

MADE IN MEMPHIS

Manufacturing Industry Survey Report and Recommendations

April 2013

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I. Executive Summary

Introduction

In the U.S., manufacturing has historically anchored the national economy. Though the number of domestic manufacturing jobs has declined, the U.S. still ranks as the world's top manufacturer of goods. A recent report by the Boston Consulting Group projects over five million new manufacturing jobs will be available in the U.S. through 2020 due to a surge in reshoring of manufacturing back to the U.S. and a rise in exports.

In the near term, Memphis faces a similar opportunity. Successful economic development efforts led by the Memphis and Shelby County Mayors, together with the Greater Memphis Chamber, have resulted in an influx of manufacturing companies to the Memphis area, as well as significant expansions by area manufacturers.

According to a 2012 jobs analysis performed by the Workforce Investment Network (TN LWIA 13, or WIN), local manufacturers plan to hire over 4,000 employees from 2012-2016.

The creation of 4,000 manufacturing jobs paying an average of \$32,180/year would result in an annual influx of \$129 million in direct wages and a total economic impact exceeding a third of a billion dollars, annually.

This trend diversifies the Memphis economy, which has historically been dominated by logistics and distribution, healthcare, and tourism. The rapid growth presents an opportunity and a challenge to provide a skilled manufacturing workforce.

Memphis once had a thriving manufacturing economy but, as in many other parts of the U.S., the 1990s saw plant closures and job losses as manufacturing in the U.S. shrank and jobs moved overseas. Also, in the last two decades, the requirement for greater productivity has driven technological advances in operations, requiring a manufacturing workforce that must continually learn new skills. Finally, manufacturers in Memphis face a retiring workforce.

Recognizing the need to understand and serve area manufacturing employers' growing workforce needs, WIN has partnered with the Greater Memphis Chamber (the Chamber), the Memphis and Shelby County Mayors, and Southwest Tennessee Community College to create the MADE IN MEMPHIS workforce initiative.

The MADE IN MEMPHIS workforce initiative will create a pipeline of qualified employees to meet the needs of local manufacturing companies as they continue to achieve and grow.

WIN commissioned a study to record and assess local manufacturing employer needs through an online survey and in-person interviews. Over 40 companies completed surveys and provided detailed information about high-demand occupations and the top skills necessary for these jobs. The survey also requested information on the employers' hiring practices.

Survey Results

Survey respondents confirmed the importance of frontline workers, including general operators, chemical processors, welders, and general assembly employees. At the same time, respondents classified at least half of the top-25 local in-demand manufacturing occupations as "moderately high-tech manufacturing," including technicians and engineers.

The top 25 global skills identified by area employers fell within three general concentrations:

- **Academic** – literacy, arithmetic, computer skills, logic and reasoning, measurement/conversions, compiling, categorizing, and verifying data, and understanding relationships among facts
- **Workplace** - respecting the views of others, conflict resolution, building toward consensus, and influencing, motivating, and persuading others
- **Industry specific** - creating/implementing standard operating protocols, anticipating obstacles, prioritizing assigned tasks and managing concurrent tasks

Respondents reported few effective job-announcement placement strategies. Few employers reported working with educational institutions to recruit employees.

Interview Results

Interview responses echo national challenges of finding employees trained to meet the requirements of technological advances, regulatory pressure, and a retiring workforce. Employee challenges, such as inadequate family care and transportation options, contribute to absenteeism and tardiness.

According to workforce development professionals and educators, employees frequently are unaware of career pathways available to them and the value of education in terms of job advancement. Also, according to the respondents, employees sometimes do not understand how individual roles fit into the mission and vision of their companies or how absenteeism and tardiness can negatively affect a business' ability to meet customer needs.

Employers detailed internal efforts to meet these challenges, including online hiring assessments and extensive orientation programs, along with continual in-house training on company policies and metrics backed by union bylaws. All respondents indicated that the return on investment for these measures as high. Also, when utilized, respondents listed resources such as local educational institutions and WIN as assets.

Recommendations & Best Practices

- Data related to specific employer workforce needs, such as the data compiled in the MADE IN MEMPHIS survey and interviews, should guide workforce development and education leaders in fashioning responsive workforce solutions (For example: IRT/I-BEST models).
- Career pathways, including training that can prepare employees to obtain manufacturing industry recognized credentials that qualify employees for career advancement, should be designed, communicated and implemented (For example: the Advanced Manufacturing Competency Model, the Scientific Management Technologies curriculum, and “stackable credentials”).
- Industry can help create solutions by contributing loaned expertise and equipment to enhance training (For example: the Mississippi Corridor Consortium).
- A large scale marketing campaign to create public awareness of the benefits of and pathways toward a manufacturing career should be designed and implemented (For example: the Gold Collar Careers marketing campaign).

WIN, its partners at the Chamber and Southwest, among others, stand ready to lead these further efforts, with this document serving as a foundation for future program implementation.

II. Manufacturing: A National Perspective

Manufacturing anchors the U.S. Economy

The February 2012 report, “A National Strategic Plan for Advanced Manufacturing, the National Science and Technology Council,” published by the Executive Office of the President National Science and Technology Council summarized the continued importance of manufacturing in the U.S.:

U.S. manufacturers produced about \$1.7 trillion of goods in 2010, about 11.7% of the U.S. gross domestic product (GDP). They employed 11.5 million Americans in jobs that paid on average about 21% more than average hourly compensation in private-sector service industries. Manufacturing has a larger multiplier effect than any other major economic activity -- a dollar spent in manufacturing drives an additional \$1.35 in economic activity. Manufacturing is also the largest contributor to U.S. exports. In 2010, the United States exported over \$1.1 trillion of manufactured goods, which accounted for 86% of all U.S. goods exports and 60% of U.S. total exports.

U.S. manufacturing maintains its global leadership, being the world’s largest manufacturer. According to data published by the National Association of Manufacturers (NAM), the U.S. accounts for 18.2% of globally manufactured goods. China, the U.S.’s closest competitor, represents 17.6% of the world’s manufactured goods.

U. S. Manufacturing Growth and Workforce Shortages

The Boston Consulting Group, in “Made in America, Again,” noted “Manufactured exports—a bright spot of the U.S. economy in recent years—are set to surge.” The report suggests that up to five million manufacturing jobs could be created in the U.S. by 2020 due to “reshoring” of industries previously sent overseas to countries like China.

National trends show the increase. According to the “Current Employment Statistics Highlights – December 2012” as published by the Bureau of Labor Statistics, 180,000 manufacturing jobs were added in the U.S. in the last year.

Concern exists in finding the workforce to fill these positions. In 2003, NAM published its white paper, “Keeping America Competitive: How a Talent Shortage Threatens U.S. Manufacturing.” As long as ten years ago, manufacturers were challenged to fill open positions.

In 2011, Deloitte and the Manufacturing Institute published “Boiling Point? The Skills Gap in U.S. Manufacturing,” in which over 1,100 executives at manufacturing companies shared that 5% of current manufacturing jobs goes unfilled due to a lack of qualified applications, the equivalent of 600,000 skilled positions. Sixty-seven percent reported “moderate to severe” shortages in qualified employees, and 56% predicted an increase in the shortage through 2017.

Numerous studies identify manufacturing skills gaps. The Employ Florida Banner Manufacturing Center noted in its 2007 “Manufacturing Workforce Pipeline Study” that “skill sets traditionally only needed by supervisors and managers are now needed by operators and technicians as well.” These knowledge sets included automated and computer-integrated controlling processes, lean manufacturing principles, portable skills, flexibility in work habits, and adaptability to new technologies and processes.

The Tri-State Manufacturers Alliance report titled “Survey Shows Skills Gap Still an Issue,” March 2012, reported data from 133 companies across 47 counties in Indiana, Illinois, and Kentucky. Forty percent of the surveyed manufacturers reported they will not hire applicants because of a lack of necessary technical skills.

The Skills Gap

Challenges to closing the gap between available jobs and qualified workers exist for several reasons.

Retiring Workforce - While the number of jobs grows, the workforce shrinks. In its September 2012 strategic plan, the Northern Kentucky Industrial Park Association (NKIP) noted “nearly three-fifths of anticipated job openings are a result of attrition and retirement.” The Advanced Manufacturing Plan reported that “approximately 2.8 million manufacturing workers (nearly 25%) are [retiring soon].”

Changing Technologies – In “Keeping America Competitive,” NAM listed exacerbating issues creating what it called a “genuine labor crisis.” Continual changes in technology require the need for continual re-education of a committed workforce willing to adapt. However, those employees most experienced and capable of that flexibility will retire soon, resulting in an additional shortage of ten million employees, according to NAM, in the next 15 years.

Mounting Regulatory Pressures - The Bartlett Area Chamber of Commerce (BACC), home to most of Memphis’ biomedical device manufacturers, published its “*Life Sciences Report*” in 2011. Chief among the challenges cited by these employers when surveyed and interviewed were mounting regulatory pressures by agencies like the U.S. Food and Drug Administration, along with new regulatory pressures placed upon them by their own customers. The changes in the regulatory environment have caused a shortage of personnel experienced in quality practices and record keeping.

Public Image of Manufacturing – The systematic devaluation in recent years of manufacturing careers in comparison to other professions has also challenged growth. Some community colleges and trade schools have either downsized or changed their focus to qualify students for four-year college or university programs, meaning fewer classes in basic mechanics, fewer certificate courses, and fewer internships.

The Deloitte study contends that, “exacerbating the issue is the stubbornly poor perception of manufacturing jobs among younger employees.” Deloitte cited one survey concluding that, among 18-24 year olds, “manufacturing ranks dead last” as a career option.

The “Keeping America Competitive” report states that one critical group, manufacturing apprentices, lags behind other groups. In 2007, the Bureau of Apprentice Training, a division of the U.S. Bureau of Labor and Statistics, listed nearly 400,000 registered apprentices. Only a fraction of these apprentices, 5%, were being trained for the manufacturing industry.

III. Manufacturing: The Greater Memphis Area

Local Types of Manufacturing

The Memphis economy has created a multi-faceted and robust combination of industries, with logistics, healthcare, and tourism being three of the most prominent.

Memphis has a longstanding reputation as “America’s Distribution Center,” and Memphis is “home of the world headquarters and hub of shipping powerhouse FedEx, over 400 trucking companies and major operations of UPS and USPS” (Chamber).

Memphis is regularly ranked as one of the top air cargo hubs, and now ranks second, globally. The Mississippi River, two interstate highways, and five class-one railroads provide an ideal logistics and distribution commercial infrastructure in the Memphis area.

As a result of these economic assets and resources, Memphis’ workforce has a larger percentage of logistics workers than any other metropolitan area in the county.

<u>Memphis Manufacturing Types</u>	<u>Employment</u>
Paper	4,870
Machinery	3,843
Chemical	3,677
Fabricated metal	3,458
Food	3,412
Printing	1,740
Electrical equipment and appliance	1,487
Beverage and tobacco	1,198
Nonmetallic mineral	753
Transportation equipment	667
Computer and electronic	605
Wood	507
Petroleum and coal	448
Furniture	366
Metal	357
Plastics and rubber	354
Textiles	342
Apparel	19
“Miscellaneous” manufacturing	6,170
Total Manufacturing	34,272
<i>Source: Bureau of Labor Statistics</i>	

In Memphis, an average annual manufacturing wage is \$32,180 (Bureau of Labor Statistics). As of 2010, according to a regional manufacturing report by the Brookings Institution, Memphis ranks in the mid-range of total number of manufacturing jobs (44/100) and percentage of manufacturing jobs (53/100), as compared to the U.S.’s other 100 largest metropolitan areas. Regarding pay, Memphis ranks 43/100 for all jobs and 17/100 for all manufacturing jobs.

Immediate Opportunities & Economic Impact

Successful economic development efforts led by the Memphis and Shelby County Mayors, together with the Greater Memphis Chamber, have resulted in an influx of manufacturing companies to the Memphis area, as well as significant expansions by area manufacturers.

According to a 2012 jobs analysis performed by the Workforce Investment Network (TN LWIA 13, or WIN), local manufacturers plan to hire over 4,000 employees from 2012-2016.

The creation of these jobs will impact the Memphis economy. According to Jeff Wallace, Ph.D., a Research Associate Professor at the Sparks Bureau of Business & Economic Research at the University of Memphis, an appropriate economic multiplier of 240% can be applied, meaning that each dollar paid in manufacturing wages in the Memphis area results in about \$2.40 in total economic gains.

To calculate this number, Professor Wallace used the economic tools RIMS II and IMPLAN, both of which estimate output, earnings, and employment impacts across 18 different and broadly classified manufacturing sectors.

The creation of 4,000 manufacturing jobs paying an average of \$32,180 annually would result in an influx of \$129 million in direct wages. Applying the economic multiplier noted above, the annual economic impact could be a third of a billion dollars, annually.

MADE IN MEMPHIS

Prior to the design and implementation of the MADE IN MEMPHIS strategy, there has been no strategic partnership that would enable the local high-growth manufacturing sector to drive the design of training programs to prepare the local workforce for current and expanded job opportunities. While a local sector strategy for biosciences exists, minimal workforce partnerships serve the training needs of manufacturing sectors with sizable entry-level job opportunities.

The MADE IN MEMPHIS Initiative addresses these local workforce challenges by leading the reengineering of industry training and advocating for other processes and policies to create a high-impact public/private workforce solution. MADE IN MEMPHIS also will develop partnerships among workforce development providers, post-secondary education institutions and manufacturing employers. The goal is to help prepare and connect local workers to high-demand entry level jobs, which will be the first step in the workers' manufacturing career pathway.

One of the first initiatives of the strategy is the collection of crucial data assessing the hiring and training needs of local manufacturing employers by means of a survey and interviews.

IV. Data Collection

Data for this Report was collected through the use of a written survey and a series of employer, workforce development, and post-secondary education leadership interviews.

Survey

A survey request was sent through email and regular mail to manufacturing companies throughout the greater Memphis area. WIN and Chamber personnel made personal invitations to manufacturing company leaders for participation. Forty companies completed the survey through an easy-to-access online survey tool. The survey could be completed in less than ten minutes and asked about the companies' hiring plans in the next 24 months (i.e., through 2015). The survey requested specific high-demand positions to be hired and the most desired skills sets for each position. The survey also requested information about the company's recruitment practices and general demographic information.

Interviews

A second research component was a series of 27 interviews with employers, workforce development professionals, and educators. Taking an average 30 minutes, the interviews were structured around workforce development, challenges, and best practices. Representatives of the employer group included human resource managers and plant managers of larger companies. In the case of smaller companies, interviews were conducted directly with executive management and/or principals.

The company types included:

- Biomedical device
- Chemical manufacturers and products (industrial, agricultural, and energy)
- Consumer goods
- Clothing manufacturers
- Food manufacturers
- Heavy and light metal fabricators
- Paper product manufacturers

A second set of interviews was conducted with workforce development professionals who work daily to help employers and employees. Representatives included executive directors and program managers. Finally, interviews were conducted with educators from local institutions focused on workforce development, ranging in leadership from the executive directors to program directors and coordinators.

All responses have been kept anonymous.

Secondary research included a variety of official reports, white papers, media articles, and government-issued guidelines ([Appendix A](#)). The Chamber's research staff contributed greatly to the Greater Memphis Area employment statistical data.

V. Research Results

Survey Results: Job Titles

Brookings classifies half of the top 25 occupations, as identified by the surveyed companies, as “moderately high-tech manufacturing,” including technicians and engineers whose skills cross industry types and subject-matter expertise.

Respondents indicated area operator jobs as important, particularly in the areas of general operators, chemical processors, welders, and general assembly employees.

General descriptions of the major employment categories are provided by the Bureau of Labor Statistics Occupational Outlook Handbook.

Engineers typically must have earned at least a B.S. in engineering and work “in research, development, design, testing, analysis, production, construction, maintenance, operation, planning, survey, estimating, application, or standardization of engineering facilities, systems, structures, processes, equipment, devices, or materials, requiring knowledge of the science and art by which materials, natural resources, and power are made useful.”

Maintenance refers to a wide range of activities and skills, including problem solving, interpreting written instructions and specifications, planning work flow, using hand tools machine tools, and precision measuring instruments. Sometimes, the work includes actually creating replacement parts or modifying parts to machinery, meaning the employee must have an understanding of metallurgy.

Operators monitor and operate the control consoles of manufacturing machines, working with preset instructions and specifications. Essential skills include calibration, diagnostics, and measuring, as well as maintaining operating records.

Technicians work across technologies, including electrical, electronic, and mechanical, providing support across a variety of functions, including R&D, process improvement, designing, and testing. Technicians must “have some practical knowledge of science or engineering; some positions may also require a practical knowledge of mathematics or computer science.”

Top 25 occupations identified for hire through 2015	
1	Quality Technician
2	Mechanical Engineer
3	Production Worker (General)
4	Electronics (including PLC) Technician
5	Chemical Plant & System Operator
6	Welder, Cutter, Solderer, & Brazier
7	Electrician
8	Assemblers & Fabricators
9	Stationary Engineer & Boiler Operator
10	Quality Engineer
11	Plant & System Operator, All Other
12	Packaging & Filling Machines Technician
13	Metal Workers & Plastic Workers, All Other
14	Machinist
15	Instrument Technician
16	CNC Machine Tool Operator
17	Chemical Engineer
18	Power Plant Operator
19	Pipefitter
20	Paper Goods Machine Setter, Operator, & Tender
21	Mixing & Blending Technician
22	Mechatronics (all levels)
23	Manufacturing Fabricator
24	IT Technician
25	Inspector, Tester, Sorter, Sampler, & Weigher

Survey Results: Skills

The skills lists compiled for the survey were adapted from the U.S. Department of Labor (DOL) Advanced Manufacturing Competency Model “skills checklist” developed in partnership with the Manufacturing Institute, the National Council for Advanced Manufacturing, and the Society of Manufacturing Engineers.

Survey: Top 25 Required Job Skills

The table on the right lists the most commonly identified skills required for manufacturing employees in Memphis.

Manufacturing production includes several interlocking steps and processes, involving different technologies, machines, and raw materials.

Employers need employees who can understand how their part in the process fits with other components of the process, and how their actions performing their part of the process will affect the rest of the process, either positively or negatively.

Employers also need employees who can be conversant across several functional divisions, as well as internal and external customers.

The survey results reflect this reality.

Skills highlighted in yellow below indicate skills listed in the TOP 25 REQUIRED JOB SKILLS.

TOP 25 REQUIRED JOB SKILLS	
1	Respecting the Views of Others
2	Creating/Implementing SOPS
3	Literacy
4	Arithmetic
5	Usage of Hand Tools
6	Computer Skills
7	Conflict Resolution
8	Logic & Reasoning
9	Building Toward Consensus
10	Measurement/Conversions
11	Troubleshooting
12	Influencing, Motivating, & Persuading Others
13	Minimizing Waste
14	Print Reading
15	Whole Numbers/Fractions/Decimals
16	Compiling, Categorizing, & Verifying Data
17	Customer Relations
18	Anticipating Obstacles
19	Ensuring Quality Standards
20	Observing & Gathering Data
21	Emergency Procedures
22	Understanding Relationships Among Facts
23	Prioritizing Assigned Tasks
24	Managing Concurrent Tasks
25	Facilitating Safe Work Activity

Survey: Academic Skills

Academic Skills dominate the Top 25. Clearly, the need for basic skills such as “Literacy” and “Arithmetic” remain prominent.

At the same time, the academic skills such as “Logic & Reasoning,” “Compiling, Categorizing, & Verifying Data,” and “Understanding Relationships Among Facts” suggests a strong need to integrate basic knowledge into the areas of problem solving and working through complex procedures.

TOP ACADEMIC SKILLS	
1	Literacy
2	Arithmetic
3	Computer Skills
4	Logic & Reasoning
5	Measurement/Conversions
6	Whole Numbers/Fractions/Decimals
7	Compiling, Categorizing, & Verifying Data
8	Observing & Gathering Data
9	Understanding Relationships Among Facts
10	Locating Information in Technical Documents

Survey: Workplace Skills

Workplace skills relates to the ability of teams completing assigned tasks. “Respecting the Views of Others” tops the Top 25 list, and all five of the Workplace skills offered in the survey appear in the Top 25.

TOP WORKPLACE SKILLS	
1	Respecting the Views of Others
2	Conflict Resolution
3	Building Toward Consensus
4	Influencing, Motivating, & Persuading Others
5	Customer Relations

Employers expect employees to work as a team to accomplish the manufacturing process. No one person can run a full production line, regardless of automation. Nor can one person fix all problems. Instead, a team of people must work together to accomplish production and maintenance processes.

Manufacturing also requires production staff to work successfully with financial, marketing, and sales staff. Externally, manufacturing employees regularly interact with quality and regulatory personnel, outside vendors, logistics providers who ship the product and, last but not least, customers. “Customer Relations” therefore naturally appears in the top 25. The modern manufacturing employee must serve and interact with these various parties on a daily basis.

Survey: Industry Specific Skills

While employees require what could be described as general skills in academics and interpersonal areas, all industries require unique skill sets, sometimes specific by company. At the same time, some global industry-specific skills can be identified and reflect the need for a wide base of skills that incorporates the full process of creating products. Below, each industry specific skill is listed per category.

Below, the skills are broken out into specific categories. In those cases that more than ten skills were listed in the top category, the top ten are shown.

Survey: Industry Specific – Engineering Skills

Engineering skills are assuredly important to employers. However, only one skill, “Print Reading,” appeared in the Top 25. As referenced above, however, the more pressing needs at this time lie in the areas of basic academics and workforce skills.

TOP ENGINEERING SKILLS	
1	Print Reading
2	Automated systems & control
3	Interpreting Schematics
4	Interpreting CAD Drawings
5	CAD/CAM/CAE Applications
6	Updating & Editing CAD Drawings
7	Creating CAD Drawings
8	Geometric Dimensioning and Tolerancing

Survey: Industry Specific – Operational Skills

Operational skills include understanding the full process that products take from raw materials to packaged materials ready to ship to customers.

While there are several areas in Operational Skills, respondents only noted “Anticipating Obstacles” and “Managing Concurrent Tasks” as important enough to be listed in the Top 25.

TOP OPERATIONS SKILLS	
1	Anticipating Obstacles
2	Managing Concurrent tasks
3	Managing Raw Materials/Consumables
4	Bulk/Continuous Flow/Line Balancing
5	Assembly Planning/Execution
6	Managing Inventory
7	Fabrication
8	Materials/Goods Transportation Methods
9	Packaging Product
10	Shipping & Receiving Products & Materials

Survey: Industry Specific – Maintenance Skills

Maintenance skills include the repair of equipment and machinery, and the respondents suggested a heavy need for the basic skill of “Usage of Hand Tools.”

However, the next two skills that appeared in the Top 25, “Troubleshooting” and “Prioritizing Assigned Tasks” are more global, crossing all forms of technology.

TOP MAINTENANCE SKILLS	
1	Usage of Hand Tools
2	Troubleshooting
3	Prioritizing Assigned Tasks
4	Calibrating Measuring Instruments
5	Mechanical
6	Electrical
7	Hydraulics & Pneumatics
8	Electronics
9	Joining, Welding, & Assembly
10	Robotics

Survey: Industry Specific – Quality/Safety/Green Skills

This broad-ranging category reflects the functions of generally minimizing waste, but also in documenting processes and historic data on the manufacturing of products. Also included are skills that rigorously test that products fall into specific parameters.

Several of the skills in this category are listed highly in the top 25, with “Creating/Implementing SOPS” listed as number two on the Top 25.

TOP QUALITY/SAFETY/GREEN SKILLS	
1	Creating/Implementing SOPS
2	Minimizing Waste
3	Ensuring Quality Standards
4	Emergency Procedures
5	Facilitating Safe Work Activity
6	Lean Manufacturing
7	Environmental/Health/Safety
8	Material Safety Data Sheet
9	Control System Documentation
10	Creating Standard Operation Protocols

Survey: Employer Recruiting Methods

Also included in the survey were questions about employers’ most common hiring methods.

This data was gathered to gauge the prevalence and effectiveness of various methods, including the effectiveness of the public workforce system in assisting employers with their hiring needs, and to identify hiring challenges. The surveyed employers use a diverse range of recruiting methods.

Internal promotions, word of mouth, and employee referral programs are the top three reported. Response patterns indicate employers prefer to find employees through internal hiring, avoiding “open call” or external recruitment. In addition to internal promotions, word of mouth and employee referrals provide employers with the ability to “know what they’re getting” when looking to hire employees they can rely on.

The next most common recruiting method is the use of WIN-facilitated job postings in the Tennessee Department of Labor job database, as offered by the WIN Business Services Department. These focused searches free employers from reviewing hundreds or thousands of resumes of applicants who do not meet their hiring criteria. The service provides employers with a smaller but better pool of candidates from which to fill open positions.

Employers indicate little use of recruitment through area post-secondary schools, or the use of internships or co-op opportunities that lead to full-time employment. As reflected in the interview summary, few employers work with local schools directly. Few employers use the Chamber’s job board or social media for recruitment.

Interviews: The Bottom Line

Employers suggested that multifaceted workforce challenges affect the financial health of their companies, sometimes stymying growth. The difficulty in hiring and retaining a sufficient number of qualified employees threatens a company’s ability to meet customer needs. Below are several commonly cited examples.

Interviews: Changing Technology

The continual upgrading of technology presents issues for the employers. Although company budgets enable them to buy new upgraded machinery, employee training considerations are significant factors. Many of the employers reported that they must expend substantial amounts contracting with outside trainers to train incumbent employees.

TOP RECRUITMENT METHODS	
1	Internal Promotions or Hire
2	Word of Mouth
3	Employee Referral Program
4	WIN-TNDOL Listings
5	External Website
6	Recruitment Services
7	College or Technical Schools Outreach
8	Company Website
9	Internship or Co-op
10	Local Job Service Office Listings
11	Greater Memphis Chamber Job Board
12	Social Media

Interviews: Regulatory Pressures

Employers cited expanding regulatory requirements as a factor in forcing the hire of quality specialists and retraining employees. Employers mentioned a challenge to convince employees of the necessity of the quality measures. In the case of medical device companies, as customers have not agreed to pay more due to new regulatory requirements, profit margins have thinned and the companies are more pressed to find the resources necessary to meet the customers' needs.

Interviews: Retiring Workforce

A retiring workforce was indicated as a challenge. Employers said that some of their most experienced and dedicated employees will soon retire. Employers expressed concern about the ability to replace these long-term employees with skilled or experienced talent.

Interviews: The Value of a Career in Manufacturing

Workforce professionals echoed the national literature's perspective of a general lack of understanding by potential employees, especially those currently in high school and degree programs, of the benefits of becoming qualified for a manufacturing career. Interviewees suggested overwhelmingly that a concerted public marketing campaign sponsored by industry partners would benefit the industry in recruiting more qualified workers.

Interviews: Pay scale

Workforce professionals indicated pay scale as a challenge. While employees, according to workforce professionals, understand employers must limit payroll costs to maximize profit margins, the entry-level pay does not offset employee costs of, for example, independent transportation or costs of childcare.

Also, some employees do not seem to understand the value of employee benefits, when offered, and instead focus on the amount of hourly wages. The employees, according to the workforce professionals interviewed, frequently use these perceptions as reasons to leave companies in favor of sometimes only slight increases in pay.

Interviews: Internal Employee Advancement

Employers generally reported that internal promotion from entry-level to floor leadership was possible. In contrast, employees are limited in their advancement to the so-called "front office" positions, as employers prefer to hire executives outside the company. Therefore, according to workforce professionals, employees see little control of their own careers, as they see limited opportunities to advance into management positions. Further, few employees seem to understand the connection between continued training and advancement in position or pay.

Interviews: Tardiness and Absenteeism

Both employers and workforce professionals reported the combination of tardiness and absenteeism as challenges. The employers noted as essential the employees' presence to continually monitor equipment and safety and quality measures. Absent employees challenge employers to fill that position on short notice, frequently requiring other employees to be called in for additional shifts, causing overtime pay costs.

Some employers reported a need to change practices in the distribution of checks, for example, as a portion of employees would leave after receiving pay. Instances were reported of employees receiving pay, being absent for several days, and then reappearing “when their money ran out.” The employers reported that such employees expressed no understanding as to why they were not allowed to return to work after being absent.

Workforce development leaders indicated that family care and transportation challenges frequently result in absenteeism or tardiness. At the same time, employees sometimes do not communicate these issues to employers, who in turn also do not make their own inquiries.

Interviews: Criminal Backgrounds

Employers expressed little tolerance for offering “second chances.” Employers felt compelled to pass over potential employees with histories of drug abuse or felony convictions. This view related to any criminal background, regardless of whether the offenses were very recent or long in the employee’s past. Even potential employees with several years’ separation from a conviction were seen as less desirable.

Although several employers expressed sympathy for applicants in such cases, the employers were clear that their priority must be to move their companies forward. In some cases, corporate restrictions also limit the choice to hire even the most qualified employees if they have drug or felony convictions.

How Employers and Workforce Development Professionals Currently Meet these Challenges

In some cases, employers reported success in substantial assessment programs, including online screening, extensive orientation activities (including tours of the facilities and speaking with current employees), and personal interviews.

Employers who reported significant progress shared a practice of setting expectations for tardiness and absenteeism explicitly that are sometimes backed by union regulations on a maximum number of absences. In these cases, the employers admit that the level of necessary oversight resources was high. However, each felt the return was worth the investment.

In some cases, training partnerships, such as the Industrial Readiness Training (IRT) classes, supported by WIN and administered by Southwest Tennessee Community College, allow employers to have a first-hand experience with potential employees to observe their academic abilities, interpersonal skills, and basic mechanical training.

Other Existing Resources

As the home of several well-regarded public and private educational institutions, including technology centers, 2-year community colleges, and 4-year colleges and universities that provide academic and technical training and credentials, Memphis already has in place resources that can address these challenges. A variety of for-profit and not-for-profit entities offer training in a wide variety of certifications and other credentials, some of which are recognized nationally.

WIN alone has over thirty approved training providers who are eligible for program funding for qualified candidates. However, currently no local institution serves as a certified testing site for NAM credentials such as certified production technician.

WIN Services

WIN has a full complement of business services to help employers recruit, screen, and facilitate interviews with potential employees. WIN also assists employers with staging job fairs. WIN offers funding for standardized assessments that are recognized by industry employers, such as the ACT WorkKeys that results in the National Career Readiness Certification. These metrics allow pre- and post-testing to chart progress of potential employees.

WIN offers funding resources for on-the-job training, incumbent worker training and individual training tuition and fees to help eligible job seekers obtain career-based training. WIN offers workshops for resume writing and interview skills, along with job search services and GED educational assistance referrals. Other supportive services include issuing gas cards to facilitate travel for job searches and interviews.

VI. Recommendations & Best Practices

Recommendations

To find solutions to these industry workforce needs, the following recommendations are offered.

Data related to specific employer workforce needs, such as the data compiled in the MADE IN MEMPHIS survey and interviews, should guide workforce development and education leaders in fashioning responsive workforce solutions.

Using employer provided data to drive training and curriculum changes can lead to systemic changes in the design of business driven training, enabling workforce development leaders and education and training leaders to respond to industry needs as opposed to fashioning solutions that they believe will meet business needs. For example, short term and non-credit training offerings can be developed that teach the specific skills businesses identify as priorities.

Best Practices: I-BEST/IRT

A nationally recognized model for training of low skilled workers for success along career pathways is the Integrated Basic Education and Skills Training Program (I-BEST) developed by community colleges in Washington State. The I-BEST approach combines basic workplace and technical content, reading, and math contextually linked to the specific occupation for which the student trained. Using a two-instructor approach, I-BEST has been shown statistically significant improvements in workforce, academic and technical readiness. A critical component: I-BEST participants earn college credits through the training.

Southwest has recently implemented a non-credit I-BEST based training program, its IRT course, that addresses basic academic, interpersonal/teamwork and industrial skills required for entry level manufacturing jobs. Southwest offers each class in partnership with an employer ready to hire new positions, customized to the employer's specifications to ensure that the course content meets the company's needs. Employers visit the classes, observe and talk with participants, and build relationships during the classes. At the end of training, employers interview participants for consideration in open positions.

In a *Commercial Appeal* article that appeared on October 12, 2012 Ann Fleck of KTG (USA) commented: "I can't say enough good things about this course ... Our experience with the candidates we have (been) hiring from this process has been very positive."

IRT provides participants a basis upon which to build industry-specific skills, or from which they can launch into further training. IRT also focuses on helping participants understand work culture, teamwork, and problem solving.

The program includes pre-testing to establish a baseline established by the ACT WorkKeys foundational skills test of frontline workforce competence and a mechanical aptitude test. At program's end, participants complete a post-test to measure improvement.

The IRT program has expanded to include several companies and as of February 2013 has graduated 365 participants.

Career pathways, including training that can prepare employees to obtain manufacturing industry recognized credentials that qualify employees for career advancement, should be designed, communicated and implemented.

The January 2013 report titled “State Sector Strategies COMING OF AGE: Implications for State Workforce Policymakers,” as published by the National Governors Association, the Corporation for a Skilled Workforce and the National Skills Coalition, suggests that:

Career pathways offer a clear sequence of coursework and credentials aligned with the natural paths of advancement in an industry, and often across similar occupations in related industries, for students, job seekers, and incumbent workers returning to school. When done right, career pathway programs engage regularly with employers in their target industry so as to constantly and accurately assess the skills and knowledge they need and re-calibrate curricula, programs, and credentials. They also coordinate among multiple education and training providers to build a complex of courses and credentials that impart and demonstrate qualifications from work readiness to advanced-level skills.

A model career pathway should clearly show the progression from entry level occupations to more advanced level positions, and should provide clear information about the education and training required to gain entry level work and advance along the career path, beginning in high school, through short-term training, longer term certificate training, associate degree programs and ultimately four-year college degrees.

The Advanced Manufacturing Competency Model (AMCM) developed by the Department of Labor Employment and Training Administration in partnership with the National Council for Advanced Manufacturing and the Society of Manufacturing Engineers, provides a framework for such career pathways. More information about the AMCM can be found in [Appendix B](#).

[Appendix C](#) shows an example career pathway created in partnership with a specific industry partner. The description features tasks associated with the position described. The description includes educational and experience requirements, required licensures/certifications, average salary expectations, and an employment outlook.

The second part of [Appendix C](#) is a demonstration of “Critical Development Experiences” that can be tracked to advance the employee from the original position (Numerical Tool Programmer) to more advanced positions (For example: Mechanical Engineer, Engineering Manager, and Industrial Production Manager).

Best Practices: Scientific Management Technologies (SMT)

Models for advance industrial training include SMT. SMT training includes an intense 23-volume training course that can be completed in 160 hours of classroom work. The course features basic and advanced mechanics and systematically educates the employee in several technologies and skills, including print reading, measurement, use of hand tools, and basic pneumatics and hydraulics, electronics and electricity.

The course emphasizes problem solving as a key skill. The SMT skills and experiences can seamlessly mesh into stackable credentials, which prepare employees for career advancement.

Best Practices: Stackable Credentials

The “Career and Technical Education Stackable Credential Model,” as presented by the Salt Lake Community College, describes stackable credentials as “demonstrated skill, concentrated work experience, approved licensure, recognized certification, or academic degree that, when coupled (or stacked upon) any others, qualifies the possessor for increased workforce responsibilities, enhanced career opportunities, and/or higher pay.”

The goals of employers, employees, and educators vary. While educational facilities look to provide students with credentials upon completion of programs, employers frequently only want proof that a potential employee can complete certain tasks in a satisfactory manner. Employees look for employment but sometimes desire continued career growth.

Stackable credentials offer a bridge for these competing needs. The practice of stackable credentials acknowledges that employees need a wide variety of skills and experiences to be most effective, as explicitly illustrated in the AMCM. At the same time, by definition, the different types of training (work experience, schoolwork, certifications) do not usually provide a standard measure of competency. Stackable credentials allow this sort of metric.

Stackable credentials rely on systematic “grading” of experiences to fit into each company’s competency model. For example, the stackable credential program created and endorsed by NAM begins with the ACT WorkKeys assessments provided by WIN and tested in the IRT training program. Following achievement of a satisfactory WorkKeys assessment, which results in a National Career Readiness Certificate, employees can continue training and demonstrate advancement toward a variety of NAM endorsed credentials and certifications, including those recognized by the Manufacturing Skill Standards Council, the National Institute of Metalworking Skills, the American Welding Society, and the Society of Manufacturing Engineers.

Stackable Credentials are most effective when the coursework provides a link between non-credit and for-credit programming. Using the I-BEST/IRT example above, participants could enroll in a college credit program and receive credit for previous short term training, which helps the student negotiate the path toward a post-secondary degree. The I-BEST model has found success in keeping employees engaged in the process through this “return on investment.”

Industry can help create solutions by contributing loaned expertise and equipment to enhance training.

Several possible industry relationships exist. Training instructors might be hired by training providers from the employers’ own staff, allowing the creation of an up-to-date curriculum and current “hands on” experience. Donating equipment or leveraging relationships with equipment manufacturers would provide real world equipment for training.

Best Practices: Mississippi Corridor Consortium

The Mississippi Corridor Consortium, an example of which resides at the Workforce Development and Training Program at Itawamba Community College in Tupelo, Mississippi, provides one regional example of industry involvement.

The Consortium first offers a selection of resources for industry, including customized training programs. The training programs include training on currently-used equipment, donated by industry partners.

The Consortium also draws in industry by providing comprehensive skills testing, along with testing to determine whether applicants are physically capable of performing job functions for each industry partner. The program has a close integration with its local WIN offices and, according to the program's website, "state training projects provide more than \$1 million each year in reimbursements to area organizations to offset their training expenses."

Tennessee could benefit from an examination of Mississippi's and Arkansas' investments in community college consortia and the adoption of effective workforce development practices that are based in collaboration and business engagement.

A large scale marketing campaign to create public awareness of the benefits of and pathways toward a manufacturing career should be designed and implemented.

Employer and workforce professionals should jointly develop marketing campaigns to communicate the benefits of today's manufacturing careers, the current demand for manufacturing employees and the basic requirements for employment. This effort should be aimed at high school students and parents as well as at adults, including post-secondary students, through schools and educational institutions.

Best Practices: Gold Collar Careers

The Gold Collar Careers initiative, begun in 2004 in Wisconsin, provides an example of a successful marketing campaign. The program promotes manufacturing as a career of choice, focusing on middle and high school students and displaced workers. Supported heavily by industry cash donations, the program offers education through online videos of industry professional interviews, career fairs, and special events.

The STEM NASCAR Race Engineering Camp illustrates one example. According to the Gold Collar Careers website, "The camps will provide an integrated approach to solving real world STEM [science, technology, engineering, and mathematics] problems. The curriculum has been developed through funding from the National Science Foundation and in coordination and endorsement by NASCAR." This program shows a creative solution to draw in high school students to an automotive repair career by associating it directly to a nationally popular sport.

VII. Conclusion

This report summarizes the current hiring needs of Memphis manufacturing employers, in terms of occupations and skills sets, based on direct data from the MADE IN MEMPHIS survey and interviews with industry representatives and workforce professionals.

The magnitude of the opportunity is clear:

According to a 2012 jobs analysis performed by the Workforce Investment Network (TN LWIA 13, or WIN), local manufacturers plan to hire over 4,000 employees from 2012-2016.

The creation of 4,000 manufacturing jobs paying an average of \$32,180 would result in \$129 million in direct wages earned. Applying the cited 240% economic multiplier noted in Section III, the entire economic impact could exceed a third of a billion dollars, annually.

This paper provides a snapshot of industry needs and those needs identified by workforce development professionals and educators. Also included are best practices that can provide a prototype blueprint. Next steps should include bringing together industry partners, workforce development professionals, and educators to build sector-based employment pathways and specific programs

The Workforce Investment Network in Memphis and its partners at the Greater Memphis Chamber and the Southwest Tennessee Community College, among others, stand ready to lead these efforts, with this document serving as a foundation for future program implementation.

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Appendix B: The Advanced Manufacturing Competency Model

The U.S. Department of Labor Employment and Training Administration (DOL/ETA) has designed a model in partnership with National Council for Advanced Manufacturing and the Society of Manufacturing Engineers, called the Advanced Manufacturing Competency Model. The Model illustrates a series of competencies housing appropriate skill sets.

Most importantly, while the general structure remains the same, the Model can be modified to meet the needs of each industry, or even the needs of individual companies.

The Model provides a specific career pathway any employee can follow over the course of his or her career. Each competency can be reasonably measured to chart growth in skill level over time. That growth can then be linked to further education opportunities or increased pay/benefits.

Advanced Manufacturing Competency Model

Competency	Example Demonstrable Skills
Management	Motivating others, monitoring and controlling processes, budgeting and auditing, strategic planning, human resource issues
Industry Specific	Competencies specified by sector representatives
Workplace	Teamwork, adaptability/flexibility, customer focus, problem solving, scheduling and coordinating, business fundamentals
Academic	Reading, writing, mathematics, etc.
Personal Effectiveness	Integrity, professionalism, initiative, dependability, willingness to learn

The DOL/ETA has created a “Competency Model Clearinghouse” at <http://www.careeronestop.org> as a guide to help users create models for individual industries (or even companies). The online tool includes tutorials and libraries of models of general industries.

Appendix C: Example Competency Model Career Pathway: Numerical Tool Programmer

Job Level

Mid-level (Supervisory)

Job Description

Develops programs to control machining or processing of parts by automatic machine tools, equipment, or systems.

Tasks

- Determine the sequence of machine operations, and select the proper cutting tools needed to machine work pieces into the desired shapes.
- Revise programs and/or tapes to eliminate errors, and retest programs to check that problems have been solved.
- Analyze job orders, drawings, blueprints, specifications, printed circuit board pattern films, and design data in order to calculate dimensions, tool selection, machine speeds, and feed rates.
- Determine reference points, machine cutting paths, or hole locations, and compute angular and linear dimensions, radii, and curvatures.
- Observe machines on trial runs or conduct computer simulations to ensure that programs and machinery will function properly and produce items that meet specifications.
- Compare encoded tapes or computer printouts with original part specifications and blueprints to verify accuracy of instructions.
- Enter coordinates of hole locations into program memories by depressing pedals or buttons of programmers.
- Write programs in the language of a machine's controller and store programs on media such as punch tapes, magnetic tapes, or disks.
- Modify existing programs to enhance efficiency.

Education

Most positions require training in vocational schools, related on-the-job experience, or an Associate's degree. Some may require a Bachelor's degree.

Workforce Preparation

Employees in these positions usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.

Work Experience

Previous work-related skill, knowledge, or experience is required for these positions.

Licensure/Certification

Licensure required. License requirements vary by state.

Salary

\$20.11 hourly, \$41,830 annually

Critical Development Experiences:

From Numerical Tool Programmer to Mechanical Engineer

Mechanical Engineering positions require a Bachelor's degree, generally in engineering.

- Assist in the development and implementation of production tracking and quality control systems. Analyze production, quality control, maintenance, and other operational reports to detect production problems.
- Review operations and confer with technical or administrative staff to resolve production or processing problems.
- Prepare and maintain production reports and personnel records.

From Numerical Tool Programmer to Engineering Manager

For Engineering Manager positions, a Bachelor's degree is the minimum formal education required. However, many positions also require a Master's degree and/or a Ph.D. or J.D.

- Confer with management, production, and marketing staff to discuss project specifications and procedures.
- Coordinate and direct a project, making detailed plans to accomplish goals and directing the integration of technical activities.

From Numerical Tool Programmer to Industrial Production Manager

Industrial Production Manager positions require a Bachelor's degree, generally in engineering.

- Review operations and confer with technical or administrative staff to resolve production or processing problems.
- Assist in the development and implementation of production tracking and quality control systems. Analyze production, quality control, maintenance, and other operational reports to detect production problems.