	Yes	Yes	No	No	No	No	Yes
Integrated circuit testers	Higher	Yes	No	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Computer servers	Higher	Yes	No	Yes	No	Yes	No	No	Yes
	Lower	No	No	No	No	No	No	No	No
Special purpose telephones	Higher	No	No	No	No	No	No	No	No
	Lower	No	Yes	Yes	No	No	Yes	No	No
Personal computers	Higher	No	No	No	No	No	No	No	No
	Lower	No	Yes	No	Yes	No	Yes	No	No
Scanners	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	Yes	No	Yes	No	No
Laser printers	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	Yes	No	No	No	No	Yes

Utility knives	Higher	No	No	No	No	No	No	No	No
	Lower	No	No	No	No	Yes	No	Yes	No
Photocopiers	Higher	No	No	No	No	No	No	No	No
	Lower	No	Yes	No	No	No	Yes	No	No
Laser fax machine	Higher	No	No	No	No	No	No	No	No
	Lower	No	Yes	No	No	No	Yes	No	No
Aircraft guidance systems	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Airships	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Gas detectors	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Global positioning system GPS receiver	Higher	Yes	Yes	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Infrared camera	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Lasers	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Level sensors or transmitters	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Levels	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No
Portable data input terminals	Higher	Yes	Yes	No	No	No	No	No	No
	Lower	No	No	No	No	No	No	No	No
Radarbased surveillance systems	Higher	No	No	No	Yes	No	No	No	No
	Lower	No	No	No	Yes	No	No	No	No

APPENDIX

1. Stakeholder Index
2. Skill Gap Analyses for Key Industry Clusters
3. Definition of Technical Skills

APPENDIX 1: Stakeholder Index

The Long Island Workforce Development "Stakeholder Index" is a roster of the different organizations involved with workforce development, job training, or the "talent pipeline" on Long Island. The index includes each organization's name and a general overview of some of their programs or efforts as it pertains to workforce development. Its objective is to provide readers of this report with an understanding of the workforce development landscape on Long Island and who could potentially be a resource as new initiatives come about. Each organization included in the index was either the product of independent research conducted by JLP+D or referrals from stakeholders the firm spoke with after beginning the interview process.

Academic and Research Institution

(alphabetical order)

Adelphi University	- Runs a "science advancement" program that seeks to prepare students for careers in STEM, targets both high school and Adelphi students from underrepresented groups
Advanced Energy Research and Technology Center	- Located in the Research & Development Park at Stony Brook University - Runs an "advanced energy incubator" that seeks to commercialize new technologies and spinout startup companies, provides research & education resources to academic and industry partners
Brookhaven National Laboratory	- Primarily funded by the Department of Energy. Partners with a number of colleges and universities - Hosts science education programs for Long Island students and teachers at all levels of education - Potential collaborator for the workforce training center or program
Cold Spring Harbor Laboratory	- Has an on-site learning center for K-12, undergraduate, graduate, and doctoral students - The lab's workforce development offerings are currently targeted at postdoc scientists working in relevant fields
Eastern Suffolk BOCES (Board of Cooperative Educational Services)	- Runs "Academy LI", a vocational school that teaches applied technology skills to high school students - Operates several postsecondary certificate programs in nursing, cosmetology, and other vocations
Farmingdale State College	- One of SUNY's four "public technology" colleges - Nexus Center for Applied Learning partners with local employers and seeks to provide students with the skills they need - Growing focus on sustainability through its Solar Energy Center and Green Building Institute
Hofstra University	- Hofstra's Continuing Education programs provide mid-career adults with an opportunity to either revamp their skills or stay current with the changing skill demands of their field
Island Drafting and Technical Institute	- Provides post-secondary vocational certificate training and associate degree-level coursework
Long Island University	- Potential collaborator for future initiative
Molloy College	- Operates the Molloy Institute for Lifelong Learning, a membership-based center

	that helps mid-to-late career adults adapt their skills - Offers a number of postsecondary certificate programs that have a vocational training focus
Nassau BOCES (Board of Cooperative Educational Services)	- Provides STEM curriculum development services, technology integration advising, and professional development workshops for educators in Nassau County
Nassau Community College	- Operates a Center for Workforce Development that primarily serves adults seeking continuing education - Offers vocational programs for specific careers, including dental assistant and EMT, among others
New York Institute of Technology	- Partnered with the Institute for Career Development, a workforce training and job placement organization based in NYC and Nassau BOCES, a Nassau-based cooperative education group
St. Joseph's College	- Offers several postsecondary certificate programs that help students enter careers in IT, home care, etc. and offers customized training workshops for local companies - Partnered with Suffolk Community College to earn a $100k NYS grant to retrain 100+ unemployed individuals with manufacturing skills - Conducts regular reviews to identify new industries or areas of vocational specialization its program offerings can serve
Stony Brook University	- Offers skill-based training programs to both students and community members through its Center for Corporate Education - The Center also manages the Advanced Energy Training Institute, which works with partners in the clean energy industry to develop the skills, knowledge, and credentials necessary to serve the growing industry on Long Island
Suffolk Community College	- One of two community colleges on Long Island, programs spread across five campuses - Operates an Advanced Manufacturing Training Center, Corporate Training Center, and a hospitality/culinary institute - Programs service approximately 11-14 industry clusters including aerospace, composites, electromechanical, and pharmaceuticals
SUNY Old Westbury	- Potential collaborator for future initiative
Western Suffolk BOCES (Board of Cooperative Educational Services)	- Runs "Wilson Technological Center", which has four locations that provide career and technical education to both high school students and adults

Public Agency

(alphabetical order)

Brookhaven Industrial Development Agency	- The IDA has the authority to issue bonds, grant abatements, and offer other incentives in support of local economic development objectives related to industrial growth and expansion.
Hempstead Works	- Provides job seekers with training programs, career counseling, referrals, and job listing databases. Appears to specialize in working with veterans, disadvantaged youth, and those with disabilities
Long Island Regional Economic Development Council	- Stewards state funding from the Governor's Workforce Development Initiative into Long Island, helps Long Island businesses secure state contracts - Seeking to increase cooperation and collaboration around workforce development on Long Island
Long Island Regional Planning Council	- Conducts research on economic conditions on Long Island and spearheads key initiatives - Partnered with county and local governments on Long Island as well as other key stakeholders (universities, industry groups, etc.)
Nassau County Department of Economic Development	- Maintains two "one-stop" employment centers (Hicksville and Massapequa) and oversees Hempstead Works (row 29). The "one-stop" centers offer free service to those 55 and older and provide a range of vocational assessment, counseling, training, and placement
Nassau County Industrial Development Agency	- Provides incentives to help businesses relocate and expand in Nassau County
Suffolk County Department of Economic Development and Planning	- Primary economic development administrator in Suffolk County - Oversees the implementation of a number of technical and financing programs concerning affordable and workforce housing, downtown revitalization, energy, and trade - Collects and manages a significant amount of economic data on Suffolk County
Suffolk County Department of Labor, Licensing, and Consumer Affairs	- Oversees all of Suffolk County's workforce development programs and entities, including the Workforce Development Board, STEMM jobs initiative, and the One-Stop Employment Center. One of the largest funders and providers of education and training on Long Island (involved in 100+ programs) - Has a standing Workforce Development Board that regularly meets to discuss and address workforce needs. The board is comprised of local company representatives, educational administrators, and nonprofit/community representatives
Suffolk County Industrial Development Agency	- Provides incentives to help businesses relocate and expand in Suffolk County and conducts economic research on communities and industries in Long Island

Nonprofit/Community Group

(alphabetical order)

Addapt (LI Aerospace & Defense)	- Trade association for Long Island's aerospace and defense sectors - Conducts government relations work on behalf of the industry and helps companies improve their marketing.
Community Program Centers of Long Island	- Provides child and elder care services to low and moderate income families
Composite Prototyping Center	- Provides training and other educational support services to composite manufacturers on Long Island. This includes both classroom and hands-on coursework on prototype manufacturing and testing
Economic Opportunity Commission of Nassau County	- Provides social services, early childhood education, and job placement services
Erase Racism	- Supports efforts to create a pipeline of diverse teachers and administrators, oversees anti-bias task forces and forums, seeks to ensure access to quality education for all - Has over 1,000 members of its Partnership for Racial Equity
Hauppauge Industrial Association	- Runs the Workforce Development Initiative, which is developing opportunities to attract, train, and retain employees for Long Island businesses - Runs a series of parallel initiatives to seed key industrial clusters on Long Island - Manages memberships of businesses in the Long Island Innovation Park
IBEW Local 25	- Operates a training facility that offers programs to both current and aspiring electricians on Long Island - Has an apprenticeship and training committee that seeks to help electricians get on the job experience
Long Island Association	- Conducts government relations for LI small business community and publishes research on Long Island's economy
Long Island Builders Institute	- Conducts government relations for LI construction industry - Concerned about the construction industry's workforce pipeline
Long Island Business Development Council	- Hosts convenings for industry and government officials concerning economic and business development
Long Island Community Foundation	- Makes grants to LI nonprofits, many of which focus on education and the workforce
Long Island Contractors	- Government relations for Long Island's construction industry

Association	- Conducts market research on the industry's state and trajectory
Long Island Development Corporation	- Provides lending services for economic development and technical assistance
Long Island Federation of Labor	- Government relations on behalf of Long Island's labor unions, conducts workforce training and outreach for the construction industry
Long Island Regional Adult Education Network	- Offers adult education classes and technical assistance to other providers
Long Island Software and Technology Network	- Trade association for Long Island's technology sector - Hosts workshops for member companies and their employees - Operates a coworking and incubation center in Plainview
Long Island STEM Hub	- Association of businesses, nonprofits and educational institutions on Long Island who seek to prepare Long Island's youth for tech jobs, works across several of the key industrial clusters identified in the HIP report - One of 10 centers within the Empire State STEM Learning Network. Has one anchor site in Nassau County and another in Suffolk County
Rauch Foundation	- Publishes the annual Long Island Index, a key source for data on Long Island's population and economy, and other reports regarding innovative activity on Long Island - Funds the "Right Track for Long Island" Coalition
Regional Plan Association	- Partnered with JLP+D on the HIP report, has produced other periodic research on the workforce in Long Island - Has a sizable research team and connections to all of the relevant public sector stakeholders on Long Island
United Way of Long Island	- Funds and directly operates a number of programs including youth vocational training and training for "green" home construction
Workforce Development Institute - Long Island	- Develops skills assessment tools, funds skill training and workforce development programs, provides childcare subsidies

Corporation/Private Sector

(alphabetical order)

Amneal	- Major employer on Long Island
Caithness Energy	- Providing scholarships to LI students pursuing careers in STEM. Working on the AERTC project with Stony Brook
Cameron Engineering	- Founder John Cameron is the Chairman of the LIRPC. While the firm is not directly involved in any workforce development initiatives, they likely have a working knowledge of the Long Island construction sector and its workforce needs
Canon Solutions	- Operates a workforce development center in Virginia that partners with local community colleges - 1,400 employees based out of Canon USA's Melville, NY HQ
Contract Pharmacal	- Major employer in the Long Island Innovation Park at Hauppauge
Estee Lauder	- Estee Lauder offers skills training opportunities to all employees as a benefit, has a long-standing partnership with LinkedIn Learning - Estee Lauder's main research center is on Long Island, launched a $14.5M expansion in 2018
Flexible Business Solutions	- Participated in interviews for the Long Island Innovation Park at Hauppauge opportunity analysis, interested in connecting the workforce training center to local universities
Home Depot	- Home Depot Foundation has committed to train 20k tradespeople by 2028, veterans are a major target demographic - Home Depot is one of the largest employers on Long Island
Millennial Strategies	- Managing partner sits on board of LIRPC, works on issues related to the "brain drain" on Long Island including "Innovate LI"
Nature's Bounty	- Important employer on Long Island
Northrop Grumman	- Funds cybersecurity education programs at a number of colleges and universities (primarily those in the DMV area) - Has two locations on Long Island, one in Bethpage, the other in Islip
Northwell Health	- Co-Steward of the LI STEM hub, which seeks to prepare LI students for careers in the sciences - Has representation on the Suffolk County Workforce Development Board
PSEG	- Offers apprenticeship training classes to the members of community where the company operates, donates to local economic development organizations

APPENDIX 2: Skill Gap Analyses for Key Industry Clusters

The sections below detail the analysis of skill gap and identification of training needs for each of the key tradable industry clusters. The scope of this report focuses on the tradable sectors that export goods and services to other regions. Separate studies would be needed to analyze the skill gaps and training needs of other large and important industries on Long Island, such as healthcare and local education.

Aerospace and Defense Cluster Skill Gap Analysis

To better prepare Long Island for the future growth of its strategic industries, one needs to understand the changing landscape of work and re-assess the skill requirements in key clusters. In the skill gap analysis for Long Island's aerospace and defense cluster, we asked the following questions:

- What job positions are local companies in this cluster trying to hire?
- In the national benchmark region where this cluster is strong, what job positions are companies trying to hire?
- What are the differences in job hiring pattern between Long Island and the benchmark region? Which region is more prepared for the future?
- In order for Long Island to fully prepare itself for future growth of this cluster, what are the specific training needs for technical skills and knowledge?

To answer the questions above, we performed multiple quantitative data analyses. Below is a summary of the results for this cluster. At the end of the section are four sets of tables of specific training needes identified for this cluster.

On Long Island, what kinds of job positions are aerospace companies trying to hire?

Recent job posting data reveals important industry trends. In our research, we divided job postings into two categories: positions requiring a Bachelor's degree or above and positions requiring less than a Bachelor's degree. The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019 for the two educational requirement levels.

Long Island Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Software Developers, Applications	23%	Bachelor's Degree
Computer Occupations, All Other	21%	Bachelor's Degree
Managers, All Other	13%	Bachelor's Degree
Purchasing Agents, Except Wholesale, Retail, and Farm Products	10%	Bachelor's Degree

Mechanical Engineers	8%	Bachelor's Degree
Electrical Engineers	7%	Bachelor's Degree
Civil Engineers	5%	Bachelor's Degree
Engineers, All Other	5%	Bachelor's Degree
Engineering Technicians, Except Drafters, All Other	4%	Bachelor's Degree
Inspectors, Testers, Sorters, Samplers, and Weighers	4%	High School Diploma or equivalent

Long Island Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Machinists	18%	Post-Secondary Certificate
Maintenance and Repair Workers, General	14%	High School Diploma or equivalent
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	14%	High School Diploma or equivalent
Engineering Technicians, Except Drafters, All Other	11%	Bachelor's Degree
Stock Clerks and Order Fillers	10%	High School Diploma or equivalent
Inspectors, Testers, Sorters, Samplers, and Weighers	9%	High School Diploma or equivalent
Team Assemblers	8%	High School Diploma or equivalent
Human Resources Specialists	6%	Bachelor's Degree
Electrical And Electronics Engineering Technicians	6%	Associate's Degree (or other 2-year degree)
Drafters, All Other	5%	Associate's Degree (or other 2-year degree)

What occupations are companies in the national benchmark region trying to hire?

We chose St. Louis MO-IL Metro Area as the benchmark region, because it satisfies the following criteria: large cluster, substantial growth.

The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019.

St. Louis MO-IL Metro Area Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Software Developers, Applications	31%	Bachelor's Degree
Computer Occupations, All Other	20%	Bachelor's Degree
Managers, All Other	9%	Bachelor's Degree
Engineers, All Other	9%	Bachelor's Degree
Computer Systems Analysts	7%	Bachelor's Degree
Electrical Engineers	6%	Bachelor's Degree
Mechanical Engineers	5%	Bachelor's Degree
Civil Engineers	5%	Bachelor's Degree
Aerospace Engineers	4%	Bachelor's Degree
Management Analysts	3%	Bachelor's Degree

St. Louis MO-IL Metro Area Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Human Resources Specialists	18%	Bachelor's Degree
Network and Computer Systems Administrators	13%	Bachelor's Degree
Engineering Technicians, Except Drafters, All Other	13%	Bachelor's Degree
Training and Development Specialists	11%	Bachelor's Degree
Production, Planning, and Expediting Clerks	11%	High School Diploma or equivalent
Team Assemblers	9%	High School Diploma or equivalent
Computer User Support Specialists	7%	Bachelor's Degree
Avionics Technicians	7%	Post-Secondary Certificate

Logisticians	7%	Bachelor's Degree
Maintenance and Repair Workers, General	5%	High School Diploma or equivalent

What are the differences in terms of industry hiring needs between the benchmark region and Long Island?

Compared with Long Island, occupations associated with aerospace job postings in the Benchmark region are facing fewer automation risks (the risk of being replaced by computers and/or robots in the future).

For jobs requiring higher educational attainment, there are 3 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing a variety of automation risks.[44] These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Purchasing Agents, Except Wholesale, Retail, and Farm Products	Yes	No	Medium Risk
Engineering Technicians, Except Drafters, All Other	Yes	No	Low Risk
Inspectors, Testers, Sorters, Samplers, and Weighers	Yes	No	High Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing lower automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Computer Systems Analysts	No	Yes	Low Risk
Aerospace Engineers	No	Yes	Low Risk
Management Analysts	No	Yes	Low Risk

[44] The risk of automation score is the probability of computerization for an occupation within the next 20 years, provided by Burning Glass Labor Insight.

For jobs requiring lower educational attainment, there are 6 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing medium and high automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Machinists	Yes	No	Medium Risk
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	Yes	No	Medium Risk
Stock Clerks and Order Fillers	Yes	No	Medium Risk
Inspectors, Testers, Sorters, Samplers, and Weighers	Yes	No	High Risk
Electrical And Electronics Engineering Technicians	Yes	No	Medium Risk
Drafters, All Other	Yes	No	Medium Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing both mid-high risks and low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Network and Computer Systems Administrators	No	Yes	Low Risk
Training and Development Specialists	No	Yes	Low Risk
Production, Planning, and Expediting Clerks	No	Yes	High Risk
Computer User Support Specialists	No	Yes	Low Risk
Avionics Technicians	No	Yes	Medium Risk
Logisticians	No	Yes	Low Risk

Based on hiring needs, which region is better prepared for the future?

Based on job posting data, the benchmark region is better prepared for the future where automation and computerization will redefine employment and reshape the demand for skills.

On Long Island, the jobs being posted by companies have a 36% overall chance of being replaced by computers in 20 years. In comparison, the benchmark region's chance is only 14%.[45]

Chance of jobs being replaced by computers in 20 years (0-100%)					
Overall - All jobs		Jobs requiring more than a Bachelor's degree		Jobs requiring less than a Bachelor's degree	
Long Island	Benchmark	Long Island	Benchmark	Long Island	Benchmark
36%	14%	22%	9%	67%	45%

The difference in hiring needs means a difference in workforce skill requirements. In order to better prepare for future economic growth and transformation, Long Island industries need to look beyond what they currently need. Instead, companies can benefit from training programs that can teach skills associated with jobs facing fewer automation risks, such as those sought by companies in the benchmark region.

In order to better prepare Long Islanders for the future of industry growth, what are the skill training needs?

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- General technical skills (These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.)
- Knowledge (This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications.)
- Software (This refers to the capability of operating specific software applications. There are 127 software applications included in the analysis.)
- Tools (This refers to the capability of using specific machines and/or tools. There are 4,180 tools included in the analysis.)

[45] The probability of automation for each occupation is calculated and presented in the seminal Oxford University study on automation, *The Future of Employment: How Susceptible are Jobs to Computerisation?* The same probability statistics determine the Burning Glass Labor Insight's risk of automation levels. The breakdown of scores are as follows: High risk of automation: The top quartile of scores (ex: Insurance Underwriters). Medium risk of automation: The third quartile of scores (ex: Machinists). Low risk of automation: The bottom two quartiles of scores (ex: Home Health Aides).

Based on employment, job postings, and occupational skills data, we identified specific skills where there exist the largest gaps between what the industries need and what the current workforce of Long Island can provide.

We first identified the most in-demand skills for the industries, based on job posting data from the benchmark region. O*NET links skills to each occupation. If a significant portion of the region's Top 10 job posting occupations is associated with a particular skill, that skill is then marked as a "core industry need".

When then checked how prepared Long Island's current workforce is for each skill in the core industry needs. Again, as O*NET links skills to occupations, the employment data was used in combination with O*NET to produce the "skill palette" of Long Island. For instance, based on the data analysis, for jobs typically requiring a Bachelor's degree or above, 99% of Long Island's current occupations are associated with Office Suite software, while only 4% are associated with graphic user interface development software.

Once we identified the core industry needs and the skill palette of Long Island's current workforce, we compared these two statistics to identify the need for skill training. A core industry need is not necessarily a training need, if most of Long Islanders already possess that skill. Only when a core skill is severely undersupplied by the current population, which means that the gap between industry demand and current workforce characteristics is large, can we identify that skill as being in need of training.[46]

We compared the industry needs against Long Island-wide workforce characteristics. Instead of comparing the needs against workforce characteristics within the same industry, because we anticipate the workforce training program to facilitate people currently not employed in the particular industry to take job opportunities in the key industry cluster. If we limit the scope of analysis, we will only be assuming that workers stay within the same industries in the future, thus missing the potential shift of employment from non-strategic industries to strategic industries.

The lists of training needs below are the results of the quantitative data analysis prior to qualitative assessment and validation. For definitions and examples of specific skills, as well as

[46] In our analysis, we analyzed skill gaps by checking two criteria: If the skill is associated with more than a certain portion, say 70%, of the region's Top 10 job posting occupations, we then mark it as a core industry need (the percentage threshold can change from one skill category to another). For a given skill marked as a core industry need, if less than X% of Long Island's current occupations are associated with that particular skill, then it will be marked as a training need. The value of X is dependent on the demand of that skill, indicated by job postings. This is because, for skills in more demand by the industries, you will need the workforce to be more prepared also. For example, in our analysis of general technical skills, X is calculated as 10 percentage points below the respective skill's frequency in job postings. So for skills associated with 70% of job postings, they are marked as training needs if less than 60% of the current workforce is associated with the skills; for skills associated with 80% of job postings, they are marked as training needs if fewer than 70% of the current workforce are associated with the skills. The percentage threshold also changes from one skill category to another.

information about how each of the recommended training needs apply to specific occupations, see Appendix 3.

General technical skills training needs[47]

General technical skills training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Troubleshooting	36%	14%
Technology Design	41%	19%
Quality Control Analysis	45%	27%
Programming	51%	18%
Operations Analysis	59%	33%
Operation Monitoring	41%	28%

General technical skills training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Operations Analysis	30%	13%
Quality Control Analysis	42%	29%

Knowledge training needs[48]

Knowledge training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Engineering and Technology	68%	26%
Design	53%	21%
Computers and Electronics	79%	57%

[47] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.
[48] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Knowledge training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Engineering and Technology	38%	18%
Computers and Electronics	58%	39%
Personnel and Human Resources	45%	31%
Education and Training	53%	40%
Production and Processing	41%	30%

Software training needs[49]

Software training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Requirements analysis and system architecture software	81%	9%
Operating system software	95%	55%
Object or component oriented development software	100%	43%
Map creation software	96%	29%
Industrial control software	96%	18%
Graphics or photo imaging software	100%	59%
File versioning software	81%	10%
Enterprise application integration software	94%	32%
Development environment software	100%	47%
Data base management system software	85%	35%
Configuration management software	86%	17%
Computer aided design CAD software	97%	30%
Analytical or scientific software	100%	59%

[49] Threshold: Core industry needs are identified as the skills associated with 80% of the Top 10 posted occupations. Training needs are skills where the current supply is 40 percentage points lower than the demand statistics.

Software training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Project management software	84%	39%
Presentation software	88%	44%
Enterprise resource planning ERP software	93%	44%
Analytical or scientific software	86%	19%

Tools training needs[50]

Tools training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Portable data input terminals	38%	9%
Plotter printers	44%	3%
Oscilloscopes	34%	2%
Mainframe computers	71%	9%
Integrated circuit testers	60%	2%
Global positioning system GPS receiver	43%	3%
Flash memory storage card	31%	1%
Computer servers	67%	6%

Tools training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Wire lug crimping tool	33%	4%
Torque wrenches	34%	4%
Soldering iron	34%	7%
Screwdrivers	54%	31%
Respirators	34%	10%
Reflectometers	40%	1%
Punches or nail sets or drifts	54%	8%
Power meters	40%	1%

[50] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 20 percentage points lower than the demand statistics.

Notebook computers*	91%	46%
Network analyzers	33%	0%
Liquid crystal display projector	35%	4%
Hex keys	34%	7%
Desktop computers*	100%	62%
Calipers	34%	10%

*While computers and printing devices are widely used now in most white-collar occupations, they are becoming increasingly important for jobs of lower educational requirement in the biopharmaceutical cluster. The result of the data analysis indicates that Long Island's current workforce with lower educational attainment can potentially benefit from computer-related training.

Biopharmaceutical Cluster Skill Gap Analysis

To better prepare Long Island for the future growth of its strategic industries, one needs to understand the changing landscape of work and re-assess the skill requirements in key clusters. In the skill gap analysis for Long Island's biopharmaceutical cluster, we asked the following questions:

- What job positions are local companies in this cluster trying to hire?
- In the national benchmark region where this cluster is strong, what job positions are companies trying to hire?
- What are the differences in job hiring pattern between Long Island and the benchmark region? Which region is more prepared for the future?
- In order for Long Island to fully prepare itself for future growth of this cluster, what are the specific training needs for technical skills and knowledge?

To answer the questions above, we performed multiple quantitative data analyses. Below is a summary of the results for this cluster. At the end of the section are four sets of tables of specific training needes identified for this cluster.

On Long Island, what kinds of job positions are biopharmaceutical companies trying to hire?

Recent job posting data reveals important industry trends. In our research, we divided job postings into two categories: positions requiring a Bachelor's degree or above and positions requiring less than a Bachelor's degree. The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019 for the two educational requirement levels.

Long Island Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Managers, All Other	14%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	14%	Bachelor's Degree
Engineers, All Other	13%	Bachelor's Degree
Inspectors, Testers, Sorters, Samplers, and Weighers	13%	High School Diploma or

		equivalent
Operations Research Analysts	10%	Master's Degree
Chemists	9%	Bachelor's Degree
Sales Managers	7%	Bachelor's Degree
General and Operations Managers	7%	Bachelor's Degree
Life, Physical, and Social Science Technicians, All Other	7%	Bachelor's Degree
First-Line Supervisors of Production and Operating Workers	6%	High School Diploma or equivalent

Long Island Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	20%	Bachelor's Degree
Inspectors, Testers, Sorters, Samplers, and Weighers	18%	High School Diploma or equivalent
Laborers and Freight, Stock, and Material Movers, Hand	13%	High School Diploma or equivalent
Production Workers, All Other	13%	High School Diploma or equivalent
First-Line Supervisors of Production and Operating Workers	8%	High School Diploma or equivalent
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	7%	High School Diploma or equivalent
Customer Service Representatives	5%	High School Diploma or equivalent
Industrial Machinery Mechanics	5%	Post-Secondary Certificate
Automotive and Watercraft Service Attendants	5%	High School Diploma or equivalent
Packaging and Filling Machine Operators and Tenders	5%	High School Diploma or equivalent

What occupations are companies in the national benchmark region trying to hire?

We chose San Francisco CA Metro Area as the benchmark region, because it satisfies the following criteria: large cluster, substantial growth, leader in innovation.

The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019.

San Francisco CA Metro Area Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Managers, All Other	19%	Bachelor's Degree
Natural Sciences Managers	14%	Bachelor's Degree
Medical Scientists, Except Epidemiologists	11%	Post-Doctoral Training
Operations Research Analysts	11%	Master's Degree
Medical and Health Services Managers	10%	Bachelor's Degree
Biologists	8%	Bachelor's Degree
Computer Occupations, All Other	7%	Bachelor's Degree
Marketing Managers	7%	Bachelor's Degree
Sales Managers	7%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	6%	Bachelor's Degree

San Francisco CA Metro Area Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	21%	Bachelor's Degree
Production Workers, All Other	13%	High School Diploma or equivalent
Administrative Services Managers	13%	Bachelor's Degree
Inspectors, Testers, Sorters, Samplers, and Weighers	12%	High School Diploma or equivalent
Human Resources Specialists	9%	Bachelor's Degree
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	9%	High School Diploma or equivalent

Chemical Technicians	7%	Associate's Degree (or other 2-year degree)
Engineering Technicians, Except Drafters, All Other	7%	Bachelor's Degree
First-Line Supervisors of Production and Operating Workers	6%	High School Diploma or equivalent
Executive Secretaries and Executive Administrative Assistants	4%	Some College Courses

What are the differences in terms of industry hiring needs between the benchmark region and Long Island?

Compared with Long Island, occupations associated with biopharma job postings in the Benchmark region are facing fewer automation risks (the risk of being replaced by computers and/or robots in the future).

For jobs requiring higher educational attainment, there are 6 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing a variety of automation risks.[51] These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Engineers, All Other	Yes	No	Low Risk
Inspectors, Testers, Sorters, Samplers, and Weighers	Yes	No	High Risk
Chemists	Yes	No	Low Risk
General and Operations Managers	Yes	No	Low Risk
Life, Physical, and Social Science Technicians, All Other	Yes	No	Medium Risk
First-Line Supervisors of Production and Operating Workers	Yes	No	Low Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing lower automation risks. These jobs are:

[51] The risk of automation score is the probability of computerization for an occupation within the next 20 years, provided by Burning Glass Labor Insight.

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Natural Sciences Managers	No	Yes	Low Risk
Medical Scientists, Except Epidemiologists	No	Yes	Low Risk
Medical and Health Services Managers	No	Yes	Low Risk
Biologists	No	Yes	Low Risk
Computer Occupations, All Other	No	Yes	Low Risk
Marketing Managers	No	Yes	Low Risk

For jobs requiring lower educational attainment, there are 5 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing medium and high automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Laborers and Freight, Stock, and Material Movers, Hand	Yes	No	Medium Risk
Customer Service Representatives	Yes	No	Medium Risk
Industrial Machinery Mechanics	Yes	No	Medium Risk
Automotive and Watercraft Service Attendants	Yes	No	Medium Risk
Packaging and Filling Machine Operators and Tenders	Yes	No	High Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing both mid-high risks and low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Administrative Services Managers	No	Yes	Medium Risk
Human Resources Specialists	No	Yes	Low Risk
Chemical Technicians	No	Yes	Medium Risk
Engineering Technicians, Except Drafters, All Other	No	Yes	Low Risk
Executive Secretaries and Executive Administrative Assistants	No	Yes	High Risk

Based on hiring needs, which region is better prepared for the future?

Based on job posting data, the benchmark region is better prepared for the future where automation and computerization will redefine employment and reshape the demand for skills.

On Long Island, the jobs being posted by companies have a 53% overall chance of being replaced by computers in 20 years. In comparison, the benchmark region's chance is only 26%.[52]

Chance of jobs being replaced by computers in 20 years (0-100%)					
Overall - All jobs		Jobs requiring more than a Bachelor's degree		Jobs requiring less than a Bachelor's degree	
Long Island	Benchmark	Long Island	Benchmark	Long Island	Benchmark
53%	26%	35%	13%	80%	71%

The difference in hiring needs means a difference in workforce skill requirements. In order to better prepare for future economic growth and transformation, Long Island industries need to look beyond what they currently need. Instead, companies can

[52] The probability of automation for each occupation is calculated and presented in the seminal Oxford University study on automation, *The Future of Employment: How Susceptible are Jobs to Computerisation?* The same probability statistics determine the Burning Glass Labor Insight's risk of automation levels. The breakdown of scores are as follows: High risk of automation: The top quartile of scores (ex: Insurance Underwriters). Medium risk of automation: The third quartile of scores (ex: Machinists). Low risk of automation: The bottom two quartiles of scores (ex: Home Health Aides).

benefit from training programs that can teach skills associated with jobs facing fewer automation risks, such as those sought by companies in the benchmark region.

In order to better prepare Long Islanders for the future of industry growth, what are the skill training needs?

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- General technical skills (These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.)
- Knowledge (This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications.)
- Software (This refers to the capability of operating specific software applications. There are 127 software applications included in the analysis.)
- Tools (This refers to the capability of using specific machines and/or tools. There are 4,180 tools included in the analysis.)

Based on employment, job postings, and occupational skills data, we identified specific skills where there exist the largest gaps between what the industries need and what the current workforce of Long Island can provide.

We first identified the most in-demand skills for the industries, based on job posting data from the benchmark region. O*NET links skills to each occupation. If a significant portion of the region's Top 10 job posting occupations is associated with a particular skill, that skill is then marked as a "core industry need".

When then checked how prepared Long Island's current workforce is for each skill in the core industry needs. Again, as O*NET links skills to occupations, the employment data was used in combination with O*NET to produce the "skill palette" of Long Island. For instance, based on the data analysis, for jobs typically requiring a Bachelor's degree or above, 99% of Long Island's current occupations are associated with Office Suite software, while only 4% are associated with graphic user interface development software.

Once we identified the core industry needs and the skill palette of Long Island's current workforce, we compared these two statistics to identify the need for skill training. A core industry need is not necessarily a training need, if most of Long Islanders already possess that skill. Only when a core skill is severely undersupplied by the current population, which means

that the gap between industry demand and current workforce characteristics is large, can we identify that skill as being in need of training.[53]

We compared the industry needs against Long Island-wide workforce characteristics. Instead of comparing the needs against workforce characteristics within the same industry, because we anticipate the workforce training program to facilitate people currently not employed in the particular industry to take job opportunities in the key industry cluster. If we limit the scope of analysis, we will only be assuming that workers stay within the same industries in the future, thus missing the potential shift of employment from non-strategic industries to strategic industries.

The lists of training needs below are the results of the quantitative data analysis prior to qualitative assessment and validation. For definitions and examples of specific skills, as well as information about how each of the recommended training needs apply to specific occupations, see Appendix 3.

General technical skills training needs[54]

General technical skills training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Operations Analysis	50%	33%

General technical skills training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of lower educational requirement, Long Island's current workforce are relatively prepared in terms of general technical skill capabilities.	NA	NA

[53] In our analysis, we analyzed skill gaps by checking two criteria: If the skill is associated with more than a certain portion, say 70%, of the region's Top 10 job posting occupations, we then mark it as a core industry need (the percentage threshold can change from one skill category to another). For a given skill marked as a core industry need, if less than X% of Long Island's current occupations are associated with that particular skill, then it will be marked as a training need. The value of X is dependent on the demand of that skill, indicated by job postings. This is because, for skills in more demand by the industries, you will need the workforce to be more prepared also. For example, in our analysis of general technical skills, X is calculated as 10 percentage points below the respective skill's frequency in job postings. So for skills associated with 70% of job postings, they are marked as training needs if less than 60% of the current workforce is associated with the skills; for skills associated with 80% of job postings, they are marked as training needs if fewer than 70% of the current workforce are associated with the skills. The percentage threshold also changes from one skill category to another.

[54] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Knowledge training needs[55]

Knowledge training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Biology	42%	21%
Chemistry	34%	19%
Engineering and Technology	40%	26%
Production and Processing	39%	28%

Knowledge training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Administration and Management	56%	46%
Production and Processing	47%	30%

Software training needs[56]

Software training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Analytical or scientific software	100%	59%
Data base management system software	81%	35%
Graphics or photo imaging software	100%	59%
Map creation software	93%	29%
Object or component oriented development software	100%	43%

Software training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Analytical or scientific software	87%	19%
Enterprise resource planning ERP software	87%	44%
Presentation software	87%	44%

[55] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.
[56] Threshold: Core industry needs are identified as the skills associated with 80% of the Top 10 posted occupations. Training needs are skills where the current supply is 40 percentage points lower than the demand statistics.

Tools training needs[57]

Tools training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Conductivity meters	33%	2%
Digital camcorders or video cameras	41%	19%
Global positioning system GPS receiver	48%	3%
Mainframe computers	37%	9%
pH meters	33%	3%
Portable data input terminals	34%	9%
Soil core sampling apparatus	33%	2%
Two way radios	33%	6%

Tools training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Desktop computers*	88%	62%
Laser fax machine*	48%	23%
Liquid crystal display projector	34%	4%
Notebook computers*	68%	46%
Personal computers*	100%	75%
Photocopiers*	48%	24%
Safety glasses	33%	10%
Special purpose telephones*	48%	23%

*While computers and printing devices are widely used now in most white-collar occupations, they are becoming increasingly important for jobs of lower educational requirement in the biopharmaceutical cluster. The result of the data analysis indicates that Long Island's current workforce with lower educational attainment can potentially benefit from computer-related training.

[57] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 20 percentage points lower than the demand statistics.

Business Services Cluster Skill Gap Analysis

To better prepare Long Island for the future growth of its strategic industries, one needs to understand the changing landscape of work and re-assess the skill requirements in key clusters. In the skill gap analysis for Long Island's business services cluster, we asked the following questions:

- What job positions are local companies in this cluster trying to hire?
- In the national benchmark region where this cluster is strong, what job positions are companies trying to hire?
- What are the differences in job hiring pattern between Long Island and the benchmark region? Which region is more prepared for the future?
- In order for Long Island to fully prepare itself for future growth of this cluster, what are the specific training needs for technical skills and knowledge?

To answer the questions above, we performed multiple quantitative data analyses. Below is a summary of the results for this cluster. At the end of the section are four sets of tables of specific training needes identified for this cluster.

On Long Island, what kinds of job positions are business services companies trying to hire?

Recent job posting data reveals important industry trends. In our research, we divided job postings into two categories: positions requiring a Bachelor's degree or above and positions requiring less than a Bachelor's degree. The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019 for the two educational requirement levels.

Long Island Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Software Developers, Applications	21%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	17%	Bachelor's Degree
Computer Occupations, All Other	13%	Bachelor's Degree
Accountants and Auditors	10%	Bachelor's Degree

Bookkeeping, Accounting, and Auditing Clerks	10%	High School Diploma or equivalent
Tax Preparers	6%	High School Diploma or equivalent
Managers, All Other	6%	Bachelor's Degree
Paralegals and Legal Assistants	6%	Bachelor's Degree
Computer User Support Specialists	6%	Bachelor's Degree
Computer Systems Analysts	4%	Bachelor's Degree

Long Island Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Customer Service Representatives	28%	High School Diploma or equivalent
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	21%	Bachelor's Degree
Bookkeeping, Accounting, and Auditing Clerks	13%	High School Diploma or equivalent
Tax Preparers	8%	High School Diploma or equivalent
Paralegals and Legal Assistants	8%	Bachelor's Degree
Computer User Support Specialists	7%	Bachelor's Degree
Retail Salespersons	4%	High School Diploma or equivalent
Network and Computer Systems Administrators	4%	Bachelor's Degree
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3%	High School Diploma or equivalent
First-Line Supervisors of Office and Administrative Support Workers	3%	Bachelor's Degree

What occupations are companies in the national benchmark region trying to hire?

We chose San Jose CA Metro Area as the benchmark region, because it satisfies the following criteria: relatively large cluster, substantial growth, leader in innovation.

The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019.

San Jose CA Metro Area Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Software Developers, Applications	41%	Bachelor's Degree
Computer Occupations, All Other	21%	Bachelor's Degree
Web Developers	9%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	6%	Bachelor's Degree
Managers, All Other	5%	Bachelor's Degree
Database Administrators	5%	Bachelor's Degree
Computer Systems Analysts	4%	Bachelor's Degree
Engineers, All Other	3%	Bachelor's Degree
Computer User Support Specialists	3%	Bachelor's Degree
Management Analysts	3%	Bachelor's Degree

San Jose CA Metro Area Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	26%	Bachelor's Degree
Customer Service Representatives	19%	High School Diploma or equivalent
Computer User Support Specialists	14%	Bachelor's Degree
Network and Computer Systems Administrators	8%	Bachelor's Degree
Paralegals and Legal Assistants	8%	Bachelor's Degree
Human Resources Specialists	7%	Bachelor's Degree
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	6%	High School Diploma or equivalent
Bookkeeping, Accounting, and Auditing Clerks	4%	High School Diploma or equivalent
Engineering Technicians, Except Drafters, All Other	4%	Bachelor's Degree
Maintenance and Repair Workers, General	4%	High School Diploma or equivalent

What are the differences in terms of industry hiring needs between the benchmark region and Long Island?

Compared with Long Island, occupations associated with business services job postings in the Benchmark region are facing fewer automation risks (the risk of being replaced by computers and/or robots in the future).

For jobs requiring higher educational attainment, there are 4 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing high automation risks.[58] These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Accountants and Auditors	Yes	No	High Risk
Bookkeeping, Accounting, and Auditing Clerks	Yes	No	High Risk
Tax Preparers	Yes	No	High Risk
Paralegals and Legal Assistants	Yes	No	High Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing lower automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Web Developers	No	Yes	Low Risk
Database Administrators	No	Yes	Low Risk
Engineers, All Other	No	Yes	Low Risk
Management Analysts	No	Yes	Low Risk

For jobs requiring lower educational attainment, there are 3 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing mostly high automation risks. These jobs are:

[58] The risk of automation score is the probability of computerization for an occupation within the next 20 years, provided by Burning Glass Labor Insight.

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Tax Preparers	Yes	No	High Risk
Retail Salespersons	Yes	No	High Risk
First-Line Supervisors of Office and Administrative Support Workers	Yes	No	Low Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing both mid-low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Human Resources Specialists	No	Yes	Low Risk
Engineering Technicians, Except Drafters, All Other	No	Yes	Low Risk
Maintenance and Repair Workers, General	No	Yes	Medium Risk

Based on hiring needs, which region is better prepared for the future?

Based on job posting data, the benchmark region is better prepared for the future where automation and computerization will redefine employment and reshape the demand for skills.

On Long Island, the jobs being posted by companies have a 63% overall chance of being replaced by computers in 20 years. In comparison, the benchmark region's chance is only 26%.[59]

Chance of jobs being replaced by computers in 20 years (0-100%)					
Overall - All jobs		Jobs requiring more than a Bachelor's degree		Jobs requiring less than a Bachelor's degree	
Long Island	Benchmark	Long Island	Benchmark	Long Island	Benchmark
63%	26%	55%	17%	73%	65%

[59] The probability of automation for each occupation is calculated and presented in the seminal Oxford University study on automation, *The Future of Employment: How Susceptible are Jobs to Computerisation?* The same probability statistics determine the Burning Glass Labor Insight's risk of automation levels. The breakdown of scores are as follows: High risk of automation: The top quartile of scores (ex: Insurance Underwriters). Medium risk of automation: The third quartile of scores (ex: Machinists). Low risk of automation: The bottom two quartiles of scores (ex: Home Health Aides).

The difference in hiring needs means a difference in workforce skill requirements. In order to better prepare for future economic growth and transformation, Long Island industries need to look beyond what they currently need. Instead, companies can benefit from training programs that can teach skills associated with jobs facing fewer automation risks, such as those sought by companies in the benchmark region.

In order to better prepare Long Islanders for the future of industry growth, what are the skill training needs?

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- General technical skills (These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.)
- Knowledge (This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications.)
- Software (This refers to the capability of operating specific software applications. There are 127 software applications included in the analysis.)
- Tools (This refers to the capability of using specific machines and/or tools. There are 4,180 tools included in the analysis.)

Based on employment, job postings, and occupational skills data, we identified specific skills where there exist the largest gaps between what the industries need and what the current workforce of Long Island can provide.

We first identified the most in-demand skills for the industries, based on job posting data from the benchmark region. O*NET links skills to each occupation. If a significant portion of the region's Top 10 job posting occupations is associated with a particular skill, that skill is then marked as a "core industry need".

When then checked how prepared Long Island's current workforce is for each skill in the core industry needs. Again, as O*NET links skills to occupations, the employment data was used in combination with O*NET to produce the "skill palette" of Long Island. For instance, based on the data analysis, for jobs typically requiring a Bachelor's degree or above, 99% of Long Island's current occupations are associated with Office Suite software, while only 4% are associated with graphic user interface development software.

Once we identified the core industry needs and the skill palette of Long Island's current workforce, we compared these two statistics to identify the need for skill training. A core industry need is not necessarily a training need, if most of Long Islanders already possess that skill. Only when a core skill is severely undersupplied by the current population, which means that the gap between industry demand and current workforce characteristics is large, can we identify that skill as being in need of training.[60]

We compared the industry needs against Long Island-wide workforce characteristics. Instead of comparing the needs against workforce characteristics within the same industry, because we anticipate the workforce training program to facilitate people currently not employed in the particular industry to take job opportunities in the key industry cluster. If we limit the scope of analysis, we will only be assuming that workers stay within the same industries in the future, thus missing the potential shift of employment from non-strategic industries to strategic industries.

The lists of training needs below are the results of the quantitative data analysis prior to qualitative assessment and validation. For definitions and examples of specific skills, as well as information about how each of the recommended training needs apply to specific occupations, see Appendix 3.

[60] In our analysis, we analyzed skill gaps by checking two criteria: If the skill is associated with more than a certain portion, say 70%, of the region's Top 10 job posting occupations, we then mark it as a core industry need (the percentage threshold can change from one skill category to another). For a given skill marked as a core industry need, if less than X% of Long Island's current occupations are associated with that particular skill, then it will be marked as a training need. The value of X is dependent on the demand of that skill, indicated by job postings. This is because, for skills in more demand by the industries, you will need the workforce to be more prepared also. For example, in our analysis of general technical skills, X is calculated as 10 percentage points below the respective skill's frequency in job postings. So for skills associated with 70% of job postings, they are marked as training needs if less than 60% of the current workforce is associated with the skills; for skills associated with 80% of job postings, they are marked as training needs if fewer than 70% of the current workforce are associated with the skills. The percentage threshold also changes from one skill category to another.

General technical skills training needs[61]

General technical skills training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Troubleshooting	37%	14%
Technology Design	40%	19%
Quality Control Analysis	44%	27%
Programming	61%	18%
Operations Analysis	56%	33%
Operation Monitoring	40%	28%

General technical skills training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of lower educational requirement, Long Island's current workforce are relatively prepared in terms of general technical skill capabilities.	NA	NA

Knowledge training needs[62]

Knowledge training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Engineering and Technology	58%	26%
Design	45%	21%
Computers and Electronics	84%	57%

Knowledge training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Computers and Electronics	60%	39%
Clerical	56%	43%

[61] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.
[62] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Software training needs[63]

Software training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Web platform development software	95%	25%
Web page creation and editing software	97%	42%
Video creation and editing software	87%	45%
Transaction server software	86%	23%
Transaction security and virus protection software	88%	33%
Sales and marketing software	91%	26%
Requirements analysis and system architecture software	89%	9%
Program testing software	89%	9%
Portal server software	89%	8%
Operating system software	100%	55%
Object oriented data base management software	89%	17%
Object or component oriented development software	100%	43%
Network monitoring software	89%	18%
Metadata management software	86%	15%
Medical software	97%	55%
Map creation software	100%	29%
Industrial control software	86%	18%
Human resources software	82%	42%
Graphics or photo imaging software	100%	59%
Financial analysis software	97%	45%
File versioning software	89%	10%
Expert system software	95%	15%
Enterprise system management software	95%	30%
Enterprise resource planning ERP software	100%	57%
Enterprise application integration software	100%	32%
Document management software	95%	50%
Development environment software	100%	47%

[63] Threshold: Core industry needs are identified as the skills associated with 80% of the Top 10 posted occupations. Training needs are skills where the current supply is 40 percentage points lower than the demand statistics.

Desktop publishing software	97%	50%
Data mining software	88%	28%
Data base reporting software	97%	40%
Data base management system software	100%	35%
Customer relationship management CRM software	91%	47%
Content workflow software	89%	22%
Configuration management software	89%	17%
Computer aided design CAD software	88%	30%
Communications server software	91%	24%
Business intelligence and data analysis software	97%	40%
Application server software	95%	15%
Analytical or scientific software	100%	59%
Access software	83%	28%

Software training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Web page creation and editing software	80%	23%
Video creation and editing software	84%	11%
Project management software	100%	39%
Presentation software	96%	44%
Operating system software	92%	51%
Medical software	85%	33%
Internet browser software	92%	50%
Information retrieval or search software	84%	16%
Graphics or photo imaging software	84%	22%
Financial analysis software	85%	14%
Enterprise system management software	80%	6%
Enterprise resource planning ERP software	92%	44%
Document management software	96%	30%
Desktop publishing software	96%	30%
Customer relationship management CRM software	92%	28%
Business intelligence and data analysis software	88%	9%
Analytical or scientific software	92%	19%
Accounting software	84%	42%

Tools training needs[64]

Tools training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Mainframe computers	78%	9%
Integrated circuit testers	65%	2%
Computer servers	74%	6%

Tools training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Special purpose telephones*	47%	23%
Notebook computers*	100%	46%
Liquid crystal display projector*	33%	4%
Laser printers*	49%	26%
Desktop computers*	100%	62%

*While computers and printing devices are widely used now in most white-collar occupations, they are becoming increasingly important for jobs of lower educational requirement in the biopharmaceutical cluster. The result of the data analysis indicates that Long Island's current workforce with lower educational attainment can potentially benefit from computer-related training.

[64] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 20 percentage points lower than the demand statistics.

Construction Cluster Skill Gap Analysis

To better prepare Long Island for the future growth of its strategic industries, one needs to understand the changing landscape of work and re-assess the skill requirements in key clusters. In the skill gap analysis for Long Island's construction cluster, we asked the following questions:

- What job positions are local companies in this cluster trying to hire?
- In the national benchmark region where this cluster is strong, what job positions are companies trying to hire?
- What are the differences in job hiring pattern between Long Island and the benchmark region? Which region is more prepared for the future?
- In order for Long Island to fully prepare itself for future growth of this cluster, what are the specific training needs for technical skills and knowledge?

To answer the questions above, we performed multiple quantitative data analyses. Below is a summary of the results for this cluster. At the end of the section are four sets of tables of specific training needes identified for this cluster.

On Long Island, what kinds of job positions are construction companies trying to hire?

Recent job posting data reveals important industry trends. In our research, we divided job postings into two categories: positions requiring a Bachelor's degree or above and positions requiring less than a Bachelor's degree. The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019 for the two educational requirement levels.

Long Island Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Construction Managers	39%	Bachelor's Degree
Civil Engineers	10%	Bachelor's Degree
Electrical Engineers	9%	Bachelor's Degree
Construction and Building Inspectors	8%	Post-Secondary Certificate
Architectural and Engineering Managers	7%	Bachelor's Degree

Managers, All Other	7%	Bachelor's Degree
Computer Occupations, All Other	5%	Bachelor's Degree
Occupational Health and Safety Specialists	5%	Bachelor's Degree
Market Research Analysts and Marketing Specialists	5%	Bachelor's Degree
Bookkeeping, Accounting, and Auditing Clerks	5%	High School Diploma or equivalent

Long Island Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Construction Managers	44%	Bachelor's Degree
Maintenance and Repair Workers, General	13%	High School Diploma or equivalent
Construction and Building Inspectors	9%	Post-Secondary Certificate
Customer Service Representatives	6%	High School Diploma or equivalent
Bookkeeping, Accounting, and Auditing Clerks	6%	High School Diploma or equivalent
Telecommunications Equipment Installers and Repairers, Except Line Installers	5%	Post-Secondary Certificate
Cost Estimators	5%	Bachelor's Degree
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	5%	Post-Secondary Certificate
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	4%	High School Diploma or equivalent
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4%	Bachelor's Degree

What occupations are companies in the national benchmark region trying to hire?

We chose Washington DC Metro Area as the benchmark region, because it satisfies the following criteria: relatively large cluster, innovation.

The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019.

Washington DC Metro Area Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Construction Managers	43%	Bachelor's Degree
Computer Occupations, All Other	10%	Bachelor's Degree
Managers, All Other	9%	Bachelor's Degree
Civil Engineers	7%	Bachelor's Degree
Cost Estimators	6%	Bachelor's Degree
Management Analysts	6%	Bachelor's Degree
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	6%	High School Diploma or equivalent
Sales Managers	5%	Bachelor's Degree
Software Developers, Applications	4%	Bachelor's Degree
Human Resources Specialists	4%	Bachelor's Degree

Washington DC Metro Area Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Construction Managers	55%	Bachelor's Degree
Cost Estimators	8%	Bachelor's Degree
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	8%	High School Diploma or equivalent
Maintenance and Repair Workers, General	6%	High School Diploma or equivalent
Human Resources Specialists	5%	Bachelor's Degree
Electrical Power-Line Installers and Repairers	4%	Post-Secondary Certificate
Construction and Building Inspectors	4%	Post-Secondary Certificate
Sales Representatives, Wholesale and Manufacturing,	4%	Bachelor's Degree

Except Technical and Scientific Products		
First-Line Supervisors of Construction Trades and Extraction Workers	3%	High School Diploma or equivalent
Inspectors, Testers, Sorters, Samplers, and Weighers	3%	High School Diploma or equivalent

What are the differences in terms of industry hiring needs between the benchmark region and Long Island?

Compared with Long Island, occupations associated with construction job postings in the Benchmark region are facing fewer automation risks (the risk of being replaced by computers and/or robots in the future).

For jobs requiring higher educational attainment, there are 6 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing a variety of automation risks.[65] These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Electrical Engineers	Yes	No	Low Risk
Construction and Building Inspectors	Yes	No	Medium Risk
Architectural and Engineering Managers	Yes	No	Low Risk
Occupational Health and Safety Specialists	Yes	No	Low Risk
Market Research Analysts and Marketing Specialists	Yes	No	Medium Risk
Bookkeeping, Accounting, and Auditing Clerks	Yes	No	High Risk

[65] The risk of automation score is the probability of computerization for an occupation within the next 20 years, provided by Burning Glass Labor Insight.

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing slightly lower automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Cost Estimators	No	Yes	Medium Risk
Management Analysts	No	Yes	Low Risk
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	No	Yes	High Risk
Sales Managers	No	Yes	Low Risk
Software Developers, Applications	No	Yes	Low Risk
Human Resources Specialists	No	Yes	Low Risk

For jobs requiring lower educational attainment, there are 5 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing mostly medium automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Customer Service Representatives	Yes	No	Medium Risk
Bookkeeping, Accounting, and Auditing Clerks	Yes	No	High Risk
Telecommunications Equipment Installers and Repairers, Except Line Installers	Yes	No	Low Risk
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Yes	No	Medium Risk
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	Yes	No	Medium Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing mostly low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	No	Yes	High Risk

Human Resources Specialists	No	Yes	Low Risk
Electrical Power-Line Installers and Repairers	No	Yes	Low Risk
First-Line Supervisors of Construction Trades and Extraction Workers	No	Yes	Low Risk
Inspectors, Testers, Sorters, Samplers, and Weighers	No	Yes	High Risk

Based on hiring needs, which region is better prepared for the future?

Based on job posting data, the benchmark region is better prepared for the future where automation and computerization will redefine employment and reshape the demand for skills, but the difference is not as significant as observed in other key clusters.

On Long Island, the jobs being posted by companies have a 30% overall chance of being replaced by computers in 20 years. In comparison, the benchmark region's chance is 24%.[66]

Chance of jobs being replaced by computers in 20 years (0-100%)					
Overall - All jobs		Jobs requiring more than a Bachelor's degree		Jobs requiring less than a Bachelor's degree	
Long Island	Benchmark	Long Island	Benchmark	Long Island	Benchmark
30%	24%	21%	19%	40%	31%

The difference in hiring needs means a difference in workforce skill requirements. In order to better prepare for future economic growth and transformation, Long Island industries need to look beyond what they currently need. Instead, companies can benefit from training programs that can teach skills associated with jobs facing fewer automation risks, such as those sought by companies in the benchmark region.

[66] The probability of automation for each occupation is calculated and presented in the seminal Oxford University study on automation, *The Future of Employment: How Susceptible are Jobs to Computerisation*? The same probability statistics determine the Burning Glass Labor Insight's risk of automation levels. The breakdown of scores are as follows: High risk of automation: The top quartile of scores (ex: Insurance Underwriters). Medium risk of automation: The third quartile of scores (ex: Machinists). Low risk of automation: The bottom two quartiles of scores (ex: Home Health Aides).

In order to better prepare Long Islanders for the future of industry growth, what are the skill training needs?

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- General technical skills (These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.)
- Knowledge (This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications.)
- Software (This refers to the capability of operating specific software applications. There are 127 software applications included in the analysis.)
- Tools (This refers to the capability of using specific machines and/or tools. There are 4,180 tools included in the analysis.)

Based on employment, job postings, and occupational skills data, we identified specific skills where there exist the largest gaps between what the industries need and what the current workforce of Long Island can provide.

We first identified the most in-demand skills for the industries, based on job posting data from the benchmark region. O*NET links skills to each occupation. If a significant portion of the region's Top 10 job posting occupations is associated with a particular skill, that skill is then marked as a "core industry need".

When then checked how prepared Long Island's current workforce is for each skill in the core industry needs. Again, as O*NET links skills to occupations, the employment data was used in combination with O*NET to produce the "skill palette" of Long Island. For instance, based on the data analysis, for jobs typically requiring a Bachelor's degree or above, 99% of Long Island's current occupations are associated with Office Suite software, while only 4% are associated with graphic user interface development software.

Once we identified the core industry needs and the skill palette of Long Island's current workforce, we compared these two statistics to identify the need for skill training. A core industry need is not necessarily a training need, if most of Long Islanders already possess that skill. Only when a core skill is severely undersupplied by the current population, which means that the gap between industry demand and current workforce characteristics is large, can we identify that skill as being in need of training.[67]

[67] In our analysis, we analyzed skill gaps by checking two criteria: If the skill is associated with more than a certain portion, say 70%, of the region's Top 10 job posting occupations, we then mark it as a core industry need (the percentage threshold can change from one skill category to another). For a given skill marked as a core industry need, if less than X% of Long Island's current occupations are associated with that particular skill, then it will be marked as

We compared the industry needs against Long Island-wide workforce characteristics. Instead of comparing the needs against workforce characteristics within the same industry, because we anticipate the workforce training program to facilitate people currently not employed in the particular industry to take job opportunities in the key industry cluster. If we limit the scope of analysis, we will only be assuming that workers stay within the same industries in the future, thus missing the potential shift of employment from non-strategic industries to strategic industries.

The lists of training needs below are the results of the quantitative data analysis prior to qualitative assessment and validation. For definitions and examples of specific skills, as well as information about how each of the recommended training needs apply to specific occupations, see Appendix 3.

General technical skills training needs[68]

General technical skills training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Quality Control Analysis	37%	27%
Operations Analysis	52%	33%

General technical skills training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Quality Control Analysis	43%	29%
Operations Analysis	45%	13%

a training need. The value of X is dependent on the demand of that skill, indicated by job postings. This is because, for skills in more demand by the industries, you will need the workforce to be more prepared also. For example, in our analysis of general technical skills, X is calculated as 10 percentage points below the respective skill's frequency in job postings. So for skills associated with 70% of job postings, they are marked as training needs if less than 60% of the current workforce is associated with the skills; for skills associated with 80% of job postings, they are marked as training needs if fewer than 70% of the current workforce are associated with the skills. The percentage threshold also changes from one skill category to another.

[68] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Knowledge training needs[69]

Knowledge training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Production and Processing	38%	28%
Mechanical	37%	18%
Engineering and Technology	60%	26%
Design	52%	21%
Building and Construction	54%	13%

Knowledge training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Physics	31%	13%
Personnel and Human Resources	42%	31%
Mechanical	51%	26%
Mathematics	64%	44%
Law and Government	43%	28%
English Language	74%	61%
Engineering and Technology	59%	18%
Economics and Accounting	43%	26%
Design	54%	17%
Computers and Electronics	51%	39%
Building and Construction	70%	15%
Administration and Management	66%	46%

[69] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Software training needs[70]

Software training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Web page creation and editing software	87%	42%
Human resources software	87%	42%
Graphics or photo imaging software	100%	59%
Enterprise resource planning ERP software	100%	57%
Document management software	100%	50%
Computer aided design CAD software	85%	30%
Analytical or scientific software	100%	59%
Accounting software	93%	49%

Software training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Project management software	96%	39%
Presentation software	90%	44%
Graphics or photo imaging software	86%	22%
Enterprise resource planning ERP software	96%	44%
Document management software	83%	30%
Computer aided design CAD software	88%	22%
Analytical or scientific software	86%	19%
Accounting software	84%	42%

[70] Threshold: Core industry needs are identified as the skills associated with 80% of the Top 10 posted occupations. Training needs are skills where the current supply is 40 percentage points lower than the demand statistics.

Tools training needs[71]

Tools training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Radarbased surveillance systems	53%	2%
Levels	50%	1%
Level sensors or transmitters	50%	1%
Lasers	43%	4%
Infrared camera	43%	0%
Gas detectors	43%	1%
Digital cameras	79%	29%
Airships	43%	0%
Aircraft guidance systems	43%	0%

Tools training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Scanners	80%	31%
Radarbased surveillance systems	55%	1%
Personal computers	100%	75%
Notebook computers	93%	46%
Levels	73%	12%
Level sensors or transmitters	63%	5%
Lasers	55%	1%
Infrared camera	55%	0%
Gas detectors	64%	5%
Digital cameras	70%	13%
Airships	55%	0%
Aircraft guidance systems	55%	0%

*While computers and printing devices are widely used now in most white-collar occupations, they are becoming increasingly important for jobs of lower educational requirement in the biopharmaceutical cluster. The result of the data analysis indicates that Long Island's current workforce with lower educational attainment can potentially benefit from computer-related training.

[71] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 20 percentage points lower than the demand statistics.

Distribution and E-Commerce Cluster Skill Gap Analysis

To better prepare Long Island for the future growth of its strategic industries, one needs to understand the changing landscape of work and re-assess the skill requirements in key clusters. In the skill gap analysis for Long Island's distribution and e-commerce cluster, we asked the following questions:

- What job positions are local companies in this cluster trying to hire?
- In the national benchmark region where this cluster is strong, what job positions are companies trying to hire?
- What are the differences in job hiring pattern between Long Island and the benchmark region? Which region is more prepared for the future?
- In order for Long Island to fully prepare itself for future growth of this cluster, what are the specific training needs for technical skills and knowledge?

To answer the questions above, we performed multiple quantitative data analyses. Below is a summary of the results for this cluster. At the end of the section are four sets of tables of specific training needes identified for this cluster.

On Long Island, what kinds of job positions are distribution companies trying to hire?

Recent job posting data reveals important industry trends. In our research, we divided job postings into two categories: positions requiring a Bachelor's degree or above and positions requiring less than a Bachelor's degree. The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019 for the two educational requirement levels.

Long Island Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	34%	Bachelor's Degree
Demonstrators and Product Promoters	16%	High School Diploma or equivalent
Educational, Guidance, School, and Vocational Counselors	11%	Master's Degree

Software Developers, Applications	9%	Bachelor's Degree
Sales Representatives, Services, All Other	7%	Bachelor's Degree
First-Line Supervisors of Retail Sales Workers	6%	High School Diploma or equivalent
Sales Managers	4%	Bachelor's Degree
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	4%	High School Diploma or equivalent
Computer Occupations, All Other	4%	Bachelor's Degree
Transportation, Storage, and Distribution Managers	4%	Bachelor's Degree

Long Island Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Stock Clerks and Order Fillers	28%	High School Diploma or equivalent
Bus and Truck Mechanics and Diesel Engine Specialists	16%	High School Diploma or equivalent
Laborers and Freight, Stock, and Material Movers, Hand	11%	High School Diploma or equivalent
Merchandise Displayers and Window Trimmers	10%	High School Diploma or equivalent
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	10%	Bachelor's Degree
Retail Salespersons	8%	High School Diploma or equivalent
Driver/Sales Workers	5%	High School Diploma or equivalent
Demonstrators and Product Promoters	5%	High School Diploma or equivalent
Heavy and Tractor-Trailer Truck Drivers	5%	High School Diploma or equivalent
Customer Service Representatives	4%	High School Diploma or equivalent

What occupations are companies in the national benchmark region trying to hire?

We chose Riverside CA Metro Area as the benchmark region, because it satisfies the following criteria: relatively large cluster, substantial growth.

The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019.

Rierside CA Metro Area Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Software Developers, Applications	19%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	18%	Bachelor's Degree
Computer Occupations, All Other	14%	Bachelor's Degree
General and Operations Managers	10%	Bachelor's Degree
First-Line Supervisors of Retail Sales Workers	9%	High School Diploma or equivalent
Commercial and Industrial Designers	8%	Bachelor's Degree
Web Developers	6%	Bachelor's Degree
Managers, All Other	6%	Bachelor's Degree
Inspectors, Testers, Sorters, Samplers, and Weighers	6%	High School Diploma or equivalent
Marketing Managers	5%	Bachelor's Degree

Riverside CAMetro Area Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Stock Clerks and Order Fillers	16%	High School Diploma or equivalent
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	14%	Bachelor's Degree
Heavy and Tractor-Trailer Truck Drivers	14%	High School Diploma or equivalent
Retail Salespersons	11%	High School Diploma or equivalent
Laborers and Freight, Stock, and Material Movers, Hand	11%	High School Diploma or equivalent
Industrial Truck and Tractor Operators	10%	High School Diploma or equivalent
Merchandise Displayers and Window Trimmers	8%	High School Diploma or

		equivalent
First-Line Supervisors of Retail Sales Workers	7%	High School Diploma or equivalent
Shipping, Receiving, and Traffic Clerks	5%	High School Diploma or equivalent
Inspectors, Testers, Sorters, Samplers, and Weighers	5%	High School Diploma or equivalent

What are the differences in terms of industry hiring needs between the benchmark region and Long Island?

Compared with Long Island, occupations associated with distribution job postings in the Benchmark region are facing fewer automation risks (the risk of being replaced by computers and/or robots in the future) in the higher-educational attainment category.

For jobs requiring higher educational attainment, there are 6 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing a variety of automation risks.[72] These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Demonstrators and Product Promoters	Yes	No	Medium Risk
Educational, Guidance, School, and Vocational Counselors	Yes	No	Low Risk
Sales Representatives, Services, All Other	Yes	No	Low Risk
Sales Managers	Yes	No	Low Risk
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	Yes	No	High Risk
Transportation, Storage, and Distribution Managers	Yes	No	Medium Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are mostly low automation risks. These jobs are:

[72] The risk of automation score is the probability of computerization for an occupation within the next 20 years, provided by Burning Glass Labor Insight.

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
General and Operations Managers	No	Yes	Low Risk
Commercial and Industrial Designers	No	Yes	Low Risk
Web Developers	No	Yes	Low Risk
Managers, All Other	No	Yes	Low Risk
Inspectors, Testers, Sorters, Samplers, and Weighers	No	Yes	High Risk
Marketing Managers	No	Yes	Low Risk

For jobs requiring lower educational attainment, there are 4 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing mostly medium automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Bus and Truck Mechanics and Diesel Engine Specialists	Yes	No	Medium Risk
Driver/Sales Workers	Yes	No	High Risk
Demonstrators and Product Promoters	Yes	No	Medium Risk
Customer Service Representatives	Yes	No	Medium Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing high and low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Industrial Truck and Tractor Operators	No	Yes	High Risk
First-Line Supervisors of Retail Sales Workers	No	Yes	Low Risk
Shipping, Receiving, and Traffic Clerks	No	Yes	High Risk
Inspectors, Testers, Sorters, Samplers, and Weighers	No	Yes	High Risk

Based on hiring needs, which region is better prepared for the future?

Based on job posting data, for occupations requiring higher educational attainment, the benchmark region is better prepared for the future where automation and computerization will redefine employment and reshape the demand for skills. For jobs requiring lower educational attainment, Long Island outperforms the benchmark region.

On Long Island, the jobs being posted by companies have a 67% overall chance of being replaced by computers in 20 years. In comparison, the benchmark region's chance is 56%.[73]

Chance of jobs being replaced by computers in 20 years (0-100%)					
Overall - All jobs		Jobs requiring more than a Bachelor's degree		Jobs requiring less than a Bachelor's degree	
Long Island	Benchmark	Long Island	Benchmark	Long Island	Benchmark
67%	56%	49%	32%	72%	77%

The difference in hiring needs means a difference in workforce skill requirements. For occupations requiring higher educational attainment, in order to better prepare for future economic growth and transformation, Long Island industries need to look beyond what they currently need. Instead, companies can benefit from training programs that can teach skills associated with jobs facing fewer automation risks, such as those sought by companies in the benchmark region.

In order to better prepare Long Islanders for the future of industry growth, what are the skill training needs?

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- General technical skills (These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.)

[73] The probability of automation for each occupation is calculated and presented in the seminal Oxford University study on automation, *The Future of Employment: How Susceptible are Jobs to Computerisation?* The same probability statistics determine the Burning Glass Labor Insight's risk of automation levels. The breakdown of scores are as follows: High risk of automation: The top quartile of scores (ex: Insurance Underwriters). Medium risk of automation: The third quartile of scores (ex: Machinists). Low risk of automation: The bottom two quartiles of scores (ex: Home Health Aides).

- Knowledge (This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications.)
- Software (This refers to the capability of operating specific software applications. There are 127 software applications included in the analysis.)
- Tools (This refers to the capability of using specific machines and/or tools. There are 4,180 tools included in the analysis.)

Based on employment, job postings, and occupational skills data, we identified specific skills where there exist the largest gaps between what the industries need and what the current workforce of Long Island can provide.

We first identified the most in-demand skills for the industries, based on job posting data from the benchmark region for higher educational requirement occupations and posting data from Long Island for lower educational requirement occupations. O*NET links skills to each occupation. If a significant portion of the region's Top 10 job posting occupations is associated with a particular skill, that skill is then marked as a "core industry need".

When then checked how prepared Long Island's current workforce is for each skill in the core industry needs. Again, as O*NET links skills to occupations, the employment data was used in combination with O*NET to produce the "skill palette" of Long Island. For instance, based on the data analysis, for jobs typically requiring a Bachelor's degree or above, 99% of Long Island's current occupations are associated with Office Suite software, while only 4% are associated with graphic user interface development software.

Once we identified the core industry needs and the skill palette of Long Island's current workforce, we compared these two statistics to identify the need for skill training. A core industry need is not necessarily a training need, if most of Long Islanders already possess that skill. Only when a core skill is severely undersupplied by the current population, which means that the gap between industry demand and current workforce characteristics is large, can we identify that skill as being in need of training.[74]

We compared the industry needs against Long Island-wide workforce characteristics. Instead of comparing the needs against workforce characteristics within the same industry, because

[74] In our analysis, we analyzed skill gaps by checking two criteria: If the skill is associated with more than a certain portion, say 70%, of the region's Top 10 job posting occupations, we then mark it as a core industry need (the percentage threshold can change from one skill category to another). For a given skill marked as a core industry need, if less than X% of Long Island's current occupations are associated with that particular skill, then it will be marked as a training need. The value of X is dependent on the demand of that skill, indicated by job postings. This is because, for skills in more demand by the industries, you will need the workforce to be more prepared also. For example, in our analysis of general technical skills, X is calculated as 10 percentage points below the respective skill's frequency in job postings. So for skills associated with 70% of job postings, they are marked as training needs if less than 60% of the current workforce is associated with the skills; for skills associated with 80% of job postings, they are marked as training needs if fewer than 70% of the current workforce are associated with the skills. The percentage threshold also changes from one skill category to another.

we anticipate the workforce training program to facilitate people currently not employed in the particular industry to take job opportunities in the key industry cluster. If we limit the scope of analysis, we will only be assuming that workers stay within the same industries in the future, thus missing the potential shift of employment from non-strategic industries to strategic industries.

The lists of training needs below are the results of the quantitative data analysis prior to qualitative assessment and validation. For definitions and examples of specific skills, as well as information about how each of the recommended training needs apply to specific occupations, see Appendix 3.

General technical skills training needs[75]

General technical skills training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Technology Design	31%	19%
Programming	38%	18%
Operations Analysis	47%	33%

General technical skills training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of lower educational requirement, Long Island's current workforce are relatively prepared in terms of general technical skill capabilities.	NA	NA

Knowledge training needs[76]

Knowledge training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Engineering and Technology	46%	26%
Design	41%	21%

[75] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.
[76] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Knowledge training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Sales and Marketing	45%	32%

Software training needs[77]

Software training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Web page creation and editing software	86%	42%
Video creation and editing software	89%	45%
Sales and marketing software	81%	26%
Object or component oriented development software	100%	43%
Map creation software	81%	29%
Graphics or photo imaging software	100%	59%
Financial analysis software	94%	45%
Enterprise resource planning ERP software	100%	57%
Enterprise application integration software	83%	32%
Document management software	94%	50%
Desktop publishing software	94%	50%
Data mining software	81%	28%
Data base management system software	92%	35%
Computer aided design CAD software	89%	30%
Business intelligence and data analysis software	86%	40%
Analytical or scientific software	100%	59%

Software training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of lower educational requirement, Long Island's current workforce are relatively prepared in terms of software capabilities.	NA	NA

[77] Threshold: Core industry needs are identified as the skills associated with 80% of the Top 10 posted occupations. Training needs are skills where the current supply is 40 percentage points lower than the demand statistics.

Tools training needs[78]

Tools training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Mainframe computers	33%	9%
Integrated circuit testers	39%	2%
Computer servers	39%	6%

Tools training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Workshop cranes	43%	6%
Utility knives	53%	13%
Ticket dispensing machines	35%	12%
Tape measures	51%	22%
Shears	53%	9%
Ladders	46%	25%
Label dispensers	35%	8%
Hoists	43%	15%
Forklifts	43%	23%
Dollies	38%	12%
Claw hammer	53%	14%

[78] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 20 percentage points lower than the demand statistics.

Financial Services Cluster Skill Gap Analysis

To better prepare Long Island for the future growth of its strategic industries, one needs to understand the changing landscape of work and re-assess the skill requirements in key clusters. In the skill gap analysis for Long Island's financial services cluster, we asked the following questions:

- What job positions are local companies in this cluster trying to hire?
- In the national benchmark region where this cluster is strong, what job positions are companies trying to hire?
- What are the differences in job hiring pattern between Long Island and the benchmark region? Which region is more prepared for the future?
- In order for Long Island to fully prepare itself for future growth of this cluster, what are the specific training needs for technical skills and knowledge?

To answer the questions above, we performed multiple quantitative data analyses. Below is a summary of the results for this cluster. At the end of the section are four sets of tables of specific training needes identified for this cluster.

On Long Island, what kinds of job positions are finance companies trying to hire?

Recent job posting data reveals important industry trends. In our research, we divided job postings into two categories: positions requiring a Bachelor's degree or above and positions requiring less than a Bachelor's degree. The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019 for the two educational requirement levels.

Long Island Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Securities, Commodities, and Financial Services Sales Agents	39%	Bachelor's Degree
Personal Financial Advisors	14%	Bachelor's Degree
Loan Officers	11%	Bachelor's Degree
Financial Managers	10%	Bachelor's Degree
Financial Analysts	8%	Bachelor's Degree

Managers, All Other	5%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4%	Bachelor's Degree
Accountants and Auditors	3%	Bachelor's Degree
Software Developers, Applications	3%	Bachelor's Degree
First-Line Supervisors of Retail Sales Workers	3%	High School Diploma or equivalent

Long Island Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Securities, Commodities, and Financial Services Sales Agents	31%	Bachelor's Degree
Tellers	28%	High School Diploma or equivalent
Customer Service Representatives	13%	High School Diploma or equivalent
Loan Officers	9%	Bachelor's Degree
Retail Salespersons	8%	High School Diploma or equivalent
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	3%	Bachelor's Degree
First-Line Supervisors of Retail Sales Workers	2%	High School Diploma or equivalent
Loan Interviewers and Clerks	2%	Associate's Degree (or other 2-year degree)
Production, Planning, and Expediting Clerks	2%	High School Diploma or equivalent
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	2%	High School Diploma or equivalent

What occupations are companies in the national benchmark region trying to hire?

We chose San Francisco CA Metro Area as the benchmark region, because it satisfies the following criteria: large cluster, substantial growth, leader in innovation.

The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019.

San Francisco CA Metro Area Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Financial Analysts	19%	Bachelor's Degree
Securities, Commodities, and Financial Services Sales Agents	15%	Bachelor's Degree
Financial Managers	12%	Bachelor's Degree
Software Developers, Applications	11%	Bachelor's Degree
Computer Occupations, All Other	9%	Bachelor's Degree
Managers, All Other	8%	Bachelor's Degree
Personal Financial Advisors	8%	Bachelor's Degree
Marketing Managers	7%	Bachelor's Degree
Loan Officers	6%	Bachelor's Degree
General and Operations Managers	6%	Bachelor's Degree

San Francisco CA Metro Area Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Securities, Commodities, and Financial Services Sales Agents	30%	Bachelor's Degree
Tellers	19%	High School Diploma or equivalent
Customer Service Representatives	14%	High School Diploma or equivalent
Loan Officers	11%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	8%	Bachelor's Degree
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	6%	High School Diploma or equivalent
Human Resources Specialists	4%	Bachelor's Degree
Executive Secretaries and Executive Administrative Assistants	3%	Some College Courses
First-Line Supervisors of Office and Administrative Support Workers	3%	Bachelor's Degree
Bookkeeping, Accounting, and Auditing Clerks	2%	High School Diploma or equivalent

What are the differences in terms of industry hiring needs between the benchmark region and Long Island?

Compared with Long Island, occupations associated with finance job postings in the Benchmark region are facing slightly fewer automation risks (the risk of being replaced by computers and/or robots in the future).

For jobs requiring higher educational attainment, there are 3 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing a variety of automation risks.[79] These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	Yes	No	Medium Risk
Accountants and Auditors	Yes	No	High Risk
First-Line Supervisors of Retail Sales Workers	Yes	No	Low Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Computer Occupations, All Other	No	Yes	Low Risk
Marketing Managers	No	Yes	Low Risk
General and Operations Managers	No	Yes	Low Risk

For jobs requiring lower educational attainment, there are 4 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

[79] The risk of automation score is the probability of computerization for an occupation within the next 20 years, provided by Burning Glass Labor Insight.

The occupations most desired by Long Island companies but not in the benchmark region are facing mostly high automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Retail Salespersons	Yes	No	High Risk
First-Line Supervisors of Retail Sales Workers	Yes	No	Low Risk
Loan Interviewers and Clerks	Yes	No	High Risk
Production, Planning, and Expediting Clerks	Yes	No	High Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing high and low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Human Resources Specialists	No	Yes	Low Risk
Executive Secretaries and Executive Administrative Assistants	No	Yes	High Risk
First-Line Supervisors of Office and Administrative Support Workers	No	Yes	Low Risk
Bookkeeping, Accounting, and Auditing Clerks	No	Yes	High Risk

Based on hiring needs, which region is better prepared for the future?

Based on job posting data, the benchmark region is better prepared for the future where automation and computerization will redefine employment and reshape the demand for skills, but the difference is not as significant as observed in other key clusters.

On Long Island, the jobs being posted by companies have a 47% overall chance of being replaced by computers in 20 years. In comparison, the benchmark region's chance is 33%.[80]

[80] The probability of automation for each occupation is calculated and presented in the seminal Oxford University study on automation, *The Future of Employment: How Susceptible are Jobs to Computerisation*? The same probability statistics determine the Burning Glass Labor Insight's risk of automation levels. The breakdown of scores are as follows: High risk of automation: The top quartile of scores (ex: Insurance Underwriters). Medium risk of automation: The third quartile of scores (ex: Machinists). Low risk of automation: The bottom two quartiles of scores (ex: Home Health Aides).

Chance of jobs being replaced by computers in 20 years (0-100%)					
Overall - All jobs		Jobs requiring more than a Bachelor's degree		Jobs requiring less than a Bachelor's degree	
Long Island	Benchmark	Long Island	Benchmark	Long Island	Benchmark
47%	33%	31%	21%	60%	57%

The difference in hiring needs means a difference in workforce skill requirements. In order to better prepare for future economic growth and transformation, Long Island industries need to look beyond what they currently need. Instead, companies can benefit from training programs that can teach skills associated with jobs facing fewer automation risks, such as those sought by companies in the benchmark region.

In order to better prepare Long Islanders for the future of industry growth, what are the skill training needs?

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- General technical skills (These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.)
- Knowledge (This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications.)
- Software (This refers to the capability of operating specific software applications. There are 127 software applications included in the analysis.)
- Tools (This refers to the capability of using specific machines and/or tools. There are 4,180 tools included in the analysis.)

Based on employment, job postings, and occupational skills data, we identified specific skills where there exist the largest gaps between what the industries need and what the current workforce of Long Island can provide.

We first identified the most in-demand skills for the industries, based on job posting data from the benchmark region. O*NET links skills to each occupation. If a significant portion of the region's Top 10 job posting occupations is associated with a particular skill, that skill is then marked as a "core industry need".

When then checked how prepared Long Island's current workforce is for each skill in the core industry needs. Again, as O*NET links skills to occupations, the employment data was used in combination with O*NET to produce the "skill palette" of Long Island. For instance, based on the data analysis, for jobs typically requiring a Bachelor's degree or above, 99% of Long Island's current occupations are associated with Office Suite software, while only 4% are associated with graphic user interface development software.

Once we identified the core industry needs and the skill palette of Long Island's current workforce, we compared these two statistics to identify the need for skill training. A core industry need is not necessarily a training need, if most of Long Islanders already possess that skill. Only when a core skill is severely undersupplied by the current population, which means that the gap between industry demand and current workforce characteristics is large, can we identify that skill as being in need of training.[81]

We compared the industry needs against Long Island-wide workforce characteristics. Instead of comparing the needs against workforce characteristics within the same industry, because we anticipate the workforce training program to facilitate people currently not employed in the particular industry to take job opportunities in the key industry cluster. If we limit the scope of analysis, we will only be assuming that workers stay within the same industries in the future, thus missing the potential shift of employment from non-strategic industries to strategic industries.

The lists of training needs below are the results of the quantitative data analysis prior to qualitative assessment and validation. For definitions and examples of specific skills, as well as information about how each of the recommended training needs apply to specific occupations, see Appendix 3.

[81] In our analysis, we analyzed skill gaps by checking two criteria: If the skill is associated with more than a certain portion, say 70%, of the region's Top 10 job posting occupations, we then mark it as a core industry need (the percentage threshold can change from one skill category to another). For a given skill marked as a core industry need, if less than X% of Long Island's current occupations are associated with that particular skill, then it will be marked as a training need. The value of X is dependent on the demand of that skill, indicated by job postings. This is because, for skills in more demand by the industries, you will need the workforce to be more prepared also. For example, in our analysis of general technical skills, X is calculated as 10 percentage points below the respective skill's frequency in job postings. So for skills associated with 70% of job postings, they are marked as training needs if less than 60% of the current workforce is associated with the skills; for skills associated with 80% of job postings, they are marked as training needs if fewer than 70% of the current workforce are associated with the skills. The percentage threshold also changes from one skill category to another.

General technical skills training needs[82]

General technical skills training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of higher educational requirement, Long Island's current workforce are relatively prepared in terms of general technical skill capabilities.	NA	NA

General technical skills training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of lower educational requirement, Long Island's current workforce are relatively prepared in terms of general technical skill capabilities.	NA	NA

Knowledge training needs[83]

Knowledge training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Sales and Marketing	48%	36%
Mathematics	67%	56%
Economics and Accounting	62%	39%
Computers and Electronics	67%	57%

[82] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.
[83] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Knowledge training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Sales and Marketing	53%	32%
Mathematics	58%	44%
Law and Government	41%	28%
Economics and Accounting	56%	26%
Customer and Personal Service	81%	69%
Computers and Electronics	55%	39%
Clerical	54%	43%

Software training needs[84]

Software training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Object or component oriented development software	94%	43%
Financial analysis software	100%	45%
Development environment software	92%	47%
Customer relationship management CRM software	92%	47%
Business intelligence and data analysis software	87%	40%
Accounting software	100%	49%

Software training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Presentation software	100%	44%
Internet browser software	100%	50%
Financial analysis software	81%	14%
Enterprise resource planning ERP software	89%	44%
Customer relationship management CRM software	81%	28%
Accounting software	100%	42%

[84] Threshold: Core industry needs are identified as the skills associated with 80% of the Top 10 posted occupations. Training needs are skills where the current supply is 40 percentage points lower than the demand statistics.

Tools training needs[85]

Tools training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Tablet computers	75%	39%
Personal digital assistant PDAs or organizers	67%	39%

Tools training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Tablet computers	41%	10%
Special purpose telephones	59%	23%
Scanners*	92%	31%
Photocopiers*	59%	24%
Personal computers*	98%	75%
Notebook computers*	81%	46%
Laser fax machine*	59%	23%
Desktop computers*	100%	62%
Desktop calculator*	61%	19%

*While computers and printing devices are widely used now in most white-collar occupations, they are becoming increasingly important for jobs of lower educational requirement in the biopharmaceutical cluster. The result of the data analysis indicates that Long Island's current workforce with lower educational attainment can potentially benefit from computer-related training.

[85] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 20 percentage points lower than the demand statistics.

Food Processing and Manufacturing Cluster Skill Gap Analysis

To better prepare Long Island for the future growth of its strategic industries, one needs to understand the changing landscape of work and re-assess the skill requirements in key clusters. In the skill gap analysis for Long Island's food processing and manufacturing cluster, we asked the following questions:

- What job positions are local companies in this cluster trying to hire?
- In the national benchmark region where this cluster is strong, what job positions are companies trying to hire?
- What are the differences in job hiring pattern between Long Island and the benchmark region? Which region is more prepared for the future?
- In order for Long Island to fully prepare itself for future growth of this cluster, what are the specific training needs for technical skills and knowledge?

To answer the questions above, we performed multiple quantitative data analyses. Below is a summary of the results for this cluster. At the end of the section are four sets of tables of specific training needes identified for this cluster.

On Long Island, what kinds of job positions are food processing companies trying to hire?

Recent job posting data reveals important industry trends. In our research, we divided job postings into two categories: positions requiring a Bachelor's degree or above and positions requiring less than a Bachelor's degree. The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019 for the two educational requirement levels.

Long Island Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	35%	Bachelor's Degree
First-Line Supervisors of Retail Sales Workers	12%	High School Diploma or equivalent
First-Line Supervisors of Mechanics, Installers, and Repairers	11%	High School Diploma or equivalent

Registered Nurses	11%	Master's Degree
Life, Physical, and Social Science Technicians, All Other	8%	Bachelor's Degree
Industrial Production Managers	6%	Bachelor's Degree
First-Line Supervisors of Production and Operating Workers	5%	High School Diploma or equivalent
Human Resources Specialists	5%	Bachelor's Degree
Production, Planning, and Expediting Clerks	5%	High School Diploma or equivalent
General and Operations Managers	3%	Bachelor's Degree

Long Island Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Laborers and Freight, Stock, and Material Movers, Hand	23%	High School Diploma or equivalent
Driver/Sales Workers	16%	High School Diploma or equivalent
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	12%	Bachelor's Degree
Merchandise Displayers and Window Trimmers	11%	High School Diploma or equivalent
Retail Salespersons	9%	High School Diploma or equivalent
Stock Clerks and Order Fillers	8%	High School Diploma or equivalent
Bus and Truck Mechanics and Diesel Engine Specialists	7%	High School Diploma or equivalent
Heavy and Tractor-Trailer Truck Drivers	5%	High School Diploma or equivalent
Industrial Truck and Tractor Operators	5%	High School Diploma or equivalent
First-Line Supervisors of Retail Sales Workers	4%	High School Diploma or equivalent

What occupations are companies in the national benchmark region trying to hire?

We chose Los Angeles CA Metro Area as the benchmark region, because it satisfies the following criteria: large cluster, substantial growth, leader in innovation.

The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019.

Los Angeles CA Metro Area Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	30%	Bachelor's Degree
Sales Managers	18%	Bachelor's Degree
Managers, All Other	13%	Bachelor's Degree
Marketing Managers	8%	Bachelor's Degree
Industrial Production Managers	6%	Bachelor's Degree
First-Line Supervisors of Retail Sales Workers	6%	High School Diploma or equivalent
First-Line Supervisors of Production and Operating Workers	5%	High School Diploma or equivalent
Transportation, Storage, and Distribution Managers	5%	Bachelor's Degree
Human Resources Specialists	4%	Bachelor's Degree
General and Operations Managers	4%	Bachelor's Degree

Los Angeles CA Metro Area Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	27%	Bachelor's Degree
Merchandise Displayers and Window Trimmers	24%	High School Diploma or equivalent
Retail Salespersons	8%	High School Diploma or equivalent
Driver/Sales Workers	8%	High School Diploma or equivalent
Heavy and Tractor-Trailer Truck Drivers	7%	High School Diploma or equivalent
Laborers and Freight, Stock, and Material Movers, Hand	6%	High School Diploma or equivalent
First-Line Supervisors of Retail Sales Workers	6%	High School Diploma or

		equivalent
Stock Clerks and Order Fillers	5%	High School Diploma or equivalent
First-Line Supervisors of Production and Operating Workers	5%	High School Diploma or equivalent
Production Workers, All Other	5%	High School Diploma or equivalent

What are the differences in terms of industry hiring needs between the benchmark region and Long Island?

Compared with Long Island, occupations associated with food processing job postings in the Benchmark region are facing slightly fewer automation risks (the risk of being replaced by computers and/or robots in the future).

For jobs requiring higher educational attainment, there are 4 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing a variety of automation risks.[86] These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
First-Line Supervisors of Mechanics, Installers, and Repairers	Yes	No	Low Risk
Registered Nurses	Yes	No	Low Risk
Life, Physical, and Social Science Technicians, All Other	Yes	No	Medium Risk
Production, Planning, and Expediting Clerks	Yes	No	High Risk

[86] The risk of automation score is the probability of computerization for an occupation within the next 20 years, provided by Burning Glass Labor Insight.

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing mostly low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Sales Managers	No	Yes	Low Risk
Managers, All Other	No	Yes	Low Risk
Marketing Managers	No	Yes	Low Risk
Transportation, Storage, and Distribution Managers	No	Yes	Medium Risk

For jobs requiring lower educational attainment, there are 2 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing medium-high automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Bus and Truck Mechanics and Diesel Engine Specialists	Yes	No	Medium Risk
Industrial Truck and Tractor Operators	Yes	No	High Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing high and low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
First-Line Supervisors of Production and Operating Workers	No	Yes	Low Risk
Production Workers, All Other	No	Yes	High Risk

Based on hiring needs, which region is better prepared for the future?

Based on job posting data, the benchmark region is better prepared for the future where automation and computerization will redefine employment and reshape the demand for skills.

On Long Island, the jobs being posted by companies have a 70% overall chance of being replaced by computers in 20 years. In comparison, the benchmark region's chance is 53%.[87]

Chance of jobs being replaced by computers in 20 years (0-100%)					
Overall - All jobs		Jobs requiring more than a Bachelor's degree		Jobs requiring less than a Bachelor's degree	
Long Island	Benchmark	Long Island	Benchmark	Long Island	Benchmark
70%	53%	45%	36%	79%	69%

The difference in hiring needs means a difference in workforce skill requirements. In order to better prepare for future economic growth and transformation, Long Island industries need to look beyond what they currently need. Instead, companies can benefit from training programs that can teach skills associated with jobs facing fewer automation risks, such as those sought by companies in the benchmark region.

In order to better prepare Long Islanders for the future of industry growth, what are the skill training needs?

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- General technical skills (These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.)
- Knowledge (This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications.)
- Software (This refers to the capability of operating specific software applications. There are 127 software applications included in the analysis.)
- Tools (This refers to the capability of using specific machines and/or tools. There are 4,180 tools included in the analysis.)

[87] The probability of automation for each occupation is calculated and presented in the seminal Oxford University study on automation, *The Future of Employment: How Susceptible are Jobs to Computerisation?* The same probability statistics determine the Burning Glass Labor Insight's risk of automation levels. The breakdown of scores are as follows: High risk of automation: The top quartile of scores (ex: Insurance Underwriters). Medium risk of automation: The third quartile of scores (ex: Machinists). Low risk of automation: The bottom two quartiles of scores (ex: Home Health Aides).

Based on employment, job postings, and occupational skills data, we identified specific skills where there exist the largest gaps between what the industries need and what the current workforce of Long Island can provide.

We first identified the most in-demand skills for the industries, based on job posting data from the benchmark region. O*NET links skills to each occupation. If a significant portion of the region's Top 10 job posting occupations is associated with a particular skill, that skill is then marked as a "core industry need".

When then checked how prepared Long Island's current workforce is for each skill in the core industry needs. Again, as O*NET links skills to occupations, the employment data was used in combination with O*NET to produce the "skill palette" of Long Island. For instance, based on the data analysis, for jobs typically requiring a Bachelor's degree or above, 99% of Long Island's current occupations are associated with Office Suite software, while only 4% are associated with graphic user interface development software.

Once we identified the core industry needs and the skill palette of Long Island's current workforce, we compared these two statistics to identify the need for skill training. A core industry need is not necessarily a training need, if most of Long Islanders already possess that skill. Only when a core skill is severely undersupplied by the current population, which means that the gap between industry demand and current workforce characteristics is large, can we identify that skill as being in need of training.[88]

We compared the industry needs against Long Island-wide workforce characteristics. Instead of comparing the needs against workforce characteristics within the same industry, because we anticipate the workforce training program to facilitate people currently not employed in the particular industry to take job opportunities in the key industry cluster. If we limit the scope of analysis, we will only be assuming that workers stay within the same industries in the future, thus missing the potential shift of employment from non-strategic industries to strategic industries.

The lists of training needs below are the results of the quantitative data analysis prior to qualitative assessment and validation. For definitions and examples of specific skills, as well as

[88] In our analysis, we analyzed skill gaps by checking two criteria: If the skill is associated with more than a certain portion, say 70%, of the region's Top 10 job posting occupations, we then mark it as a core industry need (the percentage threshold can change from one skill category to another). For a given skill marked as a core industry need, if less than X% of Long Island's current occupations are associated with that particular skill, then it will be marked as a training need. The value of X is dependent on the demand of that skill, indicated by job postings. This is because, for skills in more demand by the industries, you will need the workforce to be more prepared also. For example, in our analysis of general technical skills, X is calculated as 10 percentage points below the respective skill's frequency in job postings. So for skills associated with 70% of job postings, they are marked as training needs if less than 60% of the current workforce is associated with the skills; for skills associated with 80% of job postings, they are marked as training needs if fewer than 70% of the current workforce are associated with the skills. The percentage threshold also changes from one skill category to another.

information about how each of the recommended training needs apply to specific occupations, see Appendix 3.

General technical skills training needs[89]

General technical skills training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of higher educational requirement, Long Island's current workforce are relatively prepared in terms of general technical skill capabilities.	NA	NA

General technical skills training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of lower educational requirement, Long Island's current workforce are relatively prepared in terms of general technical skill capabilities.	NA	NA

Knowledge training needs[90]

Knowledge training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Sales and Marketing	70%	36%
Production and Processing	47%	28%
Administration and Management	70%	58%

Knowledge training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Sales and Marketing	63%	32%

[89] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.
[90] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Software training needs[91]

Software training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Web page creation and editing software	84%	42%
Object or component oriented development software	90%	43%
Financial analysis software	100%	45%
Enterprise resource planning ERP software	100%	57%
Data base reporting software	82%	40%
Computer aided design CAD software	88%	30%
Business intelligence and data analysis software	95%	40%
Analytical or scientific software	100%	59%
Accounting software	95%	49%

Software training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of lower educational requirement, Long Island's current workforce are relatively prepared in terms of software capabilities.	NA	NA

Tools training needs[92]

Tools training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of higher educational requirement, Long Island's current workforce are relatively prepared in terms of tool capabilities.	NA	NA

[91] Threshold: Core industry needs are identified as the skills associated with 80% of the Top 10 posted occupations. Training needs are skills where the current supply is 40 percentage points lower than the demand statistics.
[92] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 20 percentage points lower than the demand statistics.

Tools training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Utility knives	34%	13%
Ladders	48%	25%

IT and Analytical Instruments Skill Gap Analysis

To better prepare Long Island for the future growth of its strategic industries, one needs to understand the changing landscape of work and re-assess the skill requirements in key clusters. In the skill gap analysis for Long Island's IT and analytical instruments cluster, we asked the following questions:

- What job positions are local companies in this cluster trying to hire?
- In the national benchmark region where this cluster is strong, what job positions are companies trying to hire?
- What are the differences in job hiring pattern between Long Island and the benchmark region? Which region is more prepared for the future?
- In order for Long Island to fully prepare itself for future growth of this cluster, what are the specific training needs for technical skills and knowledge?

To answer the questions above, we performed multiple quantitative data analyses. Below is a summary of the results for this cluster. At the end of the section are four sets of tables of specific training needes identified for this cluster.

On Long Island, what kinds of job positions are IT companies trying to hire?

Recent job posting data reveals important industry trends. In our research, we divided job postings into two categories: positions requiring a Bachelor's degree or above and positions requiring less than a Bachelor's degree. The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019 for the two educational requirement levels.

Long Island Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Software Developers, Applications	21%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	20%	Bachelor's Degree
Computer Occupations, All Other	16%	Bachelor's Degree
Market Research Analysts and Marketing Specialists	7%	Bachelor's Degree

Computer User Support Specialists	7%	Bachelor's Degree
Marketing Managers	6%	Bachelor's Degree
Management Analysts	6%	Bachelor's Degree
Sales Managers	6%	Bachelor's Degree
Managers, All Other	6%	Bachelor's Degree
Educational, Guidance, School, and Vocational Counselors	5%	Master's Degree

Long Island Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	34%	Bachelor's Degree
Computer User Support Specialists	11%	Bachelor's Degree
Maintenance and Repair Workers, General	11%	High School Diploma or equivalent
Customer Service Representatives	10%	High School Diploma or equivalent
Human Resources Specialists	8%	Bachelor's Degree
Engineering Technicians, Except Drafters, All Other	6%	Bachelor's Degree
Bookkeeping, Accounting, and Auditing Clerks	5%	High School Diploma or equivalent
First-Line Supervisors of Production and Operating Workers	5%	High School Diploma or equivalent
First-Line Supervisors of Retail Sales Workers	5%	High School Diploma or equivalent
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	5%	High School Diploma or equivalent

What occupations are companies in the national benchmark region trying to hire?

We chose San Francisco CA Metro Area as the benchmark region, because it satisfies the following criteria: large cluster, substantial growth, leader in innovation.

The tables below list the Top 10 occupations with the most job postings from August 2018 to July 2019.

San Francisco CA Metro Area Cluster Jobs typically requiring higher educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Software Developers, Applications	25%	Bachelor's Degree
Computer Occupations, All Other	16%	Bachelor's Degree
Marketing Managers	16%	Bachelor's Degree
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	12%	Bachelor's Degree
Managers, All Other	10%	Bachelor's Degree
Sales Managers	5%	Bachelor's Degree
Web Developers	5%	Bachelor's Degree
General and Operations Managers	4%	Bachelor's Degree
Human Resources Specialists	3%	Bachelor's Degree
Market Research Analysts and Marketing Specialists	3%	Bachelor's Degree

San Francisco CA Metro Area Cluster Jobs typically requiring lower educational attainment		
Occupation Title	Percentage of Postings in Top 10 Occupations	Generally Required Level of Education (US Average)
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	43%	Bachelor's Degree
Human Resources Specialists	12%	Bachelor's Degree
Computer User Support Specialists	8%	Bachelor's Degree
First-Line Supervisors of Office and Administrative Support Workers	7%	Bachelor's Degree
Customer Service Representatives	6%	High School Diploma or equivalent
Network and Computer Systems Administrators	5%	Bachelor's Degree
Retail Salespersons	5%	High School Diploma or equivalent
Sales Representatives, Services, All Other	5%	Bachelor's Degree
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	4%	High School Diploma or equivalent
First-Line Supervisors of Retail Sales Workers	4%	High School Diploma or equivalent

What are the differences in terms of industry hiring needs between the benchmark region and Long Island?

Compared with Long Island, occupations associated with IT job postings in the Benchmark region are facing slightly fewer automation risks (the risk of being replaced by computers and/or robots in the future).

For jobs requiring higher educational attainment, there are 3 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing low automation risks.[93] These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Computer User Support Specialists	Yes	No	Low Risk
Management Analysts	Yes	No	Low Risk
Educational, Guidance, School, and Vocational Counselors	Yes	No	Low Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing slightly lower automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Web Developers	No	Yes	Low Risk
General and Operations Managers	No	Yes	Low Risk
Human Resources Specialists	No	Yes	Low Risk

For jobs requiring lower educational attainment, there are 4 occupations in Long Island's Top 10 list that do not appear in the benchmark region's list.

The occupations most desired by Long Island companies but not in the benchmark region are facing a variety of automation risks. These jobs are:

[93] The risk of automation score is the probability of computerization for an occupation within the next 20 years, provided by Burning Glass Labor Insight.

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
Maintenance and Repair Workers, General	Yes	No	Medium Risk
Engineering Technicians, Except Drafters, All Other	Yes	No	Low Risk
Bookkeeping, Accounting, and Auditing Clerks	Yes	No	High Risk
First-Line Supervisors of Production and Operating Workers	Yes	No	Low Risk

In comparison, the occupations most desired by the benchmark region's companies but not on Long Island are facing mostly low automation risks. These jobs are:

Occupation Title	Appear in Long Island's Top 10	Appear in Benchmark region's Top 10	Risk of Automation
First-Line Supervisors of Office and Administrative Support Workers	No	Yes	Low Risk
Network and Computer Systems Administrators	No	Yes	Low Risk
Retail Salespersons	No	Yes	High Risk
Sales Representatives, Services, All Other	No	Yes	Low Risk

Based on hiring needs, which region is better prepared for the future?

Based on job posting data, the benchmark region is better prepared for the future where automation and computerization will redefine employment and reshape the demand for skills, but the difference is not as significant as observed in other key clusters.

On Long Island, the jobs being posted by companies have a 44% overall chance of being replaced by computers in 20 years. In comparison, the benchmark region's chance is 31%.[94]

[94] The probability of automation for each occupation is calculated and presented in the seminal Oxford University study on automation, *The Future of Employment: How Susceptible are Jobs to Computerisation?* The same probability statistics determine the Burning Glass Labor Insight's risk of automation levels. The breakdown of scores are as follows: High risk of automation: The top quartile of scores (ex: Insurance Underwriters). Medium risk of automation: The third quartile of scores (ex: Machinists). Low risk of automation: The bottom two quartiles of scores (ex: Home Health Aides).

Chance of jobs being replaced by computers in 20 years (0-100%)					
Overall - All jobs		Jobs requiring more than a Bachelor's degree		Jobs requiring less than a Bachelor's degree	
Long Island	Benchmark	Long Island	Benchmark	Long Island	Benchmark
44%	31%	33%	22%	64%	61%

The difference in hiring needs means a difference in workforce skill requirements. In order to better prepare for future economic growth and transformation, Long Island industries need to look beyond what they currently need. Instead, companies can benefit from training programs that can teach skills associated with jobs facing fewer automation risks, such as those sought by companies in the benchmark region.

In order to better prepare Long Islanders for the future of industry growth, what are the skill training needs?

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- General technical skills (These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control.)
- Knowledge (This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications.)
- Software (This refers to the capability of operating specific software applications. There are 127 software applications included in the analysis.)
- Tools (This refers to the capability of using specific machines and/or tools. There are 4,180 tools included in the analysis.)

Based on employment, job postings, and occupational skills data, we identified specific skills where there exist the largest gaps between what the industries need and what the current workforce of Long Island can provide.

We first identified the most in-demand skills for the industries, based on job posting data from the benchmark region. O*NET links skills to each occupation. If a significant portion of the region's Top 10 job posting occupations is associated with a particular skill, that skill is then marked as a "core industry need".

When then checked how prepared Long Island's current workforce is for each skill in the core industry needs. Again, as O*NET links skills to occupations, the employment data was used in combination with O*NET to produce the "skill palette" of Long Island. For instance, based on the data analysis, for jobs typically requiring a Bachelor's degree or above, 99% of Long Island's current occupations are associated with Office Suite software, while only 4% are associated with graphic user interface development software.

Once we identified the core industry needs and the skill palette of Long Island's current workforce, we compared these two statistics to identify the need for skill training. A core industry need is not necessarily a training need, if most of Long Islanders already possess that skill. Only when a core skill is severely undersupplied by the current population, which means that the gap between industry demand and current workforce characteristics is large, can we identify that skill as being in need of training.[95]

We compared the industry needs against Long Island-wide workforce characteristics. Instead of comparing the needs against workforce characteristics within the same industry, because we anticipate the workforce training program to facilitate people currently not employed in the particular industry to take job opportunities in the key industry cluster. If we limit the scope of analysis, we will only be assuming that workers stay within the same industries in the future, thus missing the potential shift of employment from non-strategic industries to strategic industries.

The lists of training needs below are the results of the quantitative data analysis prior to qualitative assessment and validation. For definitions and examples of specific skills, as well as information about how each of the recommended training needs apply to specific occupations, see Appendix 3.

[95] In our analysis, we analyzed skill gaps by checking two criteria: If the skill is associated with more than a certain portion, say 70%, of the region's Top 10 job posting occupations, we then mark it as a core industry need (the percentage threshold can change from one skill category to another). For a given skill marked as a core industry need, if less than X% of Long Island's current occupations are associated with that particular skill, then it will be marked as a training need. The value of X is dependent on the demand of that skill, indicated by job postings. This is because, for skills in more demand by the industries, you will need the workforce to be more prepared also. For example, in our analysis of general technical skills, X is calculated as 10 percentage points below the respective skill's frequency in job postings. So for skills associated with 70% of job postings, they are marked as training needs if less than 60% of the current workforce is associated with the skills; for skills associated with 80% of job postings, they are marked as training needs if fewer than 70% of the current workforce are associated with the skills. The percentage threshold also changes from one skill category to another.

General technical skills training needs[96]

General technical skills training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Technology Design	31%	19%
Programming	43%	18%
Operations Analysis	51%	33%

General technical skills training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
None. The data implies that for jobs of lower educational requirement, Long Island's current workforce are relatively prepared in terms of general technical skill capabilities.	NA	NA

Knowledge training needs[97]

Knowledge training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Sales and Marketing	48%	36%
Engineering and Technology	48%	26%
Design	40%	21%
Computers and Electronics	70%	57%

Knowledge training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Sales and Marketing	59%	32%
Economics and Accounting	36%	26%
Computers and Electronics	53%	39%
Clerical	55%	43%
Administration and Management	58%	46%

[96] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.
[97] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 10 percentage points lower than the demand statistics.

Software training needs[98]

Software training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Web platform development software	86%	25%
Web page creation and editing software	100%	42%
Video creation and editing software	90%	45%
Transaction security and virus protection software	92%	33%
Sales and marketing software	90%	26%
Operating system software	100%	55%
Object or component oriented development software	100%	43%
Map creation software	84%	29%
Graphics or photo imaging software	100%	59%
Financial analysis software	100%	45%
Enterprise system management software	86%	30%
Enterprise resource planning ERP software	100%	57%
Enterprise application integration software	92%	32%
Document management software	100%	50%
Development environment software	100%	47%
Desktop publishing software	100%	50%
Data mining software	90%	28%
Data base reporting software	100%	40%
Data base management system software	97%	35%
Customer relationship management CRM software	90%	47%
Business intelligence and data analysis software	100%	40%
Analytical or scientific software	100%	59%
Accounting software	92%	49%

[98] Threshold: Core industry needs are identified as the skills associated with 80% of the Top 10 posted occupations. Training needs are skills where the current supply is 40 percentage points lower than the demand statistics.

Software training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Web page creation and editing software	95%	23%
Video creation and editing software	85%	11%
Project management software	100%	39%
Presentation software	100%	44%
Operating system software	95%	51%
Medical software	86%	33%
Internet browser software	95%	50%
Information retrieval or search software	80%	16%
Graphics or photo imaging software	95%	22%
Financial analysis software	95%	14%
Enterprise resource planning ERP software	100%	44%
Document management software	95%	30%
Desktop publishing software	95%	30%
Customer relationship management CRM software	100%	28%
Business intelligence and data analysis software	90%	9%
Analytical or scientific software	90%	19%
Accounting software	90%	42%

Tools training needs[99]

Tools training needs For jobs typically requiring higher educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Mainframe computers	41%	9%
Integrated circuit testers	41%	2%
Computer servers	46%	6%

[99] Threshold: Core industry needs are identified as the skills associated with 30% of the Top 10 posted occupations. Training needs are skills where the current supply is 20 percentage points lower than the demand statistics.

Tools training needs For jobs typically requiring lower educational attainment	Percentage of job postings associated with this skill	Percentage of current workforce associated with this skill
Notebook computers*	91%	46%
Liquid crystal display projector*	62%	4%
Laser printers*	60%	26%
Desktop computers*	100%	62%

*While computers and printing devices are widely used now in most white-collar occupations, they are becoming increasingly important for jobs of lower educational requirement in the biopharmaceutical cluster. The result of the data analysis indicates that Long Island's current workforce with lower educational attainment can potentially benefit from computer-related training.

APPENDIX 3: Definition of Technical Skills

Using O*NET (Occupational Information Network), the nation's primary source of occupational information, we investigated 4 categories of skills associated with any given occupation.

- **General technical skills:** These refer to general capabilities of designing, setting up, operating, and correcting malfunctions involved in machines and/or technological systems, such as equipment installation, programming, and quality control. There are **11** general technical skills included in the analysis.

- **Knowledge:** This refers to the general understanding of principles and facts in subject areas, such as biology, language(s), and telecommunications. There are **33** types of knowledge included in the analysis.

- **Software:** This refers to the capability of operating specific software applications. There are **127** types of software applications included in the analysis.

- **Tools:** This refers to the capability of using specific machines and/or tools. There are **4,180** tools included in the analysis.

For a complete list of the above knowledge and skills, their definitions, and relevant examples, please visit the following link:
http://jameslimadevelopment.com/wp-content/uploads/2019/12/Appendix_-Definitions_Examples-of-skills.pdf

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