



CENTER OF EXCELLENCE
FOR LABOR MARKET RESEARCH

ORANGE COUNTY



ORANGE COUNTY SECTOR PROFILE:
ADVANCED MANUFACTURING

2024

ORANGE COUNTY
REGIONAL CONSORTIUM

WORKFORCE
DEVELOPMENT ALLIANCE



California
Community
Colleges

TABLE OF CONTENTS

- Table of Contents 1
- Introduction..... 2
- Advanced Manufacturing Occupational Data Analysis..... 3
- Job Postings Information..... 8
- Key Occupations Driving Employment..... 12
- Advanced Manufacturing Supply..... 17
- Demographics..... 19
- Public Policy and Funding Opportunities 21
- Appendix A: Methodology 23
- Appendix B: Sector Occupations..... 24
- Appendix C: TOP Codes..... 26
- Appendix D: End Notes 27

[Supplemental Appendices](#)¹ are available as a companion to this report and include the following:

- Appendix D: Advanced Manufacturing Demand – Labor Market Data
- Appendix E: Advanced Manufacturing Supply – Community College and Non-Community College Awards
- Appendix F: Advanced Manufacturing CIP Codes



INTRODUCTION

This report is the seventh in a series of 12 sector profiles that aim to provide a comprehensive analysis of Orange County's occupational landscape. This series dives into each of the 12 community college sectors, offering historical and projected occupational insights while building upon foundational research established through the [Orange County Labor Market Overview](#).² This sector profile focuses on Advanced Manufacturing, which the Orange County Region has ranked eighth out of the 12 sectors based on the Orange County Labor Market Overview and corresponding region-wide survey of community colleges and key partners.

The Advanced Manufacturing sector is crucial to the economy, driving innovation, productivity, and competitiveness in industries ranging from electronics and food production. By leveraging advanced technologies and skilled labor, this sector not only creates high-quality jobs but also boosts exports and contributes to economic growth and sustainability.

The sector consists of a wide array of occupations that support the production of goods using cutting-edge technology and specialized equipment. Key jobs include *Machinists (51-4041)*, *Industrial Engineers (17-2112)*[^], and *Electrical Engineers (17-2071)*[^], all of whom ensure the design, development, and maintenance of machinery and tools used in manufacturing processes. *Computer Numerically Controlled Tool Programmers (51-9162)* play a vital role in automating manufacturing operations for precision and efficiency. Jobs such as *Welders, Cutters, Solderers, and Brazers (51-4121)* contribute to the assembly of components, while *Packaging and Filling Machine Operators and Tenders (51-9111)** handle final product preparation.

Other essential positions include *Maintenance Workers, Machinery (49-9043)* and *Food Batchmakers (51-3092)**, all of whom ensure smooth operations across various industries, from textiles to food processing. Safety and efficiency are maintained through the efforts of *Occupational Health and Safety Specialists (19-5011)*[^]. This diverse workforce drives innovation in production techniques, ensuring high-quality outcomes in both large-scale and niche manufacturing subsectors.

The Advanced Manufacturing sector is comprised of 104 occupations, 13 of which were highlighted in the Orange County Labor Market Overview. These 104 occupations account for 13% of the total number of occupations in the federal Bureau of Labor Statistics (BLS) Standard Occupational Classification (SOC) system and only 1% (1) is on the U.S. News & World Report's 100 Best Jobs of 2024 list.³

Occupations are denoted throughout this report in italics, with their corresponding SOC code in parentheses, with below middle-skill occupations denoted with an * and above middle-skill occupations denoted with a ^ and occupation(s) that are on the U.S. News & World Report's 2024 100 Best Jobs list denoted by #, such as *Mechanical Engineers (17-2141)*[^]#.

By examining key aspects such as occupational trends, major employers, skills, program completions, and opportunities, the OC COE seeks to highlight underlying dynamics and intricacies shaping the Advanced Manufacturing sector in Orange County. Community colleges and regional stakeholders can use this information for strategic planning and data-informed decision making to address workforce needs in this sector.



ADVANCED MANUFACTURING OCCUPATIONAL DATA ANALYSIS

Orange County's Occupational Landscape

The Advanced Manufacturing sector is comprised of 104 occupations that accounted for 111,821 jobs in 2022, representing 6% of all jobs in Orange County. These jobs are expected to grow by 1% through 2027, resulting in 13,021 projected annual openings.

Advanced Manufacturing Sector Key Facts



111,821

Number of Jobs
in 2022



869

5-Year Change
through 2027



1%

5-Year Percent
Change



13,021

Annual
Openings



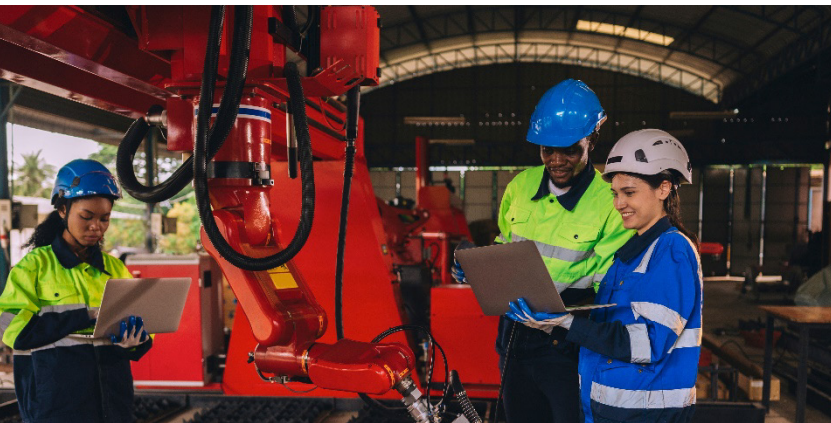
4,925

Establishments



\$14.06 - \$45.85

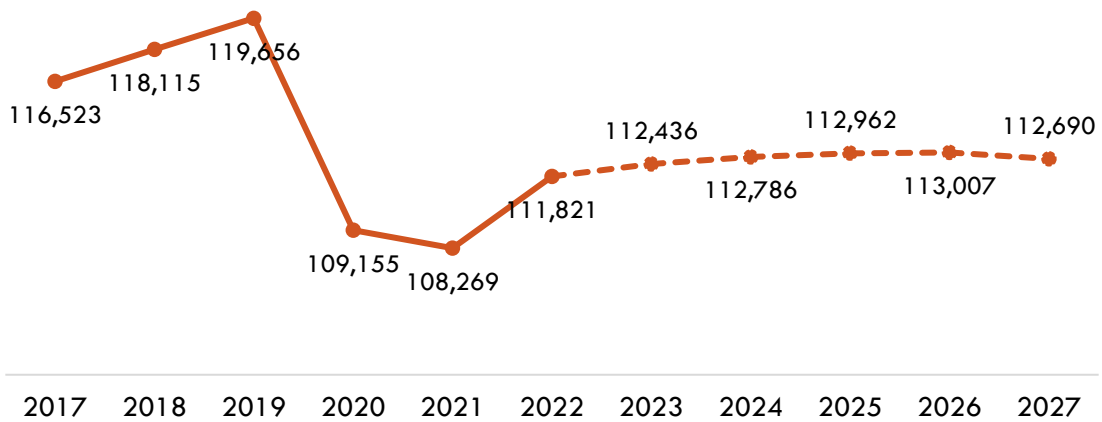
Occupational Entry-Level
Wage Range



Historical and Projected Employment

Over a 10-year period, from 2017 projected through 2027, Advanced Manufacturing jobs have been and are projected to continue steadily rise at a consistent pace, except in 2020 and 2021 due to the COVID-19 pandemic-related economic downturn (Exhibit 1). Notably, employment in this sector has not and is not projected to return to pre-pandemic levels.

Exhibit 1: Historical and Projected Advanced Manufacturing Employment in Orange County (2017-2027)



The 104 occupations in the Advanced Manufacturing sector are categorized into 10 above middle-skill, 39 middle-skill, and 55 below middle-skill occupations (Exhibit 2). In 2022, the 55 below middle-skill occupations accounted for 56,354 jobs, representing 50% of the total workforce in the Advanced Manufacturing sector; followed by 39 middle-skill occupations with 42,215 jobs, comprising 38% of the total workforce (Exhibit 3).

Exhibit 2: Skill-Level for Advanced Manufacturing Occupations

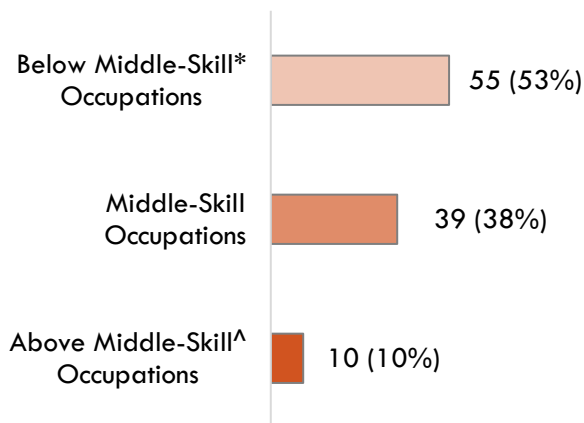
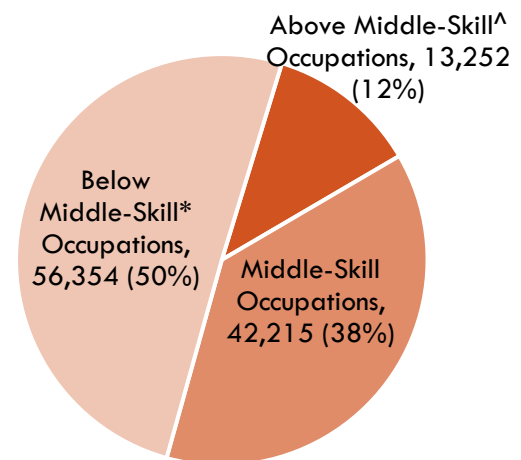


Exhibit 3: Breakdown of 2022 Jobs for Advanced Manufacturing Occupations by Skill-Level



*Note: Throughout this report, Below Middle-Skill Occupations are denoted with an * and Above Middle-Skill Occupations are denoted with a ^.*

Trends In Occupational Demand

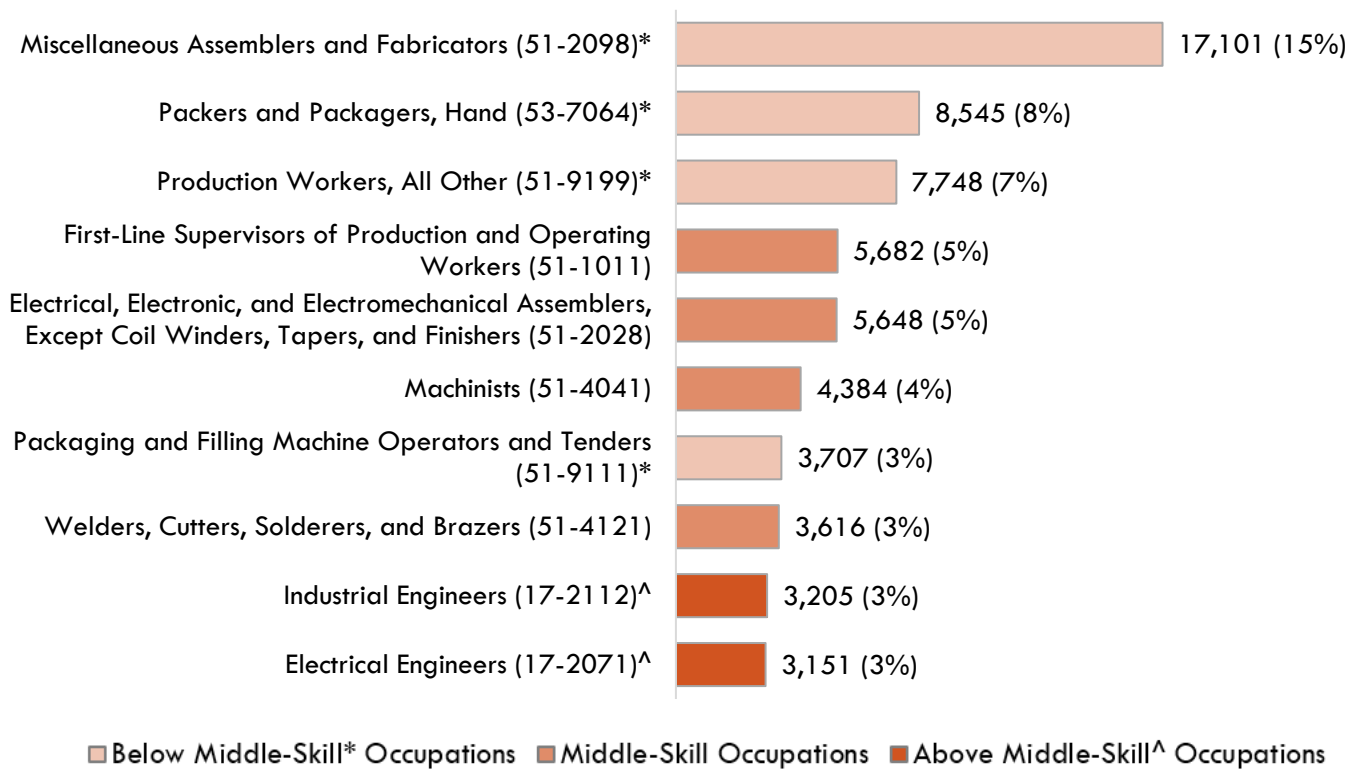
The United States is the second largest manufacturer in the world and manufacturing accounts for 11% of the country’s gross domestic product.⁴ Nationally, the manufacturing industry is the 5th largest employment sector employing over 12 million people. California is at the center of the nation’s manufacturing, with over 35,000 firms and 1.2 million jobs in the industry. Manufacturing is 12% of California’s economic output.⁵ Though automation will impact occupations in this sector and may eliminate some jobs with repetitive tasks, new opportunities will be created for jobs that require human skills such as problem solving, adaptability, and creative thinking.⁶ According to Oracle, leading manufacturers are investing in technology, attracting and nurturing talent to diversify the workforce and retaining current employees, investing in sustainability, addressing supply chain disruptions, and modernizing factories with robotics and automation.⁷

Regionally, the 104 occupations in this sector accounted for nearly 112,000 jobs in 2022 and are estimated to have over 13,000 annual openings through 2027 in Orange County. Jobs in this sector are projected to grow at a slower rate compared to all occupations in Orange County through 2027 and 9% of the occupations have entry-level wages above the MIT Living Wage for Orange County of \$30.48.⁸ Half of Advanced Manufacturing jobs are for below middle-skill occupations while 38% are for middle-skill occupations.

Jobs

Jobs equate to the number of people currently in an occupation as opposed to unmet demand, which refers to the number of people still needed in an occupation. Comprising 15% of all jobs in Orange County’s Advanced Manufacturing sector, *Miscellaneous Assemblers and Fabricators (51-2098)**, a below middle-skill occupation, has the most jobs (17,101), followed by *Packers and Packagers, Hand (53-7064)**, another below middle skill occupation with 8% of all jobs. All top 10 Advanced Manufacturing jobs, 2022 are shown in in Exhibit 4.

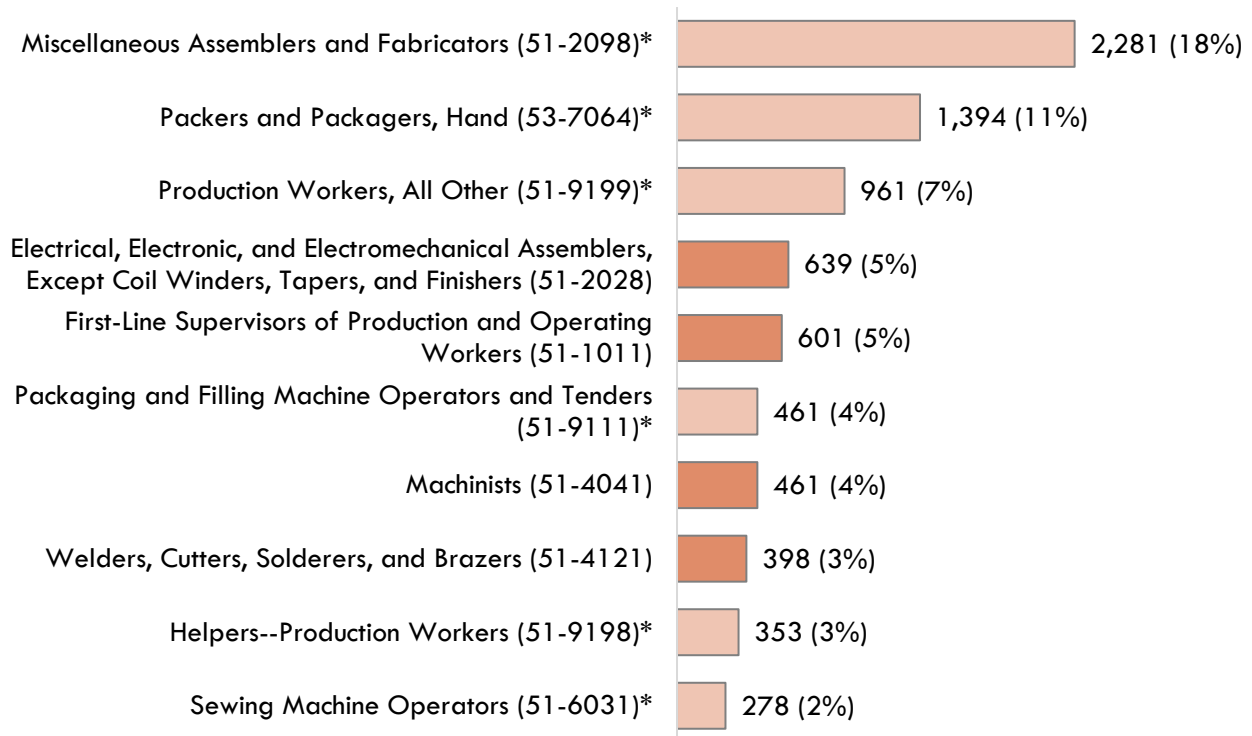
Exhibit 4: Top 10 Advanced Manufacturing Jobs, 2022



Annual Openings

There are 13,021 Advanced Manufacturing sector annual openings, also known as “demand” or “unmet demand”, in Orange County. *Miscellaneous Assemblers and Fabricators (51-2098)** accounts for the largest percentage of annual openings (18%), followed by *Packers and Packagers, Hand (53-7064)** (11%), with *Sewing Machine Operators (51-6031)** (2%) rounding out the sector’s annual openings, as shown in .

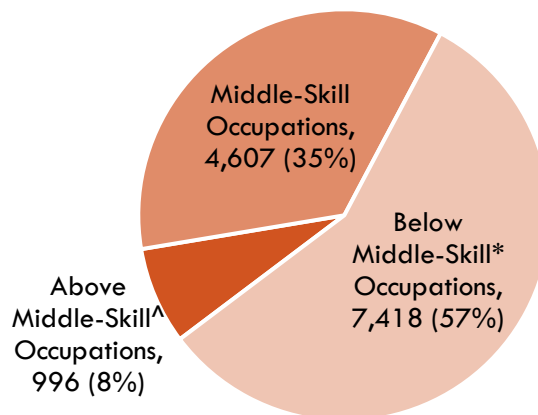
Exhibit 5: Top 10 Annual Openings by Advanced Manufacturing Occupation



■ Below Middle-Skill* Occupations
 ■ Middle-Skill Occupations
 ■ Above Middle-Skill^ Occupations

Below-middle-skill occupations comprise 57% of all annual openings in the Advanced Manufacturing sector followed by middle-skill occupations (35%). Exhibit 6 shows the annual openings by skill-level.

Exhibit 6: Distribution of All Advanced Manufacturing Annual Openings by Skill-Level

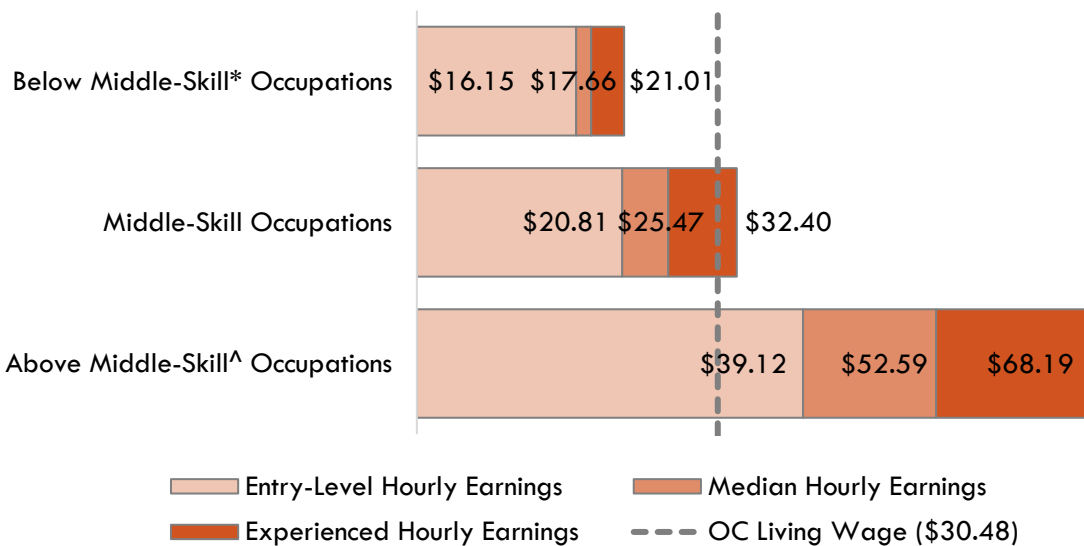


Earnings

In Orange County, the MIT Living Wage for one adult is \$30.48 per hour, which is the floor benchmark for wages in the county. Of the 104 occupations, only nine occupations have entry-level wages above Orange County's living wage. Entry-level wages across all 104 Advanced Manufacturing occupations range from \$14.06 to \$45.85 per hour, with *Meat, Poultry, and Fish Cutters and Trimmers (51-3022)** and *Electrical Engineers (17-2071)^* at the lower- and upper-end of this range, respectively.

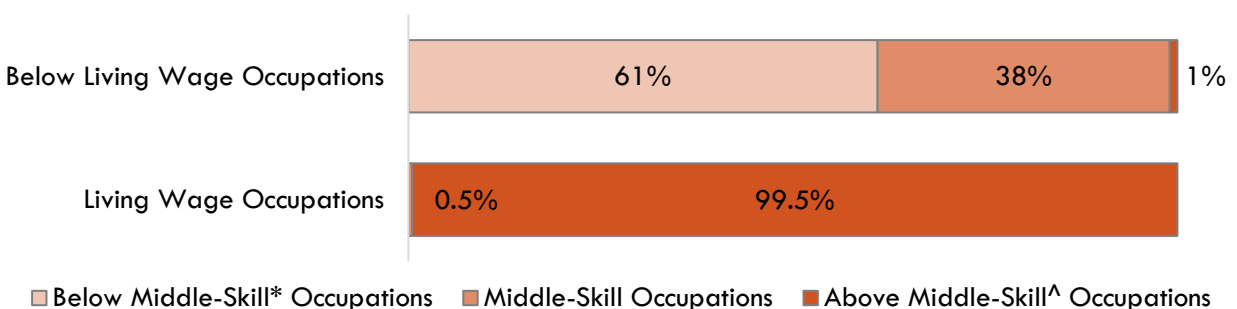
To better understand Advanced Manufacturing sector wages in Orange County, wages are weighted by the number of 2022 jobs. This accounts for wage variation between occupations by normalizing the data based on the number of jobs. It adjusts for situations like a large number of low-wage jobs, a small number of high-wage jobs, or any combination of the two. Exhibit 7 shows the full spectrum of weighted wages (from entry-level to experienced) by skill level for the 104 Advanced Manufacturing occupations, ranging from below-middle-skill entry-level wages of \$16.15 to above middle-skill experienced wages of \$68.19.

Exhibit 7: Advanced Manufacturing Occupational Wages by Skill Level, Weighted by 2022 Jobs



Notably, only 7% of the annual job openings in this sector have entry-level wages above the living wage; 99.5% are for above-middle skill occupations and 0.5% are for middle-skill occupations as shown in Exhibit 8.

Exhibit 8: Comparison of Living Wages by Advanced Manufacturing Annual Openings and Skill Level

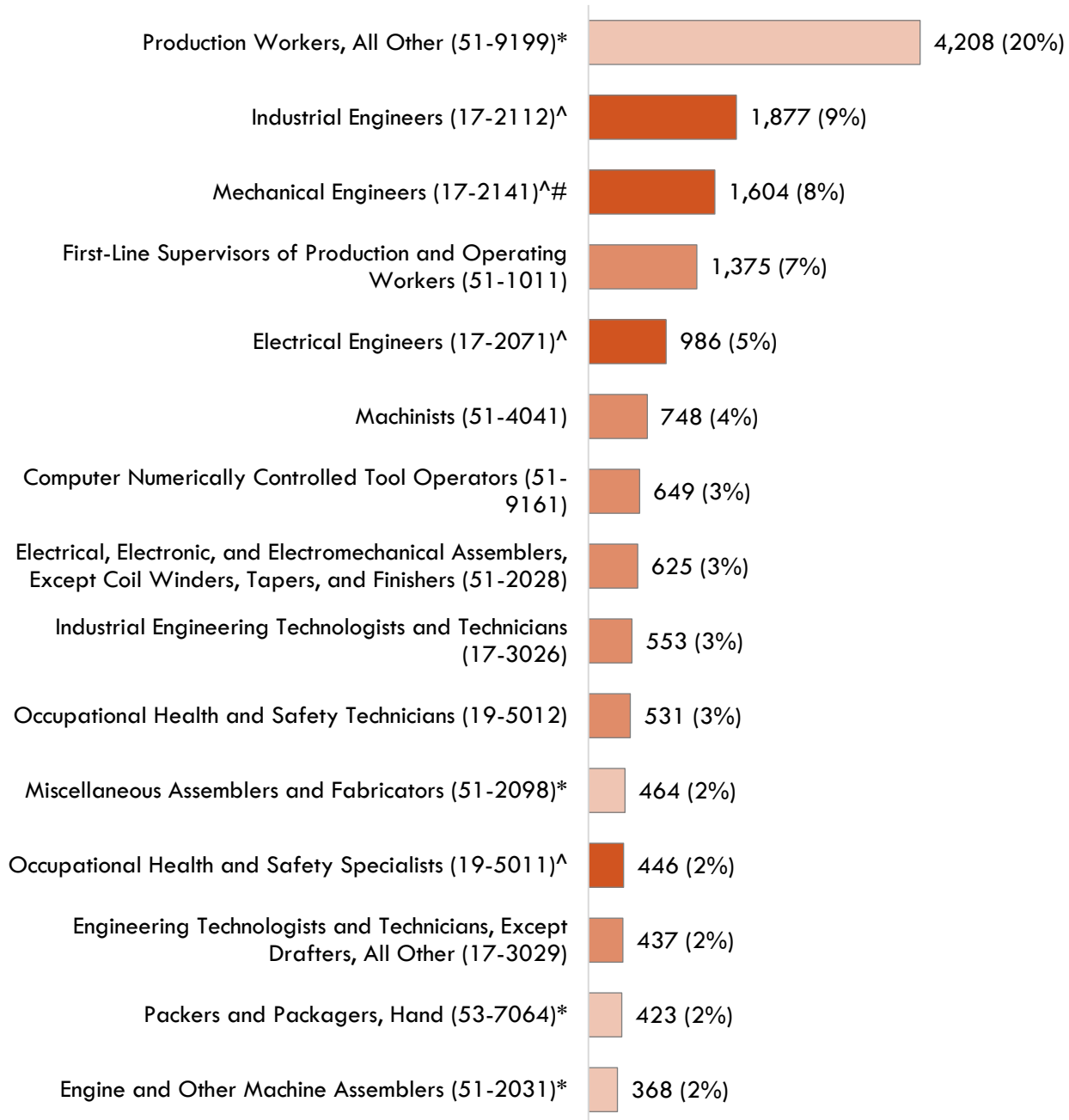


JOB POSTINGS INFORMATION

Job Postings in Orange County

Over the past 12 months (September 2023 – August 2024), there were 20,681 employer job postings within Orange County for all Advanced Manufacturing occupations. Exhibit 9 shows the 15 occupations with the highest number of job postings, which represents approximately 74% of all postings within the sector. Most notably, *Production Workers, All Other (51-9199)** comprise one fifth (20%) of the job postings.

Exhibit 9: Top 15 Advanced Manufacturing Media Occupations by Number of Job Postings



■ Below Middle-Skill* Occupations
 ■ Middle-Skill Occupations
 ■ Above Middle-Skill^ Occupations

Top Employers

Orange County’s Advanced Manufacturing employers are very diverse, as shown in Exhibit 10. Employers with postings for below middle-skill occupations, such as Aerotek, Adecco, and Randstad are staffing agencies and may focus on general labor positions. These employers provide opportunities for individuals with minimal experience or specialized training. Employers with postings for middle-skill occupations include a mix of staffing agencies, educational institutions, and large corporations, such as Kelly Services, University of California, and Stanley Black & Decker. These jobs typically require more specialized skills, vocational training, apprenticeship, and/or an associate degree. Employers in the above middle-skill category offer jobs that demand higher levels of expertise, often requiring advanced degrees, extensive experience, and/or professional certifications. These jobs include managerial positions, specialized technical jobs, and professional services for employers including Boeing, Apple, and SpaceX. No employer appears in all three categories.

Exhibit 10: Top 10 Advanced Manufacturing Regional Employers with the Most Job Postings by Skill Level

Below Middle-Skill*	Middle-Skill	Above Middle-Skill^
1. Aerotek	1. Aerotek	1. Jobot
2. Volt	2. Volt	2. Actalent
3. Kroger	3. Applied Medical Resources Corporation	3. Boeing
4. Kimco Staffing Services	4. Kelly Services	4. Anduril Industries
5. NR Consulting	5. University of California	5. Rivian
6. Adecco	6. Randstad	6. ATR International
7. Randstad	7. ManpowerGroup	7. Edwards Lifesciences
8. Partners Personnel	8. Stanley Black & Decker	8. Apple
9. Belcan	9. Kimco Staffing Services	9. Skyworks
10. Flag Solutions	10. Parker Hannifin	10. SpaceX

Top Job Titles

Below middle-skill job titles such as Assemblers, Machine Operators, and Production Workers typically require minimal training and focus primarily on manual labor and basic technical skills. Middle-skill job titles such as CNC Machinists, Production Supervisors, and CNC Programmers, reflect positions that require more technical expertise, experience, or training. These jobs involve a higher level of responsibility, such as overseeing production processes or working with specialized machinery. Above middle-skill job titles incorporate professions with a higher degree of technical complexity and require advanced education and/or specialized training, such as Electrical Engineers, Design Engineers, and Safety Managers. Job titles by skill level are shown in Exhibit 11.

Exhibit 11: Top Advanced Manufacturing Job Titles in Orange County by Skill Level

Below Middle-Skill *	Middle-Skill	Above Middle-Skill^
1. Assemblers	1. CNC Machinists	1. Electrical Engineers
2. Machine Operators	2. Production Supervisors	2. Manufacturing Engineers
3. Mechanical Assemblers	3. Electronic Assemblers	3. Quality Engineers
4. Assembly Technicians	4. CNC Programmers	4. Mechanical Engineers
5. Production Workers	5. Electromechanical Assemblers	5. Mechanical Design Engineers
6. Production Operators	6. Manufacturing Technicians	6. Design Engineers
7. Production Associates	7. CNC Operators	7. Maintenance Engineers
8. Meat Clerks	8. CNC Machine Operators	8. Environmental Health and Safety Managers
9. Production Assemblers	9. Production Technicians	9. Safety Managers
10. Assemblers/Testers	10. Machinists	10. Packaging Engineers

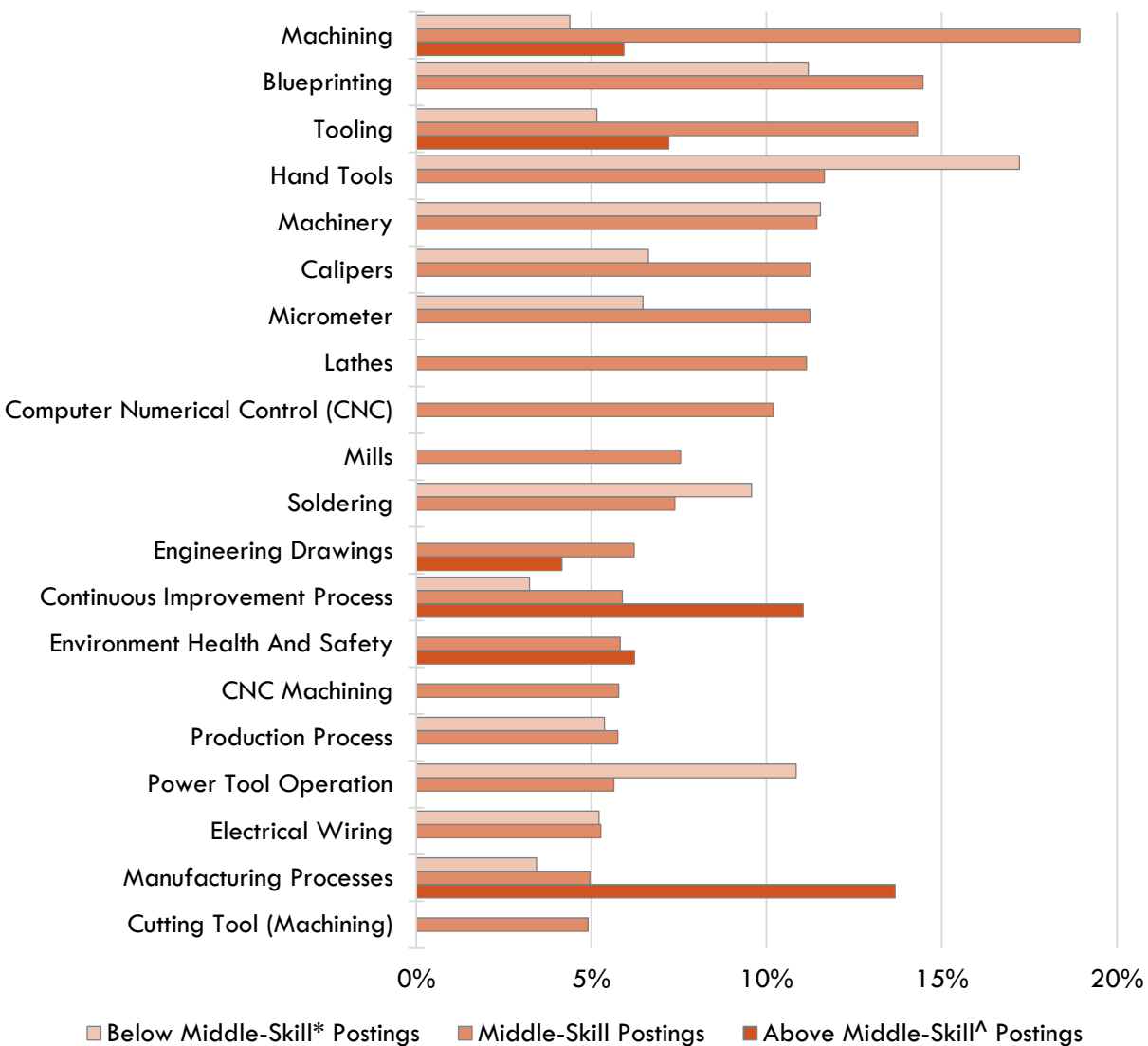
Skills in Job Postings

There are three types of skills listed in job postings: specialized (“technical” or “hard”), common (“soft” or “human”), and computer skills.

Top Specialized Skills

Among the 20 specialized skills listed, only four (4) are common across all three occupational skill levels: machining, tooling, continuous improvement process, and manufacturing processes. Coincidentally, manufacturing processes (14%) and continuous improvement process (11%) are the highest requested skills in above middle-skill postings, indicating their significance in jobs requiring advanced expertise, such as *Industrial Engineers (17-2112)*[^] and *Mechanical Engineers (17-2141)*^{^#}. Conversely, skills like machining (19%), blueprinting (14%), and tooling (14%) are prevalent in middle-skill occupations, such as *Machinists (51-4041)* and *Computer Numerically Controlled Tool Operators (51-9161)*. Notably, the below middle-skill postings category shows relatively higher percentage for hand tools (17%), machinery (12%), and power tool operation (11%), as shown in Exhibit 12.

Exhibit 12: Top 20 Specialized Skills in Advanced Manufacturing Occupations



Top Common Skills

Among the top 10 common skills listed in Exhibit 13, communication skills are the most frequently demanded overall, peaking at 42% in above middle-skill postings, 29% in middle-skill postings, and 22% in below middle-skill postings. Operations is more highly requested for middle-skill (26%) than in above middle-skill (19%) and below middle-skill (19%) postings. Also notable is lifting ability which is requested in 15% of below middle-skill and 13% of middle-skill postings, but not listed in above middle-skill postings. Above middle-skill postings rank management (26%), and problem solving (26%) as the most requested common skills after communication.

Exhibit 13: Top 10 Common Skills in Advanced Manufacturing Occupations

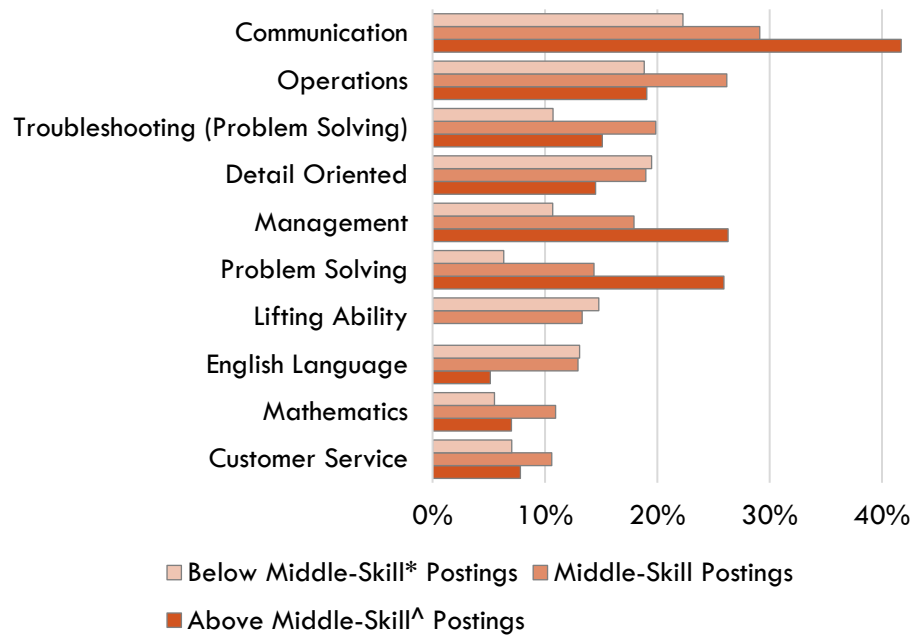
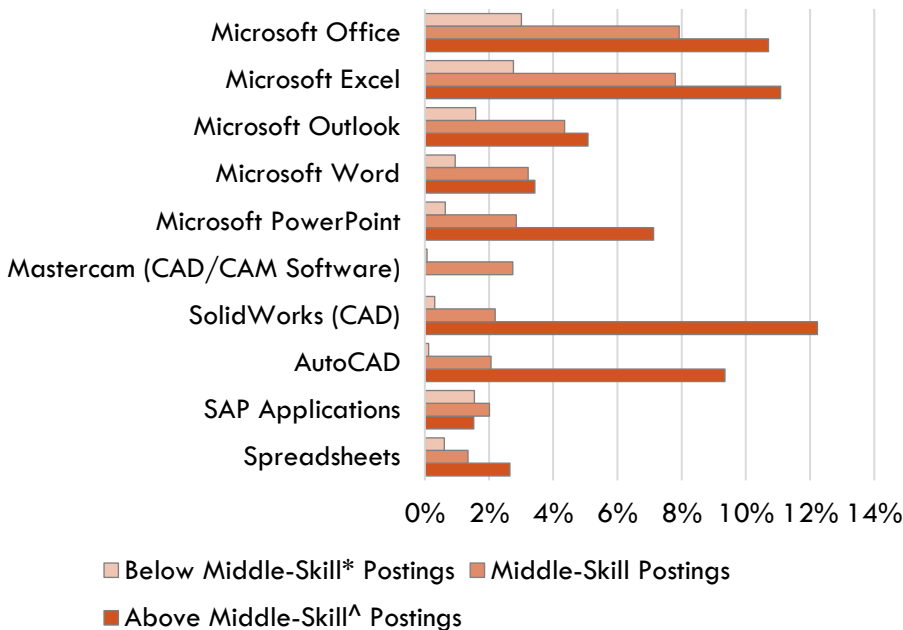


Exhibit 14: Top 10 Computer Skills in Advanced Manufacturing Occupation



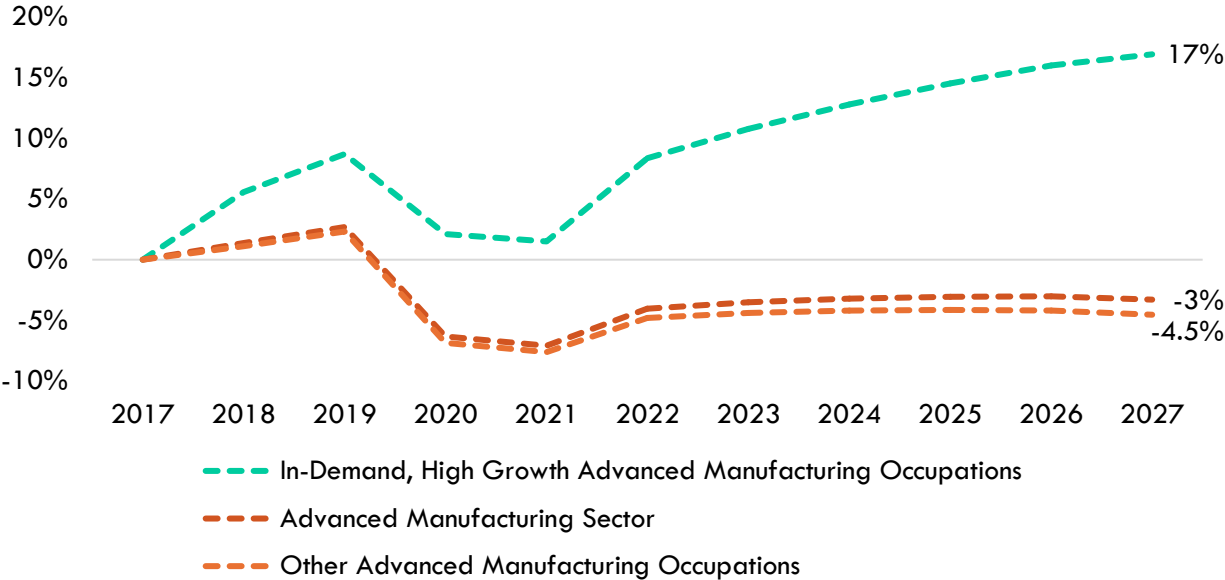
Top Computer Skills

Computer skills are not requested nearly as often as those in the other skills categories within the Advanced Manufacturing sector. However, in general, they are most frequently requested in above middle-skill job postings. Microsoft Office is mentioned in 11% of above middle-skill postings, 8% of middle-skill postings, and 3% of below middle-skill postings. Notably, SolidWorks (CAD) is the highest in above middle-skill postings (12%), compared to 2% in middle-skill postings and none (0%) in below middle-skill postings. Mastercam (CAD/CAM Software) is higher in middle-skill (3%), compared to 0.1% of below middle-skill and it is not requested at all in above middle-skill postings. The top 10 computer skills are shown in Exhibit 14.

KEY OCCUPATIONS DRIVING EMPLOYMENT

There are four Advanced Manufacturing occupations, 4% of the total 103 occupations in the sector, that have a significant number of jobs and annual openings and are projected to have high growth through 2027. These four occupations are anticipated to drive employment with a projected 17% increase from 2017 to 2027; during the same period, employment for all other occupations in the Advanced Manufacturing sector is projected to decline 4.5%, as shown in Exhibit 15.

Exhibit 15: Advanced Manufacturing Development Employment Change, 2017-2027



Key occupations driving employment in the Advanced Manufacturing Sector can be grouped into three broad categories:

Food Batchmaking

- *Food Batchmakers (51-3092)**

Industrial Engineering

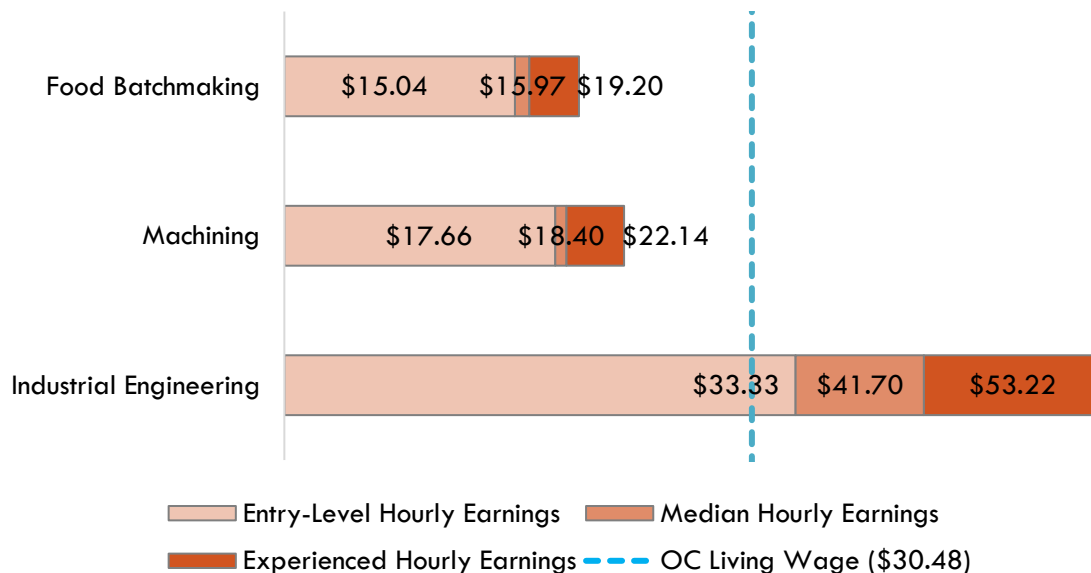
- *Industrial Engineers (17-2112)^*
- *Industrial Machinery Mechanics (49-9041)*

Machining

- *Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic (51-4081)*

Wages for these high-growth occupations vary greatly for each group, with the Food Batchmaking group of occupations having the lowest entry-level hourly wages (\$15.04) and Industrial Engineering having the highest (\$33.33). Exhibit 16 shows the wage range for these three groups.

Exhibit 16: Wages by Key Advanced Manufacturing Occupation Group, Weighted by 2022 Jobs



Though these three key occupations groups comprise only 4% of the occupations, they accounted for 11% of the Advanced Manufacturing sector’s online job postings over the past 12 months, as shown in Exhibit 17. Notably, 98% (2,183) of the postings for these three groups were for Industrial Engineering. For the purposes of this analysis, online job postings data for the Machining group was sourced from JobsEQ, rather than Lightcast.¹

Exhibit 17: Number of Job Postings by Key Advanced Manufacturing Occupation Group

Key Occupation Group	Number of Postings	% of Total Advanced Manufacturing Postings
Industrial Engineering	2,183	11%
Food Batchmaking	36	0.2%
Machining	22	0.1%
Total	2,219	11.3%

¹ An analysis of Lightcast job postings data for *Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic (51-4081)* showed that there were no postings for this occupation in the last 12 months in Orange County. An inquiry was submitted to Lightcast, which explained that there were only two job postings for this occupation in Orange County since 2010. Lightcast noted that potential job postings for this occupation were assigned to other occupations such as *Machinists (51-4041)*. To overcome this limitation, the OC COE utilized JobsEQ, another labor market and job postings data analysis tool, to analyze postings for *Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic (51-4081)* in this section.

The skills requested by employers in online job postings for these occupations vary significantly. When considering the top 10 skills for each group, no skills overlap between the three groups. There are numerous unique skills requested in online job postings for these five groups, as shown in Exhibit 18.

- Food Batchmaking skills include food safety, sanitation, manufacturing, and specific food preparation tasks.
- Industrial Engineering skills are related to manufacturing processes, quality management, auditing, and specifically call out medical devices.
- Machining skills include a variety of tools and machinery such as micrometers, punch presses, hand tools, and calipers.

Exhibit 18: Advanced Manufacturing Key Occupations Unique Skills Analysis

Food Batchmaking	Industrial Engineering	Machining
<ul style="list-style-type: none"> • Food Safety And Sanitation • Good Manufacturing Practices • Food Manufacturing • Cooking • General Mathematics • Mopping • Food Preparation • Dough Preparation • Machine Setup • Ingredient Preparation 	<ul style="list-style-type: none"> • Manufacturing Processes • New Product Development • Project Management • Continuous Improvement Process • Auditing • Quality Management Systems • Medical Devices • Manufacturing Engineering • Process Improvement • Lean Manufacturing 	<ul style="list-style-type: none"> • Micrometers • Blueprint Reading • Punch Presses • Ability to Lift 41-50 lbs. • Manufacturing Resource Planning (MRP) • Oracle • Manufacturing • Ability to Lift 31-40 lbs. • Hand Tools • Calipers

The following sections highlight trends, specific occupations, and examine emerging topics and areas for each of the three groups of key occupations driving employment in the Advanced Manufacturing sector.

Food Batchmaking

The Food Batchmaking group includes one key occupation that is a below middle-skill occupation: *Food Batchmakers (51-3092)**.

Plant-Based Food Manufacturing

Advances in technology are driving changes to how food is produced. Notably, an increase in demand for plant-based food has led to different food processing methods that make plant-based products resemble their animal product counterparts. According to Bloomberg Intelligence, the plant-based food market could account for nearly 8% of all global protein by 2030.⁹ Companies such as Beyond Meat and Impossible Foods continue to develop new ways to produce plant-based protein and have also negotiated deals with international and national restaurant chains. There are numerous ways to process plant-based meat, including chemical enzyme-assisted and physical-assisted techniques, extrusion processing, electrospinning methods, and 3D printing.¹⁰ These technological advances could provide more opportunities for food manufacturing workers in the rapidly evolving plant-based food industry.

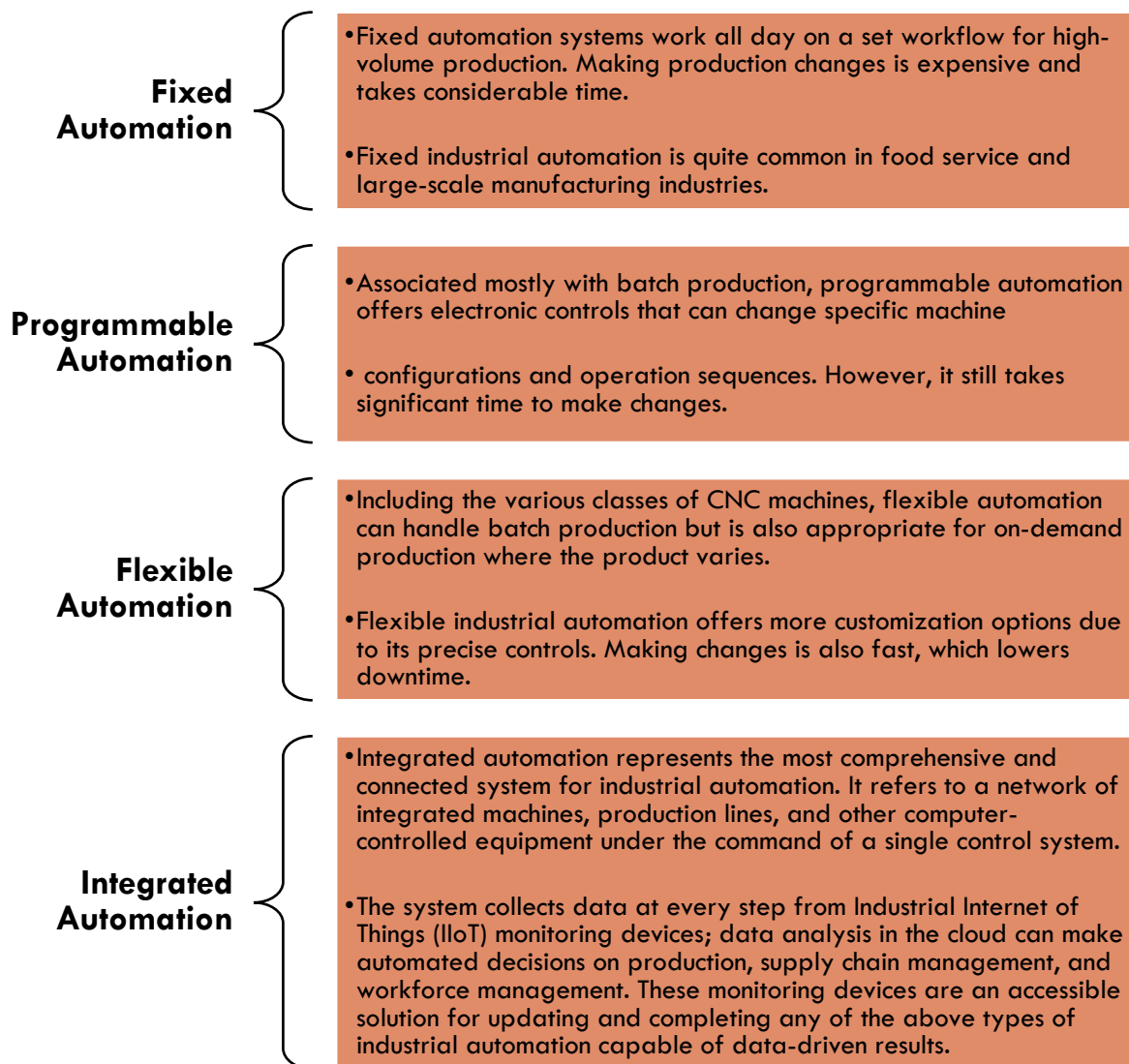
Industrial Engineering

There are two occupations, one middle-skill and one above middle-skill, in the Industrial Engineering key occupation group: *Industrial Engineers (17-2112)*^A and *Industrial Machinery Mechanics (49-9041)*.

Industrial Automation

According to McKinsey, automation has been present in the manufacturing sector for decades, “but historically, few manufacturers have used the approach to target labor shortages. Instead, companies tend to look at automation to improve quality or to address specific health and safety issues.”¹¹ However, this trend is shifting. Results from a national industry survey of over 1,500 manufactures conducted by Rockwell Automation show that 42% of respondents are increasing their use of automation to address labor shortages and skills gaps.¹²

Though automation will likely reduce the need for positions with rote, repetitive tasks, it also creates new job opportunities for more technical roles, such as those related to industrial automation, which “uses information technologies and control systems like robotics and sensors to carry out industrial tasks previously performed by human workers.” Autodesk, a global leader in software for designers, engineers, builders, and creators, defines the four main types of automation as¹³:



The variety of different forms of industrial automation can increase productivity, provide consistent results, and can increase worker safety. Workers with knowledge of programmable logic controllers, robotics, automated controls systems, human machine interfaces, and more, are required so that automated systems operate properly. Employers in Rockwell Automation's survey acknowledged that lack of the proper skill set to implement and optimize smart manufacturing and automated systems is the primary barrier to adopting smart manufacturing technologies. Almost 80% of respondents cited knowledge of smart technology as the number-one skill they are seeking.

Machining

The Machining group includes only one middle-skill occupation: *Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic (51-4081)*.

Manufacturing and Machining Skills Gap

A 2021 study from Deloitte estimated that there will be 2.1 million unfilled manufacturing jobs throughout the country by 2030. Deloitte notes that employers have difficulty filling middle-skill jobs that typically require specific training or skills. One of the areas where employers have particular challenges are computer numerical controlled (CNC) machinists.¹⁴ As noted in the job postings section of this report, machining is the top skill requested in job postings in Orange County, CNC ranks ninth, and CNC machining ranks 15th.

One reason that explains the high demand and reported shortage of machining skills is the aging workforce. Demographic data for machining-related occupations in Orange County shows that 51% of workers in these occupations are 50 and older, mirroring national trends. To help fill the skills gap, employers are increasing their use of automation, with one national survey from Deloitte showing that "manufacturing respondents were able to use automation to help fill 16% of open jobs."¹⁵ Accordingly, employment for machining occupations nationally and in Orange County are projected to decline through 2027.

To address demand that cannot be filled by automation, several organizations including Deloitte¹⁶, the federal National Institute of Standards and Technology¹⁷, and Ernst & Young (EY)¹⁸, all recommend developing internal training programs, using technology such as Augmented Reality (AR)/Virtual Reality (VR) for immersive learning and to attract younger workers, engaging specific cohorts of workers such as veterans, and developing an external talent pool with community colleges or other training providers.

Notably, machining and machine tools is the program with the most awards conferred by Orange County community colleges over the past three years. Community colleges throughout the region should consider developing apprenticeships, customized training, and other partnerships with local employers to meet workforce needs and close the manufacturing and machining skills gap.

ADVANCED MANUFACTURING SUPPLY

Orange County’s educational institutions provide programs tailored to equip students with skills suited for different levels of occupations within the Advanced Manufacturing sector. The following visuals outline the number of awards conferred by both community colleges and non-community colleges, program observations from COCI¹⁹, as well as the regional programs and institutions that have conferred the most awards.



522

community college awards



1,335

non-community college awards



1,857

total awards conferred

COCI Observations

- There are 114 unique Advanced Manufacturing programs offered by Orange County community colleges.
- Most programs (61%) are for Certificates of Achievement, distantly followed by Associate degrees (34%) and noncredit awards (4%).
- Orange Coast offers the most Advanced Manufacturing programs (30), followed by Santa Ana (26) and Fullerton (22).
- The plurality of Advanced Manufacturing programs are listed under the 0956.00 Manufacturing and Industrial Technology (18%) and 0956.30 Machining and Machine Tools (18%) TOP codes, followed by 0934.00 Electronics and Electric Technology (12%).

Top Program Awards

Community College:
 Machining and Machine Tools: 100
 Welding Technology: 88
 Electronics and Electric Technology: 79
 Surveying: 61
 Drafting Technology: 50

Non-Community College:
 Mechanical Engineering: 540
 Computer Engineering, General: 323
 Electrical and Electronics Engineering: 283
 Chemical Engineering: 90
 Materials Engineering: 56

Most Awards

Community College:
 Santa Ana: 197
 Orange Coast: 103
 Santiago Canyon: 75
 Saddleback: 41
 Coastline: 40

Non-Community College:
 University of California-Irvine: 883
 California State University-Fullerton: 409
 Southern California Institute of Technology: 40
 California Career School: 1
 Chapman University: 1

Community College Student Outcomes

Orange County community college students account for 10% of all Advanced Manufacturing community college students in California. The visuals below show the Strong Workforce Program (SWP) metrics for the Advanced Manufacturing sector in Orange County.²⁰



2,808

SWP Students
(2021-22)



295

SWP Students Who
Earned a Degree or
Certificate or Attained
Apprenticeship Journey
Status (2021-22)



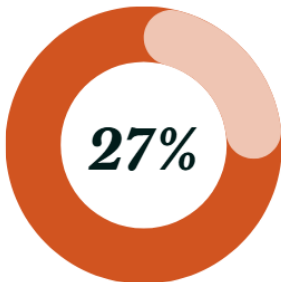
141

SWP Students Who
Transferred to a Four-
Year Postsecondary
Institution (2019-20)

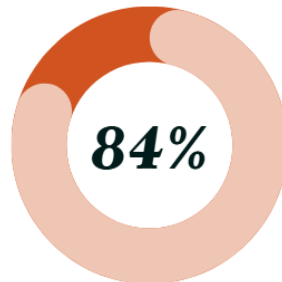


\$48,752

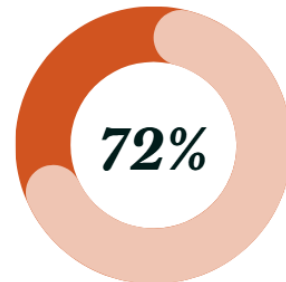
Median Annual Earnings
for SWP Exiting Students
(2020-21)



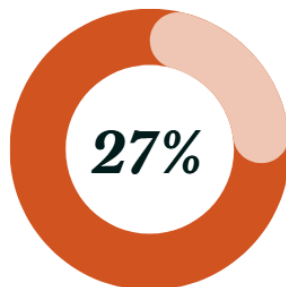
SWP Students Who
Earned 9 or More Career
Education Units in the
District in a single Year
(2021-22)



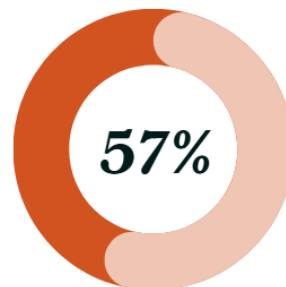
SWP Students Who
Completed a Noncredit
CTE or Workforce
Preparation Course
(2021-22)



SWP Students with a
Job Closely Related
to Their Field of
Study (2019-20)



Median Change (Gain) in
Earnings for SWP Exiting
Students (2020-21)



SWP Exiting Students Who
Attained the Living Wage
(2020-21)

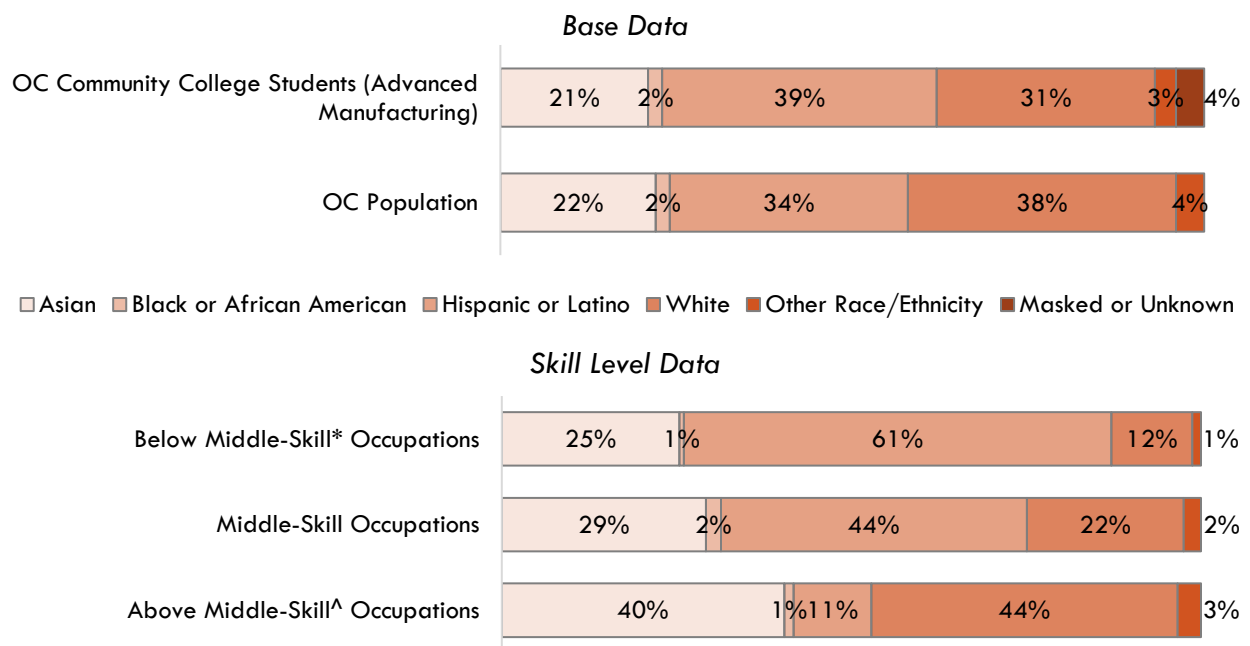
DEMOGRAPHICS

Ethnicity

Exhibit 19 shows the ethnicity of Orange County community college students enrolled in Advanced Manufacturing programs compared to the overall Orange County population and the three skill-level occupational groups. Notably, 39% of Advanced Manufacturing students are Hispanic or Latino, which is slightly higher than the population (34%), and significantly higher than workers in above middle-skill occupations (11%). Conversely, 44% of workers in these above middle-skill occupations are white, which is higher than the population (38%), and community college Advanced Manufacturing students (31%).

Nearly two-thirds (61%) of workers in below middle-skill occupations are Hispanic or Latino; nearly half (44%) of workers in middle-skill occupations are Hispanic or Latino.

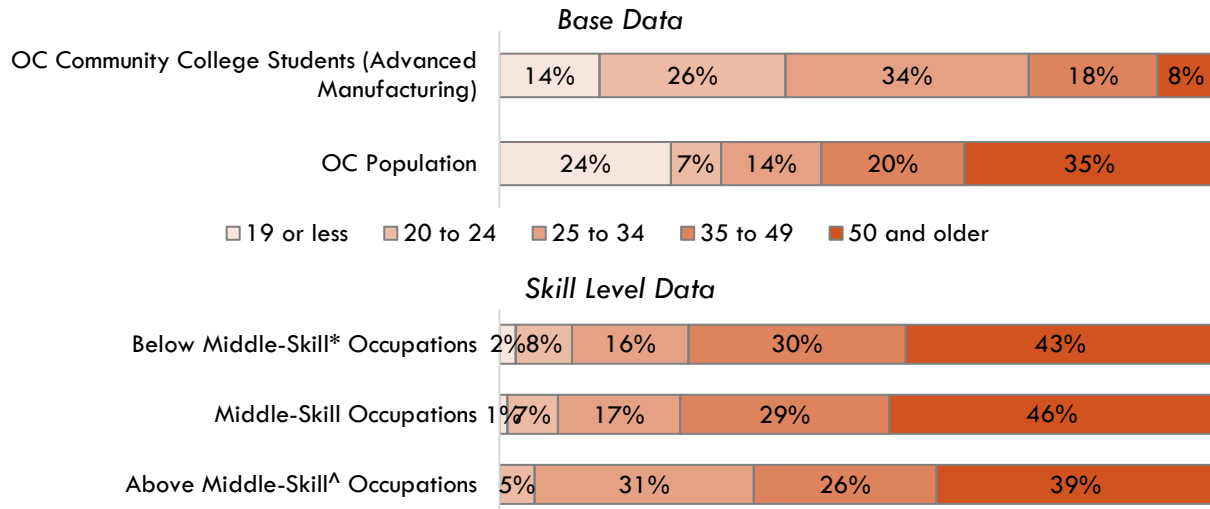
Exhibit 19: Advanced Manufacturing Sector Demographics by Ethnicity



Age Group

Exhibit 20 shows the age of Orange County community college students enrolled in Advanced Manufacturing programs compared to the overall Orange County population and the three skill-level occupational groups. At least 65% of workers in each of the three skill level occupations are 35 and older, which is higher than the population (55%) and community college Advanced Manufacturing students (26%). Notably, nearly half of middle-skill workers (46%) and roughly two-fifths of below and above middle-skill workers, respectively, are 50 and older which is higher than Orange County population of the same age group (35%).

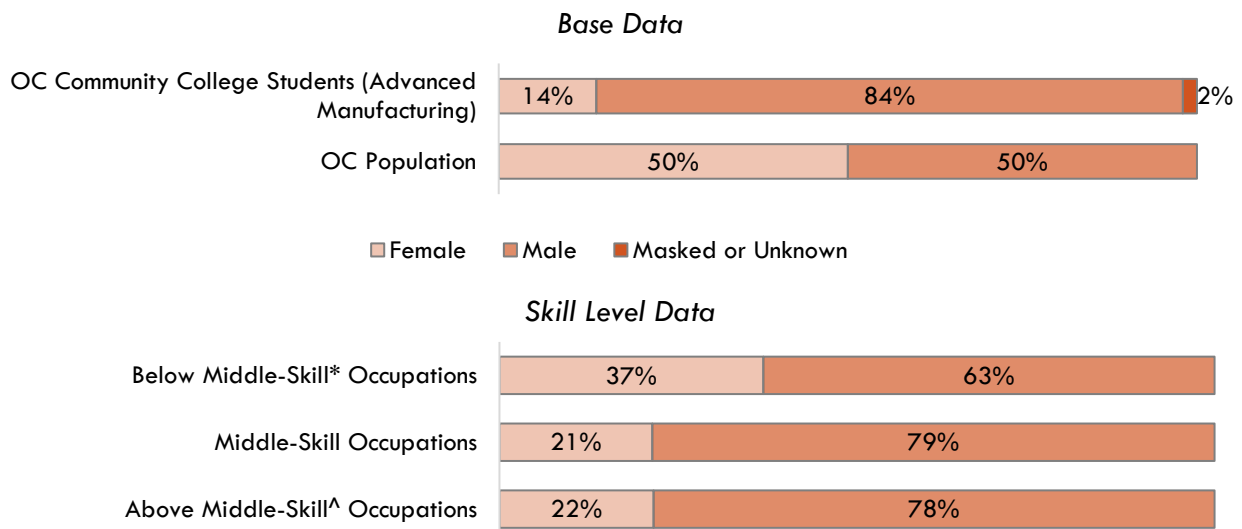
Exhibit 20: Advanced Manufacturing Sector Demographics by Age Group



Sex

Exhibit 21 shows the sex of Orange County community college students enrolled in Advanced Manufacturing programs compared to the overall Orange County population and the three skill-level occupational groups. Though the population is split evenly, 84% of Advanced Manufacturing students and between 63% and 79% of workers in these occupations are men.

Exhibit 21: Advanced Manufacturing Sector Demographics by Sex



PUBLIC POLICY AND FUNDING OPPORTUNITIES

Federal Policies

Federal policies related to the advanced manufacturing industry in the U.S. aim to bolster technological innovation, strengthen the economy, enhance national security, and create high-paying jobs. Key initiatives include:

- **Manufacturing USA:** A network of public-private partnerships that drive innovation in advanced manufacturing bringing together industry, academia, and government to develop cutting-edge manufacturing technologies and build workforce skills across the country. The Manufacturing USA network is operated by the interagency Advanced Manufacturing National Program Office headquartered in the National Institute of Standards and Technology (NIST).²¹
- **Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act – Public Law 117-167:** This policy aims to revitalize the U.S. semiconductor industry by providing substantial investments in research, development, and manufacturing of microelectronics, with the goal of reshoring – reducing dependence on foreign supply chains.²²
- **National Strategy for Advanced Manufacturing:** Launched by the Biden-Harris administration as part of Executive Orders 14005 and 14017, this plan focuses on three core goals: developing advanced manufacturing technologies, growing the workforce, and building resilient supply chains. The strategy also prioritizes innovation in sectors like semiconductors, biomanufacturing, and clean energy. A report by the national Subcommittee on Advanced Manufacturing Committee on Technology justifies this policy by stating, “The United States remains a leader in advanced technologies; however, production and employment in several high-technology manufacturing industries have fallen sharply in the 21st century. To address global competition, the United States has taken steps to revitalize the manufacturing sector, increase the resilience of U.S. supply chains and national security, invest in R&D, and train Americans for jobs of the future.”^{23,24}
- **NIST’s Office of Advanced Manufacturing:** This office coordinates efforts to advance U.S. manufacturing by supporting initiatives like the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) and issuing funding opportunities to foster the development of smart manufacturing technologies.²⁵

These policies aim to ensure U.S. leadership in advanced manufacturing, support decarbonization efforts, and increase supply chain resilience while fostering job growth and economic stability.

State Policies

California’s advanced manufacturing policies prioritize strengthening the sector by providing a range of incentives, financial support, and regulatory measures that foster growth, technological innovation, and sustainable practices. These initiatives aim to drive economic expansion, enhance competitiveness, and support the transition to cleaner technologies.

- **Tax Incentives:** The state offers several tax benefits to manufacturers, such as the California Competes Tax Credit, which encourages businesses to expand or relocate in the state, and a partial sales and use tax exemption on manufacturing equipment. This exemption applies to machinery used for manufacturing, research and development, food processing, and biotech equipment.^{26,27}
- **Zero-Emission Manufacturing:** California places strong emphasis on zero-emission vehicle (ZEV) manufacturing. The Clean Transportation Program provides funding to support in-state production of ZEVs and related components. This aligns with California’s environmental goals, promoting a transition to green technologies while generating high-quality jobs.²⁸
- **Supply Chain and Infrastructure Support:** California recognizes the need for resilient supply chains to support its large manufacturing base. GO-Biz (Governor’s Office of Business and

Economic Development) offers assistance to manufacturers looking to reshore and onshore production to build robust supply chains.²⁹

- **Workforce Development:** The state invests in initiatives that align workforce development with advanced manufacturing needs. The Community Economic Resilience Fund (CERF) supports regions aiming to strengthen their manufacturing ecosystems, offering resources for innovation, infrastructure, and education.³⁰

These policies are designed to enhance California’s position as a leader in manufacturing by tackling key issues such as sustainability, economic growth, and workforce inclusion, ensuring the state’s industry remains competitive and forward-looking in an evolving global market.

Funding Opportunities

Both federal and California governments offer a range of funding initiatives to support advanced manufacturing, focusing on innovation, sustainability, and workforce development. In addition to the tax initiatives mentioned above, here are a sample of key programs at both levels:

- **National Institute of Standards and Technology (NIST) Manufacturing Programs:** NIST provides grants and technical assistance through its Hollings Manufacturing Extension Partnership (MEP), aimed at improving the competitiveness of small and mid-sized manufacturers.³¹
- **Department of Energy (DOE) Advanced Manufacturing Office:** DOE offers funding for research into energy-efficient technologies and advanced materials through its Industrial Efficiency and Decarbonization Office (IEDO). It promotes projects that improve the energy efficiency of manufacturing processes and reduce carbon emissions.³²
- **U.S. Small Business Administration (SBA):** The SBA established a Manufacturing Office that prioritizes the expansion of small U.S. manufacturers and offers a variety of funding opportunities including government contracting assistance programs and loans for capital.³³
- **California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA):** CAEATFA offers a sales and use tax exclusion (STE) program for manufacturers involved in alternative energy or advanced transportation, providing financial relief for the purchase of equipment.³⁴

Via its “Made California Program”, California’s GO-Biz allocated \$1.5 million for eligible organizations to apply to provide marketing and engagement services to support the awareness and use of the Made in California label and promotional services by California’s manufacturing businesses. The application deadline was in April of 2024 and \$800,000 was awarded to California Manufacturing Technology Consulting. The grant performance period runs from June 1, 2024, through May 30, 2026. It is not yet known if another solicitation for applications will occur for the remaining funding allocation.³⁵



APPENDIX A: METHODOLOGY

Traditional Labor Market Data Methodology

The COE analyzed traditional labor market demand information, which includes job counts, projections, wages, typical education requirements, for the Advanced Manufacturing sector. Traditional labor market demand data was sourced from Lightcast (Datarun 2023.4), a labor market analytics firm that aggregates data from public statistical agencies including the Bureau of Labor Statistics, Census Bureau, and the California Employment Development Department. Living wage data was sourced from the Insight Center California Family Needs Calculator.³⁶ The traditional labor market demand data analyzed in this report includes:

- **2022 Jobs:** the number of jobs by industry and occupation in 2022.
- **2027 Jobs:** the projected number of jobs by industry and occupation in 2027. Projections are based on the assumption that past trends will continue into the future, including the assumption that the economy, during the projection period, will be at approximately full employment. Projections do not consider potential recessions or labor shocks, such as natural disasters or pandemics, and are intended to capture structural change in the economy over time.
- **Change:** the projected change in the number of jobs, expressed as an actual number and a percentage.
- **Average Annual Openings (Demand):** the projected number of annual job openings. This figure is the sum of job growth and replacement jobs. Job growth is the result of job creation while replacement jobs are the result of retirements and workers leaving the filled, creating the need to hire a replacement.
- **Hourly Wages:**
 - **Entry-level (25th percentile):** the typical entry-level wages for an occupation; 25% of workers earn less than this amount and 75% earn more.
 - **Median:** the median wages for an occupation; 50% of workers earn less than this amount and 50% earn more.
 - **Experienced (75th percentile):** the typical experienced-level wages for an occupation; 75% of workers earn less than this amount and 25% earn more.
- **Typical Entry-Level Education:** represents the typical education level needed to enter an occupation.
- **Educational Attainment:** the percentage of workers employed in an occupation by their highest level of education attained.

Demographic data for the Orange County population comes from the Census Bureau's American Community Survey (5-Year Estimates, 2018-2022). Demographic data for occupations was sourced via IPUMS USA and student demographic data was sourced from the LaunchBoard Community College Pipeline (2020-21 Academic Year).^{37 38}

The COE also analyzed labor market supply data that is calculated using the number of awards conferred in related training programs at community college and non-community college institutions over the past three years of available data. Community college data is sourced from the California Community College Chancellor's Office Data Mart³⁹ and includes the years 2020-2023; non-community college data is sourced from the Integrated Postsecondary Education Data System and includes the years 2019-2022.⁴⁰

Job Postings Analysis Methodology

In addition to traditional labor market information, the COE analyzed real-time labor market information using online job postings data sourced from Lightcast (Datarun 2024.3), with one exception as noted in the [Key Occupations Driving Employment](#) section. The job postings data in this report covers the last 12 months of available data (September 2023 – August 2024). This data is derived from online job postings that are parsed and classified into industry and occupational groups using natural language processing (NLP) to determine the related company, industry, occupation, and other information for each job posting. Online job postings do not equate to labor market demand or replace traditional labor market data. They should only be considered a supplement to traditional LMI.

APPENDIX B: SECTOR OCCUPATIONS

SOC	Occupation
43-5111	Weighers, Measurers, Checkers, and Samplers, Recordkeeping*
51-2021	Coil Winders, Tapers, and Finishers*
51-2031	Engine and Other Machine Assemblers*
51-2041	Structural Metal Fabricators and Fitters*
51-2051	Fiberglass Laminators and Fabricators*
51-2061	Timing Device Assemblers and Adjusters*
51-2098	Miscellaneous Assemblers and Fabricators*
51-3022	Meat, Poultry, and Fish Cutters and Trimmers*
51-3023	Slaughterers and Meat Packers*
51-3091	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders*
51-3092	Food Batchmakers*
51-3093	Food Cooking Machine Operators and Tenders*
51-3099	Food Processing Workers, All Other*
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic*
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic*
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic*
51-4051	Metal-Refining Furnace Operators and Tenders*
51-4052	Pourers and Casters, Metal*
51-4071	Foundry Mold and Coremakers*
51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic*
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic*
51-4192	Layout Workers, Metal and Plastic*
51-4193	Plating Machine Setters, Operators, and Tenders, Metal and Plastic*
51-4194	Tool Grinders, Filers, and Sharpeners*
51-5113	Print Binding and Finishing Workers*
51-6031	Sewing Machine Operators*
51-6061	Textile Bleaching and Dyeing Machine Operators and Tenders*
51-6062	Textile Cutting Machine Setters, Operators, and Tenders*
51-6063	Textile Knitting and Weaving Machine Setters, Operators, and Tenders*
51-6064	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders*
51-6091	Extruding and Forming Machine Setters, Operators, and Tenders, Synthetic and Glass Fibers*
51-6099	Textile, Apparel, and Furnishings Workers, All Other*
51-7021	Furniture Finishers*
51-9012	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders*

SOC	Occupation
51-9021	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders*
51-9022	Grinding and Polishing Workers, Hand*
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders*
51-9031	Cutters and Trimmers, Hand*
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders*
51-9041	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders*
51-9051	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders*
51-9111	Packaging and Filling Machine Operators and Tenders*
51-9123	Painting, Coating, and Decorating Workers*
51-9151	Photographic Process Workers and Processing Machine Operators*
51-9191	Adhesive Bonding Machine Operators and Tenders*
51-9192	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders*
51-9193	Cooling and Freezing Equipment Operators and Tenders*
51-9194	Etchers and Engravers*
51-9196	Paper Goods Machine Setters, Operators, and Tenders*
51-9197	Tire Builders*
51-9198	Helpers--Production Workers*
51-9199	Production Workers, All Other*
53-7011	Conveyor Operators and Tenders*
53-7063	Machine Feeders and Offbearers*
53-7064	Packers and Packagers, Hand*
17-3012	Electrical and Electronics Drafters
17-3013	Mechanical Drafters
17-3023	Electrical and Electronic Engineering Technologists and Technicians
17-3024	Electro-Mechanical and Mechatronics Technologists and Technicians
17-3026	Industrial Engineering Technologists and Technicians
17-3027	Mechanical Engineering Technologists and Technicians
17-3028	Calibration Technologists and Technicians
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other
19-5012	Occupational Health and Safety Technicians
49-2092	Electric Motor, Power Tool, and Related Repairers
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door
49-9031	Home Appliance Repairers

SOC	Occupation
49-9041	Industrial Machinery Mechanics
49-9043	Maintenance Workers, Machinery
49-9044	Millwrights
49-9069	Precision Instrument and Equipment Repairers, All Other
51-1011	First-Line Supervisors of Production and Operating Workers
51-2028	Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic
51-4041	Machinists
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4111	Tool and Die Makers
51-4121	Welders, Cutters, Solderers, and Brazers

SOC	Occupation
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders
51-4199	Metal Workers and Plastic Workers, All Other
51-5111	Prepress Technicians and Workers
51-5112	Printing Press Operators
51-8091	Chemical Plant and System Operators
51-9011	Chemical Equipment Operators and Tenders
51-9083	Ophthalmic Laboratory Technicians
51-9141	Semiconductor Processing Technicians
51-9161	Computer Numerically Controlled Tool Operators
51-9162	Computer Numerically Controlled Tool Programmers
51-9195	Molders, Shapers, and Casters, Except Metal and Plastic
17-2041	Chemical Engineers [^]
17-2061	Computer Hardware Engineers [^]
17-2071	Electrical Engineers [^]
17-2112	Industrial Engineers [^]
17-2131	Materials Engineers [^]
17-2141	Mechanical Engineers ^{^#}
19-2032	Materials Scientists [^]
19-2099	Physical Scientists, All Other [^]
19-5011	Occupational Health and Safety Specialists [^]
27-1021	Commercial and Industrial Designers [^]

■ Below Middle-Skill* Occupations

■ Middle-Skill Occupations

■ Above Middle-Skill[^] Occupations

APPENDIX C: TOP CODES

TOP Code	Program Name
0924.00	Engineering Technology, General
0934.00	Electronics and Electric Technology
0934.10	Computer Electronics
0934.20	Industrial Electronics
0934.80	Laser and Optical Technology
0935.00	Electro-Mechanical Technology *
0935.10	Appliance Repair
0936.00	Printing and Lithography
0943.00	Instrumentation Technology
0943.30	Vacuum Technology
0945.00	Industrial Systems Technology and Maintenance
0947.20	Heavy Equipment Maintenance*
0950.00	Aeronautical and Aviation Technology
0950.40	Aircraft Electronics (Avionics)
0950.50	Aircraft Fabrication
0953.00	Drafting Technology*
0953.30	Electrical, Electronic, and Electro-Mechanical Drafting
0953.40	Mechanical Drafting
0953.60	Technical Illustration
0954.20	Plastics and Composites
0954.30	Petroleum Technology
0956.00	Manufacturing and Industrial Technology
0956.30	Machining and Machine Tools
0956.40	Sheet Metal and Structural Metal*
0956.50	Welding Technology
0956.70	Industrial and Occupational Safety and Health
0956.80	Industrial Quality Control
0957.30	Surveying
0961.00	Optics
1303.30	Fashion Production
1920.00	Ocean Technology

Note: Four (4) TOP codes, denoted above with an asterisk (), have corresponding occupations that crosswalk to other sectors, but they train for occupations within Advanced Manufacturing, so they and their respective supply are added to this sector profile. However, in the last Community College Chancellor's Office [TOP code inventory](#), Electro-Mechanical Technology (TOP 0935.00), Drafting Technology (TOP 0953.00), and Sheet Metal and Structural Metal (TOP 0956.40) are classified as being in the Energy, Construction, & Utilities sector while Heavy Equipment Maintenance (TOP 0947.20) is classified as being in the Advanced Transportation & Logistics sector.*

APPENDIX D: END NOTES

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- ¹⁴ "Creating Pathways for Tomorrow's Workforce Today," Deloitte Insights, last modified May 4, 2021, <https://www2.deloitte.com/us/en/insights/industry/manufacturing/manufacturing-industry-diversity.html>.
- ¹⁵ *Ibid.*
- ¹⁶ *Ibid.*
- ¹⁷ "Infographic: Training: Responding to the Skills Gap," National Institute of Standards and Technology, last modified January 14, 2023, <https://www.nist.gov/blogs/manufacturing-innovation-blog/infographic-training-responding-skills-gap>.
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Important Disclaimers

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. This study examines the most recent data available at the time of the analysis; however, data sets are updated regularly and may not be consistent with previous reports. Efforts have been made to qualify and validate the accuracy of the data and the report findings; however, neither the Centers of Excellence for Labor Market Research (COE), COE host district, nor California Community Colleges Chancellor's Office are responsible for the applications or decisions made by individuals and/or organizations based on this study or its recommendations.

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