The Knowledge Economy Workforce and Higher Education in Western New York: A Match-Gap Analysis

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I. Executive Summary

The region's colleges and universities provide a vital source of educated labor for employers in Western New York. Strategic alignment of graduate supply and workforce demand is essential to steering the region's knowledge economy. The Western New York Consortium of Higher Education commissioned the University at Buffalo Regional Institute to conduct the following analysis to assess gaps, identify areas for realignment and improve synergies across higher education and the regional workforce. Findings are summarized below:

Key Findings

- Annually through 2014 the region's colleges and universities are expected to graduate nearly 16,000 students who will enter the workforce, while degree-requiring job openings in the region will be fewer than 5,000. These 11,000+ "surplus" graduates may be forced to look to other regions for employment, accept positions in different fields, or accept jobs for which they are overqualified. Such a surfeit of educated labor presents a tremendous opportunity for expanding the region's knowledge economy, while also portending a significant loss of economic potential if regional job growth does not surpass current estimates.
- The widest graduate-workforce gaps occur at advanced degree levels, with a glut of graduates with master's degrees (about 5,600 more graduates than job openings requiring a master's degree). The region will also see a surplus of about 4,000 bachelor's degree graduates and 2,000 associate's degree graduates. Employers seeking candidates with a PhD degree will find them in short supply, however.
- Looking ahead, job openings requiring an associate's degree will make the biggest jump, or about 15 percent from 2004 to 2014. Jobs requiring first-professional degrees will grow at the slowest clip, at about 6 percent.
- An overwhelming majority of overall job openings in Western New York require no college degree – nearly 16,000 (75 percent) compared to 5,000 job openings requiring a college degree.
- Almost half of degrees awarded in the region – nearly 13,000 – are in the fields of education, business, liberal arts and health. One in five students in Western New York – or 4,600 annually – earns a degree in education, with graduate totals increasing 68 percent in this field since 1995.

- Western New York colleges and universities generate more graduates than there are job opportunities in the region for all but four of the more than 20 occupational fields reviewed for this analysis. Absolute gaps are biggest for the region's most popular degree programs – education and business management. As a ratio of graduates per job opening, those trained in arts, media and communications will enter the tightest labor market, with six graduates vying for each job opening (compared to 2.5 and 3.4 per job opening for education and business management, respectively).
- Occupational fields commonly cited as areas with a labor shortage in Western New York, including architecture and engineering and health care practice, are projected to have a slight oversupply of graduates.
- Employers can anticipate a deficit of graduates trained in computers and mathematics. The small surplus of graduates in the fields of health care support (just four graduates) and business and finance (30 graduates) also warrants attention. Though an oversupply exists for the broad category of science occupations, significant gaps will challenge the niche of life sciences.
- Graduate supply and employer demand varies significantly across the dozens of occupational titles within each occupational field. Job titles for which the region generates too many graduates include writers, authors, teachers, librarians, social workers, lawyers, electrical engineers, architects, chemists, network and computer systems administrators and pharmacists. Alternatively, graduate shortages are expected for computer programmers, accountants and auditors, post-secondary teachers, registered nurses and rehabilitation and mental health counselors.
- Colleges and universities are unable to supply graduates for several job titles due to the absence of degree programs in those areas. These include several technical and health-related positions, veterinarians and environmental scientists.
- Many graduates of the region's higher education degree programs earn a degree that is not necessary for most jobs in that field, while falling short of requirements for those jobs that are degree-based. Examples of the former include graduates holding an associate's degree in criminal justice or child care, while examples of the latter include a bachelor's degree in philosophy or music.
- Western New York's life sciences cluster has placed the region on the cutting edge of the knowledge economy. Yet higher education in Western New York will fall short of the emerging industry's demand for labor, producing 59 graduates compared to 80 life scientists and technician job openings annually through 2014.

- Life sciences employers will find a dearth of graduates for eight out of the industry's 10 occupational titles. Graduate shortages cut across all levels of training – from biological and chemical technicians trained at the associate's level to graduates at the doctoral level.
- Life sciences employers also cite labor shortages in critical support areas for the industry such as computer programmers and non-degree requiring positions in biomanufacturing. The lack of entrepreneurial and business management capacities in life scientists and recent life science graduates further hampers the transfer of science into the commercial marketplace.
- Efforts working to address the region's life sciences labor shortages include multiple programs to build awareness of career opportunities for high school and college students and career-changing adults. New and expanding academic programs in the life sciences at several of the region's colleges and universities may also help to reinforce graduate supply, although additional specializations are necessary to develop the diverse talent in demand by life sciences employers.

Recommendations

The extent of the gap between graduate supply and workforce demand, including the dearth of employment opportunities for graduates in general and critical shortages of graduates in key fields such as the life sciences, demand deliberate action at the regional scale. The Western New York Consortium of Higher Education, along with economic development and business leaders, can play a lead role in implementing the following recommendations:

1. Disseminate report findings and seek input from key regional stakeholders.
2. Implement a multi-pronged approach to realigning higher education with workforce needs.
    - *Inform prospective college students and college graduates of regional labor demand*
    - *Shift resources within academic programs, to the extent practicable*
    - *Develop new academic programming, to the extent practicable*
    - *Develop joint programming across the region's colleges and universities in strategic knowledge economy sectors*
3. Establish a region-wide forum of key stakeholders to regularly monitor progress and adjust resource allocation.

4. With respect to the life sciences, Consortium members can:

- *Expand existing and develop new academic programming to increase scientist and technician graduate numbers.*
- *Target prospective college students and college graduates to build life sciences workforce capacity.*
- *Build entrepreneurial capacity in life sciences students and leading researchers and scientists in the industry.*

II. Introduction

Western New York's colleges and universities play a fundamental role in the growth and competitiveness of the region's knowledge economy by supplying employers with qualified, educated workers. Sustained and strategic growth of the region's knowledge economy is closely linked to the dynamics of graduate supply and workforce demand. Colleges need to generate adequate graduate numbers and equip graduates with the skills that meet workforce needs and support business growth. At the same time, the region risks losing these graduates – fuel for knowledge economy growth – if job opportunities fall short. While the region cannot realistically expect to hold onto all graduates (in fact, recent studies have shown that "brain drain" in Western New York is right in line with other major knowledge economies such as Philadelphia, Baltimore and Raleigh-Durham),[1] the region's knowledge economy growth will stall if graduate numbers fail to meet employer demand.

The Western New York Consortium of Higher Education, representing 22 colleges and universities in Erie, Niagara, Cattaraugus, Chautauqua, Allegany and Genesee Counties, commissioned the University at Buffalo Regional Institute to assess how well higher education in the region meets workforce demands. The gaps identified will inform strategic realignment of graduate training and job demand and thus ensure higher education continues to propel the Western New York knowledge economy. Noteworthy is that employers in the region are also exploring workforce training needs through an analysis of their hard-to-fill positions.

The Consortium's match-gap analysis is part of its *Better by Degrees* initiative, a multi-pronged program to build understanding of higher education and advance the sector's role in the Western New York knowledge economy. Other components of *Better by Degrees* include: 1) a review of regional higher education collaborative networks ("Higher Education Connections"); 2) an assessment of national best practices ("Regional Higher Education Consortia: A Review of Best Practices"); 3) an assessment of Western New York higher education relative to 12 peer regions ("A Comparative Analysis of Higher Education in the Buffalo Metropolitan Region"), and 4) an economic impact assessment of higher education in the region ("The Impact of Higher Education in Western New York").

[1] See the Better by Degrees report, "A Comparative Analysis of Higher Education in the Buffalo Metropolitan Region," conducted by the University at Buffalo Regional Institute, November 2008, which compares "brain drain" in 12 knowledge regions by measuring the ratio of college students or young graduates to the population of college-educated adults at key career ages.

III. Scope

The findings in this study are shaped by numerous assumptions, the availability of data and the framework used to conduct match-gap calculations. Additional details are provided, as related, throughout the report and in **Appendix A** (Data Sources and Detailed Methodology).

Geographic scope of analysis: Employment data and projections are for the counties of Allegany, Cattaraugus, Chautauqua, Erie, and Niagara, defined as Western New York by the New York State Department of Labor, the primary source of data for this report. This five-county region captures about 96 percent of total employment within the eight-county region typically defined as Western New York. In the few cases where these data were unavailable, U.S. Department of Labor statistics for the bi-county Buffalo Niagara metropolitan area (Erie-Niagara) were used to approximate employment across the eight counties. Graduate totals reflect the counties of the 22 schools (Allegany, Cattaraugus, Erie, Genesee, Niagara, Orleans and Wyoming).

Supply of college graduates: The number of workforce-ready graduates generated each year by the region's colleges and universities reflects total degrees granted by the 22 institutions of higher education in Western New York. Second majors, which account for 1 percent of total degrees, were excluded to develop a supply figure representative of actual graduates entering the workforce. Graduate numbers do not include students earning a postsecondary certificate.

Demand for college-educated workers: Demand for graduates in the region was gauged by the number of annual job openings requiring a college degree (associate's, bachelor's, master's, doctoral or first-professional degree). Specific graduate-to-workforce matches and gaps were determined based on a U.S. Department of Labor (Bureau of Labor Statistics) matrix linking each occupational title with the most common level and field of educational training held by those employed in such a position. Factored into this analysis is that a college degree, depending on the field of study, typically qualifies an applicant for multiple job opportunities. Thus, for each potential job opportunity, the pool of qualified applicants may be depleted by other occupations seeking similarly trained graduates. However, this analysis does not account for job openings that may be filled with graduates that have relevant skills and work experience, but not necessarily the college degree typically held by those seeking such a position. Also, job titles requiring a bachelor's degree plus work experience – primarily business management positions – were included in the mix of degree-requiring positions for

which a new graduate might qualify since some students obtain professional experience through employment prior to or while in college. This is especially the case for nontraditional students.

Timeframe: The match gap analysis uses 2005-06 student graduation data, the latest year for which data are available from the National Center for Education Statistics. Projected job openings reflect the current year through 2014, as provided by the New York State Department of Labor.

Summary of key assumptions: Several assumptions regarding graduate supply were necessary to further define the scope of the following match-gap analysis.

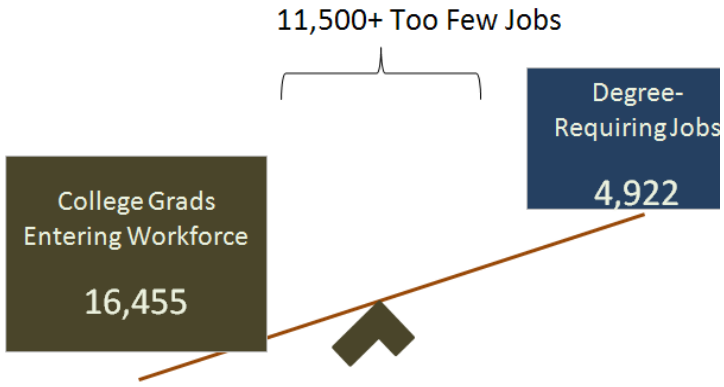
- It was assumed that graduates of Western New York schools who opt to enter the workforce will vie for employment within the region. This may overestimate the supply of new graduates available for the Western New York labor market, as many students originating from outside the region will seek to return home, while others may move for factors related or unrelated to employment. Out-of-state and international students, 8 percent of Western New York's college population, are especially likely to fall into this category. Moreover, rates of out-migration likely vary by degree level, according to the proportion of international and out-of-region students.
- An assumption was made that demand for Western New York graduates by employers outside the region has no impact on whether graduates stay or go. With graduate demand across the nation high, especially in growing fields such as health care and the sciences, this assumption may overestimate the number of graduates available to Western New York employers.
- This analysis assumes that graduates will, where necessary, accept jobs requiring a level of education lower than what they have obtained. In actuality, these graduates may opt to leave the region for employment that has demand for and salaries that reflect their level of education. Therefore, assuming that graduates will take a job for which they are overqualified in terms of educational level may overstate the number of graduates available to Western New York employers.

IV. College Graduates and the Western New York Workforce

Overall Supply and Demand. Western New York's 22 colleges and universities annually prepare more than 16,000 graduates for entry into the regional workforce.[2] In general, these prospective graduates can expect to enter a tight Western New York labor market over the next several years. Between 2008 and 2014, the region is projected to have an annual shortage of more than 11,500 degree-requiring job opportunities relative to college graduates. The approximately 16,500 college graduates are anticipated to enter the Western New York workforce annually over the next six years, all vying for about 4,900 jobs requiring a degree at the associate's level or beyond (**Figure 1**).

Figure 1

A lack of job opportunities for more than 11,500 college graduates in the region could inhibit growth of the Western New York knowledge economy.



This imbalance is despite a projected 11 percent increase in degree-requiring job opportunities between 2008 and 2014 and a stabilization of graduation rates after recently peaking.[3] While supply-demand ratios vary by occupation, and some graduates may leave the region for reasons other than employment, the degree of the graduate-to-jobs imbalance still warrants

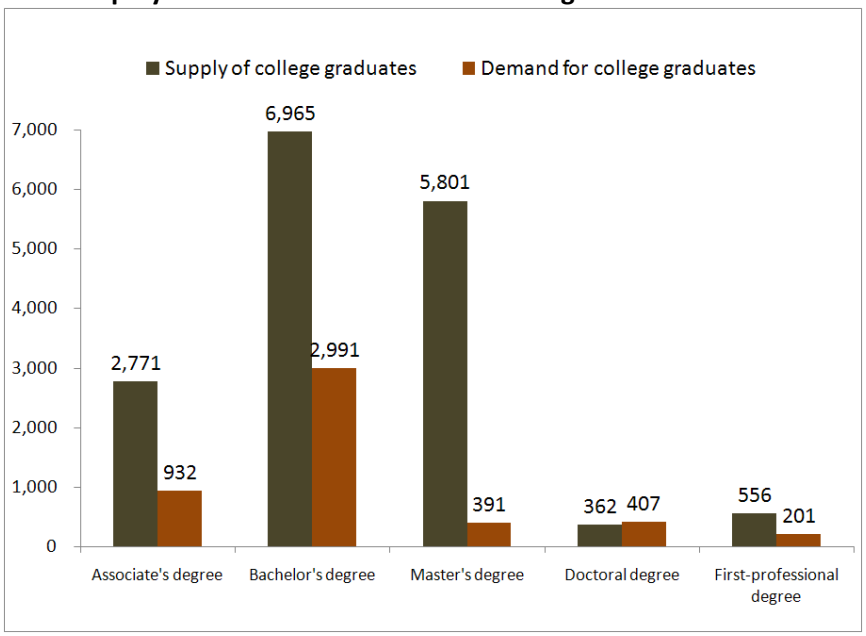
[2] Western New York's 22 colleges and universities graduated 22,656 students in 2005-06, but not all students entered the workforce immediately after graduation. The figure of 16,455 graduates entering the workforce reflects a survey of several community colleges, which found that about half of graduates with two-year degrees enter the workforce while the balance pursues a four-year bachelor's degree. Among those graduating with a bachelor's degree, a national study (*Baccalaureate and Beyond,* National Center for Education Statistics) shows that one-third stay in school to pursue a master's, doctoral or professional degree, while the other two-thirds enter the workforce (the rate at which associate's and bachelor's graduates return to school likely varies by area of study and regional demand for labor). Taking into account these percentages, it is estimated that 16,455 graduates will enter the workforce annually.

[3] While the number of graduates might grow slightly over the next several years—as the result of a peak of an enrollment boom in fall 2008—enrollment, and, in turn, graduations, are projected to then decline. See Rey, Jay, "Colleges cherry-pick from big pool as enrollment boom hits its peak" in *The Buffalo News*, August 29, 2008.

attention. Indeed, many of the region's graduates may be forced to accept jobs for which they are overqualified, accept positions in different fields or leave the region to find employment. Such scarcity in overall professional employment opportunities for college graduates presents obstacles in retaining this vast supply of educated labor, representing a critical missed opportunity to grow the region's knowledge economy. Consequently, regional leaders can consider better aligning academic programming and enrollment with workforce needs, as well as redoubling job growth efforts to help stem the tide of graduate loss. Indeed, economic development entities could attempt to leverage the plentiful supply of graduates in attracting new or expanding existing businesses in Western New York.

The oversupply of college graduates in the region is likely related to the spike in graduate numbers over the past decade, a trend attributed to children of the Baby Boomer generation reaching college-age as well as several economic factors. The annual pool of Western New York college graduates increased 20 percent since 1995, with the sharpest growth occurring since 2000.[4] At the same time, growth of degree-requiring job openings has not kept pace.

Figure 2
Job opportunities will be most scarce for master's degree graduates, while employers will find a dearth of doctoral graduates.



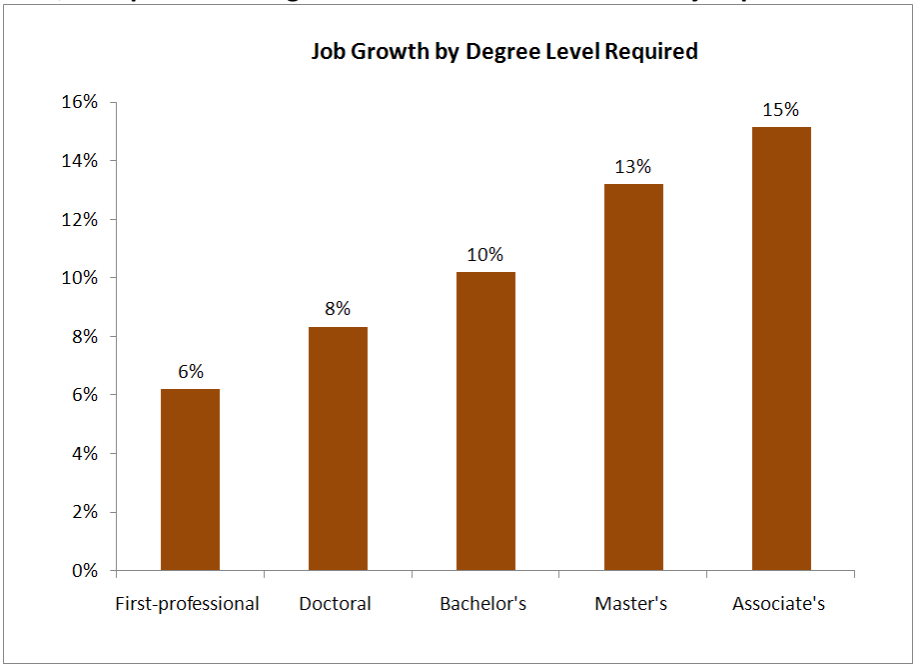
Supply and Demand by Degree Level. A closer look at the balance of graduates entering the workforce to employment opportunities by degree level shows the widest gaps for advanced degrees. At the master's degree level, for instance, the region graduated nearly 6,000 students but had fewer than 400 job openings requiring such a degree (**Figure 2**). This marked surplus of master's degrees is likely a product of the 79 percent increase in degrees

[4] All historical trends figures on degrees awarded exclude Erie Community College for which such data are not available.

awarded at this level since 1995. Indeed, as competition for jobs increases, students are increasingly returning to school to gain a competitive edge in the form of a higher degree.

At the opposite end of the spectrum, the region will have a slight shortage of doctoral (PhD) graduates, with slightly more job opportunities than there are graduates in Western New York. Though in absolute terms, job openings at the first-professional level are the fewest – 201 – the region generates more than 550 graduates at this level, resulting in an oversupply of more than 300 medical doctors, dentists, attorneys and the like. Compared to about a decade ago, the region is awarding 18 percent more doctoral and first-professional degrees.

Figure 3
The number of associate's degree graduates will grow the most through 2014; first-professional graduates will make the smallest jump.



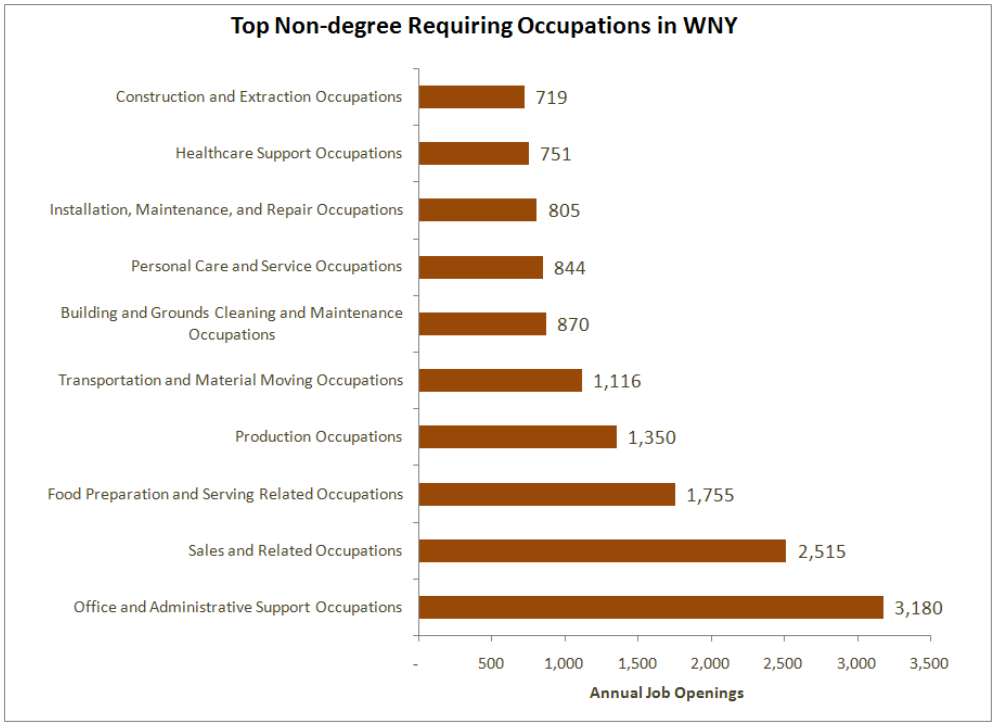
The regional labor market is not likely to have capacity for more than half of the nearly 7,000 graduates with bachelor's degrees. The prospective 2,900 associate's degree graduates will also enter a competitive labor market, with just over 900 job openings from which to choose. Bachelor's and associate's degrees awarded today number 38 percent more compared to 1995 levels.

Looking ahead in terms of job growth, positions requiring an associate's degree will make the biggest jump, or about 15 percent from 2004 to 2014. Jobs requiring first-professional and doctoral degrees will grow only 6 percent and 8 percent, respectively (**Figure 3**).

Non-Degree Requiring Jobs. Western New York is still making the transition to a knowledge-based economy, a point made abundantly clear in the overwhelming majority of regional employment that does not require a college degree. Of the more than 21,000 annual job

openings in Western New York, 75 percent, or 15,817, require no college degree, but rather post-secondary vocational training or on-the-job experience. Those college graduates committed to staying within the region – or unable to leave – may find themselves, equipped with a competitive edge, applying for one of these openings.

Figure 4
The top two categories of non-degree requiring jobs in Western New York are office and administrative support and sales.



The largest categories of non-degree-requiring occupations in Western New York include office and administrative support (3,180 annual openings, or 20 percent), sales (2,515 openings, or 16 percent), food preparation (1,755 openings, or 11 percent) and production (1,350 openings, or 9 percent) (**Figure 4**).[5] Among the more highly paid positions in this category of employment are sales representatives, correctional officers, mechanical drafters and real estate appraisers, with median salaries close to $50,000. Total jobs in this category will grow 3.7 percent by 2014.

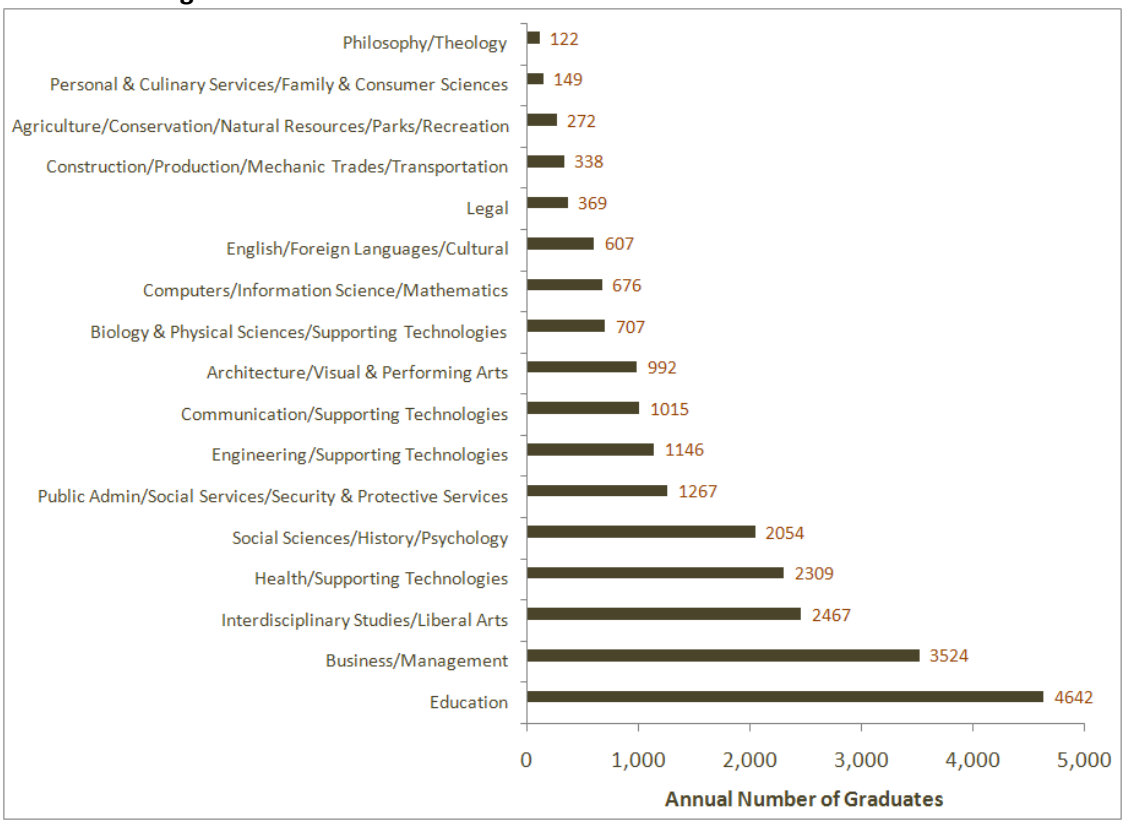
[5] These numbers largely reflect turnover within these fields, as opposed to job growth.

V. Occupational Matches and Gaps in Western New York

Western New York's demand for labor varies greatly across occupational fields and, more specifically, occupational titles within those fields. Thus, depending on the field of study, some college graduates in Western New York may have a relatively easy time finding a job that applies their degree, while others will have to fend with fierce competition. The following match-gap analysis examines for each occupation in the region the supply-demand ratio of job opportunities to qualified college graduates. The supply-demand dynamics of this analysis were significantly shaped by several key assumptions (see **Section III (Scope),** and **Appendix A** for detailed methodology).

Top Fields of Study. Together, almost half of degrees awarded in the region—nearly 13,000—are in the fields of education, business, liberal arts and health (**Figure 5**). Education is by far the most frequent field of choice for Western New York's college and university students. One in five students in Western New York – or 4,600 annually – earns a degree in education. Noteworthy is that the field of education has grown increasingly popular over the years. Since 1995, the number of education graduates has increased 68

Figure 5
Education, business, liberal arts and health are the most popular fields of study for Western New York college students.



percent, despite several factors that have limited demand for teachers in the region. Business management is also a common path of study for the region's college students. About one in six (more than 3,500 annually) earns a degree in business or business management. The broad degree area of liberal arts and interdisciplinary studies, and the study of health and health care technologies are the next most common higher education tracks in Western New York, with each accounting for about 10 percent of total degrees conferred (slightly fewer than 2,500 annually).

Top Fields of Study by Degree Level

The most common fields of study vary by degree level. An assessment of the top three fields of study shows health at the top for all but one degree level, with students of this discipline most concentrated at the doctoral/professional level (**Figure 6**). Education dominates at the master's level, with more than half of the region's master's students seeking this degree. The three most selected fields of study at the bachelor's level – where the diversity in academic programs is greatest – comprise just about 50 percent of all graduates and include business, social sciences and education.

Figure 6

Top 3 Fields of Study in WNY by Degree Level

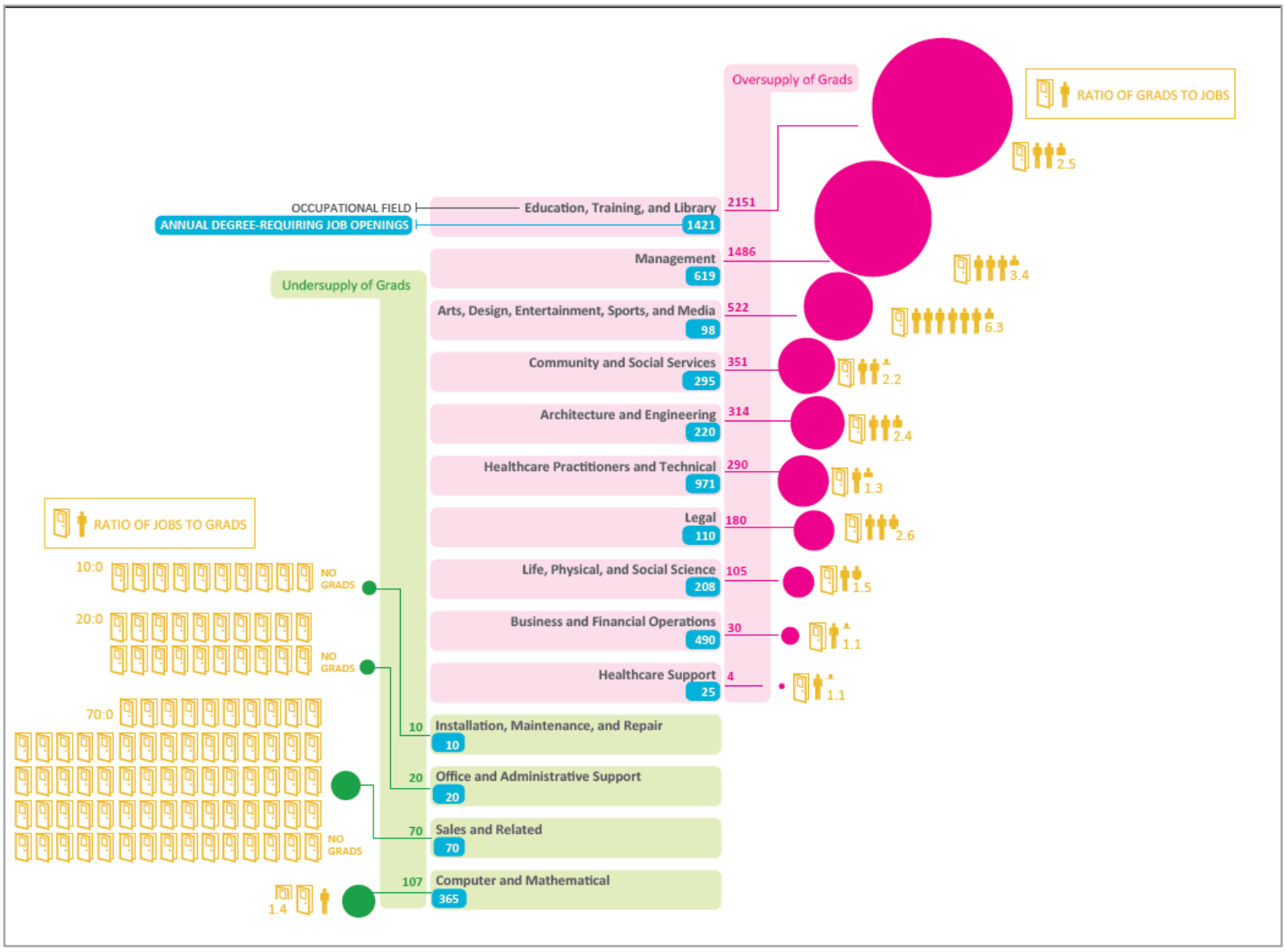
Associate's		Bachelor's		Master's		Doctoral/Professional	
1. Liberal Arts	30%	1. Business/ Management	18%	1. Education	53%	1. Health	42%
2. Health	18%	2. Social Science/ Psychology/History	17%	2. Business/ Management	11%	2. Law	25%
3. Business/ Management	18%	3. Education	14%	3. Health	7%	3. Biology/ Physical Science	8%
Total:	**66%**	**Total:**	**49%**	**Total:**	**71%**	**Total:**	**75%**

Graduate Supply and Demand by Occupational Field. Western New York colleges and universities produce a surplus of graduates for all but four of the more than 20 occupational fields reviewed for this analysis (**Figure 7**). Graduates of the region's most popular degree programs – education and business management – can expect a struggle in securing employment, as both are among the top occupational fields in Western New York for labor surplus. There are roughly three graduates per job opening in either field. In looking at the absolute size of the gap between graduate numbers and job openings, education tops the list, with more than 2,000 more graduates than there are openings for teachers. It should be noted that education is a popular field of study among Canadian students attending schools in the region; many of these students return to Canada to find employment. The total annual surplus of management graduates approaches 1,500.

But the tightest labor market in Western New York will await graduates of arts, media and communications degree programs. On an annual basis through 2014, there will be a surplus of more than 500 qualified college graduates in Western New York relative to openings in this occupational field, or six graduates vying for every single job opening in this field. Occupational fields commonly cited as areas with a labor shortage in Western New York are actually projected to have a slight oversupply of labor over the next several years. In the field of architecture and engineering, the region is projected to annually have 314 more qualified graduates than there are openings. Graduate oversupply in the health care practice field will approach 300. Meanwhile, the region will have no job openings for more than 100 graduates trained for work in the life, physical and social sciences (although **Section VI** examines the life sciences more closely, revealing graduate shortages in this niche field).

Other occupational fields with an overabundance of graduates, including law and community and social services, are not surprising. The region's colleges are graduating too many school

Figure 7
A surplus of graduates – or a deficit of job opportunities – is expected in all but four of the 20 occupational fields.



counselors and social workers, with a surplus of more than 350 graduates qualified in this occupational field. Though the region has only one law school and four paralegal programs, they are graduating more students – about 200 – than the region has the capacity to employ.

Western New York will need to boost enrollment is in its degree programs that train students for employment in the field of computers and mathematics – one of only four fields for which there is an anticipated annual deficit in Western New York, numbering at 107 graduates.[6] The region is straddling the line between surplus and scarceness, with only four surplus graduates in the field of health care support and 30 extra graduates in business and finance.

Demand for Graduates by Occupational Title. A closer look at the dozens of job titles within each occupational field reveals a significantly more nuanced picture of graduate supply and demand, reflecting the complexity of labor markets (**Appendix B** provides results for every occupational title in Western New York for which a college degree is required.)

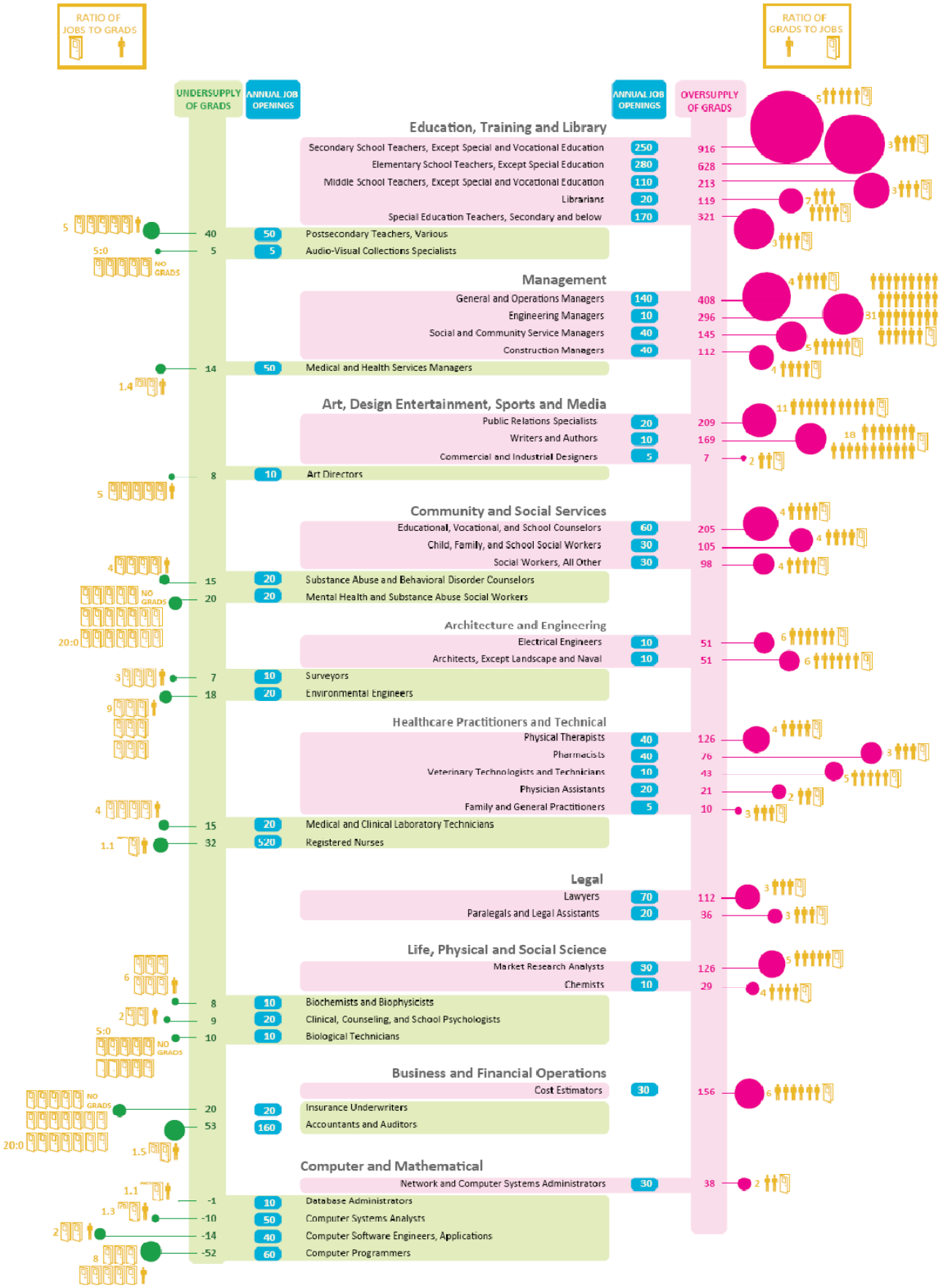
The starving artist adage holds true in Western New York, where graduates with the fewest employment options include those seeking jobs as writers and authors. The annual surplus of about 170 in this field will supply 18 graduates for every job opening in this category (**Figure 8**). Public relations job openings are similarly scarce, with an excess of more than 200 graduates, or 11 graduates per opening.

The region is also generating more graduates than there are job openings in certain scientific and technical areas. Colleges and universities are churning out more electrical engineers and architects than there are annual job openings – with 51 surplus graduates in each category. Job opportunities for chemists will be limited – with 29 too many graduating each year from a Western New York college or university. The region will also see somewhat of a glut of network and computer systems administrators. In health care, the region's pharmaceutical and physical therapy programs generate graduate numbers beyond the region's capacity for employment.[7]

[6] The other three fields where deficits occur (Sales, Office and Administrative Support, and Installation, Maintenance and Repair) are those for which the majority of jobs require no degree. The deficits reflect the few job titles that do require degrees and are not supplied with regional graduates due to a lack of degree programs (e.g., bachelor's degrees in insurance, associate's degree in medical equipment repair). See Figure 10, p. 18.

[7] This finding contradicts severe pharmacy shortages noted by employers in the region. As reviewed in the report's Scope and Methodology, this analysis assumes all graduates of the region's colleges and universities are available to fill job openings in Western New York. However, certain graduates, including pharmacists and physical therapists, are likely recruited in large numbers by regions experiencing severe shortages, thereby diminishing the supply of these graduates for regional needs.

Figure 8
The balance of graduates to job opportunities varies widely across the dozens of job titles within each occupational field.



Teachers at nearly every level will be challenged to find employment in Western New York. Those trained to teach at the secondary level will have the hardest time, with nearly 1,000 more graduates than there are openings in the region – or five graduates vying for every secondary teaching position available. The region also will have a surfeit of librarians and special education teachers.

The University at Buffalo Law School, the only law school in the region, graduates 114 more lawyers than there are attorney positions in Western New York. More than 200 social workers will graduate in Western New York without a job opening awaiting them.

There are several positions for which the region's higher education institutions are not training enough students to meet labor market demands. In the field of computers and mathematics, the region is projected to have an annual deficit of 52 computer programmers – or more than seven openings per graduate – a position which requires a bachelor's degree and pays up to $67,000 a year, notably more than the region's median household income.[8]

Although the region will see a significant oversupply of managers of all different sorts – with hundreds more general managers, engineering managers, community service managers and even construction managers than there is demand – the field of business will be tighter in the area of finance. Accountants and auditors, among other positions, are expected to be in short supply. Employers will also find a deficit of post-secondary teachers for nearly every discipline.

The region is graduating too many school counselors, but it is falling short of employers' demand for rehabilitation and mental health counselors. Similarly, health care provider demand for registered nurses in the region exceeds the rate at which area programs are producing graduates, with 32 more openings annually than there are graduates.[9]

[8] According to the 2006 American Community Survey, the median household income in the Buffalo Niagara Metropolitan Region is $48,451.

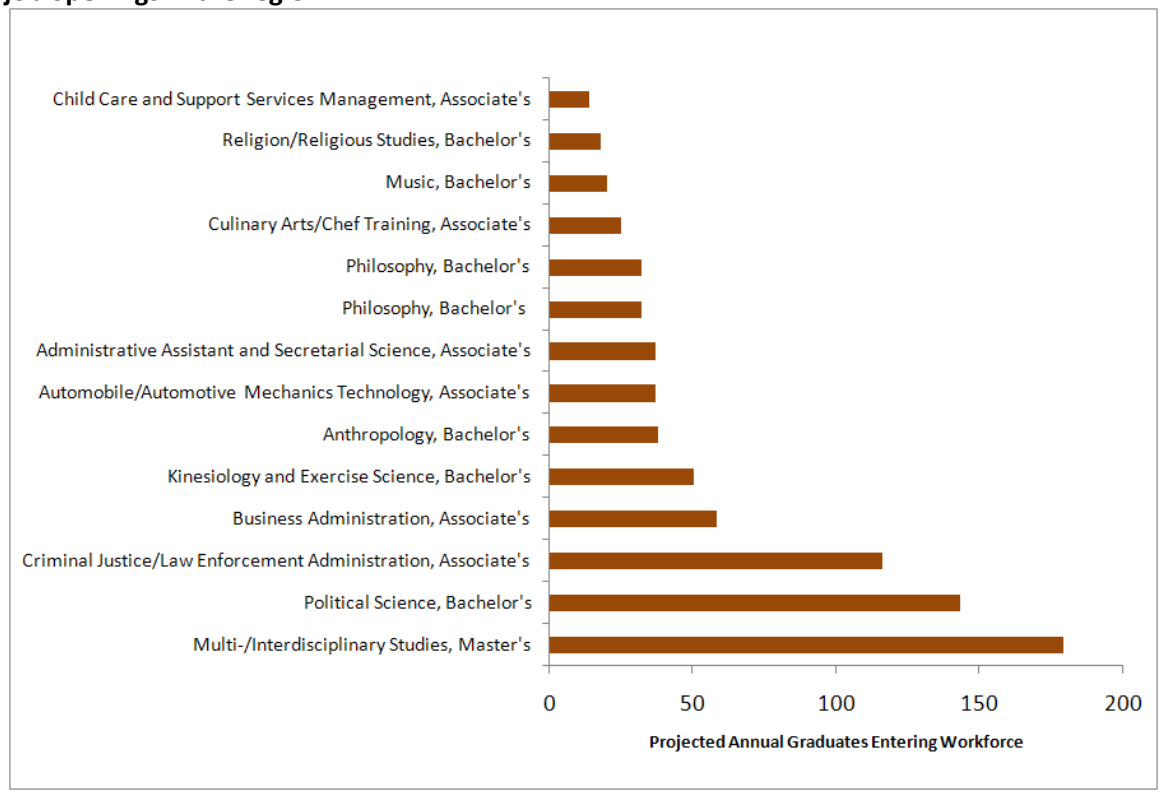
[9] The region's nursing shortage is likely more significant than reflected here, as this analysis does not account for factors pulling nursing graduates out of the region, including high demand for nurses across the nation.

Figure 9
There are more than 100 job openings in Western New York for which regional colleges produce no qualified graduates.

Job Title	Annual Openings	Matching Field of Study
Associate's Degree		
Medical equipment repairers	10	Biomedical Technology
Diagnostic medical sonographers	5	Diagnostic Medical Sonography and Ultrasound Technician
Cardiovascular technologists and technicians	5	Cardiovascular Technology/Technologist
Funeral directors	2	Funeral Service and Mortuary Science
Bachelor's Degree		
Securities, commodities, and financial services sales agents	20	Financial Planning and Services
Insurance underwriters	20	Insurance
Sales engineers	10	Selling Skills and Sales Operations
Biological technicians	10	Biology Technician/Biotechnology Laboratory Technician
Property, real estate, and community association managers	7	Real Estate
Master's Degree		
Environmental scientists and specialists, including health	10	Environmental Science
Operations research analysts	5	Operations Research or Management Science
Doctoral Degree		
Vocational Education Teachers, Postsecondary	11	Trade and Industrial Teacher Education
First-Professional Degree		
Veterinarians	10	Veterinary Sciences

Among the more troubling findings of this analysis are the several job openings for which the region's colleges and universities lack the degree programs which traditionally prepare workers for such employment (**Figure 9**). For instance, about 30 mainly technical and health-related positions likely will not be filled by Western New York college graduates due to the absence of programs offering the related associate's or bachelor's degree. The region also will not generate any qualified college graduates for the 50 job openings requiring sales and finance training at the bachelor's level. At more advanced levels, the absence of programs such as veterinary and environmental science could force employers to look elsewhere to fill more than 35 annual openings. Noteworthy is that several jobs for which the region generates no graduates fall in the field of life sciences. This industry is leading the region's knowledge economy growth; labor shortages could pose a significant roadblock to its continued expansion (see **Section VI, Focus on the Life Sciences**). These numbers should be interpreted conservatively, however, as employers in several of these areas, especially sales, often select candidates based on work experience and skills rather than a degree. Nonetheless, these gaps in graduate supply present an opportunity for the region's colleges and universities to develop new academic programming and/or tailor existing programs to better align with the region's knowledge workforce needs.

Figure 10
Many degrees offered by Western New York colleges and universities match no degree-requiring job openings in the region.



Many graduates of the region's higher education degree programs will fall between the cracks, having earned a degree that is not necessary for most positions in that field and inadequate for degree-requiring openings in that field (**Figure 10**). For instance, the nearly 120 graduates who earn an associate's degree in criminal justice are over qualified as a security guard (a position requiring no college degree). In other cases, a bachelor's degree in philosophy or music does not meet the level of education required for degree-requiring positions in these areas (e.g., a university professor of philosophy or music). These findings may overestimate the oversupply of students however, as many may opt to stay in school, depending on local job opportunities, to pursue a higher degree that qualifies them for advanced positions in that field. It also should be noted that the Bureau of Labor Statistics' classification system on which this analysis is based conservatively matches degree types with occupations. For instance, multi- and interdisciplinary studies represents a field of study for which the analysis found no employment matches in the region, even though this degree likely qualifies students for several degree-requiring positions.

VI. Focus on the Life Sciences

Positioning Western New York on the cutting edge of the knowledge economy is its emerging life sciences cluster, which leverages the region's biological and medical research capacity for technological innovations and commercial applications. With an imperative for increased health care quality driving nationwide growth in the industry, Western New York is distinguished by its rich history of life sciences advances and critical mass of research centers and academic institutions in medicine and health. More than $300 million in public and private investment has supported infrastructure and program development, including the Buffalo Niagara Medical Campus and the Buffalo Life Sciences Complex, which links units such as the University at Buffalo, Roswell Park Cancer Institute, Hauptman-Woodward Medical Research Institute and dozens of private companies. Fundamental to continued growth in the life sciences is an even stronger academic-industry partnership that incubates research concepts into entrepreneurial opportunities and strategically develops a life sciences workforce.

Western New York's life sciences industry already employs approximately 2,800 professionals ranging from medical scientists and microbiologists to biological and chemical technicians. Support staff such as clerks, bookkeepers and grant writers, accounts for an additional 3,700 workers, bringing total industry employment to nearly 6,500.[10] Industry growth in the region is anticipated to create 50 openings for life scientists and 30 for biological and chemical technicians annually through 2014, according to the New York State Department of Labor. Undoubtedly, the region's colleges and universities will play a critical role in supplying labor for this nascent industry.

At this point, however, higher education in Western New York will fall short of life science demand for labor with a shortage of more than 20 graduates relative to job openings annually through 2014 (**Figure 11**).

[10] See Buffalo Niagara Enterprise, *Buffalo Niagara Life Sciences: Opportunities and Advantages*, http://www.buffaloniagara.org/files/pdf/LifeSci-Brochure.pdf.

Figure 11

Match-Gap Analysis for Life Sciences

Life Sciences Occupational Titles	Degree Required	Average Salary	Projected Openings	Projected Graduates Entering Workforce	Gap Between Openings & Graduates
Biochemists and Biophysicists	Doctoral	$ 84,410	10	3	7
Medical Scientists, Except Epidemiologists	Doctoral	$ 59,340	20	23	-3
Microbiologists	Doctoral	$ 122,970	10	17	-7
Conservation Scientists	Bachelor's	$ 54,640	0	0	0
Food Scientists and Technologists	Bachelor's	$ 53,810	0	0	0
Zoologists and Wildlife Biologists	Bachelor's	$ 53,300	0	0	0
Biological Scientists, All Other	Bachelor's	$ 59,560	10	13	-3
Biological Technicians	Associate's	$ 34,570	10	0	10
Chemical Technicians	Associate's	$ 39,770	10	1	9
Other Life, Physical & Social Science Technicians	Associate's	$ 44,240	10	2	8
TOTAL			80	59	21

1.1 doctoral graduates per opening

1.3 bachelor's graduates per opening

10 openings per graduate with an associate's degree

Microbiology graduates include those projected to earn a doctoral degree in microbiology and/or cell and molecular biology through Roswell Park Institute, a program that is associated with the University at Buffalo but separate from those offered through the UB School of Medicine and Biomedical Sciences.

For all but three occupational titles within the field of life sciences, employers will be required to look outside the region for qualified labor. The shortages cut across all levels of training – from associate's to doctoral degrees. In fact, the labor gap as a ratio of job openings to graduates is starkest for science technicians trained at the associate's level (an average of 10 job openings for every graduate). Moreover, the slight oversupply of life science doctorates relative to job openings may not reflect the actual marketplace, as more than half of those graduating with a doctoral degree in the biological sciences are not permanent residents of the United States and will likely return to their native country after graduation. However, employers seeking to fill positions at this level typically recruit nationally and even internationally anyway.[11]

[11] Many universities do not expect to fill doctoral-level scientist positions with in-region labor. Recruitment efforts are nationwide and sometimes international, according to a personal interview with Walter A. Pangborn, Executive Vice President, Hauptman-Woodward Medical Research Institute.

In shortest supply will be graduates trained as biological technicians, a position which requires an associate's degree not offered by any of the 22 colleges and universities in Western New York. While Erie Community College offers a degree in clinical/medical technology, somewhat related to training for biological technicians, these students are generally trained to work in clinical settings versus the research-oriented environment of life sciences. The region also lacks bachelor's degree programs in conservation science, food science and technology, and zoology and wildlife biology, though there are no job openings requiring this degree.

Other significant gaps exist for biochemist doctorates and associate's-level chemical technicians. The projected ratio of openings to graduates for chemical technicians is 10 to one. In 2005-06, a single student graduated from Erie Community College with the required associate's degree.

There are only three life sciences positions for which graduate numbers exceed job openings. The biggest gap exists in the area of microbiology, where the region will have a surplus of seven doctorates relative to job openings. The medical science doctoral program, generating more graduates than any other life sciences program in the region, will have a small oversupply of graduates. Again, these surpluses are likely overstated given the proportion of non-native students in these programs. The region's bachelor's programs in biology are graduating more than are in demand by regional employers, likely because more advanced training is typically required for positions in this field.

Figure 12

Labor Shortages in Life Sciences Support Areas May Further Challenge Industry Growth

Several leaders in the region's life sciences industry consulted for this report highlighted shortages in areas that provide critical support to the life sciences industry. For instance, the region's scarcity of computer programmers is an obstacle for this highly technical industry. Many companies in the industry also cite a need for medical technicians and entry-level biomanufacturing employees, positions which require no college degree but certificate training.

The region has developed several programs to cultivate such industry support, including Career Pathways in Life Sciences provided by the Educational Opportunity Center and Millard Fillmore College of Continuing Education, in collaboration with the New York State Center of Excellence. Erie Community College and several biopharmaceutical manufacturers now offer a certificate program in biomanufacturing to address current and projected shortages.* Graduates of the (full) first class will be introduced to area employers with job openings.

*Buffalo & Erie County Workforce Investment Board, *Bio-Manufacturing and Pharmaceutical Manufacturing Workforce Needs Assessment Survey* (2006).

Sustained growth of Western New York's life sciences industry will be highly dependent on the access employers have to a talented and educated workforce, from leading life scientists to professional support staff including lab technicians. Graduate shortages cut across the life sciences industry (and even critical support areas, see **Figure 12**), curtailing the region's ability to grow existing and attract new businesses. Continued development of life scientists, especially in the areas of entrepreneurship and business management, also will be critical to the transfer of science into the commercial marketplace.[12]

Several workforce development efforts and new academic programs may help to address the region's life sciences labor shortages. Genesee Community College reached out to about 40 high schools students through a summer 2008 program, Wired Biotechnology Program, featuring college-level coursework, tours of life sciences companies and paid internships. ISciWNY (http://iSciWNY.com) links high school students, college students and adults seeking a career change with life sciences training. A collaboration among the New York State Center of Excellence in Bioinformatics and Life Sciences, the Educational Opportunity Center, the New York State Department of Labor and the Bank of America, the ISciWNY initiative also targets high school science teachers in building awareness of potential life sciences career opportunities for their students.

Recently developed programs at area colleges and universities include biotechnology, bioinformatics, combinatorial chemistry and biotech management at the bachelor's level and beyond, and biomanufacturing and laboratory practices at the certificate and associate's level.[13] A proposed bioengineering program at the University at Buffalo could generate 80 bioengineering graduates at the bachelor's, master's and doctoral levels.[14] However, without a comprehensive strategy for building degree programs around sub-disciplines such as microbiology, biochemistry and biophyisics, the region will likely fail to supply the wide band of talent needed by this industry.

[12] Personal interview, Marnie LaVigne, Director of Business Development at the New York State Center of Excellence in Bioinformatics and Life Sciences.

[13] See Buffalo Niagara Enterprise, *Buffalo Niagara Life Sciences: Opportunities and Advantages*, http://www.buffaloniagara.org/files/pdf/LifeSci-Brochure.pdf.

[14] See Rey, Jay, "Oishei grant to help UB establish biomedical engineering program," *The Buffalo News*, September 18, 2008.

VII. Recommendations

Western New York's 22 colleges and universities constitute a key underpinning of the region's knowledge workforce, generating nearly 16,000 well-educated, labor-ready graduates on an annual basis. In general, however, the region's labor market does not – and is not anticipated to over the next several years – have the capacity to absorb these graduates, with just under 5,000 annual degree-requiring annual job openings. Such a breach in the region's graduate supply and labor demand portends a significant loss of growth potential for the region's knowledge economy, as these graduates trickle out to other regions for better job opportunities, or accept employment in the region for which they are overqualified. Though employing all these graduates is not to be expected, critical shortages in the field of life sciences could stifle growth in a foundational industry for the region's knowledge economy. With such opportunity loss looming, it is incumbent upon the region to take steps to realign higher education with workforce needs.

The Western New York Consortium of Higher Education, along with economic development and business leaders, can play a lead role in implementing the following recommendations:

General Recommendations

1. **Disseminate Report Findings, Seek Input from Regional Stakeholders**
   This analysis represents a key first step in building understanding of the relationship between higher education and workforce demand in Western New York. Before strategic action is taken, however, the Consortium should consider vetting the findings of this analysis with economic development and workforce development leaders. Such deliberation with the broader regional community is especially critical given the limitations of this analysis. As noted previously, the match-gap analysis examines the supply-demand dynamics within the confines of the Western New York region, and does not make adjustments for extra-regional forces that push and pull labor supply in and graduates out.

2. **Broaden Economic Development and Job Growth Efforts in Areas with Graduate Oversupply**

   Not only should regional leaders consider better aligning academic programming and enrollment with workforce needs, but efforts to generate job growth could be directed toward stemming the tide of graduate loss. Economic development entities should leverage the plentiful supply of graduates in attracting new or expanding existing businesses in Western New York. The region has a powerful economic development advantage in its supply of thousands of diversely educated graduates, especially as related research connects regional economic growth to the concentration of this population.[15] In targeting business development and expansion in the region, economic development officials should be encouraged to promote the ready supply of college graduates, especially in the fields of business, engineering, arts and design, and health care. At the same time, regional leaders might consider assessing whether graduates in areas of oversupply are getting jobs elsewhere.

3. **Implement a Multi-Pronged Approach to Realigning Higher Education with Workforce Needs**

   While it would be imprudent to make long-term policy, enrollment or programming changes in areas where graduate-workforce gaps are relatively narrow (especially given fluctuations in labor demand base on economic forces), such action may be considered where the deficiency or oversupply of graduates is extreme. Areas with the broadest gaps include education (more than 2,000 surplus graduates), business and management (nearly 1,500 graduates) and arts and entertainment (more than 500 graduates). At the same time, labor shortages are significant in the field of computers and mathematics, while narrow surpluses in the areas of business finance, health care support and the sciences merit attention. Consideration should be given however to programs where graduates are in oversupply are actually e provide schools of choice for education preparatio

   - *Inform Prospective College Students and College Graduates of Regional Labor Demand.* To shift enrollment away from areas of oversupply to areas of undersupply, the region will need to start at the high school level to build awareness of occupational areas with the greatest demand as well as those

[15] In *The Rise of the Creative Class*, author Richard Florida connects success in the new economy to a region's ability to attract and retain a "creative class" of individuals such as artists, engineers and scientists. Florida, R.A. (2002). *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. New York: Basic Books.

where there is an oversupply of labor. Expand existing and develop new programs that reach out to high school teachers and guidance counselors, and thereby help students make more informed choices regarding their college studies. At the same time, half of all associate's degree graduates and one-third of graduates of bachelor degree programs return to school. With many of the degrees awarded at this level in broad fields such as the liberal arts and business, the potential to train these students toward advanced degrees in fields where regional labor demand is strong could help correct the supply-demand imbalance.

- *Shift Resources within Programs.* Higher education institutions may want to consider shifting enrollment, where practicable. For instance, encouraging enrollment in specializations where there are shortages could limit the oversupply of graduates for other occupations (e.g., the region has a glut of graduates in secondary education, but a significant need for teachers at the post-secondary level; business managers are overly abundant, but graduates trained in business finance are in greater demand).
- *Develop New Academic Programming.* There are several areas of labor demand where the region's schools generate no graduates, including several technical programs in the life and physical sciences at the associate's level, and others at the master's and doctoral levels. Such gaps could be filled by enhancing or expanding existing, related fields of study with coursework or specializations. In some cases, new academic programs may need to be developed.
- *Develop Joint Programming Across the Region's Colleges and Universities.* The region's colleges and universities should identify complementary academic programming and develop strategic cross-registration programs to better train students for the needs of the Western New York workforce.

4. **Establish Region-Wide Forum to Monitor Progress and Adjust Resource Allocation**
College and university career services, key academic officials across the 22 schools, the region's economic development and workforce development community, employers, and the region's elementary and secondary schools, should consider collaborating on regular basis to anticipates shifts in labor demand and graduate supply, and reallocate resources accordingly. Continued monitoring of graduate supply and workforce demand would further inform policy action.

Focus on the Life Sciences

5. **Expand Existing and Develop New Programming to Increase Scientist and Technician Graduate Numbers**
   Western New York will be hard-pressed to continue to grow the research end of this sector without developing capacity to meet employer demand for scientists and supporting technicians. The University at Buffalo should consider expanding its doctoral programs in microbiology, biochemistry and pharmacology. Erie Community College might also expand its two-year chemical technician program while developing an associate's-level biology technician program. All colleges could consider the addition of specialized coursework to the bachelor's program in biology, one of only two life sciences areas generating a surplus of graduates. Attention should also be given to programs that generate graduates in critical support areas such as computer scientists and cultivate skills through certificate programs.

6. **Target Prospective College Students and College Graduates to Build Life Sciences Workforce Capacity**
   Building on the success of existing programs such as Genesee Community College's Wired Biotechnology initiative, ISciWNY and Career Pathways, life sciences employers and representatives of Western New York higher education and secondary education should consider partnering to expand efforts that build interest in life sciences as well as science and math skills among the region's youth. Moreover, these same leaders should reach out to associate's and bachelor's graduates that plan to pursue advanced degrees to encourage specialization in life sciences fields.

7. **Build Entrepreneurial Capacity in Life Sciences Students and Existing Life Scientists**
   Without fundamental skills in entrepreneurship and business management, the region's life scientists are limited in their ability to convert research into commercial and economic development opportunities. The region's higher education institutions can play a part in cultivating this aptitude through complementary courses linking business and management with life sciences disciplines, as well as providing professional development opportunities for the existing life sciences workforce.

In the end, the onus is not on higher education to enhance the knowledge economy in Western New York. This will involve deliberate collaborative efforts among key stakeholders in education, private, nonprofit and public sectors to strategically position the region for the 21st century economy.

Appendix A: Data Sources and Detailed Methodology

The purpose of this match-gap analysis is to identify misalignments between the demand for college-educated workers in Western New York and the supply of college graduates by the 22 institutions of higher education in the region. The analysis was conducted in a two-step process using data from the National Center for Educational Statistics (graduate supply) and the Bureau of Labor Statistics and the New York State Department of Labor (job openings). Matches were determined based on the National Crosswalk Service Center which links fields of study with appropriate occupational titles. The methodology for the analysis was modified from similar studies conducted by the Washington Higher Education Coordinating Board (2006) and the Kansas Department of Commerce. The following reviews more specifically the data sources and methodology employed by this analysis.

Data Sources

Supply of Graduates: Data on the number of graduates entering the workforce for each degree program within Western New York were obtained through the IPEDS Dataset Cutting Tool (http://nces.ed.gov/ipedspas/dct/index.asp). Graduation data were gathered for the 22 member schools of the Western New York Consortium of Higher Education.

Job Openings: The number of regional job openings available was determined based on the New York State Department of Labor's (NYSDOL) *Occupational Employment Statistics Survey* (http://www.labor.state.ny.us/workforceindustrydata/descriptor_print.asp?reg=wny&sort=s.soctitlel). For occupations where projections were not calculated, total employment for the region was pulled from the NYSDOL 2006 Occupational Employment Survey (OES). For occupations where these data were unavailable, annual job openings were estimated using an index determined by the Bureau of Labor Statistics' *Job Openings and Labor Turnover Survey (http://data.bls.gov/cgi-bin/dsrv?jt).* National turnover rates were inferred to be comparable to those observed regionally. This survey catalogues turnover using the broad North American Industry Classification System (NAICS). For purposes of comparability, NAICS descriptions and associated turnover rates were matched as closely as possible to the employment data SOC labeling.

For certain occupations, however, estimates were withheld either for failure to meet Bureau of Labor Statistics quality standards, or to protect the confidentiality of respondents. In such cases, employment numbers were obtained through 2007 Bureau of Labor Statistics data for the two-county (Erie, Niagara) Buffalo-Niagara metropolitan area.

Consequently, employment data for occupations missing from the OES report will be conservative as they reflect employment in two counties rather than the five-county Western New York Region.

Occupational training requirements: Occupational training requirements were determined based on the experience requirements identified by the Bureau of Labor Statistics for each job title (http://data.bls.gov/oep/noeted/empoptd.jsp). It was assumed that a graduate with a matching or higher-level degree than required for each position would be qualified for employment. Certain occupations, however, did not have listed requirements. Such positions were typically specific post-secondary education positions in which a doctoral degree would be required, or medical occupations in which a first-professional degree would be required. Consequently, the overarching SOC for post-secondary education and certain medical fields was applied to specific post-secondary education positions (e.g. history, post-secondary education) or medical positions where it was inferred there would be a comparable entry-level requirement.

First-Professional Degrees:

Chiropractic (DC or DCM)
Dentistry (DDS. or DMD)
Law (LLB, JD)
Medicine (MD)
Optometry (OD)
Osteopathic Medicine (DO)
Pharmacy (PharmD)
Podiatry (DPM, DP, or PodD)
Theology (MDiv, MHL, BD, or Ordination)
Veterinary Medicine (DVM)

Linking college degrees to occupations: A six digit Classification of Instruction Program (CIP) code, as provided by the National Center for Educational Statistics, was requested for all programs and degrees awarded by the 22 colleges and universities at the Associate, Bachelor, Master, Doctoral and First-Professional levels. Using these codes, educational programs and graduate numbers were mapped to degree-requiring occupations with job openings in Western New York. Matches were revealed using a system developed by the National Crosswalk Service Center (http://www.xwalkcenter.org/), which summarizes for each educational program and degree level the occupations for which it would qualify a graduate.

Additional Data Sources

Consultation with Leaders of Western New York Life Sciences Industry:

Marnie LaVigne, Director of Business Development, University at Buffalo Center for Advanced Biomedical and Bioengineering Technology, New York State Center of Excellence in Bioinformatics & Life Sciences

Walter A. Pangborn, Executive Vice President, Hauptman-Woodward Medical Research Institute

Sherryl D. Weems, Director, University at Buffalo Educational Opportunity Center

Analyses

The match-gap analysis was conducted in a two-step process, carried out for every job opening in Western New York requiring a college degree.

Step one: For each degree-requiring position in Western New York, the projected number of openings was matched to the projected number of graduates entering the workforce with a degree level equal to or higher than that required by the position.

Example: The job title "writers and authors" has a projected 10 openings annually in Western New York through 2014. There are 577 students who enter the workforce every year with a bachelor's degree or higher in a matching field such as communications studies, creative writing and journalism (**Figure A**).[16] The majority of these students major in communications studies/speech communication and rhetoric. This analysis reveals a gap between employer demand for college graduates (10 openings) and the supply of new college graduates (577 graduating students).

Figure A

SOC	SOC Title	Degree required	Projected Annual Openings	Related CIP	Projected graduates entering workforce with matching or higher degree
27-3043	Writers and Authors	Bachelor's	10	Communication Studies/Speech Communication and Rhetoric	401
				Communication, Journalism, and Related Programs, Other	31
				Creative Writing	1
				English Composition	0
				Journalism	68
				Mass Communication/Media Studies	75
				Technical and Business Writing	1
				Total:	577

Step two: Depending on the degree, graduates are qualified for more than one job opening. Thus, the actual supply of qualified graduates for a certain job opening is depleted by demand for these graduates in other areas. The next step adjusts the

[16] These figures take into account the estimated third of bachelor's degree graduates who will stay in school and pursue a higher degree.

graduate-to-jobs gap in consideration of all degree-requiring occupations in Western New York that have demand for these graduates.

Example: Communication Studies/Speech Communication and Rhetoric graduates are hired by employers seeking communication teachers and public relations specialists, as well as those seeking writers and authors. The latter accounts for only 29 percent of total employer demand for Communications Studies graduates in Western New York (**Figure B**). Consequently, it was estimated that 29 percent of Communications Studies graduates entering the workforce (115 graduates) would be available to employers seeking writers and authors.

Figure B

Related CIP	Degree-requiring occupations in WNY that hire these graduates	Projected Annual Openings	% Total job demand
Communication Studies/Speech Communication and Rhetoric	Communications Teachers, Postsecondary	5	14%
	Public Relations Specialists	20	57%
	Writers and Authors	10	29%
	Total:	35	100%

This process was carried out for all fields of study that generate college-educated workers for writer and author jobs in Western New York. In the end, of the 577 qualified graduates, about 400 are sought for other positions, leaving only 179 graduates available for the projected 10 writer and author openings (**Figure C**).

Figure C

SOC Title	Degree required	Projected Annual Openings	Related CIP	Projected graduates entering workforce with matching or higher degree	Projected graduates distributed to this job
Writers and Authors	Bachelor's	10	Communication Studies/Speech Communication and Rhetoric	401	114
			Communication, Journalism, and Related Programs, Other	31	16
			Creative Writing	1	0
			English Composition	0	0
			Journalism	68	23
			Mass Communication/Media Studies	75	25
			Technical and Business Writing	1	0
			Total:	577	179

The ratio of graduates to job openings was calculated by dividing the 179 graduates by the 10 openings, resulting with 18 graduates with an appropriate degree vying for every opening as a writer or author.

Appendix B: Summary Matrix of Occupation-Education Gaps

SOC	Job Title	Projected Annual Openings	Projected Annual Graduates	Gap Between Graduates and Job Openings (+)=Oversupply of grads; (-)=Undersupply of grads
	Management Occupations			
11-1021	General and Operations Managers	140	548	408
11-9041	Engineering Managers	10	306	296
11-9121	Natural Sciences Managers	5	258	253
11-1011	Chief Executives	50	196	146
11-9151	Social and Community Service Managers	40	185	145
11-9021	Construction Managers	40	152	112
11-3011	Administrative Services Managers	30	114	84
11-2022	Sales Managers	20	103	83
11-3021	Computer and Information Systems Managers	20	39	19
11-9033	Education Administrators, Postsecondary	20	31	11
11-9039	Education Administrators, All Other	20	31	11
11-2021	Marketing Managers	20	27	7
11-2011	Advertising and Promotions Managers	5	7	2
11-9031	Education Administrators, Preschool and Child Care	5	5	0
11-9061	Funeral Directors	2	0	-2
11-9032	Education Administrators, Elementary and Secondary School	40	37	-3
11-3049	Human Resources Managers, All Other	5	0	-5
11-3042	Training and Development Managers	5	0	-5
11-2031	Public Relations Managers	5	0	-5
11-9141	Property, Real Estate, and Community Association Managers	7	0	-7
11-3041	Compensation and Benefits Managers	10	1	-9
11-3061	Purchasing Managers	10	0	-10
11-1031	Legislators	10	0	-10
11-9111	Medical and Health Services Managers	50	36	-14
11-3031	Financial Managers	50	31	-19
	Business and Financial Operations Occupations			
13-1051	Cost Estimators	30	186	156
13-1111	Management Analysts	30	114	84
13-2041	Credit Analysts	10	10	0
13-2031	Budget Analysts	5	5	0
13-1073	Training and Development Specialists	20	18	-2
13-2061	Financial Examiners	5	3	-2
13-1079	Human Resources, Training, and Labor Relations Specialists,	40	37	-3
13-2081	Tax Examiners, Collectors, and Revenue Agents	10	6	-4
13-1081	Logisticians	5	0	-5
13-1121	Meeting and Convention Planners	5	0	-5
13-2021	Appraisers and Assessors of Real Estate	10	0	-10
13-2051	Financial Analysts	20	10	-10
13-2072	Loan Officers	20	8	-12
13-1071	Employment, Recruitment, and Placement Specialists	20	2	-18
13-1072	Compensation, Benefits, and Job Analysis Specialists	20	2	-18
13-2053	Insurance Underwriters	20	0	-20
13-1199	Business Operations Specialists, All Other	60	12	-48
13-2011	Accountants and Auditors	160	107	-53
	Computer and Mathematical Occupations			
15-1071	Network and Computer Systems Administrators	30	68	38
15-1099	Computer Specialists, All Other	5	24	19
15-1032	Computer Software Engineers, Systems Software	40	50	10
15-2041	Statisticians	1	2	1
15-1061	Database Administrators	10	9	-1
15-1011	Computer and Information Scientists, Research	4	0	-4
15-2031	Operations Research Analysts	5	0	-5
15-1081	Network Systems and Data Communications Analysts	40	32	-8
15-1051	Computer Systems Analysts	50	40	-10
15-1031	Computer Software Engineers, Applications	40	26	-14
15-1021	Computer Programmers	60	8	-52
15-1041	Computer Support Specialists	80	0	-80

SOC	Job Title	Projected Annual Openings	Projected Annual Graduates	Gap Between Graduates and Job Openings (+)=Oversupply of grads; (-)=Undersupply of grads
	Architecture and Engineering Occupations			
17-2071	Electrical Engineers	10	61	51
17-1011	Architects, Except Landscape and Naval	10	61	51
17-3023	Electrical and Electronic Engineering Technicians	10	50	40
17-2051	Civil Engineers	20	58	38
17-3027	Mechanical Engineering Technicians	10	46	36
17-2141	Mechanical Engineers	30	63	33
17-3029	Engineering Technicians, Except Drafters, All Other	10	43	33
17-2072	Electronics Engineers, Except Computer	5	31	26
17-2112	Industrial Engineers	40	58	18
17-3026	Industrial Engineering Technicians	10	24	14
17-2041	Chemical Engineers	5	16	11
17-2131	Materials Engineers	5	7	2
17-1012	Landscape Architects	5	5	0
17-3022	Civil Engineering Technicians	5	3	-3
17-2061	Computer Hardware Engineers	5	1	-4
17-2111	Health and Safety Engineers, Except Mining Safety Engineers	5	1	-4
17-3025	Environmental Engineering Technicians	5	0	-5
17-1022	Surveyors	10	3	-7
17-2081	Environmental Engineers	20	2	-18
	Life, Physical and Social Science Occupations			
19-3021	Market Research Analysts	30	156	126
19-2031	Chemists	10	39	29
19-3051	Urban and Regional Planners	10	24	14
19-1022	Microbiologists	10	17	7
19-4011	Agricultural and Food Science Technicians	5	12	7
19-3093	Historians	1	7	6
19-1029	Biological Scientists, All Other	10	13	3
19-1042	Medical Scientists, Except Epidemiologists	20	23	3
19-2042	Geoscientists, Except Hydrologists and Geographers	5	5	-1
19-1031	Conservation Scientists	5	0	-5
19-3039	Psychologists, All Other	22	17	-5
19-4091	Environmental Science and Protection Technicians, Including	10	4	-6
19-1021	Biochemists and Biophysicists	10	2	-8
19-4099	Life, Physical, and Social Science Technicians, All Other	10	2	-8
19-3031	Clinical, Counseling, and School Psychologists	20	11	-9
19-4031	Chemical Technicians	10	1	-10
19-2041	Environmental Scientists and Specialists, Including Health	10	0	-10
19-4021	Biological Technicians	10	0	-10
	Community and Social Science Occupations			
21-1012	Educational, Vocational, and School Counselors	60	265	205
21-1021	Child, Family, and School Social Workers	30	135	105
21-1029	Social Workers, All Other	30	128	98
21-1092	Probation Officers and Correctional Treatment Specialists	10	43	33
21-1019	Counselors, All Other	5	16	11
21-1013	Marriage and Family Therapists	5	16	11
21-2021	Directors, Religious Activities and Education	5	0	-5
21-1091	Health Educators	10	0	-10
21-2011	Clergy	30	19	-11
21-1011	Substance Abuse and Behavioral Disorder Counselors	20	5	-15
21-1023	Mental Health and Substance Abuse Social Workers	20	0	-20
21-1014	Mental Health Counselors	40	15	-25
21-1015	Rehabilitation Counselors	30	3	-27
	Legal Occupations			
23-1011	Lawyers	70	182	112
23-2011	Paralegals and Legal Assistants	20	56	36
23-1023	Judges, Magistrate Judges, and Magistrates	10	26	16
23-1021	Administrative Law Judges, Adjudicators, and Hearing	5	13	8
23-2092	Law Clerks	5	13	8

SOC	Job Title	Projected Annual Openings	Projected Annual Graduates	Gap Between Graduates and Job Openings (+)=Oversupply of grads; (-)=Undersupply of grads
	Education, Training and Library Occupations			
25-2031	Secondary School Teachers, Except Special and Vocational	250	1166	916
25-2021	Elementary School Teachers, Except Special Education	280	908	628
25-2041	Special Education Teachers, Preschool, Kindergarten, and	100	388	288
25-2022	Middle School Teachers, Except Special and Vocational	110	323	213
25-3099	Teachers and Instructors, All Other	140	320	180
25-4021	Librarians	20	139	119
25-3011	Adult Literacy, Remedial Education, and GED Teachers and	20	94	74
25-1123	English Language and Literature Teachers, Postsecondary	6	29	23
25-2043	Special Education Teachers, Secondary School	50	73	23
25-2042	Special Education Teachers, Middle School	20	29	9
25-1124	Foreign Language and Literature Teachers, Postsecondary	5	12	7
25-4011	Archivists	5	11	6
25-2012	Kindergarten Teachers, Except Special Education	40	44	4
25-4012	Curators	2	4	2
25-1067	Sociology Teachers, Postsecondary	5	7	2
25-1042	Biological Science Teachers, Postsecondary	4	4	0
25-1052	Chemistry Teachers, Postsecondary	5	5	0
25-1066	Psychology Teachers, Postsecondary	2	1	-1
25-1125	History Teachers, Postsecondary	5	4	-1
25-1021	Computer Science Teachers, Postsecondary	2	0	-2
25-1121	Art, Drama, and Music Teachers, Postsecondary	5	2	-3
25-1122	Communications Teachers, Postsecondary	5	1	-4
25-1022	Mathematical Science Teachers, Postsecondary	5	1	-4
25-2023	Vocational Education Teachers, Middle School	5	1	-4
25-1072	Nursing Instructors and Teachers, Postsecondary	5	0	-5
25-9011	Audio-Visual Collections Specialists	5	0	-5
25-1011	Business Teachers, Postsecondary	10	0	-10
25-1191	Graduate Teaching Assistants	11	0	-11
25-1194	Vocational Education Teachers, Postsecondary	11	0	-11
25-2032	Vocational Education Teachers, Secondary School	30	4	-26
25-1199	Postsecondary Teachers, All Other	258	0	-258
	Arts, Design, Entertainment, Sports and Media Occupations			
27-1011	Art Directors	10	2	-8
27-1014	Multi-Media Artists and Animators	10	10	0
27-1021	Commercial and Industrial Designers	5	12	7
27-1024	Graphic Designers	10	25	15
27-1025	Interior Designers	5	7	2
27-2041	Music Directors and Composers	8	45	37
27-3022	Reporters and Correspondents	10	48	38
27-3031	Public Relations Specialists	20	229	209
27-3041	Editors	10	64	54
27-3043	Writers and Authors	10	179	169
	Healthcare Practioners and Technical Occupations			
29-1022	Oral and Maxillofacial Surgeons	Not Available	0	N/A
29-1123	Physical Therapists	40	166	126
29-1069	Physicians and Surgeons, All Other	40	119	79
29-1051	Pharmacists	40	116	76
29-2056	Veterinary Technologists and Technicians	10	53	43
29-1127	Speech-Language Pathologists	40	63	23
29-1071	Physician Assistants	20	41	21
29-1122	Occupational Therapists	20	38	18
29-1062	Family and General Practitioners	5	15	10
29-9091	Athletic Trainers	5	13	8
29-2071	Medical Records and Health Information Technicians	20	25	5
29-1031	Dietitians and Nutritionists	10	14	4
29-2033	Nuclear Medicine Technologists	5	6	1
29-1121	Audiologists	5	5	0
29-2011	Medical and Clinical Laboratory Technologists	10	10	0

SOC	Job Title	Projected Annual Openings	Projected Annual Graduates	Gap Between Graduates and Job Openings (+)=Oversupply of grads; (-)=Undersupply of grads
29-2054	Respiratory Therapy Technicians	5	4	-1
29-2034	Radiologic Technologists and Technicians	40	38	-2
29-1065	Pediatricians, General	4	0	-4
29-2021	Dental Hygienists	30	26	-4
29-1126	Respiratory Therapists	20	16	-4
29-1023	Orthodontists	5	0	-5
29-1061	Anesthesiologists	5	0	-5
29-1063	Internists, General	5	0	-5
29-1066	Psychiatrists	5	0	-5
29-2031	Cardiovascular Technologists and Technicians	5	0	-5
29-2032	Diagnostic Medical Sonographers	5	0	-5
29-9011	Occupational Health and Safety Specialists	5	0	-5
29-1064	Obstetricians and Gynecologists	7	0	-7
29-1125	Recreational Therapists	10	0	-10
29-1131	Veterinarians	10	0	-10
29-2012	Medical and Clinical Laboratory Technicians	20	6	-15
29-1111	Registered Nurses	520	488	-32
	Healthcare Support Occupations			
31-2011	Occupational Therapist Assistants	5	19	14
31-2021	Physical Therapist Assistants	20	10	-10
	Sales and Related Occupations			
41-9031	Sales Engineers	10	0	-10
41-3031	Securities, Commodities, and Financial Services Sales Agents	20	0	-20
41-3021	Insurance Sales Agents	40	0	-40
	Office and Adminisrative Support Occupations			
43-6012	Legal Secretaries	20	0	-20
	Installation, Maintenance and Repair Occupations			
49-9062	Medical Equipment Repairers	10	0	-10