



Creating Pathways to Careers in Precision Machining For Opportunity Youth

A Working Concept Paper

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Corporation for a Skilled Workforce is a national nonprofit that partners with government, business, and community leaders to connect workers with good jobs, increase the competitiveness of companies, and build sustainable communities. For more than 22 years, we have been an effective catalyst for change. We identify opportunities for innovation in work and learning and provoke transformative change in policy and practice. We have worked with dozens of workforce investment boards, state and local workforce agencies, community-based organizations, foundations, federal agencies, and colleges to create lasting impact through their collaborative activities.

Commonwealth Corporation designs and executes workforce strategies in partnership with businesses, educators, and training providers across the state. Our priority is to address the skills gap to meet the needs of businesses and workers, including the underemployed and unemployed, as well as teens and young adults, so that all people can thrive in our highly skilled economy. The context for our work is the knowledge and innovation economy of the Commonwealth – one of the most highly skilled economies in the world. We are committed to ensuring that Massachusetts businesses have access to a pipeline of highly skilled workers and that youth and adults in Massachusetts have pathways to good jobs in the knowledge economy.

Background

The Manufacturing Renaissance

The United States ascended to its place as a global superpower in the 20th century on the backs of millions of American workers who produced the goods that the world desired. Manufacturing was the economic engine that drove the country's growth and helped build the American middle class. Then, during the 1970s, three things happened that reduced the number of manufacturing jobs in this country: first, increasing labor costs in the U.S. relative to other countries contributed to the off-shoring of production to lower wage regions; second, technological advancements in the manufacturing process decreased the number of workers needed to produce goods; third, the 'post-industrial' U.S. economy demanded more services and fewer goods.¹

Simultaneously, the U.S. experienced yet another evolutionary trait of wealthy countries: increased educational attainment. The resulting push to send young people to college contributed to the changing perception of manufacturing careers. The days of making a very good living, working for an automaker or textile factory and armed with only a high school education, seemed to be over. The message sent by higher education, government and the recession was that one now needed a college degree to achieve a family sustaining salary and job security.

Manufacturing employment in 2000 suffered the sharpest decline in jobs in 30 years. Large numbers of jobs were lost, but there were deep wage cuts as well.² All of these factors combined have resulted in a negative perception of manufacturing as a career pathway, which was once the pride of this country.

However, typical of cyclical economic forces, a recovery is underway and manufacturing is experiencing a resurgence. If we are cognizant of how manufacturing is changing and train workers for what the future of manufacturing will require, it will once again fuel our economy, lend stability to our communities and decrease our import-reliance and trade deficits. "Taken alone, manufacturing in the United States would be the 10th largest economy in the world... and has the highest multiplier effect of any other sector of our economy."³

Since January of 2010, the United States has added 520,000 manufacturing jobs, according to the Bureau of Labor Statistics. One contributing factor to the manufacturing resurgence has been the 're-shoring' of jobs back to the U.S. from other countries. This is occurring, in part, because the wage disadvantage that drove jobs to developing countries thirty years ago is of less concern to employers today. For many products, manufacturers place a higher premium on quick turn-around times between creating a prototype and scaling up full production – to the point that many differences in labor costs are outweighed

¹ Blackburn, Bradley and Eric Noll. "Made in America: A Brief History of U.S. Manufacturing". *ABCNews*, February 17, 2011. Accessed at: <http://abcnews.go.com/Business/made-america-middle-class-built-manufacturing-jobs/story?id=12916118>

² Barker, Megan. "Manufacturing Employment hard hit during 2007-09 Recession". *U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review*. April, 2011. Accessed at: <http://www.bls.gov/opub/mlr/2011/04/art5full.pdf>

³ "A Growth Agenda: Four Goals for a Manufacturing Resurgence in America". *National Association of Manufacturers (NAM)*, February 14, 2013. Accessed at: <http://www.nam.org/~media/39CF92351DD24DED8EC0663CBA8021AF.ashx>

by the need for local production capacity. Other factors that favor re-shoring include higher energy costs, political instability in developing countries, and greater attention to foreign environmental impacts.

While the sector is making a comeback, a new challenge is emerging: employers within the sector are reporting that they face a skilled worker shortage. In an online national survey of 1,123 U.S. manufacturing executives, 83% of American manufacturers reported experiencing a moderate or severe shortage of skilled workers.⁴ In 2011, one third of U.S. production workers were 55 or older, and 10,000 Americans are retiring every day.⁵

A 2013 report by ThomasNet⁶ warns of manufacturing's "biological clock" and recommends looking to the largely untapped workforce of 18-32 year-old workers, which are expected to comprise 75% of the national workforce by 2025, as a viable succession plan for the aging industry. The report goes on to point out "a disconnect with the upward trajectory of manufacturing and the lack of urgency to recruit the next generation of workers."

In part, this lack of urgency stems from recruiting barriers and what companies perceive as a lack of basic skills in young workers. According to the same ThomasNet report:

"More than one-quarter of companies (27%) say high schools should offer more technical training to encourage students to pursue manufacturing careers. Other suggestions include greater emphasis on STEM (science, technology, engineering and math) courses, along with more partnerships between manufacturers and colleges and technical schools to inform students about industry opportunities. Respondents also see value in providing internships and apprenticeships, and in parents encouraging their children to consider or choose manufacturing careers. In fact, the two major areas from which 51% of manufacturers recruit young workers are apprenticeship and internship programs."⁷

A strategy that improves the basic and technical skills of young workers, especially when done in the context of work experience and on-the-job training, could create a fresh pipeline of workers for manufacturing employers, while also creating real career pathways for our country's 3.8 million opportunity youth.⁸ This cohort presents us with an interesting and exciting challenge.

⁴ Morrison, Tom and Emily DeRocco. "Boiling point? The skills gap in U.S. manufacturing". *Deloitte Touche and The Manufacturing Institute*, 2011. Accessed at:

<http://www.themanufacturinginstitute.org/~media/A07730B2A798437D98501E798C2E13AA.ashx>

⁵ Bernard, Dave. "The Ripple Effect of Baby Boomer Retirement". U.S. News and World Report; Money, August 3, 2012. Accessed at: <http://money.usnews.com/money/blogs/on-retirement/2012/08/03/the-ripple-effect-of-baby-boomer-retirement>

⁶ ThomasNet. "Technology Transforms Manufacturing into a Hotbed of Innovation". *ThomasNet.com Industry Market Barometer Survey Findings*, September 2013. Accessed at:
http://www.thomasnet.com/pressroom/Industry_Market_Barometer.html

⁷ Ibid.

⁸ "Employment and Unemployment Among Youth – Summer 2013". *U.S. Department of Labor, Bureau of Labor Statistics*, July 2013. Accessed at: <http://www.bls.gov/news.release/youth.nr0.htm>

Opportunity Youth

At the same time there is growing labor market demand for workers, there is a growing population of young adults who are not enrolled in school and not employed. These “opportunity youth” are 18-24 year olds who may or may not have completed high school, have been unable to find work, and have one or more barriers to education and employment, leaving them in danger of long-term disconnection from the labor market.

Many opportunity youth come from low income families, have low literacy/numeracy, are ESL speakers and/or have a criminal history. Young men in this cohort are slightly more likely to be unemployed than women, and only one in two African American males in their 20s have a job.⁹

Despite these circumstances, a recent national survey ¹⁰ suggest the majority of these youth deeply want jobs, but point to barriers such as a limited work experience, limited education, and limited work readiness skills that prevent them from obtaining employment. In the same survey, nearly two in three opportunity youth say they have a goal to finish high school or college and believe they will, while 85% say it is important for them to have a good job in order to live the life they want.

While many of these youth are highly motivated to earn and learn, they often apply their energies in industries that offer limited career pathways and few if any family-sustaining jobs. Historically 30% of young people 15-17 find work in the hospitality industry. The next largest percentage is grocery stores at around 11%. However, both of these industries pay on average 30% lower wages than even entry-level advanced manufacturing jobs.⁶

We incur tremendous economic and social costs when these youth face limited work and learning opportunities. The lifetime taxpayer burden of opportunity youth consists of lost taxes, and increased costs for corrections and welfare/transfer payments, expressed as a net present value of \$258,240. The net lifetime social burden is composed of lost earnings, additional health expenditures, and crime costs, and is estimated at \$755,900. ¹¹

Again, it is clear that a strategy to improve the basic and technical skills of young workers, especially when in the context of work experience and on-the-job training, could create real career pathways for our opportunity youth and multiple benefits for employers, including: increased shareholder satisfaction and customer loyalty, based on support of a corporate commitment to working with opportunity youth as a critical social issue; increased diversity of the worker pipeline; increased worker engagement and retention as workers engage in on-the-job learning activities with opportunity youth and are inspired to model excellence within their professional fields.

⁹ Kuehn, Daniel. “The Labor Market Performance of Young Black Men in the Great Recession”. *The Urban Institute*, February 13, 2013. Accessed at: <http://www.urban.org/publications/412747.html>

¹⁰ Bridgeland, John M. and Jessica A. Milano. “Opportunity Road: The Promise and Challenge of America’s Forgotten Youth”. *America’s Promise Alliance, Civic Enterprises, and Peter D. Hart Research Associates*, January 2012. Accessed at: http://www.americaspromise.org/~media/Files/Resources/CE_opportunity_road_2012.ashx

¹¹ Belfield, Clive, Henry Levin and Rachel Rosen. “The Economic Value Of Opportunity Youth”. *Corporation for National And Community Service & The White House Council for Community Solutions*, January 2012. Accessed at: http://www.civicenterprises.net/MediaLibrary/Docs/econ_value_opportunity_youth.pdf

Uncovering Opportunities - Supply and Demand

A Closer Look at Michigan and Massachusetts

Manufacturing firms in both Michigan and Massachusetts are reporting a shortage of skilled workers. Michigan has mature manufacturing sub-sectors in motor vehicles and electrical machinery; Massachusetts is leading the nation in electronics, medical device, precision instruments, and optical equipment manufacturing. All of these important subsectors are characterized by integrated global production technologies and a strong dependence on research and development and product innovation. In both states, small and medium-sized employers are experiencing a critical workforce issue – the lack of skilled workers to fill job vacancies related to post-recession growth as well as job openings caused by the retirement of an older workforce.

Neither state is producing enough graduates from technical training programs, at the high school level or at community colleges, to meet the hiring needs of manufacturing employers. Overall, we lack training capacity in technical programs because enrollments in machining technology programs have declined over time in response to shrinking interest among young adults to enter manufacturing as a career field. To compound dropping enrollment, career and technical education programs are often among the first programs subjected to broad funding cuts. At the same time, youth and young adults who lack advanced education or training credentials can't crack a challenging labor market that demands a higher level of preparation.

Michigan

Manufacturing and the auto industry have been the backbone of Michigan's economy for many years. Today, manufacturing employs over 500,000 workers statewide, which is the equivalent of one out of six private sector jobs in the state. Michigan's manufacturing base is very diverse and reflects unique opportunities for opportunity youth. Automotive manufacturing leads the state with approximately 137,500 jobs and spans the entire process of motor vehicle production and assembly. Metals manufacturing is second with 91,400 jobs, machinery manufacturing follows with 60,000 and the burgeoning food and beverage industry comes in fourth with 38,300 jobs.¹²

Even though the state has lost thousands of manufacturing jobs in the past decade, the sector still has the largest multiplier effect of any industry generating \$1.40 of output in other industries for every \$1 of final product. Because of this, 4-6 new jobs in other sectors are created with every 1 job added in manufacturing. Manufacturing ranks first among Michigan's industries with 18% of GDP (\$61 billion) and is growing at three times the rate of total private sector GDP. Despite the decrease in wages during the recession, manufacturing jobs still pay 37% higher wages than the overall median private sector wage.⁹

As of January 2013, there were 6,800 online job postings for manufacturing positions in Michigan and the top three high demand occupations were production, management and engineering.¹³ However, the average long term annual openings in manufacturing is nearly twice this number, at 12,200. This is due

¹²Quinn, Christine. "Manufacturing Cluster Workforce Analysis". *Pure Michigan Workforce Development Agency*, January 2013. Accessed at:

http://www.michigan.gov/documents/mdcd/WDA_ManufacturingFINAL_opt_410543_7.pdf

¹³Ibid.

in part to the fact that 80% of manufacturers are small or medium size companies and their primary recruiting tools are word of mouth, followed by staffing agencies.

In addition, there is a mismatch between education required for these vacancies and degrees obtained. Two-thirds of the high growth, high wage manufacturing jobs in Michigan require an associate's degree, vocational training or on-the-job training. And yet of the 7,000 manufacturing-related degrees or certificates awarded in 2010 in Michigan, over half were bachelor's degrees; the most common being mechanical and electrical engineering. While we are generating enough engineers to fill demand, occupations requiring an associate's degree or less remain severely understaffed.

A key occupation requiring an associate's degree or less is computer-numerical-controlled (CNC) operators and machinists. Of the 98 listed production occupations in Michigan, CNC operators are the third highest projected growth occupation, at 14.2% growth plus replacement over 10 years, statewide. In 2010, there were 8,910 CNC positions in Michigan and the projected percentage increase indicates there will be 10,180 by 2020. As of 2013, motor vehicle parts manufacturing still employed the largest percentage of this occupation at 23.3%. The average wage for this occupation is \$16.69/hour or \$34,710 annually.¹⁴

Evidence also suggests the manufacturing industry could benefit from diversifying its workforce, especially in terms of age. Of CNC workers in Michigan, only 6% of individuals are 18-24 years old, 51% are 25-44 and 42% are 45-64.¹⁵ This data suggests that the demand for workers will increase sharply in the coming years and having a trained cohort ready to step in will be critical.

Massachusetts

The manufacturing sector has had a long history of success in Massachusetts. New England was the locus of the American industrial revolution, providing water and steam power to drive the mills that were at the heart of national economic development. The sector itself has gone through many changes – shifting from its historic origins in textile production to a current mix that includes electronics, aerospace and computers.

Total employment in manufacturing declined continuously since its peak during World War II (800,000 jobs that comprised almost 45% of the workforce) to a low of about 300,000 workers in 2006, only 8% of the state's workforce.¹⁶ Despite this long-term decline in jobs, manufacturing is still the sixth largest job sector in Massachusetts, ahead of financial services, wholesale trade, construction, state government, and information services. It employs more than all the hotels, restaurants, and bars in the state and 50,000 more than all professional and technical service industries.¹⁷

¹⁴ "Michigan Statewide Occupational Employment Forecasts 2010-2020". *Michigan Department of Technology, Management & Budget*. Accessed at: http://www.milmi.org/admin/uploadedPublications/1440_occ_2016.htm

¹⁵ EMSI, Accessed at: <http://www.economicmodeling.com/data/usa-data/>

¹⁶ U.S. Department of Labor, Bureau of Labor Statistics, State and Metro Area Employment Series (miscellaneous data tables)

¹⁷ Massachusetts Executive Officer of Labor and Workforce Development, Current Employment Statistics (CES 790 Series), July 2012.

But jobs are not the only story: the hidden value of the sector lies in the nature of its contribution to the economy. Although manufacturing accounts for only 8% of employment, it provides more than 12% of the state's overall economic output.¹⁸ Productivity within the state's 7,500 manufacturing companies increased at an 8.7% annualized clip over the past five years, far faster than in other sectors in Massachusetts¹⁹ – the combined result of robotics, new production technologies, new forms of work organization, and training.

The average annual pay of a manufacturing worker is about \$75,000; 25% higher than the average wage for all jobs in Massachusetts, and higher than the average wage in construction, real estate, government, education, and health care sectors.²⁰

Deeper analysis shows that the Commonwealth's manufacturing base consists of two groupings of sub-sectors. The first group includes computers, semi-conductors and electronic instruments, bio-pharmaceuticals and aerospace. Important products from firms in these sectors include aerospace components, printed circuit boards, bio-surgery products, fiber-optic components, infrared sensors, optical safety lenses, and radar equipment. Firms in these sectors employ the highest-technology production processes, require the highest skill levels and produce the highest value-added products. They are characterized by integrated global production technologies and a strong dependence on both R&D and product innovation. More than 80% of all jobs in the computer and electronic instrument sub-sector, for example, require an engineering or science degree. Jobs in these sectors are typically filled through national and international recruitment networks.

A second group includes the sub-sectors of plastics, medical devices, precision instruments, and optical equipment. These sectors are somewhat less 'high-tech' than the first group, but still use production equipment and processes that require high skill levels. Between 30% and 50% of employment in firms within these sectors falls into middle-skill, production-related occupations – most of which require some specialized postsecondary training but not necessarily a college or engineering degree. Manufacturing companies in these sectors are typically small (72% have fewer than 20 employees)²¹, and most (72%) are also family-owned.²²

The demand for production workers in Massachusetts has been strong, and is expected to increase in the next decade. Over the past year, job postings in manufacturing have been second highest (to health care) of all sectors in Massachusetts. During 2011 alone, more than 73,000 open jobs were posted in

¹⁸ U.S. Bureau of Economic Analysis, 2012.

¹⁹ U.S. Bureau of Economic Analysis (Updated June 5, 2012 with revised estimates for 1997-2010), in constant 2005 dollars.

²⁰ U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Employment and Wages, Annual Wages, 2010, tables 8 & 10.

²¹ Northeastern University, Dukakis Center for Urban and Regional Policy, Manufacturing Survey, 2012.

²² Ibid.

manufacturing.²³ 36% of production workers were at least 55 years of age in 2012 – workers who will retire in the next several years.²⁴

Machinists and CNC operators are two middle-skill occupations in high demand within the manufacturing sector. These two occupations employed about 10,000 persons in 2012, and had a median annual wage of about \$45,000. Job growth and replacement demand for these production jobs are projected at about 4,000 through 2020.²⁵

Education and Training

There are a vast number of credentials in the manufacturing industry and the variety and value to employers is equally complicated. In Michigan, employers consider foundational skills (soft skills) to be a top priority and they can then provide training in whatever other skill areas are necessary. Because of the myriad of programs offered, the low completion rates and the discrepancies in what the credentials actually mean, foundational skills are key. Of the foundational skills certificates, NCRC (ACTWorkKeys) is the mostly widely accepted in Michigan. Among the technical skills needed in manufacturing, AWS (American Welding Society) certifications are still considered a valuable marker of ability. Employers noted that they would be happy to hire someone with a machinist certification, but the priority is to simply get enough workers in the door to stay on pace with production. At this point, due to the severe skilled labor shortage, a credential is a luxury that firms cannot afford to require or even prioritize.²⁶

In both Michigan and Massachusetts, enrollments in education and training programs that produce employable machinists or CNC operators are not high enough to fill current and projected job openings.

In Massachusetts, since 2005, there has been an average total statewide enrollment of 900 students in machine tool technology programs at vocational high schools– and only about 100 program graduates each year. Only about 70% of program students stick with manufacturing technology through graduation. Machine Tool Technology enrollment at vocational schools would have to increase 600% to fill open retiring machinist positions.

The gap is even larger at the postsecondary level. Eight community colleges (of 14 total public community colleges) in Massachusetts offer an associate's degree in manufacturing or engineering technology. In 2011-2012, there were no graduates in these fields. Five community colleges offer a one-year certificate in manufacturing technology or CNC machining. In 2011-2012, a total of 23 certificates were awarded statewide.²⁷

²³ Massachusetts Executive Office of Labor and Workforce Development, Department of Career Services, Job Vacancy Survey, 2011.

²⁴ American Community Survey, Public Use Files, 2006, 2010, Tabulations by University, Center for Labor Market Studies and Dukakis Center for Urban and Regional Policy.

²⁵ Massachusetts Executive Office of Labor and Workforce Development, Department of Career Services, Massachusetts Industry-Occupation Employment Matrix, 2010-2020.

²⁶ Employer interviews in three Michigan cities: Grand Rapids, Jackson and Flint. June – August, 2013.

²⁷ U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics – Integrated Postsecondary Data System Reports, 2012.

Young adults are not aware of opportunities to enter the field. During 2001-2012, 34,400 18-24 year-olds participated in career center services in Massachusetts. Of that group, only eight found employment in a production job within a manufacturing company.²⁸

In Michigan, in 2011, there were fewer than 10 community college programs offering CNC degrees and certificates. These programs produced 25 graduates. The reason for these incredibly low numbers is threefold. First, the numbers depend on how the colleges classify their programs (i.e., CNC training may be offered as part of a metalworking or associate's degree). Second, very few students enroll in these programs compared to other education offerings. Finally, the employer need for CNC technicians is so great that many students accept employment before completing the program.

Key Factors

CNC Machinist/Operator	Michigan	Massachusetts
Projected growth (2010-2020)	14.2%	18.39%
Opportunity youth (2012)	220,000	47,000
CNC openings (2012)	500	380
Total certificate production (2011)	25	23

Connecting the Dots

Context for a Solution

Both Michigan and Massachusetts are attempting a variety of public sector strategies that support the manufacturing sector. For example:

- Massachusetts Governor Deval Patrick launched an Advanced Manufacturing Collaborative in 2011 and the Legislature institutionalized the Collaborative in a 2012 Economic Development law. The Collaborative is comprised of leaders from industry, academia and government that has come together to enhance the competitiveness of Massachusetts manufacturing. The AMC is working to execute a five-point agenda that focuses on promoting manufacturing, workforce development, technical assistance and innovation, the cost of doing business, and access to capital.
- The Massachusetts Manufacturing Extension Partnership (MEP) has programs and services for working with small and medium sized employers on continuous improvement processing (including plant layout and lean manufacturing), sustainability (energy costs, zero waste, environmental responsiveness), technology acceleration (tech transfer, finance), and global supply chain management.

²⁸ Commonwealth Corporation analysis of data maintained in the Massachusetts One-Stop Employment System database, 2013.

- The Massachusetts legislature created an Advanced Manufacturing Futures Program within the state's economic development finance agency to promote advanced manufacturing, foster supply networking, encourage tech-transfer innovations and partnerships with research universities, colleges, and laboratories and promote regional partnerships to align resources and promote sectoral collaboration.
- The Massachusetts Community Colleges and Workforce Development Transformation Agenda (MCCWDTA), supported by a three-year grant from the U.S. Department of Labor, is aligning curriculum credentials to help residents attain certificates in advanced manufacturing.
- Commonwealth Corporation awarded a Workforce Competitiveness Training Program grant to four regional partnerships focused on machining and advanced manufacturing, to connect basic skill remediation, ESL services, and employer-sponsored on-the-job training with available training programs to meet regional demand.
- Seven Michigan Community Colleges, which are part of the Michigan Coalition for Advanced Manufacturing, will share \$24.9 million in grant funding through the Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program. The money will be used to upgrade their manufacturing and workforce development programs, as well as expand enrollment in technical programs and purchase new equipment.
- Detroit's Wayne County Community College District (WCCCD) is part of a national collaborative aimed at providing workers with the skills needed for the emerging advanced manufacturing industry. Part of the Right Skills Now Initiative, the school will run a fast track precision machining program that results in a NAM credential.
- In December of 2013, the State of Michigan will accept its first class into the newly launched Michigan Advanced Technician Training Program (MAT2). Championed by Governor Snyder, the innovative program was benchmarked on the German Dual Education System and utilizes an apprenticeship model. MAT2 completers obtain an associate's degree, industry-recognized credentials and the DOL apprenticeship certificate.

These strategies are part of the larger public effort to support advanced manufacturing – but none of them explicitly target opportunity youth as potential trainees and workers. CNC represents an advanced manufacturing career opportunity that will pay huge dividends for a fractional investment and the opportunity youth cohort is an untapped resource with no current strategy to connect them with this industry, or the broader labor market. In Michigan, there are currently 220,000 opportunity youth²⁹ and in Massachusetts, there are 47,000 such youth who could become part of the solution to our skills gaps.

Strategic Response: A Youth Advanced Manufacturing Corps

Given the opportunities described above, we are urging partners and stakeholders around the country to pursue sustainable and replicable career pathway approaches in the field of machining and advanced manufacturing that require a modest amount of training and pay family-sustaining wages for opportunity youth. These programs would aim to align foundational skills training, academic skills training, industry-

²⁹ "Youth and Work: Restoring Teen and Young Adult Connections to Opportunity". Annie E. Casey Foundation, 2012. Accessed at: <http://www.aecf.org/KnowledgeCenter/Publications.aspx?pubguid=%67b3213DA55-8216-4065-B408-D7A521CDD990%7d>

validated technical skills training, work experience through transitional employment, and comprehensive case management services at the local and state level. The resulting **Youth Advanced Manufacturing Corp** would connect multiple systems that serve young adults, ages 18 – 24, in order to overcome barriers that have blocked their entry into high demand middle skill jobs that are important to regional economies, with particular attention given to careers in CNC operation. In so doing, we will realize the potential of opportunity youth as a viable talent pipeline for growing advanced manufacturing companies, while also creating family-sustaining careers for opportunity youth.

Several key assumptions would underlie the design of the **Youth Advanced Manufacturing Corps** programs.

Creating a partnership structure is critical to enhancing program capacity, longevity and scalability. Training providers, employers and community organizations should leverage resources, staffing, relationships and institutional memory to address the specific needs of employers, target appropriate candidates and craft purposeful training. Young adults should have access to the program through various community organizations, One-Stops and educational institutions. A partnership may include small, medium and large employers who play a variety of roles, from outreach and advisory capacity to acting as a pilot site. Manufacturers should be engaged in the design and implementation of the project at the state and regional levels. A partnership should strengthen connections between economic development, workforce development and education, leverage knowledge and resources, and ensure that training design is developed based on actual employer demand now and in the future.

Integrating basic education with occupational skills training would reduce the time necessary for youth to become employable by demonstrating a method for supporting foundational learning gains within the context of occupational preparation. One of the most important components to be woven into the program design is the set of tools to coach youth on basic work readiness, interviewing and other soft skills.³⁰

To create a sustainable and replicable career pathway approach, testing how to best utilize training providers and coordinated case management and support services for young adults in the program is key. Young adults should have access to integrated English language tutoring, literacy/numeracy support, financial planning lessons, as well as transportation, child care assistance and other services necessary to promote program completion. Case management should continue after placement in order to promote job retention, encourage continued literacy/numeracy skill development, and help prepare program participants for any additional postsecondary learning.

Documentation of improvements in employment, wages, and retention among program completers should be applied to make program improvements and inform replicability. Completion of a manufacturing pathway would lead to skill gains, technical credentials, and increased employment in good jobs that provide mobility and career potential.

Educating youth and the general public about what advanced manufacturing looks like today is essential to garnering interest and participation in the program. A rebranding campaign would help to change the

³⁰ Commonwealth Corporation recently developed a curriculum and lesson plans for job readiness as part of its YouthWorks Plus program – a foundation-funded effort to connect work readiness classes with a progressive sequence of subsidized employment for low-income teens. The curriculum and program design is in response to research with employers that pointed to the need for increased attention to soft skill development. See Commonwealth Corporation & Drexel University Center for Labor Markets & Policy, *Signaling Success: Boosting Teen Employment Prospects* (April 2013), available at www.commcorp.org/publications/detail.cfm?ID=988.

negative perception of the manufacturing industry, as well as generate excitement for the opportunities that this innovative program presents for young adults, their communities and regional economies.

Key Success Factors

This concept presents a unique opportunity to address two pervasive workforce conundrums: the severe shortage of skilled workers in CNC and high youth unemployment. These bold ambitions come with challenges. The eight exemplary programs below demonstrate key characteristics to consider.

1. Build the pipeline

- Jackson Area Manufacturers Association (JAMA)

Machining U is a hands-on day camp in Jackson, Michigan, run by JAMA's Academy for Manufacturing Careers at which students design, produce and test products using state-of-the-art manufacturing equipment. Attendees visit local manufacturing shops and are introduced to valuable skills such as CAD design, machining, welding, laser cutting, programming and much more. Machining U Camp is available to students ages 12-14 and space is limited to the first 20 attendees enrolled. In 2013, Machining U ran 10 sessions throughout the summer and had a waiting list for the first time. Machining U is preceded by 'I Can Make It' camp, which is for 4th-6th graders and serves as a feeder/recruiting tool for Machining U. In 2014, program staff intend to implement a high school program, which will allow students the opportunity to oversee all technical and business aspects of their own small manufacturing plant, as well as complete the pathway to post-secondary training.

- Shop Rat

The Shop Rat program in Southeast, Michigan, is operating under a 2012 Society of Manufacturing Engineers (SME) Education Foundation \$25k grant. Shop Rat offers hands-on manufacturing and engineering classes and workshops to more than 275 Jackson County area youth each year. The program focuses on providing a complete pipeline for students who plan to pursue manufacturing careers. There are three program levels, all offered after school from introductory to Master Shop Rat (which pairs students with an industry mentor). SME also runs a week-long camp for 6th-8th graders to introduce them to the industry, called Gateway Academy.

2. Intensive case management

- The Source/Cascade Engineering

Located in Grand Rapids, Michigan, Cascade Engineering's innovative and socially conscious 'Welfare to Career' Model or W2C has attracted national attention and been the subject of countless case studies and presentations. Championed by CEO Fred Keller and started in the 1999, one of the primary contributors to the success of the program is the case manager on site. Because of the variety of challenges that the incoming workers face, the case manager maintains close relationships with them as they move through the employment process and this has resulted in 727 employees trained and 96% annual retention. The case manager conducts interviews, assists workers with paperwork and develops resources assistance plans including financial assistance, transportation logistics, child care and mental health counseling.

- Lake Michigan College

Located in Benton Harbor, Michigan, the college serves a diverse population, many of whom are low income, have a criminal history or are single parents. The manufacturing program has a full time career advisor, who provides a wide variety of services to students. In addition to academic planning, the advisor provides assistance with financial aid documents, resume and interview preparation, transportation, child care and goal setting. The Manufacturing Technology (M-TEC) staff work very closely with their local employers. They even suggested that the manufacturers have their annual meetings at the Lake Michigan College M-TEC facility and in this way, the college staff has become a critical part of the meetings. Employers send members of their staff to teach classes at the M-TEC and almost every machine in the shop has a sign with the name of a local employer who donated it.

3. Support infrastructure

- Cascade Engineering

The case manager at Cascade was hired in 1999 to increase retention. Because of the key role that she plays in the Welfare to Career (W2C) program, she now works on-site and serves several other area manufacturers and approximately 100 clients. She is the 'jack of all trades' for her clients and has built the relationships necessary to help them get and keep good manufacturing jobs. What makes her so valuable is her vast network of connections. When a problem arises, she knows who to reach out to and can provide a tailored solution quickly. Cascade assists with a variety of daily challenges that recipients of Temporary Assistance for Needy Families (TANF) face, including transportation, bills, childcare arrangements, legal obligations and counseling. All Cascade employees undergo the same orientation and training, including diversity awareness and 'Hidden Rules' training based on the book, "Hidden Rules of the Middle Class" by Ruby Payne. This programming bridges the gap between cultures and creates a new, unified workplace cohesion that increases retention and satisfaction overall.

- Mott Community College

Located in Flint, Michigan, Mott Community College serves one of the nation's highest-risk communities. The college has a robust and diverse portfolio of programs and support services offered by their Workforce Education Center (WEC) and has been able to create innovative, tailored solutions for its students that are making a difference. Recently, Mott Community College worked in partnership with the local transit authority to create a new bus route, which transports workers from the WEC to a Flint manufacturing plant that runs a paid internship-to-employment program with the school. The bus stop at the WEC ensures a safe, reliable pick up area and encourages workers to be accountable to each other and to school officials, who now have a built-in opportunity to interact with them daily. The new route is one of the critical supports that makes the difference between getting to work every day and losing a good job.

- Youth Transit Alliance

With generous support from the Skillman Foundation, the Detroit Bus Company is collaborating with community leaders and after-school programs across the target areas to ensure safe, reliable transportation to after-school activities for Detroit's children. In July, the YTA began offering zero-cost rides to students in Southwest Detroit and Chadsey-Condon between their schools, after-school activities and homes. The program combines custom-

designed, interactive planning software and a deep collaboration with the neighborhoods' existing youth service experts to create a groundbreaking transportation service. The model appears to be promising and scalable. In 2014, Detroit Bus Company hopes to expand the route structure and double the number of youth served.³¹

4. Bridge programming

- Humboldt Park/Wilbur Wright & Instituto

Humboldt Park Vocational Education Center, which is part of the City Colleges of Chicago system, has had a long standing partnership with Instituto del Progreso Latino with regards to manufacturing programs. The Fast Track CNC program provides ESL/low literacy students with a short-term pathway to employment through contextualized math and English at the partner organizations, and basic manufacturing and initial credentialing at Humboldt Park Vocational Education Center (HPVEC), while also providing them with the opportunity to complete the Advanced Certificate programs in CNC and EEIM. The program results in MSSC and NIMS credentials. Paid internships have been made possible in part by the Illinois Board of Higher Education Cooperative Work Study Grant.³²

5. Quick career exploration

- Exploratory Phase

One of the primary reasons why youth programs fail is because students are unaware of what type of commitment they are making at the beginning. We believe that a key success factor of the **Youth Advanced Manufacturing Corps** will be ensuring the program is a good fit for youth who enroll. Recruits should be given an opportunity to explore several available career pathways, including manufacturing, to learn about challenges and benefits of each choice, prospects for employment in each field, and the education/training paths necessary for employment. Young people who are not attracted to manufacturing could then be given information about ways to pursue other options. Participants would benefit from access to resources such as Commonwealth Corporation's *Empower Your Future* curriculum and the on-line Massachusetts Career Information System to explore career options and make their own assessments about the appropriateness of careers in advanced manufacturing. This process would lessen the growing pains that many similar programs experience and minimize loss of time and resources.

6. Effective marketing and recruiting

- AMP it Up!

AMT it Up! was created to inform students, parents and educators about the great opportunities in advanced manufacturing in Massachusetts. The website provides a variety of resources including lists of manufacturers by geographic region, job postings, manufacturing events from a local to national level and media coverage. There is also a series of YouTube

³¹ The Detroit Bus Company. Accessed at: <http://thedetroitbus.com/yta/>

³² Humboldt Park Vocational Education Center Community Partnerships, City Colleges of Chicago. Accessed at: <http://www.ccc.edu/colleges/wright/departments/Pages/Community-Partnerships.aspx>

videos and information on education and training programs that will lead to credentials and careers in manufacturing.³³

- Manufacturing is Cool

This interactive website, maintained by the Society of Manufacturing Engineers (SME) Education Foundation in Michigan, is another tool designed to engage young people and generate excitement about the industry. The goal of the website is to provide information in a fun and efficient way in order to educate today's learner and encourage site visitors to explore advanced manufacturing as a career option. The graphics on the website include an iPhone that provides testimonials from 'real life engineers,' a bag of Doritos that leads the user to a page on consumable goods and a robot that allows the user to share the website with your friends through Facebook.³⁴

- Capital Area Manufacturing Council (CAMC)

CAMC is a sector partnership formed in 2004 and comprised of small, medium and large manufacturers in the greater Lansing, Michigan area. CAMC works closely with area high schools and will be launching its first Manufacturing Tour Day, where local engineering students from MSU will be visiting three manufacturing plants and then attend a networking happy hour. CAMC also works closely with Capital Area Michigan Works! to connect opportunity youth, ages 18-24, with education and employment opportunities in the area as well as counseling services, financial planning, soft skills training and other support functions.

7. Robust and diverse partnerships

- AMTEC

The Automotive Manufacturing Technical Education Collaborative (AMTEC) started out as a multi-state program between major auto manufacturers and community colleges. Today it spans from Michigan to South Carolina throughout the industry's natural cluster around the I-75 corridor. It includes multiple community colleges, foreign and domestic firms and union and non-union shops. Its goal: to make sure that a new generation of skilled, globally competitive auto workers exists. AMTEC uses a sector partnership approach to precisely identify the skills needs of workers across two critical job classifications (production and maintenance), and a career pathway approach to making sure coursework is modularized, flexible, contextualized, and results in stackable credentials.³⁵

- Year Up, Inc. Professional Training Corps (PTC)

At the Clinton Global Initiative Meeting in July 2012, Year Up announced its new program called Professional Training Corps (PTC). Modeled after the Reserve Officers' Training Corps (ROTC), Year Up's PTC is a community college-based program that will help students earn associate's degrees while providing them with professional development and work

³³ AMP It Up! Advanced Manufacturing Program, Massachusetts. Accessed at: <http://ampitupma.com/>

³⁴ Manufacturing is Cool, Society of Manufacturing Engineers (SME) Education Foundation. Accessed at: <http://www.manufacturingiscool.com/HTML5/main.html>

³⁵ Woolsey, Lindsey. "Aligning Targeted Industry Strategies to Increase Economic Competitiveness and Worker Success – A Concept Paper by the National Governors Association Center for Best Practices and the Corporation for a Skilled Workforce". CSW, March 2010.

experience closely linked to labor market demand. Year Up announced that it will launch a new community college program in partnership with Miami Dade College in August 2012 as part of the PTC initiative. Miami Dade College is the largest institution of higher education in the United States, with over 174,000 students.³⁶ Year Up helps "disconnected" young people not enrolled in school or participating in the labor market cross the opportunity divide to access living-wage employment and higher education. In turn, companies gain access to a pipeline of high-quality entry-level talent. For 10 years, nearly 400 employers, primarily consisting of Fortune 500 companies, have found added value in Year Up students as interns and permanent hires. And 84% of Year Up's alumni are employed and/or attending college full-time within 4 months of graduation, moving them along a path to economic self-sufficiency.³⁷

Next Steps

Developing the **Youth Advanced Manufacturing Corps** program offers tremendous opportunities and payoffs, but not without first overcoming formidable obstacles. We are encouraging partners and stakeholders around the country to focus on this issue and its potential to meet the needs of our opportunity youth and our manufacturing industry. We are pursuing several activities to continue to explore and hone the concepts presented in this initial paper:

- Expand our network of stakeholders with interests in connecting opportunity youth with careers in precision manufacturing.
- Catalyze program design efforts in collaboration with interested stakeholders.
- Explore further the value of this integrated approach for both opportunity youth, and also the manufacturing industry.
- Support the deployment of Youth Advanced Manufacturing Corps programs through technical assistance and research support.
- Define key research questions associated with this effort and an evaluation framework that captures data to inform continuous improvement and replication.

We are eager to identify partners for these efforts and believe local context and partnerships will be vital to the creation of effective Youth Advanced Manufacturing Corps programs. For more information on our research in this area and potential opportunities for future engagement, please contact Katie Hall, Policy Associate at Corporation for a Skilled Workforce, (734) 769-2900 x230 or khall@skilledwork.org.

³⁶ Clinton Global Initiative CGI America Announcement, June 18, 2012. Accessed at: http://www.youtube.com/watch?v=PapTeEzKzM&feature=player_embedded

³⁷ "Year Up Inc. Announces Partnership with Miami Dade College at Clinton Global Initiative America Meeting". *Year Up, Inc.* June 7, 2012. Accessed at: <http://www.prnewswire.com/news-releases/year-up-inc-announces-partnership-with-miami-dade-college-at-clinton-global-initiative-america-meeting-157833935.html>