

OCTOBER 2018

LABOR MARKET ANALYSIS

Mechanized Agriculture



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SUMMARY

This study conducted by the Central Valley/Mother Lode Center of Excellence examine labor market demand, wages, skills and community college supply for occupations related to mechanized agriculture. Five occupations were provided: agriculture equipment operators (SOC 45-2091), industrial machinery mechanics (SOC 49-9041), mobile heavy equipment mechanics, except engines (SOC 49-3042), farm equipment mechanics and service technicians (SOC 49-3041); and outdoor power equipment and other small engine mechanics (SOC 49-3053).

KEY FINDINGS:

- **Occupational demand** — The largest (agriculture program applicable) occupation is mobile heavy equipment mechanics, except engines, with 1,435 workers in 2017 and 140 annual openings.
- **Wages** — The highest paid occupation is also mobile heavy equipment mechanics, except engines, with an entry-level wage of \$21.16/hourly. All five of the occupations exceed the region's self-sufficiency wage and living wage at entry level.
- **Employers** — Top employers in the region include the U.S. Air Force, Ahern Rentals and Lockheed Martin Corporation.
- **Job titles** — The most common occupational title in job postings is industrial machinery mechanic (49-9041.00), and the most common job titles are mechanic and maintenance mechanic.
- **Skills and certifications** — The top baseline skill requirement is troubleshooting, and the top specialized skill is repair. The top certification is a Driver's License.
- **Education** — The education required for the four occupations that are middle-skill and application to a community college education is a high school diploma with on-the-job training.
- **Supply** — Analysis of community college completions in the region shows that, on average, 245 certificates and 16 degrees are conferred each year related to the occupations analyzed in this study.

Based on a comparison of occupational demand and community college supply using four of the five provided occupations, there is an undersupply of 437 trained workers in the subregion and 472 trained workers in the region. As a result, the Center of Excellence recommends that Bakersfield College work with the agriculture, water and environmental technologies deputy sector navigator, the college's advisory board and local industry in an expansion or addition of a mechanized agriculture program.

INTRODUCTION

The Central Valley/Mother Lode Center of Excellence was asked by Bakersfield College to provide labor market information for Mechanized Agriculture. The requester also provided Taxonomy of Programs (TOP) code 011600-Agriculture Power Equipment Technology. This analysis focuses on the South Central Valley/Southern Mother Lode (SCV/SML) subregion. Occupational demand, supply and wage data for the region are included for broader applicability and use. Analysis of the program and occupational data related to the TOP title-code resulted in the identification of two applicable occupations; however, five were provided for inclusion by the requester. Those provided Standard Occupational Classification (SOC) System titles and codes are:

- Agriculture equipment operators (SOC 45-2091);
- Industrial machinery mechanics (SOC 49-9041);
- Mobile heavy equipment mechanics, except engines (SOC 49-3042);
- Farm equipment mechanics and service technicians (SOC 49-3041); and
- Outdoor power equipment and other small engine mechanics (49-3053).

The SOC codes, occupational titles, job descriptions, sample job titles, and knowledge and skills from the Bureau of Labor Statistics and O*NET OnLine are shown in Exhibit 1.

EXHIBIT 1. Mechanized agriculture SOC titles, job descriptions, sample job titles, and knowledge and skills

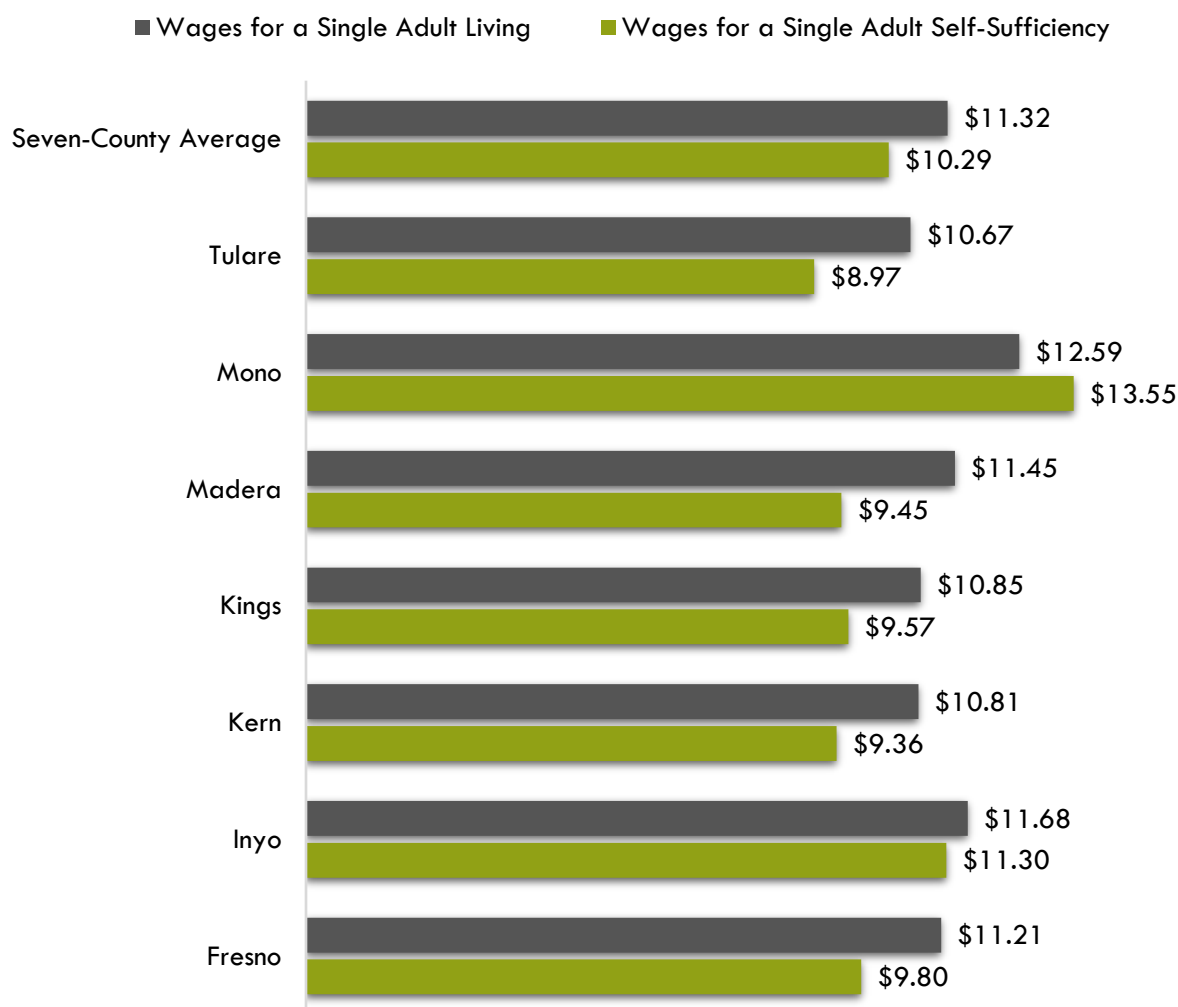
SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE AND SKILLS
49-9041.00			Knowledge Mechanical Engineering & Technology Production & Processing English Language Mathematics
Industrial Machinery Mechanics	Repair, install, adjust, or maintain industrial production and processing machinery or refinery and pipeline distribution systems.	Industrial Mechanic, Loom Fixer, Machine Adjuster, Maintenance Mechanic, Maintenance Technician, Master Mechanic, Mechanic, Overhauler	Skills Equipment Maintenance Repairing Operation Monitoring Troubleshooting Operation & Control
49-3042.00			Knowledge Mechanical Customer & Personal Service Mathematics Computer & Electronics
Mobile Heavy Equipment Mechanics, Except Engines	Diagnose, adjust, repair, or overhaul mobile mechanical, hydraulic, and pneumatic equipment, such as cranes, bulldozers, graders, and conveyors, used in	Construction Equipment Mechanic, Equipment Mechanic, Equipment Technician, Field Mechanic, Field Service Technician,	Skills Repairing

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE AND SKILLS
	construction, logging, and surface mining.	Field Technician, Heavy Equipment Mechanic, Heavy Equipment Technician, Mechanic	Troubleshooting Equipment Maintenance Operation Monitoring Operation & Control
49-3041.00			Knowledge
Farm Equipment Mechanics and Service Technicians	Diagnose, adjust, repair, or overhaul farm machinery and vehicles, such as tractors, harvesters, dairy equipment, and irrigation systems.	Agricultural Mechanic, Agricultural Technician, Agriculture Mechanic, Farm Equipment Mechanic, Field Technician, Mechanic, Service Technician, Tractor Mechanic, Tractor Technician	Mechanical Customer & Personal Service Computer & Electronics English Language Mathematics
			Skills
			Equipment Maintenance Repairing Troubleshooting Operation & Control Critical Thinking
46-2091.00			Knowledge
Agriculture Equipment Operators	Drive and control farm equipment to till soil and to plant, cultivate, and harvest crops. May perform tasks, such as crop baling or hay bucking. May operate stationary equipment to perform post-harvest tasks, such as husking, shelling, threshing, and ginning.	Baler Operator, Cutter Operator, Equipment Operator, Farm Hand, Farm Laborer, Hay Baler, Irrigation Worker, Rake Operator, Tractor Driver, Tractor Operator	Food Production Personnel & Human Resources Chemistry Administration & Management English Language
			Skills
			Operation & Control Operation Monitoring Quality Control Analysis Repairing Troubleshooting
49-3053.00			Knowledge
Outdoor Power Equipment and Other Small Engine Mechanics	Diagnose, adjust, repair, or overhaul small engines used to power lawn mowers, chain saws, recreational sporting equipment and related equipment	Chainsaw Technician, Golf Cart Mechanic, Lawnmower Repair Mechanic, Mechanic, Outdoor Power Equipment Service Technician, Service Technician (Service Tech), Shop	Mechanical Customer & Personal Service English Language Engineering & Technology Education & Training
			Skills
			Equipment Maintenance

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE AND SKILLS
		Mechanic, Small Engine Mechanic, Small Engine Technician	Repairing Troubleshooting Operation Monitoring Critical Thinking

The 2014 average self-sufficiency wage for a single adult in the South Central Valley/Southern Mother Lode (SCV/SML) subregion is \$10.29/hour, and the current average living wage for a single adult is \$11.32/hour. Self-sufficiency and living wage data by county and the overall seven-county average are shown in Exhibit 2. In the wages sections of this report, Pct.10 hourly denotes entry-level wages, and median represents experienced wages.

EXHIBIT 2. Self-sufficiency and living wages in the SCV/SML subregion



OCCUPATIONAL DEMAND

There were 10,929 mechanized agriculture workers employed in 2017 in the South Central Valley/Southern Mother Lode subregion (Exhibit 3). The largest occupation provided for inclusion is agriculture equipment operators with 4,913 workers in 2017. This occupation is expected to increase by 6% over the next five years and has the greatest number of projected annual openings, 839. The second largest occupation is industrial machinery mechanics. This occupation is not considered part of a mechanized agriculture program, but was listed for inclusion by the requesting faculty member. The third largest occupation related to mechanized agriculture is mobile heavy equipment mechanics (except engines) with 1,435 jobs in 2017. This occupation is projected to undergo only 1% growth with 140 annual openings.

EXHIBIT 3. Mechanized agriculture employment and occupational projections in the SCV/SML subregion

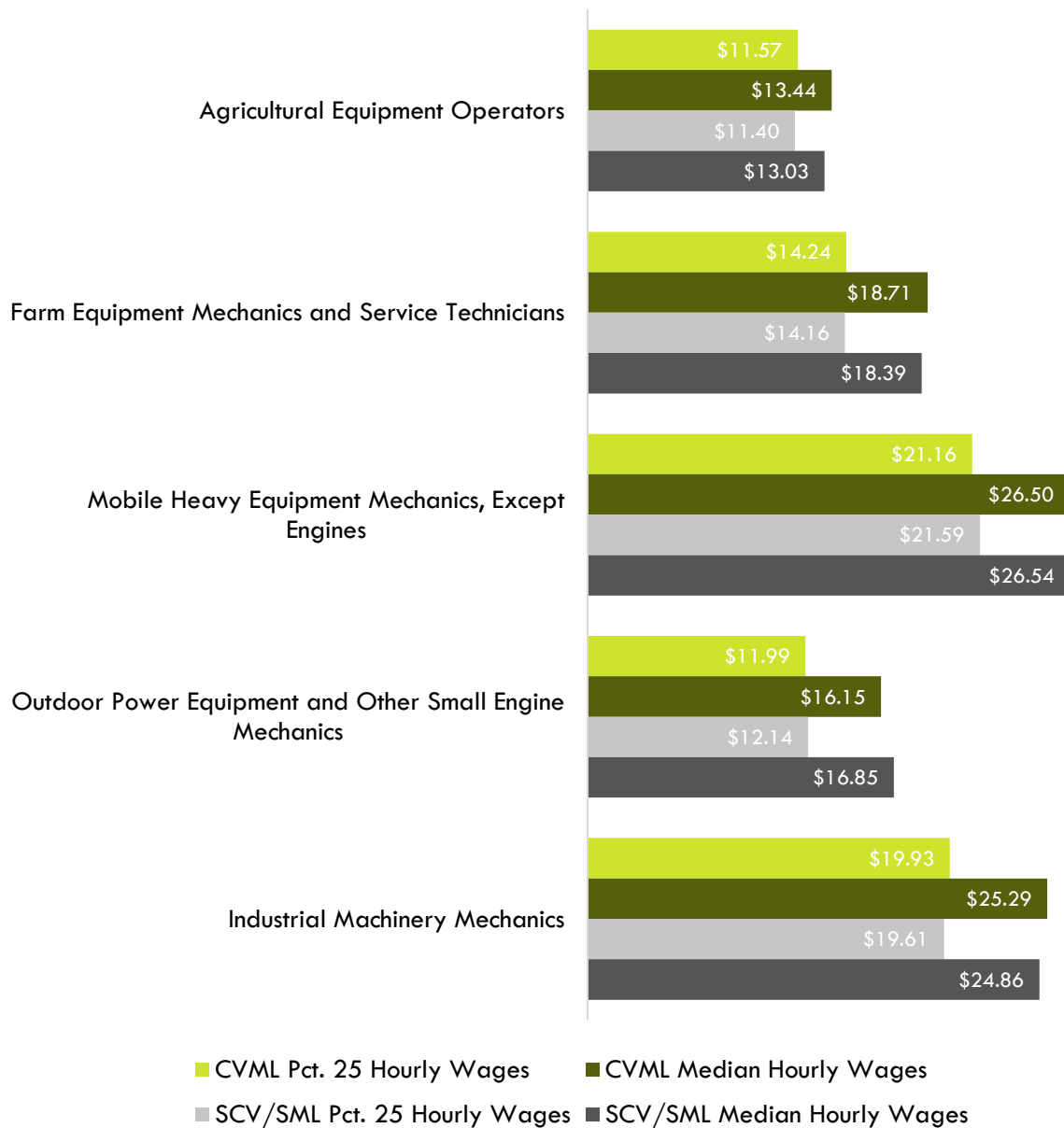
OCCUPATION	2017 JOBS	5-YEAR CHANGE	5-YEAR % CHANGE	ANNUAL OPENINGS
Agricultural Equipment Operators	4,913	317	6%	839
Industrial Machinery Mechanics	3,458	210	6%	345
Mobile Heavy Equipment Mechanics, Except Engines	1,435	14	1%	140
Farm Equipment Mechanics and Service Technicians	969	74	8%	109
Outdoor Power Equipment and Other Small Engine Mechanics	153	12	8%	19
TOTAL	10,929	625	6%	1,452



WAGES

Exhibit 4 compares the entry-level and experienced wages of the five mechanized agriculture occupations. The entry-level wages for all five occupations exceed the average self-sufficiency wage for a single adult in the eight-county subregion, \$10.29/hour. Entry-level wages are also higher than the average living wage for a single adult, \$11.32/hour, in the subregion.

EXHIBIT 4. Entry-level and experienced wage comparison in the region and subregion



JOB POSTINGS

There were 413 job postings for the five mechanized agriculture occupations in the seven counties of the South Central Valley/Southern Mother Lode subregion from September 2017 through August 2018. The top employers advertising for the 413 jobs are listed in Exhibit 5.

EXHIBIT 5. Top mechanized agriculture employers by number of job postings

EMPLOYER	JOB POSTINGS
US Air Force	13
Ahern Rentals	10
Lockheed Martin Corporation	9
Altec Industries	8
Bowlmor Amf	8

Exhibit 6 shows the job postings for the five mechanized agriculture occupations in the subregion. The majority of job postings were for industrial machinery mechanics, 236, followed by mobile heavy equipment mechanics (except engines), 160.

EXHIBIT 6. Occupational titles related to mechanized agriculture in job postings

OCCUPATION	JOB POSTINGS
Industrial Machinery Mechanics (49-9041.00)	236
Mobile Heavy Equipment Mechanics, Except Engines (49-3042.00)	160
Farm Equipment Mechanics and Service Technicians (49-3041.00)	13
Agricultural Equipment Operators (45-2091.00)	3
Outdoor Power Equipment and Other Small Engine Mechanics (49-3053.00)	1

JOB TITLES

Analysis of the 413 advertised job titles for the targeted occupations reveals that the top job titles are all mechanic related. Exhibit 7 shows the top job titles among the job postings.

EXHIBIT 7. Top mechanized agriculture job titles by number of job postings

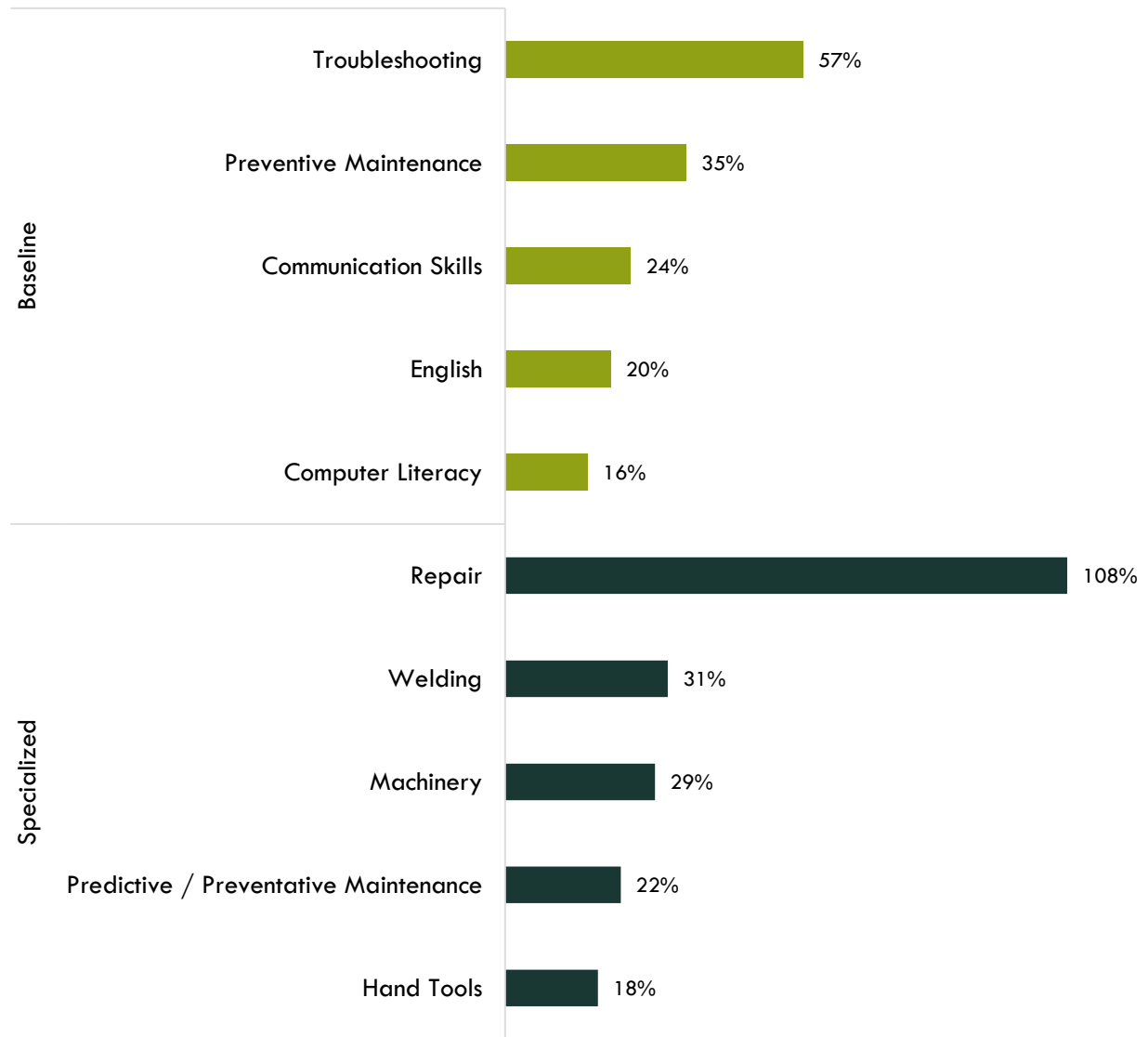
TITLE	JOB POSTINGS
Maintenance Mechanic	119
Mechanic	106
Equipment Mechanic	69
Heavy Equipment Mechanic	34
Industrial Maintenance Mechanic	14

SKILLS

Exhibit 8 depicts the top baseline and specialized skills for the five mechanized agriculture occupations. Roughly 90% of the 413 job postings contained skills data.

Of the 365 job postings with skills data, the three most important baseline skills are troubleshooting 57% of job postings, preventative maintenance, 35%, and communication, 24%. The top three specialized skills are repair, 108% of job postings (listed multiple times in single postings), welding, 31%, and machinery, 29%.

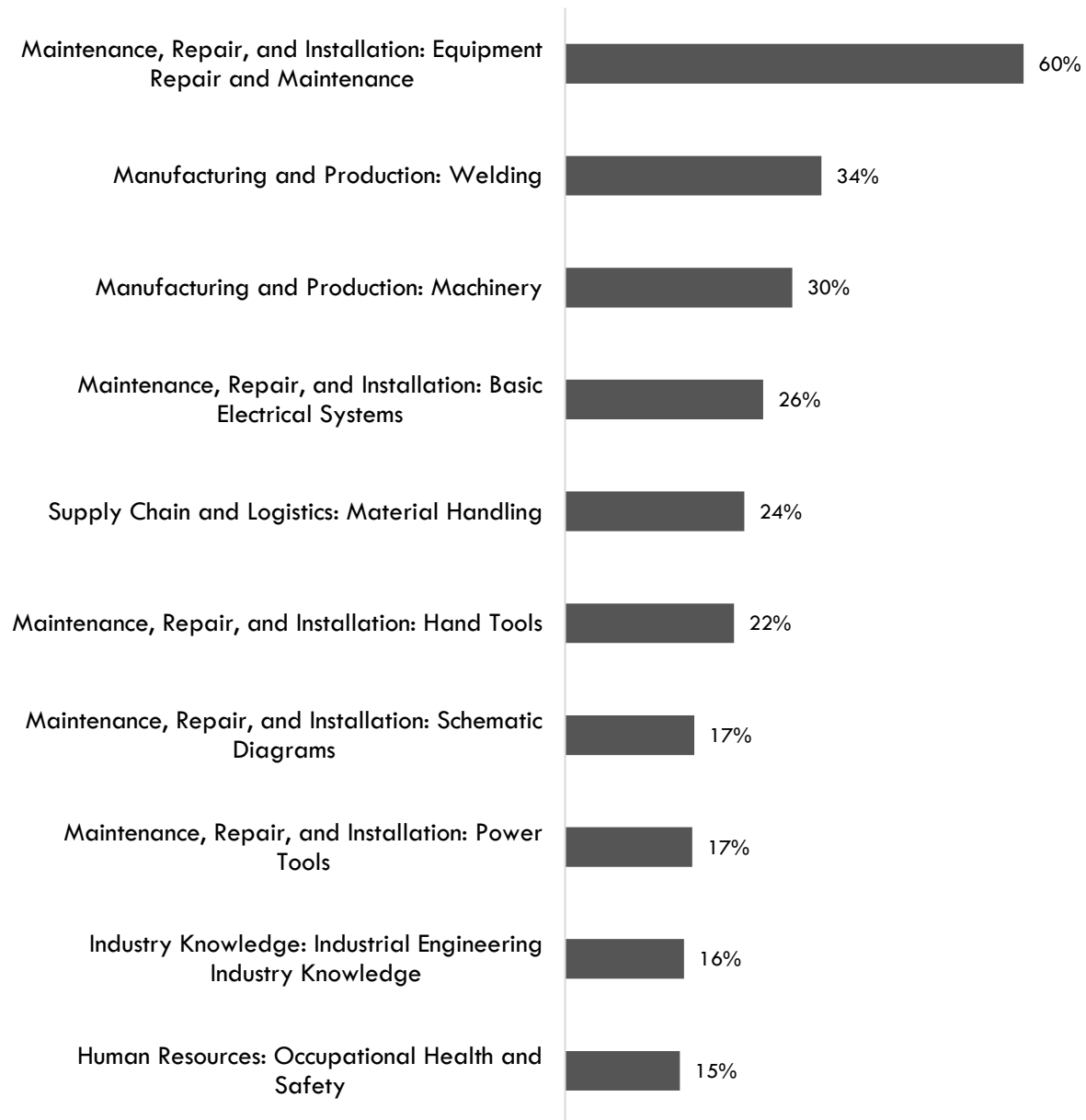
EXHIBIT 8. Top baseline and specialized skills for welders in job postings



SKILL CLUSTER PROJECTIONS

Nearly three-quarters of the job postings contain skill cluster projections data. An evaluation of the top skill clusters that will have the greatest gains in level of importance shows that the top area is maintenance, repair and installation: equipment repair and maintenance, 60% (Exhibit 9). Other clusters with large gain projections include manufacturing and production: welding (34%); manufacturing and production: machinery (30%); and maintenance, repair and installation: basic electrical systems (26%).

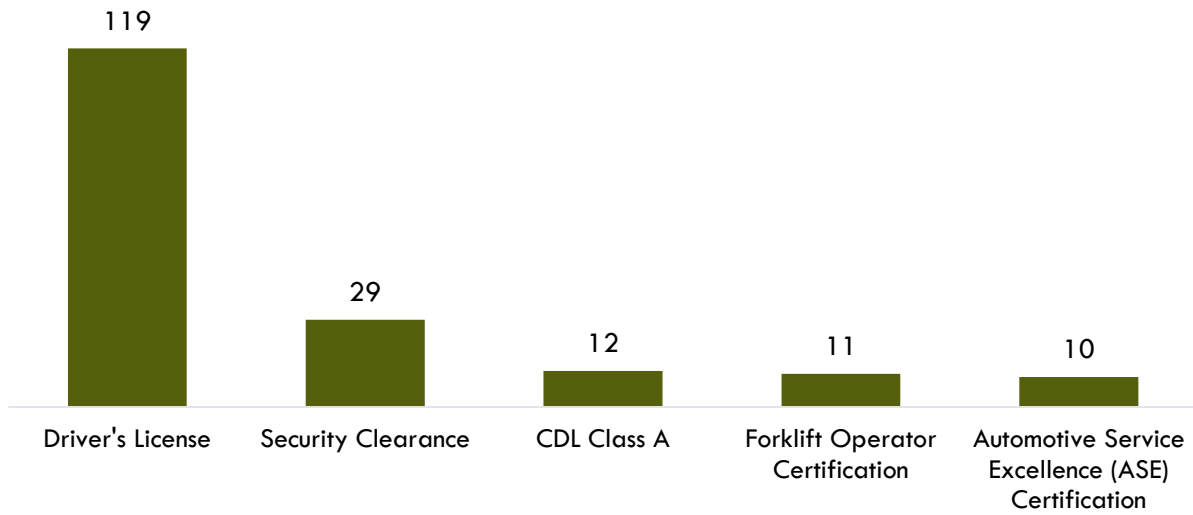
EXHIBIT 9. Skill cluster projections for mechanized agriculture occupations



CERTIFICATIONS

Of the 162 postings that contain certification data, 119 indicate a need for a driver's license. The next two top certifications are security clearance and CDL Class A (Exhibit 10).

EXHIBIT 10. Mechanized agriculture certifications requested in job postings



EDUCATION, WORK EXPERIENCE AND TRAINING

The typical entry-level education for agriculture equipment operators is no formal educational credential; this job is a below-middle-skill occupation (Exhibit 11).

The remaining four occupations—farm equipment mechanics and service technicians; mobile heavy equipment mechanics, except engines; outdoor power equipment and other small engine mechanics; and industrial machinery mechanics—require only a high-school diploma, but are considered middle-skill occupations. Beyond the need for on-the-job training, they qualify as relevant to community colleges due to one or more of the following requirements:

- State of California certification requirements,
- Specialized industry knowledge, and
- Performance of duties that are taught through programs offered by local community colleges.

EXHIBIT 11. Education, work experience, training and Current Population Survey results¹

OCCUPATION	TYPICAL ENTRY-LEVEL EDUCATION	WORK EXPERIENCE REQUIRED	TYPICAL ON-THE-JOB TRAINING	CPS
Agricultural Equipment Operators	No formal educational credential	None	Moderate-term	12.7%
Farm Equipment Mechanics and Service Technicians	HS diploma	None	Long-term	37.4%
Mobile Heavy Equipment Mechanics, Except Engines	HS diploma	None	Long-term	37.4%
Outdoor Power Equipment and Other Small Engine Mechanics	HS diploma	None	Moderate-term	35.7%
Industrial Machinery Mechanics	HS diploma	None	Long-term	41.4%

SUPPLY

Analysis of California Community Colleges Chancellor’s Office Curriculum Inventory (COCI) program data shows there are six community colleges in the region offering a total of 30 programs (seven degree programs and 23 certificate programs). The colleges offering programs are:

- Bakersfield
- Merced
- Modesto Junior
- Reedley
- San Joaquin Delta
- Sequoias

¹ “Labor Force Statistics from the Current Population Survey,” Bureau of Labor Statistics, <https://www.bls.gov/cps/>.

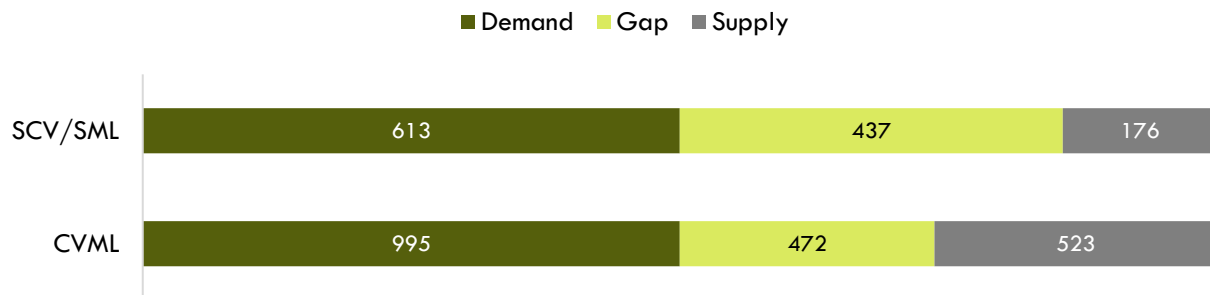
Analysis of the last three years of TOP code data, from 2014 through 2017, showed that, on average, 23 non-credit awards, 245 certificates and 16 degrees were conferred in the Central Valley/Mother Lode region each year (Exhibit 12). Porterville’s program is not listed in the COCI data.

EXHIBIT 12. Community college supply for mechanized agriculture in the subregion and region

TOP TITLE-CODE	COLLEGE	2014-17 AVERAGE ANNUAL AWARDS			
		NON-CREDIT	CERTIFICATE	DEGREE	SUBTOTAL
Agricultural Power Equipment Technology-011600	Merced		42	4	46
	Modesto Junior		18	4	23
	Reedley		117	3	120
	San Joaquin Delta		4		4
	Sequoias		1	1	2
	Diesel Technology-094700	San Joaquin Delta		9	1
Manufacturing and Industrial Technology-095600	Bakersfield		1	2	2
	Fresno City	23	3	2	28
	Modesto Junior		3		3
	Porterville		24		24
	Reedley		0		0
	TOTAL		23	222	16

Even with the below middle-skill occupation of agriculture equipment operators removed from the demand total, an undersupply of mechanized agriculture workers appears to exist in the region and subregion. In the subregion, there is a shortage of 437 trained workers. In the region, the shortage is 472 trained workers (Exhibit 13).

EXHIBIT 13. Mechanized agriculture workforce annual demand and supply in the subregion and region



STUDENT OUTCOMES

Exhibit 14 summarizes employment and wage outcomes for the California Community College Chancellor’s Office Cal-PASS Plus LaunchBoard for TOP code 011600. The 2015-16 data revealed that 51 students transferred after their community college studies, while 78% of respondents were employed in the second quarter after exit, and 73% attained a living wage.

Exhibit 14: Career Technical Education Outcomes Survey, Central Valley/Mother Lode²

METRIC	011600* AGRICULTURAL POWER EQUIPMENT TECHNOLOGY
Course Enrollments	1,455
Students Who Got a Degree or Certificate	99
Number of Students Who Transferred	51
Employed in the Second Fiscal Quarter after Exit	78% (n=209)
Attained a Living Wage	73% (n=134)

*** Top in the state across all above metrics for this TOP program!**

CONCLUSION

The entry-level wages for mechanized agriculture workers exceed the average self-sufficiency and living wages at the regional and subregional levels for a single adult. There were 413 job postings in the past 12 months for occupations related to mechanized agriculture in the South Central Valley/Southern Mother Lode subregion. Analysis of skills and certificate requirements in job postings indicates:

- The top baseline skill requirement is troubleshooting, and the top specialized skill is repair.
- The top certification is a driver’s license.

There are seven community colleges in the region offering a total of 30 programs with the TOP code 011600-Agriculture Power Equipment Technology in the region, but there remains an undersupply of trained workers, a shortage of 437 in the subregion and 472 in the region.

RECOMMENDATION

It is recommended that Bakersfield College work with the agriculture, water and environmental technologies deputy sector navigator, the college’s advisory board and local industry in the expansion or addition of a mechanized agriculture program.

² The Cal-PASS LaunchBoard is a California Community College Chancellor’s Office dashboard that compiles management information system, unemployment insurance supply and EMSI demand data. Detailed information can be obtained by following this link: <https://doingwhatmatters.cccco.edu/LaunchBoard.aspx>.

APPENDIX A: METHODOLOGY & DATA SOURCES

DATA SOURCES

Labor market and educational supply data compiled in this report derive from a variety of sources. Data were drawn from external sources, including the Economic Modeling Specialists, Inc., the California Community Colleges Chancellor's Office Management Information Systems Data Mart and the National Center for Educational Statistics (NCES) Integrated Postsecondary Education Data System (IPEDS). Below is the summary of the data sources found in this study.

DATA TYPE	SOURCE
Labor Market Information/Population Estimates and Projections/Educational Attainment	Economic Modeling Specialists, Intl. (EMSI). EMSI occupational employment data are based on final EMSI industry data and final EMSI staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates also affected by county-level EMSI earnings by industry: economicmodeling.com .
Living Wage	A living wage calculator that estimates the cost of living in a specific community or region: livingwage.mit.edu .
Typical Education Level and On-the-job Training	Bureau of Labor Statistics (BLS) uses a system to assign categories for entry-level education and typical on-the-job training to each occupation for which BLS publishes projections data: www.bls.gov/emp/ep_education_tech.htm .
Labor Force, Employment and Unemployment Estimates	California Employment Development Department, Labor Market Information Division, labormarketinfo.edd.ca.gov
Job Posting and Skills Data	Burning Glass, http://www.burning-glass.com/
Additional Education Requirements/ Employer Preferences	The O*NET Job Zone database includes over 900 occupations as well as information on skills, abilities, knowledge, work activities and interests associated with specific occupations: www.onetonline.org

KEY TERMS AND CONCEPTS

Annual Job Openings: Annual openings are calculated by dividing the number of years in the projection period by total job openings.

Education Attainment Level: The highest education attainment level of workers age 25 years or older.

Employment Estimate: The total number of workers currently employed.

Employment Projections: Projections of employment are calculated by a proprietary Economic Modeling Specialists, Intl. (EMSI) formula that includes historical employment and economic indicators along with national, state and local trends.

Living Wage: The cost of living in a specific community or region for one adult and no children. The cost increases with the addition of children.

Occupation: An occupation is a grouping of job titles that have a similar set of activities or tasks that employees perform.

Percent Change: Rate of growth or decline in the occupation for the projected period; this does not factor in replacement openings.

Replacements: Estimate of job openings resulting from workers retiring or otherwise permanently leaving an occupation. Workers entering an occupation often need training. These replacement needs, added to job openings due to growth, may be used to assess the minimum number of workers who will need to be trained for an occupation.

Total Job Openings (New + Replacements): Sum of projected growth (new jobs) and replacement needs. When an occupation is expected to lose jobs, or retain the current employment level, number of openings will equal replacements.

Typical Education Requirement: represents the typical education level most workers need to enter an occupation.

Typical On-The-Job Training: indicates the typical on-the-job training needed to attain competency in the skills needed in the occupation.

Wages Family Compositions: The living wage calculator estimates the living wage needed to support families. For single adult families, the adult is assumed to be employed full time. For two adult families where both adults are in the labor force, both adults are assumed to be employed full time. For two adult families where one adult is not in the labor force, one of the adults is assumed to be employed full time while the other non-wage-earning adult provides full-time child care for the family's children. Full-time work is assumed to be year-round, 40 hours per week for 52 weeks, per adult. Families with one child are assumed to have a 'young child' (4 years old). Families with two children are assumed to have a 'young child' and a 'child' (9 years old). Families with three children are assumed to have a 'young child,' a 'child,' and a 'teenager' (15 years old).