Labor Market Analysis

Advanced Manufacturing in Imperial County

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CENTERS OF EXCELLENCE
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Acknowledgements

About the Centers of Excellence

The Centers of Excellence (COE) provide customized workforce development reports for employers and the California community college system. Funding from the California Community College Chancellor's Office established seven regional COEs to conduct research to assist with labor market analysis, decision making and resource development. These regional centers offer technical assistance, conduct labor market research and facilitate partnerships for community colleges.

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Executive Summary

With the assistance of the Imperial Valley Economic Development Corporation (IVEDC), this study was conducted by the San Diego-Imperial Center of Excellence for Labor Market Research (COE) to gain a better understanding of current and future employment needs within the advanced manufacturing industry in Imperial County.

The study's objectives included identifying advanced manufacturing businesses, workforce trends and employer job requirements. The study's findings include employment projections for four occupational clusters related to advanced manufacturing as well as entry-level and median wages for jobs within those sectors. In addition, the study took a close look at the availability of educational programs related to advanced manufacturing within the Imperial Valley, with the goal of identifying how institutions of higher education can do a better job of preparing students to enter the advanced manufacturing workforce.

Data sources utilized by the COE include the Standard Occupational Classification System, Integrated Postsecondary Education Data System and California Community Colleges Chancellor's Office Data Mart System. A survey of advanced manufacturing businesses and executive level interviews were also conducted.

The report's key findings include:

- The most common advanced manufacturing process used by businesses is computer technologies, indicating that advanced technologies are prevalent within the industry in Imperial County.

- More than 70% of respondents identified themselves as small businesses with 50 or fewer employees.

- Employment is greatest within the production occupational cluster. Businesses reported employing 233 production workers and said they expect to create 37 new positions in the next year.

- The highest paid occupational sector within the advanced manufacturing industry is engineering occupations, followed by drafters and technicians occupations.

- The employers surveyed are most commonly having difficulty hiring for helpers of production workers.

- The majority of jobs associated with drafters and technicians, computer/software occupations and engineers require an associate degree or bachelor's degree.

The study also concludes that education providers in Imperial County offer a number of programs related to advanced manufacturing. Imperial Valley College, a public community college in the area, offers 14 degree and certificate programs that can lead to careers in advanced manufacturing. Employers have expressed a need for workers trained in such areas as welding, electronics and electric technology, engineering and computer science and could look into hiring directly from these programs. Increased collaboration between the community college and advanced manufacturing businesses could help to meet workforce demand while activities such as site visits or guest speakers from the industry could help encourage students to pursue employment within advanced manufacturing.

> **Based on responses from advanced manufacturing employers, all four occupational clusters studied are expected to grow within the next year.**
>
> *-COE & IVEDC study findings*

Introduction

It is well known that Imperial County has a long history of agriculture, reaching back to the early 1900s when the California Development Company acquired land in the region for crop farming. Today, Imperial County is one of the most agriculturally active counties in the nation, along with Yuma County in Arizona and Hidalgo and Cameron counties in Texas.

While agriculture dominates Imperial County's economy, other industries are active and growing. Advanced manufacturing in the county dates back to 1910 when A. E. Chaffey opened a manufacturing business in downtown El Centro. Chaffey already had manufacturing facilities in Los Angeles and Seattle and had decided to expand to Imperial County. He named the new facility the Art Metal Manufacturing Company, cranking out metal building materials such as metal ceilings, sidewalls and imitation brick. The company also made Mission-style tiles and metal shingles. At the time, the new facility was heralded as a harbinger of more manufacturing in the Imperial Valley.

Like many communities on the U.S. Southern Border, Imperial County's economy has a number of unusual labor market conditions. Many communities along the border, whether in Mexico or the United State, have integrated, interdependent economies, providing each other with goods and labor. In the case of Imperial County, residents of Mexicali just across the border hold approximately 40% of jobs in the county. This means there are a substantial number of people who cross the border to commute each day to Imperial County for work. Further facilitating linkages between Mexico and the United States, are the Imperial Valley's three ports of entry, which in 2006 generated more than $8.3 billion in binational trade,[1] a number of great significance which puts a unique spin on any economic analysis of the region.

Notable economic incentives include the Imperial Valley Foreign Trade Zone (IVTFZ) which is located in the Cities of Brawley, Imperial, El Centro, Calexico and unincorporated areas of Imperial County, to expedite and encourage foreign commerce in area adjacent to customs ports of entry. The IVFTZ provides the following key benefits: relief from inverted tariffs, duty exemption on re-exports, duty elimination on waste, scrap, and yield loss, weekly manifest entry savings and duty deferral. The IVFTZ currently has two operators within its boundaries. Coppel, Inc. concentrates on purchasing and finding products from all over the country for their department store chains in Mexico. The Warehouse Bonded Services dba Margarita Pimentel is a third party logistics (3PL) company that provides logistical solutions and distribution services[2].

Additionally the Southern California Border Region Recycling Markets Development Zone, a program under the management of CalRecycle, is designed to provide economic incentives and technical services to businesses that divert waste from California's landfills while adding jobs and revenues to the local economy. Program benefits consist of business loans, creative partnerships, free statewide advertising and permitting assistance.[3]

Lastly, the statewide California Competes Tax Credit program, devised as a replacement to the former Enterprise Zone program, provides an income tax credit to businesses that want to relocate to California or

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[1] "Imperial Valley International Trade and Logistics." Imperial Valley Economic Development Corporation. http://www.lee-associates.com/elee/sandiego/LeeLandTeam/536Acres-Calexico/EastPortStatistics.pdf
[2] Additional information can be found at www.ivedc.com/site-selection/incentives.
[3] Additional information can be found at www. socalrmdz.com.

stay and grow in California. Tax credit agreements are negotiated by GO-Biz and approved by a newly created "California Competes Tax Credit Committee".[4]

The advanced manufacturing sector in Imperial County has established a sound foothold in the regional economy and shows promise. Notable manufacturing businesses in El Centro include United States Gypsum Company, industrial fabricator EW Corporation, K-C Welding and Rentals, M&M Pump and Metal Fabricators, and DEF Products, which manufactures diesel exhaust fluids. Brawley's prominent manufacturers include Fiesta Tortilla Company and mining company New Gold.

Methodology

This report summarizes federal labor data and findings from an advanced manufacturing survey distributed throughout Imperial County by the Imperial Valley Economic Development Corporation (IVEDC)[5] in partnership with the California Community Colleges San Diego Imperial Counties Regional Consortium[6] and the Advanced Manufacturing Deputy Sector Navigator (DSN)[7].

Collection and analysis of quantitative and qualitative data were conducted for this report. In addition, labor market data and postsecondary completion numbers were analyzed. Of particular importance to this study were primary and secondary data related to industry workforce demands, occupational employment and community colleges. The North American Industry Classification System (NAICS) and the Standard Occupational Classification (SOC) System were used to identify specific occupations and industries related to advanced manufacturing. These two data sources assisted in deriving a more complete understanding of occupational trends in Imperial County.

To understand forces shaping educational attainment and training, the study analyzed data from the California Community Colleges Chancellor's Office Data Mart System and the Integrated Postsecondary Education Data System (IPEDS). College programs were identified using Taxonomy of Programs (TOP) codes and the Classification of Instructional Programs (CIP) system. For more information on the data sources employed by this study, please refer to Appendix A.

Two separate primary data collection efforts targeting advanced manufacturing firms in Imperial County were utilized. The first was a phone and email survey which asked questions about primary industries, manufacturing processes, total number of employees and hiring trends. The sample size for this survey was 24 businesses that manufacture or produce products or goods in the county. Then, several businesses in the county were asked to participate in the in-depth interviews responding to various questions about the technology required for their manufacturing processes as well as their training and employment needs. These interviews resulted in the business profiles presented in this report.

> **Business profile:**
> ### EW Corporation
>
> **Industry focus:** precious metals, fabricating metal products, transportation equipment
>
> **Important skills needed for new employees:**
> - Computer Numerical Controls machining
> - Ability to read blue prints and technical drawings
> - Math skills
> - Willingness to learn new skills and acquire new training
>
> **Workforce challenge:**
> "So far, we have not been able to find employees with the skills necessary in neighboring counties."

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[4] Additional information can be found at www.business.ca.gov/Programs/CaliforniaCompetesTaxCredit.aspx

[5] www.ivedc.com

[6] http://myworkforceconnection.org/

[7] http://doingwhatmatters.cccco.edu/Contact.aspx

Industry Overview

The study conducted by the COE and IVEDC addressed a number of areas to form a complete picture of the advanced manufacturing industry in Imperial County. Businesses were surveyed about the primary types of industries they serve as well as the manufacturing processes they most commonly use. Businesses were also asked about how many people they employ to gauge their size.

Industry types

Table 1 shows the primary industries identified by the businesses that participated in the survey. Respondents were also given the option of selecting a secondary industry with which to identify. Businesses were, for the most part, evenly distributed across all industry types, from aerospace to wood products and edible goods.

Three businesses selected metal products (except machinery & transportation equipment) as their primary industry. Two businesses identified biotechnology as their primary industry. The category of printing, publishing and allied industries was also selected twice by surveyed businesses as a primary industry. Two businesses selected food/edible goods as their secondary industry. Signs & advertising specialties were picked by two businesses as their secondary industry. Responses for the "Other" industry category agriculture compress machinery, metals distributor/processor and renewable fuels/nutritional supplements.

Table 1 – Primary and secondary industries identified by survey respondents

Industry	# of Businesses	
	Primary	Secondary
Aircraft/Aerospace	1	0
Apparel, Finished products from Fabrics & Similar materials	1	0
Biotechnology	2	0
Clean Technology	0	1
Chemicals and allied products	0	1
Electronic, electronic equipment and components, except computer equipment	1	0
Fabricate metal products, except machinery & transport equipment	3	1
Food/Edible goods	1	2
Information and communications technology	0	1
Jewelry	0	0
Leather and leather products	0	0
Lumber and wood products, except furniture	1	0
Measure/Analyze/Control Instruments, Photo/Medical/Ophthalmic goods, Watches/clocks	1	0
Printing, publishing and allied industries	2	1
Signs and advertising specialties	2	2
Transportation equipment	0	1
Other (Specify)	1	2
Total	**16**	**12**

Manufacturing processes

In addition to identifying industry types, the study sought to gauge what types of manufacturing processes are used by advanced manufacturers in Imperial County. Businesses participating in the phone survey were asked a number of questions to determine how prevalent areas such as computer technologies, cutting-edge materials and lean production processes are in their operations.

The most common manufacturing process used by these companies was computer technologies, with 58% of companies reporting that they use this process. Other frequently used processes include information

technologies, lean production processes, robotics and automation, and high-precision technologies. The least commonly used process was nanotechnology, with no business utilizing this process (Figure 1).

Figure 1 – Manufacturing processes utilized by companies (*multiple responses allowed*)

Process	Percentage
Computer Technologies (CAD/CAM)	58%
Information Technologies	29%
Lean Production Processes	21%
Robotics, Automation, Sustainable Technologies	21%
High-Precision Technologies	21%
Cutting Edge Materials	14%
Nanotechnology	0%
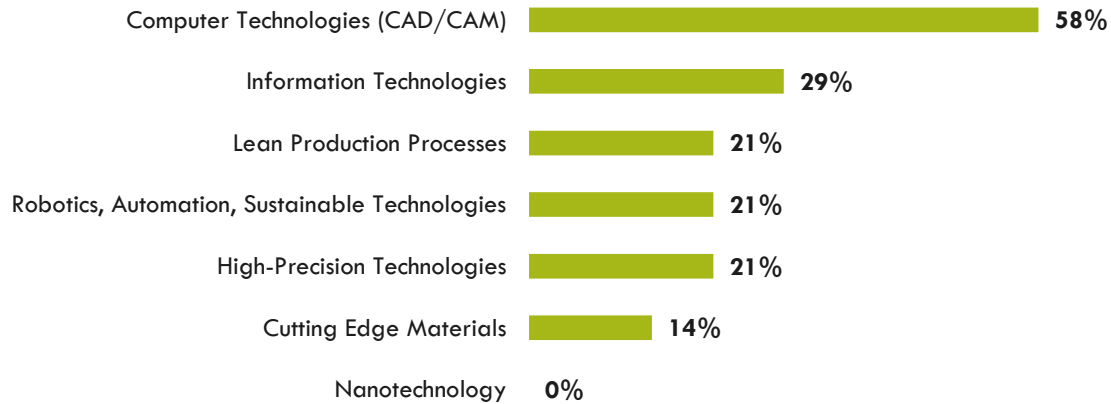
Business size

Those who participated in the survey were overwhelmingly small businesses. More than 70% of respondents identified themselves as having 50 or fewer employees. About one third of businesses employ 1-10 workers. Another third of businesses reported employing 11-25 workers. Only two respondents indicated they had over 100 employees (Figure 2).

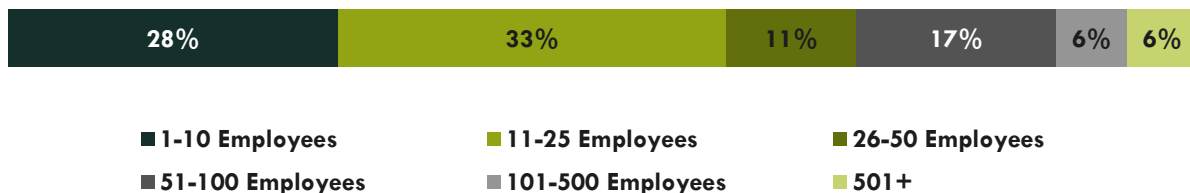**Figure 2 – Number of employees employed by businesses that participated in the survey (N=18)**

28%	33%	11%	17%	6%	6%

■ 1-10 Employees   ■ 11-25 Employees   ■ 26-50 Employees
■ 51-100 Employees   ■ 101-500 Employees   ■ 501+

Employer Response

Three businesses participated in more detailed interviews to shed light on how the advanced manufacturing in Imperial County is growing and changing. United States Gypsum Corporation, which has 210 full-time employees, shared information about its production processes and indicated it has incorporated a number of high-tech, advanced systems. These include robotics, laser equipment for material handling and product measurement and infrared technology for product verification and quality control. The company also uses unmanned autonomous material handling vehicles and forklifts and smart cameras. More workers trained in the maintenance of these technologies will be needed in the future, as will operators and computer programmers.

Enalasys Corporation, which manufactures diagnostic equipment and software for utilities and contractors to maximize energy efficiency, also participated in the interviews. The company uses a variety of advanced manufacturing technologies, such as milling equipment, injection mold processing equipment and 3D CAD Design software. Another manufacturer, EW Corporation, an industrial fabricator, reported using state of the art computer numerical control machining, which involves computers controlling machine tools, such as lathes, grinders and routers. The company also uses 3D solid modeling software.

Occupational Overview

Businesses in Imperial County were surveyed about their employment of four specific occupation groups: production occupations, drafters & technicians, computer/software occupations and engineers.

Businesses were also asked to identify the specific occupations within each group that they employ. Figure 3 illustrates the percentages by which each occupation group is employed. Respondents could select multiple occupation groups.

The first occupation cluster, production occupations, had the most employers, with 58% (14) of businesses stating they employed these occupations (Figure 3). Occupations in this group included team assemblers, agricultural and food service technicians and machinists. About a third of employers surveyed reported employing drafters and technicians. Similarly, about a third also said they employ computer/software occupations. One in four businesses reported employing engineers.

> **Business profile:**
> <u>USG Corporation</u>
>
> **Industry focus:** gypsum construction materials
>
> **Important skills needed for new employees:**
> - Process control training
> - Basic computer skills, including Microsoft
> - Electrical engineering and industrial production experience
> - Strong leadership and management skills
>
> **Workforce challenge:**
> "Many workers will be retiring soon, so there will be a need to hire a newer, younger workforce."

Figure 3 – Percentage of Businesses Reporting Employing Occupation Groups (N=24)

Occupation Group	Percentage
Production Occupations	58%
Drafters and Technicians	29%
Computer/Software Occupations	29%
Engineers	25%
None of the above	8%
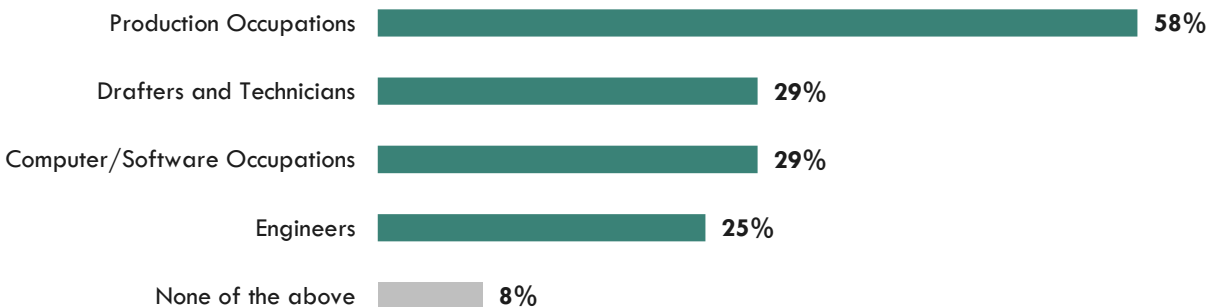
Research was conducted to determine the median and entry-level wages for workers in production occupations.[8] The codes from the Standard Occupational Classification (SOC) System were used to identify occupations are included in Appendix B.

Of the four clusters, production occupations, which have the lowest educational requirements of all four occupational subsectors, also have the lowest average entry-level wage ($11.17/hour) and lowest average median wage ($15.62/hour) (Figure 4). Wages for drafters and technicians and computer/software occupations are substantially higher than those for production occupations, likely because educational requirements for these occupations are more rigorous. Median wages for these two groups are nearly $30/hour. The highest paid occupations of the four clusters are those pertaining to engineers, with an entry-level wage of $30.21/hour and a median wage of $41.39. The entry-level wage for engineering occupations is more than twice that of production occupations.

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[8] Source: EMSI

Figure 4 – Entry-level and median wages for the four occupation clusters
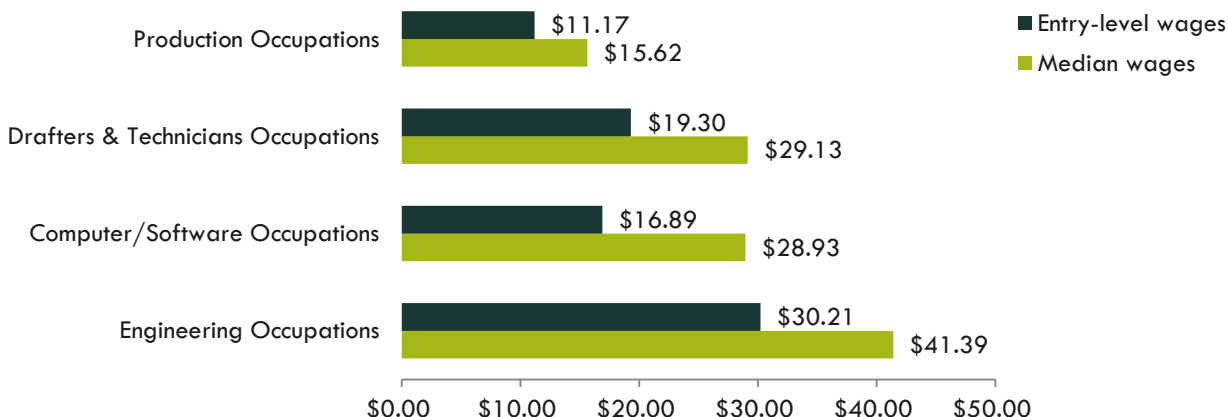
As part of the study, EMSI data were analyzed to determine current employment numbers and future employment projections for each of the occupations comprising the four primary job clusters.9 It should be noted that the employment projections resulting from the analysis of historical data varied from the projections gathered through the employer survey. Employer projections tended to be more optimistic and may be more accurate.

Employment estimates based on historical data show that production occupations employ the most workers out of the four occupation clusters. However, unlike the other three clusters which are all projected to add employees, production occupations are projected to shrink by 21%, from 628 to 497 workers by 2017. Growth among the other three groups will be modest. Drafters and technicians occupations are projected to add only one position, while computer/software occupations will add 10 jobs and engineering occupations will add four jobs by 2017.

Table 2 – Current and projected employment for the four occupation clusters

	2014 Employment	2017 Employment	Total Change	% Growth
Production Occupations	628	497	-131	-21%
Drafters & Technicians Occupations	98	99	1	1%
Computer/Software Occupations	221	231	10	5%
Engineering Occupations	114	118	4	4%

To determine whether the labor statistics analyzed for this study were accurate, employers also were asked to estimate their employment numbers looking ahead to the next year. They were asked to disclose their current number of employees, replacement employees, additional employees and any laid off employees.

Based on responses from employers, almost all of the occupational clusters can expect to grow within the next year. No business surveyed reported that it would lay off employees between 2015 and 2016. This finding contradicts the analysis of historical labor data which project that the production cluster would shed jobs. (A more extensive table with data for each specific job title within all four occupational clusters is included Appendix D.) According to surveyed businesses, the occupation sector with the most employees is

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9 EMSI Q2 2015 Data Set, economicmodeling.com.

production with 233 current employees among the 24 respondents. This occupational group can expect to see a growth of 37 occupations for an estimated future employment count of 270

Employers predict that drafters and technicians occupations will add 15 new positions, increasing from 54 to 69 total positions. Computer/software occupations are expected to add a similar number of new jobs, 14 total, growing from 38 to 52 total positions. While employment for engineering occupations is somewhat constrained, jobs in this cluster are projected increase by more than a third, from 32 to 44 positions, an addition of 12 new workers.

Figure 5 – Total current employees and new positions for the four occupation clusters based on employers surveyed
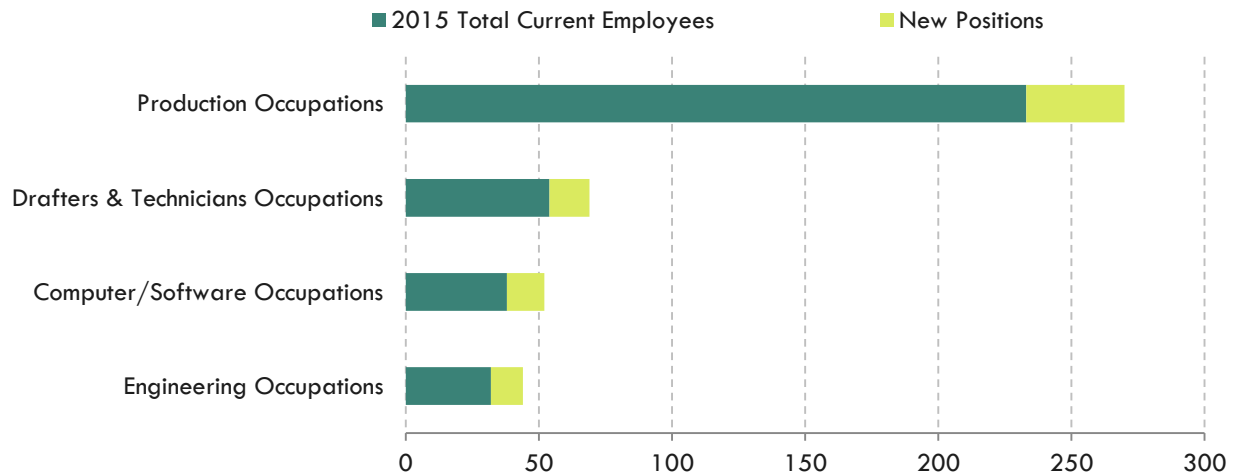
An analysis of the results of the employer survey revealed that education requirements vary among each cluster. Interestingly, prior work experience was not required for any of the jobs in the occupational clusters.

Of the four clusters, the lowest level of education is required for jobs within the production occupations sector. Almost all drafters and technicians occupations, except surveying and mapping technicians, require at least an associate degree. Educational requirements for computer/software occupations are somewhat varied. Software developer occupations require the greatest amount of education within the cluster, at least a bachelor's degree. Similarly, all engineering occupations require a bachelor's degree.

The following sections of the report include an in-depth analysis of each occupational sector: production, drafters and technicians, computer/software and engineers. Each section includes an analysis of hourly wages, current employment, skills areas where there is difficulty hiring and education requirements. Two types of employment projections have been analyzed for each occupational sector.

The Center of Excellence calculated employment projections based on historical data. In addition, data were collected from employers regarding employment projections for their specific businesses. Finally, the intention in organizing the report by the four major occupational subgroups is to take a broad view of each segment while incorporating a high-level comparison of multiple aspects that characterize each occupation.

Production Occupations

Occupations with the highest entry-level wage include machinists, agricultural and food science technicians, and welders, cutters, solderers and brazers. These jobs also garner the highest median wages. Lowest paid entry-level positions include helpers – production workers ($9/hour) and extruding, forming, pressing and compacting machine setters, operators and tenders ($9/hour) (Table 3).

Table 3 – Hourly wages for specific job titles within the production occupations sector

Production Occupations	Entry-level wages	Median wages
Helpers – Production Workers	$9.00	$11.15
Inspectors, Testers, Sorters, Samplers & Weighers	$10.45	$14.12
Extruding, Forming, Pressing, and Compacting Machine Setters, Operators & Tenders	$9.00	$9.80
Welders, Cutters, Solderers & Brazers	$16.19	$19.09
Machinists	$12.22	$19.36
Team Assemblers	$10.12	$13.67
Maintenance Workers, Machinery	$11.33	$18.22
Cutting and Slicing Machine Setters, Operators & Tenders	$10.61	$15.27
Agricultural and Food Science Technicians	$11.62	$19.92
Average Wages	$11.17	$15.62

Within the production cluster, there are nine specific occupations, for which current and future employment were estimated. By 2017, overall employment within the production occupational cluster is expected to shed 131 jobs, shrinking by 21%. Only one occupation in the cluster is projected to add jobs, that of team assemblers, which will increase by five positions, or 9% (Table 4).

Table 4 – Current and future employment for occupations in the production cluster

Production Occupations	2014 Employment	2017 Employment	Total Change	% Growth	# of Openings
Helpers – Production Workers	175	106	(69)	(39%)	
Inspectors, Testers, Sorters, Samplers and Weighers	82	69	(13)	(16%)	
Extruding, Forming, Pressing and Compacting Machine Setters, Operators and Tenders	82	52	(30)	(37%)	<10
Welders, Cutters, Solderers and Brazers	76	74	(2)	(3%)	<10
Machinists	66	65	(1)	(2%)	<10
Team Assemblers	55	60	5	9%	<10
Maintenance Workers, Machinery	42	36	(6)	(14%)	<10
Cutting and Slicing Machine Setters, Operators and Tenders	36	23	(13)	(36%)	<10
Agricultural and Food Science Technicians	14	12	(2)	(14%)	<10
Total	628	497	-131	(21%)	

The occupation of helpers – production workers is expected to decline the most, by 39%, a loss of 69 positions. Similarly, extruding, forming, pressing and compacting machine setters, operators and tenders will be reduced by 37%, forfeiting 30 positions. And the occupation of cutting and slicing machine setters, operators and tenders is projected to decline by 36%, a loss of 13 positions.

Machinery maintenance workers and the occupation of inspectors, testers, sorters, samplers and weighers will also lose positions, but not in as significant numbers as the aforementioned occupations. The occupations of welders, cutters, solderers and brazers, machinists and agricultural and food science technicians will remain somewhat stable and are projected to lose only one or two positions by 2017.

Of the four clusters studied, the production occupational cluster has the greatest number of individuals currently employed within Imperial County. As of 2014, 628 jobs existed in this cluster. In comparison, the drafters and technicians occupations accounted for 100 workers, while 221 positions existed within the computer/software occupational clusters and 114 jobs within the engineering cluster.According to employers, occupations within this sector that will experience the greatest growth include welders, solderers & brazers as well as helpers – production workers and inspectors, testers, sorters, samplers & weighers (Table 5).

Table 5 – Current and future employment for production occupations as estimated by employers surveyed

Production Occupations	2015 Total Current Employees	Laid-off Employees	New Positions	2016 Total Future Employees
Team Assemblers	7	0	0	7
Agriculture & Food Service Technicians	25	0	1	26
Machine Setters, Operators & Tenders	6	0	0	6
Machinists	26	0	2	28
Welders, Solderers & Brazers	42	0	13	55
Inspectors, Testers, Sorters, Samplers & Weighers	10	0	6	16
Machinery, Maintenance & Repair Workers	19	0	1	20
Helpers – Production Workers	84	0	11	95
Other	14	0	3	17
Total	233	0	37	270

Businesses were surveyed to gauge the difficulty they are experiencing in hiring skilled workers in all four occupational clusters. Overall, employers reported having the most difficulty hiring machinery maintenance and repair workers with the following skills: hand/power tools, HVAC, inspection, plumbing and repair. A full list of the survey results for difficulty hiring by job titles and skill sets is included in Appendix C.

The most commonly employed occupations were helpers (production workers) and machinery maintenance & repair workers. Other occupations that were mentioned by some employers included installers and pressmen. Table 6 lists specific job titles associated with production occupations, the number of businesses that employ workers with these job titles and the number of businesses experiencing difficulty hiring for those positions.

Table 6 – Difficulty hiring for production occupations (N=24)

Production Occupations	# of Employers	# of Employers Facing Some or Great Difficulty hiring
Team Assemblers	3	1
Agricultural & Food Service Technicians	3	3
Machine Setters, Operators & Tenders	3	1
Machinists	3	2
Welders, Solderers & Brazers	6	3
Inspectors, Testers, Sorters, Samplers & Weighers	2	2
Helpers – Production Workers	9	3
Machinery Maintenance & Repair Workers	8	6
Other	2	0

The majority of production jobs require a high school diploma or less (Table 7). Only one occupation – agricultural and food science technicians – requires more than a high school diploma, in this case an associate degree.

Table 7 – Education requirements for production occupations

Production Occupations	Typical Entry Level Education
Helpers – Production Workers	Less than high school
Inspectors, Testers, Sorters, Samplers and Weighers	High school diploma or equivalent
Extruding, Forming, Pressing and Compacting Machine Setters, Operators and Tenders	High school diploma or equivalent
Welders, Cutters, Solderers and Brazers	High school diploma or equivalent
Machinists	High school diploma or equivalent
Team Assemblers	High school diploma or equivalent
Maintenance Workers, Machinery	High school diploma or equivalent
Cutting and Slicing Machine Setters, Operators and Tenders	High school diploma or equivalent
Agricultural and Food Science Technicians	Associate Degree

Drafters/Technicians Occupations

Wages for drafters and technicians occupations are significantly higher than those for production workers. Entry-level electrical and electronics engineering technicians earn $24.11/hour. The median wage for that occupation is $29.57/hour. Another high-paying, entry-level wage is associated with engineering technicians (except drafters) who earn $20.11/hour. Surveying and mapping technicians earn the lowest wages in the drafters and technicians cluster. The entry-level wage is $16.41/hour, and the median wage is $23.88/hour (Table 8).

Table 8 – Hourly wages for specific job titles within the drafters and technicians occupations sector

Drafters & Technicians Occupations	Entry-level wages	Median wages
Electrical & Electronics Engineering Technicians	$24.11	$29.57
Civil Engineering Technicians	$16.57	$31.56
Engineering Technicians, Except Drafters, All Others	$20.11	$31.53
Surveying & Mapping Technicians	$16.41	$23.88
Average Wages	$19.30	$29.13

Analysis of historical data revealed that employment for the cluster of occupations encompassing drafters and technicians is projected to remain stable over the next two years. Employers are projected to continue employing electrical and electronics engineering technicians, civil engineering technicians, surveying and mapping technicians and all other engineering technicians at about the same rate as in 2014, with virtually no change over the next five years (Table 9).

Table 9 – Current and future employment for occupations in the drafters and technicians cluster

Drafters and Technicians Occupations	2014 Employment	2017 Employment	Total Change	% Growth	# of Openings
Electrical and Electronics Engineering Technicians	42	43	1	2%	<10
Civil Engineering Technicians	31	30	(1)	(3%)	<10
Engineering Technicians, Except Drafters, All Other	14	14	0	0%	<10
Surveying and Mapping Technicians	11	12	1	9%	<10
Total	98	99	1	1%	

According to employers surveyed, there are 54 existing positions within the drafters and technicians occupational sector, which is expected to add 15 positions by 2016 (Table 10). Drafters dominate this sector, and there is also a high number of engineering technicians. According to the businesses surveyed, the greatest number of positions (a total of five) will be added to the chemical technicians occupation and the engineering technicians occupation by 2016. Employers surveyed said they would be hiring two replacement employees for each of the following occupations: engineering technicians and chemical technicians (Appendix D).

Table 10 – Current and future employment for drafters and technicians occupations as estimated by employers surveyed

Drafters & Technicians Occupations	2015 Total Current Employees	Laid-off Employees	New Positions	2016 Total Future Employees
Drafters (Mechanical, Electrical, Civil)	24	0	2	26
Engineering Technicians (Mechanical, Electrical, Civil)	16	0	8	24
Chemical Technicians	7	0	5	12
Surveying & Mapping Technicians	5	0	0	5
Other	2	0	0	2
Total	54	0	15	69

Difficulty hiring also was addressed for drafters and technicians (Table 11). Overall, few businesses employ these occupations; however, the most commonly employed occupation was engineering technician (mechanical, electrical, industrial & civil) with four employers. Surveying and mapping technicians was the least common occupation with only one employer. Businesses reported difficulty hiring both drafters and engineering technicians.

Table 11 – Difficulty hiring for drafters & technicians occupations

Drafters & Technicians Occupations	# of Employers	# of Employers Facing Some or Great Difficulty hiring
Drafters (Mechanical, Electrical, Civil)	4	2
Engineering Technicians (Mechanical, Electrical, Industrial, Civil)	4	3
Chemical Technicians	2	1
Surveying & Mapping Technicians	1	0

The higher wages for the drafters and technicians cluster is likely linked to greater educational requirements compared to numbers pertaining to production workers. Three of the four job titles related to drafters and technicians require at least an associate degree: electrical and electronics technicians, civil engineering technicians and engineering technicians, except drafters (Table 12). Employers typically require a high school diploma or equivalent for the occupation of surveying and mapping technicians.

Table 12 – Education requirements for drafters & technicians occupations

Drafters & Technicians Occupations	Typical Entry Level Education
Electrical and Electronics Engineering Technicians	Associate Degree
Civil Engineering Technicians	Associate Degree
Engineering Technicians, Except Drafters, All Other	Associate Degree
Surveying and Mapping Technicians	High school diploma or equivalent

Computer/Software Occupations

Hourly wages for occupations within the computer/software cluster are nearly as high as those for drafters and technicians occupations. The highest median wages center on software developers, for both applications ($35.82/hour) and systems software ($37.79/hour). Entry-level wages for computer user support specialists are about half that of software developers, likely because lower educational attainment and skills levels are required. The entry-level wage for computer user support specialists is $9.08 (Table 13).

Table 13 – Hourly wages for specific job titles within the computer/software occupations sector

Computer/Software Occupations	Entry-level wages	Median wages
Computer User Support Specialists	$9.08	$17.59
Computer Network Support Specialists	$16.62	$24.51
Software Developers, Applications	$19.88	$35.82
Software Developers, Systems Software	$21.99	$37.79
Average Wages	$16.89	$28.93

Occupations in the computer/software cluster are projected to grow by 5% overall by 2017 (Table 14). This represents the greatest rate of growth of the four occupational clusters. Aside from production, this cluster has the highest number of workers. The occupations of computer user support specialists will increase by 6%, adding seven jobs. The occupation of applications software developers will increase by two positions while computer network support specialists will add one position. Overall, 10 positions will be added to this occupational cluster by 2017.

Table 14 – Current and future employment for occupations in the computer/software cluster

Computer/Software Occupations	2014 Employment	2017 Employment	Total Change	% Growth	# of Openings
Computer User Support Specialists	115	122	7	6%	
Computer Network Support Specialists	54	55	1	2%	<10
Software Developers, Applications	31	33	2	6%	<10
Software Developers, Systems Software	21	21	0	0%	<10
Total	221	231	10	5%	

The computer/software occupation will expand from 38 total positions to 52 positions by 2016, according to those surveyed (Table 15). Each occupation in the sector will experience some growth. The occupation of computer network support specialists will add five positions while computer user support specialists will add three positions.

Table 15 – Current and future employment for computer/software occupations as estimated by employers surveyed

Computer/Software Occupations	2015 Total Current Employees	Laid-off Employees	New Positions	2016 Total Future Employees
Software Engineer/Programmer Analyst/Developer (Applications and Systems)	11	0	2	13
Computer User Support Specialists - Technical Support/IT Specialists	10	0	3	13
Computer Network Support Specialists/LAN Specialists	9	0	5	14
Other	8	0	4	12
Total	38	0	14	52

Employer responses varied as to difficulty hiring related to computer & software occupations (Table 16). This group includes software engineers and computer support specialists. Within the "Other" category, employers listed graphic designers and programmable logic controllers. Employers had the most difficulty hiring computer user support specialists and computer network specialists.

Table 16 – Difficulty hiring for computer & software occupations

Computer/Software Occupations	# of Employers	# of Employers Facing Some or Great Difficulty hiring
Software Engineer/Programmer Analyst/Developer (Applications and Systems)	4	1
Computer user support specialists/Technical Support/IT Specialists	3	2
Computer Network Support Specialists/LAN Specialists	4	3
Other	3	2

All jobs that fall within the computer/software occupational cluster involve attaining at least some college-level education (Table 17). Again, the level of wages paid to workers appears to be commensurate with education. Employers require at least a bachelor's degree for software developers, whether they work on applications or systems software. An associate degree is required for computer support network specialists, and some college, but no degree, is the minimum required for computer user support specialists.

Table 17 – Education requirements for computer/software occupations

Computer/Software Occupations	Typical Entry Level Education
Computer User Support Specialists	Some college, no degree
Computer Network Support Specialists	Associate Degree
Software Developers, Applications	Bachelor's Degree
Software Developers, Systems Software	Bachelor's Degree
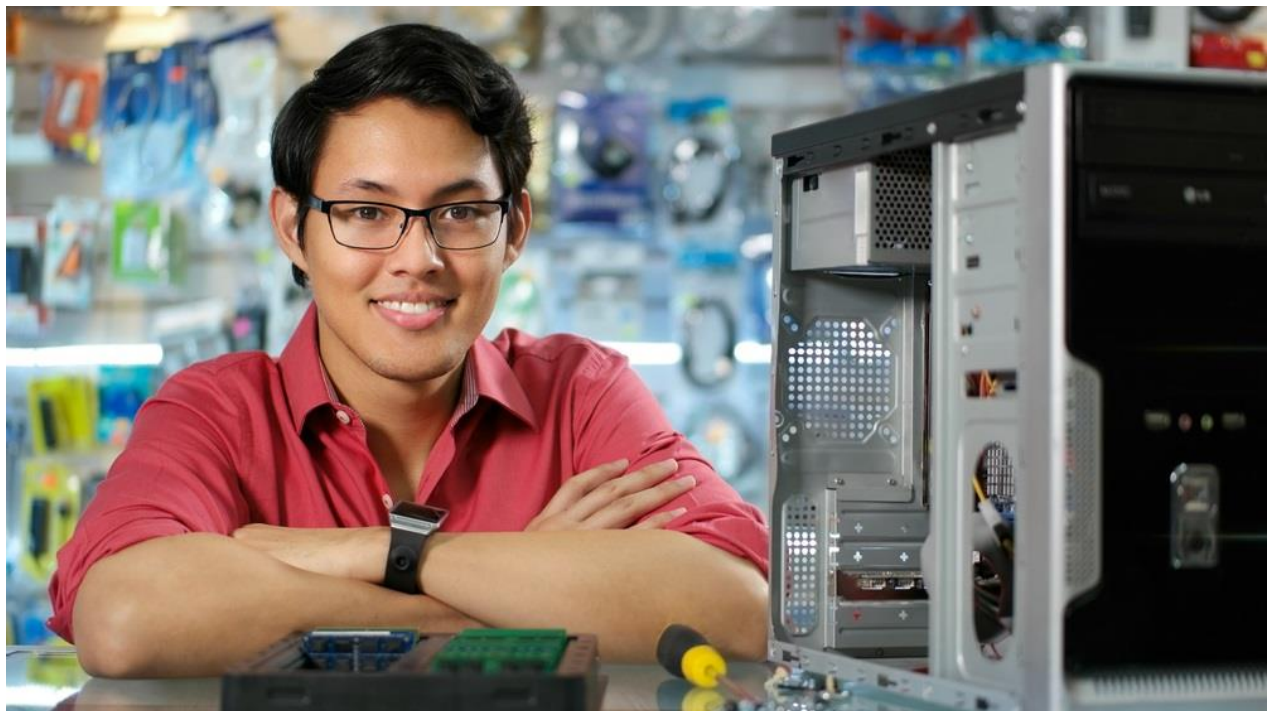
Engineers

Of the four occupational clusters, the hourly wages for engineering jobs are by far the highest. For civil engineers, the entry-level wage is $26.94/hour, with a median wage of $39.33/hour. Similarly, the entry-level wage for electrical engineers is $33.62/hour. Once they have gained experience, the median wage for electrical engineers climbs to $43.52/hour (Table 18). These wages are well above those paid in the other three occupational clusters.

Table 18 – Hourly wages for specific job titles within the engineering occupations sector

Engineering Occupations	Entry-level wages	Median wages
Civil Engineers	$26.94	$39.33
Electrical Engineers	$33.62	$43.52
Average Wage	$30.21	$41.39

The overall number of jobs within this cluster is small compared to production and computer/software. The number of workers, however, is similar to that of the drafters and technicians subgroup. By 2014, the engineering cluster is projected to add four positions overall, an increase of 4%, from 114 to 118 jobs (Table 19). Jobs for civil engineers with decrease by one position, while jobs for electrical engineers will grow by five positions (9% increase).

Table 19 – Current and future employment for occupations in the engineering cluster

Engineering Occupations	2014 Employment	2017 Employment	Total Change	% Growth	# of Openings
Civil Engineers	58	57	(1)	(2%)	<10
Electrical Engineers	56	61	5	9%	<10
Total	114	118	4	4%	

Employers reported only employing 32 engineers, the smallest subgroup of occupational sectors studied for this report (Table 20). Overall, the occupational cluster accounts for 32 engineers and will grow to 44 positions by 2016. The most significant growth will occur for electrical engineers, an occupation that will add seven new workers, totaling 20 positions by 2016.

Table 20 – Current and future employment for engineering occupations as estimated by employers surveyed

Engineering Occupations	2015 Total Current Employees	Laid-off Employees	New Positions	2016 Total Future Employees
Agricultural Engineers	1	0	0	1
Biomedical Engineers	0	0	0	0
Electrical Engineers	13	0	7	20
Industrial Safety & Health Engineers	0	0	1	1
Chemical Engineers	2	0	2	4
Environmental Engineers	0	0	0	0
Industrial Engineers	5	0	1	6
Civil Engineers	3	0	0	3
Mining & Geological Engineers	2	0	0	0
Other	6	0	1	7
Total	32	0	12	44

The final group of occupations in the survey addressed difficulty hiring engineers (Table 21). Occupations in this group included agricultural, electrical and chemical engineers among others. In addition to the occupations identified in Table 21, one employer reported employing mechanical engineers. Three businesses reported difficulty hiring industrial engineers. Other job titles associated with difficulty hiring included electrical, chemical and civil engineers.

Table 21 – Difficulty hiring for engineering occupations

Engineering Occupations	# of Employers	# of Employers Facing Some or Great Difficulty hiring
Agricultural Engineers	1	1
Biomedical Medical Engineers	0	--
Electrical Engineers	3	2
Industrial Safety & Health Managers	1	1
Chemical Engineers	2	2
Environmental Engineers	1	1
Industrial Engineers	3	3
Civil Engineers	2	2
Mining & Geological Engineers	1	1

Employers were surveyed about educational requirements for two occupations within the engineering sector – civil engineers and electrical engineers. For both occupations, the minimum educational requirement is a bachelor's degree (Table 22). This finding is characteristic of employer preferences for engineering occupations in Southern California, and likely accounts for the higher wages paid to engineers compared to other occupational clusters.

Table 22 – Education requirements for engineering occupations

Engineering Occupations	Typical Entry Level Education
Civil Engineers	Bachelor's Degree
Electrical Engineers	Bachelor's Degree
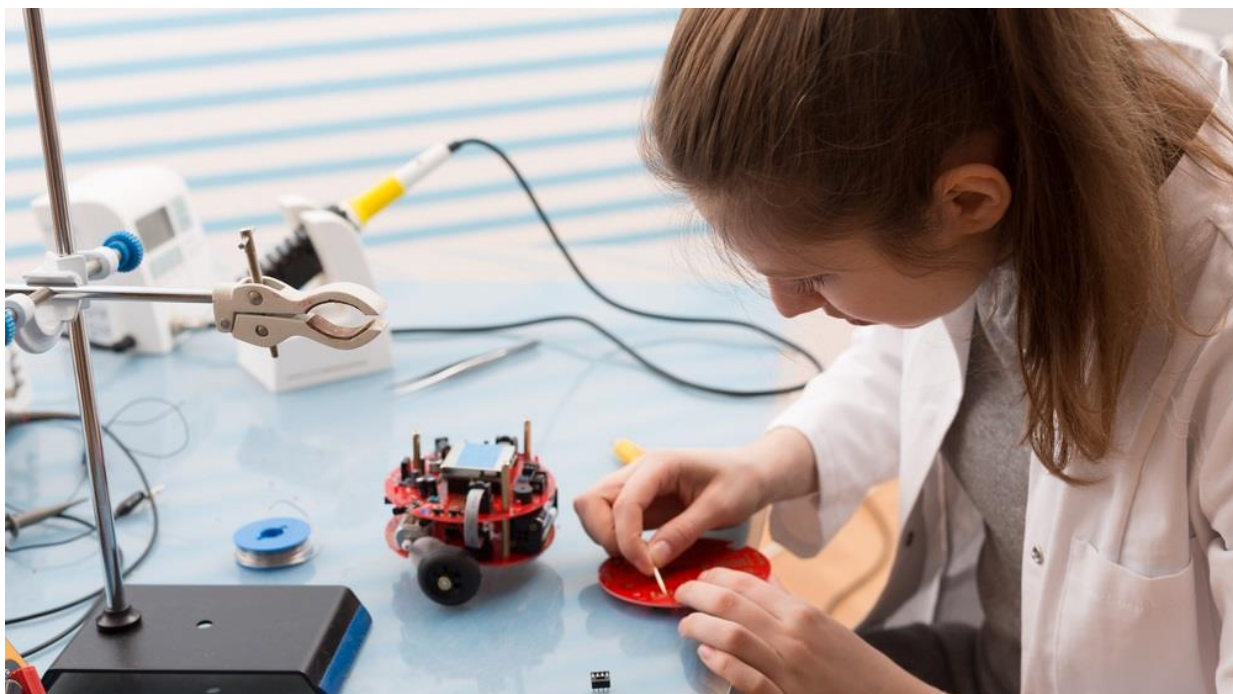
Regional Education and Training

While additional educational opportunities abound in nearby Riverside and San Diego counties, students interested in pursuing coursework or training related to advanced manufacturing have several options within Imperial County. This includes certificate and degrees offered by Imperial Valley College, as well as opportunities through Imperial Valley Regional Occupational Program and programs offered by San Diego State University at its campuses located within Imperial County.

Community college programs

Imperial Valley College offers 14 degree and certificate programs related to the job clusters identified by this study. Some of the academic programs have overlap and can lead to jobs in more than one category (Table 23). For instance, a student who studies industrial electronics could opt to become an electronics engineering technician, a job which falls within the drafters/technicians sector, or that student could pursue an engineering occupation. Similarly, a student who pursues construction crafts technology could choose to work within the production sector or could enter the drafters/technicians sector.

Table 23 – Degree and certificate programs offered by Imperial Valley College related to the four advanced manufacturing occupational clusters

Occupational Cluster	Related programs
Production Occupations	▪ Agriculture Business, Sales and Service ▪ Agriculture Technology and Sciences, General ▪ Construction Crafts Technology ▪ Welding Technology ▪ Environmental Control Technology
Drafters & Technicians Occupations	▪ Construction Crafts Technology ▪ Engineering, General ▪ Electronics and Electric Technology ▪ Industrial Electronics
Computer/Software Occupations	▪ Computer Information Systems ▪ Computer Science
Engineering Occupations	▪ Electronics and Electric Technology ▪ Engineering, General ▪ Industrial Electronics

Table 24 shows two academic programs that apply specifically to production occupations. Although, Imperial Valley College is a moderately large community college with 7,000 students, only one to two students graduate each academic year with an associate degree from an agricultural program (Table 24).

Table 24 – Agricultural associate degree completion for the past three academic years.

Program Name	Degree Type	2011-2012	2012-2013	2013-2014
Agriculture Business, Sales and Service (01-1200)	A.S.	0	1	1
Agriculture Technology and Sciences, General (01-0100)	A.S.	1	2	1

Programs that apply to multiple sectors (drafters/technicians, engineering and production occupations) were grouped in Table 25. One of the college's academic areas delivering the most completions is Construction Crafts Technology, which conferred 38 certificates in the past three years.

Another area yielding a high number of completions is Electronics and Electric Technology, which issued 25 certificates and five degrees in the last three years. Very few students are graduating with associate degrees in engineering, despite indications from employers that they would like to hire workers with these competencies.

Outreach and recruitment activities could encourage more students to enroll in the engineering program. Likewise, very few graduates have earned certificates in Industrial Electronics, despite the fact that employers expressed that they are looking for workers with these skills. Student education and recruitment, or targeting workers interested in retraining, could positively impact the number of completions.

Welding Technology has graduated a moderate number of students from related certificate and degree programs. Employers have expressed a need for workers with these skills and could look into hiring directly from these programs.

Table 25 – Associate degree and certificate completion in programs related to engineering for the past three academic years

Program Name	Degree Type	2011-2012	2012-2013	2013-2014
Construction Crafts Technology (09-5200)	A.S.	0	0	3
Construction Crafts Technology (09-5200)	Certificate	19	16	3
Electronics and Electric Technology (09-3400)	A.S.	0	3	2
Electronics and Electric Technology (09-3400)	Certificate	3	18	7
Engineering, General (09-0100)	A.S.	1	1	1
Environmental Control Technology (09-4600)	Certificate	4	8	9
Industrial Electronics (09-3420)	Certificate	0	3	1
Welding Technology (09-5650)	A.S.	0	3	0
Welding Technology-095650	Certificate	7	6	2

A third group of academic programs apply to the computer/software occupational cluster identified by the study. Over the past three academic years, Information Technology (IT) programs at Imperial Valley College have conferred 46 degrees and certificates (Table 26). Computer Information Systems issued 30 degrees in the past three years, the highest number among the three IT programs offered by the college.

Table 26 – Associate degree and certificate completion in Information Technology programs for the past three academic years

Program Name	Degree Type	2011-2012	2012-2013	2013-2014
Computer Information Systems (07-0200)	A.S.	14	7	9
Computer Information Systems (07-0200)	Certificate	5	1	2
Computer Science (07-0600)	A.S.	1	5	2

Other Training and Educational Programs

Due to Imperial County's rural characteristics and relatively small population (170,000), there is only a small number of public or private educational options in the region. Besides Imperial Valley College, only two other entities provide educational and/or training programs.

Imperial Valley Regional Occupational Program – Eight high schools in Imperial County have partnered with Imperial Valley ROP to offer training programs. Quite a few programs complement the skills advanced manufacturers say they are hiring for. Related programs include:

- Construction and Building Technology
- General Contracting
- Welding
- Food Technology
- Computer Repair
- Agriculture Mechanics
- Agriculture Fabrication/Welding

San Diego State University – Since 1959, San Diego State University (SDSU) has operated a branch in the county called the Imperial Valley Campus, which has two locations, Calexico and Brawley. Unfortunately, a limited selection of four-year programs is offered to students, and none relate specifically to the skills advanced manufacturers are seeking.

The programs offered by San Diego State University include:

- Criminal Justice
- History
- Liberal Studies
- Psychology
- Public Administration
- Mathematics
- Spanish

Employer Response

To round out the picture of educational needs in the industry, employers were surveyed about what types of training programs they utilized. Only two employers indicated they use an external training or certification program. The external training programs used by these employers are:

- Title 24 Building Energy Efficiency Standards, Home Energy Rating System (HERS)

- Occupational Safety and Health Administration (OSHA) 30-hour emergency generator and fire system maintenance safety training.

However, half of employers surveyed offer an internal training program. A total of 12 employers reported using an internal training program within their company.

> *Business profile:*
> ## Enalasys Corporation
>
> *Industry focus:* *industrial and commercial machinery and computer equipment; measure/analyze/control instruments.*
>
> *Important skills needed for new employees:*
> - *Management and leadership skills*
> - *General computer skills, including Microsoft*
> - *Basic electronics skills*
> - *Mechanical engineering in the HVAC area*
>
> *Workforce challenge:*
> *"We are having difficulty find[ing] candidates with the basic electrical experience and/or training along with computer aptitude."*

United State Gypsum Corporation reported that it primarily uses on-the-job training to train incumbent workers, but pointed out that it would be more efficient and profitable, if workers were already trained in areas such as lean manufacturing, industrial safety and Six Sigma, a process to maximize business productivity.

Asked about its educational preferences, EW Corporation responded that a positive attitude and willingness to learn are just as important as possessing relevant skills. The company has had mixed results hiring through Imperial County One Stop Business & Employment and the Center for Employment Training, and has hired some workers who graduated from Imperial Valley College.

Additional desirable skills highlighted by Enalasys Corporation include customer service, communication skills, computer skills and a strong work ethic.

While the company provides training for incumbent workers through third parties, there is a need for workers with electrical experience and computer aptitude. The firm also reported it has not had success hiring through the county workforce offices.

Conclusion & Recommendations

Advanced manufacturing businesses in Imperial County provide goods for a diverse array of industries and engage in a number of activities from fabricating metal products to specializing in signs and advertising and producing edible goods. These businesses have been shaped by technological advances and anticipate that technology will continue to play an important role in their day-to-day operations. Technological manufacturing processes that are the most common among businesses surveyed include computer technologies, information technology and lean production processes. Many of Imperial County's advanced manufacturing businesses are small, with the majority employing one to 25 employees.

The study examined four occupational clusters: production, drafters and technicians, computer/software and engineers. The cluster with the highest number of workers is production. The jobs within the production occupational subgroup are lower paying than the other subgroups, and also require lower levels of education. The highest paid subgroup comprises engineers, with an average median wage of $41.39. Most jobs within this occupational cluster require a bachelor's degree. Employers anticipate growth in all four occupational clusters. By 2016, they project that the production cluster will add 37 new jobs; drafters and technicians will add 15; computer/software will add 14; and engineering will add 12.

The study revealed that businesses are experiencing difficulty hiring in a number of areas. The greatest number of employers reported they are having difficulty hiring helpers-production workers and machinery maintenance and repair workers (production occupational cluster). Another occupations for which employers are experiencing difficulty are drafters, engineering technicians, software engineers/programmer/developer and computer network support specialists/LAN specialists.

Regarding employee recruitment strategies, United State Gypsum Corporation noted it has had "great success" with word of mouth referrals through employees. "Many of our employees have worked here for decades because it is a great place to work so they refer candidates to us whenever we have opening," the firm reported. The company anticipates that as more technology and automation are incorporated into daily operations, a younger workforce trained in areas such as programming, information technology, networking and computerized program management will be needed.

One business provided an anecdote that reaffirms what the study discovered regarding difficulty hiring drafters and engineering technicians. The company reported that while it has a need for fabricators who can read blue prints and technical drawing, it has had trouble finding workers with the necessary skills and turned to recruiting in Mexicali to find qualified workers. The business said some of its new hires can't even read a tape measure.

To further understand how the region could better prepare its workforce for advanced manufacturing jobs, three businesses were asked to participate in a written survey. They all expressed interest in participating in internship programs and company tours. They further stated that community colleges need to focus on how advanced manufacturing jobs are evolving, particularly regarding technology and automation. Workers will be needed in the areas of programming, information technology, and networking and computerized process management. Based on employer responses, improved collaboration appears to be needed between the community college and businesses to conduct job placement in the advanced manufacturing industry. Community colleges and advanced manufacturing business could work together to strengthen job placement activities. In addition, more tours of advanced manufacturing facilities would help to excite students about the manufacturing being conducted locally and would help students to understand how their education can be applied in real-world environments.

Additional recommendations from businesses surveyed:

- Workers with "solid career technical training" are the kind of employees that advanced manufacturing companies are seeking. Community colleges are adept in the area of career technical training.
- Businesses would like to be informed when Imperial Valley College offers trainings for the local workforce.
- Invite business owners to give presentations to community college classes and coordinate with businesses to offer on-site tours of advanced manufacturing companies to demonstrate high-tech career opportunities within the community.
- Businesses would like to be informed about internship programs through Imperial Valley College since these programs can provide skilled workers.
- Students pursuing welding or fabrication should be provided more assistance in obtaining hands-on work experience.

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Appendix A. How to use this report.

This report is designed to provide current labor market information to:

- Understand the factors impacting business and finance occupations and their effect on the workforce in the Imperial County, and;
- Provide information on advanced manufacturing-related education and training programs related to business and finance in the region

The information in this report has been validated by industry professionals and community colleges and includes a listing of programs being offered by colleges to address workforce needs. In some instances, the labor market information and industry validation will suggest that colleges might not want to begin or add programs, thereby avoiding needless replication and low enrollments.

The Centers of Excellence (COE) deliver regional workforce research and technical expertise to community colleges for program decision making and resource development. This information has proven valuable to colleges in beginning, revising, or updating economic development and Career Technical Education (CTE) programs, strengthening grant applications, assisting in the accreditation process, and in supporting strategic planning efforts.

More information about the Centers of Excellence is available at www.coeccc.net.

Important Disclaimer

All representations included in this report have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings; however, neither the Centers of Excellence, COE host District, nor California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon components or recommendations contained in this study.

Explanation of Data Sources

Industry Data

In order to capture a complete picture of industry employment, EMSI basically combines covered employment data from Quarterly Census of Employment and Wages (QCEW) produced by the Department of Labor with total employment data in Regional Economic Information System (REIS) published by the Bureau of Economic Analysis (BEA), augmented with County Business Patterns (CBP) and Non-employer Statistics (NES) published by the U.S. Census Bureau. Projections are based on the latest available EMSI industry data, 15-year past local trends in each industry, growth rates in statewide and (where available) sub-state area industry projections published by individual state agencies, and (in part) growth rates in national projections from the Bureau of Labor Statistics.

Occupation Data

Organizing regional employment information by occupation provides a workforce-oriented view of the regional economy. EMSI's occupation data are based on EMSI's industry data and regional staffing patterns taken from the Occupational Employment Statistics program (U.S. Bureau of Labor Statistics). Wage information is partially derived from the American Community Survey.

Education Program Data

Community college education programs were extracted from the California Community Colleges Chancellor's Office Inventory of Approved Programs. This inventory lists credit degrees and certificates approved by the Chancellors office and offered by California community colleges. California Community Colleges approved programs are identified by the Taxonomy of Programs (TOP), a system of nomenclature for designating programs in the California Community Colleges system. The complete TOP

manual can be viewed on the Chancellor's office website at
http://www.cccco.edu/Portals/4/TopTax6_rev0909.pdf

Program and completion data for four-year education institutions and technical/proprietary institutions was compiled using the Integrated Postsecondary Education Data System (IPEDS). IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. The Higher Education Act of 1965, as amended, requires that institutions that participate in federal student aid programs report data on enrollments, program completions, graduation rates, faculty and staff, finances, institutional prices, and student financial aid.

Appendix B. SOC codes used to research job titles related to advanced manufacturing.

SOC	Job titles
	Production Occupations
51-9198	Helpers--Production Workers
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers
51-9041	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders
51-4121	Welders, Cutters, Solderers, and Brazers
51-4041	Machinists
51-2092	Team Assemblers
49-9043	Maintenance Workers, Machinery
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders
19-4011	Agricultural and Food Science Technicians
	Drafters & Technicians Occupations
17-3023	Electrical and Electronics Engineering Technicians
17-3022	Civil Engineering Technicians
17-3029	Engineering Technicians, Except Drafters, All Other
17-3031	Surveying and Mapping Technicians
	Computer & Software Occupations
15-1151	Computer User Support Specialists
15-1152	Computer Network Support Specialists
15-1132	Software Developers, Applications
15-1133	Software Developers, Systems Software
	Engineering Occupations
17-2051	Civil Engineers
17-2071	Electrical Engineers

Appendix C. List of Skills Employers Have Difficulty Finding

Occupation	Skill Set	# of Employers Experiencing Some or Great Difficulty
Computer and Software Occupations		
Software Engineers/ Programmer Analysts/ Developers (Applications and Systems)	C++	1
	Electrical Engineering	1
	JavaScript	1
	Linux	1
	Software Engineering	1
	SQL	1
Computer User Support Specialists/Technical Support/IT Specialists	Computer Hardware and Software	2
	Programming	2
	Telecommunications	1
	Customer Service	1
Computer Network Support Specialists/ LAN Specialists	Local Area Network (LAN)	3
	Computer Services	2
	Hard Disk Arrays	2
	Circuit Testing	1
	Network Security	3
	Transaction Security	3
Engineers		
Agricultural Engineers	Bioinformatices	1
	Validation	1
	Python	1
	Genetics	1
	Data Collection	1
	Mathematics	1
	Biomarker	1
Electrical Engineers	Circuit Design	1
	Electrical Engineering	1
	Physics	1
	Repair	1
	Simulation	0
	Validation	0
Industrial Safety & Health Managers	Environmental Compliance	1
	Environmental Health & Safety	1
	Failure Modes & Effects Analysis	1
	Hazardous Waste	1
	Occupational Safety	1
	Training Programs	1
Environmental Engineers	Environmental Engineering	1
	Geology	0
	Chemistry	0
	Water Quality	0
	Hydraulics	0
	Hydrology	0
Industrial Engineers	Inspection	2
	Six Sigma	3
	Manufacturing Processes	3
	Validation	2
	Lean Manufacturing	3
	Product Development	2

Civil Engineers	Civil Engineering	1
	AutoCAD	1
	Construction Management	2
	Scheduling	1
	Engineering Design	1
	Inspection	1
Mining & Geological Engineers	Geology	1
	Repair	0
	Inspection	0
Drafters & Technicians		
Drafters (Mechanical, Electrical, Civil)	AutoCAD1	1
	Computer Aided Drafting/Design CAD	0
	Mechanical Design/Engineering	0
Engineering Technicians (Mechanical, Electrical, Civil)	Calibration	2
	Computer Aided Drafting/Design CAD	3
	Inspection	2
	Simulation	1
	Soldering	1
	Systems Integration	3
	Oscilloscopes	0
	Schematics Diagrams	2
	Wiring Diagrams	1
Chemical Technicians	Chemistry	1
	Enterprise Resource Planning	1
	Laboratory Equipment	1
	Mathematics	1
	Product Development	1
Production Occupations		
Team Assemblers	Environmental Compliance	0
	Hand/Power Tools	1
	Mathematics	1
	Oracle	1
	SAP	0
	Schematics Diagrams	0
	Six Sigma	0
	Active Listening	3
Agricultural & Food Service Technicians	Hand/Finger Dexterity	1
	Deductive Reasoning	3
	Oral Comprehension	3
	Operation Control	2
Machine Setters, Operators & Tenders	Blueprint Reading	0
	Computer Numerical Control (CNC)	1
	Grinders	0
	Lathes	0
	Inspection	1
	Machine Operation	1
	Machining	0
	Schematic Diagrams	0
Machinists	Computer Numerical Control (CNC)	0
	Lathes	2
	Mathematics	2
	Machining	1
	Micrometers	1
	Repair	1
Welders, Solderers & Brazers	Hand/Power Tools	2
	Inspection	2
	Repair	3
	Schematic Diagrams	2

	Soldering	1
Inspectors, Testers, Sorters, Samplers & Weighers	Calibration	2
	Calipers	1
	Inspection	2
	Mathematics	2
	Micrometers	0
	Validation	2
	Other: Accurate Measurement & Handling of Liquids	1
Helpers – Production Workers	Environmental Compliance	2
	Inspection	3
	Machine Operation	3
	Mathematics	2
	Repair	2
Machinery Maintenance & Repair Workers	Hand/Power Tools	4
	HVAC	5
	Inspection	4
	Plumbing	5
	Repair	6
	Schematic Diagrams	4

Appendix D. Projected Employment by Advanced Manufacturing Respondents

Occupation	Current Employees	Replacement Employees	Laid Off Employees	Additional Employees	Future Employees
Computer/Software Occupations					
Software Engineer/ Programmer Analyst/ Developer (Applications And Systems)	11	0	0	2	13
Computer User Support Specialist Technical Support/IT Specialists	10	0	0	3	13
Computer Network Support Specialists/LAN Specialists	9	0	0	5	14
Other	8	0	0	4	12
Total	**38**	**0**	**0**	**14**	**52**
Engineers					
Agricultural Engineers	1	0	0	0	1
Biomedical Engineers	0	0	0	0	0
Electrical Engineers	13	0	0	7	20
Industrial Safety And Health Engineers	0	0	0	1	1
Chemical Engineers	2	0	0	2	4
Environmental Engineers	0	0	0	0	0
Industrial Engineers	5	0	0	1	6
Civil Engineers	3	0	0	0	3
Mining And Geological Engineers	2	0	0	0	2
Other	6	1	0	1	7
Total	**32**	**1**	**0**	**12**	**44**
Drafters And Technicians					
Drafters (Mechanical, Electrical, Civil)	24	0	0	2	26
Engineering Technicians (Mechanical, Electrical, Industrial, Civil)	16	2	0	8	24
Chemical Technicians	7	2	0	5	12
Surveying And Mapping Technicians	5	0	0	0	5
Other	2	0	0	0	2
Total	**54**	**4**	**0**	**15**	**69**
Production Occupations (Assemblers, Machinists, Operators, Welders Etc.)					
Team Assemblers	7	0	0	0	7
Agricultural And Food Service Technicians	25	0	0	1	26
Machine Setters, Operators And Tenders	6	0	0	0	6
Machinists	26	0	0	2	28
Welders, Solderers And Brazers	42	0	0	13	55
Inspectors, Testers, Sorters, Samplers And Weighers	10	0	0	6	16
Machinery, Maintenance And Repair Workers	19	0	0	1	20
Helpers - Production Workers	84	0	0	11	95
Other	14	0	0	3	17
Total	**233**	**0**	**0**	**37**	**270**

Appendix E. Employer interview guide.

Advanced Manufacturing Interview Guide

Office Use Only
Date: _____

Company Name: _____

Contact Name: _____   Title: _____

Phone: _____   Email: _____

Facility Address: _____

Industry(ies):
Circle all from survey, star primary industry

1. Aircraft/Aerospace
2. Apparel, Finished products from Fabrics & Similar materials
3. Automotive
4. Biotechnology
5. Clean Technology
6. Chemicals and allied products
7. Electronic, electronic equipment and components, <u>except computer equipment</u>
8. Fabricate metal products, <u>except machinery & transport equipment</u>
9. Food/Edible goods
10. Furniture
11. Fixtures/Fittings
12. Games and toys
13. Industrial and commercial machinery and computer equipment
14. Information and communications technology
15. Jewelry
16. Leather and leather products
17. Lumber and wood products, <u>except furniture</u>
18. Measure/Analyze/Control Instruments, Photo/Medical/Ophthalmic goods, Watches/clocks
19. Paper and allied products
20. Petroleum and miscellaneous plastic products
21. Precious metals
22. Primary metal industries
23. Printing, publishing and allied industries
24. Signs and advertising specialties
25. Sporting and athletic goods
26. Stone, clay, glass, and concrete products
27. Textile mill products
28. Tobacco products
29. Transportation equipment
30. Other (Specify)_____---

I. Company Information

1. Can you briefly describe the focus of your company and its history?

2. What advanced technologies or techniques does your company use in its production processes? How these advanced technologies/techniques are changing your company's workforce needs and requirements?

II. Workforce Needs and Requirements

3. What is the **minimum** education required for the positions your company hires for?

Occupation #1:_____   Education: _____

Occupation #2: _____ Education:_____

Occupation #3:_____ Education:_____

Occupation #4: _____ Education:_____

4. What are the most important skills and knowledge areas for your <u>entry-level</u> employees across occupations?

5. What skills could your current workers use to help your company expand and/or be more efficient in the future?

6. What are your top workforce challenges?

7. Where do you look for qualified individuals? (e.g. job placement agencies, trade associations, veteran organizations, education programs, county career centers)

III. Education and Training

8. What education/training program(s) do you use to train your incumbent workers? Do these programs meet your needs? Please explain.

9. What can a local community college do (or do better) to meet your company's education and training needs?

10. Do you have any recommendations on how the educators can excite today's youth to enter the manufacturing workforce?

11. As we work with local educators on addressing your workforce concerns, would your company be interested in participating in any of the following:

_____Internships   _____ Summer Job Programs   _____Company Tours

_____Advisory Boards for community college program(s)

12.   Are you aware of local and state workforce training programs that can help offset your company's training expenses?

Thank you for your input!