PENNSYLVANIA'S STATE SYSTEM OF HIGHER EDUCATION

Northwest Pennsylvania's

SUPPLY/ DEMAND GAP ANALYSIS

A report for Pennsylvania's State System of Higher Education

2016

Pennsylvania's STATE SYSTEM of Higher Education

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GLOSSARY OF TERMS

The following descriptions provide a point of reference to understand terminology as well as the types of data and analysis undertaken in this study, reflecting historic and contemporary narratives.

Fastest Growing: A term used to describe the relative growth (percent change) of an industry or occupation in a given time period. Fastest growing industries and occupations in this study are identified by the highest relative change in jobs between 2014 and 2024.

High Demand: A term used to describe the demand for workers in a given occupation. High demand occupations are identified as having the highest number of new and replacement jobs projected between 2014 and 2024.

Industry Change: A measure of the change in employment within an industry, used to identify whether an industry is growing or declining, as well as the rate of change. Projected changes lay out expectations of growth/decline for specific industries.

Job Postings: The number of unique (de-duplicated) online postings for a job in a given occupation.

Location Quotient: A comparative statistic used to calculate the relative employment concentration of a given industry or occupation against the average employment of the industry in a larger geography (for example, countrywide). Industries with a higher location quotient (usually greater than 1.2) indicate that the region has a comparative advantage or specialization in the production of that good or service or has a high degree of specialization within its workforce.

New and Replacement Jobs: A demand-side estimate of the number of job openings in an occupation that result from new job growth as well as replacement demand. Replacement demand comprises occupation job leavers based on separations, retirement, and death.

Occupation Jobs: A measure of employment within an occupation category, used to identify which occupations have been growing or declining, as well as the rate of change. Projected changes lay out expectations of growth/decline for specific occupation categories.

Sub-regions: Geographic areas within Pennsylvania defined for more focused workforce and education gap analyses. Sub-regions were determined primarily on Partnerships for Regional Economic Performance (PREP) boundaries. PREP is Pennsylvania's network of business assistance partners, designed to help companies start, grow, and prosper. Please refer to Appendix A for mapping of the Sub-regions and PREP boundaries.

ACRONYMS USED

ACS: American Community Survey

BLS: Bureau of Labor Statistics

CIP: Classification of Instructional Programs

DOE: United States Department of Education

DOL: United States Department of Labor

EMSI: Economic Modeling Specialists International

CEW: Center on Education and the Workforce (Georgetown University)

IPEDS: Integrated Postsecondary Education Data System

LAUS: Local Area Unemployment Statistics

LEHD: Longitudinal Employment and Housing Dynamics

NAICS: North American Industry Classification System

NCES: National Center for Education Statistics

OES: Occupational Employment Statistics

O*NET: Occupational Network

PUMS: Public Use Microdata Sample

QCEW: Quarterly Census of Employment and Wages

SOC: Standard Occupational Classification

1. INTRODUCTION

Pennsylvania's State System of Higher Education (State System) comprises 14 universities, four branch campuses, multiple regional centers and the McKeever Environmental Learning Center.[1] The universities are located in rural, suburban, and small-town settings around Pennsylvania. The State System's two educational hubs (with locations in Harrisburg—the Dixon University Center, and Philadelphia—State System @ Center City) offer academic programs through a consortium of public and private colleges and universities.

Per Act 188 of 1982, the State System's mission "is the provision of instruction for undergraduate and graduate students to and beyond the master's degree in the liberal arts and sciences, and in the applied fields, including the teaching profession." In doing so, the State System's purpose is "to provide high quality education at the lowest possible cost to students."[2] Analysis and understanding of the economy and workforce the State System supports, as well as the alignment between education programs and talent needs, further advances the State System's mission and philosophy. This is the goal of the State System's Supply/Demand Gap Analysis Project. It enables effective and targeted strategies and decision-making, grounded in data-driven evidence. Through two earlier reports—'Pennsylvania's Workforce Characteristics Report'[3] and 'Degrees of Value: College Majors and the Pennsylvania State System's Contribution to the Workforce'[4]— foundation was laid for the State System's Supply/Demand Gap Analysis Project. This supply/demand gap analysis report establishes the framework to 'crosswalk' education programs with relevant occupations. This crosswalk establishes the relationship between the workforce

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1 One of the State System's entities, System-wide Functions and Services, is primarily located at the Dixon University Center in Harrisburg and includes: System-wide shared administrative services; System leadership functions of the Chancellor and Board of Governors; some System-wide initiatives and grants managed on behalf of the universities; and the academic, student, and facilities support for the multi-university sites in Harrisburg and Philadelphia.

2 The State System's Economic and Employment Impact on the Commonwealth of Pennsylvania—released April 15, 2015.

3 Pennsylvania's Workforce Characteristics Report—a collaboration between the Pennsylvania State System of Higher Education and Oxford Economics with input from Georgetown University's Center on Education and the Workforce, provides detailed demand-side projections for occupations within Pennsylvania, as well as other labor market intelligence for skilled occupations.

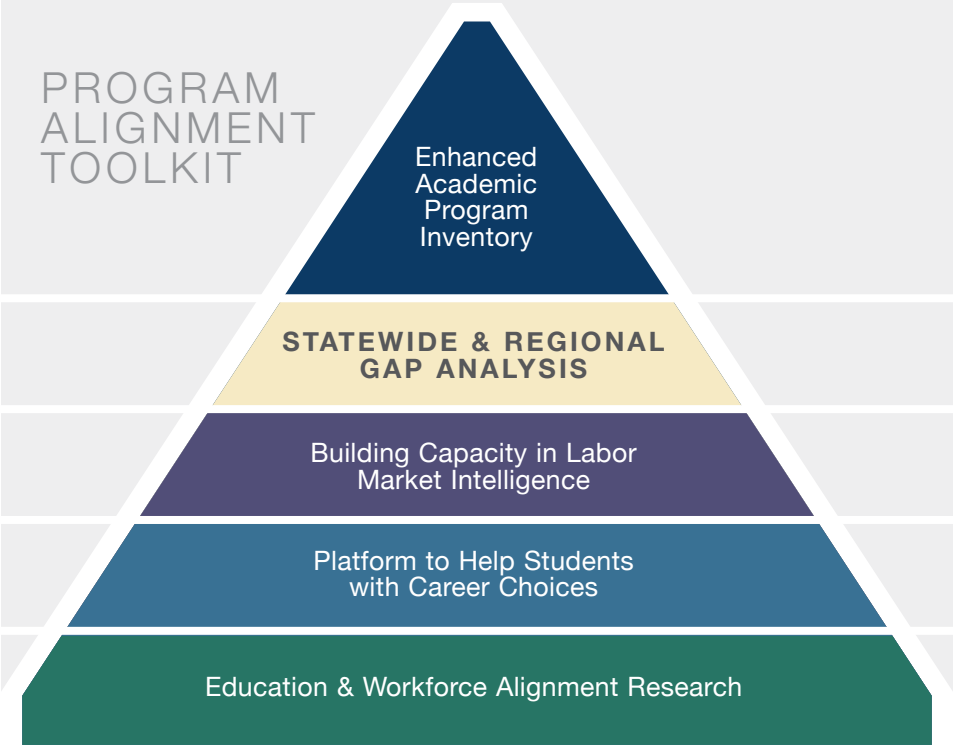
4 *Degrees of Value: College Majors and the Pennsylvania State System's Contribution to the Workforce* is an education and workforce analysis of the Commonwealth with a particular emphasis on the State System's Universities' output produced by Georgetown University's Center on Education and the Workforce.

employed in specific occupations and the degrees that those workers earned. The goal of this report is to understand this relationship in the context of Pennsylvania's projected skilled workforce needs and education output.

This study and the broader set of deliverables under the State System's Supply/Demand Gap Analysis Project will assist universities and education planners by providing an infrastructure of resources for internal planning, as well as external engagement. Understanding key gaps and surpluses within Pennsylvania helps to better align policy and strategic direction in order to continue supporting the talent needs of the Commonwealth.

The results of the State System's Supply/Demand Gap Analysis project will become part the State System's Program Alignment Toolkit (see Figure 1 below)—an infrastructure of resources that are being created to assist the State System's universities to increase their individual and collective impact on Pennsylvania's economy. The Program Alignment Toolkit complements the existing Business Intelligence Environment the State System has created to support data driven decision-making. This environment includes forward-thinking, data-rich projects such as the Financial Risk Dashboard, the Data Warehouse project, and the upcoming Student Success Dashboard.

Fig. 1: Pennsylvania's State System of Higher Education Program Alignment Toolkit Outline



ABOUT PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION

Pennsylvania's State System of Higher Education was established by statute on July 1, 1983, although the 14 universities that comprise the State System have a much longer history dating back to the 19th century.

Today, the State System serves over 110,000 students, with learners coming from every county in Pennsylvania, making it among the largest providers of higher education in Pennsylvania and the United States. It also employs more than 12,000 faculty and staff, making it one of the largest employers in the Commonwealth. Nearly 88% of students enrolled in the State System are from Pennsylvania and the vast majority of students remain after graduation—about 80%.*

The State System generates more than $6.7 billion in annual economic activity within Pennsylvania. This economic value in turn supports approximately 62,000 jobs through the State System's direct employment, operational expenditures with vendors and suppliers across Pennsylvania, and spending of those who are employed as a result of the State System's operations.

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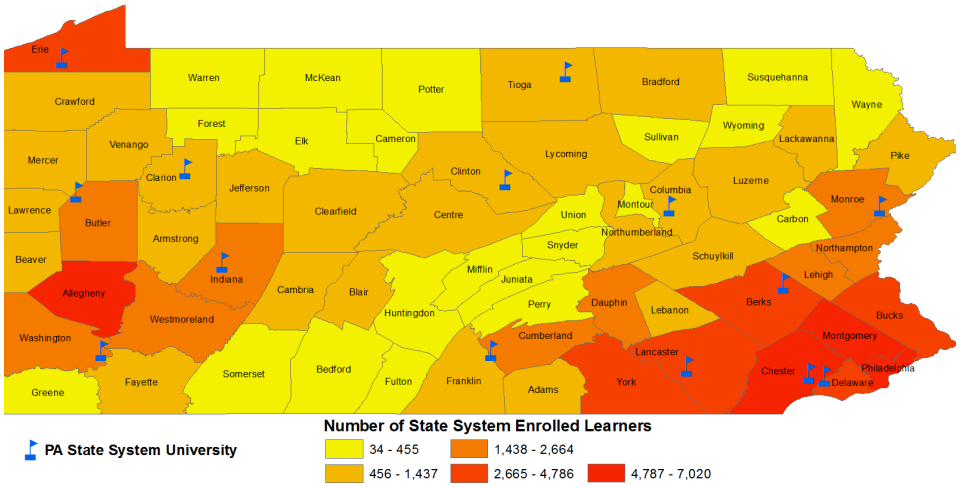
* Pennsylvania's State System of Higher Education – Student Data Fact Center

** The State System's Economic and Employment Impact on the Commonwealth of Pennsylvania – Released April 15, 2015

Fig. 2: State System Learner Enrollment by County – Fall 2014



Source: Pennsylvania State System of Higher Education

1.1 Goal of the Supply/Demand Gap Analysis Report

This Supply/Demand Gap Analysis Report is specific to the Northwest Pennsylvania region. It builds on information provided in an earlier State System report entitled Northwest Pennsylvania's Workforce Characteristics Technical Report. In the Workforce Characteristics Report, Northwest Pennsylvania's region was defined to include the following counties: Cameron, Clarion, Clearfield, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Potter, Venango, and Warren. The report also contains a set of economic, workforce, demographic, and socio-economic information to contextualize the Supply/Demand Gap Analysis.

The Supply/Demand Gap Analysis Report provides a data-driven perspective of employer demand (growing occupations across the region) and postsecondary education supply (degree production by program and level). The report will assist the State System universities with strategic engagement, program development and evaluation, student engagement, and marketing. The Supply/Demand Gap Analysis Report contains research specific to Northwest Pennsylvania in the following areas:

- Industry sector and occupation job changes and projections for new and replacement job demand to 2024;
- Size of education production by broad degree category;
- Links between occupations and education programs; and
- Analysis of gaps at the occupational level (presenting a structure to review occupations that have excess employer demand as well as those that have surplus).

While the State System's Gap Analysis project is critical to understanding the connections between education programs and occupations, it is important to note a few caveats to this Supply/Demand Gap Analysis Report:

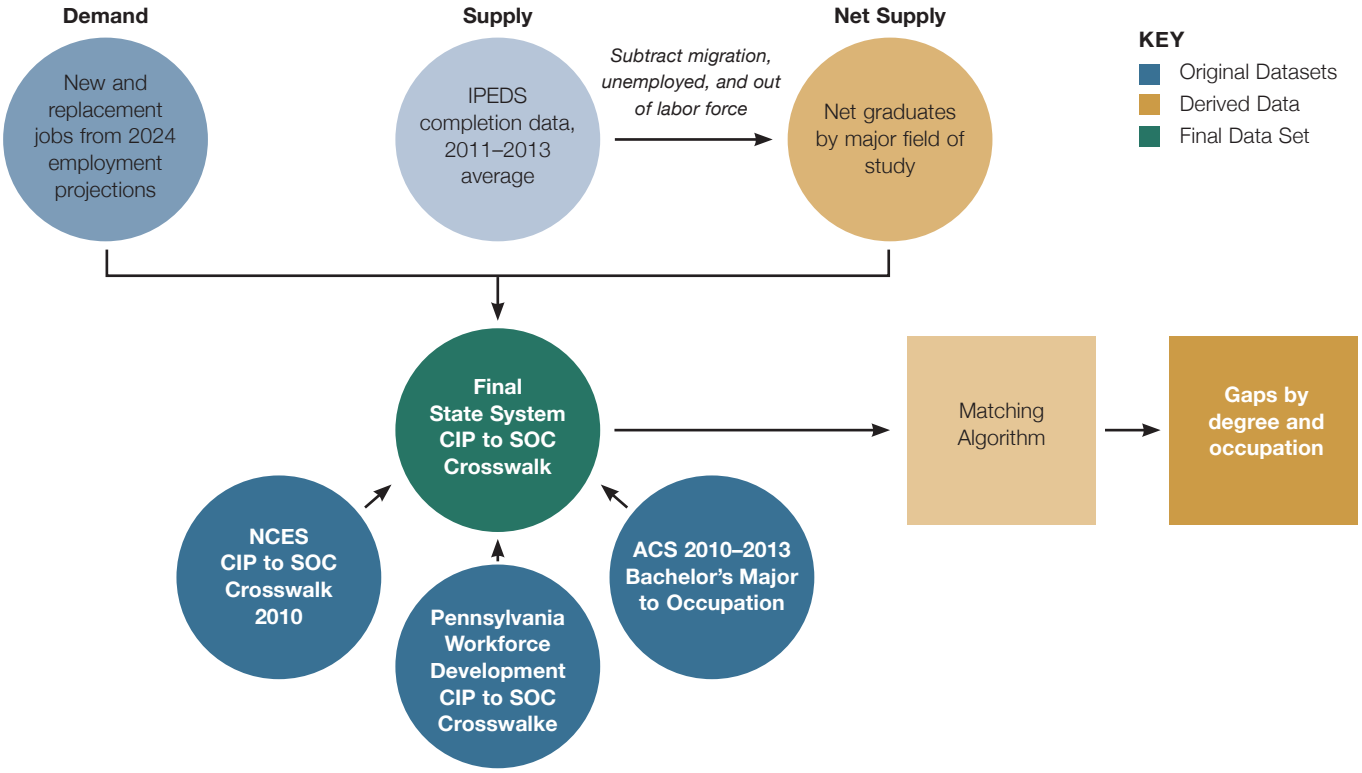
- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.
- Government data that captures labor market demand lags real-time employer demand as well higher education industry trends. As such, the gap analysis findings may lag these market changes.
- This analysis only focuses on program output as a supply pool (i.e. new graduates). However, regional workforces comprise additional pools of

ABOUT GAP ANALYSIS

A gap analysis comparing educational supply and occupational demand serves as a critical first step in efforts to align education programs with the workforce needs of Pennsylvania employers. A gap analysis provides a data-driven perspective of demand and supply, which can be connected to a larger process of program evaluation and strategic planning, engagement with employers, and student career guidance. The analysis itself is not the solution, but can lend credible insight to guide decision-making at the strategic level.

Figure 3 provides a high-level flow chart of the process to calculate gaps/surpluses. A methodological description of the supply/demand gap modeling process can be found in Appendix E.

Fig. 3: Overview of the gap analysis methodology for the State System



Source: Oxford Economics

supply—specifically: employed workers, skilled unemployed workers, and skilled underemployed workers. When evaluating gaps, this analysis focuses on new and replacement demand, as opposed to job churn. This helps to mitigate some of the issues involving the employed workforce.

1.2 Structure of the Gap Analysis Report

This Supply/Demand Gap Analysis Report for Northwest Pennsylvania is organized as follows:

Section 1 Introduction and background information.

Section 2 Overview of changes in Northwest Pennsylvania's industry sectors from a historic and projected point of view, as well as fast growing and most competitive industries.

Section 3 Overview of changes in Northwest Pennsylvania's occupations including additional detail on skilled occupations as well as high demand occupations, the fastest growing occupations, and occupations that are highly concentrated in Northwest Pennsylvania.

Section 4 Evaluation of output of education programs at the associate's, bachelor's, and graduate level, as well as the State System's contribution to the total output of bachelor's degrees.

Section 5 Comparison of demand for skilled occupations against supply of relevant education program completions.

Section 6 Conclusion and areas of future research.

Section 7 Additional information on the Gap Analysis project and contributing organizations.

Section 8 List of key data sources used in the report.

While the main body of this report provides a high level summary, the Appendices provide an abundance of information for those seeking additional detail.

Appendix A provides a map of the state sub-region boundaries along with economic development and workforce boundaries as defined by PREP and WIA.

Appendix B provides a description of O*NET Job Zone codes.

Appendix C provides further detail about strong, limited and weak connections between education programs and occupations.

Appendix D provides detailed industry employment and projections to 2024.

Appendix E provides a crosswalk and gap analysis methodology.

Appendix F provides gap analysis results for over 500 occupations.

Appendix G provides the crosswalk of programs to occupations.

2. INDUSTRY PROFILE OF NORTHWEST PENNSYLVANIA

Industry growth is a key driver of demand for occupations and talent. Hence, understanding the structure of Northwest Pennsylvania's industry sectors offers valuable insights into career opportunities that exist. As the State System implements strategies to increase the economic competitiveness of its workforce and ultimately the economic competitiveness of the state, it is important to understand the connection between occupations and industry jobs. The state's workforce changes and labor demand are presented in multiple ways in this section including:

- Major (2-digit) industries;
- Largest 4-digit industries in 2014;
- Largest growth 4-digit industries from 2014 to 2024;
- Fastest growing 4-digit industries from 2014 to 2024; and
- Industries (4-digit) with high location quotient (or concentration) in 2014.

This section explores the current strengths in Northwest Pennsylvania's economy by industry and examines trends that may affect industry structure in the coming years. A table of all 4-digit North American Industrial Classification System (NAICS) sector employment and projections for the region can be found in Appendix D.

The following sub-section begins the analysis by examining major industry groups in Northwest Pennsylvania in 2014 and projected growth to 2024.

2.1 Major Industry Groups

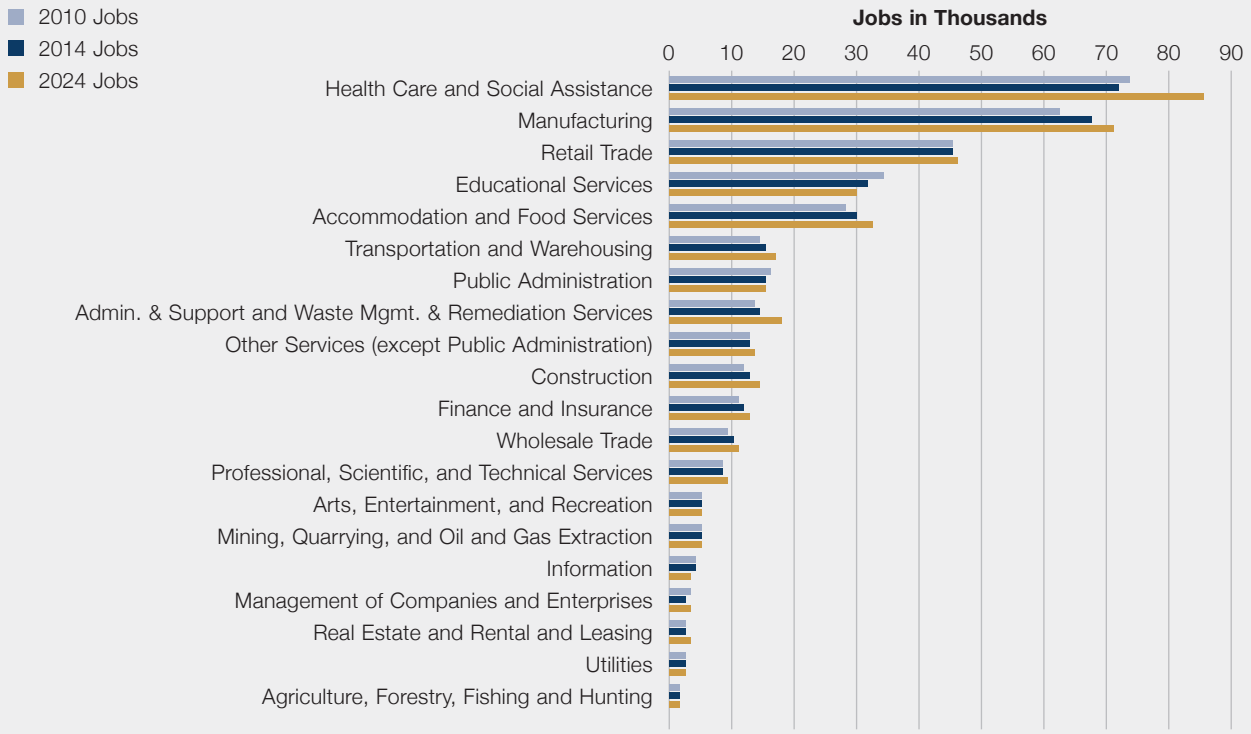
In 2014 the largest 2-digit industries in Northwest Pennsylvania include education and health services, trade, transportation and utilities, and professional and business services. As can be seen in Figure 4, health care and social assistance accounts for the most jobs (approximately 71,900 jobs), followed by manufacturing, retail trade, education services, and accommodation and food services. Furthermore, each of these industry sectors, except health care and education services, added a significant number of new jobs between 2010 and 2014, reflecting both economic recovery from the recession, as

well as continued sector growth, stemming in part from the place-based competitiveness of these sectors in the Northeast US.[5]

Projections indicate that healthcare and social assistance will add an additional 13,600 new jobs in the region between 2014 and 2024 (19% growth). Administrative and support and waste management and remediation services and construction are projected to add nearly 5,400 new jobs combined (12% growth)—which will require talent in various business disciplines to support this growth.

Substantial economic transformation is taking place across several sectors. While many sectors have experienced moderate or strong growth over the past several years, noted exceptions of job decline include government,

Fig. 4: Employment by Major Industry, 2010, 2014, and 2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

5 The strong transportation network linkages in Pennsylvania, as well as strong economic ties to other areas outside of Pennsylvania, such as New York and Washington D.C. enable a high degree of place-based competitiveness for the region.

education and information. The causes of these reductions may differ. For example, reductions in government employment could reflect changes in legislative priorities and budgets, while reductions in information are largely due to the decline in newspaper and book publishers. This, however, is offset by substantial growth in other sectors discussed earlier.

Fig. 4 depicts the number of jobs in 2010, 2014 and projections out to 2024 for each of the broad industry sectors.

2.2 Largest 4-Digit Industries

The largest 4-digit industries in Northwest Pennsylvania are identified by the volume of 2014 employment. Industry sectors that employ the most workers are critical foundations to a regional economy. In Northwest Pennsylvania, the ten[6] largest 4-digit industry classifications employed 32% of total jobs in 2014 (118,600 jobs out of 372,400 total jobs in the region). The largest industries include restaurants and other eating places, elementary and secondary schools, and general medical and surgical hospitals. Fig. 5 below displays the region's ten largest 4-digit industry sectors in 2014 and employment projections to 2024.

Fig. 5: Northwest Pennsylvania's Largest 4-Digit Industries and Projections, 2014-2024

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Restaurants and Other Eating Places	22,729	24,537	1,808	8.0%
Elementary and Secondary Schools	22,545	21,087	-1,458	-6.5%
General Medical and Surgical Hospitals	17,231	19,152	1,921	11.1%
Individual and Family Services	11,071	14,664	3,593	32.5%
Executive, Legislative, and Other General Government Support	9,179	9,292	113	1.2%
Nursing Care Facilities (Skilled Nursing Facilities)	7,894	8,983	1,089	13.8%
Colleges, Universities, and Professional Schools	7,292	6,823	-469	-6.4%
Other General Merchandise Stores	7,185	7,964	779	10.8%
Offices of Physicians	6,837	7,379	542	7.9%
Grocery Stores	6,685	6,221	-464	-6.9%
Total, 10 Largest	**118,648**	**126,102**	**7,454**	**6.3%**

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

6 There are over 300 4-digit industries in Pennsylvania reporting employment to QCEW.

2.3 Largest Growth 4-Digit Industries

The largest sectors do not necessarily generate the most new jobs. The largest growth industries are identified by the largest change in jobs from 2014 to 2024. Projections for Northwest Pennsylvania indicate that the top ten largest growth industries in the region will add about 14,800 new jobs between 2014 and 2024. Many industries in the top ten largest growth employ several occupations that require university-level skill specializations. For example:

- **Individual and family services** employ numerous counselors, social and community managers and healthcare practitioners, as well as business operations specialists and human resource specialists. Projections indicate that individual and family services is slated to grow by 3,600 new jobs between 2014 and 2024.
- General medical and surgical hospitals employ a diverse range of health care professionals at multiple levels of educational attainment. This includes professions from surgeons to medical secretaries, as well as a range of nursing professions such as nursing assistants, licensed practical nurses and registered nurses. Projections indicate the industry will add 1,900 new jobs between 2014 and 2024.

Industry sectors that are projected to add significant numbers of new jobs to Northwest Pennsylvania over the next ten years will provide opportunities to establish stronger business collaboration and course alignment to these sectors. Furthermore, State System universities currently offer a range of degree programs in health care and business that align well to opportunities within these high-growth sectors. Fig. 6 on the next page displays the ten largest growth industries projected to 2024.

Fig. 6: Northwest Pennsylvania's Top 10 Largest Growth Sectors and Projections, 2014-2024

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Individual and Family Services	11,071	14,664	3,594	32.5%
General Medical and Surgical Hospitals	17,231	19,152	1,921	11.1%
Restaurants and Other Eating Places	22,729	24,537	1,808	8.0%
Home Health Care Services	2,639	3,988	1,348	51.1%
Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities	6,028	7,184	1,156	19.2%
Employment Services	4,724	5,843	1,119	23.7%
Nursing Care Facilities (Skilled Nursing Facilities)	7,894	8,983	1,090	13.8%
Offices of Other Health Practitioners	3,405	4,339	934	27.4%
Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly	3,761	4,669	907	24.1%
Services to Buildings and Dwellings	4,762	5,662	900	18.9%
Total, 10 Largest Growth	**84,244**	**99,021**	**14,777**	**17.5%**

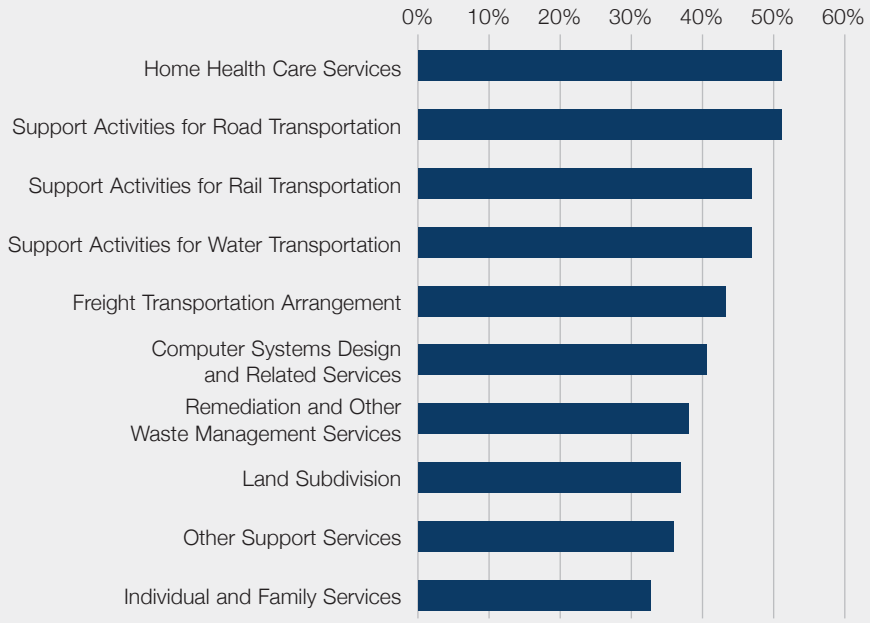
Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

2.4 Fastest Growing 4-Digit Industries

The fastest growing 4-digit industries are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. The fastest growing industries represent emerging sectors within Northwest Pennsylvania that may present opportunities for collaboration and support from postsecondary education and training institutions. Given the aging population in the U.S. and Pennsylvania, the health care sector is driving demand for workers. The fastest growing industries in Northwest Pennsylvania include support activities for road transportation, home health care services, and support activities for water transportation.

Fig. 7 depicts the fastest growing industries in Northwest Pennsylvania and the projected growth from 2014 to 2024 and Fig. 8 displays the employment in the fastest growing industries, projected job growth, and 10-year new and replacement jobs.

Fig. 7: Northwest Pennsylvania's Fastest Growing 4-Digit Industries and Projections, 2014-2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 8: Northwest Pennsylvania's Fastest Growing 4-Digit Industries and Projections, 2014-2024

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Home Health Care Services	2,639	3,988	1,349	51.1%
Support Activities for Road Transportation	274	414	140	51.1%
Support Activities for Rail Transportation	275	404	129	46.9%
Support Activities for Water Transportation	45	66	21	46.7%
Freight Transportation Arrangement	98	140	42	42.9%
Computer Systems Design and Related Services	786	1,106	320	40.7%
Remediation and Other Waste Management Services	216	298	82	38.0%
Land Subdivision	35	48	13	37.1%
Other Support Services	455	618	163	35.8%
Individual and Family Services	11,071	14,664	3,593	32.5%
Total, 10 Fastest Growing	**15,894**	**21,746**	**5,852**	**36.8%**

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

2.5 Concentration of Industries

Certain Northwest Pennsylvania industries have a greater concentration within the region as compared to the nation. A location quotient (LQ) for an industry provides perspective on statewide concentration in industry classifications. When evaluated jointly with the industry employment data, one gains a sense of the industry sectors that might benefit from efforts to align educational opportunities with economic development (i.e. industries that State System universities may consider engaging in larger conversations about aligning employer and educational needs).

Location quotients equal to 1 indicate that the area's industry concentration is equal to the national concentration of the same industry. Industries with higher location quotients (usually greater than 1.2) indicate that a region has a concentration in the production of that good or service, relative to the rest of the nation. A value of 1.5 indicates that industry employment within the region is 1.5 times more concentrated than the U.S. average. A location quotient below 1 indicates that industry employment within the region is less concentrated compared to the U.S. average. Note: High employment industries do not necessarily result in large location quotients, as this is a relative statistic.

The location quotient chart provides three key pieces of information. The vertical axis indicates the location quotient value. The horizontal axis indicates whether the industry sector is projected to grow or decline over the next 10 years. The size of the bubble indicates the size of employment in the industry.

Industries with high LQ's that are adding new jobs suggest that the comparative regional advantage may be creating further job growth. When viewed together, large employment industries (large bubbles) that have high concentrations (high LQs) and add new jobs (high growth), are significant driving forces for regional growth and advancement.

Industry sectors that are highly concentrated in Northwest Pennsylvania include: railroad rolling stock manufacturing, forging and stamping, iron and steel mills and ferroalloy manufacturing, and cutlery and handtool manufacturing.

Fig. 9 on the next page displays the most concentrated industries (as measured by LQ) for Northwest Pennsylvania at the 4-digit NAICS level in 2014. The figure reflects the comparative advantage Northwest Pennsylvania enjoys in sectors like pipeline transportation of natural gas and aquaculture as well as shows the strong and diverse manufacturing base in the region.

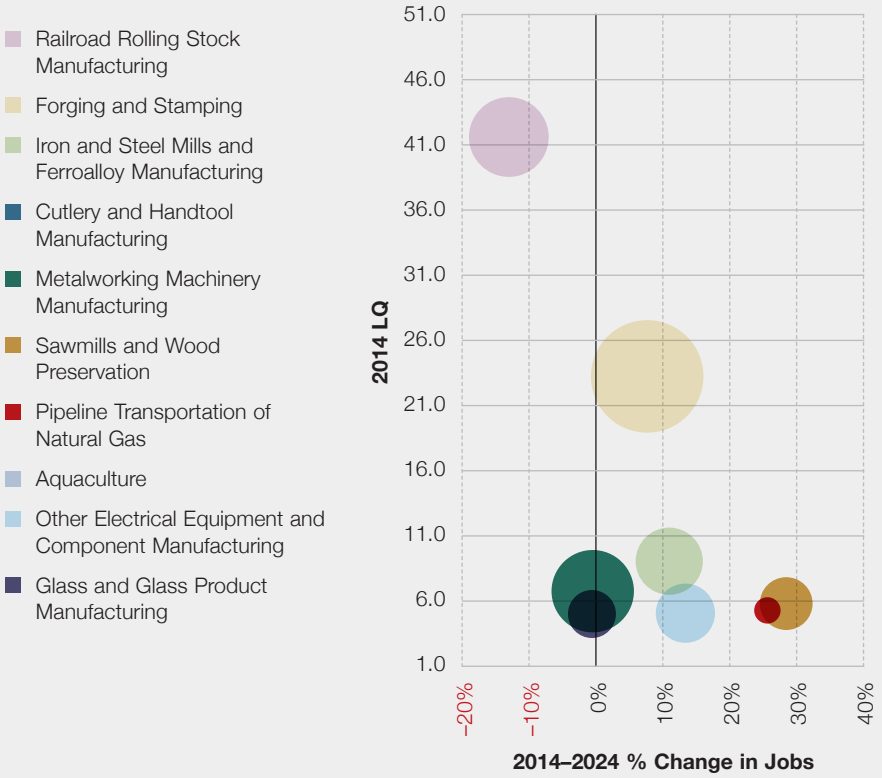
The next section provides information on occupational employment and describes the types of jobs people hold in Northwest Pennsylvania.

How to read a Location Quotient chart

The location quotient (LQ) bubble chart provides three key sources of information: level of concentration, as indicated by the LQ value, the % change in the variable measured—industries and occupations in this report—and the number of jobs employed. The LQ value is located on the vertical chart. As described above, values above the 1 on the vertical axis indicate higher levels of concentration compared to the national average. Bubbles that are situated above zero on the horizontal axis indicate positive job growth. Finally, larger bubbles indicate that the employment within the measured indicate larger levels of employment.

If one were to divide the bubble chart into sections, bubbles with LQ's greater than 1 located in the upper right hand section indicate highly concentrated industries that are projected to grow, whereas bubbles with LQ's greater than 1 in the left side indicate highly concentrated industries that are projected to decline. Similarly, LQ's less than one but on the right side, indicate job growth, but with a low concentration of employment, relative to the US average. Finally, LQ's less than one and on the left side indicate a low level of employment concentration with projected job loss.

Fig. 9: Northwest Pennsylvania's Most Concentrated 4-Digit Industries and Projected Growth, 2014-2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 10: Northwest Pennsylvania's Most Concentrated 4-Digit Industries and Projected Growth, 2014-2024

Industry Title	2014 LQ	% Change 2014-2024	2014 Jobs
Railroad Rolling Stock Manufacturing	41.6	-13.1%	3,093
Forging and Stamping	23.2	7.5%	6,325
Iron and Steel Mills and Ferroalloy Manufacturing	9.0	10.7%	2,244
Cutlery and Handtool Manufacturing	7.8	-1.8%	829
Metalworking Machinery Manufacturing	6.6	-0.7%	3,292
Sawmills and Wood Preservation	5.7	28.4%	1,406
Pipeline Transportation of Natural Gas	5.3	25.6%	421
Aquaculture	5.2	16.5%	91
Other Electrical Equipment and Component Manufacturing	5.0	13.2%	1,734
Glass and Glass Product Manufacturing	4.9	-0.8%	1,100

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3. OCCUPATIONAL PROFILE OF NORTHWEST PENNSYLVANIA

Examining occupational employment data reveals the importance of skills, experience and knowledge of workers. It showcases the types of jobs in which Northwest Pennsylvania's workforce is currently employed and projected to be employed by 2024. When evaluating occupation employment and demand, it is important to note that an occupation can be found in many different industry sectors. For example, every major industry sector employs accountants and auditors to maintain books, payroll, and ensure reporting compliance. This analysis compiles occupational employment across all industry sectors and reports the total number of jobs, median annual wages, and demand (10-year new and replacement jobs) for each occupation classification. The analysis also considers the educational attainment level that is typically required to gain employment in an occupation.

The region's workforce changes and labor demand are presented in multiple ways in this section including:

- Major occupation groups (2-digit SOC);
- Skilled occupations;
- Largest detailed occupations (6-digit SOC) in 2014;
- Occupations (6-digit SOC) with high location quotient (or concentration) in 2014; and
- Occupations aligning to educational attainment at the associate's degree level as well as the bachelor's and graduate degree level, specifically:
    - Top high demand occupations (6-digit SOC) from 2014 to 2024, and
    - Fastest growing occupations (6-digit SOC) from 2014 to 2024.

The following sub-section begins the analysis by examining major occupation groups in Northwest Pennsylvania in 2014 and projected growth to 2024.

3.1 Major Occupation Groups

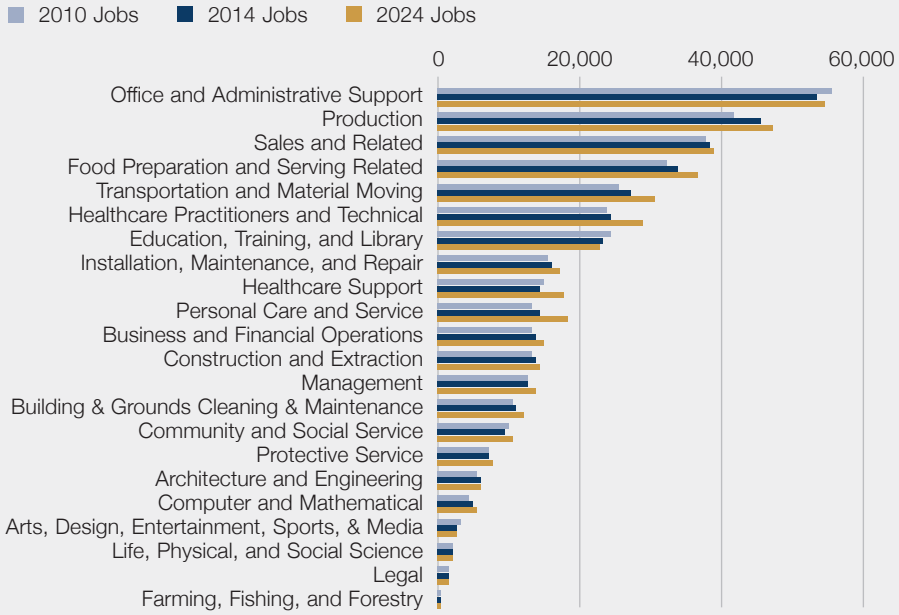
In Northwest Pennsylvania, several occupation categories are projected to grow over the next 10 years, from 2014 to 2024, as well as require a significant level

of replacement labor.[7] Certain major occupation categories—at the 2-digit Standard Occupation Classification (SOC) level–experienced substantial growth in recent years and are expected to continue to lead the pack to 2024. Between 2010 and 2014 Northwest Pennsylvania experienced growth in several occupation categories that are typically aligned with postsecondary education, including:

- Healthcare practitioners and technical occupations (100 new jobs);
- Business and financial occupations (560 new jobs);
- Computer and mathematical occupations (310 new jobs); and
- Life, physical, and social science occupations (45 new jobs).

Furthermore, these four occupation categories are projected to add 76,500 new jobs between 2014 and 2024 and will account for nearly one fifth of the total projected occupation job growth in Northwest Pennsylvania.

Fig. 11: Northwest Pennsylvania's Projected Changes in Major Occupation Categories, 2010, 2014, and 2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

7 This estimate accounts for the need to replace workers who leave an occupation permanently due to retirement, death, or a change in occupation.

Identifying Skilled Occupations

For this analysis a "skilled" occupation is defined as an occupation in O*NET Job Zones* Three, Four or Five. The O*NET program is the nation's primary source of occupational information. Central to the project is the O*NET database, containing information on hundreds of standardized and occupation-specific descriptors. The database, which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation.** Most occupations in Job Zone Three require training in vocational schools, related on-the-job experience, or an associate's degree. Most occupations in Job Zone Four require a four-year bachelor's degree, but some do not. Most occupations in Job Zone Five require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree).

For a more detailed description of O*NET Job Zones and training requirements see Appendix B.

* https://www.onetonline.org/help/online/zones

** http://www.onetcenter.org/overview.html

3.2 Skilled Occupations Overview

The Northwest Pennsylvania economy had 372,400 jobs in 2014, a number which is projected to grow to 401,000 in 2024–an increase of about 28,600 jobs or a 7.7 percent change. It is important to note that the share of Northwest Pennsylvania jobs that will require some postsecondary education will increase from 2014 to 2024, showing the employer demand for skilled workers will continue to grow. The growth in skilled occupations (Job Zones 3, 4 and 5) from 2014 to 2024 is projected to be 7.9 percent as compared to 7.4 percent for low skilled occupations (Job Zones 1 and 2). These are defined as skilled jobs or skilled occupations in the State System's Gap Analysis Project using terminology from the O*NET program.

Fig. 12 shows the number of jobs in Northwest Pennsylvania by skilled occupations (Job Zones 3-5) and low skilled occupations (Job Zones 1-2) in 2014 as well as projected growth to 2024 for each set of occupations.

Fig. 12: Northwest Pennsylvania Projected Job Growth by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
Northwest Pennsylvania, Total Jobs	**372,427**	**401,023**	**7.7%**	**100%**	**100%**
Job Zones 1-2 (Low Skilled)	201,135	216,115	7.4%	54%	54%
Job Zones 3-5 (Skilled)	171,292	184,908	7.9%	46%	46%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry, O*NET; Oxford Economics Projections

3.3 Largest Occupations

Top occupations in the state are driven by industry composition. Medical centers employ a cadre of health professionals, while enterprise management companies employ a range of business professionals. Given the dominating presence of health care and social assistance, accommodation and food services, and retail trade establishments in Northwest Pennsylvania, top occupations include: retail salespersons, cashiers, food preparation and serving workers, registered nurses, and office clerks. Fig. 13 highlights the top occupations in the state, 10-year job growth projections, and new and replacement jobs.[8] The Job Zone is also included to indicate skill level for each occupation.[9]

8 New and replacement job change takes into account demand for occupations based on: industry growth (new jobs), occupation productivity, workforce ageing (retirements and deaths), migration and other factors that would contribute to new and replacement job openings.

9 Job Zone One and Two represent low skilled occupations and Job Zone Three, Four and Five represent skilled occupations.

Fig. 13: Largest Occupations in Northwest Pennsylvania and Projected Growth, 2014-2024

Occupation Title	Job Zone	2014	2024	% Change 2014-2024	10-year New and Replacement Jobs
Retail Salespersons	2	13,396	14,261	6.5%	5,728
Cashiers	1	11,360	10,742	-5.4%	4,724
Combined Food Preparation and Serving Workers, Including Fast Food	1	9,107	10,272	12.8%	5,077
Registered Nurses	3	8,531	10,173	19.2%	3,370
Office Clerks, General	2	7,513	7,226	-3.8%	1,443
Laborers and Freight, Stock, and Material Movers, Hand	2	6,880	8,047	17.0%	3,646
Waiters and Waitresses	1	6,613	7,277	10.0%	4,163
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3	6,334	6,861	8.3%	1,349
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	2	5,926	6,283	6.0%	1,716
Customer Service Representatives	2	5,664	6,120	8.1%	2,167
Nursing Assistants	2	5,601	6,486	15.8%	2,016
Heavy and Tractor-Trailer Truck Drivers	2	5,582	6,576	17.8%	2,169
Personal Care Aides	2	5,576	8,704	56.1%	3,872
Stock Clerks and Order Fillers	2	5,098	5,048	-1.0%	1,731
Maintenance and Repair Workers, General	3	4,460	4,747	6.4%	1,270

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3.4 Concentration of Occupations

Growth in areas of comparative advantage provides career opportunities that reflect statewide workforce concentration. Just as industry location quotient analysis is used to determine industry concentration, occupation location quotient analysis is used to evaluate specializations that exist within Northwest Pennsylvania's workforce, which may indicate the presence of key occupation clusters. A classic example of one such cluster would be Silicon Valley's large concentration of IT and computer programming occupations. The presence of occupation concentration (especially skilled occupations) indicates areas of opportunity for postsecondary institutions to support workforce needs for occupations that have strong employment advantages within the region.

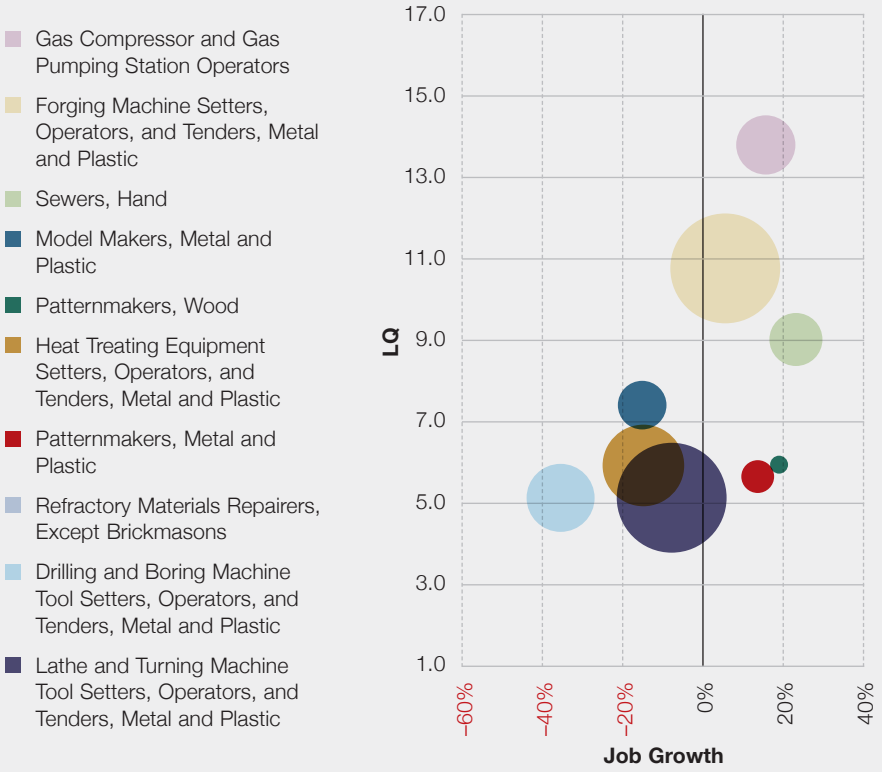
Location quotients equal to 1 indicate that the area's occupation concentration is equal to the national concentration of the same occupation. Occupations with higher location quotients (usually greater than 1.2) indicate that a region has a concentration or comparative advantage in the occupation, relative to

the rest of the nation. A value of 1.5 indicates that occupation employment within the region is 1.5 times more concentrated compared to the U.S. average. A location quotient below 1 indicates that occupation employment within the region is less concentrated compared to the U.S. average. Note: High employment occupations do not necessarily result in large location quotients, as this is a comparative statistic.

The location quotient chart provides three key pieces of information. The vertical axis indicates the location quotient value. A value of 1.5 indicates that employment within the region is 1.5 times more concentrated compared to the average region in the U.S. The horizontal axis indicates whether the occupation is projected to grow or decline over the next 10 years. Occupations with high LQ's that are adding new jobs suggest that the comparative regional advantage may be creating further employment opportunities. The size of the bubble indicates the number of jobs within the occupations. When viewed together skilled occupations with large employment (large bubbles) that have comparative advantages (high LQs) and are adding new jobs (high growth), are likely critical areas of regional workforce needs and warrant closer evaluation of program availability and completion to support statewide workforce demand.

In Northwest Pennsylvania, occupations that are highly concentrated include gas compressor and gas pumping station operators; forging machine setters, operators, and tenders, metal and plastic; sewers, hand; model makers, metal and plastic; and patternmakers, wood. Fig. 14 illustrates the LQ, projected job change and employment size of the most concentrated occupations (as measured by LQ) in Northwest Pennsylvania in 2014. Fig. 15 provides detailed data on the occupations, including LQ, 2014 jobs, projected 2024 jobs and projected percent change in jobs.

Fig. 14: Northwest Pennsylvania's Most Concentrated Occupations and Projected Growth, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 15: Northwest Pennsylvania's Most Concentrated Occupations and Projected Growth, 2014-2024

Occupation Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
Gas Compressor and Gas Pumping Station Operators	13.8	179	207	15.6%
Forging Machine Setters, Operators, and Tenders, Metal and Plastic	10.8	635	667	5.0%
Sewers, Hand	9.0	149	183	22.8%
Model Makers, Metal and Plastic	7.4	126	107	-15.1%
Patternmakers, Wood	6.0	16	19	18.8%
Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	5.9	343	293	-14.6%
Patternmakers, Metal and Plastic	5.7	59	67	13.6%
Refractory Materials Repairers, Except Brickmasons	5.2	25	26	4.0%
Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	5.2	249	161	-35.3%
Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	5.1	604	557	-7.8%

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3.5 Occupations Aligning to Associate's Degrees

Northwest Pennsylvania employment projections to 2024 conducted by the State System's Gap Analysis project indicate significant growth in many occupations that align with postsecondary education. Occupations that generally align to associate's degree programs are categorized as Job Zone Three.

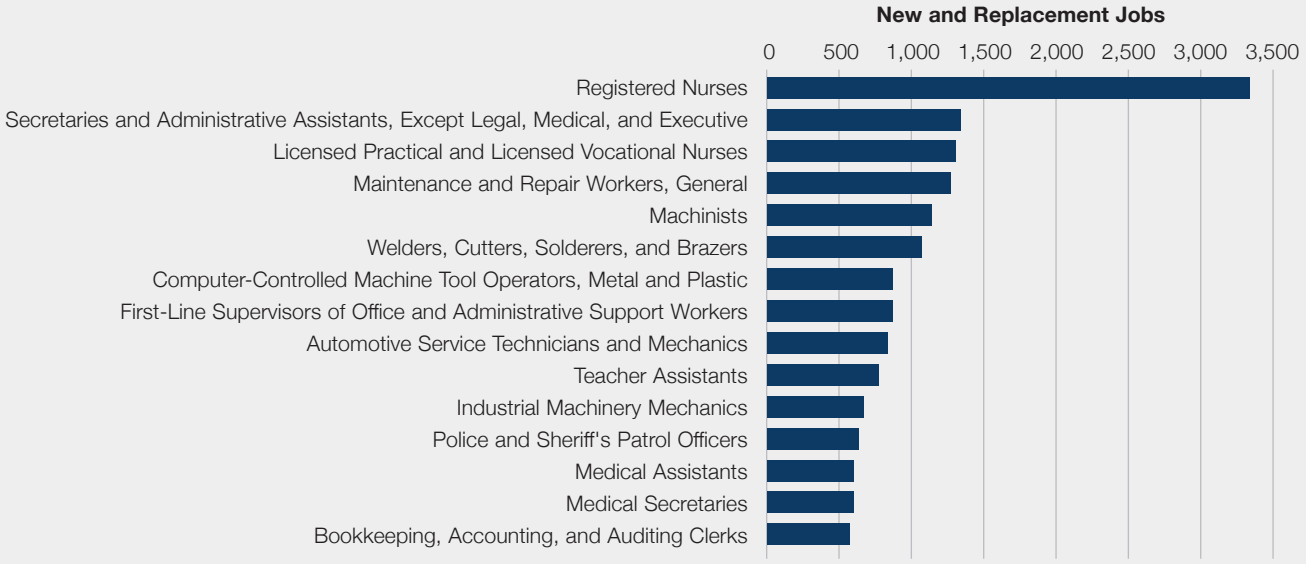
Looking ahead, many Job Zone Three occupations show significant growth and demand. In Northwest Pennsylvania, projections indicate 9.5 percent growth in Job Zone Three occupations between 2014 and 2024. Job demand is further emphasized through both new job growth and replacement job openings as workers in the profession retire, relocate, or change jobs. The projected new and replacement demand for Job Zone Three occupations is 31,400 between 2014 and 2024.

3.5.1 Top High Demand Occupations Aligning to Associate's Degrees

High demand occupations are identified as having the largest projected new and replacement demand between 2014 and 2024. The top high demand occupations in the region are largely driven by industry demand for skilled workers and typically the largest occupations in the region. However, career changes and the demographic characteristics of those who are currently employed—specifically age—also influence replacement demand. Occupations that employ an older demographic, specifically those aged 55 and older, will face increasing pressure to replace workers as older workers approach retirement age.

High demand occupations aligned to associate's degrees include: registered nurses, secretaries and administrative assistants, and licensed practical and licensed vocational nurses. Fig. 16 and Fig. 17 highlight Northwest Pennsylvania's top high demand occupations aligning to associate's degrees, projected job growth, and 10-year new and replacement jobs.

Fig. 16: Top High Demand Occupations Aligning to Associate's Degrees in Northwest Pennsylvania, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 17: Employment Projections for Top High Demand Occupations Aligning to Associate's Degrees in Northwest Pennsylvania, 2014-2024

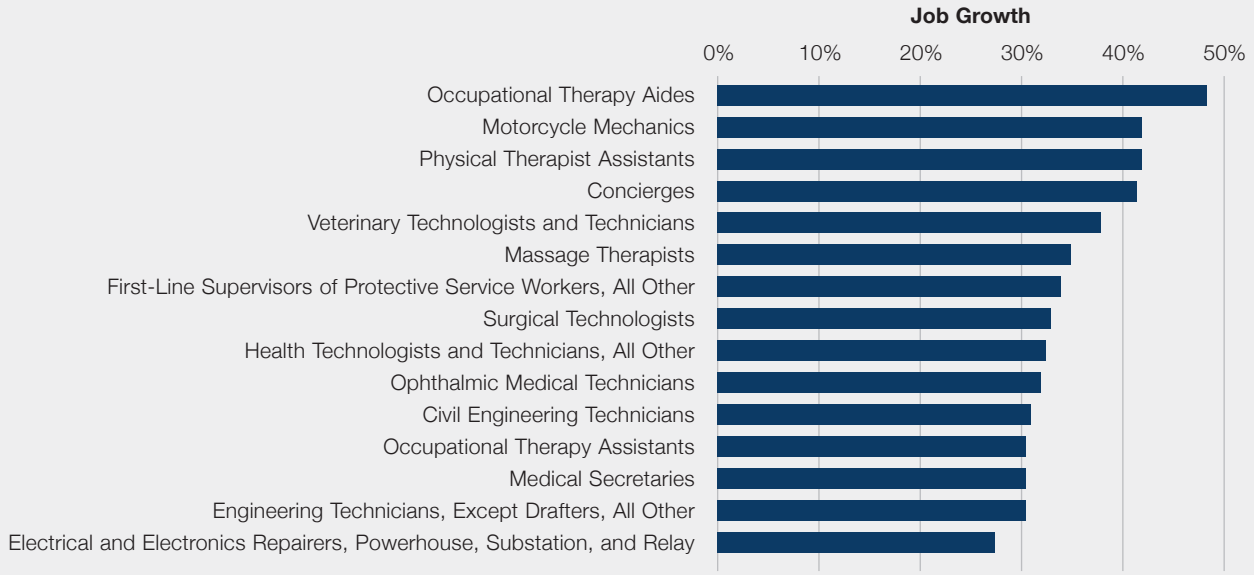
Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
Registered Nurses	8,531	10,173	19.2%	3,370
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	6,334	6,861	8.3%	1,349
Licensed Practical and Licensed Vocational Nurses	2,627	3,231	23.0%	1,298
Maintenance and Repair Workers, General	4,460	4,747	6.4%	1,270
Machinists	3,374	3,523	4.4%	1,143
Welders, Cutters, Solderers, and Brazers	2,713	2,917	7.5%	1,087
Computer-Controlled Machine Tool Operators, Metal and Plastic	1,530	1,890	23.5%	893
First-Line Supervisors of Office and Administrative Support Workers	3,091	3,215	4.0%	864
Automotive Service Technicians and Mechanics	2,433	2,568	5.5%	843
Teacher Assistants	3,293	3,257	-1.1%	782
Industrial Machinery Mechanics	1,472	1,667	13.2%	675
Police and Sheriff's Patrol Officers	1,789	1,804	0.8%	657
Medical Assistants	1,572	1,876	19.3%	620
Medical Secretaries	1,440	1,880	30.6%	607
Bookkeeping, Accounting, and Auditing Clerks	3,727	3,948	5.9%	589

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3.5.2 Fastest Growing Occupations Aligning to Associate's Degrees

The fastest growing occupations are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. In Northwest Pennsylvania, the fastest growing occupations are largely driven by industry growth and demand. Growing industries reflect the needs of the broader economy. Given the aging population in the U.S. and Pennsylvania, the health care sector is driving demand for workers. The fastest growing occupations aligning to associate's degrees include: occupational therapy aides, motorcycle mechanics, physical therapy assistants, concierges, and veterinary technologists and technicians. Fig. 18 and Fig. 19 highlight the fastest growing occupations in the region that align to associate's degrees, projected job growth, and 10-year new and replacement jobs.

Fig. 18: Fastest Growing Occupations Aligning to Associate's Degrees in Northwest Pennsylvania, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 19: Employment Projections for Fastest Growing Occupations Aligning to Associate's Degrees in Northwest Pennsylvania, 2014-2024

Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
Occupational Therapy Aides	37	55	48.6%	28
Motorcycle Mechanics	86	122	41.9%	67
Physical Therapist Assistants	335	475	41.8%	230
Concierges	36	51	41.7%	24
Veterinary Technologists and Technicians	207	286	38.2%	101
Massage Therapists	140	189	35.0%	63
First-Line Supervisors of Protective Service Workers, All Other	111	149	34.2%	72
Surgical Technologists	244	325	33.2%	105
Health Technologists and Technicians, All Other	169	224	32.5%	68
Ophthalmic Medical Technicians	75	99	32.0%	33
Civil Engineering Technicians	84	110	31.0%	48
Occupational Therapy Assistants	180	235	30.6%	111
Medical Secretaries	1,440	1,880	30.6%	607
Engineering Technicians, Except Drafters, All Other	152	198	30.3%	84
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	65	83	27.7%	37

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3.6 Occupations Aligning to Bachelor's and Graduate Degrees

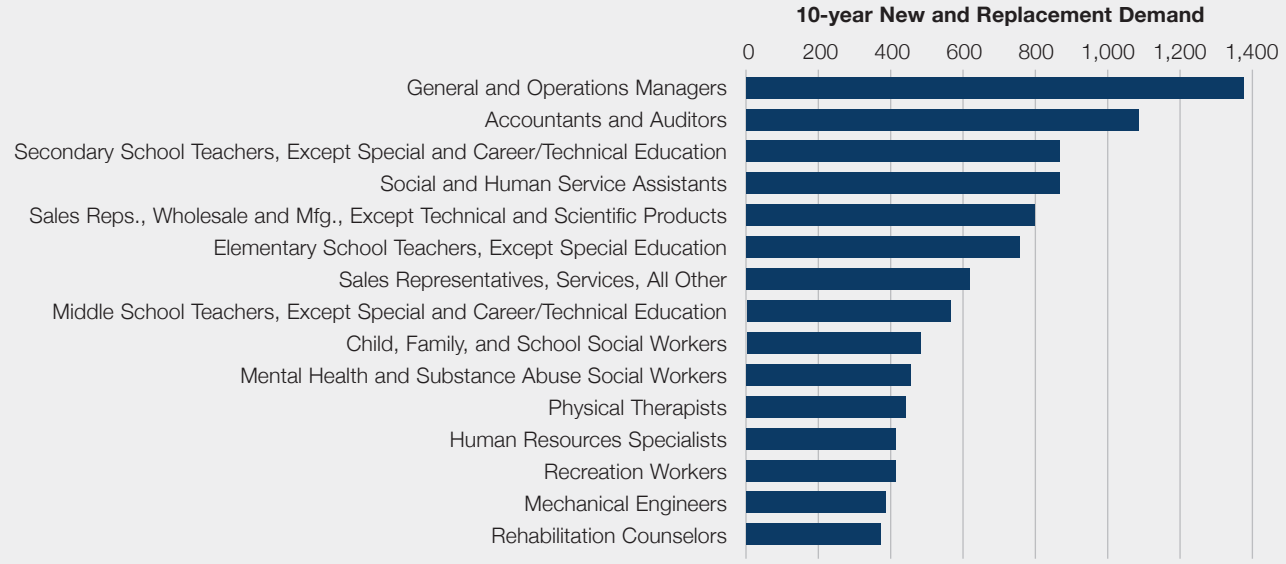
Job Zones Four and Five describe occupations that typically require a bachelor's degree or graduate degree. Northwest Pennsylvania's employment projections indicate that occupations typically requiring a bachelor's degree or higher will grow 6.1 percent between 2014 and 2024. This projected growth will result in total demand for new and replacement job openings of nearly 24,000 over the same time period.

3.6.1 Top High Demand Occupations Aligning to Bachelor's and Graduate Degrees

High demand occupations are identified as having the largest projected new and replacement demand between 2014 and 2024. The top high demand occupations in the region are largely driven by industry demand for skilled workers and typically the largest occupations in the region. However, career changes and the demographic characteristics of those who are currently employed—specifically age—also influence replacement demand. Occupations that employ an older demographic, specifically those aged 55 and older, will face increasing pressure to replace workers as older workers approach retirement age.

High demand occupations aligning to bachelor's and graduate degree level education include: general and operations managers, accountants and auditors, secondary school teachers, social and human service assistants, and sales representatives, wholesale and manufacturing. Fig. 20 and Fig. 21 highlight the top high demand occupations in the region aligning to bachelor's and graduate degrees, projected job growth, and 10-year new and replacement jobs.

Fig. 20: Top High Demand Occupations Aligning to Bachelor's and Graduate Degrees in Northwest Pennsylvania, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 21: Employment Projections for Top High Demand Occupations Aligning to Bachelor's and Graduate Degrees in Northwest Pennsylvania, 2014-2024

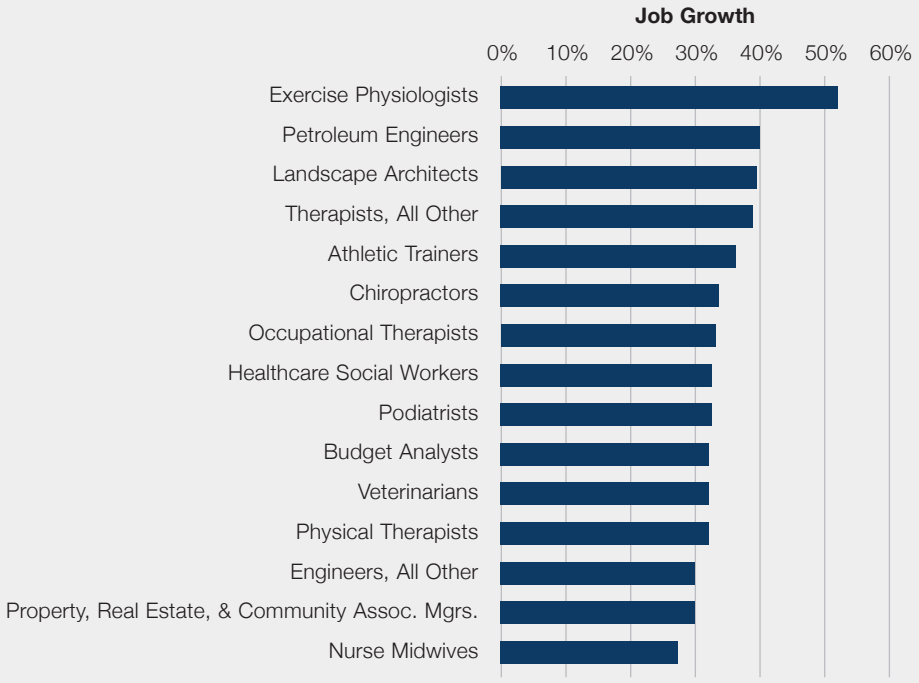
Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
General and Operations Managers	4,369	4,958	13.5%	1,367
Accountants and Auditors	2,744	2,913	6.2%	1,083
Secondary School Teachers, Except Special and Career/Technical Education	3,842	3,395	-11.6%	862
Social and Human Service Assistants	1,969	2,242	13.9%	860
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	3,734	3,654	-2.1%	788
Elementary School Teachers, Except Special Education	4,186	3,885	-7.2%	752
Sales Representatives, Services, All Other	1,218	1,486	22.0%	618
Middle School Teachers, Except Special and Career/Technical Education	1,772	1,895	6.9%	567
Child, Family, and School Social Workers	1,373	1,526	11.1%	475
Mental Health and Substance Abuse Social Workers	915	1,112	21.5%	454
Physical Therapists	730	964	32.1%	441
Human Resources Specialists	1,029	1,219	18.5%	410
Recreation Workers	1,036	1,318	27.2%	406
Mechanical Engineers	1,031	1,023	-0.8%	382
Rehabilitation Counselors	670	854	27.5%	372

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3.6.2 Fastest Growing Occupations Aligning to Bachelor's and Graduate Degrees

The fastest growing occupations are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. In Northwest Pennsylvania, the fastest growing occupations aligning to bachelor's and graduate degrees include: exercises physiologists, petroleum engineers, landscape architects, therapists, all other, and athletic trainers. Fig. 22 and Fig. 23 highlight Northwest Pennsylvania's fastest growing occupations aligning to bachelor's and graduate degrees, projected job growth, and 10-year new and replacement jobs.

Fig. 22: Fastest Growing Occupations Aligning to Bachelor's and Graduate Degrees in Northwest Pennsylvania, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 23: Employment Projections for Fastest Growing Occupations Aligning to Bachelor's and Graduate Degrees in Northwest Pennsylvania, 2014-2024

Occupation Title	2014	2024	% Change 2014-2024	10-year New and Replacement Jobs
Exercise Physiologists	23	35	52.2%	15
Petroleum Engineers	166	232	39.8%	125
Landscape Architects	33	46	39.4%	23
Therapists, All Other	31	43	38.7%	16
Athletic Trainers	85	116	36.5%	56
Chiropractors	107	143	33.6%	60
Occupational Therapists	422	562	33.2%	206
Healthcare Social Workers	586	777	32.6%	327
Podiatrists	40	53	32.5%	29
Budget Analysts	118	156	32.2%	88
Veterinarians	137	181	32.1%	94
Physical Therapists	730	964	32.1%	441
Engineers, All Other	280	364	30.0%	140
Property, Real Estate, and Community Association Managers	131	170	29.8%	73
Nurse Midwives	11	14	27.3%	5

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

The next section provides a high-level overview of Northwest Pennsylvania's education program output by broad degree category.

4. POSTSECONDARY PROGRAM COMPLETIONS IN NORTHWEST PENNSYLVANIA

Northwest Pennsylvania is home to many different postsecondary institutions, offering a range of degree programs. As reported by the National Center for Education Statistics (NCES), there are approximately 30 higher education institutions in the region that awarded an associate's degree or higher between 2011 and 2013.[10] These institutions graduated, on average, 10,200 students annually from 2011 to 2013 with an associate's degree or higher.[11] The top major fields of study include business, management, marketing, and related support services; health professions and related programs; education; biological and biomedical sciences; and social sciences.

Pennsylvania's State System of Higher Education is a large contributor to bachelor's and graduate degree completions. The State System universities in the region include: Clarion University (Clarion) and Edinboro University (EU). These universities produce approximately 37% of the total bachelor's degrees and above in the region.[12]

4.1 Associate's Degree Completions

Northwest Pennsylvania is home to approximately 22 different institutions that offer a range of associate's degree programs.[13] From 2011 to 2013, these institutions in Northwest Pennsylvania awarded, on average, 2,100 associate's degrees annually. The top three program areas in the region's associate degree production include:

- Health professions and related programs,
- Business, management, marketing, and related support services, and
- Construction trades.

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10 This number includes the location of a physical campus/structure with learner enrolment as reported to NCES. Institutions with extension campuses that report enrollment at their main campus may not be captured within this list.

11 This number is the 3-year average completions from 2011 to 2013 as reported to NCES.

12 This number is based on the 3-year average completions from 2011 to 2013 as reported to NCES.

13 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

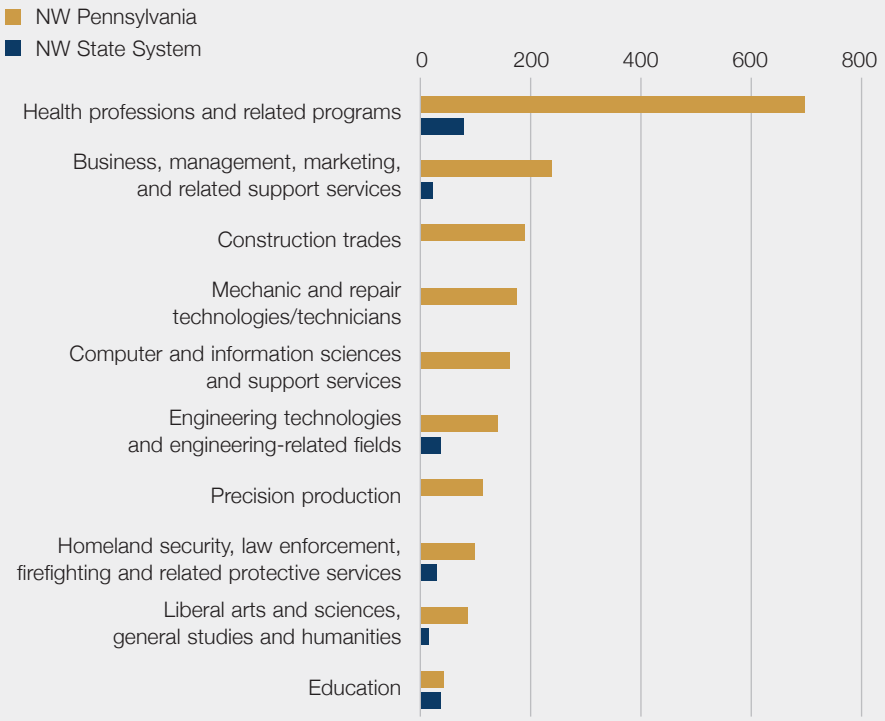
Of the 2,100 average annual completions of associate's degrees, these three program areas accounted for 55% of completions in the region.

4.1.1 State System Associate's Degree Completions

From 2011 to 2013, both State System universities in Northwest Pennsylvania awarded associate's degrees. On average, these institutions awarded 229 associate's degrees annually. The two universities accounted for 11% of associate's degree completions in the region and include: Clarion (161 annual average associate completions) and Edinboro (68 annual average associate completions). The top program areas for associate's degrees in the Northwest State System include:

- Health professions and related programs,
- Education, and
- Engineering technologies and engineering-related fields.

Fig. 24: Associate's Degrees Program Completions in Northwest Pennsylvania and the Northwest State System, 2011-2013 Annual Average



Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Of the 229 average annual completions of associate's degrees within the Northwest State System, these three program areas account for 64% of associate's degree completions.

Fig. 24 highlights the top 10 program areas for associate's completions in Northwest Pennsylvania, along with the corresponding Northwest State System associate's completions.

Fig. 25 below provides the total number of associate's degrees awarded in Northwest Pennsylvania by major field of study as well as the total number of associate's degrees awarded by the State System.

Fig. 25: Associate's Degrees Total Program Completions in Northwest Pennsylvania and the Northwest State System, 2011-2013 Annual Average

Major Category	NW Pennsylvania 3-year Average Associate Completions	Share of Total NW Pennsylvania Associate Completions	NW State System 3-year Average Associate Completions	Share of Total NW State System Associate Completions
Total	**2,086**	**100.0%**	**229**	**100.0%**
Health professions and related programs	707	33.9%	77	33.5%
Business, management, marketing, and related support services	242	11.6%	19	8.2%
Construction trades	195	9.4%	0	0.0%
Mechanic and repair technologies/technicians	181	8.7%	0	0.0%
Computer and information sciences and support services	161	7.7%	2	0.7%
Engineering technologies and engineering-related fields	139	6.7%	34	15.0%
Precision production	113	5.4%	0	0.0%
Homeland security, law enforcement, firefighting and related protective services	102	4.9%	27	11.8%
Liberal arts and sciences, general studies and humanities	85	4.1%	16	7.0%
Education	42	2.0%	35	15.3%
Legal professions and studies	37	1.8%	10	4.5%
Personal and culinary services	25	1.2%	0	0.0%
Natural resources and conservation	15	0.7%	0	0.0%
Family and consumer sciences/human sciences	14	0.7%	0	0.0%
Public administration and social service professions	9	0.4%	9	3.9%
Multi/interdisciplinary studies	6	0.3%	0	0.0%
Visual and performing arts	5	0.2%	0	0.0%
Social sciences	4	0.2%	0	0.0%
Engineering	4	0.2%	0	0.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

4.2 Bachelor Degree Completions

Northwest Pennsylvania is home to approximately 12 different institutions that offer a range of bachelor's degree programs.[14] From 2011 to 2013, these institutions in Northwest Pennsylvania awarded, on average, 5,700 bachelor's degrees annually. The top three program areas in the region's bachelor degree production include:

- Business, management, marketing, and related support services,
- Health professions and related programs, and
- Education.

Of the 5,700 average annual completions of bachelor's degrees, these three program areas accounted for 36% of completions in the region.

4.2.1 State System Bachelor's Degree Completions

From 2011 to 2013, both State System universities in Northwest Pennsylvania awarded bachelor's degrees. On average, these institutions awarded 2,000 bachelor's degrees annually. The three universities accounted for 34% of bachelor's degree completions in the region and include: EU (1,002 annual average bachelor completions) and Clarion (950 annual average bachelor completions). The top program areas for bachelor's degrees in the Northwest State System include:

- Education,
- Health professions and related programs, and
- Business, management, marketing, and related support services.

Of the 2,000 average annual completions of bachelor's degrees within the Northwest State System, these three program areas account for 38% of bachelor's degree completions.

Fig. 26 highlights the top program areas for bachelor's completions in Northwest Pennsylvania, along with the corresponding Northwest State System bachelor's completions.

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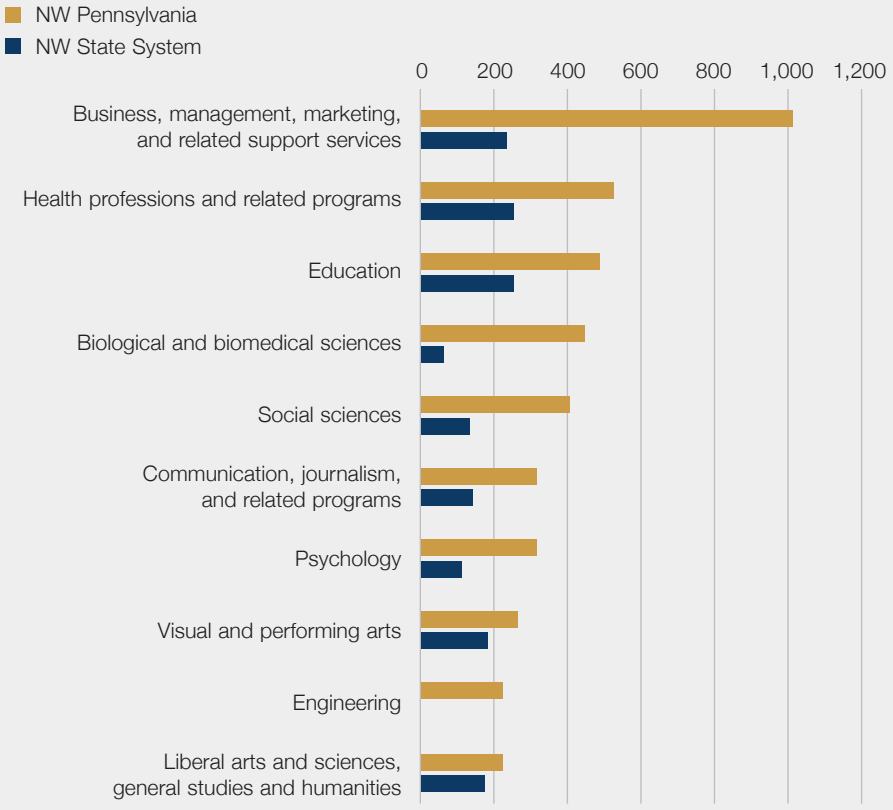
14 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

Fig. 26: Program Completions for Bachelor's Degrees in Northwest Pennsylvania and the Northwest State System, 2011-2013 Annual Average



Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Fig 27 on the next page provides the total number of bachelor's degrees awarded in Northwest Pennsylvania by major field of study as well as the total number of bachelor's degrees awarded by the State System.

Fig. 27: Total Program Completions for Bachelor's Degrees in Northwest Pennsylvania and the State System, 2011-2013 Annual Average

Major Category	NW Pennsylvania 3-year Average Bachelor Completions	Share of Total NW Pennsylvania Bachelor Completions	NW State System 3-year Average Bachelor Completions	Share of Total NW State System Bachelor Completions
Total	**5,696**	**100.0%**	**1,952**	**100.0%**
Business, management, marketing, and related support services	1,019	17.9%	239	12.2%
Health professions and related programs	532	9.3%	254	13.0%
Education	491	8.6%	257	13.2%
Biological and biomedical sciences	451	7.9%	62	3.2%
Social sciences	406	7.1%	130	6.7%
Communication, journalism, and related programs	319	5.6%	142	7.3%
Psychology	314	5.5%	112	5.7%
Visual and performing arts	263	4.6%	180	9.2%
Engineering	223	3.9%	0	0.0%
Liberal arts and sciences, general studies and humanities	221	3.9%	169	8.7%
English language and literature/letters	219	3.8%	57	2.9%
Homeland security, law enforcement, firefighting and related protective services	188	3.3%	69	3.5%
Physical sciences	147	2.6%	53	2.7%
History	133	2.3%	26	1.3%
Parks, recreation, leisure, and fitness studies	116	2.0%	57	2.9%
Mathematics and statistics	103	1.8%	30	1.6%
Multi/interdisciplinary studies	101	1.8%	13	0.7%
Computer and information sciences and support services	94	1.6%	33	1.7%
Natural resources and conservation	70	1.2%	17	0.9%
Engineering technologies and engineering-related fields	69	1.2%	0	0.0%
Philosophy and religious studies	52	0.9%	5	0.3%
Family and consumer sciences/human sciences	46	0.8%	0	0.0%
Foreign languages, literatures, and linguistics	44	0.8%	12	0.6%
Public administration and social service professions	43	0.7%	23	1.2%
Library science	10	0.2%	10	0.5%
Communications technologies/technicians and support services	8	0.1%	0	0.0%
Legal professions and studies	7	0.1%	0	0.0%
Area, ethnic, cultural, gender, and group studies	3	0.1%	1	0.1%
Theology and religious vocations	3	0.1%	0	0.0%
Personal and culinary services	1	0.0%	0	0.0%
Science technologies/technicians	1	0.0%	0	0.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

4.3 Graduate Degree Completions

Northwest Pennsylvania is home to approximately 7 different institutions that offer a range of graduate degree programs.[15] From 2011 to 2013, these institutions in Northwest Pennsylvania awarded, on average, 2,400 graduate degrees annually. Three programs dominate graduate degree completions in the region, specifically:

- Health professions and related programs,
- Education, and
- Library science.

Of the 2,400 average annual completions of graduate degrees, these three program areas accounted for 80% of completions in the region.

4.3.1 State System Graduate Degree Completions

From 2011 to 2013, both State System universities in Northwest Pennsylvania awarded graduate degrees. On average, these institutions awarded 1,000 graduate degrees annually. These universities accounted for 43% of graduate degree completions in the region and include: EU (561 annual average graduate completions) and Clarion (467 annual average graduate completions). The top three program areas in the region's graduate degree production include:

- Education,
- Library science, and
- Health professions and related programs.

Of the 1,000 average annual completions of graduate degrees within the State System, these three program areas account for 84% of graduate degree completions.

Fig. 28 highlights the top 10 program areas for graduate completions in Northwest Pennsylvania, along with the corresponding State System graduate completions.

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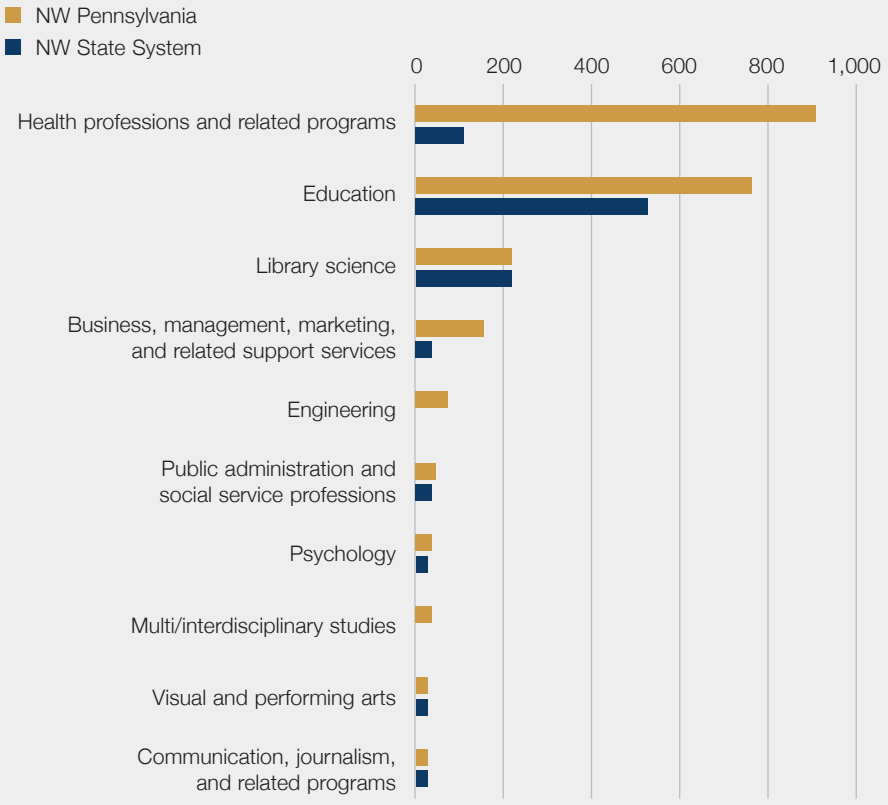
15 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

Fig. 28: Program Completions for Graduate Degrees in Northwest Pennsylvania and the State System, 2011-2013 Annual Average



Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Fig. 29 on the next page provides the total number of graduate degrees awarded in Northwest Pennsylvania by major category as well as the total number of graduate degrees awarded by the State System.

The next section evaluates the combination of completions by degree type (education supply) against the demand for skilled labor by occupation to determine whether potential gaps (excess demand or supply surplus) exist within the commonwealth's postsecondary education system.

Fig. 29: Total Program Completions for Graduate Degrees in Northwest Pennsylvania and the State System, 2011-2013 Annual Average

Major Category	NW Pennsylvania 3-year Average Graduate Completions	Share of Total NW Pennsylvania Graduate Completions	NW State System 3-year Average Graduate Completions	Share of Total NW State System Graduate Completions
Total	**2,380**	**100.0%**	**1,028**	**100.0%**
Health professions and related programs	909	38.2%	113	11.0%
Education	765	32.1%	525	51.0%
Library science	222	9.3%	222	21.6%
Business, management, marketing, and related support services	153	6.4%	32	3.1%
Engineering	73	3.1%	0	0.0%
Public administration and social service professions	49	2.1%	36	3.5%
Psychology	36	1.5%	30	2.9%
Multi/interdisciplinary studies	35	1.5%	0	0.0%
Visual and performing arts	25	1.1%	25	2.5%
Communication, journalism, and related programs	23	1.0%	23	2.3%
Computer and information sciences and support services	18	0.8%	1	0.1%
Biological and biomedical sciences	17	0.7%	11	1.1%
Engineering technologies and engineering-related fields	14	0.6%	0	0.0%
Homeland security, law enforcement, firefighting and related protective services	11	0.5%	0	0.0%
Social sciences	11	0.5%	7	0.6%
English language and literature/letters	9	0.4%	2	0.2%
Natural resources and conservation	5	0.2%	0	0.0%
Theology and religious vocations	3	0.1%	0	0.0%
Physical sciences	1	0.0%	1	0.1%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

5. OVERVIEW OF GAP ANALYSIS

A gap analysis comparing educational supply and occupational demand serves as a critical first step in efforts to align education programs with the workforce needs of Pennsylvania employers. It provides a data-driven perspective of employer demand (growing occupations across the state) and postsecondary education supply (degree production by program and level). This section focuses on the demand gaps and supply surpluses for skilled occupations in Northwest Pennsylvania.[16]

To make the connection between employer demand and education supply a crosswalk between the taxonomy of occupation codes (Standard Occupation Codes, or SOC) and major programs (Classification of Instructional Program or CIP) is required. The State System's Gap Analysis project conducted original research to enhance the traditional taxonomy of major program to occupation crosswalk using American Community Survey data that demonstrate a broader spectrum of connections between education programs and occupations.[17] This hybrid crosswalk connected the CIP and SOC using both the NCES and Pennsylvania standard crosswalks and the additional real-world connections using the American Community Survey.

16 Skilled occupations are occupation in Job Zones 3, 4, and 5.

17 The existing crosswalks available include a national NCES crosswalk and a state crosswalk specific to Pennsylvania. Additional connections were made using data available in the ACS.

EDUCATION TO OCCUPATION CROSSWALKS AND WHAT SETS THIS GAP ANALYSIS APART FROM PREVIOUS STUDIES

Typical gap analysis will use one of two approaches when building a crosswalk: The Department of Education (DOE) crosswalk or the American Community Survey (ACS) crosswalk.

The DOE crosswalk, completed through collaboration with the Bureau of Labor Statistics and the National Center for Education Statistics (NCES), attempts to link occupation classifications (SOC code) to their related educational programs (CIP code). The drawback is that there is often not a one-to-one connection between education programs and occupations and in even some extreme cases, education programs related to occupations do not match the reality of careers people enter. Another drawback is that occupations often employ a range of degree and non-degree completers, which reflects the reality of the labor market. For example a customer representative for a technology company may have a bachelor's degree in computer programming, whereas a customer service representative for a retail company may only have a high school diploma.

The ACS crosswalk is built on a large survey sample consisting of 160 education program codes and 261 occupation classifications (note: these are not as detailed as CIP and SOC codes), reflecting the careers individuals take after they complete their education programs. Whereas DOE's crosswalk seeks to state what should be, the ACS crosswalk states what is. This approach is very practical when dealing with education programs that don't match closely to a specific occupation (e.g. liberal arts degrees, history degrees, etc.). Additionally, ACS data provide a measure that estimates the demand for workers with various levels of postsecondary education in a given occupation. For example if 21% of customer service representatives have a bachelor's degree, then only 21% of the annual demand for customer service representatives will be counted against the supply of matching education programs.

The methodology developed for this gap analysis bridges the two approaches above. Occupations that are linked through DOE are not discounted, even if ACS suggests that there are relatively few degree completions entering the occupation field. Additionally, the use of ACS more closely captures the reality of where degree holders have found employment in Pennsylvania and surrounding states—note the geography for measuring gaps was restricted to Pennsylvania only, however occupation to education linkages were built on a multi-state region. While there are certainly exceptions to the rule, which were ultimately reviewed on a case-by-case basis as described in detail in Appendix E, the approach does capture the vast majority of relevant and compelling connections between education programs and occupations. Lastly, the methodology takes into account the labor market behavior of both employers and employees in the following ways:

- It provides a measure of education distribution by degree level demonstrating that a range of skill levels can exist within occupation classification.
- It captures the demand and range for bachelor's degree field of study within an occupation classification.*
- It provides a reality-driven process to connect bachelor's degree field of study to occupations, especially in the liberal arts programs.
- It provides a regionalized crosswalk that better reflects the competition for jobs in Pennsylvania and the surrounding region.

By modeling these features, this gap analysis accounts for issues that were not accounted for in previous gap analysis studies.

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* The ACS reports two separate pieces of information: highest level of educational attainment for an individual and major field of study for an individual's bachelor degree. The major field of study is not reported for associate's degrees or graduate degrees.

5.1 How to use the Gap Analysis

The gap analysis results are presented as two main sets of findings: demand gaps (excess employer demand) and supply surpluses. Each outcome has a different set of implications for area stakeholders, postsecondary education institutions, and learners. These outcomes are summarized briefly below and then described further in each relevant section.

The uses of a gap analysis are many and varied and include:

- **Strategic engagement:** Increased collaboration and alignment between regional employers and education programs helps ensure a competitive, vibrant regional economy. The gap analysis enables this process by helping postsecondary institutions identify areas of employer need. The analysis provides a data-driven starting point to begin conversations with employers on how postsecondary institutions can help meet education/training needs in the regional economy.
- **Enhanced program development/evaluation:** The gap analysis serves as an additional tool for decision-making in academic program planning by addressing one aspect of the external eco-system—alignment of academic programs to the regional labor market.
- **Student engagement/career guidance:** The analysis provides information that can be used for career guidance and job search. The gap analysis results can inform learners about the alignment of education programs to careers, as well as the market demand for jobs.
- **Marketing:** By highlighting information about high demand occupations that are linked to education programs, postsecondary education institutions can demonstrate how leaners will succeed after program completion. Where compelling information exists, this can be used in student recruitment efforts.

While the State System's Gap Analysis project is critical to understanding the connections between education programs and occupations, it is important to recall the caveats of this Gap Analysis report:

- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.
- Government data that capture labor market demand lag real-time employer demand as well as higher education industry trends. As such, the gap analysis findings may lag these market changes.

- This analysis only focuses on program output as a supply pool (i.e. new graduates). However, regional workforces comprise additional pools of supply—specifically: employed workers, skilled unemployed workers, and skilled underemployed workers. When evaluating gaps, this analysis focuses on new and replacement demand, as opposed to job churn.[18] This helps to mitigate some of the issues involving the employed workforce.

Excess Employer Demand (Demand Gap)

A demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there. Where such gaps exist businesses will likely seek talent from outside the area, which can become costly from an HR perspective. This especially affects small and medium sized businesses that usually do not have well-developed HR functions. Additionally,

ABSOLUTE DEMAND GAP VS. RELATIVE DEMAND GAP

Results for demand gaps in this analysis are calculated in two different ways. An absolute demand gap is a nominal comparison, wherein the supply of program completions which align to an occupation is subtracted from the demand for those aligned occupations. This produces a "headcount" of the additional number of program completions needed to meet the demand within an occupation.

A relative demand gap is a ratio of program supply to occupation demand, which is expressed as a percentage. A percentage below 100% indicates excess employer demand relatively (e.g. the number of program completers is less than the occupation demand), whereas a value over 100% indicates that there are more program completions relative to occupation demand.

This analysis factors in both the absolute measure and relative measure to enable a broader perspective for interpretation. For example, an occupation that may indicate an average annual demand for 40 jobs per year with 30 annual completers would require 25% more completions to bridge the gap (30 / 40 = 0.75). However, this absolute gap would suggest that the increased amount of program output—10 additional completers—is relatively small. Therefore for program planning purposes, both perspectives are helpful to set the context of the demand gap.

18 Replacement jobs include retirements, deaths, and other workers who permanently leave an occupation. Job churn occurs when a worker leaves one job for another, but continues working in the same occupation.

employers—especially those in more rural areas—may face higher costs as they attempt to draw in workers from more populated areas.

This creates an opportunity to expand output or develop programs. For education institutions, gaps present an opportunity for program expansion (where current programs align, but are not creating enough output). The strategy for increasing output may differ—whether capacity or learner recruitment is a constraining factors. If a program does not exist, a gap may present an opportunity for new program development.

Leaners may gain a competitive employment edge when excess employer demand exists. For learners, when demand exceeds supply, graduates in relevant disciplines usually benefit—providing opportunities for career progression and higher earnings in both the short and long term.

Supply Surplus (Supply Gap)

A supply surplus for an occupation exists when the number of program completions within a region exceeds the employer demand. This presents some key implications to consider.

ABSOLUTE SUPPLY SURPLUS VS. RELATIVE SUPPLY SURPLUS

Results for supply surpluses are calculated in two different ways. An absolute supply surplus is a nominal comparison, wherein the supply of program completions which align to an occupation are subtracted from the demand for those aligned occupations. This produces a "headcount" of the number of program completions that exceed the projected demand for a given occupation.

A relative supply surplus is a ratio of program supply to occupation demand, which is expressed as a percentage. A percent above 100% indicates a relative supply surplus (e.g. the number of program completers is more than the occupation demand).

This analysis factors both ways to enable a broader perspective for interpretation. For example, an occupation that may indicate an average annual demand for 40 jobs per year with 50 annual completers would suggest that there are about 25% more completions than the workforce demands for occupations that tie to that program (50 / 40 = 1.25). However, this absolute gap would suggest that the increased amount of program output—10 additional completers—is relatively small. Furthermore, this may indeed fall within "tolerable levels" of program supply surplus. Therefore for programming planning and evaluation purposes, both perspectives are helpful to set the context of the supply surplus.

If employer demand is less than education production in relevant occupations, learners are likely to leave the region after graduation causing learner attrition and out-migration. Surpluses in talent supply can also suppress wages for graduates in certain careers. Classic labor market economic theory suggests that increased competition for jobs will put downward pressure on wages—i.e. the more people competing for the same job gives an employer a better bargaining position for wage/salary. While a college degree in and of itself has a measured wage premium, specific programs areas may have a range of wage premiums based on the supply of new talent competing for jobs and the conditions of the labor market.

5.2 Excess Demand Gaps for Skilled Occupations

Excess demand gaps exist for many skilled occupations within Northwest Pennsylvania.[19] The degree programs that align to these occupations span associate's degrees through graduate degrees. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there. The top excess demand gaps are identified by the size of the annual gap.

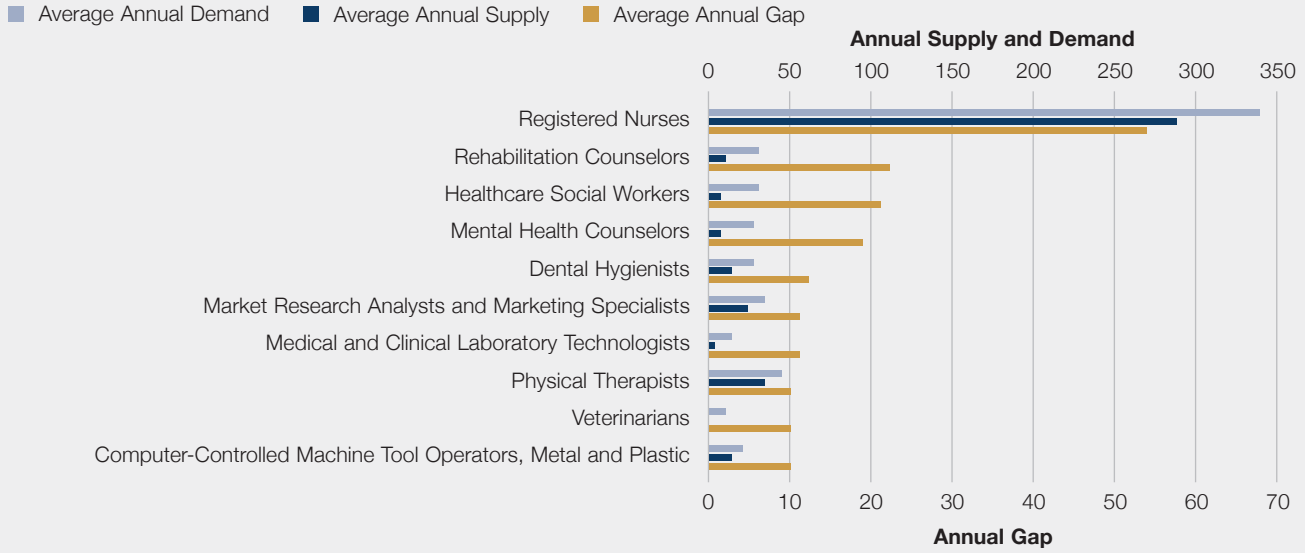
In Northwest Pennsylvania, eight out of the top ten demand gaps are occupations related to health care and community and social service and combine for an average annual demand gap of nearly 160. This reflects the strong growth in the health care and social assistance industry. The largest average annual demand gap in the region exists for registered nurses with an excess demand of 54. Rehabilitation counselors, healthcare social workers, and mental health counselors combine for an average annual demand gap of 62.

Additionally, growth in professional, technical and scientific services has driven significant demand for business, computer and engineering occupations, which, in-turn, has driven the demand for STEM majors.[20] Industrial engineers, computer-controlled machine tool operators, metal and plastic, computer systems analysts, and computer programmers combined for an average annual demand gap of 23.

Fig. 30 and Fig. 31 provide further detail about the top occupation gaps that indicate excess employer demand. The table includes the occupation title, occupation job zone, projected annual employer demand (for associate's

19 Skilled occupations are occupations in Job Zones 3, 4, and 5.
20 STEM majors include programs in the fields of Science, Technology, Engineering, and Mathematics.

Fig. 30: Top Demand Gaps for Skilled Occupations in Northwest Pennsylvania



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Fig. 31: Top Demand Gaps for Skilled Occupations in Northwest Pennsylvania

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Registered Nurses	3	338	284	54	0.84
Rehabilitation Counselors	5	31	9	22	0.29
Healthcare Social Workers	5	29	8	21	0.28
Mental Health Counselors	5	26	7	19	0.27
Dental Hygienists	3	27	15	12	0.56
Market Research Analysts and Marketing Specialists	4	35	24	11	0.69
Medical and Clinical Laboratory Technologists	4	13	2	11	0.15
Physical Therapists	5	43	33	10	0.77
Veterinarians	5	10	0	10	0.00
Computer-Controlled Machine Tool Operators, Metal and Plastic	3	22	12	10	0.55
Machinists	3	17	9	8	0.53
Sales Representatives, Services, All Other	4	32	25	7	0.78
Pharmacy Technicians	3	7	1	6	0.14
Maintenance and Repair Workers, General	3	15	9	6	0.60
Claims Adjusters, Examiners, and Investigators	4	21	16	5	0.76
Cost Estimators	4	20	15	5	0.75
Industrial Engineers	4	20	15	5	0.75
Human Resources Specialists	4	21	17	4	0.81
Computer Systems Analysts	4	23	19	4	0.83
Computer Programmers	4	14	10	4	0.71

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

degrees and higher), the annual supply of program completions (allocated to the occupation), the average annual gap, and a ratio of supply to demand (S/D Ratio).

5.3 Excess Demand Gaps For Occupations Aligning to Bachelor's and Graduate Degrees

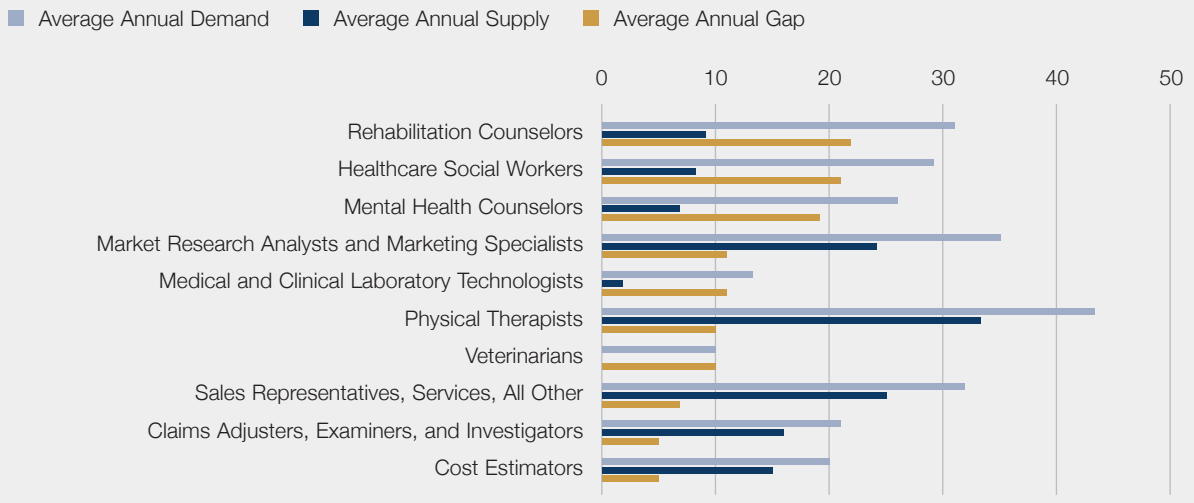
This section focuses on demand gaps for occupations that typically require a bachelor's or higher degree—occupations categorized by Job Zones Four and Five. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there.

In Northwest Pennsylvania, six of the top ten demand gaps at the bachelor's and graduate degree level are occupations related to health care and community and social assistance, including: rehabilitation counselors, healthcare social workers, mental health counselors, medical and clinical laboratory technologists, physical therapists, and veterinarians. Combined these occupations indicate an annual demand gap of 93.

Additionally, growth in professional, technical and scientific services has driven significant demand for business and technical occupations, such as sales representatives, services; claims adjusters, examiners, and investigators; cost estimators; industrial engineers; survey researchers; and urban and regional planners. Combined these occupations indicate an annual demand gap of 30.

Fig. 32 highlights the demand gap results for the top bachelor's and graduate degree level occupations. Fig. 33 includes the occupation title, occupation job zone, projected annual employer demand (for associate's degrees and higher), the annual supply of program completions (allocated to the occupation), the average annual gap, and a ratio of supply to demand (S/D Ratio).

Fig. 32: Top Bachelor's and Graduate Degree-Level Demand Gaps in Northwest Pennsylvania



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Fig. 33: Top Bachelor's and Graduate Degree-Level Demand Gaps in Northwest Pennsylvania

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Rehabilitation Counselors	5	31	9	22	0.29
Healthcare Social Workers	5	29	8	21	0.28
Mental Health Counselors	5	26	7	19	0.27
Market Research Analysts and Marketing Specialists	4	35	24	11	0.69
Medical and Clinical Laboratory Technologists	4	13	2	11	0.15
Physical Therapists	5	43	33	10	0.77
Veterinarians	5	10	0	10	0.00
Sales Representatives, Services, All Other	4	32	25	7	0.78
Claims Adjusters, Examiners, and Investigators	4	21	16	5	0.76
Cost Estimators	4	20	15	5	0.75
Industrial Engineers	4	20	15	5	0.75
Survey Researchers	5	5	1	4	0.20
Urban and Regional Planners	5	5	1	4	0.20
Substance Abuse and Behavioral Disorder Counselors	5	13	9	4	0.69
Human Resources Specialists	4	21	17	4	0.81
Computer Systems Analysts	4	23	19	4	0.83
Computer Programmers	4	14	10	4	0.71
Insurance Sales Agents	4	15	11	4	0.73
Marriage and Family Therapists	5	4	1	3	0.25
Dietitians and Nutritionists	5	3	0	3	0.00

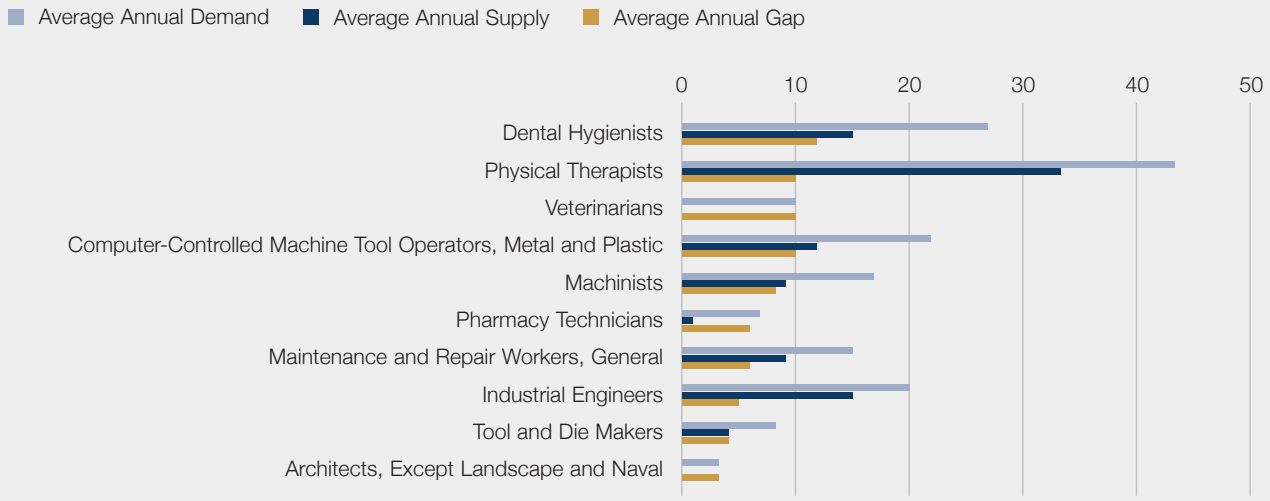
Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

5.4 Excess Demand Gaps for Occupations Without a State System Match

The breadth of programs offered at State System universities indicates a number of strong linkages to occupations. However, many occupations within Northwest Pennsylvania show excess demand for which the Northwest State System universities did not produce completers in a matching program area. Furthermore, analysis indicates continued demand for these occupations over the next decade. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there.

Fig. 34 displays the top excess demand gaps for occupations that did not have matching Northwest State System University program completers. Dental hygienists show the largest excess annual demand gap at 12. This is followed by: physical therapists; veterinarians; computer-controlled machine tool operators, metal and plastic; and machinists.

Fig. 34: Top Demand Gaps for Skilled Occupations in Northwest Pennsylvania Without a State System Program



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Fig. 35 provides detailed information for each occupation including the occupation title, occupation job zone, projected annual employer demand (for associate's degrees and higher), the annual supply of program completions (allocated to the occupation), the average annual gap, and a ratio of supply to demand (S/D Ratio).

Fig. 35: Top Demand Gaps for Skilled Occupations in Northwest Pennsylvania Without a State System Program

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Dental Hygienists	3	27	15	12	0.56
Physical Therapists	5	43	33	10	0.77
Veterinarians	5	10	0	10	0.00
Computer-Controlled Machine Tool Operators, Metal and Plastic	3	22	12	10	0.55
Machinists	3	17	9	8	0.53
Pharmacy Technicians	3	7	1	6	0.14
Maintenance and Repair Workers, General	3	15	9	6	0.60
Industrial Engineers	4	20	15	5	0.75
Tool and Die Makers	3	8	4	4	0.50
Architects, Except Landscape and Naval	4	3	0	3	0.00
Dietitians and Nutritionists	5	3	0	3	0.00
Opticians, Dispensing	3	4	1	3	0.25
Occupational Health and Safety Specialists	4	3	0	3	0.00
Structural Metal Fabricators and Fitters	3	6	3	3	0.50
Financial Analysts	4	11	9	2	0.82
Engineers, All Other	4	8	6	2	0.75
Cardiovascular Technologists and Technicians	3	2	0	2	0.00
Diagnostic Medical Sonographers	3	2	0	2	0.00
Surgical Technologists	3	2	0	2	0.00
Veterinary Technologists and Technicians	3	2	0	2	0.00

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

5.5 Supply Surplus Gaps

Supply surplus gaps for skilled occupations cover occupations in Job Zones Three, Four and Five. The degree programs that align to these occupations span associate's degrees through graduate degrees. Recall that a supply surplus for an occupation exists where the number of program completions within a region exceeds the employer demand. The top supply surplus gaps are identified by the size of the annual gap.

The top supply surpluses within Northwest Pennsylvania cover a broad range of both technical and non-technical occupations. When considering program changes in degree areas related to occupations displaying a supply surplus, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.

In Northwest Pennsylvania, the data reveal the number of graduates that are aligned to physicians and surgeons greatly exceed the annual demand for workers by 198 completions. Other occupations that indicate a supply surplus in Northwest Pennsylvania include: librarians; pharmacists; managers, all other;[21] family and general practitioners; and secondary school teachers. Program completers in the top supply surplus occupations may face increased competition for occupations related to their field of study within the region.

Fig. 36 illustrates the top supply surpluses for skilled occupations in Northwest Pennsylvania. Fig. 37 provides the occupation title, occupation job zone, projected annual employer demand (for associate's degrees and higher), the annual supply of program completions (allocated to the occupation), the average annual gap, and a ratio of supply to demand (S/D Ratio).

This section provided an overview of gaps from the perspective of excess demand and supply surpluses. It is intended to set the data-driven foundation for understanding current alignment of education production in Northwest Pennsylvania compared to the region's employer demand for graduates in specific program areas. Results for the gaps are largely driven by industry employment growth. As market conditions change, the resulting demand for skilled workers will also change. Therefore, results of this analysis should be taken in the context of changing industry sector employment and occupational demand.

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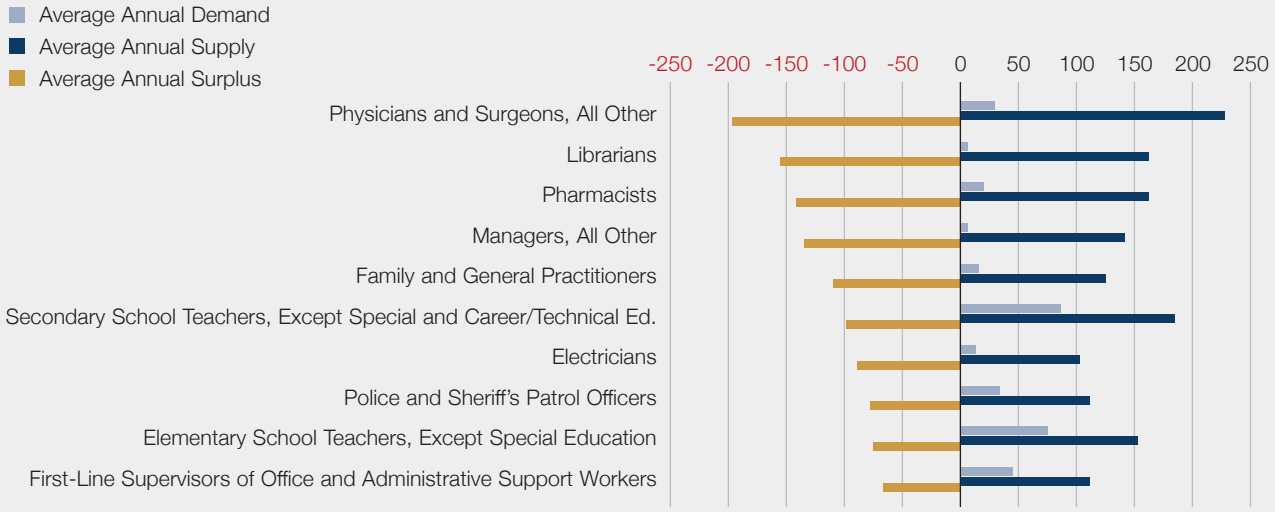
21 Managers, all other is a category for a wide range of management titles, including: regulatory affairs managers, investment fund managers, security managers, and wind energy project managers.

Fig. 36: Top Surpluses for Skilled Occupations in Northwest Pennsylvania



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Fig. 37: Top Surpluses for Skilled Occupations in Northwest Pennsylvania

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Physicians and Surgeons, All Other	5	31	229	-198	7.39
Librarians	5	6	163	-157	27.17
Pharmacists	5	20	163	-143	8.15
Managers, All Other	4	6	142	-136	23.67
Family and General Practitioners	5	17	127	-110	7.47
Secondary School Teachers, Except Special and Career/Technical Education	4	87	186	-99	2.14
Electricians	3	14	103	-89	7.36
Police and Sheriff's Patrol Officers	3	35	113	-78	3.23
Elementary School Teachers, Except Special Education	4	76	153	-77	2.01
First-Line Supervisors of Office and Administrative Support Workers	3	45	112	-67	2.49
Computer User Support Specialists	3	19	85	-66	4.47
Instructional Coordinators	5	1	61	-60	61.00
Medical Assistants	3	22	80	-58	3.64
Substitute Teachers	3	4	61	-57	15.25
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	3	1	57	-56	57.00
Physical Therapist Assistants	3	19	71	-52	3.74
Education Administrators, Elementary and Secondary School	5	14	60	-46	4.29
Middle School Teachers, Except Special and Career/Technical Education	4	57	101	-44	1.77
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	3	6	49	-43	8.17
Graphic Designers	4	10	48	-38	4.80

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

6. CONCLUSION

The State System Gap Analysis report provides a data-driven foundation for program planning and alignment in order to drive economic value and career success within the state and its regions. The analysis itself is not the solution, but can lend credible insight to guide decision-making at the strategic level. The content is designed to be a starting point and resource for program evaluation and planning.

It is important to remember that the results for the gaps are largely driven by industry employment growth. As labor market conditions change, the resulting demand for skilled workers will also change. Therefore, the results of this analysis should be taken in a context of changing industry sector employment and occupational demand.

Additionally, areas of future research should be considered when considering program evaluation and planning. These areas include (but are not limited to):

- Strong vs. weak occupation to education alignment,
- Wage trend research and supply/demand effects on wages,
- Career pathways, outcomes, and lifetime earnings,
- Issues of mal-employment[22] and underemployment,[23] and
- Program alignment best practices.

As more insights into the connections between education programs and labor market outcomes are gained, students, universities, workers, and employers will all benefit significantly.

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22 Mal-employment is a specific type of underemployment that exists in the labor market. This occurs when college-educated workers choose to work in occupations that do not utilize the skills and abilities gained in college. An example of this would include a person who has a bachelor's degree in political science but works as bartender. For more on mal-employment see Harrington and Fogg (2011) "Rising Mal-Employment and the Great Recession: The Growing Disconnection between Recent College Graduates and the College Labor Market."

23 Underemployment occurs in the labor market when workers' skills, experience, and willingness to work are not fully utilized. An example of this would include a person who is employed part-time but wants to work full-time.

7. ABOUT THE STATE SYSTEM'S GAP ANALYSIS PROJECT

The gap analysis methodology and report was produced through a multi-organization collaboration that consisted of Pennsylvania's State System of Higher Education Office of the Chancellor and Oxford Economics USA Inc.—the team. Throughout the project and research process, the team sought feedback and insight from senior administration and representatives from each of the 14 State System Universities. The team also drew on insight and feedback from Georgetown University's Center on Education and the Workforce as well as subject matter experts involved in labor market intelligence and education program alignment.

The modeling and results presented here are based on information provided by third parties, upon which Oxford Economics has relied in producing its report and forecasts in good faith. Any subsequent revision or update of those data will affect the assessments and projections shown.

Oxford Economics is a key adviser to corporate, financial, government and education decision-makers and thought leaders. Oxford Economics' worldwide client base now comprises over 1000 international organizations, including leading multinational companies and financial institutions; key government bodies and trade associations; and top universities, consultancies, and think tanks.

This report is confidential to stakeholders of Pennsylvania's State System of Higher Education and may not be published or distributed without their prior written permission. Contact information for such request is provided below:

Dr. Sue Mukherjee
Executive Director for Program Alignment and Policy Development
Phone: (717) 720-4201
Email: SMukherjee@passhe.edu

8. DATA SOURCES KEY

Bureau of Labor Statistics (BLS):

- QCEW - Quarterly Census of Employment & Wages - http://www.bls.gov/cew/
- OES – Occupational Employment Statistics - http://www.bls.gov/oes/
- LAUS – Local Area Unemployment Statistics - http://www.bls.gov/lau/

U.S. Census Bureau (Census):

- LEHD – Longitudinal Employer-Household Dynamics - http://lehd.ces.census.gov/
- ACS – American Community Survey - http://www.census.gov/acs/www/
- SAIPE – Small Area Income and Poverty Estimates - http://www.census.gov/did/www/saipe/

National Center for Education Statistics (NCES):

- IPEDS – Integrated Postsecondary Education Data System (National Center for Education Statistics) - https://nces.ed.gov/ipeds/

Pennsylvania Department of Labor and Industry (PADLI):

- www.paworkstats.pa.gov

O*NET Resource Center (O*NET)

- Job Zones – www.onetonline.org/help/online/zones

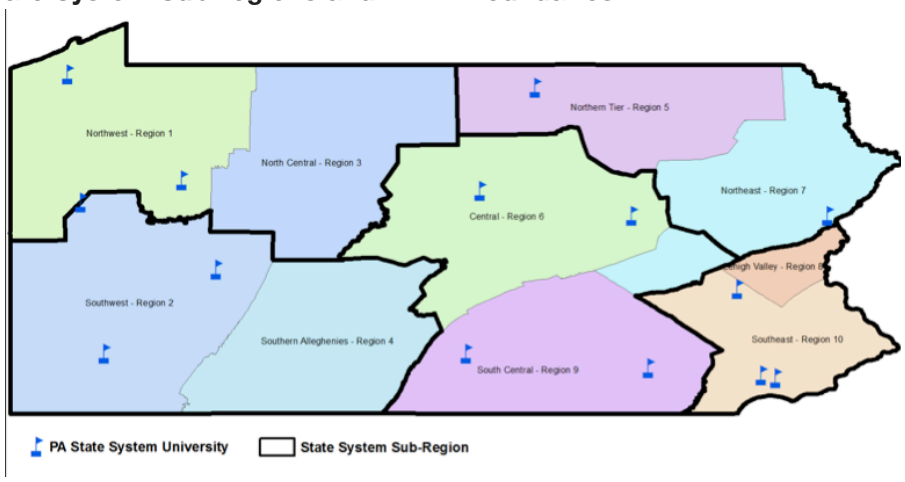
Economic Modeling Specialists International (EMSI)

APPENDIX A: STATE SYSTEM SUB-REGIONS WITH PREP REGIONS AND WIA REGIONS

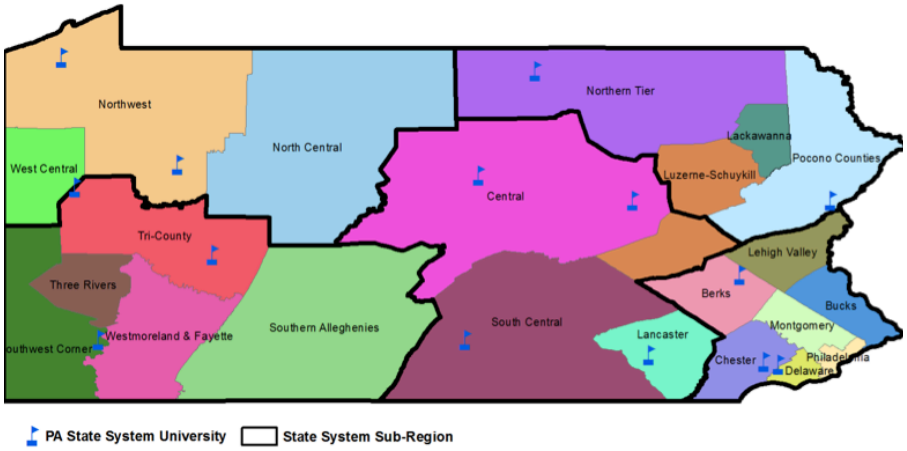
Partnerships for Regional Economic Performance (PREP) regions provide geographic context of how the Pennsylvania Department of Community & Economic Development divides resources and services to support business development, start-ups, investment and other economic development initiatives. To define sub-regions for this project, PREP regions served as the starting point. The following figures outline the sub-regions in relation to PREP regions.

An additional map of Pennsylvania's Workforce Investment Act (WIA) regional boundaries is also provided.

State System Sub-regions and PREP Boundaries



State System Sub-regions and WIA Boundaries



APPENDIX B: O*NET JOB ZONE CODES

The O*NET program is the nation's primary source of occupational information. Central to the project is the O*NET database, containing information on hundreds of standardized and occupation-specific descriptors. The database, which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation.[24]

JOB ZONE ONE: Little or No Preparation Needed

- *Education* – Some of these occupations may require a high school diploma or GED certificate.
- *Related Experience* – Little or no previous work-related skill, knowledge, or experience is needed for these occupations. For example, a person can become a waiter or waitress even if he/she has never worked before.
- *Job Training* – Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show you how to do the job.
- *Job Zone Examples* – These occupations involve following instructions and helping others. Examples include taxi drivers, amusement and recreation attendants, counter and rental clerks, nonfarm animal caretakers, continuous mining machine operators, and waiters/waitresses.

JOB ZONE TWO: Some Preparation Needed

- *Education* – These occupations usually require a high school diploma.
- *Related Experience* – Some previous work-related skill, knowledge, or experience is usually needed. For example, a teller would benefit from experience working directly with the public.
- *Job Training* – Employees in these occupations need anywhere from a few months to one year of working with experienced employees. A recognized apprenticeship program may be associated with these occupations.

24 http://www.onetcenter.org/overview.html

- *Job Zone Examples* – These occupations often involve using your knowledge and skills to help others. Examples include sheet metal workers, forest fire fighters, customer service representatives, physical therapist aides, salespersons (retail), and tellers.

JOB ZONE THREE: Medium Preparation Needed

- *Education* – Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree.
- *Related Experience* – Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing exam, in order to perform the job.
- *Job Training* – Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. A recognized apprenticeship program may be associated with these occupations.
- *Job Zone Examples* – These occupations usually involve using communication and organizational skills to coordinate, supervise, manage, or train others to accomplish goals. Examples include food service managers, electricians, agricultural technicians, legal secretaries, occupational therapy assistants, and medical assistants.

JOB ZONE FOUR: Considerable Preparation Needed

- *Education* – Most of these occupations require a four-year bachelor's degree, but some do not.
- *Related Experience* – A considerable amount of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.
- *Job Training* – Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
- *Job Zone Examples* – Many of these occupations involve coordinating, supervising, managing, or training others. Examples include accountants, sales managers, database administrators, teachers, chemists, art directors, and cost estimators.

JOB ZONE FIVE: Extensive Preparation Needed

- *Education* – Most of these occupations require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree).
- *Related Experience* – Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. For example, surgeons must complete four years of college and an additional five to seven years of specialized medical training to be able to do their job.
- *Job Training* – Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.
- *Job Zone Examples* – These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required. Examples include librarians, lawyers, sports medicine physicians, wildlife biologists, school psychologists, surgeons, treasurers, and controllers.

APPENDIX C: STRONG, LIMITED AND WEAK EDUCATION PROGRAM TO OCCUPATION CONNECTIONS[25]

	Direct Connection	Limited Connection	Weak Connection
Surplus	Definitive surplus of graduates to projected demand; indicates strong market relationship between CIP and SOC(s) suggesting limited need for additional investments in program.	Apparent surplus of graduates in most related occupations. Likely intense competition for limited job opportunities. Moderate occupation ties require identification of special market links prior to added program investments.	Data indicates surplus of graduates likely, however the weak connection of the education program to specific occupations does not conform to traditionalsupply/demand data analysis.
Balanced	Balanced supply of graduates relative to demand. Job competition for newly minted graduates will be competitive, but opportunities in related occupations exist.	Apparent balanced supply of graduates relative to job demand in most related occupations. Data may be indeterminate relative to labor surplus or shortage situation. Added program review required to determine if greater labor market opportunities are present due to emerging or evolving occupations.	Data indicates balanced supply of graduates likely, but the weak connection to specific occupations does not conform to traditional supply/ demand data analysis. Review occupational connections in CIP to SOC crosswalk to determine possible job market opportunities.
Gap	Definitive gap of completers relative to occupation demand. Data indicates likely shortages. Program is a strong candidate for additional resources and targeted recruitment efforts increase supply.	Apparent gap of graduates relative to job demand in at least one closely related occupation. Job opportunities may exist in at least one other related occupation. More research worthwhile to determine possible added occupation connections.	Data indicates gap of graduates likely, but weak connection to specific occupations does not conform to traditional supply/ demand data analysis. Related jobs may exist but are not directly connected to the program. Review crosswalk for possible occupation links.

25 The relationship matrix is drawn from: Labor Supply/Demand Analysis: Approaches and Concerns (2010) by Richard Froeschle formerly of the Texas Workforce Commission's Labor Market and Career Information (LMCI). While this context is important to know, Oxford Economics' methodology sought to minimize these issues by developing a crosswalk that uses real world education program to occupation matches through U.S. Census ACS data to more closely reflect the careers program completers actually enter into after graduation.

APPENDIX D: 4-DIGIT INDUSTRY EMPLOYMENT PROJECTIONS

The table below displays the employment numbers for industries at the four-digit NAICS level in Northwest Pennsylvania in 2014 and 2024. It also provides the detailed NAICS code, industry title, 2014 industry LQ, and projected job growth to 2024.

NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
Total	**All Industries**	**1.0**	**372,427**	**401,023**	**28,596**
1111	Oilseed and Grain Farming	0.4	63	73	10
1112	Vegetable and Melon Farming	0.4	117	133	16
1113	Fruit and Tree Nut Farming	0.2	84	96	12
1114	Greenhouse, Nursery, and Floriculture Production	0.7	286	300	14
1119	Other Crop Farming	0.1	25	26	1
1121	Cattle Ranching and Farming	0.7	297	329	32
1123	Poultry and Egg Production	0.4	39	41	2
1125	Aquaculture	5.2	91	107	16
1129	Other Animal Production	0.9	49	49	0
1131	Timber Tract Operations	1.8	35	42	7
1132	Forest Nurseries and Gathering of Forest Products	1.0	6	6	0
1133	Logging	2.1	294	297	3
1141	Fishing	0.4	7	8	1
1142	Hunting and Trapping	0.5	3	3	0
1151	Support Activities for Crop Production	0.1	58	53	-5
1152	Support Activities for Animal Production	0.4	30	29	-1
1153	Support Activities for Forestry	1.3	61	76	15
2111	Oil and Gas Extraction	2.7	1,432	1,703	271
2121	Coal Mining	3.0	590	497	-93
2123	Nonmetallic Mineral Mining and Quarrying	0.9	231	245	14
2131	Support Activities for Mining	2.1	2,497	2,557	60
2211	Electric Power Generation, Transmission and Distribution	0.7	874	824	-50
2212	Natural Gas Distribution	1.9	613	658	45
2213	Water, Sewage and Other Systems	1.6	898	953	55

NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
2361	Residential Building Construction	0.7	1,246	1,417	171
2362	Nonresidential Building Construction	0.7	1,355	1,347	-8
2371	Utility System Construction	1.0	1,267	1,606	339
2372	Land Subdivision	0.3	35	48	13
2373	Highway, Street, and Bridge Construction	1.4	1,511	1,723	212
2379	Other Heavy and Civil Engineering Construction	0.5	132	165	33
2381	Foundation, Structure, and Building Exterior Contractors	0.6	1,271	1,250	-21
2382	Building Equipment Contractors	0.7	3,428	3,650	222
2383	Building Finishing Contractors	0.5	957	1,020	63
2389	Other Specialty Trade Contractors	1.1	1,756	1,977	221
3111	Animal Food Manufacturing	2.5	374	427	53
3112	Grain and Oilseed Milling	0.0	0	0	0
3113	Sugar and Confectionery Product Manufacturing	1.9	360	406	46
3114	Fruit and Vegetable Preserving and Specialty Food Manufacturing	1.8	853	889	36
3115	Dairy Product Manufacturing	1.4	523	544	21
3116	Animal Slaughtering and Processing	0.4	500	475	-25
3118	Bakeries and Tortilla Manufacturing	0.9	749	913	164
3119	Other Food Manufacturing	0.8	385	468	83
3121	Beverage Manufacturing	0.9	466	555	89
3122	Tobacco Manufacturing	0.0	0	0	0
3132	Fabric Mills	0.4	62	75	13
3133	Textile and Fabric Finishing and Fabric Coating Mills	0.3	26	25	-1
3141	Textile Furnishings Mills	0.0	5	6	1
3149	Other Textile Product Mills	0.9	146	171	25
3152	Cut and Sew Apparel Manufacturing	0.0	12	10	-2
3159	Apparel Accessories and Other Apparel Manufacturing	0.8	24	15	-9
3161	Leather and Hide Tanning and Finishing	1.0	12	13	1
3169	Other Leather and Allied Product Manufacturing	1.1	33	40	7
3211	Sawmills and Wood Preservation	5.7	1,406	1,804	398
3212	Veneer, Plywood, and Engineered Wood Product Manufacturing	2.6	508	604	96
3219	Other Wood Product Manufacturing	4.3	2,439	3,122	683
3221	Pulp, Paper, and Paperboard Mills	0.9	266	251	-15
3222	Converted Paper Product Manufacturing	1.7	1,214	1,133	-81
3231	Printing and Related Support Activities	0.8	997	907	-90
3241	Petroleum and Coal Products Manufacturing	2.7	823	960	137
3251	Basic Chemical Manufacturing	0.8	316	291	-25
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	0.9	222	233	11

NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	0.0	5	5	0
3255	Paint, Coating, and Adhesive Manufacturing	2.2	360	323	-37
3256	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	0.1	20	20	0
3259	Other Chemical Product and Preparation Manufacturing	1.8	414	400	-14
3261	Plastics Product Manufacturing	3.5	5,237	5,469	232
3262	Rubber Product Manufacturing	3.3	1,194	1,300	106
3271	Clay Product and Refractory Manufacturing	3.4	360	348	-12
3272	Glass and Glass Product Manufacturing	4.9	1,100	1,091	-9
3273	Cement and Concrete Product Manufacturing	1.2	561	551	-10
3274	Lime and Gypsum Product Manufacturing	0.5	19	22	3
3279	Other Nonmetallic Mineral Product Manufacturing	0.7	144	144	0
3311	Iron and Steel Mills and Ferroalloy Manufacturing	9.0	2,244	2,485	241
3312	Steel Product Manufacturing from Purchased Steel	4.5	728	599	-129
3313	Alumina and Aluminum Production and Processing	0.6	100	120	20
3314	Nonferrous Metal (except Aluminum) Production and Processing	1.4	232	252	20
3315	Foundries	4.1	1,427	1,439	12
3321	Forging and Stamping	23.2	6,325	6,799	474
3322	Cutlery and Handtool Manufacturing	7.8	829	814	-15
3323	Architectural and Structural Metals Manufacturing	2.2	2,179	2,314	135
3324	Boiler, Tank, and Shipping Container Manufacturing	3.2	844	947	103
3325	Hardware Manufacturing	0.4	25	31	6
3326	Spring and Wire Product Manufacturing	2.6	300	290	-10
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	4.5	4,593	4,659	66
3328	Coating, Engraving, Heat Treating, and Allied Activities	3.7	1,409	1,510	101
3329	Other Fabricated Metal Product Manufacturing	2.9	2,218	2,376	158
3331	Agriculture, Construction, and Mining Machinery Manufacturing	2.7	1,845	1,627	-218
3332	Industrial Machinery Manufacturing	1.8	538	565	27
3333	Commercial and Service Industry Machinery Manufacturing	0.7	159	135	-24
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	1.7	592	650	58
3335	Metalworking Machinery Manufacturing	6.6	3,292	3,270	-22
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	2.0	531	439	-92
3339	Other General Purpose Machinery Manufacturing	2.2	1,603	1,663	60
3341	Computer and Peripheral Equipment Manufacturing	0.0	20	15	-5
3342	Communications Equipment Manufacturing	0.1	37	41	4
3344	Semiconductor and Other Electronic Component Manufacturing	1.1	1,092	981	-111
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	1.1	1,144	1,208	64
3351	Electric Lighting Equipment Manufacturing	1.1	145	130	-15

NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
3353	Electrical Equipment Manufacturing	1.8	694	729	35
3359	Other Electrical Equipment and Component Manufacturing	5.0	1,734	1,963	229
3362	Motor Vehicle Body and Trailer Manufacturing	2.1	823	952	129
3363	Motor Vehicle Parts Manufacturing	0.8	1,195	1,311	116
3364	Aerospace Product and Parts Manufacturing	1.1	1,494	1,789	295
3365	Railroad Rolling Stock Manufacturing	41.6	3,093	2,688	-405
3366	Ship and Boat Building	0.7	340	381	41
3371	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	0.4	283	291	8
3372	Office Furniture (including Fixtures) Manufacturing	1.4	382	474	92
3379	Other Furniture Related Product Manufacturing	0.1	7	7	0
3391	Medical Equipment and Supplies Manufacturing	0.3	287	305	18
3399	Other Miscellaneous Manufacturing	1.2	899	873	-26
4231	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	1.3	1,177	1,296	119
4232	Furniture and Home Furnishing Merchant Wholesalers	0.5	140	175	35
4233	Lumber and Other Construction Materials Merchant Wholesalers	1.4	773	955	182
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers	0.2	406	366	-40
4235	Metal and Mineral (except Petroleum) Merchant Wholesalers	1.4	481	574	93
4236	Household Appliances and Electrical and Electronic Goods Merchant Wholesalers	0.6	513	590	77
4237	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	0.6	408	483	75
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	0.9	1,695	1,737	42
4239	Miscellaneous Durable Goods Merchant Wholesalers	0.7	587	615	28
4241	Paper and Paper Product Merchant Wholesalers	0.7	221	237	16
4242	Drugs and Druggists' Sundries Merchant Wholesalers	0.3	140	165	25
4243	Apparel, Piece Goods, and Notions Merchant Wholesalers	0.0	18	18	0
4244	Grocery and Related Product Merchant Wholesalers	0.5	957	1,012	55
4245	Farm Product Raw Material Merchant Wholesalers	0.1	17	18	1
4246	Chemical and Allied Products Merchant Wholesalers	0.7	245	225	-20
4247	Petroleum and Petroleum Products Merchant Wholesalers	0.9	237	239	2
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	0.6	288	301	13
4249	Miscellaneous Nondurable Goods Merchant Wholesalers	0.5	418	473	55
4251	Wholesale Electronic Markets and Agents and Brokers	0.6	1,346	1,279	-67
4411	Automobile Dealers	1.3	4,199	4,536	337
4412	Other Motor Vehicle Dealers	1.0	397	455	58
4413	Automotive Parts, Accessories, and Tire Stores	1.1	1,571	1,689	118
4421	Furniture Stores	0.8	480	480	0
4422	Home Furnishings Stores	0.6	380	378	-2
4431	Electronics and Appliance Stores	0.6	865	807	-58

NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
4441	Building Material and Supplies Dealers	1.1	3,097	3,321	224
4442	Lawn and Garden Equipment and Supplies Stores	1.8	735	735	0
4451	Grocery Stores	0.9	6,685	6,221	-464
4452	Specialty Food Stores	0.6	386	339	-47
4453	Beer, Wine, and Liquor Stores	2.0	873	1,007	134
4461	Health and Personal Care Stores	1.1	2,944	2,851	-93
4471	Gasoline Stations	2.0	4,794	5,007	213
4481	Clothing Stores	0.9	2,428	2,285	-143
4482	Shoe Stores	1.0	566	602	36
4483	Jewelry, Luggage, and Leather Goods Stores	1.0	386	379	-7
4511	Sporting Goods, Hobby, and Musical Instrument Stores	0.9	1,268	1,356	88
4512	Book Stores and News Dealers	0.8	193	181	-12
4521	Department Stores	0.7	2,720	2,362	-358
4529	Other General Merchandise Stores	1.5	7,185	7,964	779
4531	Florists	1.2	204	180	-24
4532	Office Supplies, Stationery, and Gift Stores	0.8	638	554	-84
4533	Used Merchandise Stores	0.9	395	418	23
4539	Other Miscellaneous Store Retailers	1.0	811	839	28
4541	Electronic Shopping and Mail-Order Houses	1.2	1,075	1,056	-19
4542	Vending Machine Operators	0.4	45	44	-1
4543	Direct Selling Establishments	1.2	437	448	11
4811	Scheduled Air Transportation	0.0	40	51	11
4812	Nonscheduled Air Transportation	0.4	44	56	12
4832	Inland Water Transportation	0.2	13	17	4
4841	General Freight Trucking	1.5	3,840	4,489	649
4842	Specialized Freight Trucking	1.6	1,894	2,203	309
4851	Urban Transit Systems	0.5	332	390	58
4852	Interurban and Rural Bus Transportation	1.0	59	57	-2
4853	Taxi and Limousine Service	0.2	43	46	3
4854	School and Employee Bus Transportation	3.6	2,455	2,776	321
4855	Charter Bus Industry	2.1	169	163	-6
4859	Other Transit and Ground Passenger Transportation	0.5	120	140	20
4862	Pipeline Transportation of Natural Gas	5.3	421	529	108
4871	Scenic and Sightseeing Transportation, Land	0.3	9	8	-1
4872	Scenic and Sightseeing Transportation, Water	1.0	40	36	-4
4881	Support Activities for Air Transportation	0.3	156	159	3
4882	Support Activities for Rail Transportation	3.2	275	404	129
4883	Support Activities for Water Transportation	0.2	45	66	21

NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
4884	Support Activities for Road Transportation	0.9	274	414	140
4885	Freight Transportation Arrangement	0.2	98	140	42
4889	Other Support Activities for Transportation	0.3	24	28	4
4911	Postal Service	1.0	1,700	1,334	-366
4921	Couriers and Express Delivery Services	0.5	656	689	33
4922	Local Messengers and Local Delivery	0.5	80	85	5
4931	Warehousing and Storage	1.3	2,646	2,794	148
5111	Newspaper, Periodical, Book, and Directory Publishers	1.1	1,177	1,135	-42
5112	Software Publishers	0.1	90	69	-21
5121	Motion Picture and Video Industries	0.3	254	222	-32
5151	Radio and Television Broadcasting	0.6	391	445	54
5152	Cable and Other Subscription Programming	0.1	17	15	-2
5171	Wired Telecommunications Carriers	0.7	1,156	986	-170
5172	Wireless Telecommunications Carriers (except Satellite)	0.2	98	108	10
5179	Other Telecommunications	0.5	110	88	-22
5182	Data Processing, Hosting, and Related Services	0.2	122	139	17
5191	Other Information Services	0.5	467	584	117
5221	Depository Credit Intermediation	1.1	4,892	4,733	-159
5222	Nondepository Credit Intermediation	0.2	389	401	12
5223	Activities Related to Credit Intermediation	0.2	118	120	2
5231	Securities and Commodity Contracts Intermediation and Brokerage	0.3	334	371	37
5239	Other Financial Investment Activities	0.2	253	310	57
5241	Insurance Carriers	1.3	4,073	4,673	600
5242	Agencies, Brokerages, and Other Insurance Related Activities	0.8	2,157	2,218	61
5311	Lessors of Real Estate	0.5	829	975	146
5312	Offices of Real Estate Agents and Brokers	0.3	210	247	37
5313	Activities Related to Real Estate	0.3	599	674	75
5321	Automotive Equipment Rental and Leasing	0.4	190	232	42
5322	Consumer Goods Rental	1.4	620	711	91
5323	General Rental Centers	0.7	78	87	9
5324	Commercial and Industrial Machinery and Equipment Rental and Leasing	0.3	102	118	16
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	0.7	43	41	-2
5411	Legal Services	0.5	1,426	1,462	36
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	0.5	1,444	1,511	67
5413	Architectural, Engineering, and Related Services	0.5	2,005	2,185	180
5414	Specialized Design Services	0.4	148	166	18
5415	Computer Systems Design and Related Services	0.2	786	1,106	320

NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
5416	Management, Scientific, and Technical Consulting Services	0.3	905	811	-94
5417	Scientific Research and Development Services	0.1	99	111	12
5418	Advertising, Public Relations, and Related Services	0.3	367	411	44
5419	Other Professional, Scientific, and Technical Services	0.8	1,332	1,608	276
5511	Management of Companies and Enterprises	0.5	2,832	3,079	247
5611	Office Administrative Services	0.1	105	101	-4
5612	Facilities Support Services	1.6	587	754	167
5613	Employment Services	0.5	4,724	5,843	1,119
5614	Business Support Services	0.5	1,283	1,292	9
5615	Travel Arrangement and Reservation Services	0.5	244	229	-15
5616	Investigation and Security Services	0.7	1,612	1,999	387
5617	Services to Buildings and Dwellings	0.9	4,762	5,662	900
5619	Other Support Services	0.6	455	618	163
5621	Waste Collection	1.2	528	663	135
5622	Waste Treatment and Disposal	0.7	236	290	54
5629	Remediation and Other Waste Management Services	0.6	216	298	82
6111	Elementary and Secondary Schools	1.1	22,545	21,087	-1,458
6112	Junior Colleges	0.6	1,160	1,141	-19
6113	Colleges, Universities, and Professional Schools	0.9	7,292	6,823	-469
6114	Business Schools and Computer and Management Training	0.4	83	67	-16
6115	Technical and Trade Schools	0.3	118	123	5
6116	Other Schools and Instruction	0.4	379	467	88
6117	Educational Support Services	0.4	143	176	33
6211	Offices of Physicians	1.0	6,837	7,379	542
6212	Offices of Dentists	0.8	1,911	2,174	263
6213	Offices of Other Health Practitioners	1.6	3,405	4,339	934
6214	Outpatient Care Centers	1.7	3,618	4,440	822
6215	Medical and Diagnostic Laboratories	0.9	600	657	57
6216	Home Health Care Services	0.8	2,639	3,988	1,349
6219	Other Ambulatory Health Care Services	1.6	1,253	1,488	235
6221	General Medical and Surgical Hospitals	1.1	17,231	19,152	1,921
6222	Psychiatric and Substance Abuse Hospitals	1.1	689	639	-50
6223	Specialty (except Psychiatric and Substance Abuse) Hospitals	0.4	294	362	68
6231	Nursing Care Facilities (Skilled Nursing Facilities)	1.7	7,894	8,983	1,089
6232	Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities	3.1	6,028	7,184	1,156
6233	Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly	1.6	3,761	4,669	908

NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
6239	Other Residential Care Facilities	1.8	857	900	43
6241	Individual and Family Services	1.8	11,071	14,664	3,593
6242	Community Food and Housing, and Emergency and Other Relief Services	0.3	137	137	0
6243	Vocational Rehabilitation Services	1.4	1,359	1,673	314
6244	Child Day Care Services	1.1	2,350	2,733	383
7111	Performing Arts Companies	0.4	126	149	23
7112	Spectator Sports	0.5	191	220	29
7113	Promoters of Performing Arts, Sports, and Similar Events	1.3	469	568	99
7114	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	0.1	3	3	0
7115	Independent Artists, Writers, and Performers	0.1	8	9	1
7121	Museums, Historical Sites, and Similar Institutions	0.3	216	239	23
7131	Amusement Parks and Arcades	1.5	771	677	-94
7132	Gambling Industries	0.9	639	783	144
7139	Other Amusement and Recreation Industries	0.7	2,494	2,598	104
7211	Traveler Accommodation	0.6	2,908	3,169	261
7212	RV (Recreational Vehicle) Parks and Recreational Camps	2.0	322	355	33
7213	Rooming and Boarding Houses	0.6	24	29	5
7223	Special Food Services	1.1	1,910	2,274	364
7224	Drinking Places (Alcoholic Beverages)	1.8	1,810	1,754	-56
7225	Restaurants and Other Eating Places	0.9	22,729	24,537	1,808
8111	Automotive Repair and Maintenance	0.9	2,235	2,287	52
8112	Electronic and Precision Equipment Repair and Maintenance	0.6	165	167	2
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	1.6	869	1,005	136
8114	Personal and Household Goods Repair and Maintenance	0.4	70	75	5
8121	Personal Care Services	1.1	1,871	2,056	185
8122	Death Care Services	1.8	663	723	60
8123	Drycleaning and Laundry Services	1.0	819	832	13
8129	Other Personal Services	0.4	302	369	67
8131	Religious Organizations	0.7	373	397	24
8132	Grantmaking and Giving Services	0.7	259	243	-16
8133	Social Advocacy Organizations	0.6	357	417	60
8134	Civic and Social Organizations	3.9	4,204	4,527	323
8139	Business, Professional, Labor, Political, and Similar Organizations	0.7	795	791	-4
8141	Private Households	0.2	173	172	-1
9211	Executive, Legislative, and Other General Government Support	1.1	9,179	9,292	113
9221	Justice, Public Order, and Safety Activities	0.8	4,197	4,122	-75
9231	Administration of Human Resource Programs	0.1	270	292	22

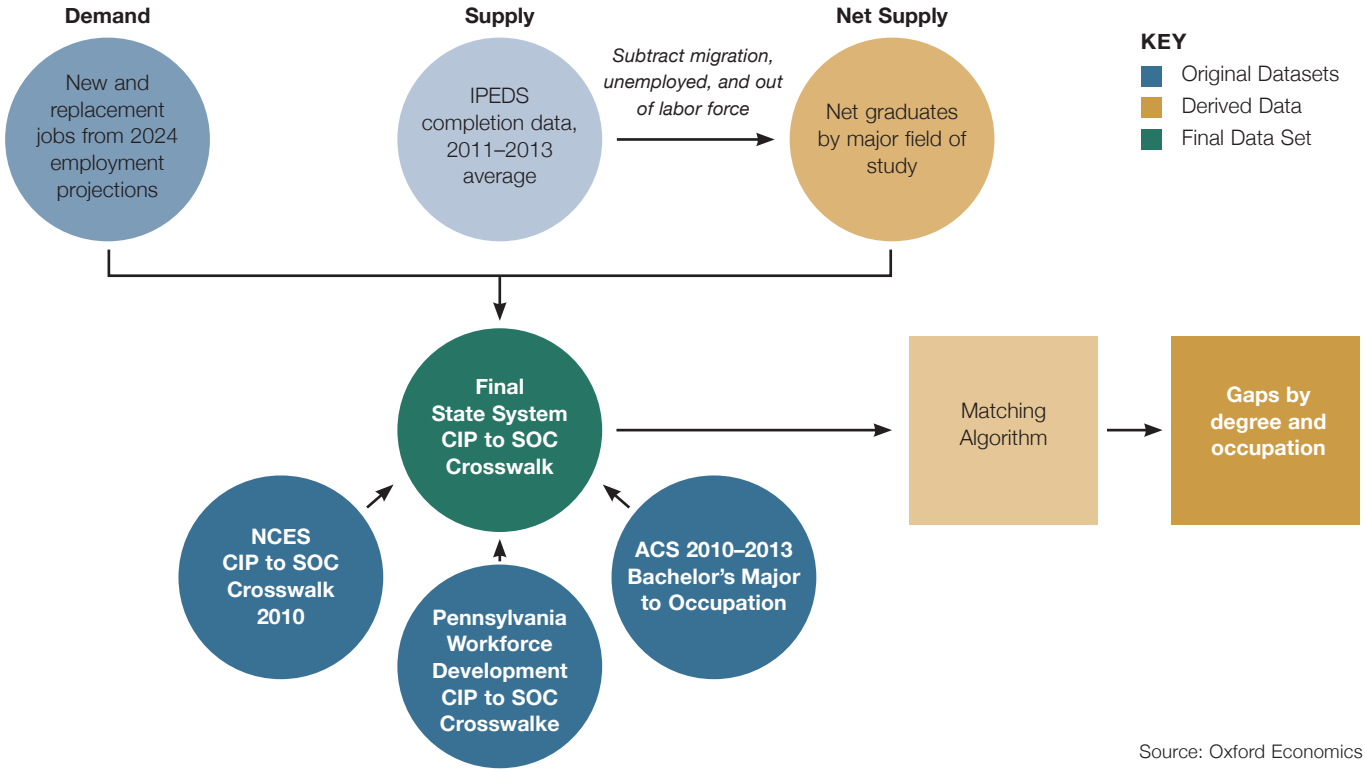
NAICS	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
9241	Administration of Environmental Quality Programs	1.3	1,080	1,109	29
9251	Administration of Housing Programs, Urban Planning, and Community Development	1.3	295	284	-11
9261	Administration of Economic Programs	0.1	242	223	-19
9281	National Security and International Affairs	0.1	164	166	2

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

APPENDIX E: METHODOLOGY

The data-driven process involved in developing this gap analysis required multiple steps including compiling education output and forecasting occupation demand. Broadly speaking, supply-side educational completion data were assembled at the program level for State System Universities as well as other institutions within Pennsylvania. A three-year average was used to mitigate year-to-year variability in completions. A mapping analysis, known as a crosswalk, was developed looking at education programs and occupations and using a combination of the National Center for Education Statistics' (NCES) and US Census American Community Survey (ACS) data. The crosswalk was applied to occupation demand projections, which were produced by Oxford Economics and updated to 2014-2024, to calculate both new and replacement jobs. Linking annual program completions (supply) and annual occupation

Fig. 38: Summary of Gap Analysis Methodology

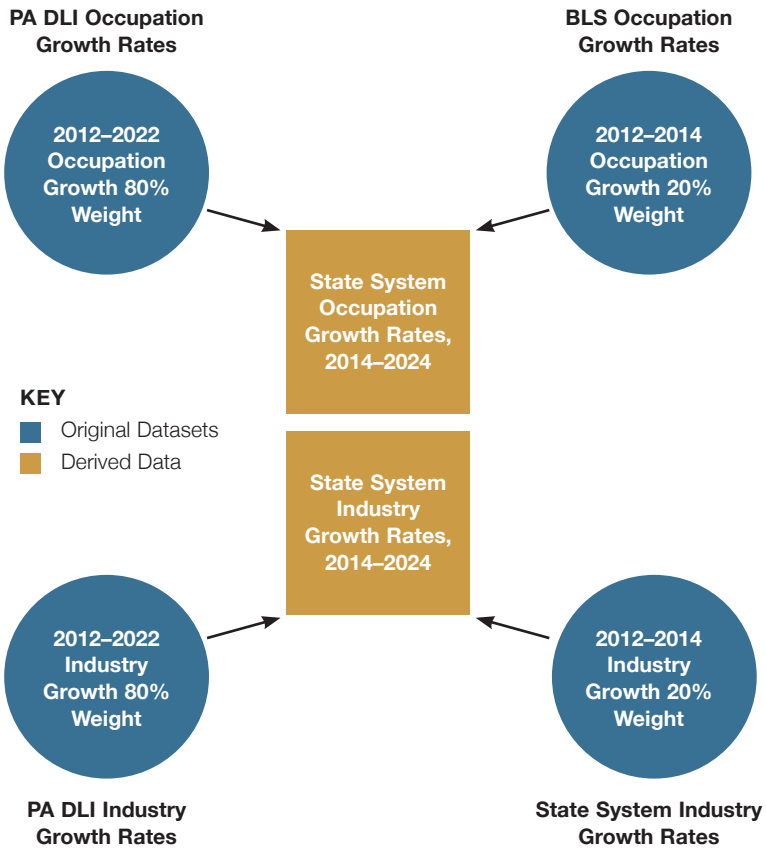


Source: Oxford Economics

projections (demand) enabled the calculation of the difference between the two, providing an insight into potential workforce gaps and surpluses for educational institutions to consider. Figure 38 provides a high-level flow chart of the process to calculate gaps/surpluses

A primary goal of the research was to produce updated forecasts for industries and occupations at the county level for Pennsylvania. Figure 39 provides a summary of the growth rate calculations used in the forecasts.

Fig. 39: Summary of Growth Rate Calculations



APPENDIX F: GAP ANALYSIS RESULTS

The following table provides the results of the gap analysis for all detailed occupations in Northwest Pennsylvania. The following information is provided in the table below:

- A description of the occupation – SOC Code and occupation title.
- A description of the level of the occupation – Job Zone.
- Gap indicator with the following color codes:
  - Green = Projected excess employer demand
  - Purple = Projected excess demand at specific degree level
  - Yellow = Projected balance
  - Blue = Projected supply surplus
- Average annual supply, demand, and gap number for each occupation and the detailed degree level supply, demand, and gap number for each occupation.
- The ratio of average annual supply to average annual demand (S/D Ratio).

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
11-1011	Chief Executives	5		14	15	-1	1.07	0	0	0	12	10	2	2	5	-3
11-1021	General and Operations Managers	4		86	96	-10	1.12	0	0	0	66	51	15	21	46	-25
11-2021	Marketing Managers	4		4	5	-1	1.25	0	0	0	4	5	-1	0	0	0
11-2022	Sales Managers	4		10	14	-4	1.40	0	0	0	8	11	-3	1	3	-2
11-3011	Administrative Services Managers	3		3	2	1	0.67	0	0	0	3	2	1	0	0	0
11-3021	Computer and Information Systems Managers	4		9	12	-3	1.33	0	0	0	6	4	2	4	8	-4
11-3031	Financial Managers	4		10	14	-4	1.40	0	0	0	6	6	0	4	8	-4
11-3051	Industrial Production Managers	4		14	15	-1	1.07	0	0	0	11	9	2	2	6	-4
11-3061	Purchasing Managers	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
11-3071	Transportation, Storage, and Distribution Managers	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
11-3121	Human Resources Managers	4		5	7	-2	1.40	0	0	0	2	2	0	2	5	-3
11-9021	Construction Managers	4		5	4	1	0.80	0	0	0	5	4	1	0	0	0
11-9031	Education Administrators, Preschool and Childcare Center/Program	4		4	14	-10	3.50	0	0	0	1	1	0	3	13	-10
11-9032	Education Administrators, Elementary and Secondary School	5		14	60	-46	4.29	0	0	0	0	0	0	14	60	-46
11-9033	Education Administrators, Postsecondary	5		3	15	-12	5.00	0	0	0	0	0	0	3	15	-12
11-9041	Architectural and Engineering Managers	5		11	20	-9	1.82	0	0	0	6	5	1	5	15	-10
11-9051	Food Service Managers	3		4	32	-28	8.00	1	20	-19	2	12	-10	0	0	0
11-9081	Lodging Managers	3		1	7	-6	7.00	0	0	0	1	7	-6	0	0	0
11-9111	Medical and Health Services Managers	5		22	27	-5	1.23	0	0	0	13	9	4	8	19	-11
11-9141	Property, Real Estate, and Community Association Managers	4		4	3	1	0.75	0	0	0	4	3	1	0	0	0
11-9151	Social and Community Service Managers	4		17	29	-12	1.71	0	0	0	9	12	-3	8	17	-9
11-9199	Managers, All Other	4		6	142	-136	23.67	0	0	0	5	108	-103	1	35	-34
13-1022	Wholesale and Retail Buyers, Except Farm Products	3		4	4	0	1.00	0	0	0	4	4	0	0	0	0
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	4		13	10	3	0.77	0	0	0	13	10	3	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
13-1031	Claims Adjusters, Examiners, and Investigators	4		21	16	5	0.76	0	0	0	21	16	5	0	0	0
13-1032	Insurance Appraisers, Auto Damage	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0
13-1041	Compliance Officers	4		11	8	3	0.73	0	0	0	11	8	3	0	0	0
13-1051	Cost Estimators	4		20	15	5	0.75	0	0	0	20	15	5	0	0	0
13-1071	Human Resources Specialists	4		21	17	4	0.81	0	0	0	21	17	4	0	0	0
13-1075	Labor Relations Specialists	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
13-1081	Logisticians	4		6	5	1	0.83	0	0	0	6	5	1	0	0	0
13-1111	Management Analysts	4		14	20	-6	1.43	0	0	0	7	5	2	7	15	-8
13-1121	Meeting, Convention, and Event Planners	4		4	18	-14	4.50	0	0	0	4	18	-14	0	0	0
13-1131	Fundraisers	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
13-1141	Compensation, Benefits, and Job Analysis Specialists	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
13-1151	Training and Development Specialists	4		7	6	1	0.86	0	0	0	7	6	1	0	0	0
13-1161	Market Research Analysts and Marketing Specialists	4		35	24	11	0.69	0	0	0	20	20	0	15	3	12
13-1199	Business Operations Specialists, All Other	4		5	4	1	0.80	0	0	0	5	4	1	0	0	0
13-2011	Accountants and Auditors	4		84	82	2	0.98	0	0	0	84	82	2	0	0	0
13-2031	Budget Analysts	4		5	5	0	1.00	0	0	0	5	5	0	0	0	0
13-2041	Credit Analysts	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
13-2051	Financial Analysts	4		11	9	2	0.82	0	0	0	11	9	2	0	0	0
13-2052	Personal Financial Advisors	4		7	7	0	1.00	0	0	0	7	7	0	0	0	0
13-2053	Insurance Underwriters	4		14	12	2	0.86	0	0	0	14	12	2	0	0	0
13-2061	Financial Examiners	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
13-2071	Credit Counselors	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
13-2072	Loan Officers	3		13	11	2	0.85	0	0	0	13	11	2	0	0	0
13-2081	Tax Examiners and Collectors, and Revenue Agents	3		4	4	0	1.00	0	0	0	4	4	0	0	0	0
15-1121	Computer Systems Analysts	4		23	19	4	0.83	0	0	0	17	12	5	6	7	-1
15-1122	Information Security Analysts	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
15-1131	Computer Programmers	4		14	10	4	0.71	0	0	0	14	10	4	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
15-1132	Software Developers, Applications	4		23	21	2	0.91	0	0	0	17	14	3	7	7	0
15-1134	Web Developers	3		3	2	1	0.67	0	0	0	3	2	1	0	0	0
15-1141	Database Administrators	4		5	5	0	1.00	0	0	0	4	3	1	1	2	-1
15-1142	Network and Computer Systems Administrators	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
15-1143	Computer Network Architects	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
15-1151	Computer User Support Specialists	3		19	85	-66	4.47	5	75	-70	14	10	4	0	0	0
15-1152	Computer Network Support Specialists	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
15-1199	Computer Occupations, All Other	4		8	7	1	0.88	0	0	0	6	4	2	2	2	0
15-2011	Actuaries	4		2	4	-2	2.00	0	0	0	2	4	-2	0	0	0
15-2031	Operations Research Analysts	5		2	2	0	1.00	0	0	0	2	2	0	0	0	0
17-1011	Architects, Except Landscape and Naval	4		3	0	3	0.00	0	0	0	3	0	3	0	0	0
17-1022	Surveyors	4		2	5	-3	2.50	0	0	0	2	5	-3	0	0	0
17-2041	Chemical Engineers	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
17-2071	Electrical Engineers	4		11	22	-11	2.00	0	0	0	6	6	0	5	17	-12
17-2072	Electronics Engineers, Except Computer	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
17-2081	Environmental Engineers	5		2	1	1	0.50	0	0	0	2	1	1	0	0	0
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
17-2112	Industrial Engineers	4		20	15	5	0.75	0	0	0	20	15	5	0	0	0
17-2131	Materials Engineers	4		3	3	0	1.00	0	0	0	3	3	0	0	0	0
17-2141	Mechanical Engineers	4		35	41	-6	1.17	0	0	0	28	27	1	6	14	-8
17-2171	Petroleum Engineers	4		6	5	1	0.83	0	0	0	6	5	1	0	0	0
17-2199	Engineers, All Other	4		8	6	2	0.75	0	0	0	8	6	2	0	0	0
17-3011	Architectural and Civil Drafters	4		2	13	-11	6.50	2	13	-11	0	0	0	0	0	0
17-3013	Mechanical Drafters	3		3	19	-16	6.33	2	17	-15	2	2	0	0	0	0
17-3022	Civil Engineering Technicians	3		2	5	-3	2.50	1	4	-3	1	1	0	0	0	0
17-3026	Industrial Engineering Technicians	3		2	13	-11	6.50	1	12	-11	1	1	0	0	0	0
17-3027	Mechanical Engineering Technicians	3		2	12	-10	6.00	1	10	-9	1	1	0	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
17-3029	Engineering Technicians, Except Drafters, All Other	3		4	21	-17	5.25	2	19	-17	2	2	0	0	0	0
19-1042	Medical Scientists, Except Epidemiologists	5		3	5	-2	1.67	0	0	0	0	0	0	3	5	-2
19-2031	Chemists	4		3	11	-8	3.67	0	0	0	3	11	-8	0	0	0
19-2041	Environmental Scientists and Specialists, Including Health	4		6	25	-19	4.17	0	0	0	4	21	-17	3	4	-1
19-2042	Geoscientists, Except Hydrologists and Geographers	4		2	12	-10	6.00	0	0	0	2	12	-10	0	0	0
19-3022	Survey Researchers	5		5	1	4	0.20	0	0	0	0	0	0	5	1	4
19-3031	Clinical, Counseling, and School Psychologists	5		13	24	-11	1.85	0	0	0	0	0	0	13	24	-11
19-3039	Psychologists, All Other	5		1	2	-1	2.00	0	0	0	0	0	0	1	2	-1
19-3051	Urban and Regional Planners	5		5	1	4	0.20	0	0	0	0	0	0	5	1	4
19-4021	Biological Technicians	4		3	8	-5	2.67	0	0	0	3	8	-5	0	0	0
19-4031	Chemical Technicians	3		4	9	-5	2.25	0	0	0	4	9	-5	0	0	0
19-4041	Geological and Petroleum Technicians	4		2	8	-6	4.00	2	8	-6	0	0	0	0	0	0
19-4061	Social Science Research Assistants	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
19-4091	Environmental Science and Protection Technicians, Including Health	4		2	10	-8	5.00	0	0	0	2	10	-8	0	0	0
19-4099	Life, Physical, and Social Science Technicians, All Other	3		3	8	-5	2.67	0	0	0	3	8	-5	0	0	0
21-1011	Substance Abuse and Behavioral Disorder Counselors	5		13	9	4	0.69	0	0	0	5	6	-1	8	2	6
21-1012	Educational, Guidance, School, and Vocational Counselors	5		18	49	-31	2.72	0	0	0	0	0	0	18	49	-31
21-1013	Marriage and Family Therapists	5		4	1	3	0.25	0	0	0	0	0	0	4	1	3
21-1014	Mental Health Counselors	5		26	7	19	0.27	0	0	0	0	0	0	26	7	19
21-1015	Rehabilitation Counselors	5		31	9	22	0.29	0	0	0	0	0	0	31	9	22
21-1019	Counselors, All Other	5		2	8	-6	4.00	0	0	0	0	0	0	2	8	-6
21-1021	Child, Family, and School Social Workers	4		41	46	-5	1.12	0	0	0	28	42	-14	14	4	10
21-1022	Healthcare Social Workers	5		29	8	21	0.28	0	0	0	0	0	0	29	8	21
21-1023	Mental Health and Substance Abuse Social Workers	5		40	44	-4	1.10	0	0	0	27	41	-14	13	4	9

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
21-1029	Social Workers, All Other	5		1	2	-1	2.00	0	0	0	1	2	-1	0	0	0
21-1091	Health Educators	4		4	5	-1	1.25	0	0	0	4	5	-1	0	0	0
21-1092	Probation Officers and Correctional Treatment Specialists	4		9	14	-5	1.56	0	0	0	6	13	-7	3	1	2
21-1093	Social and Human Service Assistants	4		41	54	-13	1.32	8	11	-3	32	43	-11	0	0	0
21-1094	Community Health Workers	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
21-1099	Community and Social Service Specialists, All Other	4		3	9	-6	3.00	0	0	0	0	0	0	3	9	-6
21-2011	Clergy	5		4	9	-5	2.25	0	0	0	2	8	-6	2	1	1
23-2011	Paralegals and Legal Assistants	3		7	39	-32	5.57	1	16	-15	6	23	-17	0	0	0
23-2093	Title Examiners, Abstractors, and Searchers	3		2	6	-4	3.00	0	0	0	2	6	-4	0	0	0
25-1011	Business Teachers, Postsecondary	5		5	11	-6	2.20	0	0	0	0	0	0	5	11	-6
25-1021	Computer Science Teachers, Postsecondary	5		3	3	0	1.00	0	0	0	0	0	0	3	3	0
25-1022	Mathematical Science Teachers, Postsecondary	5		2	1	1	0.50	0	0	0	0	0	0	2	1	1
25-1032	Engineering Teachers, Postsecondary	5		4	14	-10	3.50	0	0	0	0	0	0	4	14	-10
25-1042	Biological Science Teachers, Postsecondary	5		3	5	-2	1.67	0	0	0	0	0	0	3	5	-2
25-1052	Chemistry Teachers, Postsecondary	5		1	1	0	1.00	0	0	0	0	0	0	1	1	0
25-1054	Physics Teachers, Postsecondary	5		2	1	1	0.50	0	0	0	0	0	0	2	1	1
25-1066	Psychology Teachers, Postsecondary	5		2	4	-2	2.00	0	0	0	0	0	0	2	4	-2
25-1067	Sociology Teachers, Postsecondary	5		2	1	1	0.50	0	0	0	0	0	0	2	1	1
25-1071	Health Specialties Teachers, Postsecondary	5		3	23	-20	7.67	0	0	0	0	0	0	3	23	-20
25-1072	Nursing Instructors and Teachers, Postsecondary	5		2	24	-22	12.00	0	0	0	0	0	0	2	24	-22
25-1081	Education Teachers, Postsecondary	5		2	3	-1	1.50	0	0	0	0	0	0	2	3	-1
25-1121	Art, Drama, and Music Teachers, Postsecondary	5		9	15	-6	1.67	0	0	0	0	0	0	9	15	-6
25-1122	Communications Teachers, Postsecondary	5		2	11	-9	5.50	0	0	0	0	0	0	2	11	-9

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
25-1123	English Language and Literature Teachers, Postsecondary	5		3	6	-3	2.00	0	0	0	0	0	0	3	6	-3
25-1124	Foreign Language and Literature Teachers, Postsecondary	5		1	1	0	1.00	0	0	0	0	0	0	1	1	0
25-1125	History Teachers, Postsecondary	5		1	1	0	1.00	0	0	0	0	0	0	1	1	0
25-1126	Philosophy and Religion Teachers, Postsecondary	5		1	1	0	1.00	0	0	0	0	0	0	1	1	0
25-1199	Postsecondary Teachers, All Other	5		6	16	-10	2.67	0	0	0	0	0	0	6	16	-10
25-2011	Preschool Teachers, Except Special Education	3		26	41	-15	1.58	6	20	-14	20	21	-1	0	0	0
25-2012	Kindergarten Teachers, Except Special Education	4		7	10	-3	1.43	0	0	0	5	6	-1	2	4	-2
25-2021	Elementary School Teachers, Except Special Education	4		76	153	-77	2.01	0	0	0	25	38	-13	51	115	-64
25-2022	Middle School Teachers, Except Special and Career/Technical Education	4		57	101	-44	1.77	0	0	0	19	29	-10	39	72	-33
25-2031	Secondary School Teachers, Except Special and Career/Technical Education	4		87	186	-99	2.14	0	0	0	29	78	-49	58	108	-50
25-2032	Career/Technical Education Teachers, Secondary School	4		2	4	-2	2.00	0	0	0	2	4	-2	0	0	0
25-2051	Special Education Teachers, Preschool	4		1	3	-2	3.00	0	0	0	0	0	0	1	3	-2
25-2052	Special Education Teachers, Kindergarten and Elementary School	4		17	37	-20	2.18	0	0	0	5	6	-1	13	30	-17
25-2053	Special Education Teachers, Middle School	4		6	11	-5	1.83	0	0	0	2	1	1	4	10	-6
25-2054	Special Education Teachers, Secondary School	4		16	30	-14	1.88	0	0	0	4	2	2	12	28	-16
25-3021	Self-Enrichment Education Teachers	3		4	3	1	0.75	0	0	0	4	3	1	0	0	0
25-3097	Teachers and Instructors, All Other, Except Substitute Teachers	3		4	4	0	1.00	0	0	0	4	4	0	0	0	0
25-3098	Substitute Teachers	3		4	61	-57	15.25	0	0	0	3	3	0	1	58	-57
25-4021	Librarians	5		6	163	-157	27.17	0	0	0	0	0	0	6	163	-157
25-4031	Library Technicians	4		3	15	-12	5.00	0	0	0	3	15	-12	0	0	0
25-9031	Instructional Coordinators	5		1	61	-60	61.00	0	0	0	0	0	0	1	61	-60

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
25-9041	Teacher Assistants	3		22	30	-8	1.36	0	0	0	22	30	-8	0	0	0
27-1024	Graphic Designers	4		10	48	-38	4.80	0	0	0	10	48	-38	0	0	0
27-1025	Interior Designers	4		2	12	-10	6.00	0	0	0	2	12	-10	0	0	0
27-1026	Merchandise Displayers and Window Trimmers	3		5	24	-19	4.80	0	0	0	5	24	-19	0	0	0
27-2012	Producers and Directors	4		7	30	-23	4.29	0	0	0	7	30	-23	0	0	0
27-2022	Coaches and Scouts	4		4	4	0	1.00	0	0	0	4	4	0	0	0	0
27-3011	Radio and Television Announcers	3		2	8	-6	4.00	0	0	0	2	8	-6	0	0	0
27-3022	Reporters and Correspondents	4		3	17	-14	5.67	0	0	0	2	9	-7	1	8	-7
27-3031	Public Relations Specialists	4		3	15	-12	5.00	0	0	0	3	15	-12	0	0	0
27-3041	Editors	4		5	21	-16	4.20	0	0	0	5	21	-16	0	0	0
27-3042	Technical Writers	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
27-3043	Writers and Authors	4		1	5	-4	5.00	0	0	0	1	5	-4	0	0	0
27-4011	Audio and Video Equipment Technicians	3		1	6	-5	6.00	0	0	0	1	6	-5	0	0	0
27-4021	Photographers	3		1	6	-5	6.00	0	0	0	1	6	-5	0	0	0
29-1031	Dietitians and Nutritionists	5		3	0	3	0.00	0	0	0	3	0	3	0	0	0
29-1051	Pharmacists	5		20	163	-143	8.15	0	0	0	0	0	0	20	163	-143
29-1062	Family and General Practitioners	5		17	127	-110	7.47	0	0	0	0	0	0	17	127	-110
29-1069	Physicians and Surgeons, All Other	5		31	229	-198	7.39	0	0	0	0	0	0	31	229	-198
29-1071	Physician Assistants	5		10	38	-28	3.80	0	0	0	0	0	0	10	38	-28
29-1122	Occupational Therapists	5		20	29	-9	1.45	0	0	0	0	0	0	20	29	-9
29-1123	Physical Therapists	5		43	33	10	0.77	0	0	0	0	0	0	43	33	10
29-1124	Radiation Therapists	3		1	2	-1	2.00	0	0	0	1	2	-1	0	0	0
29-1125	Recreational Therapists	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
29-1126	Respiratory Therapists	3		10	16	-6	1.60	7	14	-7	2	2	0	0	0	0
29-1127	Speech-Language Pathologists	5		13	50	-37	3.85	0	0	0	0	0	0	13	50	-37
29-1131	Veterinarians	5		10	0	10	0.00	0	0	0	0	0	0	10	0	10
29-1141	Registered Nurses	3		338	284	54	0.84	151	181	-30	188	104	84	0	0	0
29-1151	Nurse Anesthetists	5		4	15	-11	3.75	0	0	0	0	0	0	4	15	-11
29-1181	Audiologists	5		1	6	-5	6.00	0	0	0	0	0	0	1	6	-5
29-2011	Medical and Clinical Laboratory Technologists	4		13	2	11	0.15	0	0	0	13	2	11	0	0	0

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29-2012	Medical and Clinical Laboratory Technicians	3		16	14	2	0.88	5	11	-6	11	2	9	0	0	0
29-2021	Dental Hygienists	3		27	15	12	0.56	20	14	6	7	1	6	0	0	0
29-2031	Cardiovascular Technologists and Technicians	3		2	0	2	0.00	0	0	0	2	0	2	0	0	0
29-2032	Diagnostic Medical Sonographers	3		2	0	2	0.00	0	0	0	2	0	2	0	0	0
29-2034	Radiologic Technologists	3		16	18	-2	1.13	10	9	1	5	10	-5	0	0	0
29-2041	Emergency Medical Technicians and Paramedics	3		12	12	0	1.00	6	10	-4	6	1	5	0	0	0
29-2052	Pharmacy Technicians	3		7	1	6	0.14	4	0	4	4	1	3	0	0	0
29-2055	Surgical Technologists	3		2	0	2	0.00	0	0	0	2	0	2	0	0	0
29-2056	Veterinary Technologists and Technicians	3		2	0	2	0.00	0	0	0	2	0	2	0	0	0
29-2061	Licensed Practical and Licensed Vocational Nurses	3		31	54	-23	1.74	31	54	-23	0	0	0	0	0	0
29-2071	Medical Records and Health Information Technicians	3		8	33	-25	4.13	3	28	-25	5	5	0	0	0	0
29-2081	Opticians, Dispensing	3		4	1	3	0.25	0	0	0	4	1	3	0	0	0
29-2099	Health Technologists and Technicians, All Other	3		3	4	-1	1.33	1	2	-1	2	3	-1	0	0	0
29-9011	Occupational Health and Safety Specialists	4		3	0	3	0.00	0	0	0	3	0	3	0	0	0
29-9091	Athletic Trainers	5		3	15	-12	5.00	0	0	0	3	15	-12	0	0	0
31-2011	Occupational Therapy Assistants	3		11	20	-9	1.82	7	17	-10	3	3	0	0	0	0
31-2012	Occupational Therapy Aides	3		2	4	-2	2.00	2	4	-2	0	0	0	0	0	0
31-2021	Physical Therapist Assistants	3		19	71	-52	3.74	10	66	-56	8	5	3	0	0	0
31-9011	Massage Therapists	3		3	6	-3	2.00	1	6	-5	2	0	2	0	0	0
31-9091	Dental Assistants	3		3	1	2	0.33	0	0	0	3	1	2	0	0	0
31-9092	Medical Assistants	3		22	80	-58	3.64	22	80	-58	0	0	0	0	0	0
31-9094	Medical Transcriptionists	3		1	1	0	1.00	0	0	0	1	1	0	0	0	0
31-9097	Phlebotomists	3		5	6	-1	1.20	5	6	-1	0	0	0	0	0	0
33-1012	First-Line Supervisors of Police and Detectives	3		5	16	-11	3.20	2	10	-8	3	6	-3	0	0	0
33-1099	First-Line Supervisors of Protective Service Workers, All Other	3		3	5	-2	1.67	0	0	0	3	5	-2	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
33-2011	Firefighters	3		3	6	-3	2.00	0	0	0	3	6	-3	0	0	0
33-3012	Correctional Officers and Jailers	3		5	10	-5	2.00	0	0	0	5	10	-5	0	0	0
33-3021	Detectives and Criminal Investigators	3		3	5	-2	1.67	0	0	0	3	5	-2	0	0	0
33-3051	Police and Sheriff's Patrol Officers	3		35	113	-78	3.23	13	67	-54	23	47	-24	0	0	0
33-9021	Private Detectives and Investigators	3		1	3	-2	3.00	0	0	0	1	3	-2	0	0	0
39-1021	First-Line Supervisors of Personal Service Workers	3		14	14	0	1.00	4	6	-2	10	8	2	0	0	0
39-5012	Hairdressers, Hairstylists, and Cosmetologists	3		8	14	-6	1.75	8	14	-6	0	0	0	0	0	0
39-9011	Childcare Workers	3		9	13	-4	1.44	0	0	0	9	13	-4	0	0	0
39-9031	Fitness Trainers and Aerobics Instructors	3		16	17	-1	1.06	0	0	0	16	17	-1	0	0	0
39-9032	Recreation Workers	4		26	28	-2	1.08	0	0	0	26	28	-2	0	0	0
39-9041	Residential Advisors	3		15	19	-4	1.27	0	0	0	15	19	-4	0	0	0
41-1012	First-Line Supervisors of Non-Retail Sales Workers	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
41-3011	Advertising Sales Agents	3		6	28	-22	4.67	0	0	0	6	28	-22	0	0	0
41-3021	Insurance Sales Agents	4		15	11	4	0.73	0	0	0	15	11	4	0	0	0
41-3031	Securities, Commodities, and Financial Services Sales Agents	4		8	8	0	1.00	0	0	0	8	8	0	0	0	0
41-3041	Travel Agents	3		1	1	0	1.00	0	0	0	1	1	0	0	0	0
41-3099	Sales Representatives, Services, All Other	4		32	25	7	0.78	7	1	6	25	24	1	0	0	0
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4		45	43	2	0.96	0	0	0	45	43	2	0	0	0
41-9022	Real Estate Sales Agents	3		6	4	2	0.67	0	0	0	6	4	2	0	0	0
41-9031	Sales Engineers	4		3	2	1	0.67	0	0	0	3	2	1	0	0	0
43-1011	First-Line Supervisors of Office and Administrative Support Workers	3		45	112	-67	2.49	12	86	-74	33	26	7	0	0	0
43-3031	Bookkeeping, Accounting, and Auditing Clerks	3		26	35	-9	1.35	8	18	-10	17	16	1	0	0	0
43-3061	Procurement Clerks	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0

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43-4011	Brokerage Clerks	3		3	3	0	1.00	0	0	0	3	3	0	0	0	0
43-4031	Court, Municipal, and License Clerks	3		2	2	0	1.00	0	0	0	2	2	0	0	0	0
43-4061	Eligibility Interviewers, Government Programs	3		9	12	-3	1.33	0	0	0	9	12	-3	0	0	0
43-4131	Loan Interviewers and Clerks	3		4	4	0	1.00	1	2	-1	2	2	0	0	0	0
43-4161	Human Resources Assistants, Except Payroll and Timekeeping	3		4	3	1	0.75	0	0	0	4	3	1	0	0	0
43-5061	Production, Planning, and Expediting Clerks	3		20	20	0	1.00	4	7	-3	16	12	4	0	0	0
43-6011	Executive Secretaries and Executive Administrative Assistants	3		5	7	-2	1.40	2	3	-1	4	4	0	0	0	0
43-6012	Legal Secretaries	3		5	17	-12	3.40	2	13	-11	4	4	0	0	0	0
43-6013	Medical Secretaries	3		30	46	-16	1.53	9	25	-16	21	22	-1	0	0	0
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3		63	78	-15	1.24	19	32	-13	44	45	-1	0	0	0
43-9011	Computer Operators	3		1	1	0	1.00	0	0	0	1	1	0	0	0	0
43-9041	Insurance Claims and Policy Processing Clerks	3		13	14	-1	1.08	4	7	-3	9	7	2	0	0	0
43-9199	Office and Administrative Support Workers, All Other	3		7	7	0	1.00	2	3	-1	6	4	2	0	0	0
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	3		6	5	1	0.83	0	0	0	6	5	1	0	0	0
47-2111	Electricians	3		14	103	-89	7.36	14	103	-89	0	0	0	0	0	0
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	3		13	10	3	0.77	0	0	0	13	10	3	0	0	0
49-2011	Computer, Automated Teller, and Office Machine Repairers	3		1	1	0	1.00	1	1	0	0	0	0	0	0	0
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	3		1	1	0	1.00	1	1	0	0	0	0	0	0	0
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	3		1	1	0	1.00	1	1	0	0	0	0	0	0	0
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	3		1	57	-56	57.00	1	57	-56	0	0	0	0	0	0
49-2098	Security and Fire Alarm Systems Installers	3		2	17	-15	8.50	2	17	-15	0	0	0	0	0	0

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49-3023	Automotive Service Technicians and Mechanics	3		15	36	-21	2.40	15	36	-21	0	0	0	0	0	0
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	3		6	49	-43	8.17	6	49	-43	0	0	0	0	0	0
49-9071	Maintenance and Repair Workers, General	3		15	9	6	0.60	15	9	6	0	0	0	0	0	0
51-2041	Structural Metal Fabricators and Fitters	3		6	3	3	0.50	6	3	3	0	0	0	0	0	0
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	3		22	12	10	0.55	22	12	10	0	0	0	0	0	0
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	3		2	4	-2	2.00	2	4	-2	0	0	0	0	0	0
51-4041	Machinists	3		17	9	8	0.53	17	9	8	0	0	0	0	0	0
51-4111	Tool and Die Makers	3		8	4	4	0.50	8	4	4	0	0	0	0	0	0

APPENDIX G: CROSSWALK OF PROGRAMS TO OCCUPATIONS

(Full List Available Upon Request)

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
11-1021	General and Operations Managers	44.0401	Public Administration	•		•
		50.1001	Arts, Entertainment, and Media Management, General		•	
		50.1002	Fine and Studio Arts Management		•	
		50.1003	Music Management		•	
		50.1004	Theatre/Theatre Arts Management		•	
		52.0101	Business/Commerce, General	•		•
		52.0201	Business Administration and Management, General	•	•	•
		52.0204	Office Management and Supervision	•		
		52.0205	Operations Management and Supervision	•		
		52.0206	Non-Profit/Public/Organizational Management	•		
		52.0213	Organizational Leadership	•		
		52.0299	Business Administration, Management and Operations, Other	•		
		52.0501	Business/Corporate Communications		•	
		52.0701	Entrepreneurship/Entrepreneurial Studies	•		•
		52.0703	Small Business Administration/ Management	•		
		52.0799	Entrepreneurial and Small Business Operations, Other	•		
		52.0801	Finance, General			•
		52.1101	International Business/Trade/Commerce	•		•
		52.1201	Management Information Systems, General		•	
		52.1206	Information Resources Management		•	
		52.1207	Knowledge Management		•	
		52.1299	Management Information Systems and Services, Other		•	
		52.1301	Management Science			•

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
13-1161	Market Research Analysts and Marketing Specialists	45.0101	Social Sciences, General	•		
		45.0602	Applied Economics			•
		45.9999	Social Sciences, Other	•		
		52.0101	Business/Commerce, General	•		
		52.0601	Business/Managerial Economics	•		
		52.1401	Marketing/Marketing Management, General	•	•	•
		52.1402	Marketing Research	•	•	•
		52.1403	International Marketing	•	•	•
		52.1499	Marketing, Other	•	•	
13-2011	Accountants and Auditors	43.0117	Financial Forensics and Fraud Investigation	•		•
		45.0601	Economics, General		•	
		45.0603	Econometrics and Quantitative Economics		•	
		45.0605	International Economics		•	
		45.0699	Economics, Other		•	
		52.0101	Business/Commerce, General	•		
		52.0301	Accounting	•	•	•
		52.0303	Auditing	•	•	•
		52.0304	Accounting and Finance	•	•	•
		52.0305	Accounting and Business/Management	•	•	•
		52.0399	Accounting and Related Services, Other	•	•	
		52.0601	Business/Managerial Economics		•	
		52.0801	Finance, General	•	•	
		52.0804	Financial Planning and Services		•	
		52.0807	Investments and Securities		•	
		52.0899	Finance and Financial Management Services, Other	•	•	
		52.1304	Actuarial Science		•	
		52.1601	Taxation	•		•
15-1121	Computer Systems Analysts	11.0101	Computer and Information Sciences, General	•		•
		11.0103	Information Technology	•		•
		11.0501	Computer Systems Analysis/Analyst	•	•	•
		11.0701	Computer Science		•	
		11.0801	Web Page, Digital/Multimedia and Information Resources Design	•	•	
		11.0803	Computer Graphics		•	
		11.0804	Modeling, Virtual Environments and Simulation		•	

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
		11.0899	Computer Software and Media Applications, Other		•	
		11.0901	Computer Systems Networking and Telecommunications			•
		52.1201	Management Information Systems, General	•		
		52.1207	Knowledge Management	•		
		52.1299	Management Information Systems and Services, Other	•		
29-1141	Registered Nurses	51.0000	Health Services/Allied Health/Health Sciences, General	•	•	
		51.0704	Health Unit Manager/Ward Supervisor	•	•	
		51.3801	Registered Nursing/Registered Nurse	•	•	•
		51.3803	Adult Health Nurse/Nursing	•	•	•
		51.3805	Family Practice Nurse/Nursing	•	•	•
		51.3808	Nursing Science	•	•	•
		51.3818	Nursing Practice	•	•	•
		51.3899	Registered Nursing, Nursing Administration, Nursing Research and Clinical Nursing, Other	•	•	•