Advanced Manufacturing

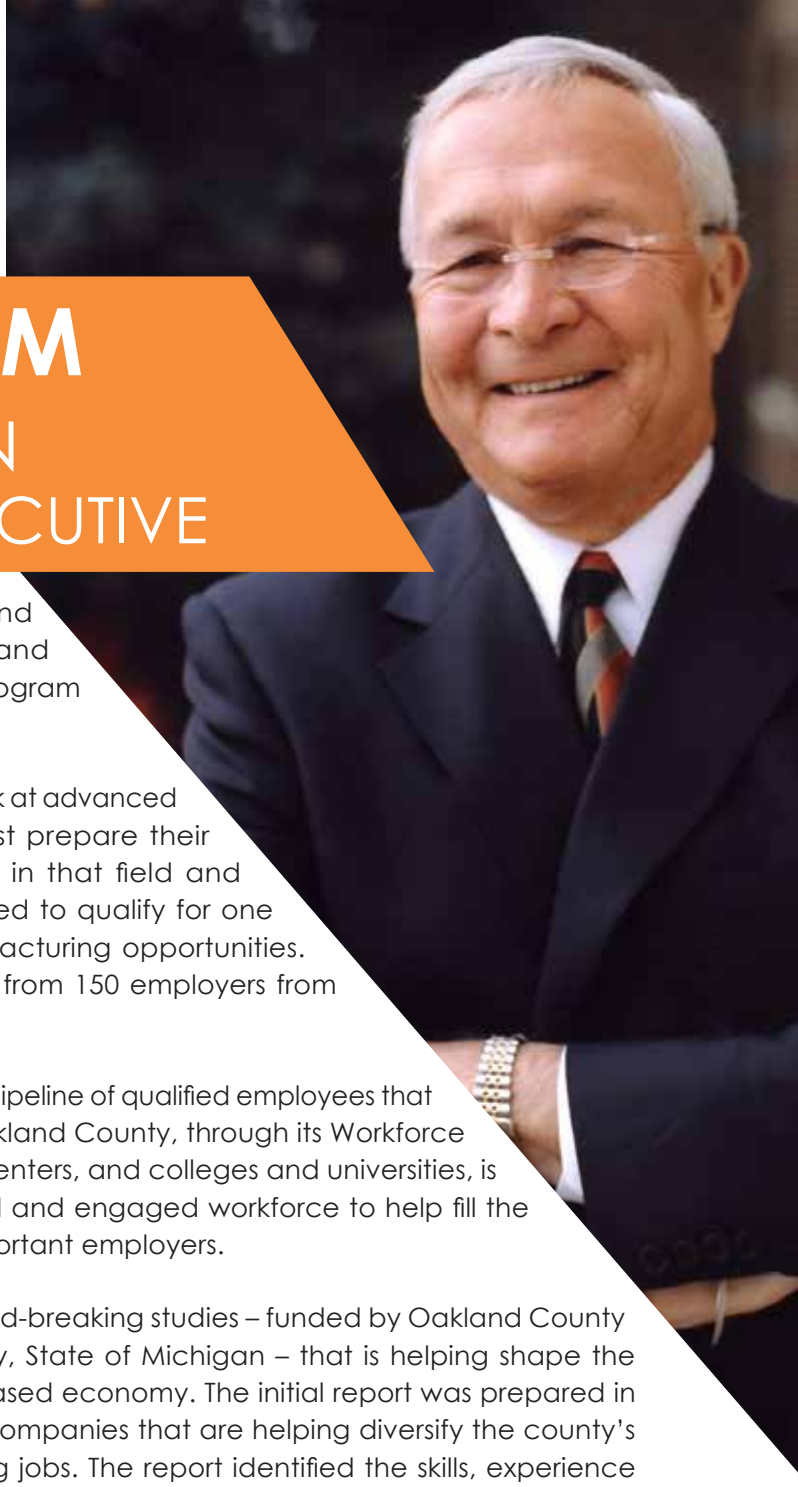
Oakland County, Michigan
SKILLS NEEDS ASSESSMENT PROJECT

Report prepared and submitted by:

EdEn Inc.
2200 N. Squirrel Road | Rochester, MI 48309

March 31, 2013

OAKLAND COUNTY MICHIGAN



A MESSAGE FROM
L. BROOKS PATTERSON
OAKLAND COUNTY EXECUTIVE

On behalf our region's employers and educators, I invite you to review Oakland County's 2013 Skills Needs Assessment Program report.

The following pages provide an in-depth look at advanced manufacturing, how educators can best prepare their curricula and students for employment in that field and what skills and education job seekers need to qualify for one of a host of attractive advanced manufacturing opportunities. The information used in the report came from 150 employers from southeastern Michigan.

Advanced manufacturers have told us the pipeline of qualified employees that once met their needs no longer exists. Oakland County, through its Workforce Development Division, Michigan Works! centers, and colleges and universities, is committed to helping prepare a qualified and engaged workforce to help fill the immediate and future needs of these important employers.

This report is the second in a series of ground-breaking studies – funded by Oakland County and the Workforce Development Agency, State of Michigan – that is helping shape the future of Oakland County's knowledge-based economy. The initial report was prepared in 2009 and focused on Emerging Sectors® companies that are helping diversify the county's economy by replacing lost manufacturing jobs. The report identified the skills, experience and education needed to work for emerging technology companies.

A third Skills Needs Assessment Project, currently underway, is examining opportunities in health care and should be completed by the end of 2013.

My sincere thanks go to the Oakland County Workforce Development Board and the Oakland County Business Roundtable's Workforce and Education Committee for their support of this project as well as the Board of Commissioners for its continued support, and to the employers in and around Oakland County who participated in this report.

I hope you find this 2013 Skills Needs Assessment Program report useful as you learn about the many opportunities available in the field of advanced manufacturing.

TABLE OF CONTENTS

FORWARD 2

EXECUTIVE SUMMARY 3

SURVEY FINDINGS 5

- SURVEY RESPONDENT DEMOGRAPHICS 6
- RESULTS BY JOB FAMILY 7
- CUSTOMIZED JOB PROFILES 14
- REGIONAL HIRING CHALLENGES AND REMEDIES 29
- GENERAL OBSERVATIONS 33

APPRENTICESHIP & INTERNSHIP FINDINGS 35

DATA ANALYSIS METHODOLOGY 43

CONSULTANT INFORMATION 45

FOREWARD

In 2009, Oakland County Executive L. Brooks Patterson commissioned a Skills Needs Assessment Project (SNAP) for the County's Emerging Sectors® program. The results of the SNAP initiative identified, for each sector, the top jobs and the skills Oakland County's job seekers and students need to qualify for and obtain those jobs. The Oakland County Executive, the Oakland County Workforce Development Board and the Workforce and Education Committee of the Oakland County Business Roundtable oversaw the project, and the Michigan Department of Energy, Labor, and Economic Growth (MDELEG) supported it, through funding from the U.S. Department of Labor.

Given the efficacy of the initial SNAP project, the Oakland County Executive and Workforce Development Board sought to replicate and expand it for the advanced manufacturing industry sector. This sector is particularly significant for the following reasons:

- ***Advanced manufacturing is currently creating jobs and is predicted to sustain this job growth***
  According to the Oakland County Economic Outlook for 2013-2015, it is predicted that the manufacturing sector will add 4,125 jobs in Oakland County over the next three years. The study asserts that the major contributing factor to the job gains in manufacturing is the resurgence of the motor vehicle industry where employment is expected to increase by 1,406 jobs between 2013 and 2015. Other manufacturing industries predicted to grow include fabricated metals, machinery, plastic products, and chemicals.

- ***The jobs the advanced manufacturing sector produces require strong basic and technical skills***
  Low-skill jobs have given way to high-skill positions that typically require college degrees, technical certifications, and/or apprenticeships.

- ***Employers indicate that they cannot find qualified workers for current job openings, and that future openings will go unfilled***
  According to a survey conducted by Deloitte and the Manufacturing Institute, manufacturing employers in the U.S. have been unable to fill 600,000 skilled positions. Employers in Oakland County have confirmed this finding and assert that they cannot find workers with the right skills. Some indicate that the specific industry certifications they require of their employees do not align with the credentials training institutions award.

EXECUTIVE SUMMARY

The Skills Needs Assessment Project (SNAP) 2012 was conducted by the Oakland County Michigan Works! Agency (MWA) on behalf of Oakland County Executive L. Brooks Patterson and the Oakland County Workforce Development Board as a direct result of the SNAP initiative conducted in 2009 targeting the County's Emerging Sectors. The 2009 published report contained "customized job profiles" for the top jobs in each of the emerging industry sectors. Individual profiles identified the skills (knowledge, skills and abilities) that job seekers and students needed in order to qualify for these positions. Given the efficacy of the initial SNAP project, the Oakland County Executive and Workforce Development Board sought to replicate and expand it for the advanced manufacturing industry sector. This sector is particularly significant for the following reasons:

- The advanced manufacturing sector is currently creating jobs and is predicted to sustain job growth
- The jobs the advanced manufacturing sector produces require strong basic and technical skills
- Employers indicate that they cannot find qualified workers for current job openings and future openings will go unfilled

The focal point of the project was the development of a comprehensive web-based survey tool for the collection of data specific to the needs of advanced manufacturing employers. Data categories on which feedback was collected included company demographics; greatest hiring challenges and suggested remedies; important but difficult to find personal competencies in job candidates; difficult to fill job openings within a particular job family; and, the knowledge, skills and abilities associated with those occupations. Customized job profiles were then created for the jobs identified as most difficult to fill. Independent secondary surveys aimed at collecting information on apprenticeship and internship programs were also included as part of the project.

"Employers have told us they're ready to hire, they want to hire, but they can't find enough qualified applicants to fill these high paying jobs. These are jobs that will go unfilled unless we find qualified workers."

L. Brooks Patterson
Oakland County Executive

To accomplish all of the designated goals and objectives while ensuring the accuracy of the initiative, the project was conducted in four distinct phases: Research, Design, Validation and Implementation. The **Research** Phase included the review and analysis of extensive employment, skills and assessment data available through various web-based information sources utilizing historic and real time labor market information. The **Design** Phase involved the development of an acceptable and preliminary survey instrument and apprenticeship/ internship inventory framework. As part of the **Validation** Phase, individuals from the educational and employer communities were engaged in the process. Educators were asked to provide feedback on job profile content; and, employers assisted in the final development of databank components, including job specific content (job families/jobs/knowledge/skills/abilities); internship/apprenticeship survey frameworks and survey dissemination strategies. This phase culminated with a survey pilot to a select group of employers. Lastly, the **Implementation** Phase involved the comprehensive roll-out of the customized web-based survey designed to obtain quantifiable data from employers.

The Skills Needs Assessment surveys were disseminated to employers throughout the Southeast Michigan region with the partnership and cooperation of several organizations, including: Automation Alley, the Economic Growth Alliance, FOCUS Hope, Kelly Services, Macomb Community College, the Michigan Manufacturing Technology Center, the National Tooling and Machining Association, Oakland Community College, and UHY Advisors. In total, surveys were pushed to approximately 1,300 advanced manufacturing

employers of all sizes across the Southeast Michigan region (Genesee, Lapeer, Livingston, Macomb, Monroe, Oakland, Saint Clair, Washtenaw, and Wayne counties).

Ultimately, survey responses were gathered from 150 employer representatives across the region with the largest percentage of employers (68%) located in Oakland County and the majority representing small business (< 500 employees).

In total, employers were given the option to select occupations from six (6) job families including Design, Engineering, and Engineering Technicians; Installation, Maintenance & Repair; Information Technology; Operational Support; Production; and, Skilled Trades. The job family most frequently selected by employers was overwhelmingly the Design, Engineering and Engineering Technicians category (48%). An analysis of each job family including jobs most frequently selected and the important knowledge, skills, and abilities (KSA's) for job candidates within those families are included within the survey findings.

Comprehensive survey data analysis resulted in the creation of 14 customized job profiles representing the occupations identified as in demand and difficult to fill with qualified candidates from the available labor pool.

Job profiles were created for the following occupations:

- Mechanical Engineers
- Tool & Die Makers
- Machinists
- Product Designers
- Electrical Engineers
- Industrial Engineers
- Manufacturing Engineers
- Controls Engineers
- Robotics Engineers
- General Maintenance & Repair Workers
- Welders, Cutters & Welder Fitters
- Team Assemblers
- First Line Supervisors
- Electrical and Electronics Installers & Repairers

In addition to information on estimated annual job openings; desired education level and regional completions; specialty knowledge areas; and, important personal competencies; each job profile contains the 20 most important KSA's and their associated Training Index (TI). The TI relates the importance of the KSA to the job to the difficulty employers have in finding job candidates with the specified KSA. A higher TI score indicates a greater need for training. This information will be useful for educators and job seekers alike.

The survey analysis also provides insight into the greatest hiring challenges encountered by regional employers and suggested remedies. Most frequently identified challenges include a virtually non-existent pipeline of young workers followed closely by insufficient training programs to meet current demand.

General observations based upon stakeholder feedback and survey responses are also detailed within the report and highlighted below.

- An increasing level of technical knowledge is a must for jobs regardless of education level
- Changing worker recruitment methods are not being adopted by all employers
- Increased focus on technical skill sets vs. personal competencies and soft skills
- Computer numerical controls (CNC) is a skill that spans multiple occupations
- Hiring projections are partly due to increased turnover rates

Lastly, a summary of findings from the apprenticeship and internship secondary surveys is provided.

ADVANCED MANUFACTURING

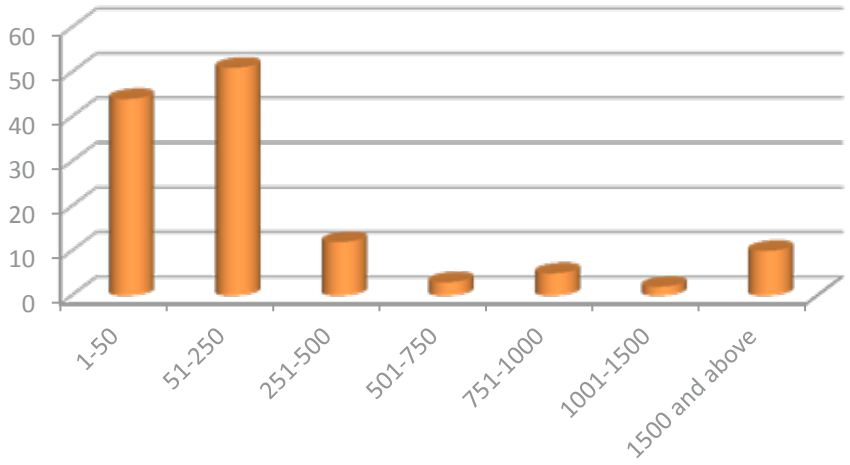
SKILLS NEEDS ASSESSMENT PROJECT

SURVEY FINDINGS

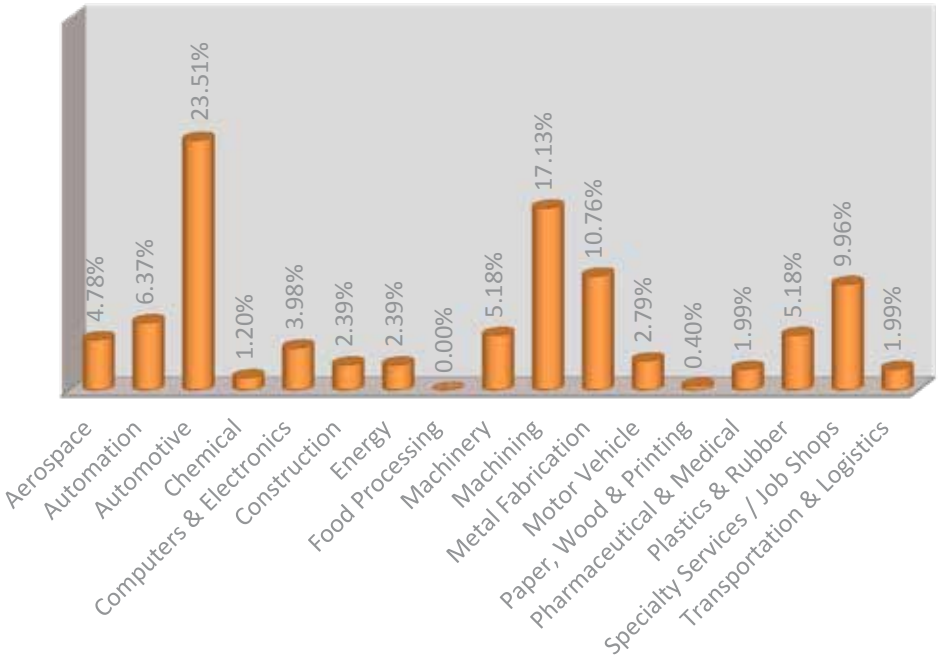
The Skills Needs Assessment Project targeting the Advanced Manufacturing industry was another landmark study for Oakland County. In an effort to continue to advance the economic prosperity of Southeast Michigan, the County was interested in obtaining a regional perspective on employment issues. Research and analysis conducted during the project coupled historical and real time labor market data which allowed for the accumulation of an empirical data set. This data set then served as a baseline for verification by survey participants. Adaptive technology was used to develop customized survey instruments for distribution to advanced manufacturing employers across the region.

The information presented in the pages that follow represents the significant survey findings based upon the responses from 150 advanced manufacturing employer representatives located in the southeast Michigan region.

EMPLOYER SIZE DISTRIBUTION



INDUSTRY REPRESENTATION



DEMOGRAPHIC QUICK FACTS

85%

of Survey Respondents have less than 500 employees

MOST REPRESENTED INDUSTRY SECTORS

Automotive
Machining
Metal Fabrication
Specialty Services/ Job Shops

61%

of Survey Respondents represent at least 1 of those 4 industries

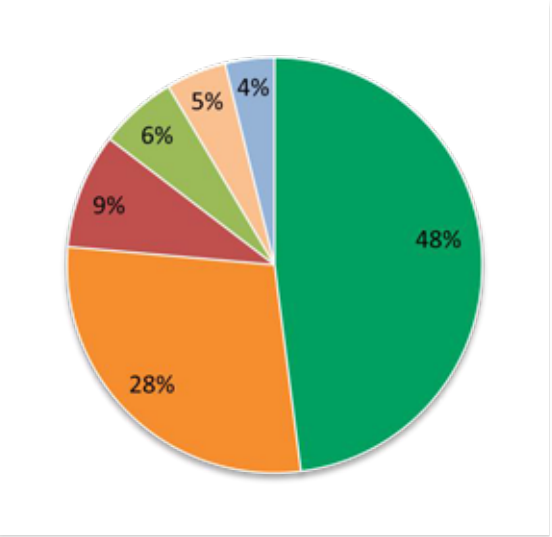
68%

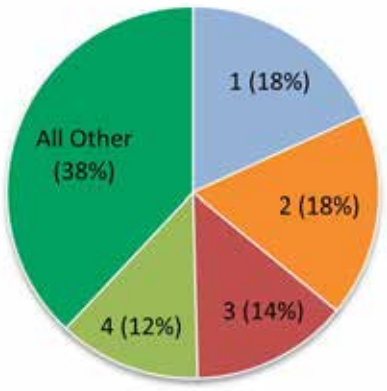
of Survey Respondents have a business presence in Oakland County

MOST FREQUENTLY SELECTED JOBS ACROSS FAMILIES

JOB	JOB FAMILY or FAMILIES	%
Mechanical Engineers	Design, Engineering & Engineering Technicians	8.82%
Tool and Die Makers & Operators	Production Skilled Trades	8.19%
Machinists	Production	6.72%
Product Designers	Design, Engineering & Engineering Technicians	5.46%
Electrical Engineers	Design, Engineering & Engineering Technicians	3.99%
Industrial Engineers	Design, Engineering & Engineering Technicians	3.99%
Manufacturing Engineers	Design, Engineering & Engineering Technicians	3.78%
Controls Engineers	Design, Engineering & Engineering Technicians	2.94%
Robotics Engineers	Design, Engineering & Engineering Technicians	2.94%
General Maintenance & Repair Workers	Installation, Maintenance & Repair	2.94%
Welder, Cutters & Welder Fitters	Production Skilled Trades	2.73%
Team Assemblers	Production	2.52%
First Line Supervisors	Production	2.31%
Electrical and Electronics Installers & Repairers	Installation, Maintenance & Repair	2.10%

MOST FREQUENTLY SELECTED JOB FAMILIES





MOST DIFFICULT TO FIND PERSONAL COMPETENCIES ACROSS JOB FAMILIES

1 - Problem Solving & Decision Making

2 - Critical & Analytic Thinking

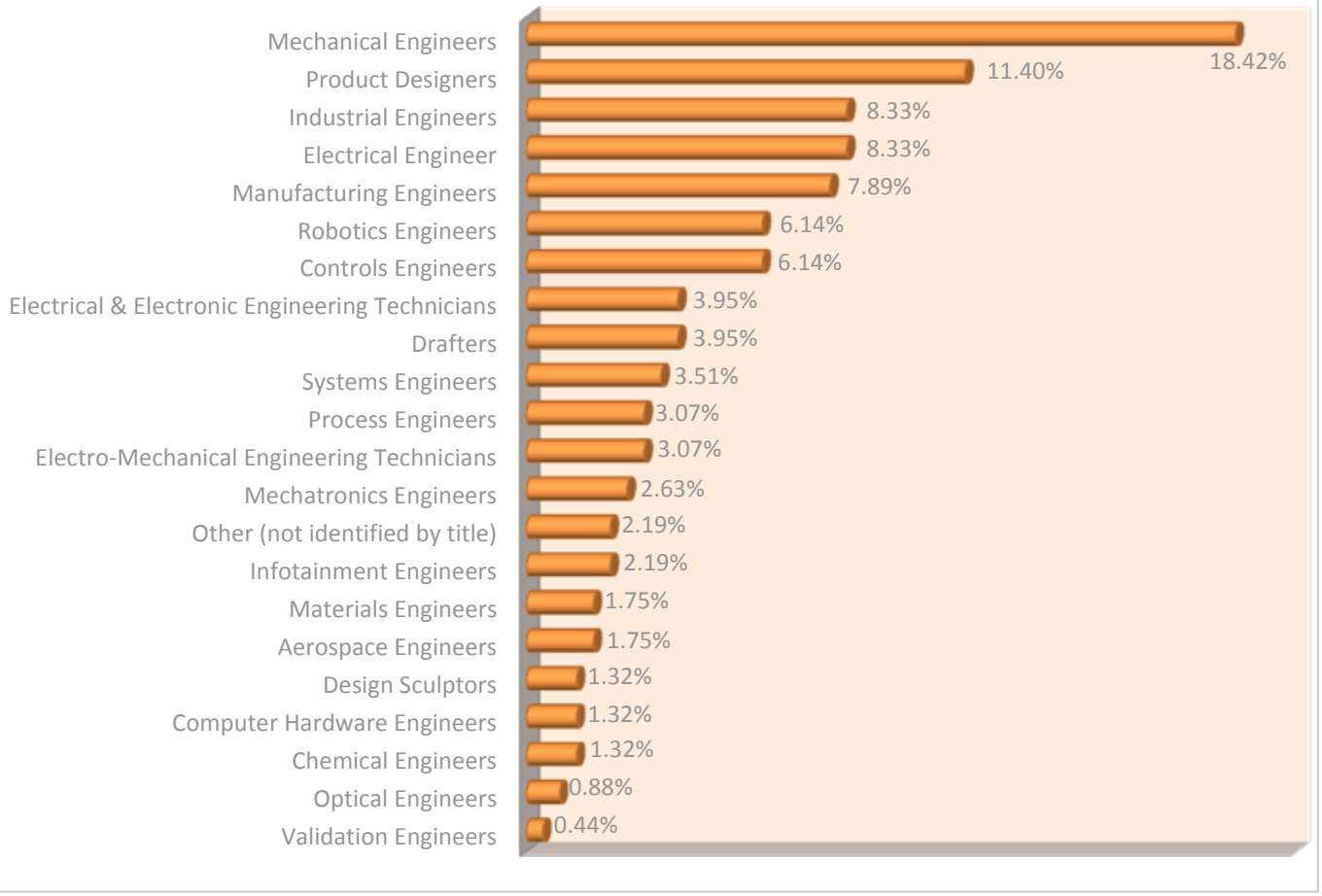
3 - Initiative

4 – Dependability & Reliability

"All Other" includes:
Adaptability/Flexibility; Communication – Listening & Speaking; Initiative; Integrity; Interpersonal Skills; Marketing & Customer Focus; Planning & Organizing; Professionalism; Teamwork

DESIGN, ENGINEERING, & ENGINEERING TECHNICIANS JOB FAMILY

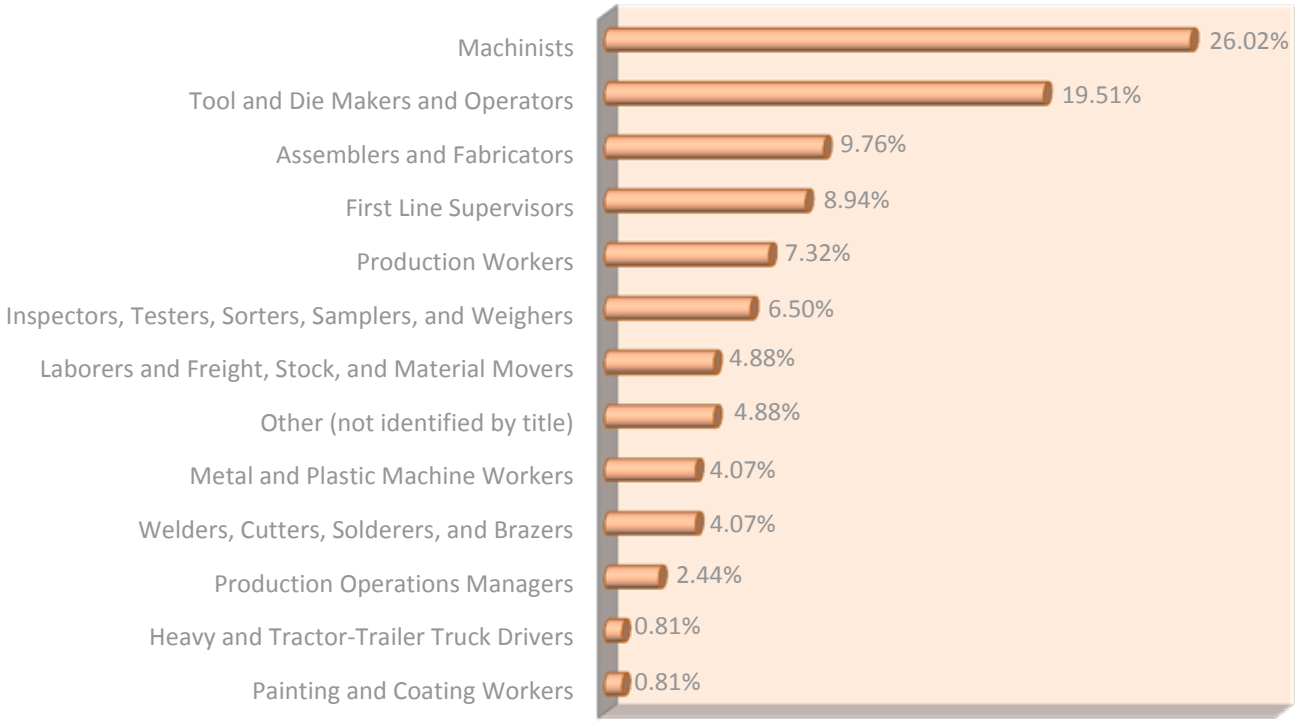
TOP JOBS SELECTED WITHIN FAMILY



KNOWLEDGE, SKILLS AND ABILITIES (KSA) – MOST FREQUENTLY SELECTED WITHIN FAMILY

	%		%
Computer Aided Design/Drafting (CAD)	79.73%	Design for Assembly	39.19%
Manufacturing Processes	79.73%	Blueprints	37.84%
Mechanical Engineering	67.57%	Robotics	36.49%
Design for Manufacture	64.86%	Mathematics	35.14%
Engineering Design	60.81%	Systems Engineering	32.43%
Geometric Dimensioning & Tolerancing (GD&T)	58.11%	Engineering Drawings	31.08%
Failure Modes and Effects Analysis	51.35%	Lean Manufacturing	31.08%
Electrical Engineering	50.00%	Engineering Support	28.38%
Concept Development	47.30%	Original Equipment Manufacturer (OEM) Systems	21.62%
Process Improvement	44.59%	Requirements Development	21.62%
Product Design	44.59%	Inspection	20.27%
Machining	43.24%	Six Sigma	20.27%
Product Development	43.24%	Validation	20.27%
Programmable Logic Control (PLC)	43.24%	Engineering Management	17.57%
Process Control	40.54%	Simulation	17.57%

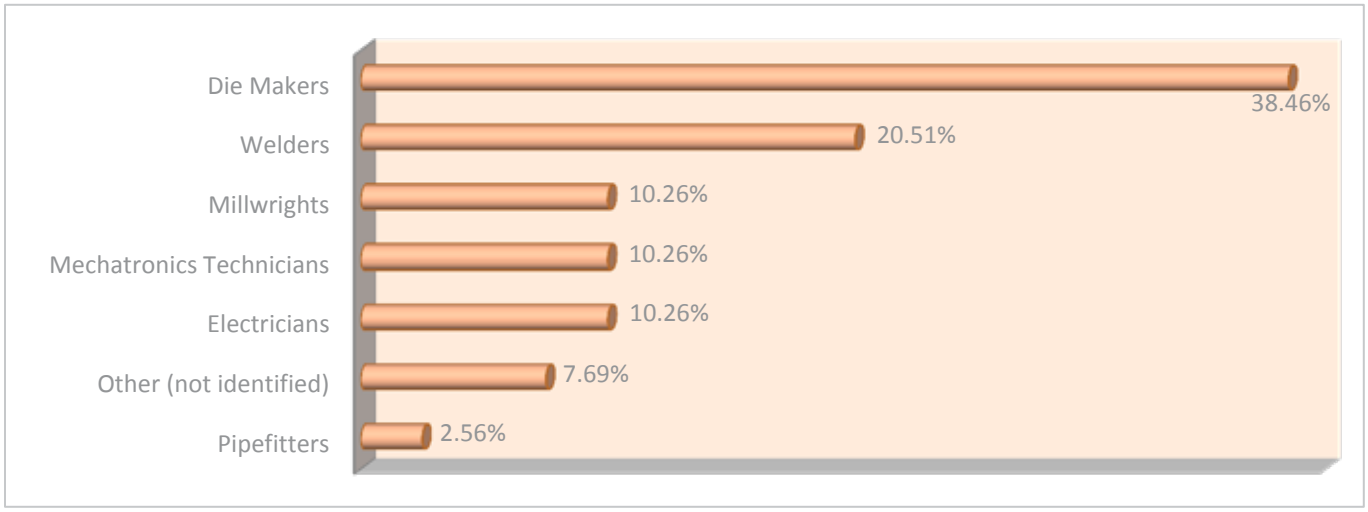
TOP JOBS SELECTED WITHIN FAMILY



KNOWLEDGE, SKILLS AND ABILITIES (KSA) – MOST FREQUENTLY SELECTED WITHIN FAMILY

	%		%
Blueprints	100.00%	Process Control	29.17%
Machine Operation	75.00%	Process Improvement	29.17%
Manufacturing Processes	64.58%	Calibration	22.92%
Quality Standards	62.50%	Computer Aided Design / Drafting (CAD)	20.83%
Computer Numerical Control (CNC)	60.42%	Forklift	18.75%
Micrometers	60.42%	Operations Management	16.67%
Machining	56.25%	Welding	16.67%
Measurement	52.08%	Lean Manufacturing	14.58%
Computerized Numerical Control Milling	45.83%	Scheduling	14.58%
Mathematics	43.75%	TIG Welding	12.50%
Machine Tools	41.67%	Inventory Management	10.42%
Inspection	41.67%	Packaging	8.33%
Computerized Numerical Control Lathes	41.67%	MIG Welding	8.33%
Calipers	39.58%	Robotics	6.25%
Grinders	37.50%	Concept Development	4.17%
Lathes	37.50%	SAP	4.17%
Hand Tools	35.42%	Six Sigma	2.08%
5 Axis Milling Equipment	31.25%	Purchasing	2.08%
Repair	31.25%	Validation	2.08%

TOP JOBS SELECTED WITHIN FAMILY

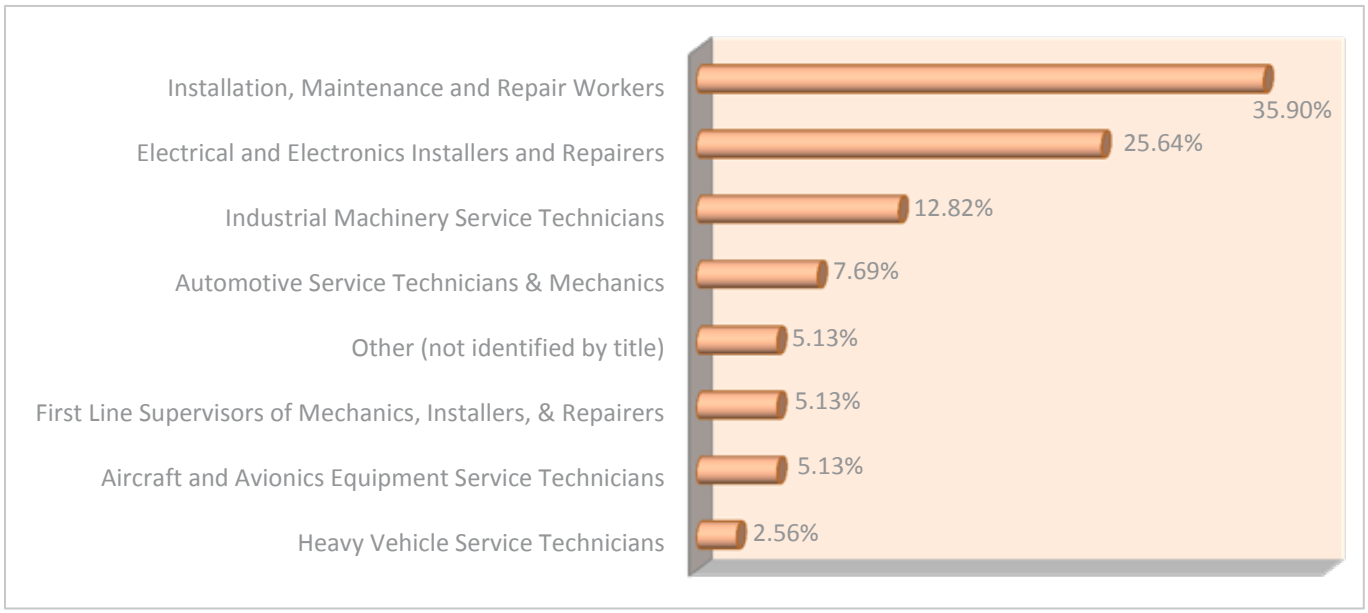


KNOWLEDGE, SKILLS AND ABILITIES (KSA) – MOST FREQUENTLY SELECTED WITHIN FAMILY

	%		%
Blueprints	66.67%	Micrometers	22.22%
Measurement	61.11%	Sheet Metal	22.22%
Mathematics	55.56%	Computer Aided Manufacturing	22.22%
Punctuality	55.56%	Programmable Logic Control (PLC)	22.22%
Fabrication	50.00%	Gas-Metal Arc Welding	22.22%
Troubleshooting	44.44%	Robotics	16.67%
Machining	38.89%	Inspection	16.67%
TIG Welding	38.89%	Stainless steel	16.67%
Manufacturing Processes	38.89%	Pipefitting	16.67%
Safety	33.33%	Schematic Diagrams	16.67%
Grinding	33.33%	Hydraulics	11.11%
Hand Tools	33.33%	Milling Machines	11.11%
MIG Welding	33.33%	Assembly	11.11%
Aluminum MIG Welding	27.78%	Dexterity	11.11%
Welding Equipment	27.78%	Repair	11.11%
Electrical Systems	27.78%	Robotics Systems	5.56%
Arc Welding	22.22%	Light Gauge	5.56%
Lathes	22.22%	Pipe Systems	5.56%
Machine Tools	22.22%	Computer Aided Design	5.56%

INSTALLATION, MAINTENANCE & REPAIR JOB FAMILY

TOP JOBS SELECTED WITHIN FAMILY



KNOWLEDGE, SKILLS AND ABILITIES (KSA) – MOST FREQUENTLY SELECTED WITHIN FAMILY

	%		%
Electrical Schematics	64.29%	Computer Numerical Control (CNC)	21.43%
Blueprints	57.14%	Forklift	21.43%
Electrical Systems	57.14%	Hoisting Equipment	21.43%
Equipment Maintenance	50.00%	Inspection	21.43%
Programmable Logic Control (PLC)	50.00%	Machine Tools	21.43%
Wiring	50.00%	Machining	21.43%
Judgment	42.86%	Original Equipment Manufacturer (OEM) Systems	21.43%
Mathematics	42.86%	Schematic Diagrams	21.43%
Calibration	35.71%	Welding	21.43%
Hand tools	35.71%	Decision Making	14.29%
Hydraulics	35.71%	Electrical Engineering	14.29%
Repair	35.71%	Power Tools	14.29%
Manufacturing Processes	28.57%	Process Improvement	14.29%
Mechanical Engineering	28.57%	Product Development	14.29%
Robotics	28.57%	Inventory Level Management	7.14%
Computer Aided Design (CAD)	21.43%	Lean Manufacturing	7.14%

OPERATIONAL SUPPORT JOB FAMILY

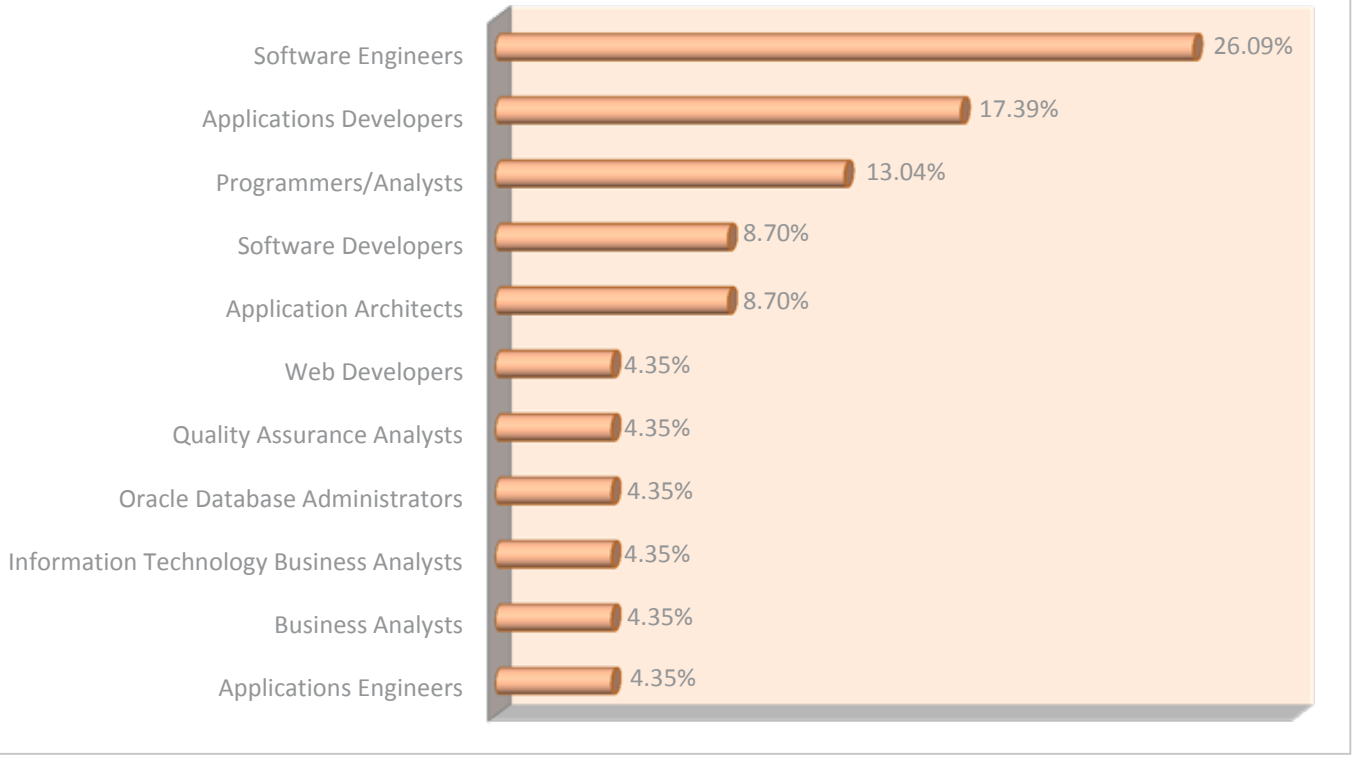
TOP JOBS SELECTED WITHIN FAMILY

KNOWLEDGE, SKILLS AND ABILITIES (KSA) – MOST FREQUENTLY SELECTED WITHIN FAMILY

	%		%
Sales	54.55%	Scheduling	27.27%
Forecasting	45.45%	Accounting	18.18%
Manufacturing Processes	45.45%	Inside Sales	18.18%
Spreadsheets	45.45%	Market Strategy	18.18%
Financial Analysis	36.36%	Process Improvement	18.18%
Sales Planning and Management	36.36%	Purchasing	18.18%
Supply Chain Management	36.36%	Business Administration	9.09%
Business Strategy	27.27%	Business Analysis	9.09%
Contract Management	27.27%	Business Development	9.09%
Enterprise Resource Planning (ERP)	27.27%	Business Planning	9.09%
Financial Reporting	27.27%	Business Processes	9.09%
Inventory Management	27.27%	Description and Demonstration of Products	9.09%
Logistics	27.27%	Outside Sales	9.09%
Procurement	27.27%	Product Sale and Delivery	9.09%
Project Management	27.27%	Quality	9.09%
SAP	27.27%		

INFORMATION TECHNOLOGY JOB FAMILY

TOP JOBS SELECTED WITHIN FAMILY



KNOWLEDGE, SKILLS AND ABILITIES (KSA) – MOST FREQUENTLY SELECTED WITHIN FAMILY

	%		%
C++	88.89%	Javascript	22.22%
Hardware / Software Configuration	77.78%	MATLAB	22.22%
Debugging	55.56%	Microsoft C#	22.22%
Java	55.56%	Object Oriented Analysis and Design	22.22%
Extensible Markup Language (XML)	44.44%	Visual Studio	22.22%
Original Equipment Manufacturer (OEM) Systems	44.44%	Business Processes	11.11%
Software Architecture	44.44%	Linux	11.11%
UNIX	44.44%	Microsoft SharePoint	11.11%
.NET	33.33%	Operating Systems	11.11%
Software Architecture	33.33%	Oracle	11.11%
SQL	33.33%	Product Development	11.11%
SQL Server	33.33%	SAP	11.11%
Technical Support	33.33%	Validation	11.11%
Technical Writing / Editing	33.33%	Web Application Development	11.11%
Data Analysis / Management	22.22%	Web Site Design	11.11%
Extraction Transformation and Loading (ETL)	22.22%		

The cumulative result of the Advanced Manufacturing Skills Needs Assessment project is the creation of customized job profiles. The profiles contain information specific to advanced manufacturing companies in the region. Below is a CUSTOMIZED JOB PROFILE GUIDE to navigating each profile.

JOB TITLE

O*NET - SOC Code

JOB DESCRIPTION

Based upon O*Net Online occupational information created for the U.S. Department of Labor

OTHER REPORTED JOB TITLES

Based upon O*Net Online occupational information created for the U.S. Department of Labor

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
KSA #1	4.33	KSA #3	4.92
KSA #2	5.74	KSA #4	2.38

This table contains the 20 most important knowledge components, skills or abilities (KSA) associated with the specified occupation based upon (and ordered by) frequency of responses. Each KSA has an associated Training Index (TI) score. The TI score compares the IMPORTANCE of each KSA to the DIFFICULTY employers have finding job candidates with the KSA. A KSA may have a TI score ranging between 0 and 10. A higher score indicates a greater need for training for that particular KSA. Individual KSA's with a training score greater than 4.50 are ORANGE.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

The section contains a comprehensive listing of any specialized software, equipment, language, or other unique knowledge requirements mentioned by respondents as important for the specified occupation.

TASKS

This section contains a listing of tasks often associated with the specified occupation as documented by O*Net Online and created for the U.S. Department of Labor.

#1
Overall ranking across job families as it relates to the difficulty employers have filling the particular occupation

#1
Ranking within the specified job family

785
Estimated annual job openings regionally (2013-2018) for the specified occupation*

$43.11
Median hourly earnings for the specified occupation*

EDUCATION LEVEL
Most desired education level *

575
Linked to desired education level and indicates how many graduates were available regionally*

308
If more than one education level was desired, this is a secondary supporting statistic

SOFT SKILLS MISSING IN JOB CANDIDATES

This block contains a listing of the soft skills most often reported as missing in job candidates for the specified occupation. Soft skills are listed in order of importance whenever applicable.

*Data Source: Economic Modeling Specialist Intl (EMSI) Analyst is a web-based tool that provides in-depth, local employment labor market data.

MECHANICAL ENGINEERS

O*NET Code 17-2141.00

JOB DESCRIPTION

Perform engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment. Oversee installation, operation, maintenance, and repair of equipment such as centralized heat, gas, water, and steam systems.

OTHER REPORTED JOB TITLES

Mechanical Engineer, Design Engineer, Product Engineer, Mechanical Design Engineer, Process Engineer, Equipment Engineer, Design Maintenance Engineer, Systems Engineer, Chassis Systems Engineer, Commissioning Engineer

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Mechanical Engineering	4.33	Product Design	3.28
Computer Aided Design / Drafting	5.74	Blueprints	4.92
Failure Modes and Effects Analysis	3.50	Lean Manufacturing	3.00
Design for Manufacture	4.23	Machining	6.50
Geometric Dimensioning & Tolerancing (GD&T)	3.22	Mathematics	3.89
Manufacturing Processes	6.71	Concept Development	2.92
Product Development	3.67	Electrical Engineering	2.88
Design for Assembly	3.97	Engineering Management	3.33
Engineering Design	5.61	Six Sigma	2.00
Process Improvement	5.83	Engineering Support	6.67

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Satisfaction Failure Correction; Systems Engineering; Benchmarking; Industrial Engineering; Process Control; Engineering Drawings; Programmable Logic Control (PLC); Industrial Ventilation; Energy; Mastercam; Fluid Systems; SolidWorks software; and, Delphi Programming Language.

TASKS

- ❑ Read and interpret blueprints, technical drawings, schematics, or computer-generated reports.
- ❑ Assist drafters in developing the structural design of products using drafting tools or computer-assisted design (CAD) or drafting equipment and software.
- ❑ Research, design, evaluate, install, operate, and maintain mechanical products, equipment, systems and processes to meet requirements, applying knowledge of engineering principles.
- ❑ Confer with engineers or other personnel to implement operating procedures, resolve system malfunctions, or provide technical information.
- ❑ Recommend design modifications to eliminate machine or system malfunctions.
- ❑ Conduct research that tests or analyzes the feasibility, design, operation, or performance of equipment, components, or systems.
- ❑ Investigate equipment failures and difficulties to diagnose faulty operation, and to make recommendations to maintenance crew.
- ❑ Develop and test models of alternate designs and processing methods to assess feasibility, operating condition effects, possible new applications and necessity of modification.
- ❑ Develop, coordinate, or monitor all aspects of production, including selection of manufacturing methods, fabrication, or operation of product designs.
- ❑ Specify system components or direct modification of products to ensure conformance with engineering design and performance specifications.

#1
Overall Ranking of Most Difficult Occupation to Fill

#1
Ranking within the Design, Engineering and Engineering Technicians Job Family

785
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$43.11
Median Hourly Earnings

BACHELOR'S DEGREE
Most Desired Education Level

575
Regional Bachelor's Degree Level Completions (2011)

308
Regional Master's Degree Level Completions (2011)

SOFT SKILLS MISSING IN JOB CANDIDATES

- Problem Solving & Decision Making
- Critical & Analytic Thinking
- Dependability & Reliability
- Initiative

TOOL & DIE MAKERS

O*NET Code 51-4111.00

JOB DESCRIPTION

Analyze specifications, lay out metal stock, set up and operate machine tools, and fit and assemble parts to make and repair dies, cutting tools, jigs, fixtures, gauges, and machinists' hand tools.

OTHER REPORTED JOB TITLES

Aircraft Tool Maker, Carbide Tool Die Maker, Die Maker, Jig and Fixture Builder, Jig and Fixture Repairer, Tool Repairer, Tool and Die Machinist, Tool and Die Maker, Toolmaker, Trim Die Maker

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Machining	4.03	Computerized Numerical Control Lathes	4.03
Blueprints	3.75	Computerized Numerical Control Milling	4.67
Machine Tools	4.03	Grinders	4.50
Lathes	3.75	Punctuality	<2.00
Micrometers	5.27	Repair	2.00
Measurement	4.03	Computer Aided Design / Drafting (CAD)	4.00
Manufacturing Processes	4.03	Hand Tools	3.00
Machine Operation	4.03	Troubleshooting	8.67
Mathematics	4.00	Inspection	6.50
Computer Numerical Control (CNC)	3.00	Grinding	8.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

G-code programming language; AutoForm; CATIA; Cimatron; Dynaform; MasterCam NC; NX Unigraphics; Solidworks; WorkNC; Coordinate-measuring machines; Mitsubishi 3-axis machining center; OKK 3-axis machining center; Yasda 3-axis machining center; Hermle 5-axis machining center; Micron 5-axis machining center.

TASKS

- ❑ Verify dimensions, alignments, and clearances of finished parts for conformance to specifications, using measuring instruments such as calipers, gauge blocks, micrometers, and dial indicators.
- ❑ Study blueprints, sketches, models, or specifications to plan sequences of operations for fabricating tools, dies, or assemblies.
- ❑ Set up and operate conventional or computer numerically controlled machine tools such as lathes, milling machines, and grinders to cut, bore, grind, or otherwise shape parts to prescribed dimensions and finishes.
- ❑ Visualize and compute dimensions, sizes, shapes, and tolerances of assemblies, based on specifications.
- ❑ Inspect finished dies for smoothness, contour conformity, and defects.
- ❑ Fit and assemble parts to make, repair, or modify dies, jigs, gauges, and tools, using machine tools and hand tools.
- ❑ Conduct test runs with completed tools or dies to ensure that parts meet specifications, making adjustments as necessary.
- ❑ Select metals to be used from a range of metals and alloys, based on properties such as hardness and heat tolerance.
- ❑ File, grind, shim, and adjust different parts to properly fit them together.
- ❑ Lift, position, and secure machined parts using hoists, vises, v-blocks, or angle plates.

#2
Overall Ranking of Most Difficult Occupation to Fill

#1,#2
Ranking within the Skilled Trades and Production Job Families, respectively

45
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$26.15
Median Hourly Earnings

POST-SECONDARY CERTIFICATE
Most Desired Education Level

NOTE:
Regional completion data for a related post-secondary certificate is not reported.

SOFT SKILLS MISSING IN JOB CANDIDATES

- Dependability & Reliability
- Critical & Analytic Thinking
- Problem Solving & Decision Making
- Initiative

MACHINISTS

O*NET Code 51-4041.00

JOB DESCRIPTION

Set up and operate a variety of machine tools to produce precision parts and instruments. Includes precision instrument makers who fabricate, modify, or repair mechanical instruments. May also fabricate and modify parts to make or repair machine tools or maintain industrial machines, applying knowledge of mechanics, mathematics, metal properties, layout, and machining procedures.

OTHER REPORTED JOB TITLES

Gear Machinist, Journeyman Machinist, Machine Operator, Machine Repair Person, Machinist, Maintenance Machinist, Maintenance Specialist, Production Machinist, Set-Up Machinist, Tool Room Machinist

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Blueprints	3.64	Lathes	3.50
Computer Numerical Control (CNC)	4.58	Calipers	2.00
Machine Operation	6.19	Hand Tools	2.00
Machining	4.06	Manufacturing Processes	3.17
Micrometers	4.62	Measurement	2.63
Computerized Numerical Control Milling	6.83	Repair	10.00
Computerized Numerical Control Lathes	4.13	Grinders	2.50
Mathematics	4.97	Process Control	2.00
Machine Tools	4.37	Process Improvement	2.17
5 Axis Milling Equipment	3.75	Computer Aided Design / Drafting	5.67

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

G-code and M-code programming languages; Mazatrol programming software; Cimatron programming software; Mastercam NC programming software; Davenport CNC machines; Mazak CNC machines; Euroturn machines; National Acme Screw Machines; Manual Bridgeport lathes; Mori Seiki CNC multi-axis lathes; Schutte CNC multi-spindle machines; Hermle 5-axis machining center; Micron 5-axis machining center; Mitsubishi 3-axis machining center; OKK 3-axis machining center; Yasda 3-axis machining center; Geometric dimensioning and tolerancing; Six Sigma.

TASKS

- ❑ Calculate dimensions or tolerances, using instruments such as micrometers or vernier calipers.
- ❑ Machine parts to specifications, using machine tools, such as lathes, milling machines, shapers, or grinders.
- ❑ Set up, adjust, or operate basic or specialized machine tools used to perform precision machining operations.
- ❑ Align and secure holding fixtures, cutting tools, attachments, accessories, or materials.
- ❑ Measure, examine, or test completed units to check for defects and ensure conformance to specifications, using precision instruments, such as micrometers.
- ❑ Monitor the feed and speed of machines during the machining process.
- ❑ Maintain machine tools in proper operational condition.
- ❑ Study sample parts, blueprints, drawings, or engineering information to determine methods or sequences of operations needed to fabricate products.
- ❑ Operate equipment to verify operational efficiency.
- ❑ Check work pieces to ensure that they are properly lubricated or cooled.

#3
Overall Ranking of Most Difficult Occupation to Fill

#1
Ranking within the Production Job Family

289
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$22.84
Median Hourly Earnings

POST-SECONDARY CERTIFICATE
Most Desired Education Level

23
Regional Completions of less than 2 academic years (2011)

SOFT SKILLS MISSING IN JOB CANDIDATES

- **Dependability & Reliability**
- **Problem Solving & Decision Making**
- **Critical & Analytic Thinking**
- **Initiative**

PRODUCT DESIGNERS

O*NET Code 27-1021.00

JOB DESCRIPTION

Develop and design manufactured products, such as cars, home appliances, and children's toys. Combine artistic talent with research on product use, marketing, and materials to create the most functional and appealing product design.

OTHER REPORTED JOB TITLES

Commercial and Industrial Designer, Designer, Industrial Designer, Product Engineer, Design Engineer, Mechanical Designer, Product Development Engineer, Engineer, Product Design Engineer, Project Engineer

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Computer Aided Design / Drafting	5.10	Class-A math data surfaces	6.67
Design for Manufacture	4.13	Product Development	10.00
Concept Development	5.17	Blueprints	2.00
Manufacturing Processes	3.38	Engineering drawings	4.00
Engineering Design	5.88	Machining	<2.00
Product Design	5.90	Electrical Engineering	2.33
Design for Assembly	6.25	Mathematics	<2.00
Mechanical Engineering	6.00	Original Equipment Manufacturer (OEM) Systems	<2.00
Geometric Dimensioning & Tolerancing (GD&T)	3.67	Requirements Development	5.00
Failure Modes and Effects Analysis	3.58	Systems Engineering	5.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Teamcenter Product Lifecycle Management (PLC) software; CATIA; UGNX; SolidWorks; Pro-E; Programmable Logic Controllers (PLC); Production Part Approval Process (PPAP); Weather-stripping and exterior sealing systems.

TASKS

- ❑ Prepare sketches of ideas, detailed drawings, illustrations, artwork, or blueprints, using drafting instruments, paints and brushes, or computer-aided design equipment.
- ❑ Confer with engineering, marketing, production, or sales departments, or with customers, to establish and evaluate design concepts for manufactured products.
- ❑ Modify and refine designs, using working models, to conform to customer specifications, production limitations, or changes in design trends.
- ❑ Direct and coordinate the fabrication of models or samples and the drafting of working drawings and specification sheets from sketches.
- ❑ Evaluate feasibility of design ideas, based on factors such as appearance, safety, function, serviceability, budget, production costs/methods, and market characteristics.
- ❑ Present designs and reports to customers or design committees for approval, and discuss need for modification.
- ❑ Investigate product characteristics such as the product's safety and handling qualities, its market appeal, how efficiently it can be produced, and ways of distributing, using and maintaining it.
- ❑ Develop manufacturing procedures and monitor the manufacture of their designs in a factory to improve operations and product quality.
- ❑ Research production specifications, costs, production materials and manufacturing methods, and provide cost estimates and itemized production requirements.
- ❑ Participate in new product planning or market research; study need for new products.

#4
Overall Ranking of Most Difficult Occupation to Fill

#2
Ranking within the Design, Engineering and Engineering Technicians Job Family

112
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$37.33
Median Hourly Earnings

BACHELOR'S DEGREE
Most Desired Education Level

69
Regional Bachelor's Degree Level Completions (2011)

14
Regional Master's Degree Level Completions (2011)

SOFT SKILLS MISSING IN JOB CANDIDATES

- **Problem Solving & Decision Making**
- **Critical & Analytic Thinking**
- **Communication – Listening & Speaking**
- **Adaptability & Flexibility**

ELECTRICAL ENGINEERS

O*NET Code 17-2071.00

JOB DESCRIPTION

Research, design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use.

OTHER REPORTED JOB TITLES

Electrical Engineer, Electrical Design Engineer, Project Engineer, Electrical Controls Engineer, Test Engineer, Hardware Design Engineer, Broadcast Engineer, Circuits Engineer, Electrical and Instrument Maintenance Supervisor (E and I Maintenance Supervisor), Electrical Project Engineer

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Electrical Engineering	3.25	Engineering drawings	<2.00
Engineering Design	2.92	Engineering Support	<2.00
Programmable Logic Control (PLC)	4.50	Process Control	4.00
Failure Modes and Effects Analysis	3.33	Process Improvement	2.00
Manufacturing Processes	<2.00	Requirements Development	2.25
Product Design	2.25	Repair	10.00
Systems Engineering	7.00	Robotics	10.00
Validation	<2.00	Design for Manufacture	<2.00
Computer Aided Design / Drafting (CAD)	4.50	Industrial Engineering	<2.00
Concept Development	4.50	Blueprints	<2.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Field Programmable Gate Array (FPGA) programming; Complementary Metal-Oxide Semiconductor (CMOS) technology; Circuit design; Circuit building; Programmable Logic Controllers (PLC).

TASKS

- ❑ Prepare technical drawings, specifications of electrical systems, or topographical maps to ensure that installation and operations conform to standards and customer requirements.
- ❑ Operate computer-assisted engineering or design software or equipment to perform engineering tasks.
- ❑ Confer with engineers, customers, or others to discuss existing or potential engineering projects or products.
- ❑ Direct or coordinate manufacturing, construction, installation, maintenance, support, documentation, or testing activities to ensure compliance with specifications, codes, or customer requirements.
- ❑ Design, implement, maintain, or improve electrical instruments, equipment, facilities, components, products, or systems for commercial, industrial, or domestic purposes.
- ❑ Prepare specifications for purchases of materials or equipment.
- ❑ Perform detailed calculations to compute and establish manufacturing, construction, or installation standards or specifications.
- ❑ Investigate customer or public complaints, determine nature and extent of problem, and recommend remedial measures.
- ❑ Oversee project production efforts to assure projects are completed on time and budget.
- ❑ Plan or implement research methodology or procedures to apply principles of electrical theory to engineering projects.

#5
Overall Ranking of Most Difficult Occupation to Fill

#3
Ranking within the Design, Engineering & Engineering Technician Job Family

90
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$39.82
Median Hourly Earnings

BACHELOR'S DEGREE
Most Desired Education Level

305
Regional Bachelor's Degree Level Completions (2011)

160
Regional Master's Degree Level Completions (2011)

SOFT SKILLS MISSING IN JOB CANDIDATES

- Communication – Listening & Speaking
- Critical & Analytic Thinking
- Adaptability & Flexibility
- Initiative
- Problem Solving & Decision Making

INDUSTRIAL ENGINEERS

O*NET Code 17-2112.00

JOB DESCRIPTION

Design, develop, test, and evaluate integrated systems for managing industrial production processes, including human work factors, quality control, inventory control, logistics and material flow, cost analysis, and production coordination.

OTHER REPORTED JOB TITLES

Quality Engineer, Process Engineer, Engineer, Operations Engineer, Engineering Manager, Manufacturing Specialist, Plant Engineer, Supply Chain Engineer, Tool Engineer, Production Engineer

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Geometric Dimensioning & Tolerancing (GD&T)	3.00	Blueprints	5.00
Manufacturing Processes	2.75	Design for Assembly	4.00
Computer Aided Design / Drafting (CAD)	3.25	Engineering drawings	2.00
Failure Modes and Effects Analysis	2.50	Satisfaction Failure Correction	2.67
Inspection	2.67	Procurement	5.00
Lean Manufacturing	<2.00	Spreadsheets	3.00
Machining	3.00	Design for Manufacture	<2.00
Mechanical Engineering	<2.00	Original Equipment Manufacturer (OEM) Systems	<2.00
Process Control	<2.00	Validation	<2.00
Process Improvement	<2.00	Benchmarking	<2.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Paint shop processes; Industrial ventilation; Coordinate Measuring Machines (CMM) operation and programming; Customer relations and communication.

TASKS

- ❑ Plan and establish sequence of operations to fabricate and assemble parts or products and to promote efficient utilization.
- ❑ Review production schedules, engineering specifications, orders, and related information to obtain knowledge of manufacturing methods, procedures, and activities.
- ❑ Estimate production costs, cost saving methods, and the effects of product design changes on expenditures for management review, action, and control.
- ❑ Draft and design layout of equipment, materials, and workspace to illustrate maximum efficiency using drafting tools and computer.
- ❑ Coordinate and implement quality control objectives, activities, or procedures to resolve production problems, maximize product reliability, or minimize costs.
- ❑ Communicate with management and user personnel to develop production and design standards.
- ❑ Recommend methods for improving utilization of personnel, material, and utilities.
- ❑ Develop manufacturing methods, labor utilization standards, and cost analysis systems to promote efficient staff and facility utilization.
- ❑ Confer with clients, vendors, staff, and management personnel regarding purchases, product and production specifications, manufacturing capabilities, or project status.
- ❑ Apply statistical methods and perform mathematical calculations to determine manufacturing processes, staff requirements, and production standards.

#6
Overall Ranking of Most Difficult Occupation to Fill

#4
Ranking within the Design, Engineering & Engineering Technician Job Family

291
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$40.90
Median Hourly Earnings

BACHELOR'S DEGREE
Most Desired Education Level

233
Regional Bachelor's Degree Level Completions (2011)

124
Regional Master's Degree Level Completions (2011)

SOFT SKILLS MISSING IN JOB CANDIDATES

- Problem Solving & Decision Making
- Critical & Analytic Thinking
- Dependability & Reliability
- Initiative

MANUFACTURING ENGINEERS

O*NET Code 17-2199.04

JOB DESCRIPTION

Design, integrate, or improve manufacturing systems or related processes. May work with commercial or industrial designers to refine product designs to increase producibility and decrease costs.

OTHER REPORTED JOB TITLES

Manufacturing Engineer, Manufacturing Director, Manufacturing Engineering Manager, Process Engineer, Facility Engineer, Plant Engineer

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Manufacturing Processes	4.40	Engineering Management	<2.00
Machining	<2.00	Failure Modes and Effects Analysis	<2.00
Geometric Dimensioning & Tolerancing (GD&T)	3.50	Process Control	2.00
Mechanical Engineering	2.33	Programmable Logic Control (PLC)	2.00
Process Improvement	3.33	Six Sigma	2.83
Blueprints	<2.00	Engineering Design	<2.00
Lean Manufacturing	5.00	Engineering Support	<2.00
Computer Aided Design / Drafting (CAD)	<2.00	Product Design	2.33
Design for Manufacture	2.00	Product Development	3.00
Mathematics	3.33	Spreadsheets	<2.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

SolarSoft Enterprise Resource Planning (ERP) software; ESPIRIT CAD/CAM software; SolidWorks CAD/CAM software; Mastercam CAD/CAM software; FANUC robotics controller software; Siemens controller software.

TASKS

- ❑ Identify opportunities or implement changes to improve products or reduce costs using knowledge of fabrication processes, tooling and production equipment, assembly methods, quality control standards, or product design, materials and parts.
- ❑ Determine root causes of failures using statistical methods and recommend changes in designs, tolerances, or processing methods.
- ❑ Provide technical expertise or support related to manufacturing.
- ❑ Incorporate new methods and processes to improve existing operations.
- ❑ Supervise technicians, technologists, analysts, administrative staff, or other engineers.
- ❑ Troubleshoot new or existing product problems involving designs, materials, or processes.
- ❑ Review product designs for manufacturability or completeness.
- ❑ Train production personnel in new or existing methods.
- ❑ Communicate manufacturing capabilities, production schedules, or other information to facilitate production processes.
- ❑ Design, install, or troubleshoot manufacturing equipment.

#7
Overall Ranking of Most Difficult Occupation to Fill

#5
Ranking within the Design, Engineering and Engineering Technicians Job Family

135
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$41.53
Median Hourly Earnings

BACHELOR'S DEGREE
Most Desired Education Level

4
Regional Bachelor's Degree Level Completions (2011)

14
Regional Master's Degree Level Completions (2011)

SOFT SKILLS MISSING IN JOB CANDIDATES

- **Problem Solving & Decision Making**
- **Critical & Analytic Thinking**
- **Initiative**
- **Adaptability & Flexibility**

CONTROLS ENGINEERS

O*NET Code 17-2199.05

JOB DESCRIPTION

Research, design, develop, or test automation, intelligent systems, smart devices, or industrial systems control.

OTHER REPORTED JOB TITLES

Mechatronics Engineer, Automation Engineer, Automation Specialist, Development Engineer, Equipment Engineer, Principal Engineer, Process Engineer, Project Engineer, Senior Design Engineer, Senior Project Engineer

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Robotics	9.00	Design for Assembly	<2.00
Programmable Logic Control (PLC)	5.75	Design for Manufacture	<2.00
Systems Engineering	3.17	Engineering drawings	2.33
Computer Aided Design / Drafting (CAD)	<2.00	Engineering Support	<2.00
Engineering Design	5.75	Mathematics	2.33
Manufacturing Processes	<2.00	Mechanical Engineering	2.33
Process Control	2.00	Mentoring	5.00
Original Equipment Manufacturer (OEM) Systems	3.00	Satisfaction Failure Correction	4.00
Process Improvement	<2.00	Geometric Dimensioning & Tolerancing	3.33
Simulation	<2.00	Six Sigma	5.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW); Allen Bradley PLC programming software; GE PLC programming software; Modicon PLC programming software; Omron PLC programming software; Siemens SIMATIC S7 programming software; Siemens Win CC programming software; Wonderware programming software; Motion Control programming software; C++ programming language; Boost C++ Libraries; Visual Basic programming language; Java programming language.

TASKS

- ❑ Design engineering systems for the automation of industrial tasks.
- ❑ Create mechanical design documents for parts, assemblies, or finished products.
- ❑ Maintain technical project files.
- ❑ Implement or test design solutions.
- ❑ Create mechanical models and tolerance analyses to simulate mechatronic design concepts.
- ❑ Conduct studies to determine the feasibility, costs, or performance benefits of new mechatronic equipment.
- ❑ Publish engineering reports documenting design details or qualification test results.
- ❑ Research, select, or apply sensors, communication technologies, or control devices for motion control, position sensing, pressure sensing, or electronic communication.
- ❑ Identify and select materials appropriate for mechatronic system designs.
- ❑ Apply mechatronic or automated solutions to the transfer of materials, components, or finished goods.

#8
Overall Ranking of Most Difficult Occupation to Fill

#6
Ranking within the Design, Engineering and Engineering Technicians Job Family

135
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$41.53
Median Hourly Earnings

BACHELOR'S DEGREE
Most Desired Education Level

0*
Regional Bachelor's Degree Level Completions (2011)

0*
Regional Master's Degree Level Completions (2011)

*Degree programs for this specific engineering title are new and/or may fall under other multi-disciplinary engineering degrees; therefore, no data regarding number of graduates for this specific job title are available at the time of publication.

SOFT SKILLS MISSING IN JOB CANDIDATES

- **Problem Solving & Decision Making**
- **Critical & Analytic Thinking**
- **Initiative**
- **Dependability & Reliability**

ROBOTICS ENGINEERS

O*NET Code 17-2199.08

JOB DESCRIPTION

Research, design, develop, or test robotic applications.

OTHER REPORTED JOB TITLES

Associate Professor of Automation, Engineer, Automation Engineer, Plant Floor Automation Manager

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Robotics	<2.00	Engineering Support	3.33
Electrical Engineering	5.00	Systems Engineering	4.00
Manufacturing Processes	2.00	Computer Aided Design / Drafting (CAD)	<2.00
Mathematics	10.00	Design for Assembly	<2.00
Mechanical Engineering	<2.00	Design for Manufacture	<2.00
Process Control	3.83	Engineering drawings	<2.00
Programmable Logic Control (PLC)	5.00	Geometric Dimensioning & Tolerancing (GD&T)	2.58
Simulation	3.50	Original Equipment Manufacturer (OEM) Systems	<2.00
Concept Development	2.00	Repair	<2.00
Engineering Design	<2.00	Computer Graphics Software	2.25

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Robot programming software; Simulation Programming software (Delmia and ROBCAD); Motion Programming software; ABB Robots; FANUC Robots; Kawasaki Robots; KUKA Robots.

TASKS

- ❑ Debug robotics programs.
- ❑ Provide technical support for robotic systems.
- ❑ Review or approve designs, calculations, or cost estimates.
- ❑ Install, calibrate, operate, or maintain robots.
- ❑ Supervise technologists, technicians, or other engineers.
- ❑ Integrate robotics with peripherals, such as welders, controllers, or other equipment.
- ❑ Process or interpret signals or sensor data.
- ❑ Investigate mechanical failures or unexpected maintenance problems.
- ❑ Create back-ups of robot programs or parameters.
- ❑ Design automated robotic systems to increase production volume or precision in high-throughput operations, such as automated ribonucleic acid (RNA) analysis or sorting, moving, or stacking production materials.

#9
Overall Ranking of Most Difficult Occupation to Fill

#7
Ranking within the Design, Engineering and Engineering Technicians Job Family

135
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$41.53
Median Hourly Earnings

BACHELOR'S DEGREE
Most Desired Education Level

0
Regional Bachelor's Degree Level Completions (2011)

0
Regional Master's Degree Level Completions (2011)

*Degree programs for this specific engineering title are new and/or may fall under other multi-disciplinary engineering degrees; therefore, no data regarding number of graduates for this specific job title are available at the time of publication

SOFT SKILLS MISSING IN JOB CANDIDATES

- **Critical & Analytic Thinking**
- **Problem Solving & Decision Making**
- **Initiative**
- **Communication – Listening & Speaking**

GENERAL MAINTENANCE & REPAIR WORKERS

O*NET Code 49-9071.00

JOB DESCRIPTION

Perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of an establishment in repair. Duties may involve pipe fitting; boiler making; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs.

OTHER REPORTED JOB TITLES

Maintenance Technician, Maintenance Mechanic, Maintenance Electrician, Maintenance Supervisor, Maintenance Engineer, Process Technician, Equipment Engineering Technician, Building Maintenance Mechanic, Building Mechanic, Facilities Technician

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Blueprints	2.53	Repair	<2.00
Mathematics	2.39	Electrical Systems	4.50
Robotics	6.33	Hydraulics	<2.00
Machine Tools	2.00	Forklift	2.25
Calibration	3.33	Welding	2.25
Judgment	<2.00	Hand tools	<2.00
Programmable Logic Control (PLC)	4.50	Inspection	<2.00
Equipment Maintenance	<2.00	Electrical Schematics	<2.00
Manufacturing Processes	<2.00	Decision Making	<2.00
Computer Numerical Control (CNC)	<2.00	Machining	<2.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

#10
Overall Ranking of Most Difficult Occupation to Fill

#1
Ranking within the Installation, Maintenance & Repair Job Family

388
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$16.59
Median Hourly Earnings

HIGH SCHOOL DIPLOMA OR EQUIVALENT
Most Desired Education Level

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Familiarity with Siemens Programmable Logic Controllers (PLC)

TASKS

- ❑ Use tools ranging from common hand and power tools, such as hammers, hoists, saws, drills, and wrenches, to precision measuring instruments and electrical and electronic testing devices.
- ❑ Perform routine preventive maintenance to ensure that machines continue to run smoothly, building systems operate efficiently, or the physical condition of buildings does not deteriorate.
- ❑ Inspect, operate, or test machinery or equipment to diagnose machine malfunctions.
- ❑ Diagnose mechanical problems and determine how to correct them, checking blueprints, repair manuals, or parts catalogs, as necessary.
- ❑ Assemble, install, or repair wiring, electrical or electronic components, pipe systems, plumbing, machinery, or equipment.
- ❑ Inspect drives, motors, and belts, check fluid levels, replace filters, or perform other maintenance actions, following checklists.
- ❑ Clean or lubricate shafts, bearings, gears, or other parts of machinery.
- ❑ Adjust functional parts of devices or control instruments, using hand tools, levels, plumb bobs, or straightedges.
- ❑ Repair or replace defective equipment parts, using hand tools and power tools, and reassemble equipment.
- ❑ Record type and cost of maintenance or repair work.

SOFT SKILLS MISSING IN JOB CANDIDATES

- **Initiative**
- **Adaptability & Flexibility**
- **Critical & Analytic Thinking**
- **Dependability & Reliability**

WELDER, CUTTERS & WELDER FITTERS

O*NET Code 51-4121.06

JOB DESCRIPTION

Use hand-welding or flame-cutting equipment to weld or join metal components or to fill holes, indentations, or seams of fabricated metal products.

OTHER REPORTED JOB TITLES

Aluminum Welder, Fabrication Welder, Fabricator, Fitter/Welder, Maintenance Welder, Mig Welder, Sub Arc Operator, Welder, Welder-Fitter, Welder/Fabricator

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Blueprints	5.11	Gas-Metal Arc Welding	4.50
MIG Welding	2.83	Grinders	<2.00
TIG Welding	3.28	Grinding	2.00
Aluminum MIG Welding	4.75	Punctuality	2.00
Measurement	4.17	Stainless steel	4.00
Arc Welding	4.50	Welding	<2.00
Fabrication	2.00	Inspection	3.17
Manufacturing Processes	9.00	Manufacturing Processes	5.83
Quality Standards	2.00	Robotics	<2.00
Welding Equipment	2.00	Safety	<2.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

None listed

TASKS

- ❑ Weld components in flat, vertical, or overhead positions.
- ❑ Operate safety equipment and use safe work habits.
- ❑ Lay-out, position, align, and secure parts and assemblies prior to assembly, using straightedges, combination squares, calipers, and rulers.
- ❑ Examine workpieces for defects and measure workpieces with straightedges or templates to ensure conformance with specifications.
- ❑ Recognize, set up, and operate hand and power tools common to the welding trade, such as shielded metal arc and gas metal arc welding equipment.
- ❑ Weld separately or in combination, using aluminum, stainless steel, cast iron, and other alloys.
- ❑ Clamp, hold, tack-weld, heat-bend, grind or bolt component parts to obtain required configurations and positions for welding.
- ❑ Select and install torches, torch tips, filler rods, and flux, according to welding chart specifications or types and thicknesses of metals.
- ❑ Ignite torches or start power supplies and strike arcs by touching electrodes to metals being welded, completing electrical circuits.
- ❑ Connect and turn regulator valves to activate and adjust gas flow and pressure so that desired flames are obtained.

#11
Overall Ranking of Most Difficult Occupation to Fill

#2, #9
Ranking within the Skilled Trades and Production Job Families, respectively

176
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$18.12
Median Hourly Earnings

Post-Secondary Certificate, High School Diploma or Equivalent
Most Desired Education Level

NOTE:
Regional completion data for a related post-secondary certificate is not reported.

SOFT SKILLS MISSING IN JOB CANDIDATES

- Dependability & Reliability
- Communication – Listening & Speaking
- Critical & Analytic Thinking
- Problem Solving & Decision Making

TEAM ASSEMBLERS

O*NET Code 51-2092.00

JOB DESCRIPTION

Work as part of a team having responsibility for assembling an entire product or component of a product. Team assemblers can perform all tasks conducted by the team in the assembly process and rotate through all or most of them rather than being assigned to a specific task on a permanent basis. May participate in making management decisions affecting the work. Includes team leaders who work as part of the team.

OTHER REPORTED JOB TITLES

Assembler, Assembly Line Machine Operator, Assembly Line Worker, Assembly Operator, Assembly Associate, Certified Composites Technician (CCT), Fabricator, Machine Operator, Operator Technician, Production Associate

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Blueprints	3.00	Quality Standards	5.00
Machine Operation	<2.00	TIG Welding	10.00
Measurement	2.92	Forklift	<2.00
Hand Tools	<2.00	Inventory Management	<2.00
Inspection	2.00	Lathes	<2.00
Manufacturing Processes	5.00	Machining	<2.00
Scheduling	5.00	Micrometers	<2.00
Calipers	2.50	Process Control	<2.00
Grinders	2.00	Process Improvement	<2.00
MIG Welding	10.00	Computerized Numeric Control Lathes	<2.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

None listed.

TASKS

- ❑ Perform quality checks on products and parts.
- ❑ Package finished products and prepare them for shipment.
- ❑ Rotate through all the tasks required in a particular production process.
- ❑ Shovel, sweep, or otherwise clean work areas.
- ❑ Review work orders and blueprints to ensure work is performed according to specifications.
- ❑ Complete production reports to communicate team production level to management.
- ❑ Determine work assignments and procedures.
- ❑ Maintain production equipment and machinery.
- ❑ Provide assistance in the production of wiring assemblies.
- ❑ Supervise assemblers and train employees on job procedures.

#12
Overall Ranking of Most Difficult Occupation to Fill

#3
Ranking within the Production Job Family

547
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$18.61
Median Hourly Earnings

HIGH SCHOOL DIPLOMA OR EQUIVALENT
Most Desired Education Level

SOFT SKILLS MISSING IN JOB CANDIDATES

- Dependability & Reliability
- Initiative
- Critical & Analytic Thinking
- Problem Solving & Decision Making

FIRST LINE SUPERVISORS

O*NET Code 51-1011.00

JOB DESCRIPTION

Directly supervise and coordinate the activities of production and operating workers, such as inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators.

OTHER REPORTED JOB TITLES

Production Supervisor, Manufacturing Supervisor, Team Leader, Shift Supervisor, Production Manager, Supervisor, Assembly Supervisor, Plant Manager, Department Manager, Molding Supervisor

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Manufacturing Processes	4.33	Machining	3.00
Quality Standards	9.00	Lathes	5.00
Machine Operation	6.67	Lean Manufacturing	4.00
Scheduling	5.00	Machine Tools	2.67
Measurement	4.50	Mathematics	4.00
Operations Management	3.42	Micrometers	<2.00
Process Improvement	2.50	Packaging	3.17
Repair	9.00	Process Control	<2.00
Blueprints	9.00	Calipers	<2.00
Inspection	3.50	Computer Numerical Control (CNC)	7.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training

#13
Overall Ranking of Most Difficult Occupation to Fill

#4
Ranking within the Production Job Family

140
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$29.98
Median Hourly Earnings

HIGH SCHOOL DIPLOMA OR EQUIVALENT
Most Desired Education Level

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Various Programmable Logic Controller (PLC) programming languages; G programming code; Hass CNC machines; Fadal CNC machines; Mazatrol machines; Interpersonal skills including coaching and conflict resolution.

TASKS

- ❑ Enforce safety and sanitation regulations.
- ❑ Direct and coordinate the activities of employees engaged in the production or processing of goods, such as inspectors, machine setters, and fabricators.
- ❑ Confer with other supervisors to coordinate operations and activities within or between departments.
- ❑ Plan and establish work schedules, assignments, and production sequences to meet production goals.
- ❑ Inspect materials, products, or equipment to detect defects or malfunctions.
- ❑ Observe work and monitor gauges, dials, and other indicators to ensure that operators conform to production or processing standards.
- ❑ Conduct employee training in equipment operations or work and safety procedures, or assign employee training to experienced workers.
- ❑ Interpret specifications, blueprints, job orders, and company policies and procedures for workers.
- ❑ Keep records of employees' attendance and hours worked.
- ❑ Read and analyze charts, work orders, production schedules, and other records and reports to determine production requirements and to evaluate current production estimates and outputs.

SOFT SKILLS MISSING IN JOB CANDIDATES

- **Dependability & Reliability**
- **Problem Solving & Decision Making**
- **Initiative**
- **Adaptability & Flexibility**

ELECTRICAL & ELECTRONICS INSTALLERS & REPAIRERS

O*NET Code 49-2093.00

JOB DESCRIPTION

Install, adjust, or maintain mobile electronics communication equipment, including sound, sonar, security, navigation, and surveillance systems on trains, watercraft, or other mobile equipment.

OTHER REPORTED JOB TITLES

Electronic Technician, Boat Rigger, Marine Electrician, Critical Systems Technician, Mechanical Electrical Plumbing Supervisor (MEP Supervisor), Electronic Bench Technician, Electronics Mechanic, Locomotive Electrician, Radio Technician, Troubleshooter

20 MOST IMPORTANT KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
Electrical Schematics	2.00	Judgment	2.23
Electrical Systems	9.50	Mechanical Engineering	2.25
Wiring	6.13	Original Equipment Manufacturer (OEM) Systems	<2.00
Blueprints	2.83	Power Tools	4.00
Equipment Maintenance	9.00	Repair	2.25
Hand tools	9.00	Calibration	2.25
Mathematics	5.50	Decision Making	2.00
Programmable Logic Control (PLC)	<2.00	Inventory Level Management	9.00
Computer Aided Design (CAD)	<2.00	Lean Manufacturing	<2.00
Inspection	9.00	Manufacturing Processes	<2.00

* TI-Training Index = Importance/Difficulty; higher score indicates greater need for training.

ADDITIONAL SPECIALTY KNOWLEDGE MENTIONED BY RESPONDENTS

Circuit boards; Soldering; Programmable Logic Controller (PLC) programming software; All proprietary robotics programming languages; Foreign language skills.

TASKS

- ❑ Inspect and test electrical systems and equipment to locate and diagnose malfunctions, using visual inspections, testing devices, and computer software.
- ❑ Reassemble and test equipment after repairs.
- ❑ Splice wires with knives or cutting pliers, and solder connections to fixtures, outlets, and equipment.
- ❑ Install new fuses, electrical cables, or power sources as required.
- ❑ Locate and remove or repair circuit defects such as blown fuses or malfunctioning transistors.
- ❑ Adjust, repair, or replace defective wiring and relays in ignition, lighting, air-conditioning, and safety control systems, using electrician's tools.
- ❑ Refer to schematics and manufacturers' specifications that show connections and provide instructions on how to locate problems.
- ❑ Maintain equipment service records.
- ❑ Cut openings and drill holes for fixtures, outlet boxes, and fuse holders, using electric drills and routers.
- ❑ Measure, cut, and install frameworks and conduit to support and connect wiring, control panels, and junction boxes, using hand tools.

#14
Overall Ranking of Most Difficult Occupation to Fill

#2
Ranking within the Installation, Maintenance, and Repair Job Family

2
Estimated Annual Job Openings for the SE MI Region (2013-2018)

$27.37
Median Hourly Earnings

ASSOCIATES DEGREE OR CERTIFICATE
Most Desired Education Level

46
Regional Certificate Level Completions (2011)

22
Regional Associate Degree Level Completions (2011)

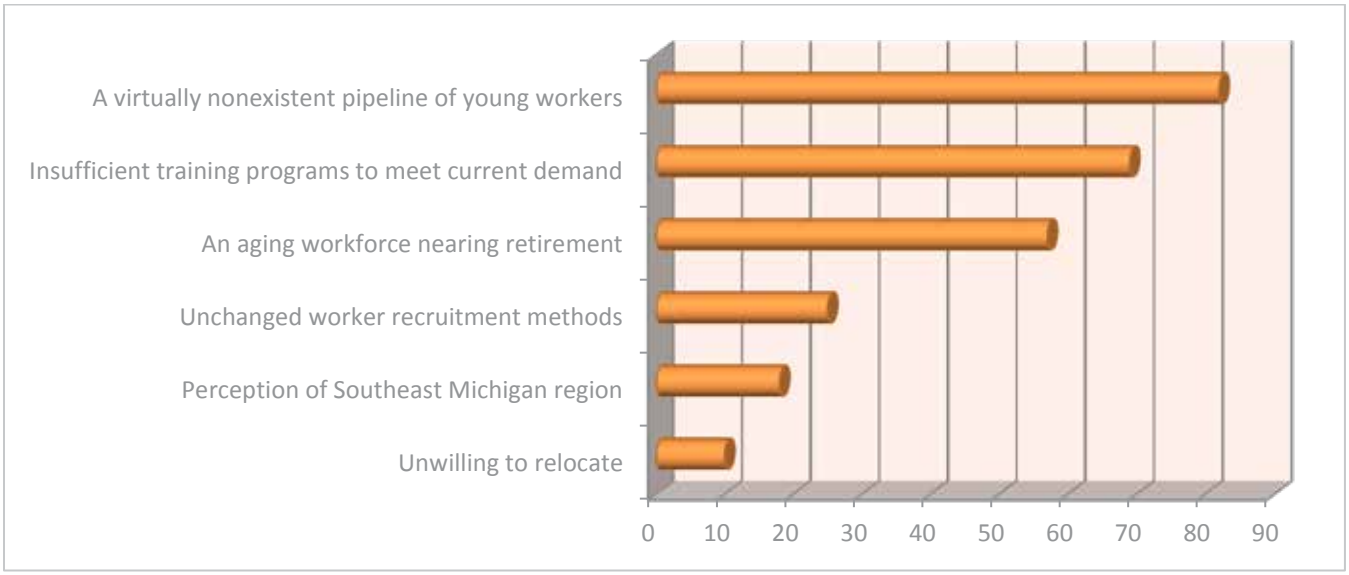
SOFT SKILLS MISSING IN JOB CANDIDATES

- Adaptability & Flexibility
- Critical & Analytic Thinking
- Dependability & Reliability
- Initiative
- Problem Solving & Decision Making

REGIONAL HIRING CHALLENGES & REMEDIES

Survey respondents were asked to provide input relevant to the greatest hiring challenge faced when attempting to fill open positions. Respondents were given the opportunity to select all applicable challenges facing their respective organizations from a list of six (6) possible options. Survey findings based upon frequency of responses are shown below.

GREATEST HIRING CHALLENGES FACING EMPLOYERS



Respondents were then given the opportunity to elaborate upon the challenges selected and/or to write another challenge based upon individual experience. Survey results indicate that there is a disconnect between the expectations/needs of employers and the pool of available candidates. Comments received through the open-ended response question have been categorized and summarized below.

INSUFFICIENT NUMBER OF ENGINEERING CANDIDATES

Employers indicate that the ideal candidate is a young engineer with a few years of manufacturing experience. Unfortunately, many engineers with experience in the industry were casualties of the economic downturn and have since either left the state of Michigan or the workforce altogether. In addition, the resurgence of the Big Three, while good for the automotive industry, has resulted in a significant upturn in hiring trends for engineers by these large corporations. This has resulted in a trickledown effect and even tighter labor pool available to the mid-size and small manufacturers seeking to hire engineers. Combined, these factors have placed significant pressure on all employers attempting to recruit engineers.

"Recruiting engineering talent seems to be impossible for midsize businesses competing with the big three."

"It has become a real challenge to find candidates that have a solid background in manufacturing coupled with years of specific engineering experience."

"Skilled veterans in the trade seem to be virtually nonexistent. Young workers in the manufacturing trade have minimal skills in the manufacturing industry."

"We are a unique industry and our challenge is to find trained individuals. Most have not done our type of work so we train them ourselves."

LACK OF SPECIFIC TRAINING/EXPERIENCE IN THE SKILLED TRADES

Employers have indicated a distinct lack of welders, engineers and machinists with the necessary experience in the available labor pool. Skilled trade veterans with experience in manufacturing are now nonexistent for various reasons including forced relocation, transition to other industry sectors and exit from the workforce. On the other hand, the younger and less experienced candidates in the labor pool typically lack the minimal skill set required for the advanced manufacturing industry.

This has forced many employers to develop proprietary training programs internally. The reason behind this trend is two-fold. Some employers have done so in order to address the lack of relevant training programs and certifications in the open market. Others indicate their products or services are unique and/or they serve a niche market which necessitates the need for internally developed, specialized training programs. Both scenarios present significant challenges for employers.

Employers also attribute shortages in the labor pool to issues within the K-12 education system. Many school districts have eliminated courses such as shop and auto mechanics from the curriculum, thereby removing exposure to the "hands-on" careers in manufacturing. This compounds the image problem faced by the manufacturing industry at large as further outlined below.

PERCEPTION OF THE MANUFACTURING INDUSTRY AND THE REGION

Advanced manufacturing employers are further hindered in their pursuit of talent by the fact that jobs or careers in manufacturing are no longer perceived as viable options. The perception, which employers believe is shared by some educators and parents alike, is that a job in manufacturing becomes an option only if a student is not successful academically and/or does not pursue a college degree. This is a source of frustration to advanced manufacturing employers as many strongly indicate that jobs within their industry have evolved into positions that require specialized technical skills and offer opportunities for advancement and success equal to careers in other industries.

The problem is exacerbated by the difficulty many employers encounter in attracting engineers, both experienced and recent college graduates, to southeast Michigan. Like it or not, the perception of southeast Michigan is tied, largely, to the City of Detroit and its negative national image adversely impacts the entire region on many fronts. Couple with this the positive image enjoyed by other metropolitan areas that serve as primary competitors for talent recruitment and the problem grows exponentially.

"I believe that training programs for trades could be developed quickly if the younger workforce has a desire to learn a trade in manufacturing. It seems that manufacturing jobs have a much less desirable image with the young work force."

"I currently am in charge of staffing the skilled trades group for our company. Mold makers, machinists, and tooling engineers - these employees are very difficult to find with experience. They are perceived to be dying trades and, thus, it is very hard to find qualified candidates."

"Process engineers are a challenge for our company as the state has lost a lot of talent. We have a hard time finding people willing to move to the state. We need to make Michigan appear as an attractive place to work."

"A significant challenge is a lack of workers with even high school level skills in math, communication and computers who are not only available but are also WILLING to consistently show up for a 40 hour a week job."

UNSATISFACTORY APPROACH TO THE JOB BY CANDIDATES

Employers expressed concern regarding new employee expectations related to job responsibilities and compensation packages that result in increased employee turnover especially in production occupations. Comparatively speaking, the wages and benefits offered have been reduced significantly post-recession. Consequently, employees are quick to leave their position for a minimal hourly pay raise offered by a direct competitor in the industry or for a job outside of the manufacturing arena. As a result, hiring forecasts by some employers may not be entirely reflective of new jobs but also take into consideration an anticipated consistently high employee turnover rate. Further, employers point to overall poor work ethic as a challenge that further limits the pool of qualified job candidates.

EMPLOYER PROPOSED REMEDIES TO HIRING CHALLENGES

Employer input surrounding remedies to address hiring challenges was equally divided between the need to refocus the approach to manufacturing-based education/training programs, particularly at the K-12 level; and, the need to address the prevailing negative perception of the industry as a whole and its impact on recruitment and the employee pipeline. Fully 76% of the respondents that offered remedies through this open-ended survey question focused on these two areas.

EDUCATION AND TRAINING

Employers indicated that increased emphasis needs to be placed on the development of specific manufacturing-related education and training curriculums at the secondary and post-secondary levels. Specifically, respondents suggested reintroducing shop and/or other courses emphasizing skilled trades into middle and high school mainstream curriculums. Focus should be directed to real world application of these basic and technological skill sets and their relevance to careers in advanced manufacturing. At a post-secondary level, employers continue to emphasize the importance of specialized curriculums and customized training programs developed in collaboration with employers. Together, K-12 educators, vocational/technical schools, post-secondary institutions, employers, and political leaders need to advance the development of manufacturing curriculums to supply more talent to the employee pipeline.

"School systems need to offer more and encourage participation in vocational programs instead of sending everyone on a track to a four-year university."

"Fully teach individual areas of the basic trades, not a compilation of watered down components."

"Promote local colleges and universities to work in collaboration with companies to educate and recruit talent for real world jobs."

"Manufacturing has a major image problem; it needs to be "cool" again. Instead of fixing it at the community college level with training, attack the problem at the K-12 student level."

"The region and state need to promote a re-branding of manufacturing jobs as challenging and rewarding versus the colloquial assumption that working in manufacturing is something to be done when you can't get better work."

"The schools have to accept the fact that not all children are meant to attend a four-year college and get a degree. We need mechanically minded young people to pursue the trades."

PERCEPTION AND RECRUITMENT

Employer suggestions to address the perception of the advanced manufacturing industry and the ensuing difficulty in talent recruitment were focused in two primary areas.

The first is the need for the development of a concerted approach within the K-12 system to make students aware of the growing job prospects and the unique skills that are now necessary to prosper in an advanced manufacturing career. Young people should also be educated about the earning potential that accompanies a career in the skilled trades.

Of equal importance is the need for public awareness campaign(s) with a dual purpose. The campaign(s) should target secondary students and their parents with a refreshed vision and perspective on available advanced manufacturing careers while also reaching out to former workers to communicate the renewed vitality of the advanced manufacturing industry in Michigan.

IMPORTANCE OF INTERNSHIPS

Just over 10% of respondents to this question also voiced support for the establishment of formal internship or co-op programs. Employers indicated that the programs should be established in cooperation with local post-secondary institutions in an effort to provide college students with "real world" manufacturing experience and mentorship. The importance of collaboration between educators and advanced manufacturing employers cannot be overemphasized in order to ensure that programs are relevant and tailored to the needs of both the student and the business unit.

"We would be supportive of student work rotation programs for permanent placement upon graduation."

"An internship for college students/recent graduates would provide necessary real world experience."

The following is a summary of general observations based upon an analysis of survey responses.

INCREASING LEVEL OF TECHNICAL KNOWLEDGE IS A MUST FOR JOBS REGARDLESS OF EDUCATION LEVEL

The job profiles highlight the overall importance of technical knowledge, skills and abilities (KSA) for jobs at all education levels; however, the most striking technical KSA requirements are found on jobs requiring only a high school diploma or equivalent. In reviewing job profiles for General Maintenance/Repair Workers, First Line Supervisors, and Team Assemblers, it is important to draw attention to some of the important but difficult to find KSA's associated with these occupations. The KSA's employers are seeking include but are not limited to: robotics, programmable logic controls (PLC), manufacturing processes, quality standards, blueprints, and Computer Numerical Controls (CNC). As can be expected given the desired education level of a high school diploma or equivalent, the associated training index (TI) for these named KSA's is a 4.50 or higher.

CHANGING WORKER RECRUITMENT METHODS NOT ADOPTED BY ALL EMPLOYERS

Worker recruitment methods continue to evolve with technological advancements resulting in an increasing number of online job postings and applications. Not all companies, however, are adapting to the changing methodologies. Many employers still place signs in windows and in front lawns to attract qualified job candidates thereby severely limiting their prospective pool of applicants. As a result, the demand for certain occupations may not be reflected in the real time labor market data used to identify in demand occupations.

FOCUS ON TECHNICAL SKILL SETS VS. PERSONAL COMPETENCIES AND SOFT SKILLS

In the previous Skills Needs Assessment Project focused on the Emerging Sectors, personal competencies and soft skills came to the forefront and were emphasized as lacking in many job candidates. Since that time, educational institutions have made a concerted effort to teach these soft skills/personal competencies when possible or to incorporate the importance of them into various curriculums. In this iteration of the project, soft skills were less significant in terms of overall importance. This may be indicative of the advanced manufacturing industry's pressing need to find candidates with technical skills immediately which is in contrast to the Emerging Sectors long range viewpoint; or, it may be an acknowledgment of the increased emphasis by educational institutions in this area.

COMPUTER NUMERICAL CONTROLS IS A SKILL THAT SPANS MULTIPLE OCCUPATIONS

Economic and workforce developers have echoed employers concerns regarding the inability to find Computer Numerical Control (CNC) machine operators. Consequently, when reviewing the top 14 job profiles, one may expect to find a profile under this occupation title. It is important to note that CNC along with CNC Lathes and CNC Milling are specific skills that appear as KSA's under multiple occupations rather than as a specified occupational title.

HIRING PROJECTIONS PARTLY DUE TO INCREASED TURNOVER RATES

While hiring within the advanced manufacturing industry may be on the upswing, it is important to recognize that a segment of the job openings is due to increased turnover rather than growth. Reductions in pay and benefit packages necessitated by the economic downturn have resulted in a change in perspective by job seekers with many no longer viewing employment in manufacturing as a secure or attractive long-term

proposition. Many are willing to leave for a minimal pay or benefit increase. In addition, competition among employers for a limited number of qualified candidates to fill production jobs as well as more highly skilled, technical positions will impact turnover rates and, consequently, the number of open job postings in the region.

APPRENTICESHIP & INTERNSHIP FINDINGS

In addition to the comprehensive Skills Needs Assessment Project (SNAP) advanced manufacturing employer survey, the EdEn Team collaborated with Dr. Donald Blum, Blum & Associates, to conduct a separate effort targeted toward apprenticeship and internship programs. Dr. Blum served as Project Manager for the apprenticeship and internship components and was tasked with gathering relevant input offered from employers related to this particular subject matter. Specifically, this segment of the study was designed to ascertain the level of participation by employers in these types of programs. Further, the study attempted to determine (1) the reasons for and benefits of participation, and (2) the underlying reasons behind non-participation and what could be done by workforce developers to assist in program implementation. Separate web-based surveys addressing apprenticeship and internship programs were included as part of the SNAP webpage interface. The apprenticeship and internship surveys contained 16 and 19 questions respectively with the majority being open-ended.

In addition to being included in the normal distribution channel for the broad-based survey, the apprenticeship and internship surveys were targeted for distribution through additional sources including: Oakland Community College and Macomb Community College apprenticeship and internship departments and Focus Hope. These five supplementary resources generated additional companies known to have an apprenticeship and/or internship programs. Furthermore, data was collected via independent secondary research; the collaborative focus group; phone and face-to-face interviews with employers, representatives from professional organizations, and educators.

A high rate of return for the apprenticeship and internship surveys was not anticipated due, in large part, to the very specific nature of the topics coupled with the fact that neither program is incorporated universally throughout the industry. A concerted effort was made to get the surveys to the "right" person within an organization rather than focusing on a high response rate. As a direct result of the web-based initiative, 81 completed surveys (39 apprenticeships; 42 internships) were received. Employer representation was heavily skewed towards automotive and machining companies with less than 250 employees. Separate phone interviews were conducted with 31 employers from a list of companies provided by the Oakland County Michigan Works! Agencies.

U.S. News reported that among the Top 10 National Universities for student Internships, the #1 school had 86% of graduating seniors with internship experience, and an average of 62% of undergraduate students served at least one internship. There were no Michigan colleges/universities in this group.

According to Crain's Detroit Business, nearly half of the more than 300,000 students educated in Michigan's 15 public universities will leave the state upon graduation. Many business leaders believe that internship programs will help to reverse this exodus and retain the talent that hampers the state's ability to move forward.

According to State Talent Director Robert Sherer, "The current skill shortage crisis is a problem of supply and demand; there is no shortage of workers, just a shortage of workers with the right skills. The combination of too few workers in the pipeline, too little training, and too many baby boomers exiting the workplace created the crisis we face today." Some employers believe that a renewed focus on apprenticeship-type programs in the manufacturing industry will assist with addressing the shortage.

In an effort to understand existing programs and future direction, survey data was supplemented by information gathered through 15 in-person and two in-depth phone interviews with representatives from academia, service providers, professional organizations, and training organizations. Secondary research of over 100 articles and studies was conducted and a professional conference and two task force meetings were attended to gain an appreciation of the issues and opportunities facing advanced manufacturing within southeast Michigan.

APPRENTICESHIP STUDY RESULTS

RESPONDENT DEMOGRAPHICS

Fifty-four percent of survey respondents represented some form of machining followed by automotive at 21%. Together, these two groups accounted for approximately 75% of all respondents while the remainder consisted of one or two companies per industry sector.

Just fewer than fifty percent (46%) of companies had 51-250 employees in southeast Michigan; 28% employed 1-50; and, 13% employed 251-500. Of the remaining respondents, three companies employed 751-1000 employees; one employed 1001-1500; and, one employed 1500+ employees. No responses were gathered from companies employing 501-750 employees.

Of the responses received, 56% of the employers are located in Oakland County followed by Macomb and Wayne counties with 18% and 15%, respectively. Responses were also received from two employers located in Jackson County and one from Lapeer County.

TYPES OF PROGRAMS

Apprenticeships tend to fall into two categories: federally registered and non-federally registered programs. A federally registered program must comply with the Department of Labor (DOL) Standards of Apprenticeship which requires a pre-determined program length (usually 4 years in the manufacturing arena); 1:1 ratio of skilled craftsman/journeyperson to apprentice; extensive and varied equipment training; potential affirmative action plans; random compliance reviews, and, testing requirements (those with the highest scores are hired first). This comprehensive, monitored program is proven to yield highly trained workers with a recognized, respected, and transferable DOL certificate upon graduation.

QUICK SURVEY FINDINGS:

1/3 OF EMPLOYER RESPONDENTS described their apprenticeship program as a partnership between a community college and the employer.

PARTNERING ACADEMIC INSTITUTIONS in order of frequency selected include:

- Macomb Community College
- Oakland Community College
- Jackson Community College
- Mott Community College

PREDOMINANT APPRENTICE CLASSIFICATIONS selected were:

- Die Maker
- Machinist
- Electrician
- Machine Repairer
- CNC Operator/Programmer

IMPORTANT KSA'S for apprenticeship candidates:

- Math aptitude
- Mechanical aptitude
- Blueprint reading
- Attitude
- Computer skills
- Spatial relations
- Knowledge of metal working machinery
- Good attendance
- Willingness to learn
- Work ethic

The trend for smaller companies who are unable meet the stringent DOL Standards of Apprenticeship is to create a non-federally registered program. With this arrangement, companies can determine required program hours and design their own standards and on-the-job (OJT) training plan. It is worth noting that the potential disadvantage to the employee is he/she does not receive a recognized, transferable certificate upon completion.

In addition to OJT, both types of apprenticeship programs require formal technical instruction usually provided by a community college or an employer/labor apprenticeship school. The instruction can vary by trade but generally consists of 450-700 contact hours or 28 - 45 credit hours. Upon successful completion, the employee will receive a training certificate from the training provider. If the apprentice chooses to further his/her education, he/she may have the option of applying some or all of the technical training towards a degree. Typically, with the addition of a handful of general education classes, an apprentice can receive an associate degree in a related discipline.

Approximately 66% of respondents do not have a federally registered apprenticeship program. Respondents provided the following as rationale for this decision:

- Current business levels do not support an apprenticeship program
- Cost is prohibitive
- Company is too small and cannot meet the stipulations for a Federally Registered Program
- Reluctance to allow government agencies to examine financial records

RATE OF PAY

Over half (58%) of the responding companies start their apprentices at $10 - $14 per hour, with a top pay of $20 - $24 per hour. This appears to be a competitive wage, as validated by the Tool & Die Employment Needs Survey conducted by the Michigan Economic Development Corporation (MEDC) in March, 2012; on average, companies indicated that apprentices have a starting wage of $13.70 per hour, with experienced workers receiving $21.39 per hour.

RECRUITING SOURCES

Three-fourths of respondents indicated they fill their apprenticeship openings with internal candidates; however, one-third of those also indicated they would fill a position with an external candidate, if necessary. Internal placements provide the employer with the advantage of evaluating the employee's technical ability, work ethic, and motivation prior to offering an apprenticeship opportunity. The processes used to find external candidates were fairly equally distributed between through the local college, posting on a job board, posting on their company website, and advertising in the newspaper.

It is interesting to note that half of the employers are able to retain 100% of their apprentices for at least three years after successful completion of their apprenticeship program. The other half are able to retain at least 80% for over three years after program completion.

PROGRAM EVALUATION AND EFFECTIVENESS

Companies that conduct an evaluation of their apprenticeship program tend to use the following criteria:

- Grades in school, hours worked, and the ability to learn and perform on the shop floor

- Quality of work and teamwork; working relationship, technical knowledge, environmental, initiative, mechanical aptitude, general aptitude, and employee motivation

Although the response to the survey was limited on this issue, it is worth noting that when asked what made their program "work well or Best-in-Class," the themes that came through were:

- The need for an effective apprenticeship coordinator at the site
- The cross training of apprentices through working in several different areas within a shop
- The development of bench strength to enable a pipeline

ADVICE TO COMPANIES – CHARACTERISTICS OF SUCCESSFUL PROGRAMS

Companies that have apprenticeship programs offered "Words of Wisdom" to companies contemplating the introduction of an apprenticeship program. They were as follows:

- Be prepared to make a long-term commitment; you will not benefit immediately
- This is a long-term solution/program; be prepared for this to cost money in the short-term but it will reap long-term benefits
- Ensure your program is competitive in terms of pay and benefits
- Develop a retention plan
- Be prepared for the apprentices to have the opportunity to leave as soon as they get their certification

It is worth noting that the last comment regarding eventual attrition floats to the top as one that should be addressed from the beginning with the introduction of any apprenticeship program. While attainment of a certification makes an employee more valuable to the organization, it also increases their potential value to other employers. A retention effort should start early.

It should be noted there are numerous cooperative initiatives underway that explore new business models and accelerate the required training instruction.

WHAT OAKLAND COUNTY CAN DO TO HELP

When asked what Oakland County could do, or provide, that would help companies with their apprenticeship program, these suggestions were offered:

- Develop a financial assistance program
- Need coordination of program awareness
- Take the lead and oversee a coordinated effort to market technical careers in manufacturing
- Apprenticeships must be marketed as a respected and strong, viable career option, not a consolation prize
- Develop an aggressive plan to market the "technical" career path to middle and high school students
- Develop a technology hub similar to Medical Main Street
- Provide additional information on how to start an apprenticeship program, the difference between a registered and non-registered program, required resources, cost, share best practices, etc.

RESPONDENT DEMOGRAPHICS

Approximately 50% of employer respondents represented the automotive sector, about 25% represented machining; and, representation from the aerospace was a distant third.

Companies with 51-250 employees outnumbered all other size companies with 45% falling into this category followed by employers with 1-50 (29%) and 251-500 (14%) employees, respectively. A minimal number of responses were received from companies in all other size ranges. No responses were gathered from companies employing 501-750 employees.

Of the survey responses received, 88% of employers have a presence in the tri-county area with 57% located in Oakland County, 17% in Macomb County, and 16% in Wayne County.

TYPES OF PROGRAMS

The questions asked of employers were related to formal and informal internship programs. In a formal program, an employer partners with a college or university in a structured program whereby the student/intern would receive college credit and the employer would provide feedback to the school through a student/intern evaluation process. An informal program involves a non-academic credit relationship created between the student and the employer, whereby the school may or may not play a role in matching students to employers.

There were some commonalities between the formal and informal programs. In both cases, all employers indicated the intern reports to the working department rather than human resources. Over half (60%) of the responding companies include departmental or job rotations as part of their program. All formal programs used Michigan colleges/universities; however, it is interesting to note that the employers with informal programs also included out-of-state universities.

Given the number of schools with the availability of formal programs in the region, it was interesting to learn that three-fourths of the respondents do not have a formal internship program. About one-third of the companies, however, expressed a desire to implement a formal program.

QUICK SURVEY FINDINGS:

MOST HIGHLY SOUGHT AFTER INTERNSHIP DISCIPLINES include:

LEVEL ONE:
- Engineering
- Finance
- Human Resources

LEVEL TWO:
- Marketing
- Design
- Logistics
- Sales
- Purchasing
- Quality

LEVEL THREE:
- Robotics
- Test Lab
- Skilled Trades
- Information Technology
- Supply Chain Management
- Packaging Engineering

LENGTH OF INTERNSHIP PROGRAMS was equally split between:

- Single semester
- Entire academic year

HIRING TREND for college interns showed most were offered positions after the junior year of college

IMPORTANT ATTRIBUTES for internship candidates:

- Strong academic track record
- Skills related to their discipline
- Ability to work with others
- Problem solving
- Technology proficiency
- Attitude and aptitude
- Strong communication skills
- Decision making
- Ability to multi-task
- Cultural fit
- University attended

Of those that do not have a formal program and no intention of implementing one, the rationale given centered on three themes:

- The employer's growth projections do not warrant a program
- It is too costly to run and maintain a program
- The company is too small to implement a program

Of those that would consider a formal program, it was indicated that the following would be helpful for them to move forward:

- Financial assistance from an external source
- Detailed information from others who have developed successful Internship programs or other external organizations in order to better understand best practices and the costs involved

As it relates to internship programs in general, formal or informal alike, the study revealed the following:

The three most highly sought after disciplines were engineering, followed by finance and human resources. Those in lesser demand fell into two groups: marketing, design, logistics, sales, purchasing, and quality followed by robotics, test lab, skilled trades, IT, supply chain management, and packaging engineering. The length of the internship program was equally split between a semester and school year, with fewer programs being offered during the summer only. The trend is for companies to hire Interns in their third year of college (juniors), and those that perform well are brought back in their fourth year, as seniors. One-third of the employers averaged an intern return rate of 85-100%, and one-fourth averaged 50-60% return-rate.

RATE OF PAY

Just over 90% of responding employers offer paid internships. Almost 60% of employers pay at a rate of $14 - $16 per hour; 22% pay $17 - $19, and 17% pay $8 - $11. There was no apparent correlation between rate of pay and size of the company. In the way of comparison, according to a 2012 study by career site Glassdoor, undergraduate interns will average $14.21; with freshmen getting $13.91 an hour and seniors earning $17.57. Engineering majors have the highest rate at $20.79 an hour, nearly as much as general Master's degree level interns, who earn $21.93 an hour. In addition, more than 80% of companies now plan to offer some sort of added benefit to interns, such as social activities and paid holidays. Nearly 60% of firms will help Interns with relocation costs.

RECRUITING SOURCES

Companies search for internship candidates through multiple avenues. The Career Services department within the academic institutions topped the list, followed in rank order by company website, job boards and campus advertising. There were two employers that indicated (through write in comments) that they use career fairs and one that uses Michigan Works!

PROGRAM EVALUATION AND EFFECTIVENESS

Employers that have formalized an evaluation process indicated that they utilize the following evaluation criteria for interns in their programs:

- Benchmarking against agreed-upon goals and objectives between the intern and the employer
- Use of the school's online work term evaluation

- Use of the same performance appraisal as utilized for other company salaried associates (expectation is that the intern should perform at the same level as all associates)
- "Experience" paper summarizing lessons learned, likes/dislikes, improvements, and evaluation of program written by intern

In general, employers evaluate an individual intern based upon the following dimensions: communication, creativity, time management, vision, problem solving, and the ability to apply educational skill sets.

When asked to rate the effectiveness of the internship programs in general, the majority of companies rated their programs in the highly effective/effective category. Of the remaining input, companies were fairly evenly divided between those that indicated extremely effective and ineffective. Input from approximately half of the companies revealed the following factors that made their programs effective:

- Size of the company (1,001-1,500); volume of interns (100 per year); university partnership program
- Creation of a good process for feedback; a more solid structure around the program; expansion of sourcing options
- Ability to offer housing assistance and rotational assignments
- Good managers within the organization
- Departmental rotation, effective corporate strategies and culture

ADVICE TO COMPANIES – CHARACTERISTICS OF SUCCESSFUL PROGRAMS

Companies that indicated that their program was "successful" offered the following advice to employers considering the implementation of an internship program:

- Start small and use the program as a testing ground for future hires by building an entry-level talent pool
- Establish clearly defined expectations through effective communication between managers and Co-ops/interns
- Conduct timely performance evaluations
- Provide interns with meaningful work that challenges them so that they will find value in the program and speak well of your company
- Pay interns a competitive rate to get the best people; if possible, provide benefits or other perks
- Create a mentoring relationship and, when possible, provide the interns access to senior management
- Treat interns as valued individuals and with respect
- Hire more than one intern; this will provide them with someone at their level with whom to interact

ADVICE TO INTERNSHIP SEEKERS

Employer input identified the following advice for individuals seeking an internship:

- Pursue courses in a specific area of interest as soon as possible. Employers would like interns who have some professional knowledge of the area in which they will be working. Focus on excelling in academics first and foremost
- Go to recruiting events; develop an attention grabbing résumé that highlights experience and relevant activities. Attend career fairs and work with a university's Career Services department
- Prepare for an internship interview by treating it like it's for a full-time career position, because it may be just that in the long term since many co-ops/interns are hired after graduation

- Enter an intern position with the understanding that the working world requires a different set of expectations. Be willing to put in the time doing basic-level work in order to demonstrate a capability to handle more complex work
- Keep in mind that it is many times beneficial to stay with the same organization throughout the course of studies as the chances of being hired directly are enhanced
- Don't dress or act too casual; business acumen and a professional approach to the job demonstrate an understanding of the fact that it is a business

WHAT OAKLAND COUNTY CAN DO TO HELP

When asked what Oakland County could do, or provide, that would help their internship program, employers indicated the following:

- Provide a centralized source or website that matches candidates with employers, not only for current students but also alumni, where universities/career services/professors can direct their students
- Provide more information on available formal (for credit) programs for employers and students
- Provide information on best practices from other companies

DATA ANALYSIS METHODOLOGY

DATA SCREENING

As a first step in the data analysis process, all variables were screened to assure that the properties of the data met the assumptions of the statistical procedures to be used. Specifically, data were screened to ensure that there were no errant values (i.e., values that were outside the possible range), that the distribution of values adequately followed the normal bell shaped curve with extreme values occurring with a low frequency and more mid-range values occurring with a high frequency, and that there were no statistical outliers, which are values that are substantially different from the bulk of the values.

Traditional statistical analyses are sensitive to deviations from these distributional properties and if such deviations are not accounted for, the analyses will produce biased results. As the majority of the data collected from this survey were categorical frequency counts, distributional properties are of less concern for the majority of the analyses reported. However, for each job skill selected, respondents were asked to rate "how important" that skill is for a given job and "how hard it is to find" someone with that skill. Each of these questions used a 10-point Likert scale response format. These response formats exhibit the statistical properties of continuous variables and thus, are sensitive to distributional properties.

The data screening procedures found that both of these continuous variables had distributional properties which sufficiently approximated those assumed by traditional statistical analyses and so no further adjustments or corrections were made.

MISSING VALUE ANALYSIS

One of the most common concerns with large scale survey data collection is missing data. Missing values occur for a wide array of reasons, but they can be categorized into three broad groups based on their statistical properties. The first is missing completely at random (MCAR). This type of missing data occurs when a respondent does not record a value for some reason that does not occur systematically; for example, the respondent might accidentally skip over a question while reading. The important thing is that the reason they didn't respond had nothing to do with either their potential response or any characteristic of the respondent. This type of missing data does not negatively impact statistical findings.

The second type of missing data is missing at random (MAR). While this seems an odd distinction from the MCAR category, there is a subtle, but meaningful difference. MAR data might be missing for some systematic reason, such as the order of the question on a survey with the amount of missing data increasing towards the end of the survey, but the pattern of missingness is statistically independent of the potential value of the individual's response. In other words, a respondent might have chosen not to answer a question for a specific reason, such as fatigue or running out of time, but the reason had nothing to do with the answer they would have given had they answered the question. This type of missing data has less impact on the validity of statistical conclusions and adjustments can be made to the analyses to account for this pattern of missingness.

The third type of missing data is referred to as missing not at random (MNAR). This pattern of missingness is a direct function of the potential value of the missing data. Here the respondent chose not to answer a particular question specifically due to what their answer would have been. This final pattern of missing data is highly detrimental to statistical findings and cannot be corrected statistically.

On examination, most of the missingness did appear to be related to the order of questions on the questionnaire, such that as the respondent continued with the survey process they were more likely to skip questions at the end, or end the survey prematurely. Additionally, there did appear to be a considerable amount of missing data that could be considered missing by design. In other words, there were patterns of missing data that were due to the questions not being applicable for a given respondent, given their earlier responses. This is not an uncommon finding in branching survey structures, such as was implemented in this study. While various statistical imputation techniques are available for estimating missing values, there was too much globally missing data to implement them in this dataset. In cases where the data seemed to be missing by design there is no need to impute data in any case. In only one set of reported analyses were missing data of any concern, and it was corrected for within the analyses.

ANALYSIS OF VARIANCE

An Analysis of Variance was conducted to determine if there were statistically significant differences in the importance of the skills being sought, the difficulty finding those skills, and the ratio of skill importance to difficulty obtaining across job families. The results indicate that there are, indeed, significant differences in the overall training needs. The specific skills needed for jobs in skilled trades and operational support are, in general, more critical to the performance of a given job in those fields. Yet, the availability of individuals with those requisite skills is relatively low compared to the other job families. Additionally, the skills needed for engineering and design jobs, while not as tightly coupled to job performance on average, are relatively harder for employers to find in job candidates. As a result, jobs within those families (skilled trades; operational support; design, engineering, and engineering technicians) have a significantly higher need for the development of training programs. Post hoc analyses, using a Bonferonni-Sidak correction for reducing type I error, confirmed that the aforementioned observed differences in need and availability are statistically significant.

CONSULTANT INFORMATION

EdEn Inc., located in Rochester, MI, is a project management firm focused on helping clients navigate the economic development landscape. Over the years, EdEn has earned a reputation for excellence as a "bridge" firm connecting southeast Michigan businesses, educational institutions, workforce development agencies, and economic development entities. As a direct result of experience working with and for regional stakeholders, EdEn has gained a unique working knowledge and perspective on collaborative initiatives. EdEn team members involved in this Oakland County Skills Needs Assessment Project included:

- David Banchiu, President
- Kristina Arnone, Vice President
- Dawn Campbell, Program Manager

In addition, EdEn collaborated with the following individuals for completion of various project components.

- Troy Lindner, President, Lindner Technology Group, Inc. (LTGI)
- Dr. Ty Partridge, Statistician, Wayne State University
- Dr. Donald Blum, President, Blum & Associates

AT YOUR SERVICE...

Oakland County's Workforce Development team opens the door for thousands of employers as it provides convenient one-stop access to free recruitment tools, job training programs and services. Employers and job seekers are encouraged to use one of the eight Michigan Works! career centers in Oakland County to access these services.

Oakland County
MICHIGAN WORKS!®

FERNDALE
713 E. 9 Mile Road | Ferndale MI 48220
248-545-0222

HIGHLAND
2218 S. Milford Road | Highland MI 48357
248-889-0410

NOVI
31186 Beck Road | Novi MI 48377
248-926-1820

OAK PARK
22180 Parklawn Street | Oak Park MI 48237
248-691-8437

PONTIAC
1850 North Perry Street | Pontiac MI 48340
248-276-1777

SOUTHFIELD
21030 Indian Street | Southfield MI 48033
248-796-4580

TROY
550 Stephenson Highway, Ste 400 | Troy MI 48083
248-823-5101

WATERFORD
501 N. Cass Lake Road | Waterford MI 48328
248-682-3417

Open Monday - Friday, except for state holidays

The Skills Needs Assessment Project was funded by:
L. Brooks Patterson, Oakland County Executive
Oakland County Workforce Development Board
Workforce Development Agency, State of Michigan

For more information, contact:
Oakland County Workforce Development Division
John Almstadt, Manager
2100 Pontiac Lake Road | Waterford, MI 48328
almstadtj@oakgov.com | (248) 972-2256
www.AdvantageOakland.com

JOBS AVAILABLE

Go to MITradeSchool.org

OAKLAND COUNTY MICHIGAN

L. BROOKS PATTERSON
OAKLAND COUNTY EXECUTIVE

WORKFORCE DEVELOPMENT

MICHIGAN WORKS!
Oakland County

SKILLED TRADES ARE A GREAT CAREER CHOICE

Getting the qualifications you need often takes less than a year so training is affordable. And, lots of interesting jobs that pay well are waiting to be filled. Explore more than 100 careers in the skilled trades, find out how to learn a trade and get to know who's hiring at MITradeSchool.org. Oakland County Michigan Works! also can help in finding the right job for you.

Bright futures start at

MITradeSchool.org

OAKLAND®
COUNTY MICHIGAN

L. BROOKS PATTERSON
OAKLAND COUNTY EXECUTIVE

ADVANTAGEOAKLAND.COM