

Talent Pipeline Management in the NIMBLE Region Conclusions and Possible Action Steps

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The findings and conclusions presented in this report are those of the author alone and do not necessarily reflect the views, opinions, or policies of the officers and/or trustees of Northern Illinois University. For more information, please contact Diana Robinson at drobinson@niu.edu.

Prepared by Diana Robinson

NORTHERN ILLINOIS UNIVERSITY, CENTER FOR GOVERNMENTAL STUDIES

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Background

In February 2016, the Northern Illinois Workforce Alliance received a grant from the Community Foundation of Northern Illinois to explore manufacturing talent pipeline issues in Boone, Winnebago, Stephenson, and Ogle counties. Following a series of meetings with employers, business associations, education and training providers, and economic development entities, it was agreed that the Talent Pipeline Management (TPM) model developed by the U.S. Chamber of Commerce Foundation (USCCF) would serve as the organizing framework for this four-county initiative.

TPM applies the principles of supply chain management to talent development by engaging employers in demand planning, communicating competency and credential requirements, and analyzing talent flows. These activities will enable employers to manage the talent pipeline through clear and concise communications with education and training providers in the supply chain and address three core goals:

1. reduce skills gaps that result in a better-prepared manufacturing workforce,
2. increase job candidates' understanding of employer hiring expectations and requirements, and
3. improve retention and job placement outcomes for education and training partners.

Employers met between June 2016 and October 2017 to discuss how they would implement TPM in the NIMBLE region. Early efforts focused on understanding the USCCF model and undertaking an initial foray into collecting demand data. However, this focus soon shifted to two other issues of critical importance to employers: essential employability skills for every entry-level worker and presenting manufacturing as a viable career to job-seekers of all ages, but particularly young people. These interests led the NIMBLE manufacturers to an existing manufacturing competency model that addresses four areas identified as important by the NIMBLE manufacturers: personal effectiveness, basic academic skills, workplace basics, and industry-wide technical competencies (see Appendix A). Another result was a discussion with regional educational providers to discuss how career awareness and exploration efforts in manufacturing might be expanded.

As this work unfolded, a number of other existing initiatives were discussed that related directly to talent pipeline management and specific interests of the NIMBLE manufacturers. Four of these are:

- A statewide career clusters/pathways initiative that is connecting learners of all ages with career planning and credentialing tools,
- New regional and state-level essential/soft skills frameworks that can help ensure all current and prospective job-seekers understand and can demonstrate the importance of soft skills,
- A range of federally-funded workforce development resources for Illinois job seekers and employers made available through a network of one-stop centers, and

- An “Education Works” engagement initiative of the Community Foundation in Northern Illinois that supports the regional education system in developing healthy and productive citizens.

As the planning phase of TPM in the NIMBLE region concludes, an opportunity exists to integrate these important regional system resources into the USCCF model by and prioritize employers’ concerns and needs. This report presents five conclusions from the NIMBLE work to date with potential action steps for each.

Conclusion 1: The human talent potential to bridge the skills gaps exists in the NIMBLE region, but it will require increased efforts by employers, education and training providers, and regional leadership to realize this potential.

Available information regarding the supply and demand dynamics in the NIMBLE region, while incomplete, provides a broad framework for considering talent pipeline management strategies (see Appendix B for a detailed description of available data sources). Even though each estimate is subject to a variety of caveats, it is still possible to weave together the information to provide an approximate level of supply and demand.

Demand. After considering three estimates of projected manufacturing job demand from the Illinois Department of Employment Security, Burning Glass Technologies, and a local employer survey undertaken by the Northern Illinois Development Alliance (NIDA), the largest projection of 3,650 entry-level workers was selected to estimate demand over the next five years.

Supply. For the supply side, estimates of potential manufacturing workers from seven main suppliers serving the NIMBLE region are summarized below for 2015-16. These include:

- high school students enrolled in manufacturing-related career and technical education (CTE),
- Illinois community college manufacturing-related program completers (Highland Community College, Kishwaukee College, Rock Valley College, and Sauk Valley Community College),
- Completers of manufacturing-related programs offered by Wisconsin-based Blackhawk Technical College,
- Completers of CNC and cold forming programs offered by TechWorks, a manufacturing training program housed in Rock Valley College,
- Northern Illinois University’s engineering program completers,
- Manufacturing workers who have been terminated as a result of downsizing, automation, off-shoring, etc., and
- Registered apprenticeships.

The total estimated potential manufacturing employees available over the next five years that are represented by these seven main sources is 27,900 (see Table 1). It is important to note that there is an unknown level of duplication in these figures as high school students may be enrolled in CTE over

several years and others may be enrolled in more than one program simultaneously (for example, “dual enrollment” students who are concurrently enrolled in high school and community college courses). On the other hand, these figures exclude “discouraged workers” who are not actively seeking employment, retirees who may be interested in returning to work, and others with barriers to employment.

Table 1
Estimated Potential Manufacturing Workforce Entrants by Source in the NIMBLE Region

Source	Annual	5-Year	Comments
High School	4,412	22,060	Students taking an industrial technology class beyond introductory level
Community College	522	2,610	Completions in manufacturing-related programs
Blackhawk Tech. College	260	1,300	Completions in manufacturing-related programs
TechWorks	84	420	CNC and cold forming
Northern IL University	224	1,120	Bachelor’s level only in engineering
Separations	68	340	Net decreases in specific manufacturing occupations
Apprenticeships	10	50	Estimate for registered apprenticeship only
Total	5,580	27,900	

The ratio of potential supply to demand is estimated to be 27,900 to 3,650, or approximately 7.6 potential manufacturing workers for each projected job opening. Given this relatively abundant supply of potential workers, the NIMBLE employers’ emphasis on career awareness and basic employability skills is well-placed. Five possible action steps to build on existing statewide efforts and resources are described below.

Potential Action Steps

- a. ***Champion and connect with the State of Illinois’ career cluster/pathways model*** that has been adopted by K-12 school districts, community colleges, regional “Education for Employment” systems, local workforce areas, and civic leadership organizations (e.g. Alignment Rockford) in the region. This model is similar to the multi-level manufacturing competency model identified by the NIMBLE employers and has the added advantage of well-developed implementation resources. The highly regarded Career Cruising platform with its “Unite” employer engagement tool represents a framework into which NIMBLE manufacturers can plug to engage directly with schools and students.

An important take-away from the recent Education Works Summit convened by the Community Foundation of Northern Illinois was that educators and educational administrators were often unaware of important occupational and industry trends. Strengthening connections between

employers and schools will be key to providing young people with current and relevant labor market information. Extra-curricular programs such as Junior Achievement (JA) offers opportunities for business people, college students, parents, and retirees to discuss these ideas within the core JA content areas of work readiness, entrepreneurship, and financial literacy.

- b. ***Continue providing information to students and their parents about the education and technical skills required for good jobs*** in the New Economy. The misalignment between the degrees that college graduates earn and the skills needed for a job that fits their interest, abilities, education, and training has resulted in an estimated one-half of college grads being underemployed. A 2013 video by Kevin Fleming¹ continues to circulate and emphasizes the “1:2:7 Ratio,” or for every job requiring a master’s degree or higher, two bachelor level jobs will be available and seven associate degree or certificate jobs will be available. These associate degree or certificate occupations, many of which are in manufacturing, require high levels of technical skills, pay well, and can save students years of college and tuition.
- c. ***Adopt a region-wide essential/soft skills framework*** to help ensure a consistent approach to addressing employers’ needs for qualified entry-level workers. The Workforce Connection is funding the development of an employability certificate based on entry-level skills identified by area manufacturing and placement supervisors. Training modules have been developed for four entry-level skill sets:
- **Communications** (oral communication, e-mail etiquette, meeting participation, obstacles to good communication, listening styles, assertiveness, dealing with difficult people),
 - **Time Management** (keeping a time log, prioritizing at work and home, overcoming time obstacles, planning to deal with obstacles, dealing with stress, goal setting),
 - **Teamwork** (working with others, working in improvement teams, team process, statistical tools, brainstorming, data collection, affinity grouping, multi voting, situational leadership, group behaviors, trust, cause and effect, fishbone diagramming, flow charting), and
 - **Professionalism** (basic skills, manners, language and behavior, hygiene, dress for job, meeting and introducing people, plans for getting to work and back up plans, giving and receiving feedback and criticism, meeting and exceeding goals, how to interview).

In addition to these training modules, training programs on appraising performance and conflict resolution for supervisors also have been developed. As of the writing of this report, 12 individuals completed a train-the-trainer program and are prepared to teach these classes to participants and to supervisors at companies. Pre- and post-assessments will be given to

¹ Fleming, k. (2013). *Success in the New Economy: How prospective college students can gain a competitive advantage*. <https://vimeo.com/67277269>,

determine the level of learning acquired as a result of the training. A December 2017 launch of this initiative is anticipated.

- d. **Address real and perceived barriers in marketing manufacturing careers.** Manufacturers have long struggled to overcome outdated and inaccurate perceptions about manufacturing work and workplaces. Engaging with regional education and training providers provides an opportunity to dispel those myths and inspire young people to pursue careers in manufacturing. However, other barriers may exist as individuals consider manufacturing as a career pathway. As apparent in Table 2, industry-wide, women made up about one in four manufacturing employees in 2016, and increased at a slower rate than their male counterparts from 2010-16.

Table 2
Gender Distribution of the Manufacturing Workforce
in the NIMBLE Region: 2010 and 2016

Gender	2010	% of Total	2016	% of Total	% Change 2010-2016
Total	32,340	100.0%	37,139	100.0%	14.8%
Male	23,246	71.9%	27,093	73.0%	16.5%
Female	9,093	28.1%	10,046	27.0%	10.5%

Source: U.S. Census Bureau, *Quarterly Workforce Indicators*, 2010-2016.

Further, the wage gap between men and women in manufacturing, while having decreased between 2010 and 2016, remains significant. Table 3 shows that in 2010 women earned an average salary that was only 69.8% of men’s salaries, a proportion that increased to 75.9% in 2016. Because industry data includes a wide array of occupations, the gap may be due in part to differences in the types of jobs that men and women hold. Regardless, if the recruitment of women to help fill entry-level jobs is desirable, addressing the wage gap is likely to emerge as an important consideration.

Table 3
Wage by Gender of the Manufacturing Workforce
in the NIMBLE Region: 2010 and 2016

Average Wage			
Gender	2010	2016	% Change
Total	52,943	59,139	11.7%
Male	57,861	63,259	9.3%
Female	40,373	48,028	19.0%

Source: U.S. Census Bureau, *Quarterly Workforce Indicators*, 2010-2016.

Another relevant consideration in promoting manufacturing careers is the risk of automation. Burning Glass Technologies has added this to its database for various occupations and scores the probability of computerization for an occupation within the next 20 years. These scores are based on an Oxford University study on automation² that assigns scores by quartile, with “high risk of automation” reflecting the top quartile of scores (e.g., insurance underwriters), “medium risk” the next lowest quartile (e.g. machinists), and “low risk” reflecting the bottom two quartiles (e.g. home health aides). Eight of 10 occupational titles selected for this analysis were either at medium or high risk of automation (see Table B-6 in the appendix).

There is no argument that robotics and intelligent systems with self-learning algorithms will automate job tasks associated with blue-collar work, as well as less-routine job tasks that have been considered knowledge work³. However, young people thinking about their career choices may be recruited to manufacturing to help apply these digital tools in ways that generate new employment and organize work to augment skills.⁴

- e. ***Facilitate effective transitions from workforce preparation to the actual workplace*** for students and trainees. This last step of the education and training process was identified by NIMBLE employers as critical yet often missing in education and training programs. This transition also provides valuable feedback to the education and training providers regarding the readiness of their candidate for the workplace.

Conclusion 2: Real-time occupational demand data from employers - including specific skills and competencies - must be made available to accurately understand current and projected talent needs.

Illinois Department of Employment Security job projection data are used in state and regional workforce planning to identify anticipated occupational shortages and priority labor market needs. While IDES cautions that their data are only estimates, they nonetheless carry significant weight and are often relied upon for workforce and career planning. Another source of job projection data are tools that aggregate on-line job postings to provide “real-time” data. While such databases also provide information about in-demand skills and credentials, they only capture job openings that are publicly available. As a result, jobs filled by temporary staffing agencies or internal networks are not counted.

Employer surveys are the best source of local, accurate, timely demand data and are invaluable complements to federal and state labor market information. For example, an emerging urgent need for cold forming and cold heading process employees was described in a recent meeting of education

² Frey, C.B. and Osborne, M.A. (2013). *The Future of Employment: How Susceptible Are Jobs to Computerisation?* Oxford University. http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf

³ Brynjolfsson, E., and McAfee, A. (2014). *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. W.W. Norton.

⁴ Kenney, M. and Zysman, J. (2017). *Entrepreneurial Finance in the Platform Economy Era: What Consequences for Labor?* Conference draft prepared for “Futures of Work” Conference, Chicago October 5/6, 2017.



providers. This need was too recent to be reflected in IDES data and was not picked up in Burning Glass data. The only way to identify and respond to needs like this is for employers to share information about their hiring needs directly with providers or through employer demand surveys. As critical as these surveys are, resources are needed for regular updating and analysis.

Potential Action Steps

- a. ***Strengthen communication between service providers and employers*** to ensure needs are being met on both sides. Providers must receive timely and useful information about education and training needs and candid feedback on the work readiness of graduates.

- b. ***Task a trusted regional employer-led organization with collecting and disseminating this information*** in a confidential manner, and ***provide the resources*** to enable this critical function to be carried out on a regular basis. The US Chamber's TPM implementation guide provides a step-by-step blueprint for collecting this data.

Conclusion 3: The resources offered by the two local workforce offices in the NIMBLE region could serve as the backbone to addressing workforce shortages throughout the region. The Workforce Connection (TWC), serving Boone, Winnebago, and Stephenson Counties, and The Business Employment Skills Team (BEST), serving Ogle and seven other counties in northwest Illinois, provide many workforce services to business including recruitment, access to a job matching system and labor market data, assessment, and training, at little or no cost to employers. Like their 20 counterparts throughout Illinois, a major challenge is marketing themselves to area employers. Ensuring that manufacturers and other employers throughout the region are aware of available business services through WIOA and have a quality customer experience will assist TWC and BEST in brokering workforce supply and demand.

Potential Action Steps

- a. ***Intensify and support awareness raising efforts by TWC and BEST*** so they become the first source of employees by manufacturers and other employers throughout the region. Employers benefit through access to value-add workforce services, and TWC and BEST benefit by having more complete information about manufacturing supply and demand throughout the regions they serve.

Conclusion 4: Strategies for meeting employer talent needs vary by lead time and draw upon different local resources. Manufacturers in the NIMBLE region have expressed hiring needs that range from immediate (one month or less) to short-term (one month to one year) and long-term (more than one year).

Immediate (one month or less): TWC and BEST offer job placement services to job-seekers and employers through their one-stop centers. Area community colleges offer short-term training programs that may align with employers' immediate needs, and NIU also works with area employers to connect

qualified engineering and engineering technology students with internships and placements that help meet entry-level skill needs. Private sector staffing agencies, while not a focus of this analysis, are also available to assist with immediate talent needs.

Short-term (one month to one year): Employer collaboratives can be effective in working with local providers in the short term. By identifying specific emerging and ongoing skill needs and numbers of jobs to be filled, local providers, particularly community colleges, can reactivate or expand existing programs or quickly develop new ones. Resources described above to assist with immediate needs are also well positioned to help address short-term needs. In particular, this includes graduating high school seniors and community college students who are looking for summer or permanent employment. These latter opportunities are facilitated when employers engage with their educational institutions and are able to provide students with first-hand information about manufacturing careers and work-based learning opportunities.

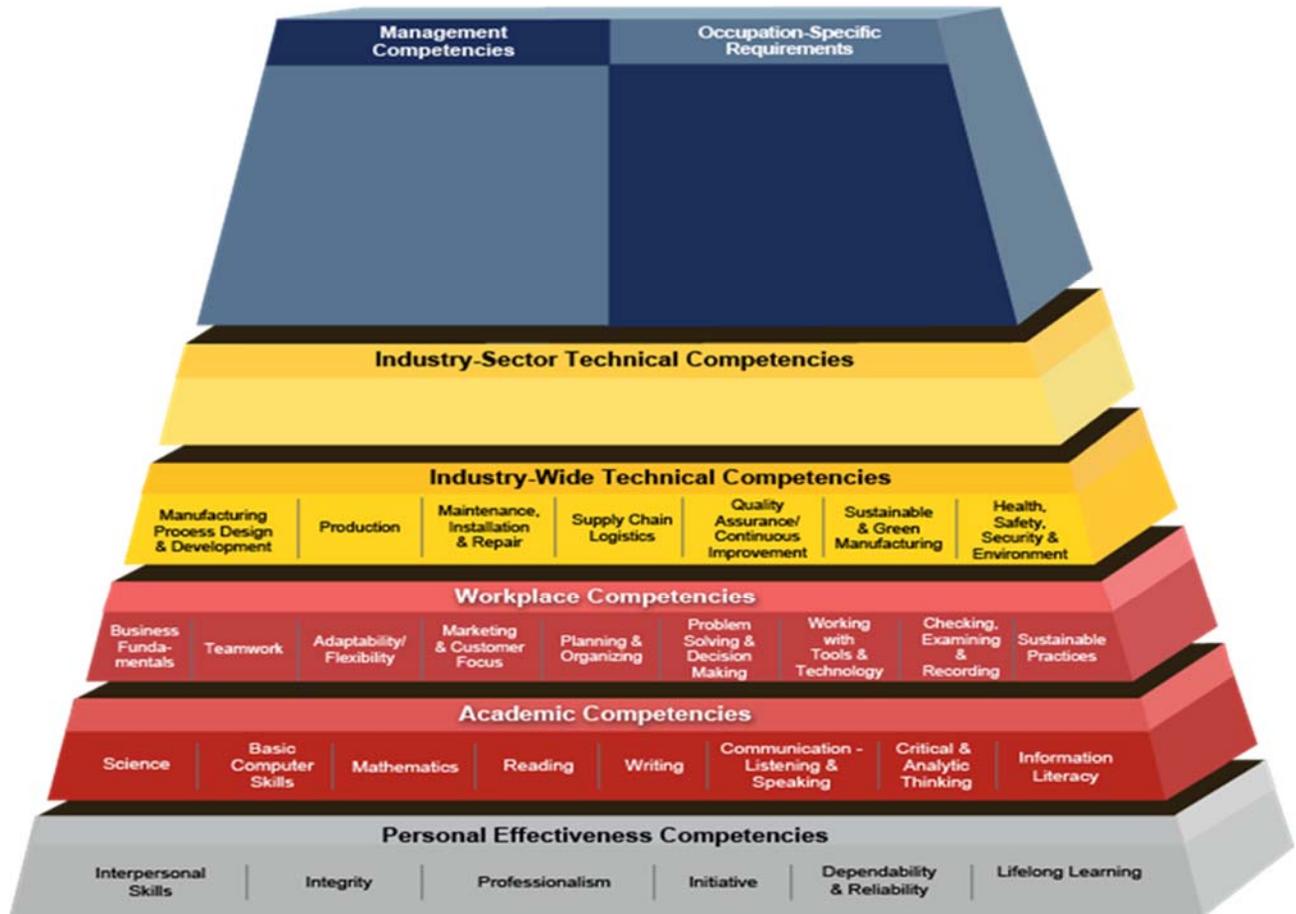
Long-term (more than one year): The Education for Employment systems in the NIMBLE region⁵ offer career development activities that begin in the elementary grades. Providing K-12 students with accurate information about opportunities in manufacturing is key to generating interest that will be sustained through high school and into college and the workplace. Forming new partnerships between employers and schools, such as the Aerospace Institute at Jefferson High School, Rock Valley College's TechWorks Program, and new apprenticeship initiatives, are long-term opportunities for filling the pipeline.

Potential Action Steps

- a. ***Ensure that these time frames are vetted and included in marketing material*** developed by education and training providers. Regional workforce plans required under the Workforce Innovation and Opportunity Act should address which strategies are useful for addressing these different timelines and assess the ability of the workforce system to meet them.

⁵ Illinois has 58 Education for Employment (EFE) Systems that provide access to high quality career and technical education programs that lead to industry certifications or post-secondary opportunities. Two EFE systems support the NIMBLE region: the Career Education Association of North Central Illinois (CEANCI) serves Boone, Winnebago, and Ogle counties; and the Career and Technical Education Consortium (CareerTEC) serves Stephenson County.

Appendix A Manufacturing Competency Model



Source: <https://www.careeronestop.org/CompetencyModel/competency-models/advanced-manufacturing.aspx>

Appendix B

Supply and Demand of Manufacturing Talent in the NIMBLE Region

The relationship between manufacturing worker supply and demand has important implications for local economies and labor markets. A *surplus* of manufacturing workers can result in workers taking jobs in other industries, moving to other areas with better employment prospects, wage suppression due to oversupply, and/or a dampening of interest in manufacturing careers. A *shortage* of workers directly impacts the ability of manufacturers to expand or replace separated employees, often leading to contraction or stagnation of manufacturing establishments. This also impacts the supply chain, with effects on an array of businesses that supply manufacturing inputs and provide goods and services to manufacturing workers and their families. Labor shortages can also foster job-hopping as workers are lured away by the prospect of higher wages. Understanding the overall relationship between supply and demand helps inform the types of pipeline management strategies likely to be most effective in a specific labor market.

While many sources of data speak to various components of workforce supply and demand, no easily accessible, comprehensive source exists for any area or industry sector in Illinois. The four-county NIMBLE area further complicates such an analysis as it straddles two local workforce areas: one administered by The Workforce Connection (LWA 3 serving Boone, Winnebago and Stephenson counties) and another administered by Business Employment Skills Team, Inc. (LWA 4 serving Ogle and seven other northwest Illinois counties). Moreover, because much of this region is located in northernmost Illinois and abuts the Wisconsin border, it shares a bi-state labor pool. Public and private sector competition for talent and for “claiming” positive education and training outcomes, as well as different data collection structures, make workforce analysis across state lines challenging. A final consideration is the dynamic nature of both supply and demand. New business products and markets can emerge rapidly and may not be captured in governmental statistics.

Projected Workforce Demand

Three different sources of projected job openings are available to estimate demand in the NIMBLE region. These include:

1. State occupational projections prepared by the Illinois Department of Employment Security based on data provided by the U.S. Bureau of Labor Statistics. These data were used to develop state and regional workforce plans required under the federal Workforce Innovation and Opportunity Act.
2. Current occupational demand provided by Burning Glass Technologies (BST). BST is one of a number of companies that collect and analyze data from publicly-available job postings by employers throughout the U.S.

3. An employer survey undertaken by the Northwest Illinois Development Alliance (NIDA) in 2016 to identify the number of entry-level manufacturing jobs over the next five years.

BLS/IDES. The Illinois Department of Employment Security (IDES) publishes short- and long-term employment projections by specific occupations. IDES projections are based on an estimation methodology used by the federal Bureau of Labor Statistics (BLS) that considers such factors as:

- Technological innovation,
- Changes in business practices or production methods,
- Replacement of one product or service by another,
- Organizational restructuring of work,
- Changes to the size of business establishments,
- Offshore outsourcing, and
- Expected employment change in a segment of an industry where an occupation is more concentrated relative to expected employment changes in other segments of the same industry.⁶

IDES provides annual projected openings due to growth and replacement for occupations in a variety of production occupations for Local Workforce Areas in Illinois. Based on the interests of employers involved in the NIMBLE initiative, 12 of 46 federally-tracked occupations were selected that met two criteria: they represented occupations in the “metal worker and plastic worker” or “assembler and fabricator” categories, and they were projected to either grow or be stable over the 2014 – 2024 period.

Table B-1 lists the 12 occupations that met these two criteria for the NIMBLE region with their associated projection data. Because the smallest geographic unit available for IDES data is the Local Workforce Area (LWA), and the four counties that make up the NIMBLE region represent one entire LWA (Boone, Winnebago and Stephenson that make up LWA 3) and one partial LWA (Ogle County is one of eight that make up LWA 4), Ogle County’s employment projections were estimated. This was done by multiplying occupational employment in LWA 4 by Ogle County’s share of manufacturing employment in the region.

⁶ Source: https://www.bls.gov/emp/ep_projections_methods.htm#occupational_employment

Table B-1
Projected Employment in the NIMBLE Region: 2014 – 2024*

Occupation	2014 Employment	Projected Annual Job Growth ¹	Projected Annual Job Replacements ²	Total Projected Growth + Replacement Annual Job Openings ³	Total Projected Employment 2024
METAL WORKERS & PLASTIC WORKERS					
Computer-Controlled Mach Tool Operator	589	13	18	31	722
Numerical Tool/Process Control Programmer	150	3	4	8	179
Machinist	2287	27	66	93	2554
Metal-Refining Furnace Operators/Tenders	45	0	1	1	45
Multiple Machine Tool Setter/Operators	521	2	9	11	539
Welders, Cutters, Solderers & Brazers	1177	5	33	39	1230
Subtotal	4769	50	131	183	5269
ASSEMBLERS & FABRICATORS					
Aircraft Struct/Surfaces/Rigging Asmlers	15	0	0	0	15
Electromechanical Equipment Assemblers	152	0	2	2	157
Engine & Other Machine Assemblers	118	1	2	3	125
Structural Metal Fabricators & Fitters	150	1	2	3	159
Team Assemblers	4,973	17	107	124	5138
Assemblers & Fabricators, All Others	553	3	12	15	587
Subtotal	5961	22	125	147	6181
Total	10,730	72	256	330	11,450

* Note: Employment figures include actual estimates from the Illinois Department of Employment Security for Boone, Winnebago, and Stephenson counties which make up Local Workforce Area (LWA) 3. Individual county-level data are not reported by IDES, and were estimated by multiplying occupational employment in LWA 4 by Ogle County's share of manufacturing employment in the region. Source: Illinois Department of Employment Security, http://www.ides.illinois.gov/LMI/Pages/Employment_Projections.aspx

¹Job growth is the gross number of jobs projected to be created.

² Job replacements are the estimated number of openings resulting from workers retiring or otherwise permanently leaving an occupation.

³Numbers in the projected job growth and replacement columns do not total to "Total Projected Growth + Replacement Annual Job Openings" due to rounding.

As evident in Table B-1, it is projected that the net number of jobs will increase from 10,730 in 2014 to 11,450 in 2024. This 2024 figure includes 72 net new jobs and 256 replacement jobs annually, or an estimated 3,300 jobs⁷ over the 10-year period. Table B-1 also shows that five of the 12 occupations represent 89.0% of all 2014 employment and of all new jobs:

- team assemblers
- machinists
- welders, cutters, solderers, and brazers
- computer-controlled machine tool operator
- Multiple machine tool setter/operator

Burning Glass Technologies. A variety of new data tools are offering insight into “real time” job demand. These tools collect data from public job postings and organize it to illuminate demand for specific occupations, credentials, skills, and other labor market needs. Data produced by Burning Glass Technologies, one such provider of labor market information, and comparable IDES estimates are provided below in Table B-2.

Table B-2
Comparison of IDES and Burning Glass 2016 Job Data

Occupation	IDES Projected Annual Job Openings 2014-2024	Burning Glass 2016 Postings
METAL WORKERS & PLASTIC WORKERS		
Computer-Controlled Mach Tool Operator	31	34
Numerical Tool/Process Control Programmer	8	18
Machinist	93	51
Metal-Refining Furnace Operators/Tenders	1	5
Multiple Machine Tool Setter/Operators	11	n/a
Welders, Cutters, Solderers & Brazers	39	2
ASSEMBLERS & FABRICATORS		
Aircraft Struct/Surfaces/Rigging Asmlers	0	19
Electromechanical Equipment Assemblers	2	2
Engine & Other Machine Assemblers	3	n/a
Structural Metal Fabricators & Fitters	3	n/a
Team Assemblers	124	45
Assemblers & Fabricators, All Others	15	1

Sources: Illinois Department of Employment Security, http://www.ides.illinois.gov/LMI/Pages/Employment_Projections.aspx; Burning Glass Technologies, Labor Insight database

⁷ Numbers in the projected job growth and replacement columns do not total to “Total Projected Growth + Replacement Annual Job Openings” due to rounding.

A number of the same occupations are projected to have annual job openings, but they differ in magnitude. There are a number of possible reasons for this. IDES projected job openings that do not have correspondingly large Burning Glass openings may be filled by non-public sources, e.g. temporary staffing agencies who do not advertise or through informal or internal networks. Also, IDES's 10-year projections reflect equal annual increments and do not predict whether demand fluctuates from year-to-year. In the few instances where Burning Glass postings are larger than the IDES projections, the skill sets may be difficult to find locally and external advertising is the most promising source of talent.

Employer Surveys. A third source of projected skill need data is local employers who conduct their own surveys. One such survey was conducted by the Northwest Illinois Development Alliance (NIDA) in 2016. Eighteen area employers identified 3,650 *entry-level* growth and replacement jobs needed over the next five years. When compared to IDES estimates of 330 annual projected job openings for the 12 targeted manufacturing occupations, or 1,650 over five years, the NIDA estimate is more than twice as large.

Another survey was conducted in June 2016 as part of the NIMBLE planning process. Of the 35 employers receiving the survey, nine (25.7%) responded. Of the 16 shortage occupations identified in that survey, three were mentioned by multiple employers: CNC operator/machinist/programmer (six mentions), maintenance technician (three mentions), and engineering-related (two mentions).

Conclusion. These three data sources yield very different employment projections, not surprising given that they all measure different aspects of demand. These discrepancies point to the value of current, real-time demand data from employers.

For purposes of estimating demand for this analysis, the NIDA estimate will be used as it is the most inclusive. That said, even at 3,650, this projected five-year demand figure may be an undercount because it reflects only the 18 employers who responded to the survey. Additional information is needed to understand the considerable discrepancies between these data sources.

Projected Workforce Supply

There are a number of sources of potential manufacturing workers. Seven of these are considered in this analysis and include:

- High school students enrolled in manufacturing-related career and technical education (CTE),
- Illinois community college manufacturing-related program completers (Highland Community College, Kishwaukee College, Rock Valley College, and Sauk Valley Community College),
- Completers of manufacturing-related programs offered by Wisconsin-based Blackhawk Technical College,
- Completers of CNC and cold forming programs offered by TechWorks, a manufacturing training program housed in Rock Valley College,
- Northern Illinois University's engineering program completers,
- Manufacturing workers who have been terminated as a result of downsizing, automation, off-shoring, etc., and

- Registered apprenticeships.

1. High School Career and Technical Education Programs. Illinois has 58 Education for Employment (EFE) Systems that provide access to high quality career and technical education programs leading to industry certifications or post-secondary opportunities. Two EFE systems support the NIMBLE region: the Career Education Association of North Central Illinois (CEANCI) that serves Boone, Winnebago, and Ogle counties; and the Career and Technical Education Consortium (CareerTEC) serving Stephenson County.

EFE directors are able to provide detailed information about students participating in various CTE programs.⁸ In the four-county NIMBLE region, enrollment in industrial technology programs in the 2015-16 school year totaled 6,818. These enrollments reflect various degrees of interest in industrial technology. For example, 2,406 students enrolled in an introductory course in one of seven areas that include architecture and drafting, automotive technology, construction trades, engineering, machine tool, millwork and wood fabrication, and welding and metal fabrication. Another 4,412 students enrolled in at least one course beyond the introductory level in one of these areas. These students have a demonstrated aptitude and interest in industrial technology and represent a core component of the manufacturing pipeline in the NIMBLE region.

Through CEANCI and CareerTEC, high school students are offered dual credit opportunities that enable students to earn high school and community college credit simultaneously. They both also provide access to “Career Cruising”, a career exploration tool that helps students discover how their strengths and interests align with careers, and builds an academic plan and course schedule to get there. An important web-based component of Career Cruising is “Unite”, a tool to connect local employers with students through short-, medium-, and long-term activities ranging from job shadowing to providing internships and part-time jobs.

High schools in the NIMBLE region also have forged strategic workforce partnerships with local employers. For example, the College of Aviation at Embry-Riddle Aeronautical University’s Daytona Beach Campus has partnered with Rockford Public Schools to establish an Aerospace Institute at Jefferson High School beginning in Fall 2013. This program provides high school students a collegiate model of aviation and aerospace education to introduce them to these career fields.

2. Area Community Colleges. Four Illinois community colleges serve the NIMBLE region: Highland Community College, Kishwaukee College, Rock Valley College (RVC), and Sauk Valley. Table B-3 lists the manufacturing-related programs⁹ that reported completions in the 2015-16 school year. Four training

⁸ Career and technical education student data were provided by Margie Hartfiel, director of CEANCI, and Jen Newendyke, director of CareerTEC.

⁹ Instructional programs in three Classification of Instructional Program (CIP) codes were included: Engineering (CIP 14), Engineering Technologies and Engineering-Related Fields (CIP 15), and Precision Production (CIP 48). Mechanic and Repair Technologies/Technicians (CIP 47) was included but no completers in those programs were reported.

programs have completers in multiple colleges, while eight are offered by a single institution. Manufacturing Technology/Technician and Welding Technology have two of the highest completions and are among the demand occupations identified earlier. The close partnership between RVC and area aerospace manufacturers is evident in completions for the airframe mechanics/aircraft maintenance tech and aircraft power plant technologist/technician programs.

**Table B-3
FY16 Annual Duplicated Completers for Manufacturing-Related Programs
in Community Colleges Serving the NIMBLE Region**

Instructional Program	Highland Community College	Kishwaukee College	Rock Valley College	Sauk Valley Community College	Total
Automated Manu Tech		5			5
Electronic Eng. Tech		3	31	1	35
Fluid Power Technology			9		9
Energy Management& Systems Tech			10		10
Solar Energy Technology/Tech				2	2
CAD/CADD Drafting/Design Tech		6	3		9
Mechanical Drafting & CAD/CADD		2			2
Electrical/Electronic Equip Repair/Install				5	5
Manu Tech/Technician	1	3	62	5	71
Industrial Mechanic/Maintenance Tech	1				1
Airframe Mechanics/Aircraft Maint. Tech			152		152
Aircraft Power Plant Tech/Technician			78		78
Tool & Die Tech			20		20
Welding Tech	16	11	36	60	123
Total	18	30	401	73	522

Source: Illinois Community College Board, *2017 Data and Characteristics of the Illinois Public Community College System*.

3. TechWorks. RVC also hosts TechWorks, an employer-driven training program that offers a customized six- to eight-week curriculum and credential in Measurement Materials & Safety and CNC Lathe or Mill Operator Level One. Students acquire a foundation of shop math, blueprint interpretation, metrology and CNC setup/operation skills. Since 2014, 240 individuals have completed TechWorks’ CNC program. A new cold forming program was recently developed in response to employer need and has seen 11 completers since May of 2017. Both CNC and cold forming programs have seen 100% completions and an 85-90% employment rate.¹⁰ Because TechWorks training is non-credit, this

¹⁰ TechWorks completion data were provided by Bernie Luecke, Director, Rock Valley College Business and Professional Institute

completion information is not captured in ICCB reports. However, for supply side accounting purposes, approximately 84 students complete CNC or cold forming training annually.

4. Blackhawk Technical College (Wisconsin). Blackhawk Technical College in Janesville, Wisconsin, located 45 miles north of Rockford, offers a number of manufacturing-related programs. For FY 16, Blackhawk Technical College reported 260 completers - one-half of the total reported by the four Illinois community colleges – in three categories:

Instructional Program	Number of Completers ¹¹
Engineering Technology and Engineering-Related Fields	19
Precision Production	181
Mechanic and Repair Technologies/Technicians	60
Total	260

Given the array of technical programs offered by community colleges, the potential for additional partnerships between manufacturing employers and community colleges is significant. As with CTE students in the K-12 system, community college level students who have committed to a career in manufacturing are another key component of the NIMBLE region’s manufacturing pipeline.

5. University-Level Programs. A partnership between Northern Illinois University (NIU) and RVC brings NIU’s engineering program to Rockford, allowing students to earn a degree without leaving the RVC campus. A B.S. in Mechanical Engineering is offered at RVC and a B.S. in Applied Manufacturing Technology is offered online, with internship opportunities in the Rockford area. Students pursuing a bachelor’s or graduate degree in engineering and engineering technology are available for part-time work while in school and permanent employment upon graduation.

Table B-4 summarizes 2015 graduates in the four engineering programs offered by NIU. A total of 345 engineering students obtained a bachelor’s or advanced degree that year.

Table B-4
Northern Illinois University Engineering Degrees Granted in FY2015

	Bachelor’s Degree	Master’s & Advanced Degree	Total
Electrical Engineering	45	30	75
Industrial & Systems Engineering	22	39	61
Mechanical Engineering	77	39	116
Technology	80	13	93
Total	224	121	345

Source: Northern Illinois University, Department of Institutional Research. *Data Book 2015-16*.

¹¹ Source: Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System

6. Separated Manufacturing Workers. IDES employment projection methodology estimates that 21 manufacturing occupations are expected to lose a net 685 jobs between 2014 and 2024. Factors contributing to these decreases include technological innovation, changes in business practices or production methods, replacement of one product or service by another, organizational restructuring of work, changes in the size of business establishments, and offshore outsourcing. These are listed below in Table B-5 for the four-county NIMBLE region. Once again, because the NIMBLE region falls into two Local Workforce Areas, Ogle County’s figures were estimated by multiplying occupational employment in LWA 4 by Ogle County’s share of manufacturing employment in the region.

**Table B-5
Projected Employment Decreases in the NIMBLE Region by Occupation: 2014 – 2024**

Occupation	Employment Decrease 2014-2024
METAL WORKERS & PLASTIC WORKERS	
Extruding/Drawing Mach Setters/Operators	-27
Forging Mach Setters/Operators/Tenders	-20
Rolling Mach Setters/Operators/Tenders	-20
Cutting/Punching Mach Setters/Operators	-145
Drilling/Boring Mach Tool Setters/Operators	-25
Grinding/Polishing Mach Setters/Operators	-84
Lathe/Turning Mach Tool Setters/Operators	-49
Milling/Planing Machine Setters/Operators	-16
Metal Pourers & Casters	-3
Model Makers, Metal & Plastic	-4
Patternmakers, Metal & Plastic	-4
Foundry Mold & Coremakers	-62
Tool & Die Makers	-43
Welding/soldering Mach Setters/Operators	-42
Heat Treating Equip Setters/Operators	-26
Lay-Out Workers Metal & Plastic	-8
Plating/Coating Mach Setters/Operators	-43
Tool Grinders, Filers & Sharpeners	-12
Metal & Plastic Workers, All Other	-1
Subtotal	-634
ASSEMBLERS & FABRICATORS	
Coil Winders/Tapers & Finishers	-4
Electronic Equipment Assemblers	-47
Subtotal	-51
Total	-685

Source: Illinois Department of Employment Security,
http://www.ides.illinois.gov/LMI/Pages/Employment_Projections.aspx

Metal and plastic working occupations represent 92.6% of all of the occupations projected to decrease over the 10-year period. It is not known to what extent these separations will be voluntary or managed through attrition, but some number of these employees will return to the labor pool and represent another source of manufacturing talent. Risk of automation is increasingly discussed in the context of the changing workplace, and Burning Glass Technologies has added that as a factor in their Labor Insight resource. Table B-6 presents the risk of automation for the occupations projected to be stable or grow over the next 10 years.

Table B-6
Risk of Automation¹² for Selected Manufacturing Occupations

Occupation Title	Risk of Automation
Welders, Cutters, Solderers, and Brazers	High Risk
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	Medium Risk
Computer-Controlled Machine Tool Operators, Metal and Plastic	High Risk
Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	Low Risk
Assemblers and Fabricators, All Other	High Risk
Structural Metal Fabricators and Fitters	Low Risk
Engine and Other Machine Assemblers	Medium Risk
Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	High Risk
Metal-Refining Furnace Operators and Tenders	High Risk
Electromechanical Equipment Assemblers	High Risk

Source: Burning Glass Technologies, Program Insight Database

The Workforce Connection (TWC) and Business Employment Skills Team (BEST), the two regional entities responsible for administering federal workforce funding, also offer Rapid Response services for employers who are laying off employees or closing an operation as well as re-employment services for dislocated workers. As such, they are a convenient source of information and assistance for employers seeking entry-level or skilled manufacturing talent.

7. Apprenticeship. Apprenticeship is seeing a resurgence in the U.S. as a strategy for providing structured, quality work-based learning opportunities. In Illinois, apprenticeship is a major focus of Illinois' Unified State Workforce Plan, and a major capacity-building and promotion effort is under way to expand the number of Registered Apprenticeships, pre- apprenticeships, and youth apprenticeships throughout the state.

¹² Risk of automation is the probability of computerization for an occupation within the next 20 years based on the seminal Oxford University study on automation, *"The Future of Employment: How Susceptible Are Jobs to Computerization?"* "High risk" represents the top quartile of scores, "medium risk" is the third quartile, and "low risk" is the bottom two quartiles of scores.

According to the U.S. Department of Labor (DOL) Registered Apprenticeship Partners Information Data System, in August 2017, 29 manufacturing employers in the four-county NIMBLE region were in the database as offering Registered Apprenticeships. Of these 29 employers, 11 were active and listed as offering a total of 33 sponsorships. According to a regional DOL program representative, the Registered Apprenticeship landscape changes very rapidly and the database is unlikely to reflect the most recent developments. Further, many employers remain “on the books” but have not sponsored a Registered Apprenticeship in recent months. Despite the shortcomings of the RAPIDS database, the DOL regional representative is aware of the current Registered Apprenticeship landscape and able to provide technical assistance to employers interested in any type of apprenticeship program.

The Rock River Valley Tooling and Machining Association (RRVTMA) administers a manufacturing apprenticeship program that includes on-the-job learning from a company mentor combined with related technical training provided by Rock Valley College. Upon successfully completing their apprenticeship, each apprentice receives a recognized credential. In addition to intermediary organizations such as the RRVTMA, small employers also work directly with apprentices, some requiring that the apprentice already be employed at their establishment.

Due to the uncertainty of the take-up rate by employers of this new opportunity, a five-year estimate of 50 is proposed for the supply side calculation, primarily as a placeholder and opportunity to be watched.

Estimates of potential manufacturing workers likely to join the labor pool over the next five years is presented below in table B-7 for the NIMBLE region. As noted above, the ratio of potential supply to demand is estimated to be 27,900 to 3,650, or approximately 7.6 potential manufacturing workers for each projected job opening.

Table B-7
Estimated Potential Manufacturing Workforce Entrants by Source in the NIMBLE Region

Source	Annual	5-Year	Comments
High School	4,412	22,060	Students taking an industrial technology class beyond introductory level
Community College	522	2,610	Completions in manufacturing-related programs
Blackhawk Tech. College	260	1,300	Completions in manufacturing-related programs
TechWorks	84	420	CNC and cold forming
Northern IL University	224	1,120	Bachelor’s level only in engineering
Separations	68	340	Net decreases in specific manufacturing occupations
Apprenticeships	10	50	Estimate for registered apprenticeship only
Total	5,580	27,900	