



CENTERS OF EXCELLENCE  
Inform Connect Advance

SERIES: 1 OF 6

# ADVANCED MANUFACTURING CLUSTER: WORKFORCE NEEDS ASSESSMENT

## SACRAMENTO CAPITAL REGION



**October 2015**

Prepared by: Centers of Excellence,  
Los Rios Community College District

Valley Vision

Burris Service Group

This research was conducted with the generous  
support of JPMorgan Chase & Co.

JPMORGAN CHASE & CO.

**Burris Service Group**



# TABLE OF CONTENTS

<b>Introduction</b> .....	<b>3</b>
<b>Cluster Definition</b> .....	<b>4</b>
<b>Establishments</b> .....	<b>5</b>
<b>Concentration of Employment</b> .....	<b>6</b>
<b>Trends and Projections</b> .....	<b>7–8</b>
<b>Earnings</b> .....	<b>9</b>
<b>Shift Share Analysis</b> .....	<b>10</b>
<b>Economic Impact</b> .....	<b>11–12</b>
<b>Economic Leakage</b> .....	<b>13</b>
<b>Challenges and Opportunities</b> .....	<b>13–14</b>
<b>Occupation Overview</b> .....	<b>15</b>
<b>Occupation Demand</b> .....	<b>15–17</b>
<b>Occupational Wages</b> .....	<b>18</b>
<b>Education Assessment</b> .....	<b>19–20</b>
<b>Skills Assessment</b> .....	<b>21</b>
<b>Summary</b> .....	<b>22–23</b>
<b>Appendix A: Advanced Manufacturing Cluster Definition</b> .....	<b>24–26</b>

## ***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.

© 2015 Chancellor’s Office California Community Colleges  
Economic and Workforce Development Program

*Please consider the environment before printing. This document is designed for double-sided printing.*

# INTRODUCTION

Starting in 2008, the six-county Sacramento Capital region (El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba counties) was rocked by the global recession, losing 10 percent of the region's jobs. In response, regional leaders initiated Next Economy, an action plan to accelerate job creation and new investment in six high-growth business (industry) clusters. Valley Vision, a regional civic leadership organization, managed the three-year Next Economy design, research and implementation process on behalf of a wide range of private and public sector partners.

As of late 2015, after a lagging recovery, the region's economy is picking up momentum, with the unemployment rate decreasing while job growth accelerating. Valley Vision received funding from JPMorgan Chase & Co. to better understand how the region's key growth industry clusters have changed since the original Next Economy research was conducted in 2012, and what new opportunities are emerging. Valley Vision is partnering with the Los Rios Center of Excellence and the Burris Service Group on this effort.

Cluster research is a widely accepted standard of practice for developing regional prosperity strategies to address multiple facets of a region's complex economy. Industry clusters reduce operating costs by shortening supply chains; increasing the flow of information regarding new business opportunities; concentrating workforce training needs in select occupations; and speeding up the identification of gaps in products or services. Firms in identified clusters may also have a reduced risk of failure, as these firms are better supported by the supply chain and can respond more rapidly to shifts in the marketplace.

This report presents findings on the analysis of the Advanced Manufacturing cluster. It is the first in a series covering the six Next Economy-identified clusters. Additional reports are forthcoming in the areas of the "clean economy," education and knowledge creation, food and agriculture, information and communications technologies, and life sciences and health services. Each report provides an overview of the cluster, industry trends and economic impact, as well as an overview of the top demand occupations in the cluster requiring postsecondary education or training, along with projected occupational demand, institutions providing related education and training, and possible workforce gaps.

This research will be used to develop cluster-based workforce action plans. Valley Vision will work alongside regional education, and workforce and economic development partners to convene six cluster-based employer forums, setting priorities and developing strategies to address critical workforce gaps, better align education and workforce development resources to meet employer and workforce needs, and strengthen the regional economy overall.



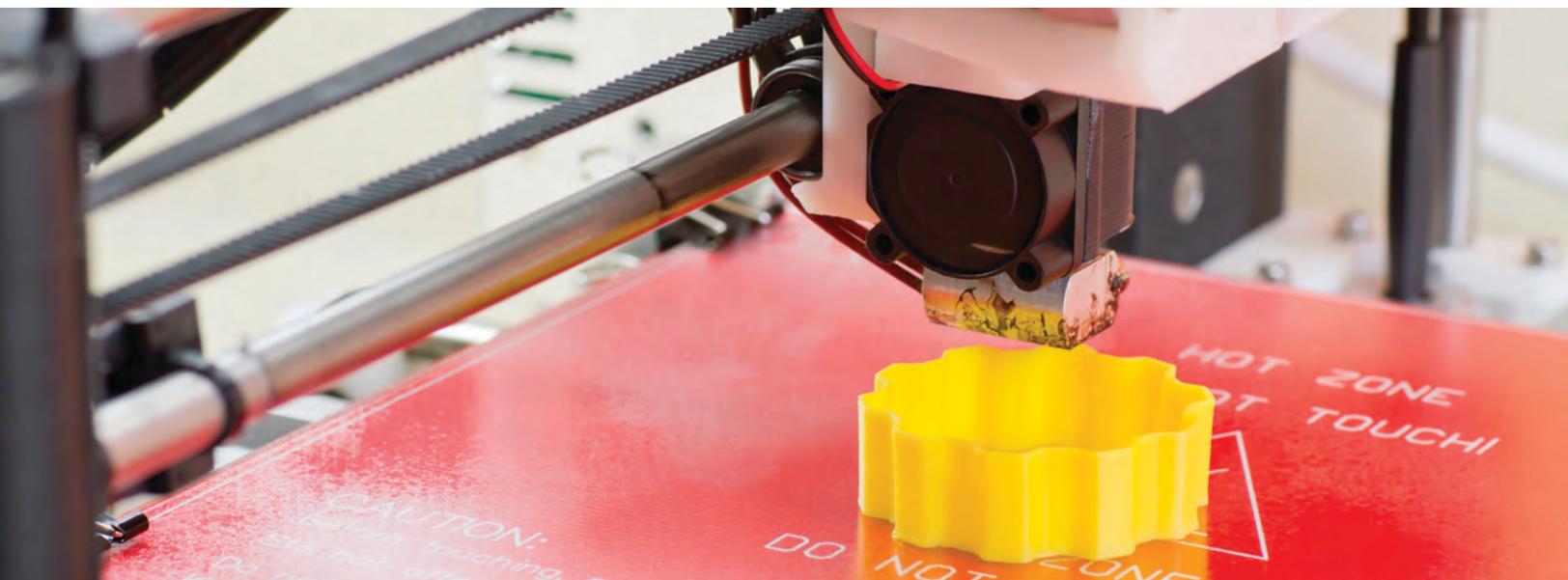
<sup>1</sup> Cluster Manufacturing: A Supply Chain Perspective

<sup>2</sup> Sacramento Area Council of Governments (SACOG) is the principal researcher for the Agriculture Cluster study, which will focus primarily on industry trends and excludes workforce development and training needs.

# CLUSTER DEFINITION

Advanced manufacturing is a process that integrates the coordinated use of information, automation, software, sensing and networking to improve the efficiency and reduce costs of manufacturing.<sup>3</sup> Although advanced manufacturing methods may be utilized by any manufacturing industry, high use of these methods tends to cluster in the following six subsectors:<sup>4</sup>

- **Aerospace Manufacturing** – firms that manufacture or assemble complete aircraft, aircraft engine, engine parts, aircraft parts, guided missiles, space vehicles, auxiliary equipment, and search, detection and navigation instruments. Support firms that provide expertise in design and production in areas such as precision tuning, control systems, and fluid power valve design are also included in this cluster.
- **Chemical Manufacturing** – firms that manufacture industrial chemicals, fertilizers/pesticides, and miscellaneous chemical products.
- **Computers/Electronics Manufacturing** – firms that manufacture computer and peripheral equipment, communications equipment, audio and video equipment, semiconductors, electronic components, and measuring, electromedical, and control instruments. This cluster also includes firms that manufacture and produce magnetic and optical media.
- **Machinery Manufacturing** – firms that manufacture agriculture, construction, and mining machinery; industrial machinery; commercial and service industry machinery; ventilation, heating, air-conditioning, and commercial refrigeration equipment; metalworking machinery; engine, turbine, and power transmission equipment; and other general purpose machinery.
- **Plastic Products Manufacturing** – firms that engage in manufacturing plastic products, such as plastic bags, packaging film, polystyrene foam products, and plastic bottles. This cluster also includes chemical industries that support plastic production.
- **Transportation Manufacturing** – firms that engage in manufacturing motor vehicles, trailers, and related parts; railroad rolling stock; ships and boats; and other transportation equipment. This cluster also includes supportive industries such as oils/lubricants and component parts.



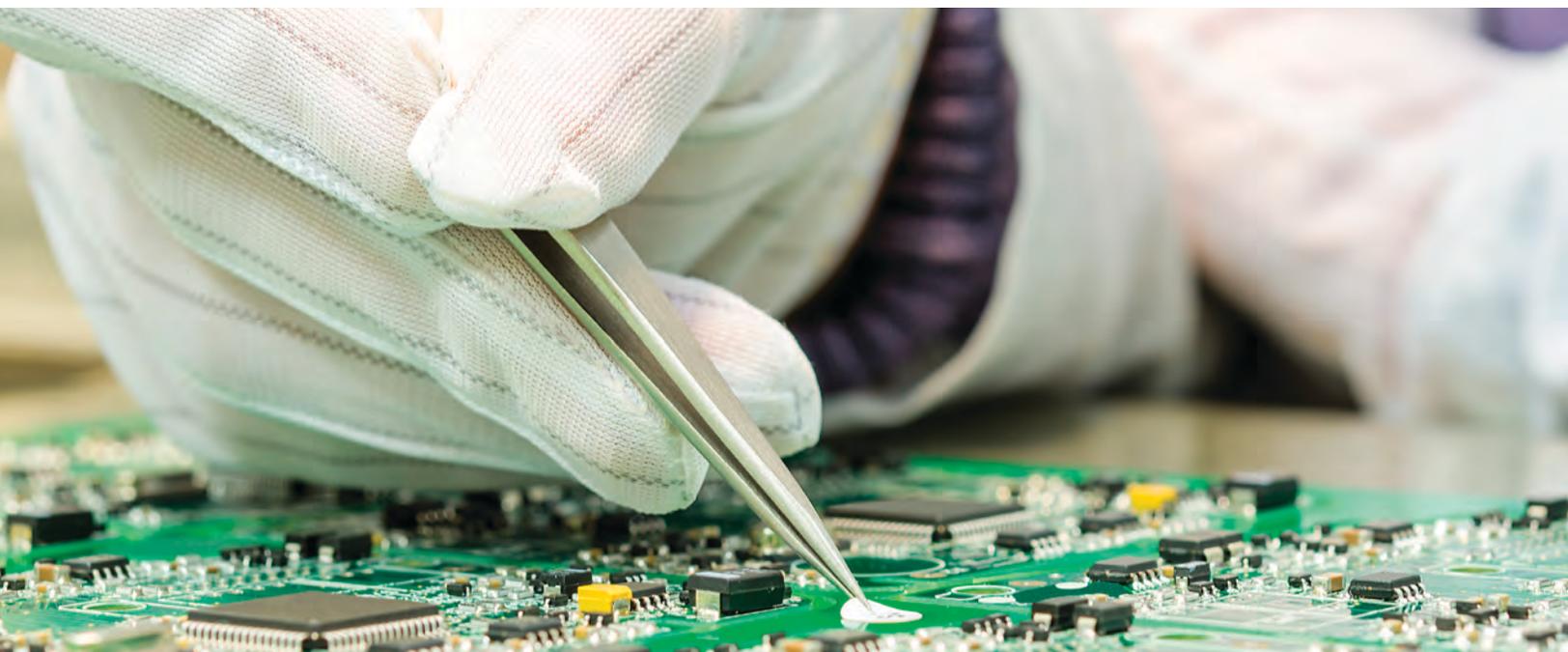
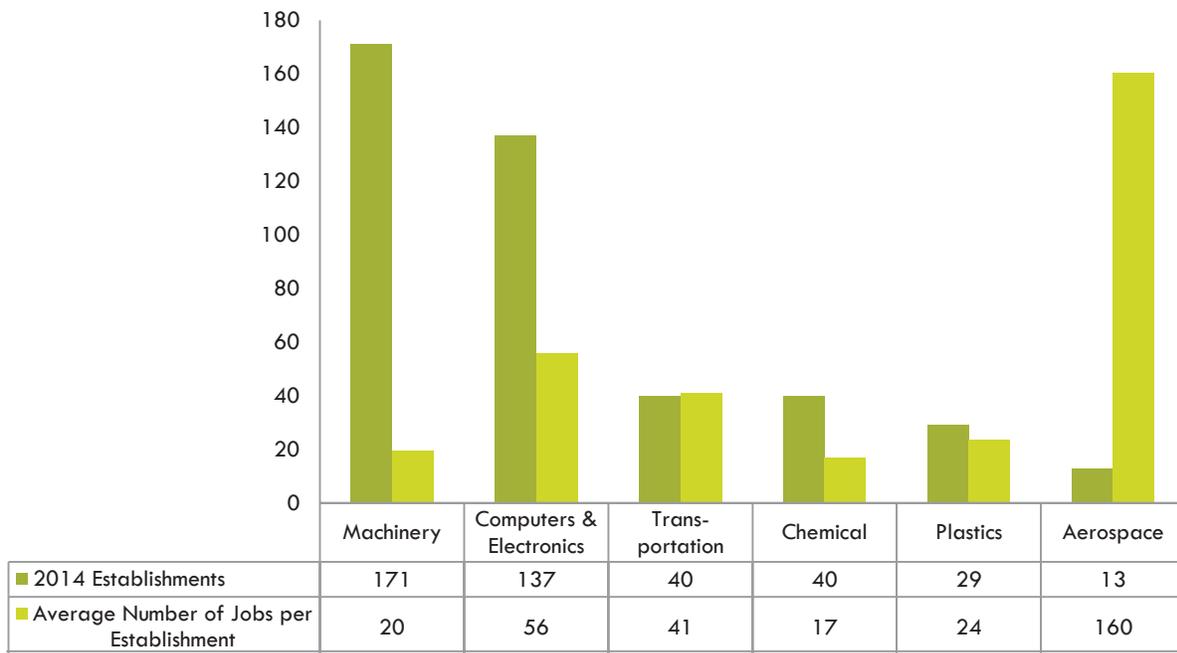
<sup>3</sup> Advanced Manufacturing Portal: [manufacturing.gov](http://manufacturing.gov).

<sup>4</sup> Establishments that use advanced manufacturing processes can be found in any manufacturing subsector. Subsectors that are known to have infrequent use of advanced manufacturing techniques were excluded from the analysis. Food processing which may represent a significant number of establishments that utilize advanced manufacturing techniques was excluded from the analysis to avoid duplication of industry employment counts published in the agriculture supply chain cluster study.

# ESTABLISHMENTS

Exhibit 1 displays establishments and the average number of jobs per establishment for the advanced manufacturing subsectors in the Sacramento Capital region. As shown, the machinery subsector has the most firms, with a low number of workers per establishment compared to other subsectors in the region. The computer and electronic subsector is the second largest subsector in terms of total establishments, and it has a relatively high number of workers per establishment. Aerospace has the fewest establishments and the highest average number of jobs per establishment, most likely due to the dominance of Aerojet Rocketdyne, a large aerospace firm located in Rancho Cordova.

**Exhibit 1: Establishments and Average Employment by Subsector, 2014<sup>5</sup>**



<sup>5</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# CONCENTRATION OF EMPLOYMENT

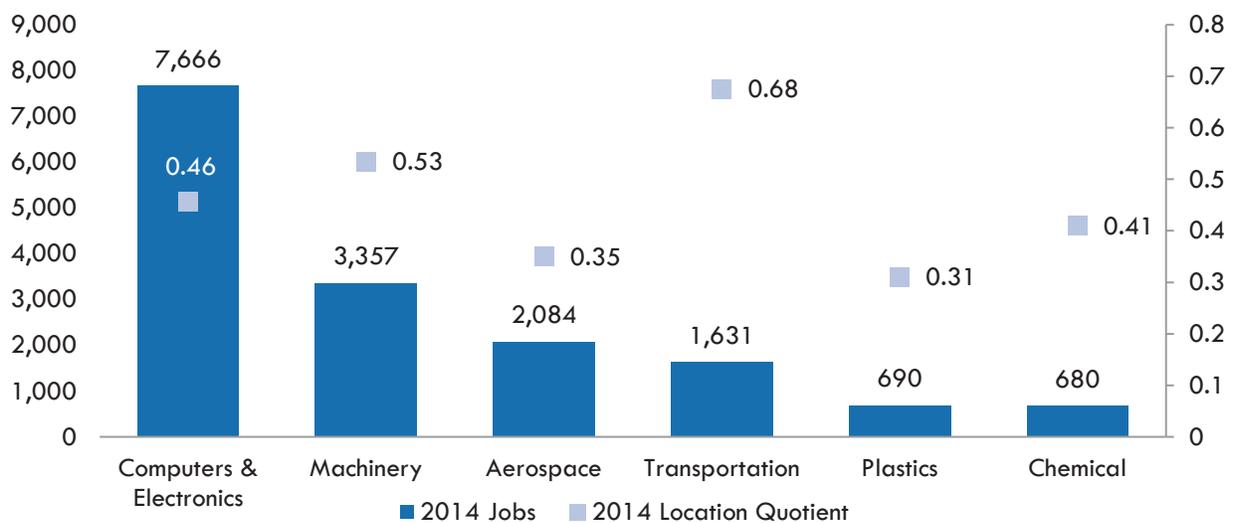
In 2014, there were about 16,100 advanced manufacturing jobs, 42 percent of the total manufacturing employment and 1.5 percent of the total employment in the Sacramento Capital region. As shown in Exhibit 2, the majority of advanced manufacturing jobs were in computer and electronic product manufacturing (48%; 7,666 jobs), followed by machinery (21%; 3,357 jobs) and aerospace (13%; 2,084 jobs).

Location quotient analysis compares the total employment in a region relative to the total employment in a larger area—in this case, California. A location quotient of less than one indicates a lower concentration of employment for that industry in the region than in the state overall. A location quotient of more than one indicates a higher concentration of employment for the region than in the state overall. All of the advanced manufacturing subsectors in the Sacramento Capital region have a location quotient that is less than one, indicating a lower concentration of employment compared to other areas of the state.

Within the subsectors, there are industries with above average location quotients, indicating a high concentration of employment for those industries than in the state overall. These include:

- **Computers & Electronics:** computer terminal and other computer peripheral equipment manufacturing (6.52 LQ); electronic computer manufacturing (2.9 LQ); carbon and graphite product manufacturing (2.81 LQ); switchgear and switchboard apparatus manufacturing (1.63 LQ) and audio and video equipment manufacturing (1.41 LQ).
- **Machinery:** printing machinery and equipment manufacturing (3.75 LQ); machine tool manufacturing (1.4 LQ); and packaging machinery manufacturing (1.25 LQ).
- **Aerospace:** guided missile and space vehicle propulsion unit and propulsion unit parts manufacturing (17.94 LQ); and guided missile and space vehicle manufacturing (1.2 LQ).
- **Transportation:** railroad rolling stock manufacturing (3.45 LQ) and travel trailer and camper manufacturing (1.22).
- **Plastics:** plastics packaging film and sheet (including laminated) manufacturing (1.87 LQ).
- **Chemical:** printing ink manufacturing (1.57 LQ).

**Exhibit 2: Total Employment and Location Quotient by Subsector, 2014<sup>6</sup>**

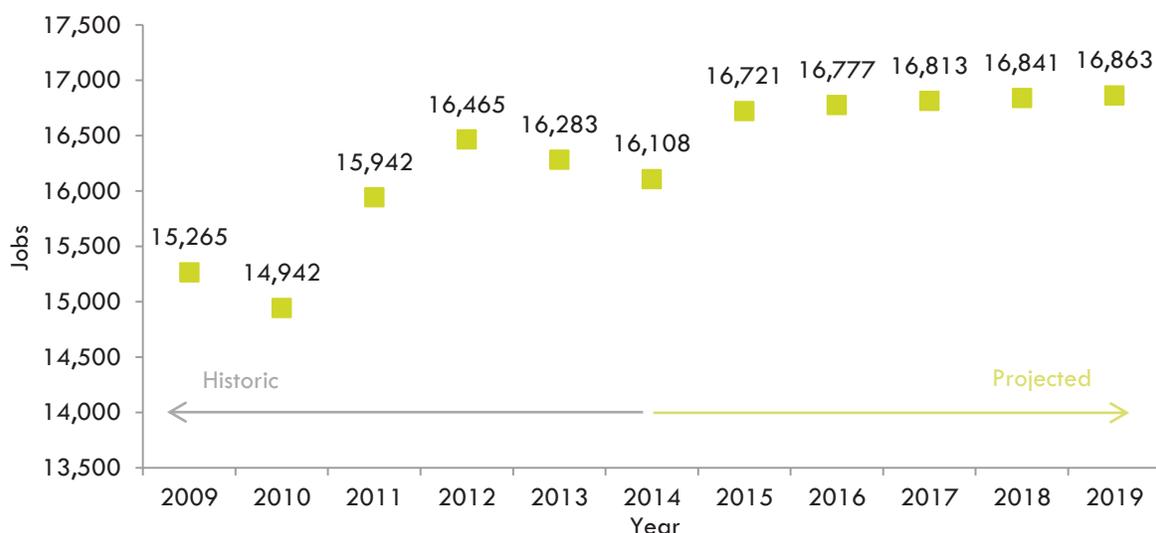


<sup>6</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# TRENDS AND PROJECTIONS

During the recession, the Advanced Manufacturing cluster declined significantly, shedding 1,770 jobs in three years (2007–09). However, in 2010, the cluster started to rebound. Over the next five years, the Advanced Manufacturing cluster is projected to grow moderately, adding as many as 755 jobs by 2019. Aerospace is projected to add the most jobs, followed by machinery manufacturing and plastics. The computers and electronics subsector is expected to slightly decline with a loss of about 100 jobs over the next five years.<sup>7</sup>

## Exhibit 3: Employment Trends and Projections, 2009–2019<sup>8</sup>



## Exhibit 4: Employment Projections by Subsector, 2014–2019<sup>8</sup>

Advanced Manufacturing Subsector	2014 Jobs	2019 Jobs	Change	% Change
Aerospace	2,084	2,410	326	16%
Chemical	680	711	31	5%
Computers & Electronics	7,666	7,564	(102)	(1%)
Machinery	3,357	3,609	252	8%
Plastics	690	863	173	25%
Transportation	1,631	1,706	75	5%
<b>Total Advanced Manufacturing Jobs</b>	<b>16,108</b>	<b>16,863</b>	<b>755</b>	<b>5%</b>

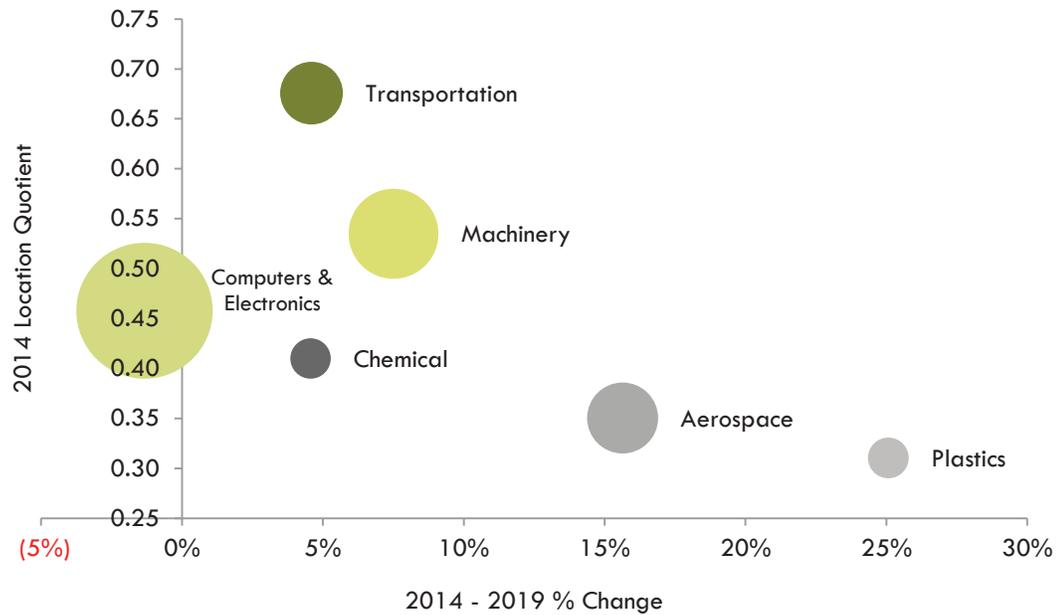
<sup>7</sup> Projection data indicates that the aerospace subsector is projected to add the most jobs over the next five years. However, recent articles in the Sacramento Business Journal report that Aerojet Rocketdyne, the largest aerospace business in the region, is reducing the size of its workforce. As such, the growth of this subsector may be less than projected by historic trends.

<sup>8</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# TRENDS AND PROJECTIONS

The bubble chart below compares the projected five-year growth rate to the concentration of employment in the region, where the size of the bubble indicates the total number of jobs for that subsector. While all of the advanced manufacturing subsectors in the Sacramento Capital region have a lower concentration of employment than the statewide average, some subsectors are closer to the average than others. The transportation and machinery subsectors have a higher location quotient than other subsectors and a moderate projected growth rate. Aerospace and plastics have a relatively low concentration of employment in the region but high projected growth rates when compared to the other subsectors.

**Exhibit 5: Growth Rate vs. Subsector Concentration<sup>9</sup>**

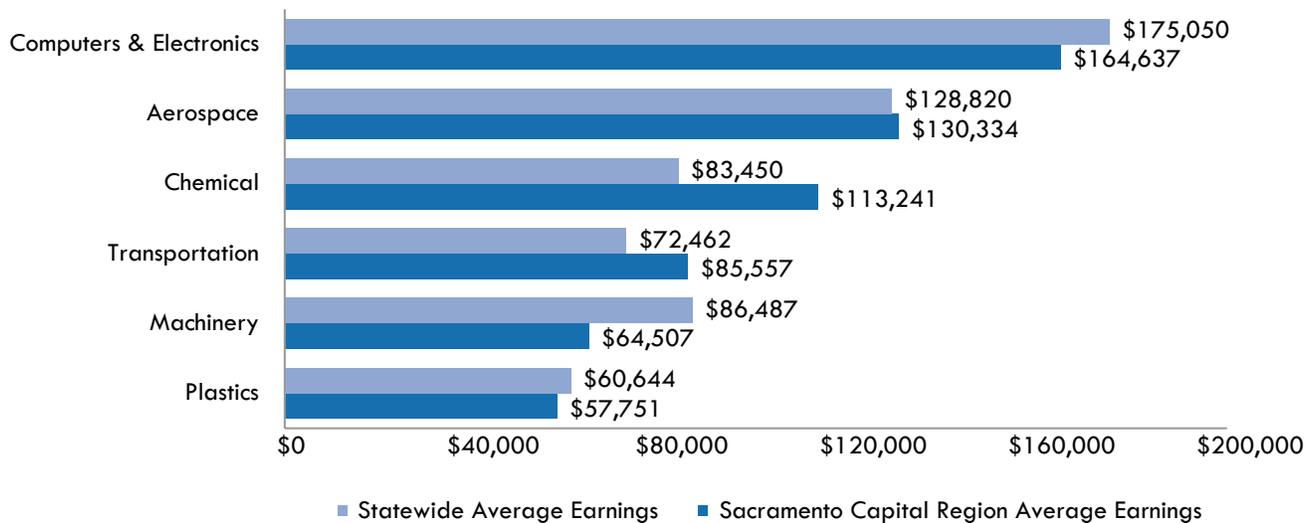


<sup>9</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EARNINGS

The computer and electronics subsector provides the best earnings in the Sacramento Capital region, followed by aerospace and chemical product manufacturing. The earning calculation includes an average of all wages, salaries, proprietor earnings and supplemental earnings (such as retirement benefits, bonuses, etc.) for all occupations in the sector. All of the subsectors, with the exception of plastics, provide earnings above the average earnings across all industries in the Sacramento Capital region.<sup>10</sup>

## Exhibit 6: Earnings by Manufacturing Subsector, 2014<sup>11</sup>



<sup>10</sup> The average earnings across all industries in the Sacramento Capital region is \$63,377.

<sup>11</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# SHIFT SHARE ANALYSIS



Shift share analysis is a method for determining how much of regional job growth can be attributed to national trends and how much is due to unique regional factors. Exhibit 7 displays four key components:

- **Industrial Mix Effect** – represents the share of regional industry growth explained by the growth of the specific industry at the national level.
- **National Growth Effect** – represents how much of the regional industry's growth is explained by the overall growth of the national economy. Given that the nation's economy is growing, it is normal to see positive change in each subsector.
- **Expected Change** – the change expected due to national growth effect and industry mix effects.
- **Regional Competitive Effect** – explains how much of the change in the subsectors is due to some unique competitive advantage that the region possesses, because the growth cannot be explained by national trends in the industry or the economy as a whole.

Five of the six subsectors are outperforming national trends (both overall national trends and national trends in the specific subsectors), while transportation is underperforming compared to national trends. This suggests that the region has a competitive advantage in the Advanced Manufacturing cluster compared to other areas of the nation.

## Exhibit 7: Shift Share Analysis by Subsector, 2013–2018<sup>12</sup>

	Industrial Mix Effect	National Growth Effect	Expected Change	Regional Competitive Effect
Aerospace	(360)	133	(227)	553
Chemical	(48)	43	(5)	35
Computers & Electronics	(881)	487	(394)	293
Machinery	(226)	213	(13)	264
Plastics	25	44	69	105
Transportation	(12)	104	92	(17)

<sup>12</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# ECONOMIC IMPACT

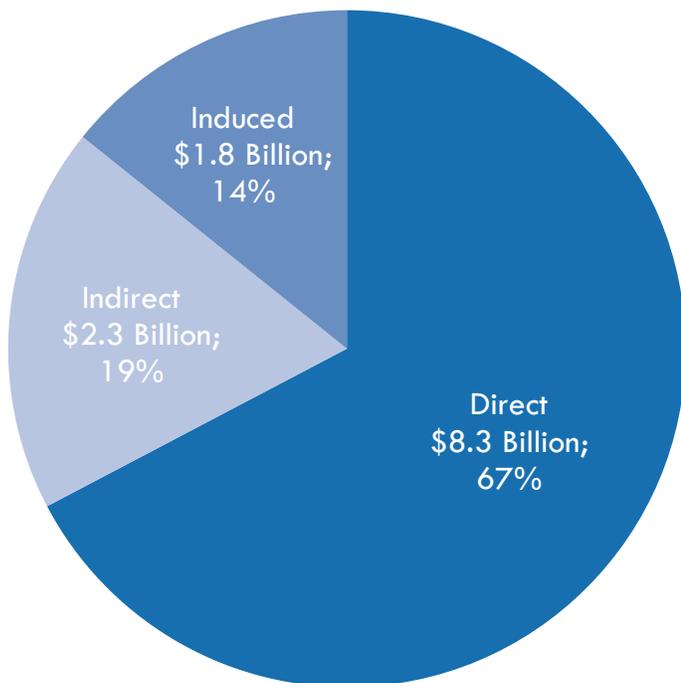
Economic impact provides a quantitative method to estimate the total economic benefit from a project, or in this case, an industry cluster. In other words, it is the “ripple effect” of all economic activities resulting from that cluster. Impact analysis is typically comprised of direct, indirect and induced impacts:

- Direct impacts are those resulting from the expenditures of operations within that industry cluster.
- Indirect impacts are those resulting from suppliers of that cluster spending money and hiring employees.
- Induced impacts are the combined value of employees of the industry cluster spending money at a household level.

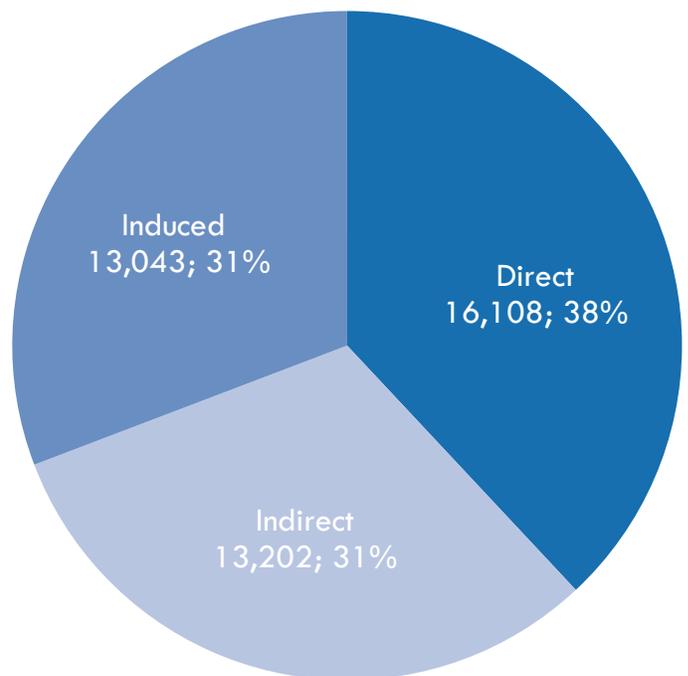
Combined, these three variables equate to the total economic impact of a project or industry cluster.

The Advanced Manufacturing cluster impacts the Sacramento Capital region’s economy in several ways. The IMPLAN input-output model was used to measure the cluster’s total economic impacts.<sup>13</sup> First, the cluster directly benefits the economy through the operations and jobs supported by the establishments within its subsectors. Exhibits 8 and 9 show that the Advanced Manufacturing cluster directly contributes over \$8.3 billion in output and 16,000 jobs to the regional economy. In addition to this direct effect, these establishments generate an indirect impact through their supplier purchases—around \$2.3 billion in output and 13,000 jobs are created within sectors that generally supply this cluster. Finally, the Advanced Manufacturing cluster creates an induced effect of almost \$1.8 billion and approximately 13,000 jobs as a result of consumption activities within the local economy of both direct (cluster) and indirect (supplier) employees.

**Exhibit 8: Total Output Impacts<sup>14</sup>**



**Exhibit 9: Total Employment Impacts<sup>14</sup>**



<sup>13</sup> IMPLAN is input-output modeling system used to conduct economic analysis.

<sup>14</sup> IMPLAN: 2013 data supplemented with EMSI data.

# ECONOMIC IMPACT

The Advanced Manufacturing cluster contributes a total of \$12.4 billion in output, more than 42,000 jobs and \$3.3 billion in labor income. Exhibit 10 breaks down the employment impacts by each subsector within the Advanced Manufacturing cluster and by output, employment, and labor income (which includes all forms of employment income, including employee compensation and proprietor income). With about \$7.1 billion in output, 23,000 jobs, and \$1.9 billion in labor income, the computers and electronics subsector, by far, accounts for the largest share of the cluster's total economic impacts while the plastics subsector has the smallest share.

## Exhibit 10: Total Economic Impacts by Cluster Subsector<sup>15</sup>

	Direct	Indirect	Induced	Total
<b>Output</b>				
<b>Total</b>	<b>\$8,347,285,605</b>	<b>\$2,291,152,989</b>	<b>\$1,765,912,765</b>	<b>\$12,404,351,359</b>
Aerospace	\$757,451,735	\$149,331,040	\$219,653,590	\$1,126,436,365
Chemical	\$684,756,534	\$180,982,176	\$81,623,742	\$947,362,451
Computers & Electronics	\$4,752,630,388	\$1,342,687,005	\$1,044,749,216	\$7,140,066,609
Machinery	\$1,027,404,219	\$276,375,394	\$215,496,190	\$1,519,275,803
Plastics	\$231,389,984	\$52,409,098	\$38,065,334	\$321,864,415
Transportation	\$893,652,746	\$289,368,276	\$166,324,693	\$1,349,345,715
<b>Employment</b>				
<b>Total</b>	<b>16,108</b>	<b>13,202</b>	<b>13,043</b>	<b>42,353</b>
Aerospace	2,084	848	1,622	4,554
Chemical	680	994	603	2,277
Computers & Electronics	7,666	7,605	7,717	22,988
Machinery	3,357	1,710	1,592	6,658
Plastics	690	308	281	1,279
Transportation	1,631	1,737	1,229	4,596
<b>Total Labor Income</b>				
<b>Total</b>	<b>\$1,891,401,897</b>	<b>\$798,205,403</b>	<b>\$597,013,936</b>	<b>\$3,286,621,236</b>
Aerospace	\$276,493,645	\$59,169,162	\$74,253,710	\$409,916,516
Chemical	\$62,219,040	\$62,245,734	\$27,594,309	\$152,059,083
Computers & Electronics	\$1,130,725,534	\$459,711,044	\$353,209,954	\$1,943,646,532
Machinery	\$230,027,954	\$97,913,785	\$72,855,596	\$400,797,335
Plastics	\$40,220,556	\$17,761,606	\$12,868,960	\$70,851,122
Transportation	\$151,715,169	\$101,404,071	\$56,231,407	\$309,350,647

<sup>15</sup> IMPLAN, 2013 data supplemented with EMSI data.

# ECONOMIC LEAKAGE

Supply chain leakage is a primary factor in determining the value of an industry multiplier used to define the total “ripple effect” of that industry cluster. Stronger supply chain linkages, better described as a cluster using more locally sourced products and services, has a reciprocal benefit of lower leakage, increasing the multiplier and the total impact on the surrounding economy.

It was determined through an in-depth analysis of the advanced manufacturing industry cluster and its subsets, that there is a relatively high level of supply chain leakage, roughly 68 percent. Conversely, 32 percent of goods and services supporting the industry cluster are purchased within the region.<sup>16</sup>

## CHALLENGES AND OPPORTUNITIES

The manufacturing sector has had a tumultuous history in the Sacramento Capital region. To encourage growth, the Advanced Manufacturing cluster must address a variety of challenges, from navigating a complex regulatory environment to developing strategies to compete with low-cost economies. National, state and local legislators can support the cluster by developing and adopting policies that eliminate barriers to success, creating incentives for local production, and reducing supply chain leakage. This section of the report reviews some of the cluster’s major challenges, as well as a few opportunities that may help drive regional growth in the future.

### Challenges

There are a number of factors that have inhibited the manufacturing sector’s ability to compete locally and internationally. Some of these challenges include:

- **Complex regulatory environment.** Employers have communicated that California’s complex regulatory climate is difficult, expensive and time-consuming to navigate, such as conducting environmental impact studies or obtaining permits.
- **International competition from low-cost economies** such as China, Singapore, South Korea, Russia, etc. According to a recent study, California manufacturing firms have:<sup>17</sup>
  - Higher health care expenditures compared to countries where health care is paid for by general tax revenues;
  - Higher salaries and other benefits, such as paid leave, insurance, and retirement plans;
  - Higher costs associated with litigation claims;
  - Higher costs associated with environmental compliance;
  - Higher corporate tax rates than most other countries (the tax rate in the United States is 40 percent, the second highest tax rate among major trading partners).
- **U.S. competition.** In addition to international competition, California-based manufacturers are targets of state government programs to recruit manufacturers from California through incentive and off-set programs. These programs target high wage jobs that will most likely not return to California.
- **U.S. high school students lag** behind in math and science based on Program for International Student Assessment (PISA) test scores.<sup>18</sup>
- **U.S. manufacturers report a shortage of skilled production workers** (machinists, operators, craft workers, etc.) which is hindering their ability to expand operations or improve productivity.<sup>19</sup>

<sup>16</sup> IMPLAN, 2013 data supplemented with EMSI data.

<sup>17</sup> The Facts About Modern Manufacturing, 9th Edition, Manufacturing Institute, Manufacturers Alliance for Productivity and Innovation (MAPI), and National Association of Manufacturers.

<sup>18</sup> Manufacturing 2.0: A More Prosperous California, Milken Institute.

<sup>19</sup> Boiling Point? The Skills Gap in U.S. Manufacturing, Deloitte and Manufacturing Institute.

# CHALLENGES AND OPPORTUNITIES



## Opportunities

Competition from low-cost economies is one of the major challenges faced by the manufacturing sector. However, the total cost of outsourcing to other countries is often miscalculated. According to the Reshore Initiative, the sticker price provided by out-of-the-country manufacturing firms does not include costs associated with:

- National policy issues (trade negotiations, etc.)
- Changes in currency exchange rates
- Trade secret thefts
- Supply chain disruptions
- Lengthy delivery times
- Traveling to the manufacturing site to assess and resolving production issues

Further, in the last few years many countries have started to raise their prices to adjust for increases in wages and higher transportation/fuel expenses in their own country. By examining the total cost of outsourcing, the Reshore Initiative argues that hiring local production firms is just as price-sensitive as hiring firms from low-cost economies. Also, there are several benefits to working local, such as

- Improved quality and consistency of inputs;
- Ability to create just-in-time operations that reduce costs and improve business-to-business relations;
- A reduction of issues related to securing intellectual property;<sup>20</sup> and,
- Good public relations/marketing for “made in America” goals. As this viewpoint gains popularity, it may shift production back to the United States, creating jobs in the process.

The Sacramento Capital region offers several benefits to businesses that choose to locate their facilities in the region. Compared to other regions in the state, the Sacramento Capital region offers a lower cost of operations, lower cost of housing for employees, access to the Port of West Sacramento, Interstate 5 and Interstate 80 to keep shipping costs low, and access to local universities and colleges with established engineering programs to support research and development, as well as workforce needs. In addition, some manufacturers may find it beneficial to be located near the state’s capital to influence policy and regulatory issues.

<sup>20</sup> The Reshore Initiative: <http://www.reshorenow.org/>

# OCCUPATION OVERVIEW

Staffing patterns were utilized to identify the top 15 occupations in the Advanced Manufacturing cluster. Occupations selected for inclusion in the study had to meet the following criteria:

- Cluster businesses employ 100 or more workers in the occupation.
- The percent of total jobs employed by the cluster is significant.
- The minimum education requirement is a high school diploma plus on-the-job training, postsecondary award, associate degree, or bachelor's degree.

Exhibit 11 displays the top occupations that meet the criteria, sorted by percent employed by cluster. As shown, the majority of semiconductor processors are employed by the advanced manufacturing sector, followed by computer-controlled machine tool operators and machinists. This report provides occupational data across all industries to provide a complete picture of the employment demand. Training requirements may vary depending on the industry that employs the occupation.

## Exhibit 11: Top 15 Occupations, 2014<sup>21</sup>

SOC	Description	Percent Employed by Cluster	Percent Employed by All Other Industries
51-9141	Semiconductor Processors	86%	14%
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	73%	27%
51-4041	Machinists	54%	46%
17-2061	Computer Hardware Engineers	47%	53%
51-9011	Chemical Equipment Operators and Tenders	45%	55%
17-2112	Industrial Engineers	35%	65%
17-2011	Aerospace Engineers	28%	72%
11-3051	Industrial Production Managers	26%	74%
17-3023	Electrical and Electronics Engineering Technicians	26%	74%
17-2141	Mechanical Engineers	23%	77%
51-4121	Welders, Cutters, Solderers, and Brazers	21%	79%
17-2071	Electrical Engineers	21%	79%
51-1011	First-Line Supervisors of Production and Operating Workers	17%	83%
17-2072	Electronics Engineers, Except Computer	17%	83%

# OCCUPATION DEMAND

Exhibit 12 displays the employment demand for the top occupations, across all industries. For each occupation, replacement estimates include retirements and general separations, but not turnover within the occupation. As such, replacements and new job growth combined is a good measure of demand for workers.

First-line supervisors of production and operating workers is the largest occupation in the group with the most annual openings over the next five years. Electrical engineers as well as welders are also large occupations with significant annual openings created by new job growth and replacement needs. Semiconductor processors is the only occupation in the group projected to decline; with a loss of three jobs over five years. While there is no new job growth for this occupation, there is a demand for replacement workers.

<sup>21</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# OCCUPATION DEMAND

## Exhibit 12: Employment Outlook, 2014–2019<sup>22</sup>

Description	2014 Jobs	2019 Jobs	2014–2019 Change	2014–2019 % Change	Total Replacements	Total Openings	Annual Openings
First-Line Supervisors of Production and Operating Workers	2,200	2,268	68	3%	192	260	52
Electrical Engineers	1,515	1,648	133	9%	178	311	62
Welders, Cutters, Solderers, and Brazers	1,389	1,503	114	8%	207	321	64
Mechanical Engineers	1,059	1,199	140	13%	199	339	68
Electronics Engineers, Except Computer	1,007	1,071	64	6%	115	179	36
Machinists	892	1,007	115	13%	123	238	48
Electrical and Electronics Engineering Technicians	811	859	48	6%	94	142	28
Computer Hardware Engineers	797	808	11	1%	134	145	29
Industrial Production Managers	681	708	27	4%	68	95	19
Industrial Engineers	542	635	93	17%	88	181	36
Aerospace Engineers	379	452	73	19%	49	122	24
Computer-Controlled Machine Tool Operators, Metal and Plastic	272	324	52	19%	43	95	19
Chemical Equipment Operators and Tenders	271	288	17	6%	60	77	15
Semiconductor Processors	146	143	(3)	(2%)	25	25	5

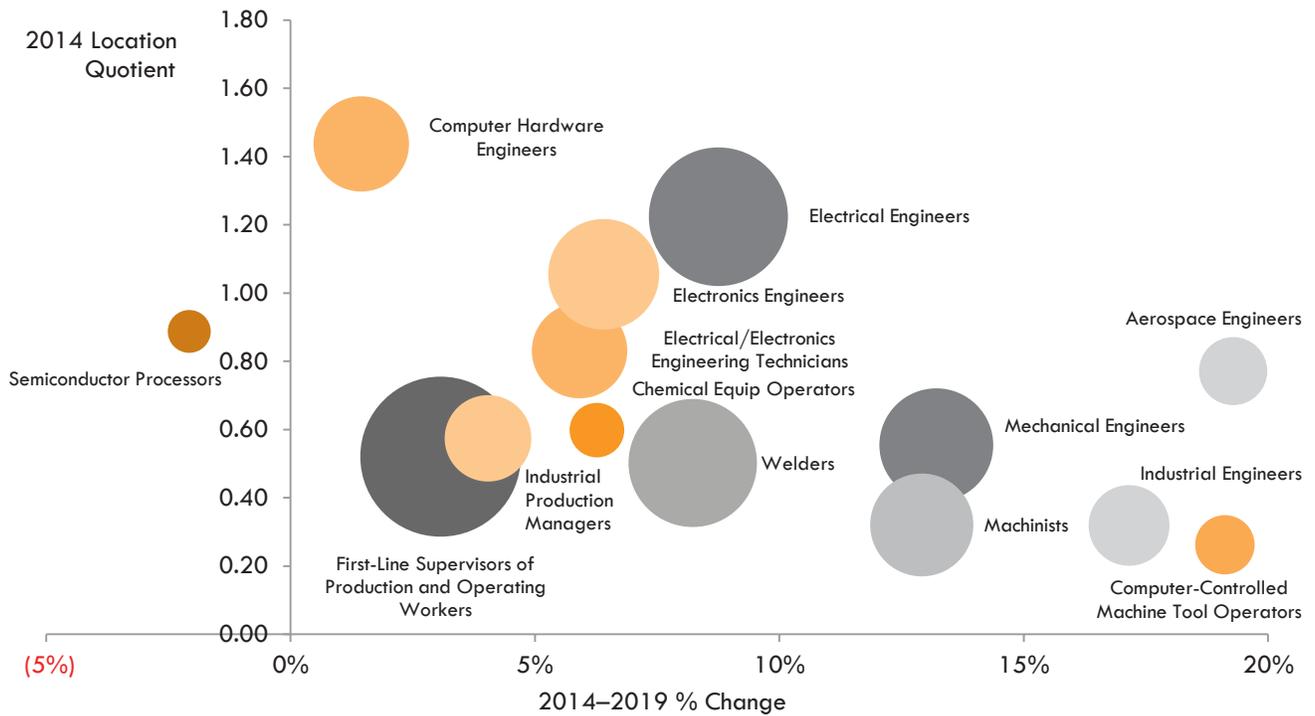
In addition to industry analysis, location quotient can also be applied to occupations. In this case, the location quotient compares an occupation's total employment in a region relative to the state's total employment for that occupation. A location quotient of less than one indicates a lower concentration of employment for that occupation in the region than in the state overall. A location quotient of more than one indicates a higher concentration of employment for the occupation than in the state overall.

The bubble chart on the following page compares the concentration of occupation employment to the projected five-year growth rate in the region, where the size of the bubble indicates the total number of jobs for each occupation. As shown below, the majority of advanced manufacturing occupations have a location quotient less than one, indicating a lower concentration of employment than in other regions of the state. Relative to the other occupations in the group, aerospace engineers, industrial engineers and computer-controlled machine tool operators are relatively small occupations with aggressive projected growth rates. Electrical engineers, mechanical engineers and machinists are mid-size occupations with moderate projected growth rates. First-line supervisors of production and operating workers is the largest occupation in the group with a modest projected growth rate.

<sup>22</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# OCCUPATION DEMAND

**Exhibit 13: Growth Rate vs. Occupation Concentration<sup>23</sup>**

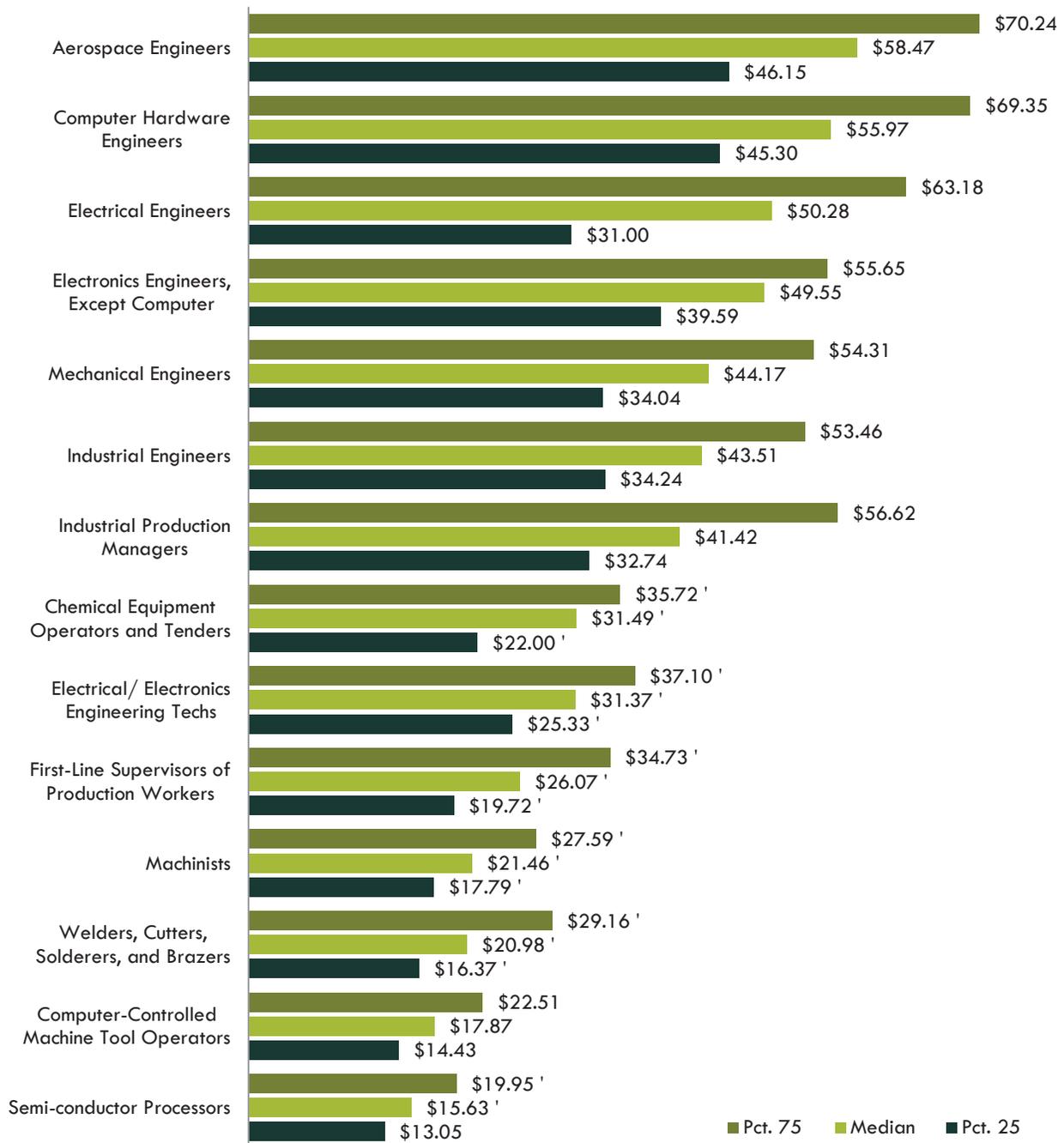


<sup>23</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# OCCUPATIONAL WAGES

The majority of occupations in the Advanced Manufacturing cluster earn wages above the regional median wage. Aerospace engineers is the highest paid occupation, followed by computer hardware engineers and electrical engineers. The lowest paid occupations in the group include semi-conductor processors, computer-controlled machine tool operators and welders. The median hourly wage across all occupations in the Sacramento Capital region is \$22.69 per hour.

**Exhibit 14: Hourly Wages, 2015<sup>24</sup>**



<sup>24</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EDUCATION ASSESSMENT

This section provides an overview of the educational programs that support occupations in the Advanced Manufacturing cluster in the Sacramento Capital region. Minimum education requirements are assigned to three categories:

- **Entry-level occupations** require a high school degree plus moderate to long-term on-the-job training. In this category, employers may prefer applicants if they have a formal education, such as a certificate or degree.
- **Mid-level occupations** require postsecondary training, certificate or associate degree.
- **Advanced-level occupations** require a bachelor's degree. Most of these positions do not require related work experience.

Exhibit 15 identifies the minimum education requirements for the top 15 occupations in the Advanced Manufacturing cluster by education category.

## Exhibit 15: Minimum Education Requirements

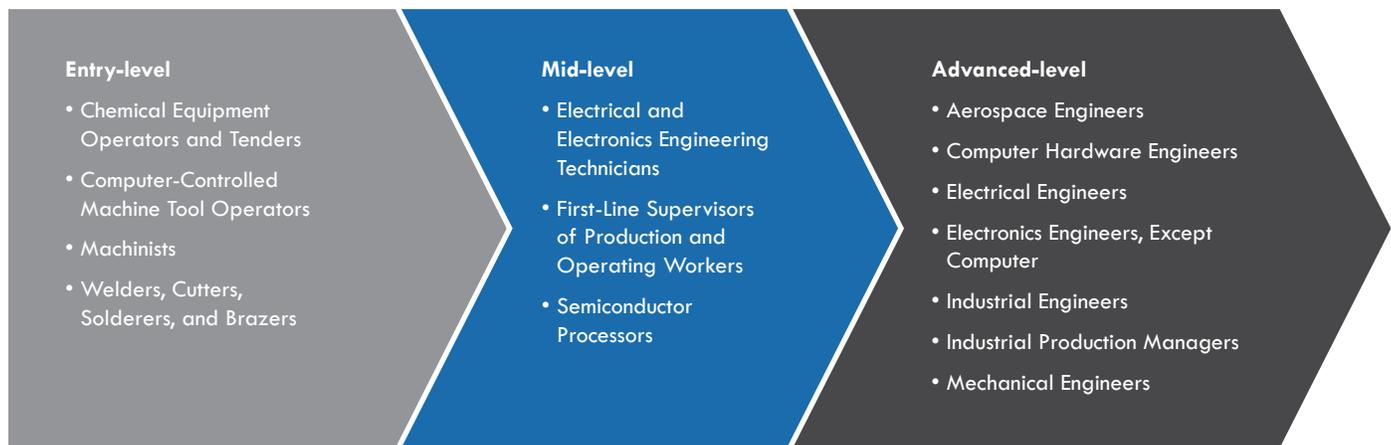


Exhibit 16 lists the colleges and programs with certificate and degree programs that provide a workforce pipeline to the Advanced Manufacturing cluster. The table organizes the programs by category: entry-level, mid-level and advanced-level. There are six programs in the entry-level occupation group, conferring 110 certificates and associate degrees annually. The welding program directly prepares for careers as welders, cutters, solderers and brazers. The manufacturing and industrial technology program provides a range of educational pathway options. There are no training programs for chemical equipment operators and tenders, computer-controlled machine tool operators or machinists.

Three public community colleges and two private education institutions provide training programs that support the mid-level occupation group. Combined, these education institutions confer an average of 345 certificates and associate degrees annually. The electronics and electric technology program prepares students for electrical and electronics engineering technicians, while industrial electronics is aligned with the semiconductor processors occupation.

There are three universities (two public, one private) with training programs that support the advanced-level occupation group. Combined, these education institutions confer an average of 825 bachelor's, master's, and PhD degrees annually. With the exception of industrial engineers, there is a training program that directly prepares students for each of the occupations in the advanced-level occupation group.

The total certificates and degrees conferred provide some information about the supply of workers to an industry or cluster. However, it is limited in that there are several unknown variables that impact the supply, such as migration trends, employer preferences, worker preparedness, and graduate/completion duplication.

# EDUCATION ASSESSMENT

## Exhibit 16: Advanced Manufacturing Education Programs & Awards, Sacramento Capital Region<sup>25&26</sup>

Category	College/Program	Award Type	3-Year Average Certificate/Degrees Conferred
Entry-Level Occupations	American River College, Welding Technology	Associate of Science, Certificate	66
	Cosumnes River College, Welding Technology	Certificate	2
	Sierra College, Welding Technology	Certificate	18
	Sierra College, Manufacturing and Industrial Technology	Associate of Science, Associate of Arts, Certificate	12
	Yuba College, Welding Technology	Associate of Science, Certificate	11
	Yuba College, Manufacturing and Industrial Technology	Associate of Science	1
Mid-Level Occupations	American River College, Electronics and Electric Technology	Associate of Science, Certificate	188
	American River College, Industrial Electronics	Certificate	3
	Sacramento City College, Electronics and Electric Technology	Associate of Science, Certificate	9
	Sierra College, Electronics and Electric Technology	Associate of Science, Certificate	1
	Sierra College, Industrial Electronics	Associate of Science, Associate of Arts, Certificate	78
	Charles A Jones Career and Education Center, Electrical and Electronic Engineering Technologies/Technicians	Certificate	29
	ITT Technical Institute-Rancho Cordova, Electrical, Electronic and Communications Engineering Technology/Technician	Associate	37
Advanced Occupations	University of California-Davis, Aerospace, Aeronautical and Astronautical/Space Engineering	Bachelor's degree	50
	University of California-Davis, Computer Engineering, General	Bachelor's degree	52
	California State University-Sacramento, Computer Engineering, General	Bachelor's degree, Master's degree	22
	University of California-Davis, Computer Science	Bachelor's degree, Master's degree, PhD	152
	California State University-Sacramento, Computer Science	Bachelor's degree, Master's degree	82
	California State University-Sacramento, Electrical and Electronics Engineering	Bachelor's degree, Master's degree	97
	University of California-Davis, Electrical and Electronics Engineering	Bachelor's degree, Master's degree, PhD	45
	University of Phoenix-Sacramento Valley Campus, Operations Management and Supervision	Bachelor's degree	0
	California State University-Sacramento, Mechanical Engineering	Bachelor's degree, Master's degree	110
	University of California-Davis, Mechanical Engineering	Bachelor's degree, Master's degree, PhD	215

<sup>25</sup> California Community College Chancellor's Office Data Mart. National Center for Education Statistics (NCES). Higher education institutions are required to report completion data to NCES if they participate in any federal financial assistance program authorized by Title IV of the Higher Education Act. Completion data not reported to the NCES or CCCCO Data Mart were not included in the estimate.

<sup>26</sup> The 3-year average includes academic years 2011-12, 2012-13 and 2013-14.

# SKILLS ASSESSMENT

Exhibit 17 displays the top skills and professional credentials for the Advanced Manufacturing cluster occupations selected for inclusion in this study. The data is based on analysis of job posting data, aggregated by Burning Glass. This online tool uses intelligent “spidering” to search the Internet for job listings, removes duplication, and aggregates the data into a search database. As shown below, most of the skills/knowledge areas are specialized and require specific training and/or certification.

## Exhibit 17: Skill and Professional Credential Preferences, Advanced Manufacturing Cluster Occupations<sup>27</sup>

Occupation	Top Skill/Knowledge Areas	Top Certifications/ Professional Credentials
Aerospace Engineers	Computer aided drafting/design (CAD), CATIA, systems engineering, physics, validation, product development, mathematics & chemistry	Federal Aviation Administration (FAA) Certification
Chemical Equipment Operators and Tenders	Forklift operation, inspection, machinery cleaning, chemical reactions and international traffic in arms regulations	Forklift Operator Certification
Computer Hardware Engineers	Electrical engineering, hardware design, validation, verilog, simulation, C++, debugging, concept development, PCB layout and design, oscilloscopes and product design	None Listed
Computer-Controlled Machine Tool Operators, Metal and Plastic	Computer Numerical Control (CNC), inspection, machine operation, machining, lathes, capability maturity model (CMM), micrometers, blueprints, calipers and mathematics	None Listed
Electrical and Electronics Engineering Technicians	Repair, test equipment, schematic diagrams, calibration, oscilloscopes, inspection, soldering, robotics, wiring, and programmable logic controller programming	None Listed
Electrical Engineers	Simulation, AutoCAD, electrical design, computer aided drafting/design (CAD), electrical systems, validation, schematic diagrams, programmable logic controller (PLC) programming	Professional Engineer, Leadership in Energy and Environmental Design (LEED), Engineer in Training Certification
Electronics Engineers, Except Computer	Simulation, test equipment, radio frequency engineering, circuit design, optimization, product development, C++, MATLAB	None Listed
First-Line Supervisors of Production and Operating Workers	Scheduling, merchandising, process improvement, administrative functions, loss prevention, payroll administration, inspection of packages, access and/or egress control, and forklift operation	Forklift Operator Certification
Industrial Engineers	Inspection, six sigma, validation, medical device, process improvement, product development, manufacturing processes, process control, failure modes and effective analysis, packaging, ISO 9001 standards, and JAVA	Certified Qualified Engineer, American Society for Quality (ASQ) Certification, Six Sigma Certification
Industrial Production Managers	Inspection, scheduling, good management practices (GMP), process improvement, six sigma, manufacturing processes, validation, lean manufacturing, collaboration, packaging, and product development	Six Sigma Certification, Quality Management Certification
Machinists	Machining, computer numerical control (CNC), lathes, inspection, blueprints, dimensions, mathematics, and micrometers	None Listed
Mechanical Engineers	Computer aided drafting/design (CAD), mechanical design, product development, validation, manufacturing processes, AutoCAD, HVAC, product design, and concept development	American Society of Mechanical Engineers (ASME) Certified, Professional Engineer
Semiconductor Processors	Inspection, process equipment, clean room experience, physics	None Listed
Welders, Cutters, Solderers, and Brazers	TIG welding, blueprints, MIG welding, inspection, inventory maintenance, hand tools, power tools, Arc welding, and flux core welding	Welding Certification (e.g. AWS Certified Welder)

<sup>27</sup> Burning Glass, 2015.

# SUMMARY

Advanced manufacturing is a process that integrates the coordinated use of information, automation, software, sensing and networking to improve the efficiency and reduce costs of manufacturing. Although advanced manufacturing methods may be utilized by any manufacturing industry, high use of these methods tends to cluster in the following subsectors: aerospace, chemical, computers/electronics, machinery, plastics production and transportation manufacturing.

In 2014, there were about 16,100 advanced manufacturing jobs, 42 percent of the total manufacturing employment and 1.5 percent of the total employment in the Sacramento Capital region. The majority of advanced manufacturing jobs were in computer and electronic product manufacturing, machinery and aerospace. Over the next five years, the Advanced Manufacturing cluster is projected to grow moderately about five percent. Overall, the Advanced Manufacturing cluster provides above average earnings compared to the average earnings across all industries in the Sacramento Capital region.

Fifteen (15) occupations were selected for inclusion based on three criteria: (1) cluster businesses employ 100 or more workers in the occupation, (2) the percent of total jobs employed by the cluster is significant, and (3) the minimum education requirement is a postsecondary award, associate degree, bachelor's degree or high school diploma plus on-the-job training. As these occupations are also employed by other industries (beyond the Advanced Manufacturing cluster), occupational data across all industries was provided for a complete picture of the employment demand.

Over the next five years, the top occupations in the Advanced Manufacturing cluster are projected to grow by 8 percent, adding over 190 new jobs and need about 315 replacement jobs annually. The majority of these occupations earn wages above the regional average. The minimum education requirements range from a high school degree plus on-the-job training to postsecondary training and associate degree to bachelor's degree. For the occupations that require a minimum of a high school degree plus on-the-job training, many employers prefer applicants if they have a formal education, such as a certificate or degree.

In the Sacramento Capital region, there are 10 education institutions supporting the advanced manufacturing occupations selected for this study. Key findings from the education assessment include:

- Four education institutions, conferring 110 certificates and associate degrees annually, support occupations in the entry-level group (i.e. minimum education is a high school degree plus on-the-job training).
- Three education institutions, conferring 345 certificates and associate degrees, provide training programs that support the mid-level occupation group (i.e. minimum education is postsecondary training, certificate or associate degree).
- Three education institutions, conferring 825 bachelor's, master's, and PhD degrees annually, have training programs that support the advanced-level occupation group.
- There are no specific training programs for chemical equipment operators, computer-controlled machine tool operators, machinists or industrial engineers. However, employers may accept other certificates/degrees when evaluating candidates for these positions.

From a high level supply and demand assessment, it appears that the region's education institutions are preparing more graduates than needed to support the top 15 occupations in the Advanced Manufacturing cluster. However, an actual oversupply may not be occurring due to unknown variables impacting the supply of workers in the region. For example, many graduates from four-year engineering programs do not stay in the region, but rather migrate to other areas to find their first job. In addition, graduate/completion duplication occurs when a student obtains more than one degree or certificate in the same year. Further, some students pursue additional education upon completion of a degree or certificate (i.e. transfer from a community college to a four-year program). Lastly, the identified educational training programs may crosswalk to occupations in other industry clusters, such as information and communication technologies (ICT). These factors inflate the total supply estimates, making it appear larger than it is.

# SUMMARY

Valley Vision, along with the Center of Excellence and other partners, will be conducting forums with advanced manufacturing employers to review the cluster findings, high priority occupation and skills gaps that can be addressed through a concerted cluster workforce action plan. Priorities that may be elevated based on this analysis include:

1. Develop or expand training programs for machinist and computer-controlled machine tool operators. These programs have high projected growth and replacement needs, and no discernible education programs in the region exist.
2. Identify engineering specialties that are the most difficult to fill. Determine strategies to recruit engineers with specific specialties from outside the area.
3. Conduct primary research to assess potential skill gaps in existing training programs. Partner with regional employers and education institutions to identify skill requirements and competencies, and to close skills gaps.
4. Incorporate training to prepare students for the professional credential/certificates most in demand, such as Certified Qualified Engineer, American Society for Quality (ASQ) Certification, and Six Sigma Certification.



# APPENDIX A: ADVANCED MANUFACTURING CLUSTER DEFINITION



The Advanced Manufacturing cluster is comprised of the following NAICS codes.

## Aerospace

- 336411 Aircraft Manufacturing
- 336412 Aircraft Engine and Engine Parts Manufacturing
- 336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing
- 336414 Guided Missile and Space Vehicle Manufacturing
- 336415 Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing
- 336419 Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing
- 334511 Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing

## Chemical Manufacturing

- 325110 Petrochemical Manufacturing
- 325120 Industrial Gas Manufacturing
- 325130 Synthetic Dye and Pigment Manufacturing
- 325180 Other Basic Inorganic Chemical Manufacturing

- 325193 Ethyl Alcohol Manufacturing
- 325194 Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing
- 325199 All Other Basic Organic Chemical Manufacturing
- 325212 Synthetic Rubber Manufacturing
- 325220 Artificial and Synthetic Fibers and Filaments Manufacturing
- 325311 Nitrogenous Fertilizer Manufacturing
- 325312 Phosphatic Fertilizer Manufacturing
- 325314 Fertilizer (Mixing Only) Manufacturing
- 325320 Pesticide and Other Agricultural Chemical Manufacturing
- 325510 Paint and Coating Manufacturing
- 325520 Adhesive Manufacturing
- 325611 Soap and Other Detergent Manufacturing
- 325612 Polish and Other Sanitation Good Manufacturing
- 325613 Surface Active Agent Manufacturing
- 325620 Toilet Preparation Manufacturing
- 325910 Printing Ink Manufacturing
- 325920 Explosives Manufacturing

# APPENDIX A: ADVANCED MANUFACTURING CLUSTER DEFINITION

325992 Photographic Film, Paper, Plate, and Chemical Manufacturing

325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing

## Computers & Electronics

334111 Electronic Computer Manufacturing

334112 Computer Storage Device Manufacturing

334118 Computer Terminal and Other Computer Peripheral Equipment Manufacturing

334210 Telephone Apparatus Manufacturing

334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing

334290 Other Communications Equipment Manufacturing

334310 Audio and Video Equipment Manufacturing

334412 Bare Printed Circuit Board Manufacturing

334413 Semiconductor and Related Device Manufacturing

334416 Capacitor, Resistor, Coil, Transformer, and Other Inductor Manufacturing

334417 Electronic Connector Manufacturing

334418 Printed Circuit Assembly (Electronic Assembly) Manufacturing

334419 Other Electronic Component Manufacturing

334513 Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables

334514 Totalizing Fluid Meter and Counting Device Manufacturing

334515 Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals

334613 Blank Magnetic and Optical Recording Media Manufacturing

334614 Software and Other Prerecorded Compact Disc, Tape, and Record Reproducing

335311 Power, Distribution, and Specialty Transformer Manufacturing

335312 Motor and Generator Manufacturing

335313 Switchgear and Switchboard Apparatus Manufacturing

335314 Relay and Industrial Control Manufacturing

335911 Storage Battery Manufacturing

335912 Primary Battery Manufacturing

335921 Fiber Optic Cable Manufacturing

335929 Other Communication and Energy Wire Manufacturing

335931 Current-Carrying Wiring Device Manufacturing

335932 Noncurrent-Carrying Wiring Device Manufacturing

335991 Carbon and Graphite Product Manufacturing

335999 All Other Miscellaneous Electrical Equipment and Component Manufacturing

511210 Software Publishers

## Machinery

332710 Machine Shops

333111 Farm Machinery and Equipment Manufacturing

333112 Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing

333120 Construction Machinery Manufacturing

333131 Mining Machinery and Equipment Manufacturing

333132 Oil and Gas Field Machinery and Equipment Manufacturing

333241 Food Product Machinery Manufacturing

333242 Semiconductor Machinery Manufacturing

333243 Sawmill, Woodworking, and Paper Machinery Manufacturing

333244 Printing Machinery and Equipment Manufacturing

333249 Other Industrial Machinery Manufacturing

333314 Optical Instrument and Lens Manufacturing

333316 Photographic and Photocopying Equipment Manufacturing

333318 Other Commercial and Service Industry Machinery Manufacturing

# APPENDIX A: ADVANCED MANUFACTURING CLUSTER DEFINITION

333413 Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing

333414 Heating Equipment (except Warm Air Furnaces) Manufacturing

333415 Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing

333511 Industrial Mold Manufacturing

333514 Special Die and Tool, Die Set, Jig, and Fixture Manufacturing

333515 Cutting Tool and Machine Tool Accessory Manufacturing

333517 Machine Tool Manufacturing

333519 Rolling Mill and Other Metalworking Machinery Manufacturing

333611 Turbine and Turbine Generator Set Units Manufacturing

333612 Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing

333613 Mechanical Power Transmission Equipment Manufacturing

333618 Other Engine Equipment Manufacturing

333911 Pump and Pumping Equipment Manufacturing

333912 Air and Gas Compressor Manufacturing

333913 Measuring and Dispensing Pump Manufacturing

333921 Elevator and Moving Stairway Manufacturing

333922 Conveyor and Conveying Equipment Manufacturing

333923 Overhead Traveling Crane, Hoist, and Monorail System Manufacturing

333924 Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing

333991 Power-Driven Handtool Manufacturing

333992 Welding and Soldering Equipment Manufacturing

333993 Packaging Machinery Manufacturing

333994 Industrial Process Furnace and Oven Manufacturing

333995 Fluid Power Cylinder and Actuator Manufacturing

333996 Fluid Power Pump and Motor Manufacturing

333997 Scale and Balance Manufacturing

333999 All Other Miscellaneous General Purpose Machinery Manufacturing

## Plastics

325211 Plastics Material and Resin Manufacturing

325991 Custom Compounding of Purchased Resins

326111 Plastics Bag and Pouch Manufacturing

326112 Plastics Packaging Film and Sheet (including Laminated) Manufacturing

326113 Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing

326121 Unlaminated Plastics Profile Shape Manufacturing

326130 Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing

326140 Polystyrene Foam Product Manufacturing

326150 Urethane and Other Foam Product (except Polystyrene) Manufacturing

326160 Plastics Bottle Manufacturing

326199 All Other Plastics Product Manufacturing

## Transportation

314994 Rope, Cordage, Twine, Tire Cord, and Tire Fabric Mills

324191 Petroleum Lubricating Oil and Grease Manufacturing

326211 Tire Manufacturing (except Retreading)

326212 Tire Retreading

326220 Rubber and Plastics Hoses and Belting Manufacturing

326291 Rubber Product Manufacturing for Mechanical Use

332613 Spring Manufacturing

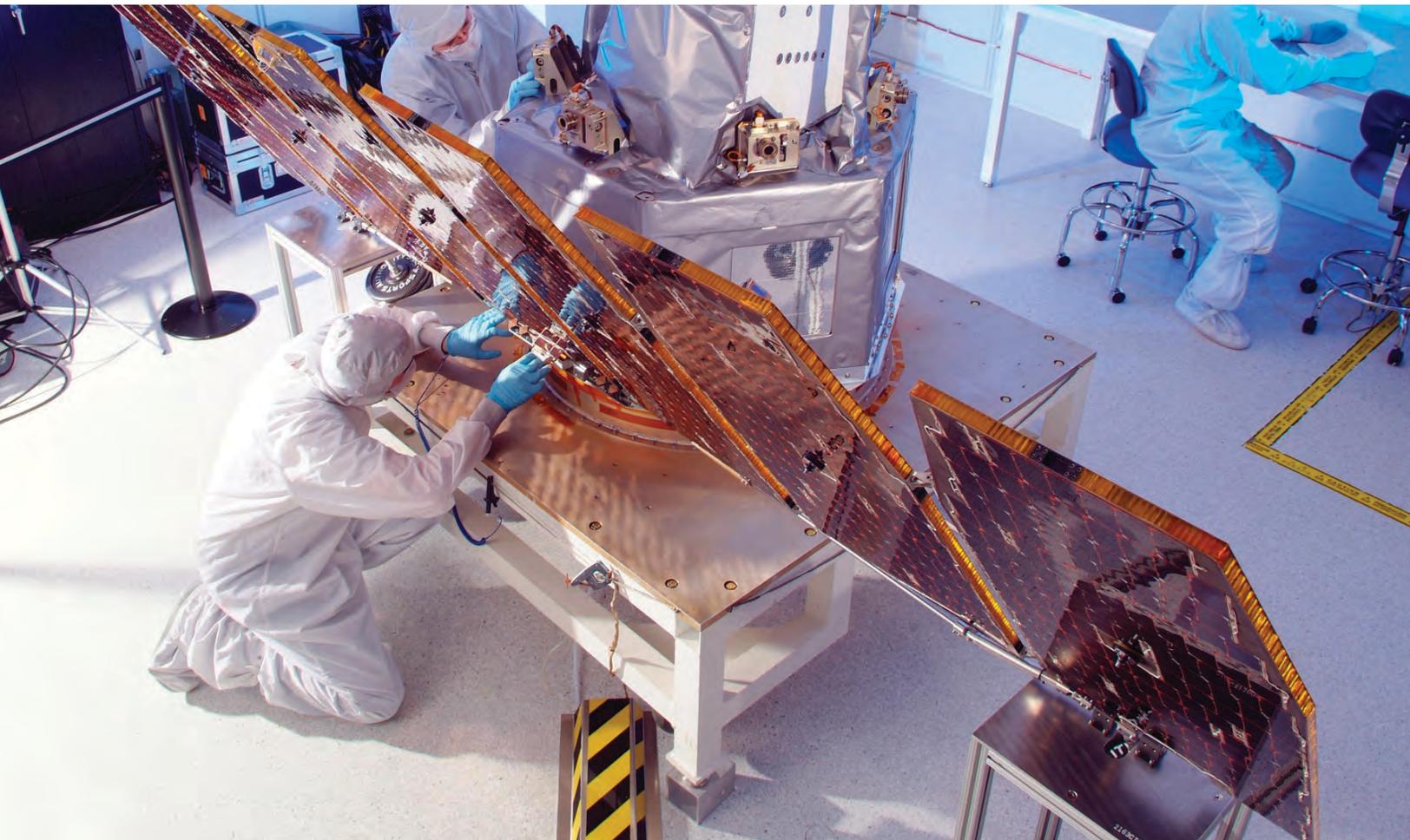
336111 Automobile Manufacturing

336112 Light Truck and Utility Vehicle Manufacturing

336120 Heavy Duty Truck Manufacturing

# APPENDIX A: ADVANCED MANUFACTURING CLUSTER DEFINITION

336211 Motor Vehicle Body Manufacturing	336360 Motor Vehicle Seating and Interior Trim Manufacturing
336212 Truck Trailer Manufacturing	336370 Motor Vehicle Metal Stamping
336213 Motor Home Manufacturing	336390 Other Motor Vehicle Parts Manufacturing
336214 Travel Trailer and Camper Manufacturing	336510 Railroad Rolling Stock Manufacturing
336310 Motor Vehicle Gasoline Engine and Engine Parts Manufacturing	336611 Ship Building and Repairing
336320 Motor Vehicle Electrical and Electronic Equipment Manufacturing	336612 Boat Building
336330 Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing	336991 Motorcycle, Bicycle, and Parts Manufacturing
336340 Motor Vehicle Brake System Manufacturing	336992 Military Armored Vehicle, Tank, and Tank Component Manufacturing
336350 Motor Vehicle Transmission and Power Train Parts Manufacturing	336999 All Other Transportation Equipment Manufacturing



# MORE ABOUT...

## More About The Centers of Excellence

The Centers of Excellence (COE) for Labor Market Research deliver regional workforce research and technical expertise to California 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.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the leading source of regional workforce information and insight for California community colleges. More information about the Centers of Excellence is available at [www.coecc.net](http://www.coecc.net).

For more information on this study, contact:

Theresa Milan, COE Director  
Northern California Region  
(916) 563-3221  
[milant@losrios.edu](mailto:milant@losrios.edu)

This study was conducted with the support of JPMorgan Chase & Co. In addition, this study was supported by Economic and Workforce Development funds awarded by the Chancellor's Office, California Community Colleges. It was produced pursuant to grant agreement number 15-305-001.

## More About Valley Vision

Since 1994, Valley Vision's work has driven transformative change and improved lives across Northern California. An independent social impact and civic leadership organization headquartered in Sacramento, Valley Vision strengthens our communities through unbiased research, boundary-crossing collaboration and change leadership. Our work improves overall quality of life and creates the conditions for economic prosperity and community health and vitality.

## More About Burris Service Group

The Burris Service Group (BSG) is a full-service consulting practice providing expertise in economic development, strategic economic research, real estate site strategy, management, and institutional growth. The company was established based on the clear need that advisory services be delivered in an "action-oriented" form. The founder of BSG, Robert Burris, brings to his clients an active local and international network of professionals, as well as 20 years of experience in economic development, market and economic analysis, commercial real estate information, corporate sales, and consulting.



**Burris Service Group**

JPMORGAN CHASE & CO.

[www.coecc.net](http://www.coecc.net)

**FIND US ON LINKEDIN GROUPS:**



<http://linkd.in/1EUU9wM>



C·O·E

CENTERS OF EXCELLENCE  
Inform Connect Advance

SERIES: 2 OF 6

# LIFE SCIENCES & HEALTH SERVICES CLUSTER: WORKFORCE NEEDS ASSESSMENT SACRAMENTO CAPITAL REGION



**December 2015**

Prepared by: Centers of Excellence,  
Los Rios Community College District

Valley Vision

Burriss Service Group

This research was conducted with the generous  
support of JPMorgan Chase & Co.

JPMORGAN CHASE & CO.

**Burriss Service Group**



# TABLE OF CONTENTS

<b>Introduction</b> .....	<b>3</b>
<b>Cluster Definition</b> .....	<b>4</b>
<b>Establishments</b> .....	<b>4</b>
<b>Concentration of Employment</b> .....	<b>5</b>
<b>Trends and Projections</b> .....	<b>6–7</b>
<b>Earnings</b> .....	<b>8</b>
<b>Shift Share Analysis</b> .....	<b>9</b>
<b>Economic Impact</b> .....	<b>10–11</b>
<b>Economic Leakage</b> .....	<b>11</b>
<b>Industry Trends</b> .....	<b>12</b>
<b>Occupation Demand</b> .....	<b>13–14</b>
<b>Occupational Wages</b> .....	<b>15</b>
<b>Education Assessment</b> .....	<b>16–17</b>
<b>Skills Assessment</b> .....	<b>18</b>
<b>Summary</b> .....	<b>19–20</b>
<b>Appendix A: Life Sciences and Health Services Cluster Definition</b> .....	<b>21</b>
<b>Appendix B: Life Sciences and Health Services Cluster Training Programs</b> .....	<b>22–23</b>

---

### ***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.

© 2015 Chancellor’s Office California Community Colleges  
Economic and Workforce Development Program

*Please consider the environment before printing. This document is designed for double-sided printing.*

# INTRODUCTION

Starting in 2008, the six-county Sacramento Capital region (El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba counties) was rocked by the global recession, losing 10 percent of the region's jobs. In response, regional leaders initiated Next Economy, an action plan to accelerate job creation and new investment in six high-growth business (industry) clusters. Valley Vision, a regional civic leadership organization, managed the three-year Next Economy design, research and implementation process on behalf of a wide range of private and public sector partners.

As of late 2015, after a lagging recovery, the region's economy is picking up momentum, with the unemployment rate decreasing while job growth is accelerating. Valley Vision received funding from the JPMorgan Chase Foundation to better understand how the region's key growth industry clusters have changed since the original Next Economy research was conducted in 2012, and what new opportunities are emerging. Valley Vision is partnering with the Los Rios Center of Excellence and the Burris Service Group on this effort.

Cluster research is a widely accepted standard of practice for developing regional prosperity strategies to address multiple facets of a region's complex economy. Industry clusters reduce operating costs by shortening supply chains; increasing the flow of information regarding new business opportunities; concentrating workforce training needs in select occupations; and speeding up the identification of gaps in products or services.<sup>1</sup> Firms in identified clusters may also have a reduced risk of failure, as these firms are better supported by the supply chain and can respond more rapidly to shifts in the marketplace.

This report presents findings on the analysis of the Life Sciences and Health Services cluster. It is one in a series of six reports covering Next Economy-identified clusters. Additional reports include advanced manufacturing, the "clean economy," education and knowledge creation, food and agriculture, and information and communications technologies.<sup>2</sup> Each report provides an overview of the cluster, industry trends and economic impact, as well as an overview of the top demand occupations in the cluster requiring postsecondary education or training, along with projected occupational demand, institutions providing related education and training, and possible workforce gaps.

This research will be used to develop cluster-based workforce action plans. Valley Vision will work alongside regional education, and workforce and economic development partners to convene six cluster-based employer forums, setting priorities and developing strategies to address critical workforce gaps, better align education and workforce development resources to meet employer and workforce needs, and strengthen the regional economy overall.



<sup>1</sup> Cluster Manufacturing: A Supply Chain Perspective

<sup>2</sup> Sacramento Area Council of Governments (SACOG) is the principal research for the Food and Agriculture Cluster study, which will focus primarily on industry trends and excludes workforce development and training needs.

# CLUSTER DEFINITION

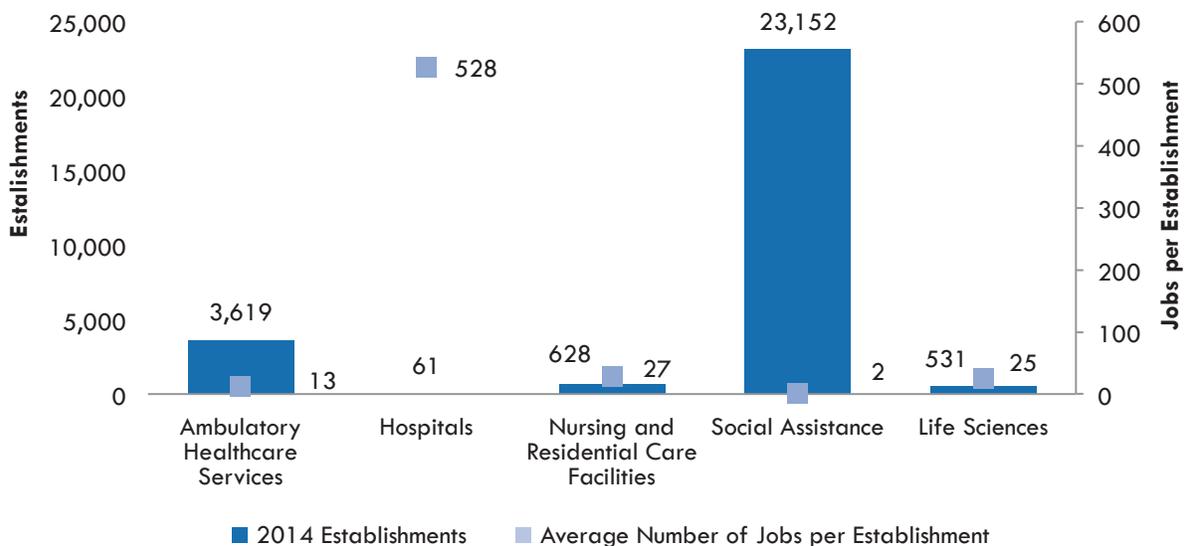
The Life Sciences and Health Services cluster is one of the largest clusters in the region, offering well-paying jobs for thousands of people. This cluster includes five subsectors:

- **Hospitals** provide medical, diagnostic, and treatment services to inpatients and some outpatient services.
- **Ambulatory Healthcare Services** provide healthcare services to outpatients in settings such as offices of physicians, outpatient care centers, and laboratories.
- **Nursing and Residential Care Facilities** provide residential care combined with either nursing, supervisory, or other types of care as needed.
- **Social Assistance** provides social assistance services directly to at-risk children and youth, persons with disabilities, unemployed and underemployed, and the elderly.
- **Life Sciences** conduct research and development; manufacture medical equipment and/or products; and/or retail medical supplies and pharmaceuticals that support the healthcare supply chain.

# ESTABLISHMENTS

Exhibit 1 displays establishments and the average number of jobs per establishment for the Life Sciences and Health Services subsectors in the Sacramento Capital region. As shown, hospitals have the fewest establishments and the highest number of workers per establishment compared to other subsectors in the region. The social assistance subsector has the most establishments and the fewest number of jobs per establishment, an estimated two per organization.

**Exhibit 1: Establishments and Average Employment by Subsector, Life Sciences and Health Services Cluster, Sacramento Capital Region, 2014<sup>3</sup>**



<sup>3</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# CONCENTRATION OF EMPLOYMENT

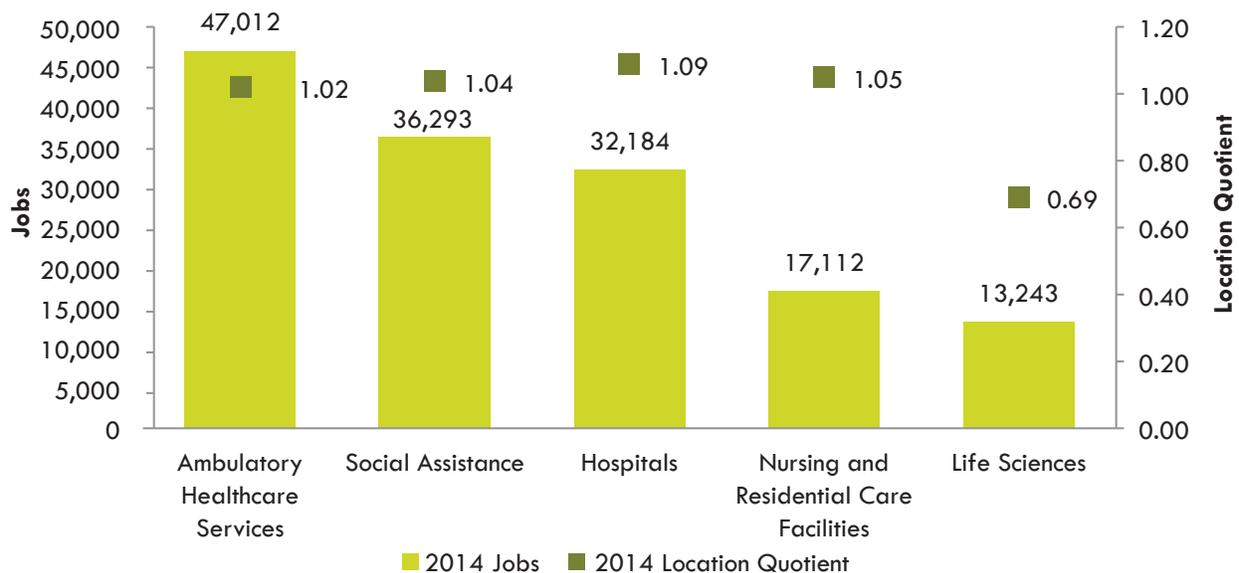
In 2014, there were about 145,800 jobs in the Life Sciences and Health Services cluster, 14 percent of the total employment in the Sacramento Capital region. As shown in Exhibit 2, the largest subsector is ambulatory healthcare services (32%; 47,000 jobs), followed by social assistance (25%; 36,300 jobs) and hospitals (22%; 32,200 jobs).

Location quotient analysis compares the total employment in a region relative to the total employment in a larger area, in this case, California. A location quotient of less than one indicates a lower concentration of employment for that industry in the region than in the state overall. A location quotient of more than one indicates a higher concentration of employment for the region than in the state overall. Most of the cluster's subsectors in the Sacramento Capital region have a location quotient that is close to one, indicating an average concentration of employment compared to other areas of the state. The life science subsector has a concentration well below one, indicating a lower than average concentration of employment.

Within the subsectors, there are industries with above average location quotients, indicating a higher concentration of employment for those industries than in the state overall. These include:

- **Hospitals:** State Government Hospitals (3.11 LQ)
- **Ambulatory Healthcare Services:** HMO Medical Centers (11.79 LQ); Family Planning Centers (1.64 LQ); and Offices of Dentists (1.31 LQ)
- **Nursing and Residential Care Facilities:** Assisted Living Facilities for the Elderly (1.64 LQ)
- **Social Assistance:** Services for the Elderly and Persons with Disabilities (2.84)
- **Life Science:** Research and Development in the Physical, Engineering and Life Sciences (1.85 LQ) and Analytical Laboratory Instrument Manufacturing (1.33 LQ)

**Exhibit 2: Total Employment and Location Quotient by Subsector, Life Sciences and Health Services Cluster, Sacramento Capital Region, 2014<sup>4</sup>**

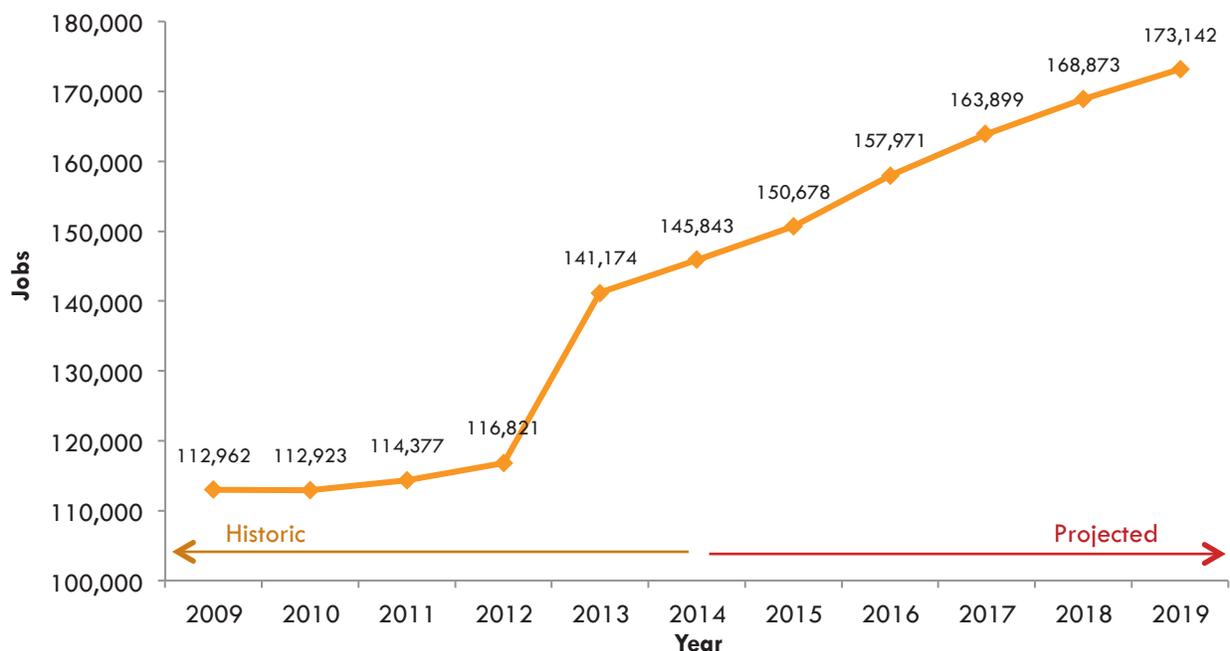


<sup>4</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# TRENDS AND PROJECTIONS

The Life Sciences and Health Services cluster has grown by 29 percent over the last five years, with a sharp increase between 2012 and 2013. The services for the elderly and persons with disabilities industry grew by the most during this time period, accounting for nearly 80% of the cluster's growth. Over the next five years, the Life Sciences and Health Services cluster is projected to grow by 19 percent, adding about 27,300 jobs by 2019. The social assistance subsector is projected to add the most jobs, followed by ambulatory healthcare services, and nursing and residential care facilities. Hospitals are expected to add the least number of positions over this time period.

## Exhibit 3: Employment Trends and Projections, Life Sciences and Health Services Cluster, Sacramento Capital Region, 2009–2019<sup>5</sup>



## Exhibit 4: Employment Projections by Subsector, Life Sciences and Health Services Cluster, Sacramento Capital Region, 2014–2019<sup>5</sup>

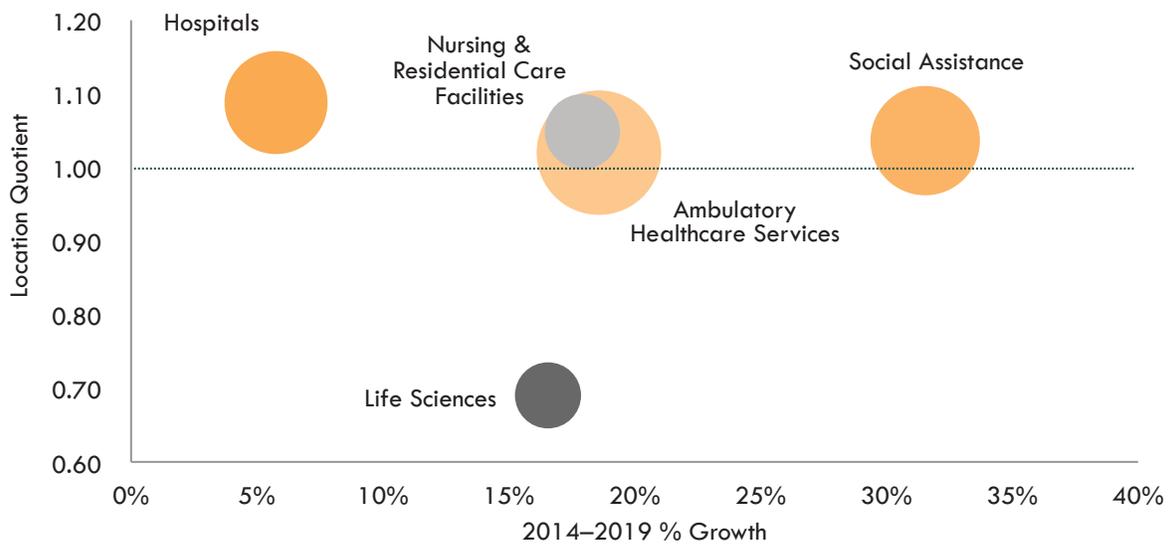
Healthcare & Life Sciences Subsector	2014 Jobs	2019 Jobs	Change	% Change
Ambulatory Healthcare Services	47,012	55,748	8,736	19%
Social Assistance	36,293	47,741	11,448	32%
Hospitals	32,184	34,037	1,853	6%
Nursing and Residential Care Facilities	17,112	20,180	3,068	18%
Life Sciences	13,243	15,436	2,193	17%
<b>Total</b>	<b>145,844</b>	<b>173,142</b>	<b>27,298</b>	<b>19%</b>

<sup>5</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# TRENDS AND PROJECTIONS

The following bubble chart compares the projected five-year growth rate to the concentration of employment in the region, where the size of the bubble indicates the total number of jobs for that subsector. All of the subsectors, except life sciences, have an average concentration of employment compared to other areas of the state. Ambulatory healthcare services and social assistance are the largest subsectors, with high projected growth. The hospitals subsector is large, but with modest projected growth over the next five years. Life sciences is the smallest subsector with a below average concentration of employment and moderate growth rate.

**Exhibit 5: Projected Growth Rate vs. Subsector Concentration, Life Sciences and Health Services Cluster, Sacramento Capital Region<sup>6</sup>**

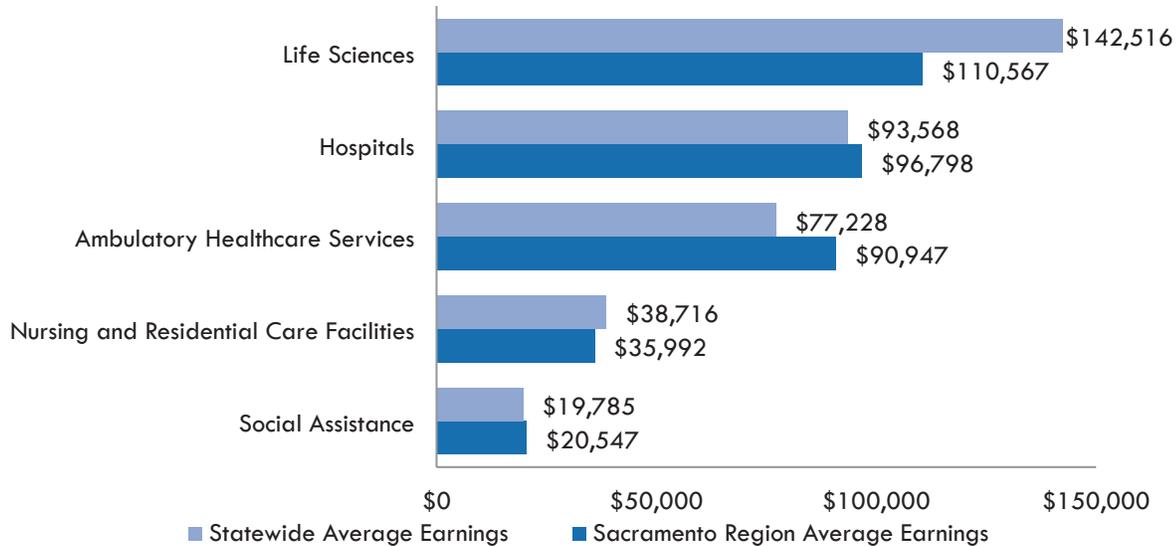


<sup>6</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EARNINGS

The life sciences subsector provides the best earnings in the Sacramento Capital region, followed by hospitals and ambulatory healthcare services. These subsectors provide earnings that are above the regional average across all industries.<sup>7</sup> Nursing/residential care facilities and social assistance organizations provide wages that are below the regional average. The earning calculation includes an average of all wages, salaries, proprietor earnings and supplemental earnings (such as retirement benefits, bonuses, etc.) for all occupations in the subsector.

## Exhibit 6: Earnings by Subsector, Life Sciences and Health Services Cluster, Sacramento Capital Region, 2014<sup>8</sup>



<sup>7</sup> The average earnings across all industries in the Sacramento region is \$63,400 and includes wages, salaries, proprietor earnings and supplements.

<sup>8</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# SHIFT SHARE ANALYSIS



Shift share analysis is a method for determining how much of regional job growth can be attributed to national trends and how much is due to unique regional factors. Exhibit 7 displays four key components:

- **Industrial Mix Effect** – represents the share of regional industry growth explained by the growth of the specific industry at the national level.
- **National Growth Effect** – represents how much of the regional industry's growth is explained by the overall growth of the national economy. Given that the nation's economy is growing, it is normal to see positive change in each subsector.
- **Expected Change** – the change expected due to national growth effect and industry mix effects.
- **Regional Competitive Effect** – explains how much of the change in the subsectors is due to some unique competitive advantage that the region possesses, because the growth cannot be explained by national trends in the industry or the economy as a whole.

Four of the five subsectors are outperforming national trends, while the hospitals subsector is underperforming compared to national trends. This suggests that the region has an overall competitive advantage in the Life Sciences and Health Services cluster compared to other areas of the nation.

## Exhibit 7: Shift Share Analysis by Subsector, 2013–2018<sup>9</sup>

	Industrial Mix Effect	National Growth Effect	Expected Change	Regional Competitive Effect
Ambulatory Healthcare Services	5,197	2,989	8,186	550
Hospitals	57	2,046	2,103	(250)
Nursing and Residential Care Facilities	828	1,088	1,916	1,152
Social Assistance	7,430	2,307	9,737	1,710
Life Sciences	179	842	1,021	1,173
<b>Cluster Total</b>	<b>13,691</b>	<b>9,272</b>	<b>22,963</b>	<b>4,335</b>

<sup>9</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# ECONOMIC IMPACT

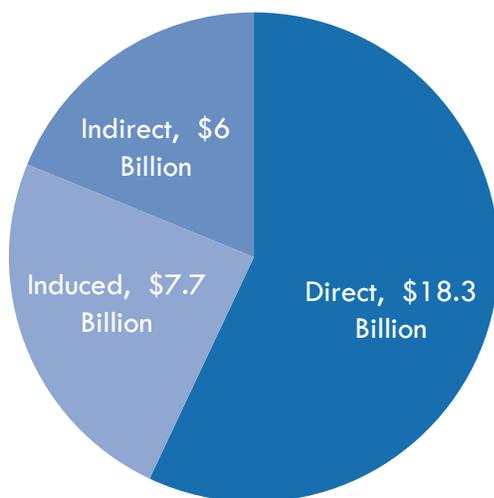
Economic impact provides a quantitative method to estimate the total economic benefit from a project, or in this case, an industry cluster. In other words, it is the “ripple effect” of all economic activities resulting from that cluster. Impact analysis is typically comprised of direct, indirect and induced impacts:

- Direct impacts are those resulting from the expenditures of operations within that industry cluster.
- Indirect impacts are those resulting from suppliers of that cluster spending money and hiring employees.
- Induced impacts are the combined value of employees of the industry cluster spending money at a household level.

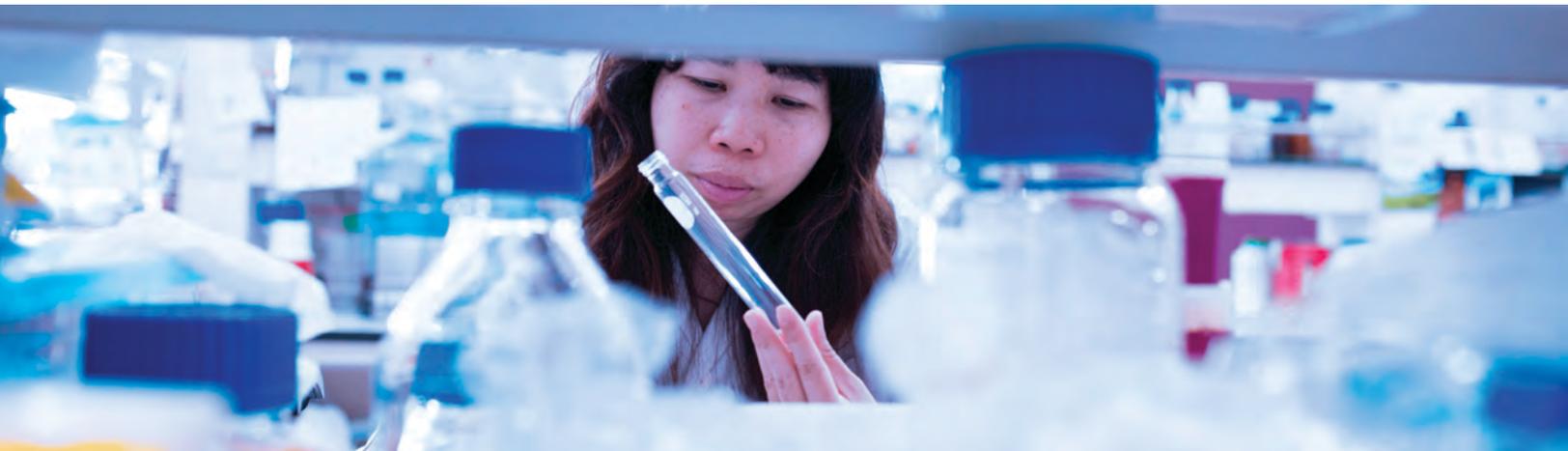
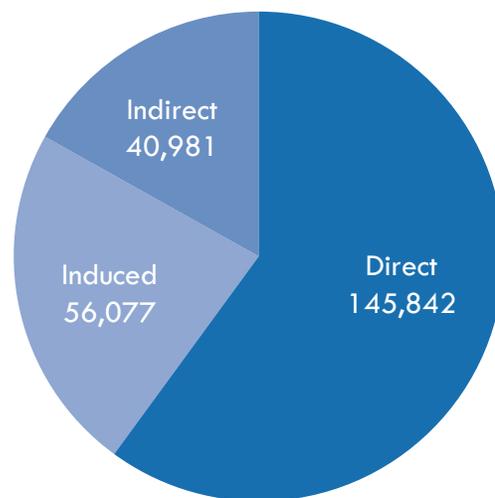
Combined, these three variables equate to the total economic impact of a project or industry cluster.

The Healthcare cluster impacts the Sacramento Capital region’s economy in several ways. The IMPLAN input output model was used to measure the cluster’s total economic impacts. First, the cluster directly benefits the economy through the operations and jobs supported by the establishments within its subsectors. Exhibits 8 and 9 show that the Healthcare cluster directly contributes nearly \$18.3 billion in output and 146,000 jobs to the regional economy. In addition to this direct effect, these establishments generate an indirect impact through their supplier purchases—around \$6.0 billion in output and 41,000 jobs are created within sectors that generally supply this cluster. Finally, the Healthcare cluster creates an induced effect of around \$7.7 billion and approximately 56,000 jobs as a result of consumption activities within the local economy of both direct (cluster) and indirect (supplier) employees.

**Exhibit 8: Total Output Impacts<sup>10</sup>**



**Exhibit 9: Total Employment Impacts<sup>10</sup>**



<sup>10</sup> EMSI employment and IMPLAN 2013 data coefficients

# ECONOMIC IMPACT

The Healthcare cluster contributes a total of about \$32.0 billion in output, almost 243,000 jobs and \$14.4 billion in labor income. Exhibit 10 provides the employment impacts by each subsector within the Healthcare cluster and by output, employment, and labor income (which includes all forms of employment income, including employee compensation and proprietor income). With about \$11.6 billion in output, 82,000 jobs, and \$5.5 billion in labor income, the ambulatory care services subsector, by far, accounts for the largest share of the cluster's total economic impacts while the nursing and residential care facilities subsector has the smallest share.

## Exhibit 10: Total Economic Impacts by Cluster Subsector<sup>11</sup>

	Direct	Indirect	Induced	Total
<b>Output</b>				
<i>Total</i>	\$18,264,356,260	\$6,029,117,542	\$7,749,627,699	\$32,043,101,500
Life Sciences	\$3,555,315,913	\$1,356,387,523	\$1,099,828,851	\$6,011,532,287
Ambulatory Care Services	\$6,715,933,047	\$1,874,234,464	\$2,982,634,470	\$11,572,801,981
Hospitals	\$5,641,456,588	\$1,873,224,134	\$2,598,021,739	\$10,112,702,461
Nursing and Residential Care Facilities	\$1,063,375,296	\$352,314,530	\$492,387,165	\$1,908,076,990
Social Assistance	\$1,288,275,416	\$572,956,891	\$576,755,474	\$2,437,987,781
<b>Employment</b>				
<i>Total</i>	145,843	40,981	56,077	242,900
Life Sciences	13,243	8,489	7,961	29,693
Ambulatory Care Services	47,012	13,068	21,586	81,666
Hospitals	32,184	13,219	18,794	64,197
Nursing and Residential Care Facilities	17,112	2,471	3,562	23,145
Social Assistance	36,293	3,734	4,174	44,201
<b>Total Labor Income</b>				
<i>Total</i>	\$9,779,595,811	\$2,038,863,930	\$2,576,689,367	\$14,395,149,108
Life Sciences	\$1,196,057,292	\$476,414,356	\$365,722,400	\$2,038,194,048
Ambulatory Care Services	\$3,936,188,414	\$605,916,768	\$991,753,841	\$5,533,859,022
Hospitals	\$3,290,297,385	\$683,565,824	\$863,728,073	\$4,837,591,282
Nursing and Residential Care Facilities	\$645,915,824	\$106,830,290	\$163,700,236	\$916,446,350
Social Assistance	\$711,136,896	\$166,136,692	\$191,784,817	\$1,069,058,406

# ECONOMIC LEAKAGE

Supply chain leakage is a primary factor in determining the value of an industry multiplier used to define the total “ripple effect” of that industry cluster. Stronger supply chain linkages, better described as a cluster using more locally sourced products and services, has a reciprocal benefit of lower leakage, increasing the multiplier and the total impact on the surrounding economy.

It was determined through an in-depth analysis of the Healthcare industry cluster and its subsets, that there is a relatively high level of supply chain leakage, roughly 57 percent. Conversely, 43 percent of goods and services supporting the industry cluster are purchased within the region.

<sup>11</sup> EMSI employment and IMPLAN 2013 data coefficients

# INDUSTRY TRENDS



Several factors are transforming the Life Sciences and Health Services cluster. At the regional level, demographic factors such as a growing and aging population are creating demand for expanded healthcare services. At the national level, the Patient Protection and Affordable Care Act (ACA) contains provisions that are increasing demand for healthcare services and changing the way services are delivered. This section explores how these factors are affecting the Life Sciences and Health Services cluster in the region.

Over the next five years, the Sacramento Capital region's residential population is projected to grow by 3.6 percent from 2.4 million to 2.5 million, which is on par with the projected growth rate for the state.<sup>12</sup> By 2019, health care organizations in the region will need to expand their operations to serve an additional 87,000 residents.<sup>13&14</sup>

Another important demographic factor influencing the Life Sciences and Health Services cluster is the region's aging population. In 2014, approximately 19 percent of the Sacramento Capital region's population was age 60 or older. By 2024, this age group is projected to increase by 28 percent, while the age cohort 20 to 59 is expected to decrease by 2 percent.<sup>13</sup> Since use of healthcare services increases with age, any increase in numbers of older population cohorts will significantly impact health care demand. Further, the aging of the healthcare workforce itself is expected to create staffing shortages as workers in key healthcare occupations become eligible for retirement.

The Patient Protection and Affordable Care Act enacted in 2010 is a multi-faceted bill that restructured the national healthcare system. The bill is making healthcare more affordable and accessible for residents across the state and nation. According to Gallup, the Affordable Care Act is facilitating the reduction of the uninsured rate across the state and nation.

With the implementation of the Health Insurance Marketplace and Medicaid expansion, the uninsured rate in California dropped by 6.3%, from 21.6% in 2013 to 15.3% in 2014.<sup>15</sup> This equates to 2.44 million more California residents with healthcare coverage than in the previous year. As of January 2015, more than three million California residents have obtained coverage through the Health Insurance Marketplace.<sup>16</sup> In addition to expanded insurance coverage, there are several provisions in the Act that are increasing demand for health services:

- Insurance companies can no longer impose lifetime dollar limits on health benefits.
- Insurance companies can no longer deny coverage due to pre-existing conditions.
- Insurance companies are required to provide benefits for mental health and substance use services.
- Many insurance plans are required to provide preventive health services with no deductible or co-pay.

These provisions as well as the expanded reach of healthcare coverage to previously uninsured individuals are driving demand for healthcare services at the local and national levels.

<sup>12</sup> California's population is projected to increase by 3.4 percent between 2014 and 2019.

<sup>13</sup> EMSI Population Demographics – 2015.2.

<sup>14</sup> The Sacramento Area Council of Governments long-term population projections indicate a higher population growth than estimated by EMSI. Should the population grow at a higher rate, it will increase the demand for health services across the region.

<sup>15</sup> *State of the State Series, Arkansas, Kentucky Sees Most Improvement in Uninsured Rates*. February, 2015. [gallup.com](http://gallup.com).

<sup>16</sup> U.S. Department of Health and Human Services. *Five Years Later: How the Affordable Care Act is Working for California*. [hhs.gov](http://hhs.gov)

# OCCUPATION DEMAND

Fifteen occupations were selected for inclusion in the study based on the following criteria:

- Annual job openings were significant.
- The minimum education requirement is a high school diploma plus on-the-job training, postsecondary award, associate degree or bachelor's degree.

Exhibit 10 displays the employment demand for the Life Sciences and Health Services cluster occupations selected for inclusion in the study. Over the next five years (2014–2019), these occupations are projected to grow by 14%, adding more than 7,400 new jobs and 6,000 replacement jobs. Sacramento Capital region employers will need to fill nearly 2,700 openings annually to keep pace with cluster growth, retirements and other separations.

Registered nurses is the largest occupation in the group with the most annual openings over the next five years. Nursing assistants and medical assistants are also large occupations with significant annual openings created by new job growth and replacement needs. For each occupation, replacement estimates include retirements and general separations, but not turnover within the occupation. As such, replacements and new job growth combined is a good measure of demand for workers.

## Exhibit 10: Employment Outlook, Life Sciences and Health Services Occupations, Sacramento Capital Region<sup>17</sup>

Description	2014 Jobs	2019 Jobs	2014–2019 Change	2014–2019 % Change	Total Replacements	Total Openings	Annual Openings
Registered Nurses	17,301	19,451	2,150	12%	1,827	3,977	795
Medical Assistants	6,245	7,090	845	14%	660	1,505	301
Nursing Assistants	5,449	6,716	1,267	23%	597	1,864	373
Dental Assistants	3,403	3,711	308	9%	376	684	137
Social and Human Service Assistants	3,106	3,597	491	16%	449	940	188
Licensed Vocational Nurses	2,919	3,537	618	21%	413	1,031	206
Pharmacy Technicians	2,551	2,788	237	9%	134	371	74
Dental Hygienists	2,165	2,431	266	12%	301	567	113
Child, Family, and School Social Workers	2,109	2,321	212	10%	239	451	90
Medical and Health Services Managers	1,848	2,141	293	16%	251	544	109
Health Information Technicians	1,250	1,419	169	14%	180	349	70
Medical Laboratory Technicians	1,202	1,388	186	15%	173	359	72
Emergency Medical Technicians and Paramedics	1,050	1,259	209	20%	168	377	75
Mental Health and Substance Abuse Social Workers	863	969	106	12%	99	205	41
Biological Technicians	667	747	80	12%	106	186	37
<b>Total</b>	<b>52,128</b>	<b>59,565</b>	<b>7,437</b>	<b>14%</b>	<b>5,973</b>	<b>13,410</b>	<b>2,682</b>

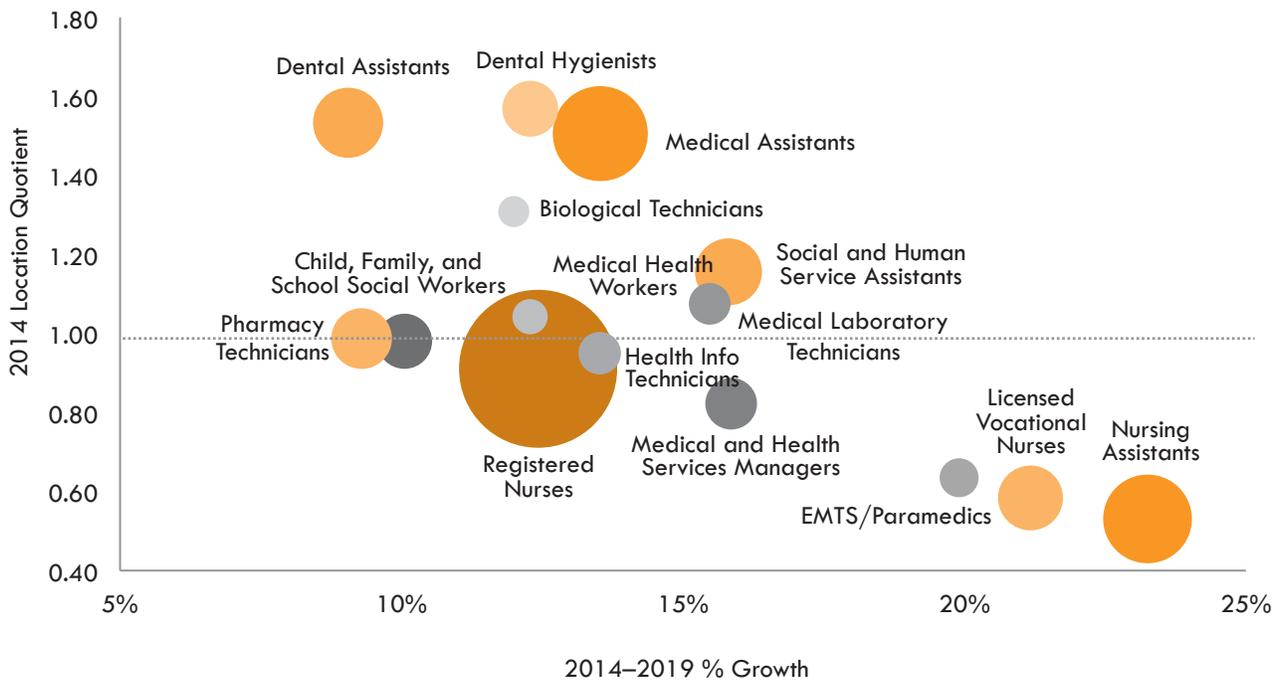
<sup>17</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# OCCUPATION DEMAND

In addition to industry analysis, location quotient can also be applied to occupations. In this case, the location quotient compares an occupation’s total employment in the region relative to the state’s total employment for that occupation. A location quotient of less than one indicates a lower concentration of employment for that occupation in the region than in the state overall. A location quotient of more than one indicates a higher concentration of employment for the occupation than in the state overall.

The bubble chart below compares the concentration of occupation employment to the projected five-year growth rate in the region, where the size of the bubble indicates the total number of jobs for each occupation. As shown below, registered nurses is the largest occupation, with average concentration in the region and a moderate projected growth rate. Dental assistants and dental hygienists have above average location quotients and moderate projected growth rates. Licensed vocational nurses and nursing assistants are projected to grow faster than any other occupation in the group, but have below average concentration of employment in the region.

**Exhibit 11: Growth Rate vs. Occupation Concentration, Life Sciences and Health Services Occupations, Sacramento Capital Region<sup>18</sup>**

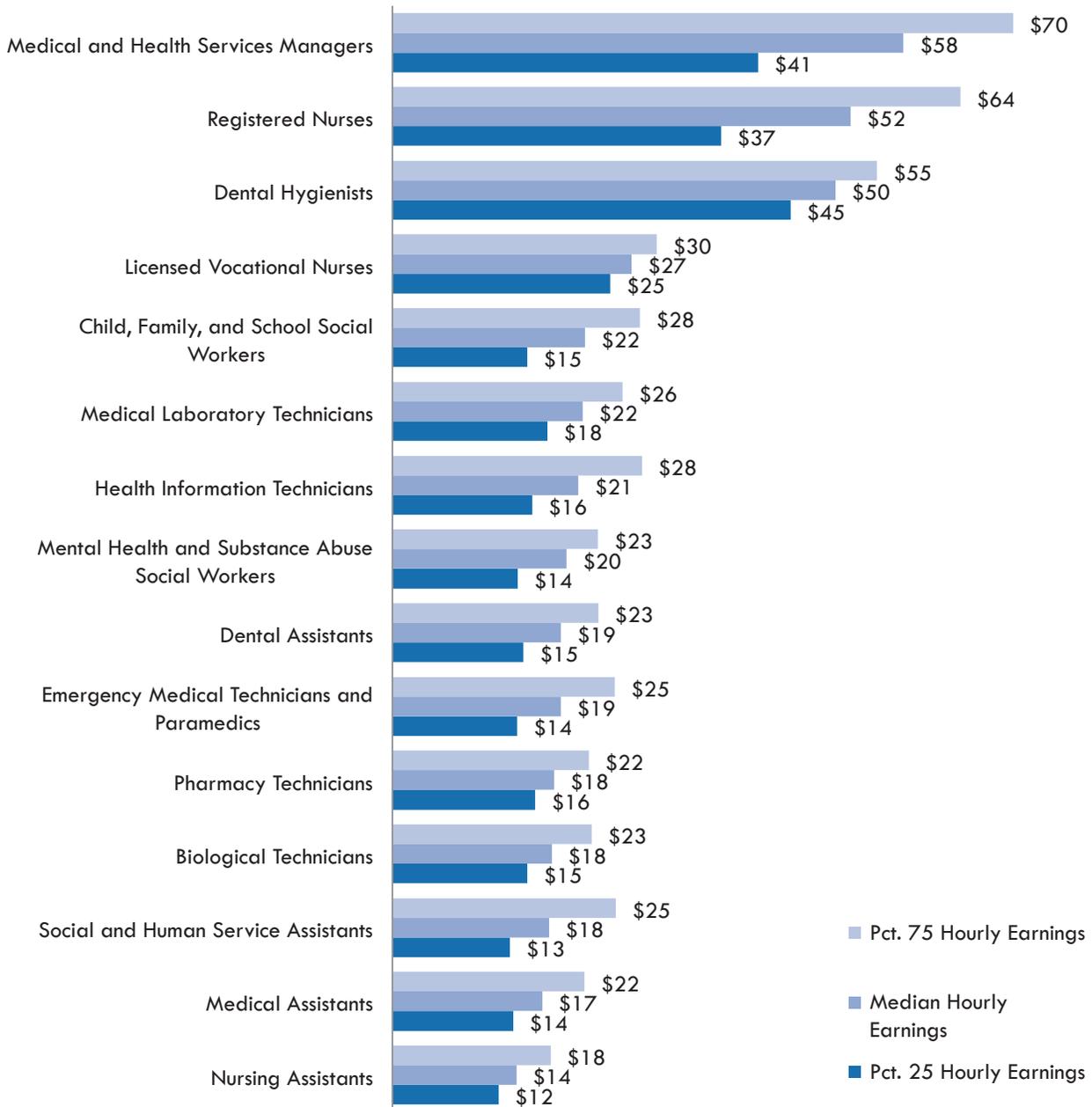


<sup>18</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# OCCUPATIONAL WAGES

Most of occupations included in the Life Sciences and Health Services cluster analysis earn wages that are close to or above the regional median wage. Medical and health services managers is the highest paid occupation, followed by registered nurses and dental hygienists. The lowest paid occupations in the group include social and human services assistants, medical assistants and nursing assistants. The median hourly wage across all occupations in the Sacramento Capital region is \$22.69 per hour.

**Exhibit 12: Hourly Wages, Life Sciences and Health Services Occupations, Sacramento Capital Region, 2015<sup>19</sup>**



<sup>19</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EDUCATION ASSESSMENT

This section provides a review of the training and education supply supporting the Life Sciences and Health Services cluster for the occupations selected for inclusion in this study. Exhibit 13 identifies the minimum education requirements for the Life Sciences and Health Services cluster occupations. The minimum education requirement for the majority of occupations is a postsecondary certificate or associate degree. Two occupations have a minimum entry-level education requirement of a high school diploma plus on-the-job training. However, postsecondary training or education may give candidates a competitive advantage in the hiring process over those with only a high school diploma.

## Exhibit 13: Minimum Education Requirements, Life Sciences and Health Services Occupations

Description	Entry Level Education	Typical On-The-Job Training
Biological Technicians	Bachelor's degree	None
Child, Family, and School Social Workers	Bachelor's degree	None
Dental Assistants	Postsecondary non-degree award	None
Dental Hygienists	Associate degree	None
Emergency Medical Technicians and Paramedics	Postsecondary non-degree award	None
Health Information Technicians	Postsecondary non-degree award	None
Licensed Vocational Nurses	Postsecondary non-degree award	None
Medical and Health Services Managers	Bachelor's degree	None
Medical Assistants	Postsecondary non-degree award	None
Medical Laboratory Technicians	Associate degree	None
Mental Health and Substance Abuse Social Workers	Bachelor's degree	None
Nursing Assistants	Postsecondary non-degree award	None
Pharmacy Technicians	High school diploma or equivalent	On-the-job training
Registered Nurses	Associate degree	None
Social and Human Service Assistants	High school diploma or equivalent	On-the-job training



# EDUCATION ASSESSMENT

Exhibit 14 lists the programs with certificate and degree programs that provide a workforce pipeline to the Life Sciences and Health Services cluster. The table includes an estimate of the certificate and degrees conferred each year, based on a three-year historical average as well as the total number of training programs in the region. Appendix B provides a complete list of the educational programs in the region, including the type of degree conferred.

In the Sacramento Capital region, there are 71 training programs supporting the Life Sciences and Health Services cluster occupations. These programs confer an average 2,700 degrees and certificates annually. Based on a high level assessment of supply and demand, there could be gaps in the workforce pipeline in several areas: biological technicians, dental hygienists, emergency medical technicians/paramedics, health information technicians/coders, medical laboratory technicians, and registered nurses.

The supply and demand data also suggests that there could be a significant oversupply of medical assistants, dental assistants and licensed vocational nurses. When there is an oversupply in the workforce systems, new graduates may not be able to find work in their field of study, forcing them to return to school, move out of the region, or find employment in other environments.

The total certificates and degrees conferred provide some information about the supply of workers to an industry or cluster. However, it is limited in that there are several unknown variables that impact the supply, such as migration trends, employer preferences, worker preparedness, qualified unemployed labor force, and graduate/completion duplication. Therefore, it is necessary to conduct additional research to verify potential training shortages in the region.

## Exhibit 14: Educational Programs & Awards, Life Sciences and Health Services Occupations, Sacramento Capital Region<sup>20&21</sup>

Educational Program	3-Year Average Certificate/Degrees Conferred	Number of Training Programs
Alcohol and Controlled Substances	135	7
Biotechnology & Biomedical Technology	18	1
Dental Assistant	282	5
Dental Hygiene/Hygienist	66	2
Emergency Medical Services/Paramedic	15	6
Health Administration	Not Available	1
Health Information Technology/Coding	33	3
Human Services	124	6
Licensed Vocational Nursing	308	6
LVN to RN Bridge	Not Available	4
Medical Assistant	779	12
Medical Laboratory Technology	6	1
Nursing Assistant	Not Available	3
Pharmacy Technician/Assistant	141	5
Registered Nursing	583	8
Social Work	221	1
<b>Total</b>	<b>2,711</b>	<b>71</b>

<sup>20</sup> California Community College Chancellor's Office Data Mart. National Center for Education Statistics (NCES). Higher education institutions are required to report completion data to NCES if they participate in any federal financial assistance program authorized by Title IV of the Higher Education Act. Completion data not reported to the NCES or CCCC Data Mart were not included in the estimate.

<sup>21</sup> The 3-year average is based on academic years 2011–12, 2012–13 and 2013–14 for private education institutions and public four-year universities and 2012–13, 2013–14, and 2014–15 for community colleges.

# SKILLS ASSESSMENT

Exhibit 15 displays the top skills and professional credentials for the Life Sciences and Health Services cluster occupations selected for inclusion in this study. The data is based on analysis of job posting data, aggregated by Burning Glass. This online tool uses intelligent “spidering” to search the Internet for job listings, removes duplication, and aggregates the data into a search database. As shown below, most of the skills/knowledge areas are specialized and require specific training and certifications.

## Exhibit 15: Skill and Professional Credential Preferences, Life Sciences and Health Services Occupations<sup>22</sup>

Occupation	Top Skill/Knowledge Areas	Top Certifications/ Professional Credentials
Biological Technicians	Biology, chemistry, botany, physics, mathematics, entomology, test equipment, experiments, medical equipment instruction, molecular biology, and data collection	Biomedical Equipment Technician (BMET)
Child, Family, and School Social Workers	Case management, social services, psychology, child development, screening, mental health, treatment planning, and therapy	Social Work License, First Aid CPR AED
Dental Assistants	Dentistry, radiology, patient treatment, front office, oral hygiene, X-Rays, dental procedures and infection control	First Aid CPR AED, Certified Dental Assistant
Dental Hygienists	Oral hygiene, treatment planning, dentistry, X-Rays, patient/family education and instruction, prophylaxis, local anesthetics, scaling, and sealants.	Dental Hygienist Certification
Emergency Medical Technicians and Paramedics	Patient care, first aid, life support, advanced cardiac life support, electrocardiogram, triage, physical demand, trauma, and emergency medical care	EMT, Paramedic Certification, First Aid CPR AED
Health Information Technicians	Medical coding, medical billing, ICD-9-CM coding, health information technology, CPT coding, medical records, data entry, medical terminology, and electronic records, ICD-10	Registered Health Information Technician, Certified Professional Coder, Registered Health Information Administrator
Licensed Vocational Nurses	Patient care, treatment planning, patient/family education and instruction, medication administration, home health, acute care, vital signs measurement, screening, infection control, patient evaluation, care planning and data collection	Licensed Vocational Nurse, First Aid CPR AED, Basic Cardiac Life Support Certification
Medical and Health Services Managers	Patient care, case management, collaboration, nurse management, scheduling, acute care, clinical experience, staff development, advanced cardiac life support, home health, treatment planning and patient direction	Registered Nurse, First Aid CPR AED, Basic Cardiac Life Support Certification, Advanced Cardiac Life Support Certification
Medical Assistants	Patient care, vital signs measurement, appointment setting, injections, scheduling, medical terminology, patient preparation, phlebotomy, front office, electrocardiogram, and electronic medical records	Certified Medical Assistant, First Aid CPR AED, Basic Cardiac Life Support Certification
Medical Laboratory Technicians	Chemistry, phlebotomy, laboratory equipment, biology, data entry, equipment maintenance, laboratory testing, laboratory procedures and pathology	Phlebotomy Certification, Certified Medical Laboratory Technician
Mental Health and Substance Abuse Social Workers	Mental health, treatment planning, case management, psychology, crisis intervention, behavioral health, patient care, discharge planning, social services and patient assistance	Social Work License
Nursing Assistants	Patient care, patient bathing, vital signs measurement, acute care, patient direction, blood pressure checking, patient assistance, and life support	Certified Nursing Assistant, First Aid CPR AED, Basic Cardiac Life Support Certification
Pharmacy Technicians	Pharmacist assistance, labeling, HIPAA, scheduling, data entry, training programs, and prescription processing	Certified Pharmacy Technician
Registered Nurses	Patient care, advanced cardiac life support, acute care, treatment planning, case management, critical care, patient/family education and instruction, collaboration, patient direction, patient evaluation, and telemetry	Registered Nurse, Advanced Cardiac Life Support Certification
Social and Human Service Assistants	Case management, social services, mental health, screening, data entry, psychology, crisis intervention and record keeping	First Aid CPR AED

<sup>22</sup> Burning Glass, 2015.

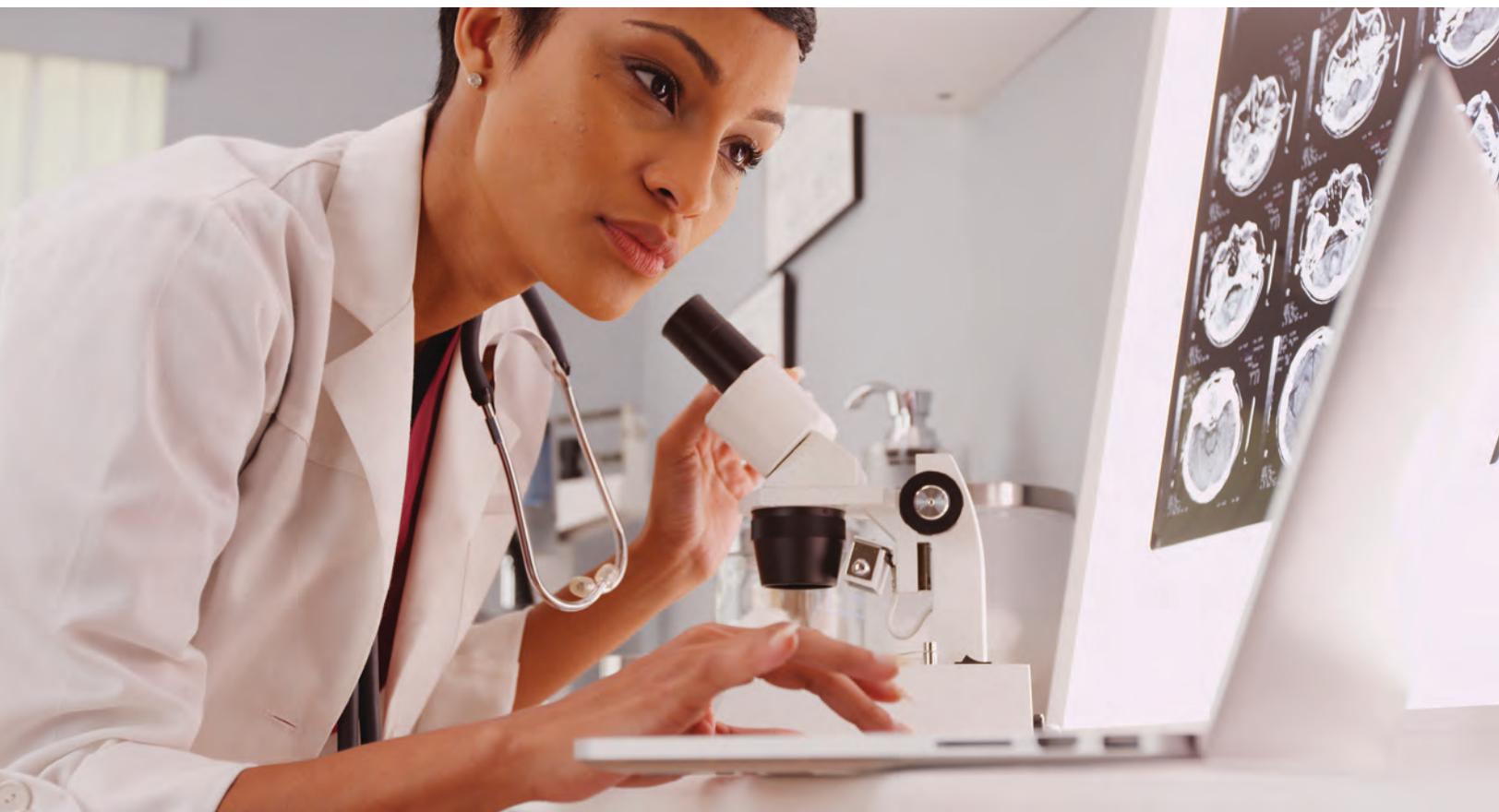
# SUMMARY

The Life Sciences and Health Services cluster employs more than 145,000 workers, about 14 percent of the total employment in the Sacramento Capital region. This cluster includes five subsectors: hospitals, ambulatory healthcare services, nursing and residential care, social assistance, and life sciences. In the last five years, this cluster has grown by 29 percent with a sharp increase between 2012 and 2013 – which corresponds with the implementation of the health insurance marketplace and the expansion of insurance coverage to thousands of previously uninsured individuals.

Over the next five years, the Life Sciences and Health Services cluster is projected to grow by 19 percent, adding about 27,300 jobs to Sacramento’s economy. Population growth and an aging workforce are driving demand, as well as expansion of care through the Patient Protection and Affordable Care Act.

There are more than 60 occupations and career tracks for individuals with an interest in the field of Life Sciences and Health Services. Fifteen occupations were selected for inclusion in this study based on total number of job openings and minimum education requirements, including:

- Biological Technicians
- Child, Family, and School Social Workers
- Dental Assistants
- Dental Hygienists
- Emergency Medical Technicians and Paramedics
- Health Information Technicians
- Licensed Vocational Nurses
- Medical and Health Services Managers
- Medical Assistants
- Medical Laboratory Technicians
- Mental Health/Substance Abuse Social Workers
- Nursing Assistants
- Pharmacy Technicians
- Registered Nurses
- Social and Human Service Assistants



# SUMMARY

Registered nurses is the largest occupation in the group, with the most annual openings over the next five years. Nursing assistants and medical assistants are also large occupations, with significant annual openings created by new job growth and replacement needs. Most of occupations in the cluster earn wages that are close to or above the regional median wage.

There are 71 training programs supporting the Life Sciences and Health Services cluster. These programs confer an average 2,700 degrees and certificates annually. Based on a high level assessment of supply and demand, there could be gaps in the workforce pipeline in several areas: biological technicians, dental hygienists, emergency medical technicians/paramedics, health information technicians/coders, medical laboratory technicians, and registered nurses. The supply and demand data also suggests that there could be a significant oversupply of medical assistants, dental assistants and licensed vocational nurses. However, due to several unknown variables that impact the supply, more research is necessary to verify potential training and education shortages or oversupplies in the region.

Valley Vision, along with the Center of Excellence and other partners, will be conducting forums with Life Sciences and Health Services employers to review the cluster findings, high priority occupations and skills gaps that can be addressed through a concerted cluster workforce action plan. Priorities that may be elevated based on this analysis include:

1. Conduct primary research to assess potential skill gaps in existing training programs. Partner with regional employers and education institutions to identify skill requirements and competencies, and to close skills gaps.
2. Identify occupations that will be most impacted by projected retirements and the Patient Protection and Affordable Care Act, and develop action steps to increase supply.
3. Develop stackable credentials and training pathways to provide students with career advancement options in the Life Science and Health Services cluster.
4. Identify other Life Science and Health Services occupations not selected for inclusion in this study for additional research and review.



# APPENDIX A: LIFE SCIENCES AND HEALTH SERVICES CLUSTER DEFINITION

The Life Sciences and Health Services cluster is comprised of the following NAICS codes.

## Life Sciences

- 325411 Medicinal and Botanical Manufacturing
- 325412 Pharmaceutical Preparation Manufacturing
- 325413 In-Vitro Diagnostic Substance Manufacturing
- 325414 Biological Product (except Diagnostic) Manufacturing
- 334510 Electromedical and Electrotherapeutic Apparatus Manufacturing
- 334516 Analytical Laboratory Instrument Manufacturing
- 334517 Irradiation Apparatus Manufacturing
- 339112 Surgical and Medical Instrument Manufacturing
- 339113 Surgical Appliance and Supplies Manufacturing
- 446110 Pharmacies and Drug Stores
- 541380 Testing Laboratories
- 541711 Research and Development in Biotechnology
- 541712 Research and Development in the Physical, Engineering, and Life Sciences

## Ambulatory Care Services

- 621111 Offices of Physicians (except Mental Health Specialists)
- 621112 Offices of Physicians, Mental Health Specialists
- 621210 Offices of Dentists
- 621310 Offices of Chiropractors
- 621320 Offices of Optometrists
- 621330 Offices of Mental Health Practitioners (except Physicians)
- 621340 Offices of Physical, Occupational and Speech Therapists, and Audiologists
- 621391 Offices of Podiatrists
- 621399 Offices of All Other Miscellaneous Health Practitioners
- 621410 Family Planning Centers
- 621420 Outpatient Mental Health and Substance Abuse Centers

- 621491 HMO Medical Centers
- 621492 Kidney Dialysis Centers
- 621493 Freestanding Ambulatory Surgical and Emergency Centers
- 621498 All Other Outpatient Care Centers
- 621511 Medical Laboratories
- 621512 Diagnostic Imaging Centers
- 621610 Home Health Care Services
- 621910 Ambulance Services
- 621991 Blood and Organ Banks
- 621999 All Other Miscellaneous Ambulatory Health Care Services

## Hospitals

- 622110 General Medical and Surgical Hospitals
- 622210 Psychiatric and Substance Abuse Hospitals
- 622310 Specialty (except Psychiatric and Substance Abuse) Hospitals
- 902622 Hospitals (State Government)
- 903622 Hospitals (Local Government)

## Nursing and Residential Care Facilities

- 623110 Nursing Care Facilities (Skilled Nursing Facilities)
- 623210 Residential Intellectual and Developmental Disability Facilities
- 623220 Residential Mental Health and Substance Abuse Facilities
- 623311 Continuing Care Retirement Communities
- 623312 Assisted Living Facilities for the Elderly
- 623990 Other Residential Care Facilities

## Social Assistance

- 624110 Child and Youth Services
- 624120 Services for the Elderly and Persons with Disabilities
- 624190 Other Individual and Family Services
- 624310 Vocational Rehabilitation Services

# APPENDIX B: LIFE SCIENCES AND HEALTH SERVICES CLUSTER TRAINING PROGRAMS

The following table provides a list of educational programs supporting the 15 life science and health services occupations selected for inclusion in this study.

Program	College	Award Type
Alcohol and Controlled Substances	American River College	Associate of Arts, Certificate
	Cosumnes River College	Associate of Science, Certificate
	InterCoast Colleges, Elk Grove	Certificate
	Lake Tahoe Community College	Associate of Arts, Certificate
	William Jessup University	Certificate
	Woodland College	Associate of Science, Certificate
	Yuba College	Associate of Science, Certificate
Biotechnology & Biomedical Technology	American River College	Associate Degree; Certificate
Dental Assistant	Carrington College California, Citrus Heights	Associate degree, Certificate
	Carrington College California, Sacramento	Associate degree, Certificate
	Kaplan College, Sacramento	Certificate
	Lake Tahoe Community College	Certificate
	Sacramento City College	Associate of Science, Certificate
Dental Hygiene/Hygienist	Carrington College California, Sacramento	Associate degree
	Sacramento City College	Associate of Science
Emergency Medical Services/Paramedic	American River College	Associate of Science, Certificate
	Cosumnes River College	Certificate
	Folsom Lake College	Course
	Lake Tahoe College	Course
	Sierra College	Course
	Yuba College	Certificate
Health Administration	University of Phoenix, Sacramento Valley Campus	Bachelor's and Master's
Health Information Technology/Coding	Asher College	Certificate
	Bryan College, Gold River	Associate degree
	Cosumnes River College	Certificate in Coding; Associate of Science in HIT
Human Services	American River College	Associate of Arts, Certificate
	Cosumnes River College	Associate of Arts, Certificate
	Sacramento City College	Associate of Arts, Certificate
	University of Phoenix, Sacramento Valley Campus	Bachelor's degree
	Woodland College	Associate of Science
	Yuba College	Associate of Science
Health Licensed Vocational Nursing	Carrington College, Sacramento	Associate degree, Certificate
	Charles A Jones Career and Education Center	Certificate
	Curam College of Nursing	Certificate
	Kaplan College, Sacramento	Certificate
	Sacramento City College	Associate of Science, Certificate
	Unitek College, Sacramento	Certificate

# APPENDIX B: LIFE SCIENCES AND HEALTH SERVICES CLUSTER TRAINING PROGRAMS

Program	College	Award Type
LVN to RN Bridge	American River College	Associate degree/Certificate
	Sacramento City College	Certificate
	Sierra College	Certificate
	Yuba College	Certificate
Medical Assistant	Cambridge Junior College, Woodland	Certificate
	Cambridge Junior College, Yuba City	Certificate
	Carrington College California, Citrus Heights	Associate degree, Certificate
	Carrington College California, Sacramento	Associate degree, Certificate
	CET, Sacramento	Certificate
	Charles A Jones Career and Education Center	Certificate
	Cosumnes River College	Associate of Science, Certificate
	InterCoast Colleges, Elk Grove	Certificate
	Kaplan College, Sacramento	Certificate
	Lake Tahoe Community College	Associate of Arts, Certificate
MTI College	Certificate	
San Joaquin Valley College, Rancho Cordova	Certificate	
Medical Laboratory Technology	Folsom Lake College	Associate of Science
Nursing Assistant	American River College	Certificate
	Cosumnes River College	Certificate
	Sierra College	Courses
Pharmacy Technician/Assistant	Asher College	Certificate
	Carrington College California, Citrus Heights	Associate degree
	Carrington College California, Sacramento	Associate degree
	Charles A Jones Career and Education Center	Certificate
Cosumnes River College	Associate of Science	
Registered Nursing	American River College	Associate of Science
	Breckinridge School of Nursing, ITT Technical Institute, Rancho Cordova	Associate degree
	California State University, Sacramento	Bachelor's and Master's degree
	Carrington College California, Sacramento	Associate degree, Certificate
	Sacramento City College	Associate of Science
	Sierra College	Associate of Science
	University of California, Davis	Master's degree
	University of Phoenix, Sacramento Valley Campus	Bachelor's degree
Yuba College	Associate of Science	
Social Work	California State University, Sacramento	Bachelor's and Master's

# MORE ABOUT...

## More About The Centers of Excellence

The Centers of Excellence (COE) for Labor Market Research deliver regional workforce research and technical expertise to California 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.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the leading source of regional workforce information and insight for California community colleges. More information about the Centers of Excellence is available at [www.coecc.net](http://www.coecc.net).

For more information on this study, contact:

Theresa Milan, COE Director  
Northern California Region  
(916) 563-3221  
[milant@losrios.edu](mailto:milant@losrios.edu)

This study was conducted with the support of JPMorgan Chase & Co. In addition, this study was supported by Economic and Workforce Development funds awarded by the Chancellor's Office, California Community Colleges. It was produced pursuant to grant agreement number 15-305-001.

## More About Valley Vision

Since 1994, Valley Vision's work has driven transformative change and improved lives across Northern California. An independent social impact and civic leadership organization headquartered in Sacramento, Valley Vision strengthens our communities through unbiased research, boundary-crossing collaboration and change leadership. Our work improves overall quality of life and creates the conditions for economic prosperity and community health and vitality.

## More About Burris Service Group

The Burris Service Group (BSG) is a full-service consulting practice providing expertise in economic development, strategic economic research, real estate site strategy, management, and institutional growth. The company was established based on the clear need that advisory services be delivered in an "action-oriented" form. The founder of BSG, Robert Burris, brings to his clients an active local and international network of professionals, as well as 20 years of experience in economic development, market and economic analysis, commercial real estate information, corporate sales, and consulting.



**Burris Service Group**

JPMORGAN CHASE & CO.

[www.coecc.net](http://www.coecc.net)

**FIND US ON LINKEDIN GROUPS:**



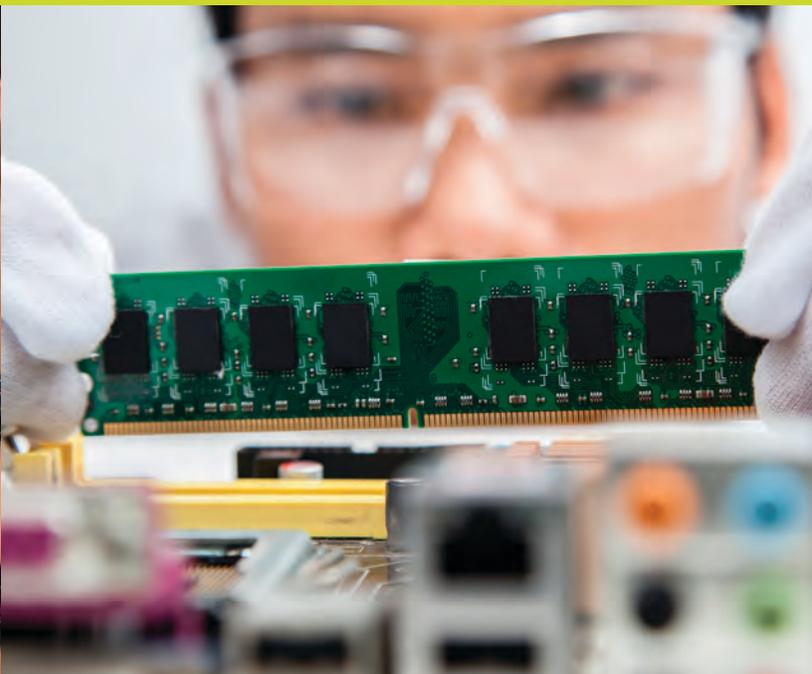
<http://linkd.in/1EUU9wM>



CENTERS OF EXCELLENCE  
Inform Connect Advance

SERIES: 3 OF 6

# INFORMATION & COMMUNICATION TECHNOLOGIES CLUSTER: WORKFORCE NEEDS ASSESSMENT SACRAMENTO CAPITAL REGION



**February 2016**

Prepared by: Centers of Excellence,  
Los Rios Community College District

Valley Vision

Burris Service Group

This research was conducted with the generous  
support of JPMorgan Chase & Co.

JPMORGAN CHASE & CO.

**Burris Service Group**



# TABLE OF CONTENTS

<b>Introduction.....</b>	<b>3</b>
<b>Cluster Definition .....</b>	<b>4</b>
<b>Establishments.....</b>	<b>5</b>
<b>Concentration of Employment.....</b>	<b>6</b>
<b>Trends and Projections .....</b>	<b>7–8</b>
<b>Earnings.....</b>	<b>9</b>
<b>Shift Share Analysis .....</b>	<b>10</b>
<b>Economic Impact.....</b>	<b>11–12</b>
<b>Economic Leakage .....</b>	<b>12</b>
<b>ICT Trends.....</b>	<b>13</b>
<b>Workforce Challenges .....</b>	<b>13</b>
<b>Occupation Demand.....</b>	<b>14–15</b>
<b>Occupational Wages.....</b>	<b>16</b>
<b>Education Assessment.....</b>	<b>17–18</b>
<b>Education Pathways .....</b>	<b>19</b>
<b>Skills Assessment .....</b>	<b>20–21</b>
<b>Summary .....</b>	<b>22–23</b>
<b>Appendix A: Information and Communication Technologies Cluster Definition.....</b>	<b>24</b>
<b>Appendix B: California Community Colleges Defining ICT Career Pathways.....</b>	<b>25</b>

## ***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.

© 2016 Chancellor’s Office California Community Colleges  
Economic and Workforce Development Program

*Please consider the environment before printing. This document is designed for double-sided printing.*

# INTRODUCTION

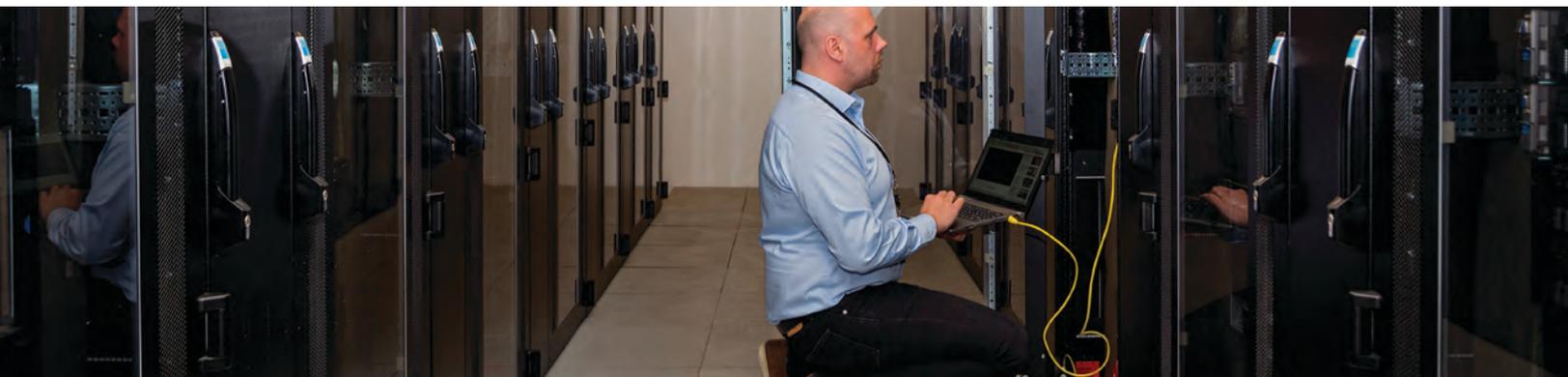
Starting in 2008, the six-county Sacramento Capital region (El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba counties) was rocked by the global recession, losing 10 percent of the region's jobs. In response, regional leaders initiated Next Economy, an action plan to accelerate job creation and new investment in six high-growth business (industry) clusters. Valley Vision, a regional civic leadership organization, managed the three-year Next Economy design, research and implementation process on behalf of a wide range of private and public sector partners.

By late 2015, after a lagging recovery, the region's economy picked up momentum, with the unemployment rate decreasing while job growth accelerated. Valley Vision received funding from JPMorgan Chase & Co. to better understand how the region's key growth industry clusters have changed since the original Next Economy research was conducted in 2012 and what new opportunities are emerging. Valley Vision is partnering with the Los Rios Center of Excellence and the Burris Service Group on this effort.

Cluster research is a widely accepted standard of practice for developing regional prosperity strategies to address multiple facets of a region's complex economy. Industry clusters reduce operating costs by shortening supply chains; increasing the flow of information regarding new business opportunities; concentrating workforce training needs in select occupations; and speeding up the identification of gaps in products or services.<sup>1</sup> Firms in identified clusters may also have a reduced risk of failure, as these firms are better supported by the supply chain and can respond more rapidly to shifts in the marketplace.

This report presents findings on the analysis of the Information and Communication Technologies (ICT) cluster. It is one in a series of six covering Next Economy-identified clusters. Additional reports include advanced manufacturing, the "clean economy," education and knowledge creation, food and agriculture, and life sciences and health services.<sup>2</sup> Each report provides an overview of the cluster, industry trends and economic impact, as well as an overview of the top demand occupations in the cluster requiring postsecondary education or training, along with projected occupational demand, institutions providing related education and training, and possible workforce gaps. Visit [valleyvision.org](http://valleyvision.org) or [coecc.net](http://coecc.net) to access completed reports.<sup>3</sup>

This research will be used to develop cluster-based workforce action plans. Valley Vision will work alongside regional education, and workforce and economic development partners to convene six cluster-based employer focus groups, setting priorities and developing strategies to address critical workforce gaps, better align education and workforce development resources to meet employer and workforce needs, and strengthen the regional economy overall.



<sup>1</sup> *Cluster Manufacturing: A Supply Chain Perspective*

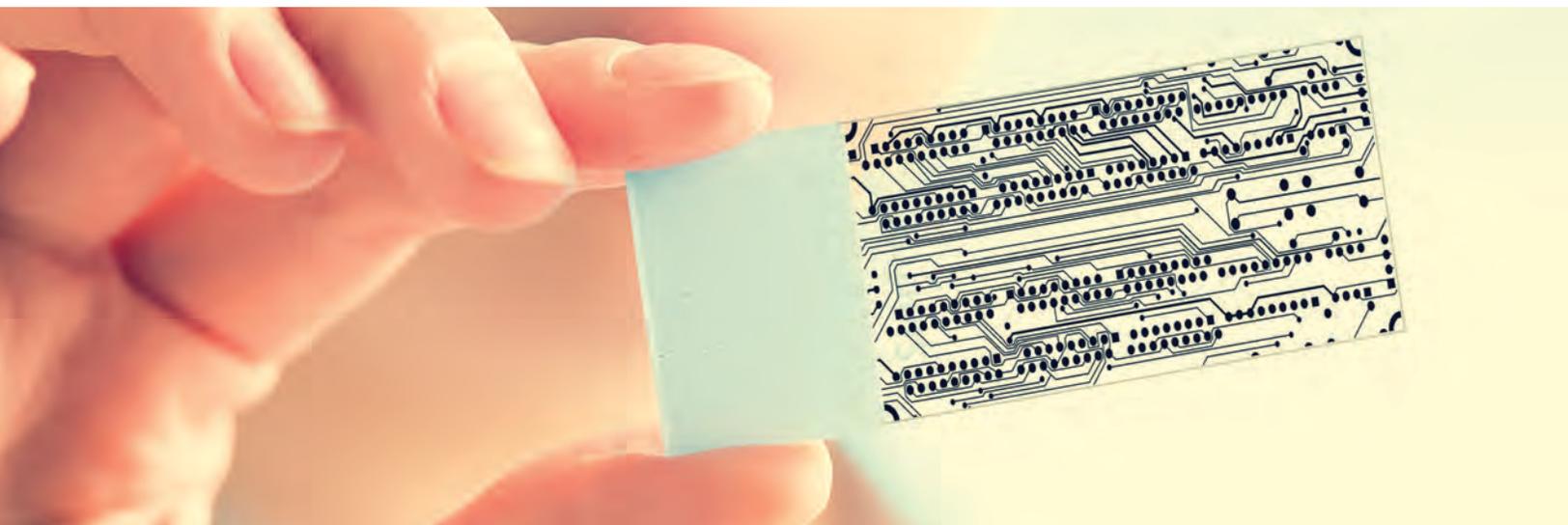
<sup>2</sup> Sacramento Area Council of Governments (SACOG) is the principal researcher for the Food and Agriculture Cluster study, which will focus primarily on industry trends and excludes workforce development and training needs.

<sup>3</sup> Reports will be posted to the [valleyvision.org](http://valleyvision.org) and [coecc.net](http://coecc.net) websites throughout the spring 2016 when finalized.

# CLUSTER DEFINITION

Information and Communications Technologies (ICT) is the convergence of computer networking and telecommunications. The ICT umbrella organizes technologies related to telecommunications, computing, networks, and other high-tech fields. ICT job functions impact all businesses, regardless of industry type or size of employment. However there are a core set of industries that engage primarily in ICT activities that can be used to define the cluster.

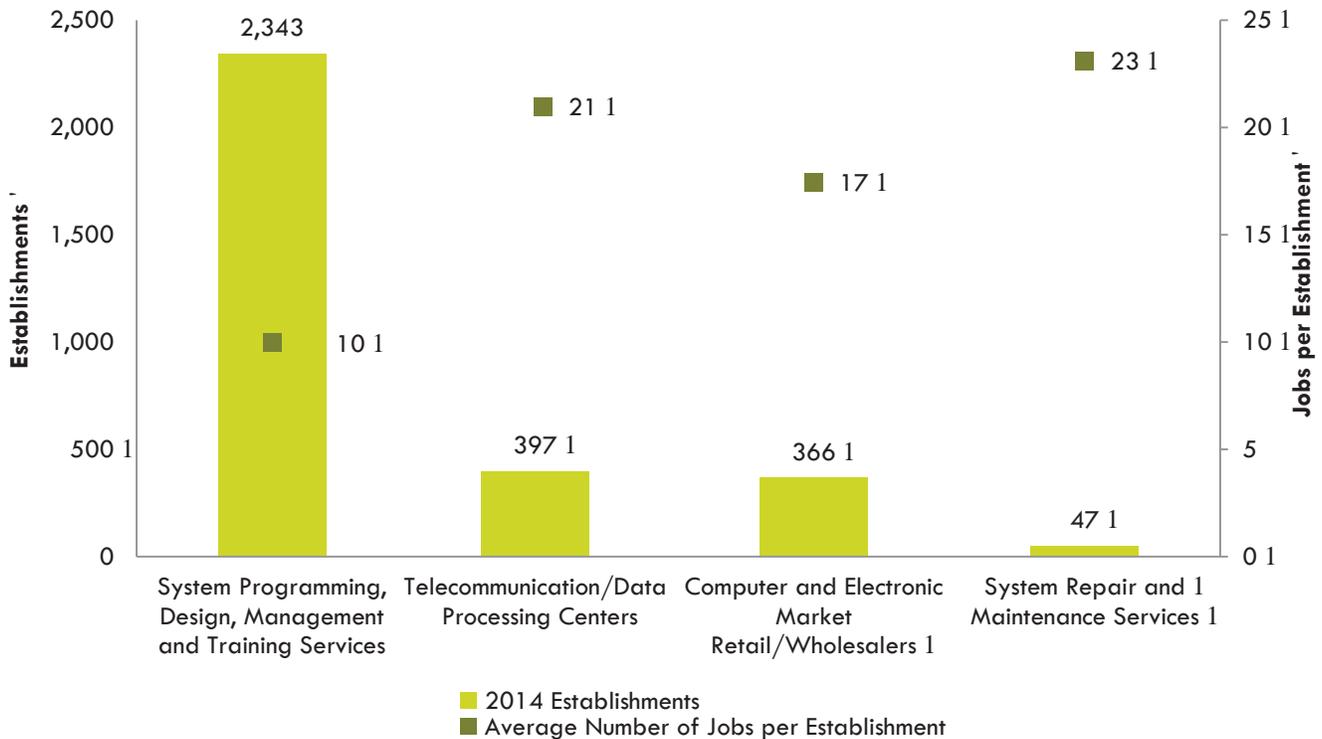
- **Computer and Electronic Market Retail/Wholesalers** – This industry group comprises establishments primarily engaged in the merchant wholesale distribution and retail of computers, computer peripheral equipment, loaded computer boards, and/or computer software. These establishments are also engaged in retailing all types of merchandise using the Internet, Internet auctioning, and business-to-business electronic markets.
- **ICT Component Manufacturing** – This industry group comprises establishments primarily engaged in manufacturing computers, storage devices, terminals, telephone apparatus, broadband and wireless communications equipment, fiber optical cable, and other peripheral and telecommunication equipment.
- **System Programming, Design, Management and Training Services** – This industry group comprises establishments primarily engaged in programming, planning and designing computer systems that integrate computer hardware, software, and communication technologies. This group also includes establishments that provide on-site management and operation of clients' computer systems and/or data processing facilities or training services.
- **System Repair and Maintenance Services** – This industry group comprises establishments primarily engaged in repairing and maintaining computers, office machines and telecommunications equipment.
- **Telecommunication/Data Processing Centers** – This industry group comprises establishments primarily engaged in operating and/or providing access to transmission facilities and infrastructure that they own and/or lease for the transmission of voice, data, text, sound, and video. This group also includes establishments that resell telecommunication services; provide specialized telecommunications services; provide data processing, hosting, and related services; and provide Internet publishing and broadcasting.



# ESTABLISHMENTS

Exhibit 1 displays establishments and the average number of jobs per establishment by ICT subsector in the Sacramento Capital region. As shown, system programming, design, management and training services is the largest subsector with over 2,300 establishments, which is nearly six times the size of telecommunication/data processing centers or computer and electronic market retail/wholesalers. System repair and maintenance services is the smallest subsector with only 47 establishments. The average number of jobs per establishment, ranging between 10 and 23, indicates that the ICT cluster is composed of mostly small organizations.

**Exhibit 1: Establishments and Average Employment by Subsector, 2014<sup>5</sup>**



<sup>5</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# CONCENTRATION OF EMPLOYMENT

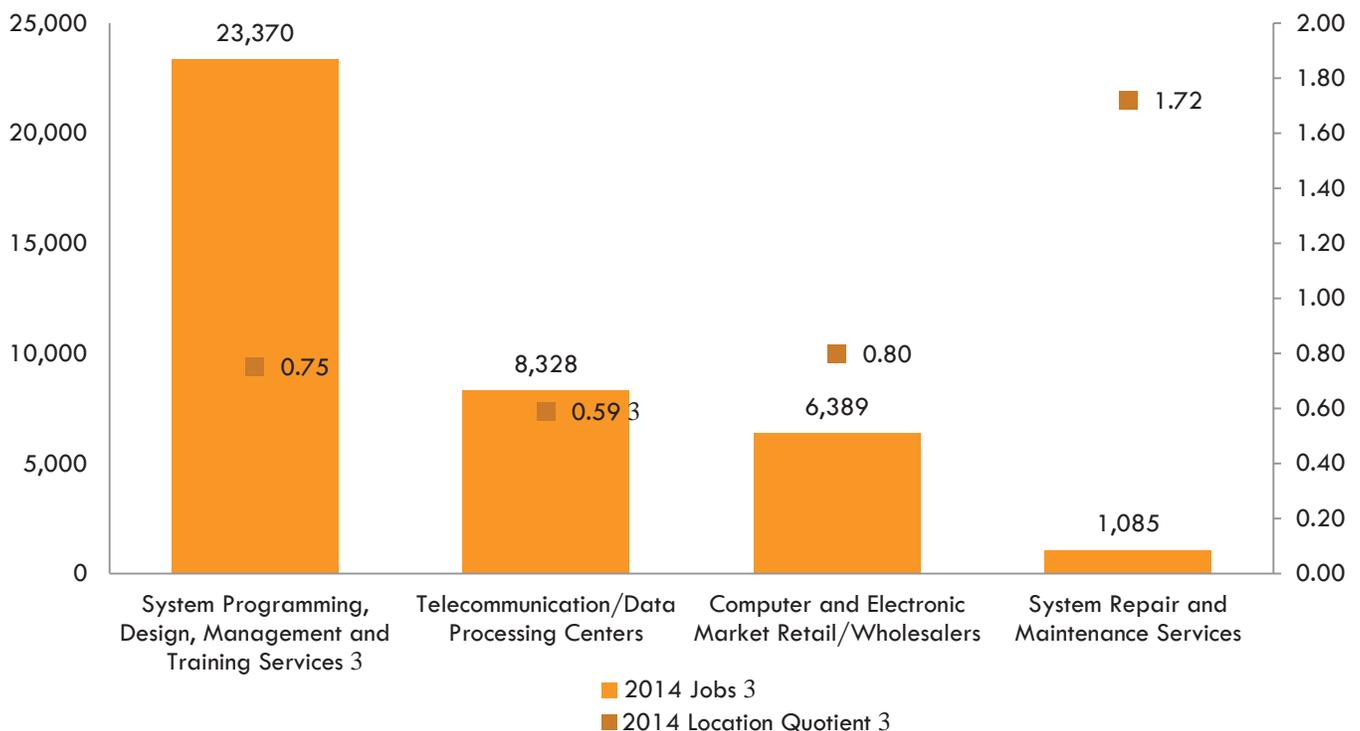
In 2014, there were about 39,200 ICT cluster jobs, about four percent of the total employment in the Sacramento Capital region. As shown in Exhibit 2, the majority of ICT jobs were in system programming, design, management and training services (60%; 23,370 jobs), followed by telecommunication/data processing centers (21%; 8,328 jobs) and computer electronic market retail/wholesalers (16%; 6,389 jobs).

Location quotient analysis compares the total employment in a region relative to the total employment in a larger area — in this case, California. A location quotient of less than one indicates a lower concentration of employment for that industry in the region than in the state overall. A location quotient of more than one indicates a higher concentration of employment for the region than in the state overall.

Three of the four ICT subsectors in the Sacramento Capital region have a location quotient that is less than one, indicating a lower concentration of employment than in other areas of the state. System repair and maintenance services, while it represents relatively low employment compared to the other subsectors, has a larger than one location quotient indicating a higher concentration of employment than the state. Within the subsectors, there are industries with above average location quotients, indicating a high concentration of employment for those industries than in the state overall. These include:

- **System Programming, Design, Management and Training Services:** Other Scientific and Technical Consulting Services (2.38 LQ).
- **Telecommunication/Data Processing Centers:** Cable and Other Subscription Programming (1.85 LQ); and Telecommunications Resellers (1.33 LQ).
- **Computer and Electronic Market Retail/Wholesalers:** Computer and Computer Peripheral Equipment and Software Merchant Wholesalers (1.12 LQ).
- **System Repair and Maintenance Services:** Computer and Office Machine Repair and Maintenance (2.45).

**Exhibit 2: Total Employment and Location Quotient by Subsector, 2014<sup>6</sup>**



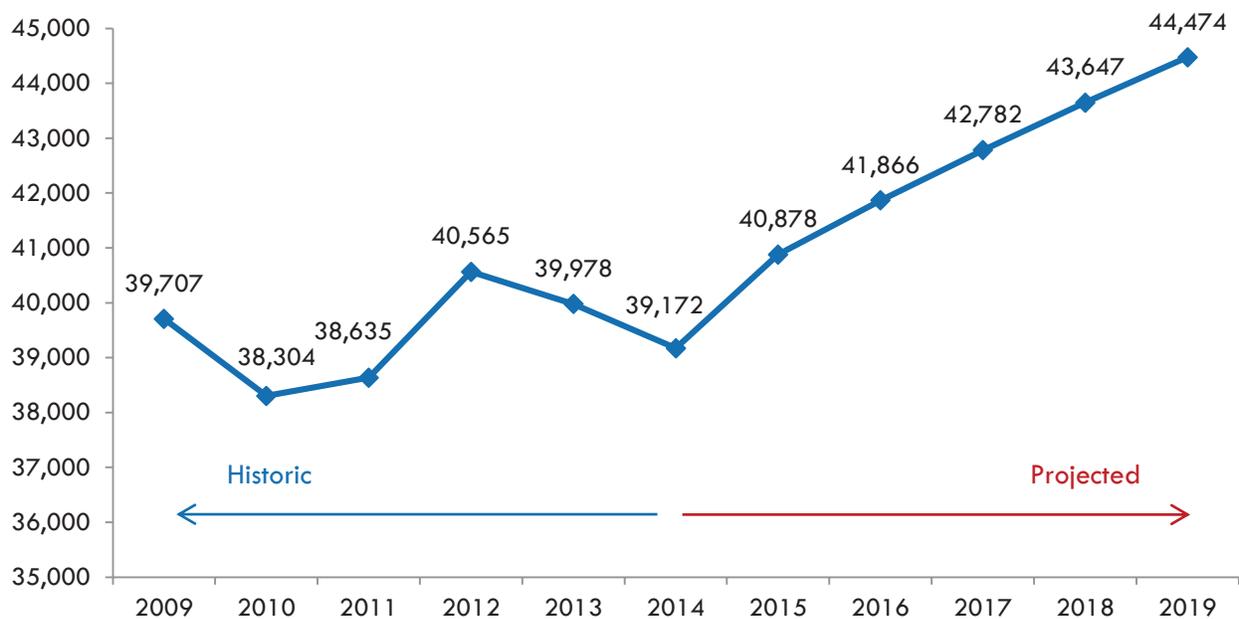
<sup>6</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# TRENDS AND PROJECTIONS



The ICT cluster has experienced several ups and downs in the last few years with both increases and declines in overall employment. However, over the next five years, the ICT cluster is projected to grow steadily, adding nearly 5,300 jobs by 2019. The system programming, design, management and training services subsector is projected to add the most jobs, followed by computer and electronic market retail/wholesalers.

**Exhibit 3: Employment Trends and Projections, 2009–2019<sup>7</sup>**



**Exhibit 4: Employment Projections by Subsector, 2014–2019<sup>7</sup>**

ICT Subsector	2014 Jobs	2019 Jobs	Change	% Change
System Programming, Design, Management and Training Services	23,370	26,667	3,297	14%
Telecommunication/Data Processing Centers	8,328	8,870	542	7%
Computer and Electronic Market Retail/Wholesalers	6,389	7,741	1,352	21%
System Repair and Maintenance Services	1,085	1,196	111	10%
<b>Total ICT Jobs</b>	<b>39,172</b>	<b>44,474</b>	<b>5,302</b>	<b>14%</b>

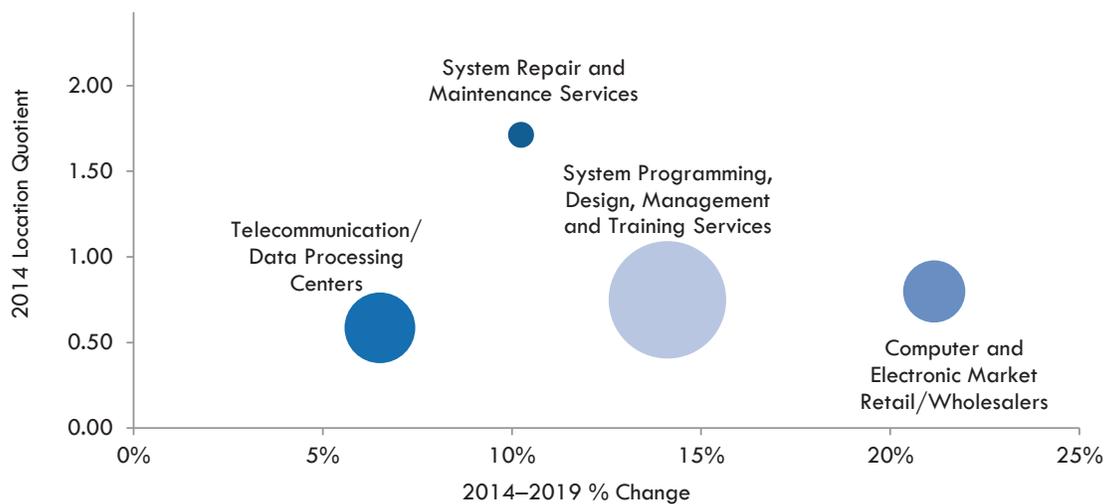
<sup>7</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# TRENDS AND PROJECTIONS

The following bubble chart compares the projected five-year growth rate to the concentration of employment in the region, where the size of the bubble indicates the total number of jobs for that subsector.

- Systems repair and maintenance services has an above average concentration of employment in the region compared to other parts of the state but is the smallest subsector in the cluster.
- Computer and electronic market retail/wholesalers has the fastest projected growth rate with the second highest location quotient.
- Systems programming, design, management and training services is the largest subsector with a strong projected growth rate and the most projected number of new jobs.
- Telecommunication/data processing centers has the lowest location quotient with a moderate projected growth rate.

**Exhibit 5: Growth Rate vs. Subsector Concentration<sup>8</sup>**

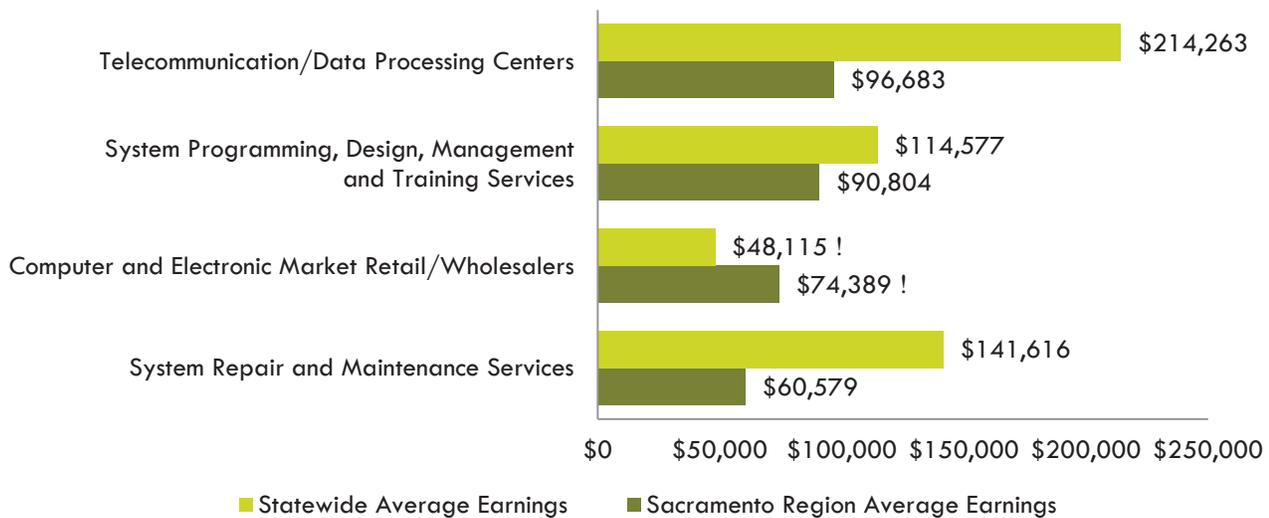


<sup>8</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EARNINGS

In the Sacramento Capital region, telecommunication/data processing centers provide the highest earnings in the cluster, followed by systems programming, design, management and training services. The earning calculation includes an average of all wages, salaries, proprietor earnings and supplemental earnings (such as retirement benefits, bonuses, etc.) for all occupations in the sector. With the exception of computer and electronic market retail/wholesalers, the ICT subsectors earn lower wages than the statewide average for the same subsectors. However, the ICT subsectors (with exception of system repair and maintenance services) provide earnings above the region's average earnings across all industries, which is \$63,400.<sup>9</sup>

**Exhibit 6: Earnings by Subsector, 2014<sup>10</sup>**



<sup>9</sup> The average earnings across all industries in the Sacramento region is \$63,400 and includes wages, salaries, proprietor earnings and supplements.

<sup>10</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# SHIFT SHARE ANALYSIS



Shift share analysis is a method for determining how much of regional job growth can be attributed to national trends and how much is due to unique regional factors. Exhibit 7 displays four key components:

- **Industrial Mix Effect** – represents the share of regional industry growth explained by the growth of the specific industry at the national level.
- **National Growth Effect** – represents how much of the regional industry's growth is explained by the overall growth of the national economy. Given that the nation's economy is growing, it is normal to see positive change in each subsector.
- **Expected Change** – the change expected due to national growth effect and industry mix effects.
- **Regional Competitive Effect** – explains how much of the change in the subsectors is due to some unique competitive advantage that the region possesses, because the growth cannot be explained by national trends in the industry or the economy as a whole.

Three of the four subsectors are outperforming national trends, while the largest ICT subsector, systems programming, design, management and training services, is underperforming compared to national trends. This suggests that the region has a slight competitive advantage in the ICT cluster overall.

## Exhibit 7: Shift Share Analysis by Subsector, 2013–2018<sup>11</sup>

	Industrial Mix Effect	National Growth Effect	Expected Change	Regional Competitive Effect
Computer and Electronic Market Retail/Wholesalers	(51)	406	355	996
Telecommunication/Data Processing Centers	(583)	530	(53)	595
System Programming, Design, Management and Training Services	3,088	1,486	4,574	(1,277)
System Repair and Maintenance Services	(41)	69	28	83
<b>Total ICT Cluster</b>	<b>857</b>	<b>1,630</b>	<b>2,487</b>	<b>472</b>

<sup>11</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# ECONOMIC IMPACT

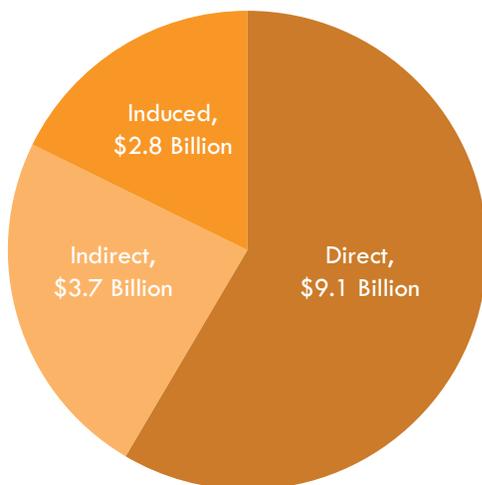
Economic impact provides a quantitative method to estimate the total economic benefit from a project, or in this case, an industry cluster. In other words, it is the “ripple effect” of all economic activities resulting from that cluster. Impact analysis is typically comprised of direct, indirect and induced impacts:

- Direct impacts are those resulting from the expenditures of operations within that industry cluster.
- Indirect impacts are those resulting from suppliers of that cluster spending money and hiring employees.
- Induced impacts are the combined value of employees of the industry cluster spending money at a household level.

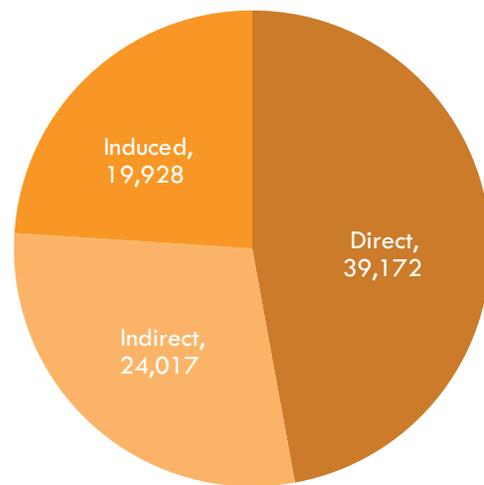
Combined, these three variables equate to the total economic impact of a project or industry cluster.

The ICT cluster impacts the Sacramento Capital region’s economy in several ways. The IMPLAN input output model was used to measure the cluster’s total economic impacts. First, the cluster directly benefits the economy through the operations and jobs supported by the establishments within its subsectors. As shown in Exhibits 8 and 9, the ICT cluster directly contributes \$9.1 billion in output and 39,000 jobs to the regional economy. In addition to this direct effect, these establishments generate an indirect impact through their supplier purchases — about \$3.7 billion in output and 24,000 jobs are created within sectors that generally supply this cluster. Finally, the ICT cluster creates an induced effect of nearly \$2.8 billion and approximately 20,000 jobs as a result of consumption activities within the local economy of both direct (cluster) and indirect (supplier) employees.

**Exhibit 8: Total Output Impacts**<sup>12</sup>



**Exhibit 9: Total Employment Impacts**<sup>12</sup>



<sup>12</sup> EMSI employment and IMPLAN 2013 data coefficients

# ECONOMIC IMPACT

The ICT cluster contributes approximately \$15.5 billion in total output, 83,000 jobs and \$5.1 billion in labor income. Exhibit 10 provides the employment impacts by each subsector within the ICT cluster and by output, employment, and labor income (which includes all forms of employment income, including employee compensation and proprietor income). With about \$5.9 billion in output, 45,000 jobs, and \$2.8 billion in labor income, the system programming, design, management and training services subsector, overall in all of these categories, accounts for the largest share of the cluster's total economic impacts while the system repair and maintenance services subsector has the smallest share.

## Exhibit 10: Total Economic Impacts by Cluster Subsector<sup>13</sup>

	Direct	Indirect	Induced	Total
<b>Output</b>				
<i>Total</i>	\$9,080,548,307	\$3,694,286,066	\$2,752,772,808	\$15,527,607,181
System Programming, Design, Management and Training Services	\$3,189,988,342	\$1,190,000,192	\$1,540,133,653	\$5,920,122,186
Telecommunication/Data Processing Centers	\$4,989,995,373	\$2,159,633,047	\$874,877,205	\$8,024,505,625
Computer and Electronic Market Retail/Wholesalers	\$759,038,485	\$311,938,680	\$274,495,375	\$1,345,472,541
System Repair and Maintenance Services	\$141,526,107	\$32,714,148	\$63,266,574	\$237,506,829
<b>Employment</b>				
<i>Total</i>	39,172	24,017	19,928	83,117
System Programming, Design, Management and Training Services	23,370	10,642	11,151	45,163
Telecommunication/Data Processing Centers	8,328	11,151	6,332	25,811
Computer and Electronic Market Retail/Wholesalers	6,389	1,973	1,986	10,348
System Repair and Maintenance Services	1,085	251	459	1,795
<b>Total Labor Income</b>				
<i>Total</i>	\$3,015,555,540	\$1,163,537,349	\$915,425,452	\$5,094,518,341
System Programming, Design, Management and Training Services	\$1,834,464,422	\$499,935,315	\$512,195,958	\$2,846,595,695
Telecommunication/Data Processing Centers	\$783,107,729	\$548,602,167	\$290,909,569	\$1,622,619,465
Computer and Electronic Market Retail/Wholesalers	\$315,214,132	\$103,141,120	\$91,269,584	\$509,624,836
System Repair and Maintenance Services	\$82,769,256	\$11,858,747	\$21,050,341	\$115,678,344

# ECONOMIC LEAKAGE

Supply chain leakage is a primary factor in determining the value of an industry multiplier used to define the total “ripple effect” of that industry cluster. Stronger supply chain linkages, better described as a cluster using more locally sourced products and services, has a reciprocal benefit of lower leakage, increasing the multiplier and the total impact on the surrounding economy.

It was determined through an in-depth analysis of the ICT industry cluster and its subsets, that there is a relatively high level of supply chain leakage, roughly 64 percent. Conversely, 36 percent of goods and services supporting the industry cluster are purchased within the region.

<sup>13</sup> EMSI employment and IMPLAN 2013 data coefficients

# ICT TRENDS

The life cycle of advancements in information and communication technologies (ICT) has been developing exponentially rather than in a sequential, linear fashion, and is projected to continue in this way. Because technology innovations are progressing at such a rapid pace, businesses are challenged to balance their technological agility to adopt new computing platforms, software, enterprise applications, and devices while continuing to drive growth and achieve productivity. This section reviews significant ICT trends affecting the business environment and the implications for workforce development and planning.

- **The Internet of Things (IoT).** By 2020 the number of things connected to the Internet is predicted to exceed 50 billion, nine times today's estimate of 4.9 billion. Smart devices or objects connected to the Internet are collecting and transmitting data and transforming the world both personally and socially, and influencing business opportunities and competitiveness. Described as the Internet of Things (IoT) because the network connectivity range is from everyday devices like mobile phones and tablets, individual health monitoring and kitchen appliances, to smart cities that track roadways for transportation planning, and monitoring energy consumption, atmospheric emissions, e-waste and water usage.

Whether data is used for personal use, business development to build and apply the systems, or to support sustainability such as green ICT initiatives driving socio-economic impacts for businesses and government organizations — all of these intelligent devices need to be programmed and integrated. And for optimal use, the data obtained needs to be analyzed and shared to be of value to business, governments, education, civic organizations and consumers.<sup>14</sup>

- **Big Data.** With the deluge of data obtained and driven by smart machines, sensors and chips connected to the Internet, many aspects of work in the Sacramento Capital region will be reshaped in the coming years. Cloud data storage and virtual computing server platforms such as Amazon Web Services, Microsoft Azure, and Google Cloud,<sup>15</sup> and the proliferation of sensors, chips and devices connected to the Internet, all translate into a flood of data streams. Being able to work with data will become more of a necessity for most professions, especially within the ICT cluster.
- **“Everything-as-a-Service” (XaaS).** For many companies, transitioning from the old infrastructure to the newest technologies creates implementation challenges, such as migrating systems, training, and motivating employees to adopt and use the new technology. To address these challenges, many organizations are opting to outsource to service providers and forgo the use of on-site services and personnel. Termed “Everything-as-a-Service” (XaaS), organizations can customize their computing environment on-demand from network management and data storage services to enterprise-hosted applications.
- **Cybersecurity and Privacy.** As new technology comes into the marketplace on a functioning digital network, cybersecurity and the impact on the workforce will be significant, driving demand for a variety of security-related occupations, such as information security professionals, computer programmers, forensic science technicians, and intelligence analysts.

These innovations will change not only the content of work but many new occupations will arise. As such, it's critical for education and training providers to continuously update curriculum to reflect the most current knowledge and skill requirements in the field.

## WORKFORCE CHALLENGES

Government entities at all levels are experiencing difficulty attracting talented ICT workers who often prefer the private sector with higher wages and benefits such as stock options and even student loan debt repayment. As public sector ICT workers begin retiring in larger numbers, closing the talent gap is necessary to ensure that public services continue to operate securely and meet constituent needs. This will require public employers to rethink how they attract and retain ICT employees and/or change how they maintain and manage their IT services (e.g. XaaS, rather than internal infrastructure).

<sup>14</sup> <https://www.comptia.org/resources/sizing-up-the-internet-of-things>

<sup>15</sup> *Amazon's \$160 billion business you've never heard of.* Found at <http://money.cnn.com/2015/11/04/technology/amazon-aws-160-billion-dollars/>

# OCCUPATION DEMAND

Fifteen occupations were selected for inclusion in the study based on the following criteria:

- Annual job openings were significant
- The minimum education requirement is a high school diploma plus on-the-job training, postsecondary award, associate degree or bachelor's degree.

Exhibit 11 displays the employment demand for ICT occupations selected for inclusion in the study.<sup>16</sup> For each occupation, replacement estimates include retirements and general separations, but not turnover within the occupation. As such, replacements and new job growth combined is a good measure of demand for workers.

Combined, there are nearly 6,200 total job openings projected between 2014 and 2019 for the occupations selected for inclusion in this study. Computer systems analysts is the largest occupation in the group, with the most job openings over the next five years. Software developers and computer user support specialists are also large occupations with significant annual openings created by new job growth and replacement needs.

## Exhibit 11: Employment Outlook, 2014–2019<sup>17</sup>

Description	2014 Jobs	2019 Jobs	2014–2019 Change	2014–2019 % Change	Total Replacements	Total Openings	Annual Openings
Computer Systems Analysts	9,568	10,468	900	9%	800	1,700	340
Software Developers, Systems Software	5,275	5,626	351	7%	413	764	153
Computer User Support Specialists	3,843	4,247	404	11%	330	734	147
Software Developers, Applications	3,309	3,780	471	14%	235	706	141
Computer and Information Systems Managers	2,801	3,015	214	8%	205	419	84
Computer Programmers	2,361	2,458	97	4%	328	425	85
Network and Computer Systems Administrators	1,810	1,980	170	9%	160	330	66
Computer Occupations, All Other	1,273	1,338	65	5%	117	182	36
Computer Network Support Specialists	1,239	1,298	59	5%	103	162	32
Web Developers	1,158	1,276	118	10%	100	218	44
Computer, Automated Teller, and Office Machine Repairers	997	1,057	60	6%	124	184	37
Computer Network Architects	556	614	58	10%	59	117	23
Database Administrators	542	595	53	10%	57	110	22
Information Security Analysts	446	531	85	19%	40	125	25
<b>Total</b>	<b>35,178</b>	<b>38,283</b>	<b>3,105</b>	<b>9%</b>	<b>3,071</b>	<b>6,176</b>	<b>1,235</b>

<sup>16</sup> This report does not provide occupational data isolated to the ICT cluster, but rather includes occupational employment estimates and projections across all industries to provide a complete picture of demand for all employers.

<sup>17</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.3

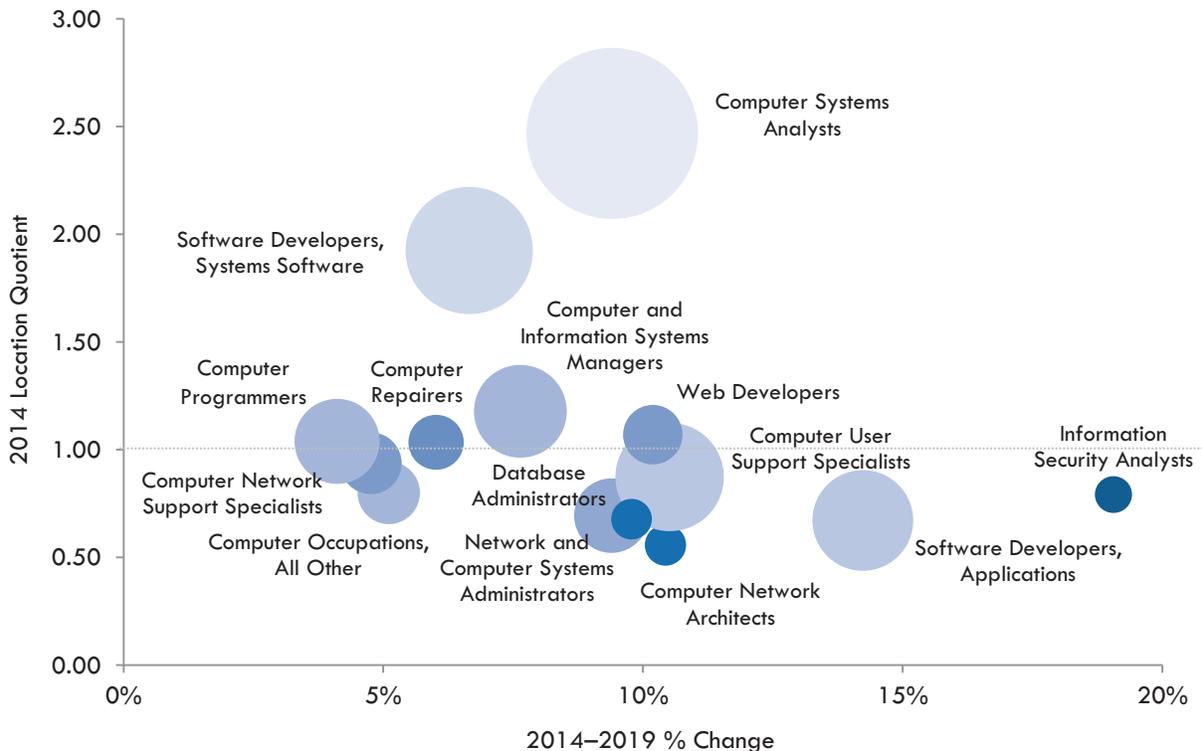
# OCCUPATION DEMAND



In addition to industry analysis, location quotient can also be applied to occupations. In this case, the location quotient compares an occupation’s total employment in the region relative to the state’s total employment for that occupation. A location quotient of less than one indicates a lower concentration of employment for that occupation in the region than in the state overall. A location quotient of more than one indicates a higher concentration of employment for the occupation than in the state overall.

The following bubble chart compares the concentration of occupation employment to the projected five-year growth rate in the region, where the size of the bubble indicates the total number of jobs for each occupation. As shown below, more than half of the ICT occupations have a location quotient that is close to one (LQ .8 to 1.18) indicating an average concentration of employment compared to other regions in the state. Relative to the other occupations in the group, computer systems analysts is the largest occupation in the group with a high location quotient and a moderate projected growth rate. System developers, systems software is also a large occupation with a high location quotient and a modest growth rate. Information security analysts is the smallest occupation in the group with the highest projected growth rate.

**Exhibit 12: Growth Rate vs. Occupation Concentration**<sup>18</sup>

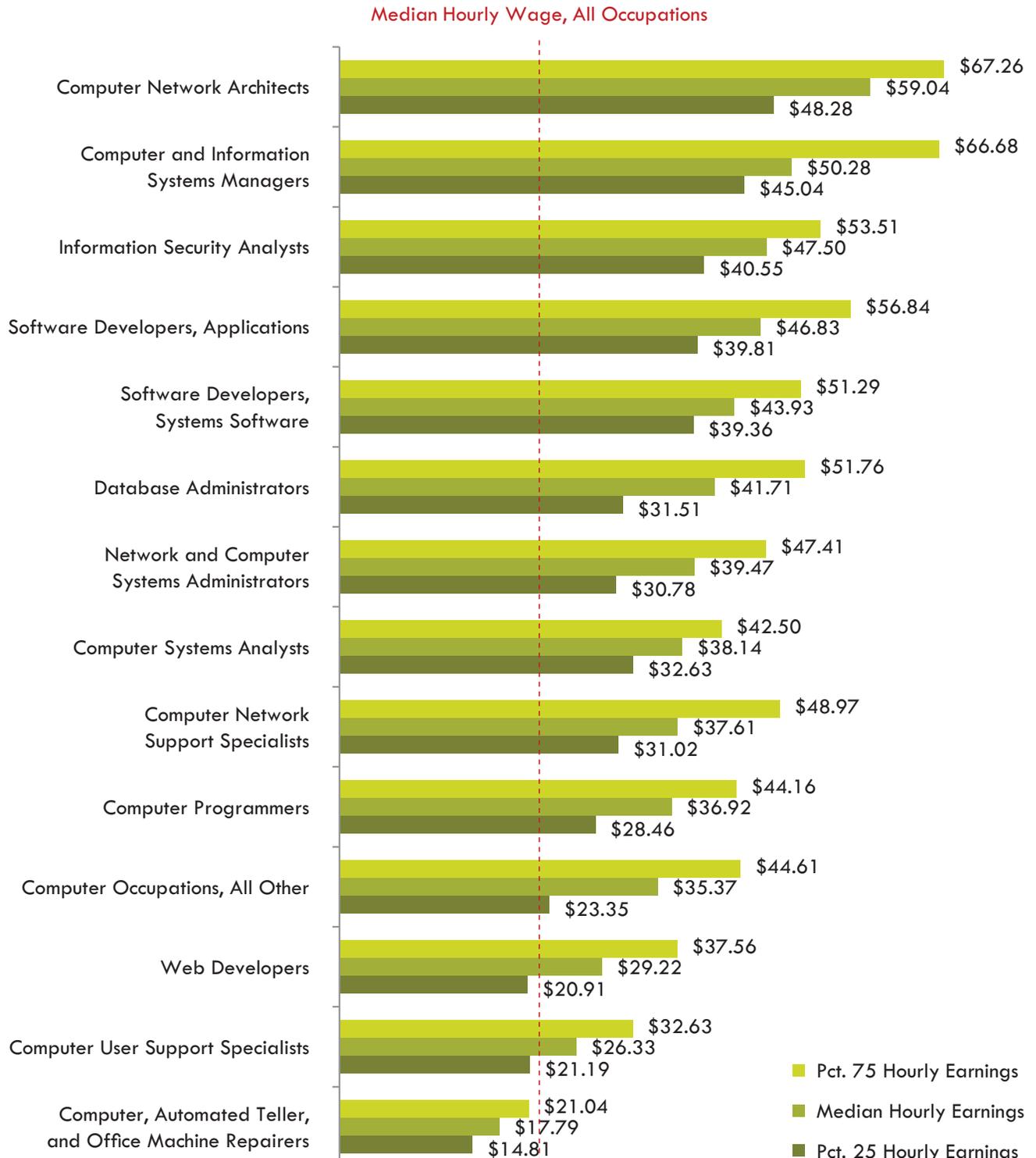


<sup>18</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.3

# OCCUPATIONAL WAGES

The median hourly wage across all occupations in the Sacramento Capital region is \$22.69 per hour. With the exception of computer, automated tellers, and office machine repairers, all of the occupations in the ICT cluster earn wages above this regional average. Computer network architects is the highest paid occupation, followed by computer/information systems managers and software developers, applications.

**Exhibit 13: Hourly Wages, 2015<sup>19</sup>**



<sup>19</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EDUCATION ASSESSMENT

This section provides a review of the educational supply supporting the ICT cluster in the Sacramento Capital region. Minimum education requirements are assigned to two categories:

- **Mid-level occupations** require postsecondary training, certificate or associate degree. Some employers may prefer applicants with a bachelor's degree.
- **Advanced-level occupations** typically require a bachelor's degree. However, some employers will accept an associate degree as the minimum education requirement.

Exhibit 14 identifies the minimum education requirements for the top 15 occupations in the ICT cluster by education category.

## Exhibit 14: Minimum Education Requirements

### Mid-level

- Computer, Automated Teller, and Office Machine Repairers
- Computer User Support Specialists
- Computer Network Support Specialists
- Web Developers

### Advanced-level

- Computer and Information Systems Managers
- Computer Systems Analysts
- Information Security Analysts
- Computer Programmers
- Software Developers, Applications
- Software Developers, Systems Software
- Database Administrators
- Network and Computer Systems Administrators
- Computer Network Architects
- Computer Occupations, All Other



# EDUCATION ASSESSMENT



Exhibit 15 displays the total number of certificates and degrees conferred annually in the Sacramento Capital region. Six public community colleges, two public universities, and five private education institutions provide training programs that support the ICT career pathway. Combined, these education institutions confer an average of 1,009 degrees and certificates annually. At a high level, this data suggests a possible training supply gap, as there are more projected annual openings than degrees conferred. Further analysis is necessary to assess alignment among specific training programs and regional workforce needs.

## Exhibit 15: ICT Associate Degrees & Certificates Conferred Annually, Sacramento Capital region<sup>20&21</sup>

Program	Certificates	Associate Degrees	Bachelor's Degree	Master's Degree	Total Awards
Computer and Information Systems Security			12		12
Computer Engineering, General			68	6	74
Computer Graphics			23		23
Computer Information Systems	5	20			25
Computer Infrastructure and Support	17	22			39
Computer Networking	82	131	8		222
Computer Programming	20	40	1		60
Computer Science	1	27	152	60	240
Computer Software Development/Engineering	1			4	5
Computer Support	168	15			183
Database Design and Administration	14	4			18
Other Information Technology	54				54
Software Applications	15	8			23
Wide Web & Multimedia Administration and Design	14	7	10		31
<b>Total</b>	<b>391</b>	<b>274</b>	<b>274</b>	<b>70</b>	<b>1,009</b>

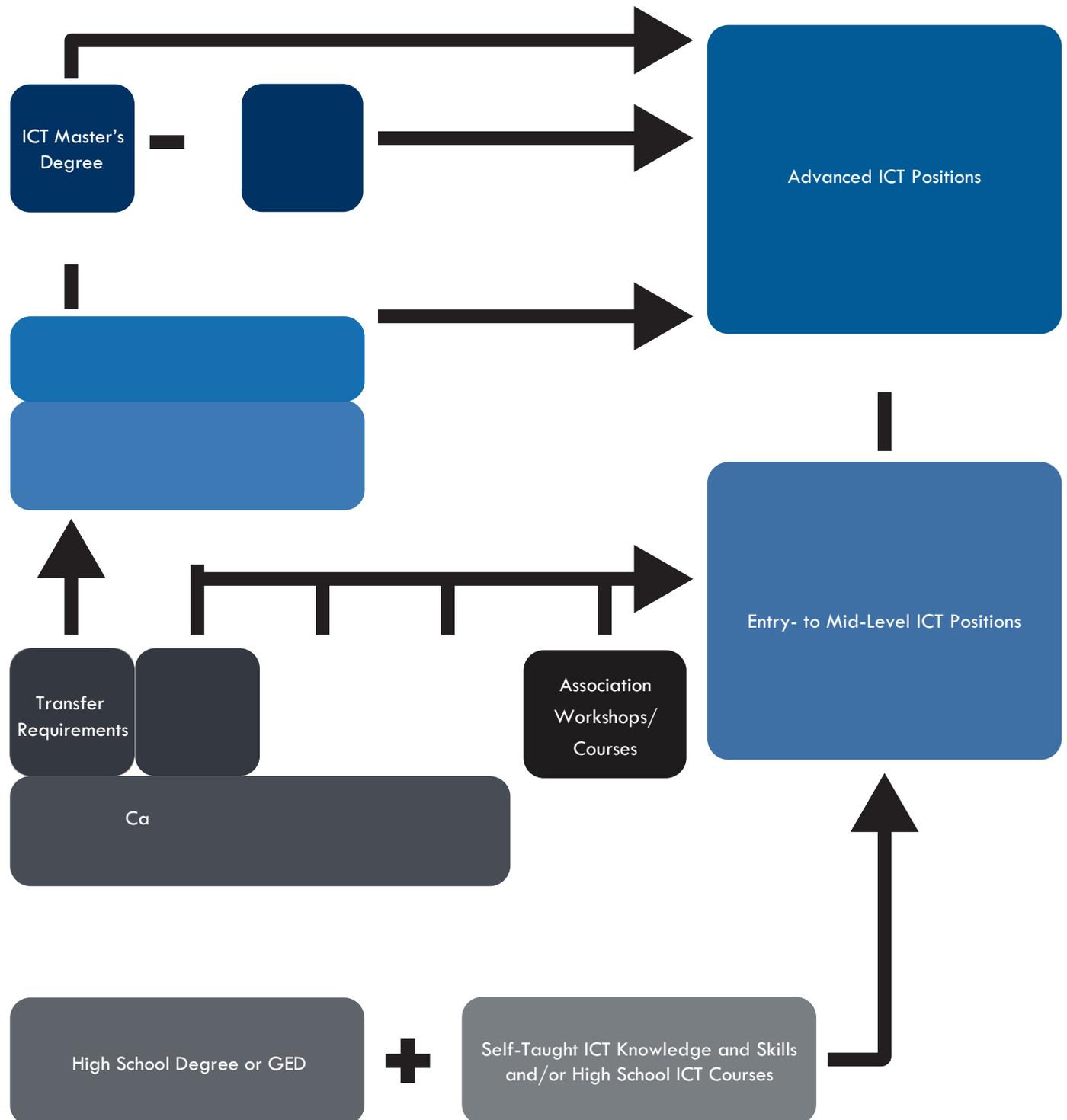
<sup>20</sup> California Community College Chancellor's Office Data Mart. National Center for Education Statistics (NCES). Higher education institutions are required to report completion data to NCES if they participate in any federal financial assistance program authorized by Title IV of the Higher Education Act. Completion data not reported to the NCES or CCCCO Data Mart were not included in the estimate.

<sup>21</sup> For private education institutions and private/public universities, the 3-year average includes academic years 2011–12, 2012–13 and 2013–14. For California Community Colleges, the 3-year average includes academic years 2012–13, 2013–14, and 2014–15.

# EDUCATION PATHWAYS

There are multiple education pathways to obtain employment in the ICT field. Some pursue a career in the ICT field by following a specific academic path — AS to BS to Master’s degree then employment, while others take only a few courses that pertain to a specific career path — such as programming or networking courses that prepare for a specific certification. In addition, it is not uncommon for incumbent workers of all education levels to take community colleges courses that help them stay current in their field or gain specialized skills that allow them to transition to a new ICT specialty.

**Exhibit 16: ICT Education Pathways**



# SKILLS ASSESSMENT

Exhibit 17 displays the top skills and professional credentials for the ICT occupations selected for inclusion in this study. The data is based on analysis of job posting data, aggregated by Burning Glass. This online tool uses intelligent “spidering” to search the Internet for job listings, removes duplication, and aggregates the data into a searchable database. As shown below, most of the skills/knowledge areas are specialized and require specific training and/or certification.

## Exhibit 17: Skill and Professional Credential Preferences, ICT Occupations

Occupation	Top Skill/Knowledge Areas	Top Certifications/ Professional Credentials
Computer Systems Analysts	Oracle, business process, SQL, SAP, systems analysis, JAVA, technical support, LINUX, Enterprise Resource Planning (ERP), system and network configuration	Certified Information Systems Auditor, Certified Information Systems Security Professional
Software Developers, Systems Software	Systems engineering, LINUX, Python, JAVA, PERL, C++, UNIX, SQL, Domain Name System (DNS), System and Network Configuration, and debugging	Microsoft Certified Systems Engineer, CISCO Certified Network Associate, VMWARE Certified Professional, CISCO Certified Network Professional
Computer User Support Specialists	Technical support, help desk support, repair, software installation, IT support, computer installation and setup, systems and network configuration, LINUX and Transmission Control Protocol/Internet Protocol (TCP/IP)	Certified A+ Technician; Microsoft Certified Systems Engineer
Software Developers, Applications	JAVA, software engineering, JavaScript, SQL, LINUX, Python, C++, Microsoft C#, Object-Oriented Analysis and Design (OOAD), software development, Oracle, Extensible Markup Language (XML)	None Listed
Computer and Information Systems Managers	Business Process, SAP, Oracle, collaboration, SQL, business development, JAVA, mentoring, Enterprise Resource Planning (ERP), ITIL, and Systems Development Life Cycle (SDLC)	Project Management Certification
Computer Programmers	SQL, JAVA, JavaScript, Python, LINUX, .NET Programming, C++, Microsoft C#, Oracle, Extensible Markup Language (XML), and jQuery	None Listed
Network and Computer Systems Administrators	Technical support, CISCO, LINUX, repair, network support, system and network configuration, and Transmission Control Protocol/Internet Protocol (TCP/IP)	CISCO Certified Network Associate, Red Hat Certified System Administrator, Red Hat Certified Engineer, Microsoft Certified Systems Engineer
Computer Network Support Specialists	Oracle, technical support, SQL, JAVA, UNIX, MySQL, LINUX	CISCO Certified Network Associate, CISCO Certified Network Professional
Web Developers	JavaScript, web site development, jQuery, HTML5, JAVA, Hypertext Preprocessor (PHP), web applications, AJAX, web site design, Adobe Photoshop, User Interface (UI) design, JSON, Extensible Markup Language (XML)	None Listed
Computer, Automated Teller, and Office Machine Repairers	Technical support, repair, technical training, record keeping, and schematic diagrams	Certified A+ Technician
Computer Network Architects	CISCO, telecommunications, network engineering, Wide Area Network (WAN), VoIP, firewalls, LINUX and OSPF	CISCO Certified Network Professional, CISCO Certified Network Associate, CISCO Certified Internetwork Expert
Database Administrators	SQL, database administration, Oracle, Extraction Transformation and Loading (ETL), SQL Server, data warehousing, database design, LINUX, JAVA, Python, UNIX and data modeling	None Listed
Computer Operators	Data management, scheduling, ITIL, LINUX, system administration	None Listed
Information Security Analysts	Information security, firewalls, network security, LINUX, cryptography	Certified Information Systems Security Professional, Certified Information Systems Auditor, Certified Information Security Manager

# SKILLS ASSESSMENT

The pace of technology is driving corporations away from requiring specific education, placing a higher value on professional certifications and skills rather than degrees. Professional credentials often increase a worker's starting salary, as well as provide a means to promote and advance in a career. The following industry certifications are considered the most in-demand according to the annual 2016 employer survey conducted by Robert Half Technologies:<sup>22</sup>

- **Cisco certifications:** Cisco Certified Network Associate (CCNA), Cisco Certified Networking Professional (CCNP)
- **Microsoft certifications:** Microsoft Certified Solutions Associate (MCSA), Microsoft Certified Solutions Expert (MCSE). These credentials replace the Microsoft Certified Professional (MCITP) certification which was retired in 2014.
- **Project management certifications:** Project Management Professional (PMP)
- **Security certifications:** Certified Information Systems Security Professional (CISSP)
- **Virtualization certifications:** VMware Certification Professional (VCP)

Beyond technical skills — soft skills and business skills are highly desirable. Some of the most commonly cited in-demand skills include: collaboration, communication, critical thinking, motivation, perseverance, problem solving, project management, and versatility.



<sup>22</sup> [https://www.roberthalf.com/sites/default/files/Media\\_Root/images/rht-pdfs/robert\\_half\\_technology\\_2016\\_salary\\_guide.pdf](https://www.roberthalf.com/sites/default/files/Media_Root/images/rht-pdfs/robert_half_technology_2016_salary_guide.pdf)

# SUMMARY

The ICT cluster organizes technologies related to telecommunications, computing, networks, and other high-tech fields. ICT job functions impact all businesses, regardless of industry type or size of employment. However, there are a core set of industries that engage primarily in ICT activities that can be used to define the cluster. These include: computer and electronic market retail/wholesalers; ICT component manufacturing; system programming, design, management and training services; system repair and maintenance services; system repair and maintenance services; and telecommunication/data processing centers.

The ICT cluster is projected to grow moderately, adding nearly 3,000 jobs by 2019. The system programming, design, management and training services subsector is projected to add the most jobs. Most of the ICT subsectors (with exception of system repair and maintenance services) provide earnings above the region's average earnings across all industries. Three of the four ICT subsectors in the Sacramento Capital region have a location quotient that is less than one, indicating a lower concentration of employment than in other areas of the state.

The ICT cluster is evolving rapidly, not only changing the content of work but also increasing demand for ICT positions. Some of the technologies impacting the region's workforce needs include:

- **Big Data.** Cloud data storage and virtual computing server platforms and the proliferation of sensors, chips and devices connected to the Internet, all translate into a flood of data streams. Being able to work with data will become more of a necessity for most professions, especially within the ICT cluster.
- **The Internet of Things (IoT).** Smart devices or objects connected to the Internet are collecting and transmitting data and transforming the world both personally and socially, and influencing business opportunities and competitiveness. All of these intelligent devices need to be programmed and integrated. And for optimal use, the data obtained needs to be analyzed and shared to be of value to business, governments, education, civic organizations, and consumers.
- **"Everything-as-a-Service" (XaaS).** On-demand outsourced ICT services from network management and data storage services to enterprise-hosted applications.
- **Cybersecurity and Privacy.** As new technology comes into the marketplace, cybersecurity and the impact on the workforce will be significant, driving demand for a variety of security-related occupations, such as information security professionals, computer programmers, forensic science technicians, and intelligence analysts.

Fifteen ICT occupations were selected for inclusion in this study based on total number of job openings and minimum education requirements, including:

- Software Developers, Systems Software
- Computer User Support Specialists
- Software Developers, Applications
- Computer and Information Systems Managers
- Computer Programmers
- Network and Computer Systems Administrators
- Computer Occupations, All Other
- Computer Network Support Specialists
- Web Developers
- Computer, Automated Teller, and Office Machine Repairers
- Computer Network Architects
- Database Administrators
- Computer Operators
- Information Security Analysts

# SUMMARY



There are six public community colleges, two public universities, and five private education institutions that provide ICT training in the Sacramento Capital region. Combined, these education institutions confer an average of 1,009 degrees and certificates annually. At a high level, this data suggests a possible training supply gap, as there are more projected job openings (1,235 annual openings) than degrees conferred (1,009 degrees). The total certificates and degrees conferred provide some information about the supply of workers to an industry or cluster. However, it is limited in that there are several unknown variables that impact the supply, such as graduate migration trends, employer preferences, worker preparedness, and graduate/completion duplication. Further analysis is necessary to assess alignment among specific training programs and region workforce needs.

In addition to formal education, it is also common for ICT employers to require professional credentials. Some of the most in-demand certificates include: Cisco, Microsoft, project management, security, and virtualization certifications. Because skills and certifications are sometimes valued more than degrees, there are multiple education pathways to obtain employment in the ICT field. Some pursue a career in the ICT field by following a specific academic path, while others take only a few courses that pertain to a specific career path. This not only makes it challenging to assess supply gaps, it also makes it difficult to standardize curriculum.

The dynamic changing nature of the ICT cluster requires a nimble education system that can develop and offer new or revised curriculum to meet evolving workforce needs. To keep current, faculty need to upskill their knowledge of and instruction in new technologies, relevant software, and certification standards. As these activities would likely occur outside of classroom instruction, faculty would need additional assigned time funded for them to do so. Having faculty externships available at high-tech companies during summer or other school breaks are a way to enhance their industry experience needed for teaching relevant and in-demand skills.

Valley Vision, along with the Center of Excellence and other partners, will be conducting focus groups with ICT employers to review the cluster findings, high priority occupation and skills gaps that can be addressed through a concerted cluster workforce action plan. Priorities that may be elevated based on this analysis include:

- Conduct a post-employment outcomes assessment to determine misalignment to existing programs.
- Align curriculum among California Community Colleges to increase the ease of transferring for students and consistent standard of instruction recognized by employers and industry.
- Invest in equipment/software and professional development for ICT instructors and educators to ensure that they are teaching the most up-to-date technology.
- Develop strong career pathways between K-12, community colleges and four-year institutions.
- Partner with businesses to increase internship opportunities for community college students and externships for instructors and faculty.

# APPENDIX A: INFORMATION AND COMMUNICATION TECHNOLOGIES CLUSTER DEFINITION



The ICT cluster is comprised of the following NAICS codes.

## Computer and Electronic Market Retail /Wholesalers

- 423430 Computer and Computer Peripheral Equipment and Software Merchant Wholesalers
- 443142 Electronics Stores
- 454111 Electronic Shopping
- 454112 Electronic Auctions
- 425110 Business to Business Electronic Markets

## Telecommunication / Data Processing Centers

- 511210 Software Publishers
- 517110 Wired Telecommunications Carriers
- 517210 Wireless Telecommunications Carriers (except Satellite)
- 517410 Satellite Telecommunications
- 517911 Telecommunications Resellers
- 517919 All Other Telecommunications
- 518210 Data Processing, Hosting, and Related Services
- 519130 Internet Publishing and Broadcasting and Web Search Portals
- 515210 Cable and Other Subscription Programming

## System Programming, Design, Management and Training Services

- 541511 Custom Computer Programming Services
- 541512 Computer Systems Design Services
- 541513 Computer Facilities Management Services
- 541519 Other Computer Related Services
- 611420 Computer Training
- 541330 Engineering Services
- 541430 Graphic Design Services
- 541490 Other Specialized Design Services
- 541690 Other Scientific and Technical Consulting Services
- 541990 All Other Professional, Scientific and Technical Services

## System Repair and Maintenance Services

- 811212 Computer and Office Machine Repair and Maintenance
- 811213 Communication Equipment Repair and Maintenance

# APPENDIX B: CALIFORNIA COMMUNITY COLLEGES DEFINING ICT CAREER PATHWAYS

The California Community College's ICT-Digital Media Sector of the "Doing What Matters For Jobs and the Economy Initiative" has created two structured career pathways in a statewide branded effort to increase employment in the ICT field. Featured are the Business Information Worker Pathway and the IT Technician Pathway. Both pathways align learning content from existing courses that have been validated to meet the needs of business, government and organizations for skill sets in demand. They also help students prepare for specific ICT careers by providing clear and defined knowledge and skills necessary to acquire industry certifications and employment.

## Educational Pathways

Sacramento Capital region community colleges have identified existing courses that meet the Business Information Worker pathway and the IT Technician Pathway, and are promoting both to students and industry partners.

### Business Information Worker Pathway (BIW)

A short-term pathway to entry-level, middle-skill office jobs requiring training of six months or less — leading to a wide variety of office positions from entry-level clerk to administrative positions in the top industry sectors in the Sacramento Capital region. This pathway offers a set of digital and soft skills in demand. Students can return for advanced credentials and pathways as their income permits.

Business Information Worker Pathway	Courses in Pathway
Requires six-months of less of training	Keyboarding, Microsoft Office, Information Systems, Business Communications, and Human Relations/Customer Service
Sacramento Colleges Identifying BIW Pathway Programs	American River College, Cosumnes River College, Folsom Lake College, Sacramento City College, Sierra College and Yuba College

### IT Technician Pathway (ITTP)

A four-stage pathway that identifies IT skill sets in demand, each stage defined by knowledge and skills to acquire third-party industry certifications and employment in the field. Suggested two-years to complete, but can be accomplished in stages over time. Stage Four is currently under development.

IT Technician Pathway	Student Learning Outcomes – Pathway Descriptors
Stage One: Computer Retail Sales & Support	Students learn fundamental IT, business and customer service by taking the first 6 IT Technician Pathway courses and the CompTIA A+ Certification exam
Stage Two: Help Desk/User Support	Students build on the IT Technician Pathway by completing additional networking and security coursework along with suggested industry certifications
Stage Three: IT Technician	Students can further their careers by taking IT courses that teach advanced concepts, including Cyber Security (Ethical Hacking), and Routing and Switching Essentials, and become certified
Stage Four: Further Specialization Options [Under development]	Additional specialty courses include Mobility and Mobile Design, Cloud Essentials, CCNA Preparation, and Project Management/Process Improvement
Sacramento Colleges Identifying ITTP Pathway Programs	Sierra College

**For more information, please visit [ict-dm.net](http://ict-dm.net).**

# MORE ABOUT...

## More About The Centers of Excellence

The Centers of Excellence (COE) for Labor Market Research deliver regional workforce research and technical expertise to California 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.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the leading source of regional workforce information and insight for California community colleges. More information about the Centers of Excellence is available at [www.coecc.net](http://www.coecc.net).

For more information on this study, contact:

Theresa Milan, COE Director  
Northern California Region  
(916) 563-3221  
[milant@losrios.edu](mailto:milant@losrios.edu)

This study was conducted with the support of JPMorgan Chase & Co. In addition, this study was supported by Economic and Workforce Development funds awarded by the Chancellor's Office, California Community Colleges. It was produced pursuant to grant agreement number 15-305-001.

## More About Valley Vision

Since 1994, Valley Vision's work has driven transformative change and improved lives across Northern California. An independent social impact and civic leadership organization headquartered in Sacramento, Valley Vision strengthens our communities through unbiased research, boundary-crossing collaboration and change leadership. Our work improves overall quality of life and creates the conditions for economic prosperity and community health and vitality.

## More About Burris Service Group

The Burris Service Group (BSG) is a full-service consulting practice providing expertise in economic development, strategic economic research, real estate site strategy, management, and institutional growth. The company was established based on the clear need that advisory services be delivered in an "action-oriented" form. The founder of BSG, Robert Burris, brings to his clients an active local and international network of professionals, as well as 20 years of experience in economic development, market and economic analysis, commercial real estate information, corporate sales, and consulting.



**Burris Service Group**

JPMORGAN CHASE & CO.

[www.coecc.net](http://www.coecc.net)

**FIND US ON LINKEDIN GROUPS:**



<http://linkd.in/1EUU9wM>



C·O·E

CENTERS OF EXCELLENCE  
Inform Connect Advance

SERIES: 4 OF 6

# EDUCATION AND KNOWLEDGE CREATION CLUSTER: WORKFORCE NEEDS ASSESSMENT SACRAMENTO CAPITAL REGION



**February 2016**

Prepared by: Centers of Excellence,  
Los Rios Community College District

Valley Vision

Burris Service Group

This research was conducted with the generous  
support of JPMorgan Chase & Co.

JPMORGAN CHASE & CO.

**Burris Service Group**



# TABLE OF CONTENTS

<b>Introduction.....</b>	<b>3</b>
<b>Cluster Definition .....</b>	<b>4</b>
<b>Establishments.....</b>	<b>4</b>
<b>Concentration of Employment.....</b>	<b>5</b>
<b>Trends and Projections .....</b>	<b>6–7</b>
<b>Earnings.....</b>	<b>8</b>
<b>Shift Share Analysis .....</b>	<b>9</b>
<b>Economic Impact.....</b>	<b>10–11</b>
<b>Economic Leakage .....</b>	<b>11</b>
<b>Industry Trends in Education and Knowledge Creation .....</b>	<b>12–14</b>
<b>Occupation Demand.....</b>	<b>15–16</b>
<b>Occupational Wages.....</b>	<b>17</b>
<b>Education Assessment.....</b>	<b>18–19</b>
<b>Skills Assessment .....</b>	<b>20</b>
<b>Summary .....</b>	<b>21–22</b>
<b>Appendix A: Education and Knowledge Creation Cluster Definition .....</b>	<b>23</b>

---

### ***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.

© 2016 Chancellor’s Office California Community Colleges  
Economic and Workforce Development Program

*Please consider the environment before printing. This document is designed for double-sided printing.*

# INTRODUCTION

Starting in 2008, the six-county Sacramento Capital region (El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba counties) was rocked by the global recession, losing 10 percent of the region's jobs. In response, regional leaders initiated Next Economy, an action plan to accelerate job creation and new investment in six high-growth business (industry) clusters. Valley Vision, a regional civic leadership organization, managed the three-year Next Economy design, research and implementation process on behalf of a wide range of private and public sector partners.

As of late 2015, after a lagging recovery, the region's economy picked up momentum, with the unemployment rate decreasing while job growth is accelerating. Valley Vision received funding from the JPMorgan Chase & Co to better understand how the region's key growth industry clusters have changed since the original Next Economy research was conducted in 2012, and what new opportunities are emerging. Valley Vision is partnering with the Los Rios Center of Excellence and the Burris Service Group on this effort.

Cluster research is a widely accepted standard of practice for developing regional prosperity strategies to address multiple facets of a region's complex economy. Industry clusters reduce operating costs by shortening supply chains; increasing the flow of information regarding new business opportunities; concentrating workforce training needs in select occupations; and speeding up the identification of gaps in products or services.<sup>1</sup> Firms in identified clusters may also have a reduced risk of failure, as these firms are better supported by the supply chain and can respond more rapidly to shifts in the marketplace.

This report presents findings on the analysis of the Education and Knowledge Creation cluster. It is one in a series of six reports covering Next Economy-identified clusters. Additional reports include advanced manufacturing, the "clean economy," food and agriculture, information and communications technologies, and life sciences and health services.<sup>2</sup> Each report provides an overview of the cluster, industry trends and economic impact, as well as an overview of the top demand occupations in the cluster requiring postsecondary education or training, along with projected occupational demand, institutions providing related education and training, and possible workforce gaps. Visit [valleyvision.org](http://valleyvision.org) or [coecc.net](http://coecc.net) to access completed reports.<sup>3</sup>

This research will be used to develop cluster-based workforce action plans. Valley Vision will work alongside regional education, and workforce and economic development partners to convene six cluster-based employer forums, setting priorities and developing strategies to address critical workforce gaps, better align education and workforce development resources to meet employer and workforce needs, and strengthen the regional economy overall.



<sup>1</sup> Cluster Manufacturing: A Supply Chain Perspective

<sup>2</sup> Sacramento Area Council of Governments (SACOG) is the principal research for the Food and Agriculture Cluster study, which will focus primarily on industry trends and excludes workforce development and training needs.

<sup>3</sup> Reports will be posted to the [valleyvision.org](http://valleyvision.org) and [coecc.net](http://coecc.net) websites throughout the spring 2016 when finalized.

# CLUSTER DEFINITION

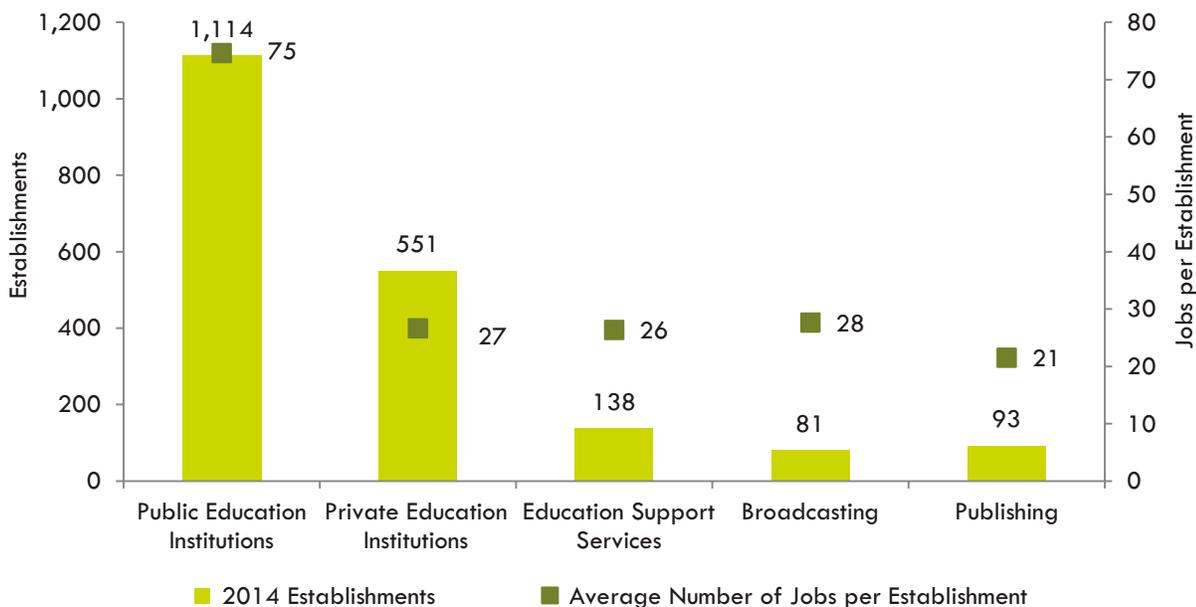
The Education and Knowledge Creation cluster includes industries and establishments that provide systematic information or instruction for the purpose of knowledge creation or learning. Within the cluster, there are five subsectors:

- **Private Education Institutions**, typically controlled by nongovernmental agencies, include preschools, secondary schools, colleges and universities.
- **Public Education Institutions**, supported primarily by public funds, include preschools, secondary schools, colleges, and universities.
- **Education Support Services** provide non-instructional services that support educational processes or systems, such as educational testing services, guidance counseling, and student exchange programs.
- **Publishing** establishments produce newspapers, magazines, other periodicals, and books.
- **Broadcasting** establishments create content or acquire the right to distribute and broadcast content via radio, television or Internet.

## ESTABLISHMENTS

Exhibit 1 displays establishments and the average number of jobs per establishment for the Education and Knowledge Creation subsectors in the Sacramento Capital region. As shown, public education institutions have the most establishments and the highest number of workers per establishment compared to other subsectors in the region.

**Exhibit 1: Establishments and Average Employment by Subsector, Education and Knowledge Creation Cluster, Sacramento Capital Region, 2014<sup>4</sup>**



<sup>4</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.3

# CONCENTRATION OF EMPLOYMENT

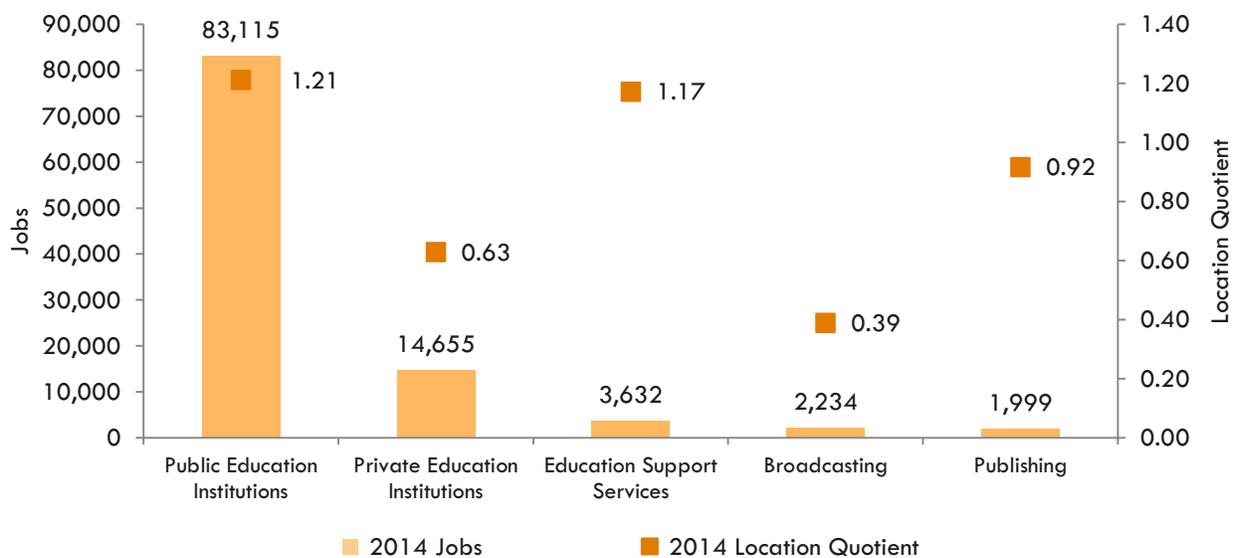
In 2014, there were about 105,600 jobs in the Education and Knowledge Creation cluster, 10 percent of the total employment in the Sacramento Capital region. As shown in Exhibit 2, the largest subsector is public education institutions (79%; 83,100 jobs), followed by private education institutions (14%; 14,700 jobs). Combined, education support services, broadcasting and publishing comprised the remaining seven percent of the cluster.

Location quotient analysis compares the total employment in a region relative to the total employment in a larger area, in this case, California. A location quotient of less than one indicates a lower concentration of employment for that industry in the region than in the state overall. A location quotient of more than one indicates a higher concentration of employment for the region than in the state overall.

In the Sacramento Capital region, public education institutions, education support services and publishing have location quotients that are close to one, indicating an average concentration of employment compared to other areas of the state. The private education institutions and broadcasting subsectors have location quotients well below one, indicating a lower than average concentration of employment. Within the subsectors, there are industries with above average location quotients, indicating a high concentration of employment for those industries than in the state overall. These include:

- **Public Education Institutions:** Colleges, Universities, and Professional Schools (State Government) (1.49 LQ); and Colleges, Universities, and Professional Schools (Local Government) (1.99 LQ)
- **Private Education Institutions:** Junior Colleges (1.53 LQ); Apprenticeship Training (2.55 LQ); Other Technical and Trade Schools (1.61 LQ); and Sports and Recreation Instruction (1.3 LQ)
- **Education Support Services:** Exam Preparation and Tutoring (1.51 LQ); and Educational Support Services (2.31 LQ)
- **Broadcasting:** Radio Networks (1.52 LQ)

**Exhibit 2: Total Employment and Location Quotient by Subsector, Education and Knowledge Creation Cluster, Sacramento Capital Region, 2014<sup>5</sup>**

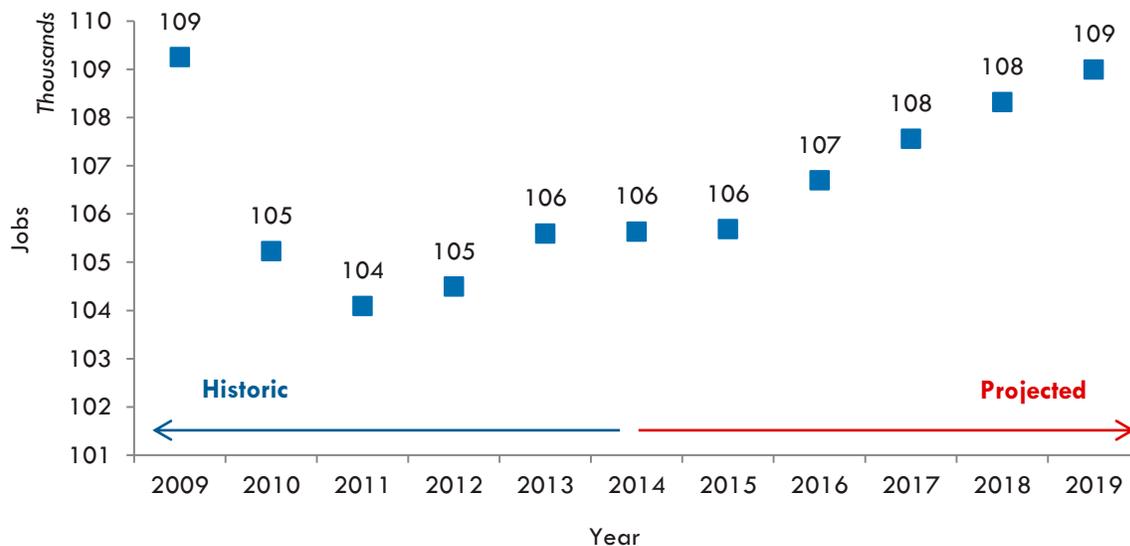


<sup>5</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# TRENDS AND PROJECTIONS

The Education and Knowledge Creation cluster declined by three percent over the last five years, mostly due to significant cuts in funding to public education. Over the next five years, the Education and Knowledge Creation cluster is projected to grow by 3 percent, adding about 3,400 jobs by 2019. The private education institutions subsector is projected to add the most jobs, followed by public education institutions and education support services. Publishing and broadcasting are expected to decline over this time period.

## Exhibit 3: Employment Trends and Projections, Education and Knowledge Creation Cluster, Sacramento Capital Region, 2009–2019<sup>6</sup>



## Exhibit 4: Employment Projections by Subsector, Education and Knowledge Creation Cluster, Sacramento Capital Region, 2014–2019<sup>6</sup>

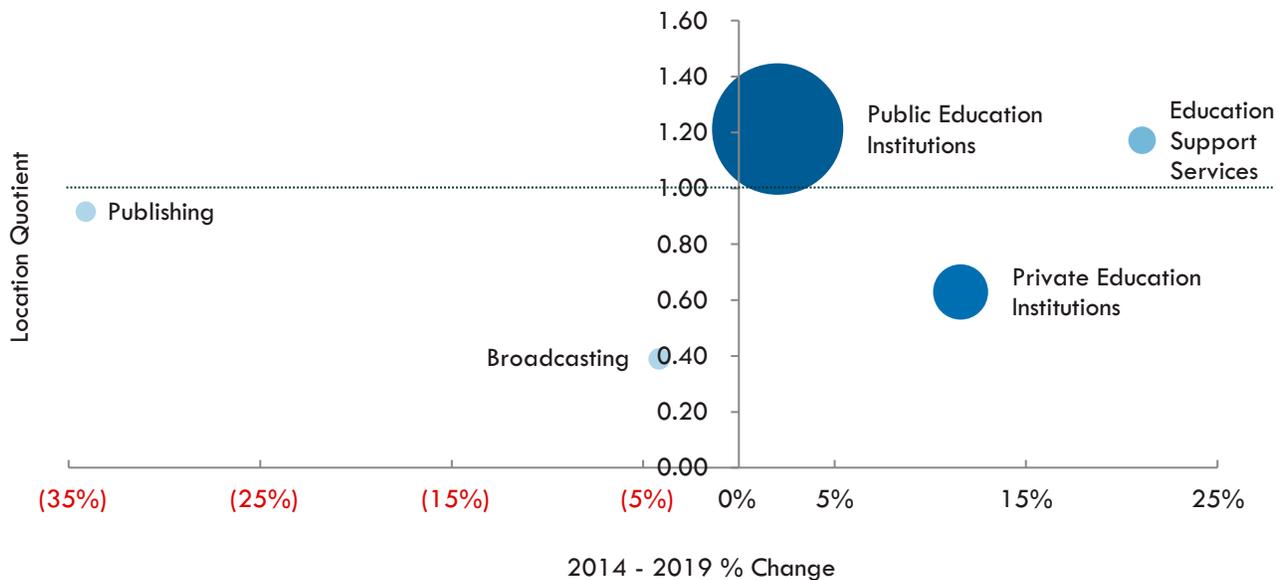
Education and Knowledge Creation Subsector	2014 Jobs	2019 Jobs	Change	% Change
Private Education Institutions	14,655	16,352	1,697	12%
Public Education Institutions	83,115	84,796	1,681	2%
Publishing	1,999	1,317	(682)	(34%)
Broadcasting	2,234	2,141	(93)	(4%)
Education Support Services	3,632	4,397	765	21%
<b>Total</b>	<b>105,636</b>	<b>109,004</b>	<b>3,368</b>	<b>3%</b>

<sup>6</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# TRENDS AND PROJECTIONS

The bubble chart below compares the projected five-year growth rate to the concentration of employment in the region, where the size of the bubble indicates the total number of jobs for that subsector. Public education institutions, education support services and publishing agencies have an average concentration of employment compared to other areas of the state. The broadcasting and private education institutions subsectors have a below average concentration of employment. Public education institutions is the largest subsector, but with slow projected growth over the next five years.

**Exhibit 5: Growth Rate vs. Subsector Concentration, Education and Knowledge Creation Cluster, Sacramento Capital Region<sup>7</sup>**

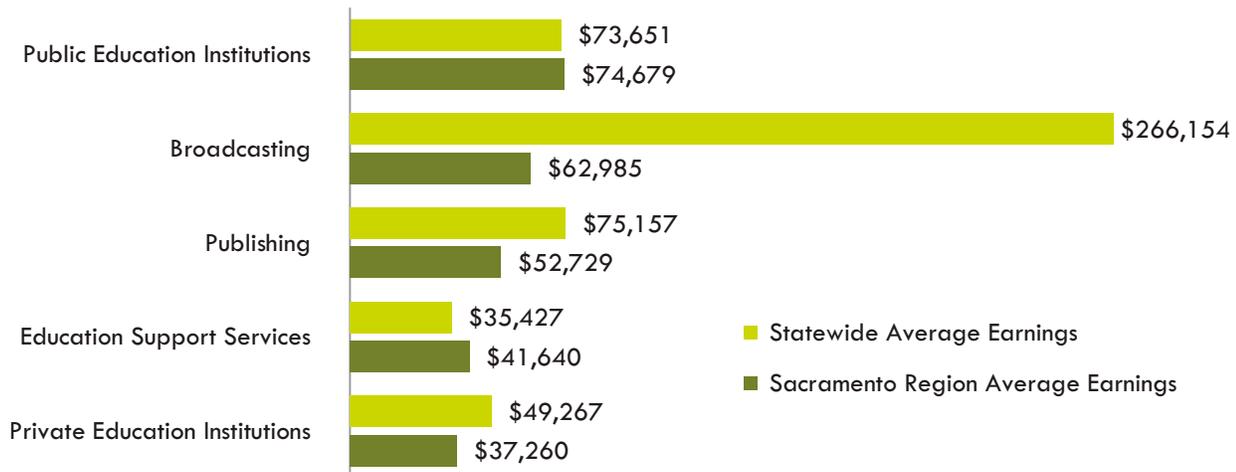


<sup>7</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EARNINGS

Public education institutions provide the best earnings in the Sacramento Capital region, followed by broadcasting. However, broadcasting wages are significantly higher in other areas of the state than in the Sacramento Capital region. All of the Education and Knowledge Creation cluster subsectors, except public education institutions, provide earnings that are below the regional average across all industries.<sup>8</sup> The earning calculation includes an average of all wages, salaries, proprietor earnings and supplemental earnings (such as retirement benefits, bonuses, etc.) for all occupations in the subsector.

**Exhibit 6: Earnings by Subsector, Education and Knowledge Creation Cluster, Sacramento Capital Region, 2014<sup>9</sup>**



<sup>8</sup> The average earnings across all industries in the Sacramento region is \$63,400 and includes wages, salaries, proprietor earnings and supplements.

<sup>9</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# SHIFT SHARE ANALYSIS



Shift share analysis is a method for determining how much of regional job growth can be attributed to national trends and how much is due to unique regional factors. Exhibit 7 displays four key components:

- **Industrial Mix Effect** – represents the share of regional industry growth explained by the growth of the specific industry at the national level.
- **National Growth Effect** – represents how much of the regional industry's growth is explained by the overall growth of the national economy. Given that the nation's economy is growing, it is normal to see positive change in each subsector.
- **Expected Change** – the change expected due to national growth effect and industry mix effects.
- **Regional Competitive Effect** – explains how much of the change in the subsectors is due to some unique competitive advantage that the region possesses, because the growth cannot be explained by national trends in the industry or the economy as a whole.

Three of the five subsectors are significantly underperforming compared to national trends; two subsectors are slightly overperforming. This suggests that the region does not have a competitive advantage in the Education and Knowledge Creation cluster compared to other areas of the nation.

## Exhibit 7: Shift Share Analysis by Subsector, Education and Knowledge Creation Cluster, Sacramento Capital Region, 2014–2019<sup>10</sup>

	Industrial Mix Effect	National Growth Effect	Expected Change	Regional Competitive Effect
Private Education Institutions	782	888	1,670	27
Public Education Institutions	(1,792)	5,036	3,244	(1,564)
Publishing	(581)	121	(460)	(222)
Broadcasting	7	135	142	(235)
Education Support Services	432	220	652	113
<b>Cluster Total</b>	<b>(1,153)</b>	<b>6,400</b>	<b>5,247</b>	<b>(1,880)</b>

<sup>10</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# ECONOMIC IMPACT



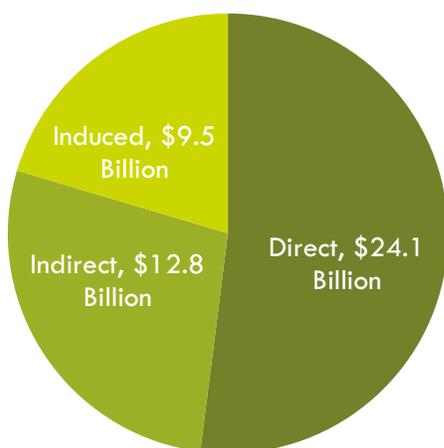
Economic impact provides a quantitative method to estimate the total economic benefit from a project, or in this case, an industry cluster. In other words, it is the “ripple effect” of all economic activities resulting from that cluster. Impact analysis is typically comprised of direct, indirect and induced impacts:

- Direct impacts are those resulting from the expenditures of operations within that industry cluster.
- Indirect impacts are those resulting from suppliers of that cluster spending money and hiring employees.
- Induced impacts are the combined value of employees of the industry cluster spending money at a household level.

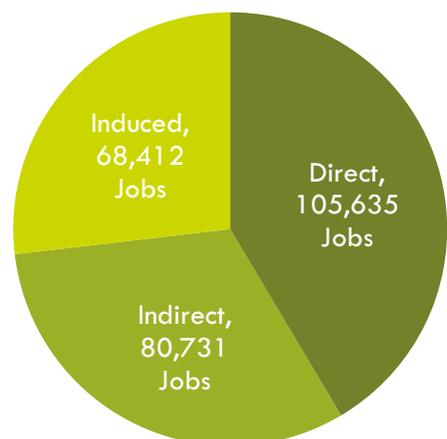
Combined, these three variables equate to the total economic impact of a project or industry cluster.

The Education & Knowledge cluster impacts the Sacramento Capital region’s economy in several ways. The IMPLAN input output model was used to measure the cluster’s total economic impacts. First, the cluster directly benefits the economy through the operations and jobs supported by the establishments within its subsectors. Exhibits 8 and 9 show that the Education & Knowledge cluster directly contributes roughly \$24.1 billion in output and 106,000 jobs to the regional economy. In addition to this direct effect, these establishments generate an indirect impact through their supplier purchases—about \$12.8 billion in output and 81,000 jobs are created within sectors that generally supply this cluster. Finally, the Education & Knowledge cluster creates an induced effect of nearly \$9.5 billion and approximately 68,000 jobs as a result of consumption activities within the local economy of both direct (cluster) and indirect (supplier) employees.

**Exhibit 8: Total Output Impacts<sup>11</sup>**



**Exhibit 9: Total Employment Impacts<sup>11</sup>**



<sup>11</sup> EMSI employment and IMPLAN 2013 data coefficients

# ECONOMIC IMPACT

The Education & Knowledge cluster contributes a total of \$46.4 billion in output, 255,000 jobs and \$17.6 billion in labor income. Exhibit 10 breaks down the employment impacts by each subsector within the Education & Knowledge cluster and by output, employment, and labor income (which includes all forms of employment income, including employee compensation and proprietor income). With about \$42.0 billion in output, 219,000 jobs, and \$16.0 billion in labor income, the public education institutions subsector accounts for the largest share of the cluster's total economic impacts while the education support services subsector has the smallest share (except in employment where publishing accounts for the smallest share).

## Exhibit 10: Total Economic Impacts by Cluster Subsector<sup>12</sup>

	Direct	Indirect	Induced	Total
<b>Output</b>				
<i>Total</i>	\$24,118,116,854	\$12,801,360,648	\$9,455,970,198	\$46,375,447,699
Public Education Institutions	\$21,676,315,368	\$11,759,078,854	\$8,607,790,366	\$42,043,184,589
Private Education Institutions	\$811,234,626	\$264,339,138	\$376,012,121	\$1,451,585,885
Education Support Services	\$183,520,747	\$66,181,351	\$89,205,761	\$338,907,859
Broadcasting	\$1,011,545,597	\$557,319,019	\$275,916,277	\$1,844,780,894
Publishing	\$435,500,515	\$154,442,286	\$107,045,672	\$696,988,473
<b>Employment</b>				
<i>Total</i>	105,635	80,731	68,412	254,777
Public Education Institutions	83,115	73,652	62,273	219,040
Private Education Institutions	14,655	1,744	2,721	19,120
Education Support Services	3,632	442	645	4,719
Broadcasting	2,234	3,921	1,998	8,153
Publishing	1,999	971	775	3,745
<b>Total Labor Income</b>				
<i>Total</i>	\$9,754,494,797	\$4,530,589,994	\$3,108,223,558	\$17,592,069,892
Public Education Institutions	\$8,925,511,057	\$4,231,939,785	\$2,861,781,580	\$16,019,232,422
Private Education Institutions	\$497,788,477	\$76,046,606	\$125,017,834	\$698,852,917
Education Support Services	\$115,648,329	\$20,623,231	\$29,658,383	\$165,929,943
Broadcasting	\$215,546,934	\$201,980,372	\$91,765,760	\$509,293,066
Publishing	\$109,807,716	\$53,361,366	\$35,592,461	\$198,761,543

# ECONOMIC LEAKAGE

Supply chain leakage is a primary factor in determining the value of an industry multiplier used to define the total "ripple effect" of that industry cluster. Stronger supply chain linkages, better described as a cluster using more locally sourced products and services, has a reciprocal benefit of lower leakage, increasing the multiplier and the total impact on the surrounding economy.

It was determined through an in-depth analysis of the Education & Knowledge Creation cluster and its subsets, that there is a high level of supply chain leakage, roughly 75 percent. Conversely, 25 percent of goods and services supporting the industry cluster are purchased within the region.

<sup>12</sup> EMSI employment and IMPLAN 2013 data coefficients

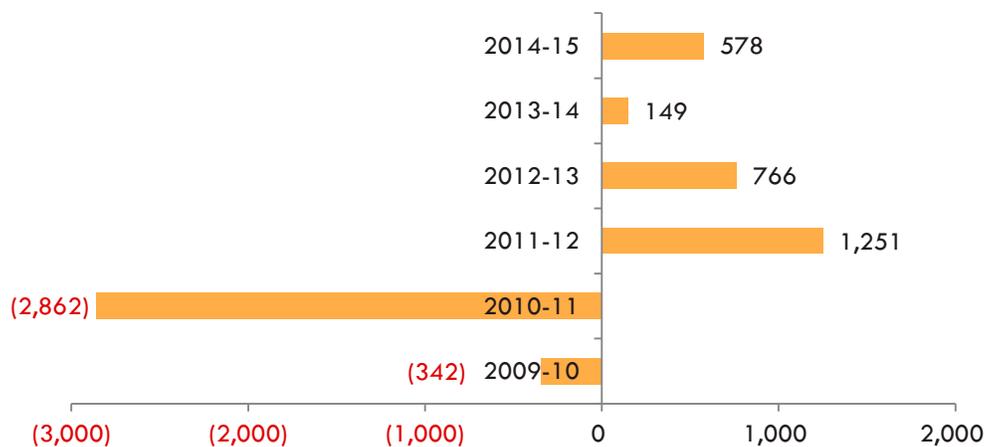
# INDUSTRY TRENDS IN EDUCATION AND KNOWLEDGE CREATION

Several environmental, demographic and regulator factors are expected to influence demand for teachers and education support professions. These include:

- **Optimistic hiring forecast** as school budgets stabilize post-recession. During the recession, K-12 new teacher hiring froze and layoffs occurred for those with the least seniority due to state funding cuts. In California, nearly 32,000 teaching jobs were eliminated between 2007 and 2012. Secondary schools in the Sacramento Capital region reduced their teacher workforce between 30 and 70 percent.<sup>13</sup> These staff reductions created larger class sizes with fewer education programs, support services and resources.<sup>14</sup> Credentialed teachers who were laid-off either entered other professions or opted to work at charter schools.

In the Sacramento Capital region, public schools experienced the largest decline in teacher staffing levels in the 2010-11 academic year. As the state budget recovered from the recession, school districts started hiring teachers, a trend which is expected to continue into the short-term future. The California Department of Education estimates that K-12 public school districts in the Sacramento Capital region will need to hire 1,288 teachers in 2016-17 academic year.

## Exhibit 11: Change in FTE Teacher Staffing Levels, Secondary Public Schools, Sacramento Capital Region<sup>15</sup>



- **Per-pupil spending may significantly increase driving demand for more services and staff in the education field.** In the proposed budget for 2016-17, Governor Brown has substantially increased funds to support K-12 education that will allow schools to expand base programs and services. Per-pupil expenditures would increase to \$10,591, an additional \$368 over 2015-16 levels. And total per-pupil spending after adding all sources of funding would rise to \$14,550, a \$366 increase over 2015-16.
- **Resurgence of enrollment in university teacher training programs.** The economic downturn that led to school districts' teacher lay-offs and hiring freezes discouraged students from entering university teacher preparation programs, resulting in a decline of more than 24,000 candidates — a 55% reduction in enrollments over the past five years statewide.<sup>16</sup> Total teacher preparation enrollment was reduced alone by 24 percent between 2011-12 and 2012-13.

<sup>13</sup> *New Teachers Scarce After State Funding Cuts*, Sacramento Bee, March 7, 2014.

<sup>14</sup> *Investing in Our Future: Returning Teachers to the Classroom*, Executive Office of the President, August 2012.

<sup>15</sup> California Department of Education. Data Reporting Office. Report Prepared: 2/5/2016.

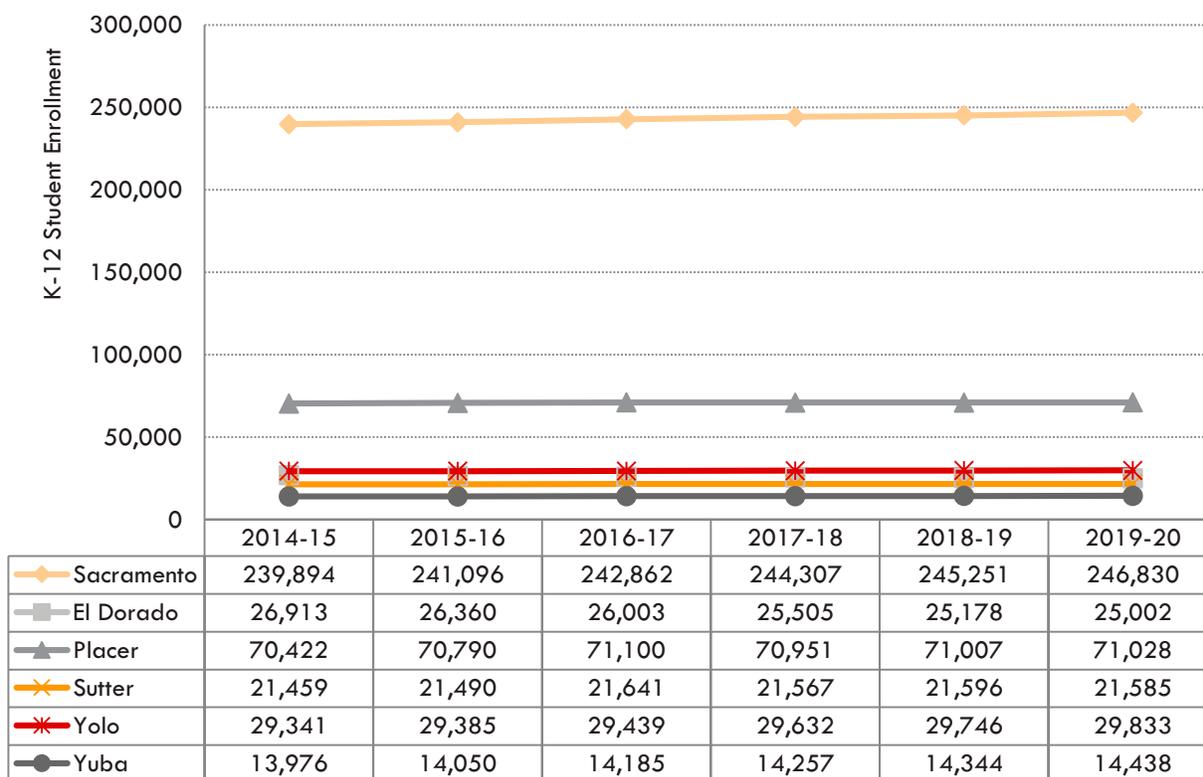
<sup>16</sup> <http://www.ctc.ca.gov/reports/TS-2013-2014-AnnualRpt.pdf>

# INDUSTRY TRENDS IN EDUCATION AND KNOWLEDGE CREATION

With increased teacher hiring underway, college students are now again being encouraged to enter teaching careers, including programs at Cal State University Sacramento and UC Davis. However, due to fewer students currently in the teacher education preparation pipeline, it may take a few years for educational supply to balance with the projected demand.

- Upcoming teacher retirements unlikely to create future workforce shortages.** Even with the region’s aging population, teacher retirements are unlikely to create future staffing shortages over the next five to ten years as previously expected.<sup>17</sup> According to analysis conducted by The Center for Teaching and Learning at WestEd, the number of teachers nearing retirement age is expected to remain constant over the next few years. Rather, governmental policy and demographic shifts will have a more significant impact on demand.
- Changing student enrollment projections drive teacher hiring.** Shifting age populations among individual communities may increase or keep teacher hiring flat. As shown in Exhibit 12, all of the Sacramento Capital region counties anticipate enrollment growth, except for El Dorado County. Within the counties, some districts anticipate growth while others continue to plan for enrollment declines.

**Exhibit 12: Secondary Student Enrollment Projections by County, Sacramento Capital Region<sup>18</sup>**



<sup>17</sup> Black, A., Tiffany-Morales, J., Tyler, N., and Sarnoff, R. (2013). *Teacher Retirement Trends in California: 2006/07–2011/12*. A Report by the Center for the Future of Teaching and Learning at WestEd. San Francisco: WestEd. Report available at: <http://www.sjsu.edu/secondary/trtc.pdf>

<sup>18</sup> California Department of Education. Data Reporting Office. Report Prepared: 2/5/2016.

# INDUSTRY TRENDS IN EDUCATION AND KNOWLEDGE CREATION

- **Anywhere, anytime learning and lifelong learning opportunities abound.** With Internet-based education and mobile computation — anywhere, anytime learning is moving out of the classroom and onto screens and even embedded in the built environment of mobile and other devices. This type of learning will mean that informal and ad hoc education will more fully complement formal education and credentialing systems.

Beyond online education credit courses offered by college and university programs, there are now a multitude of short online courses and tutorials called MOOCs — Massive Open Online Courses — offered by universities such as Stanford, UC Berkley, Harvard and MIT, among others that offer training or certifications to assist in skill development for both professionals and lifelong learners, with many subjects offered for free.<sup>19</sup> With increases in longevity, a more volatile economy and accelerating technological changes, lifelong learning and adult education will continue to expand. The idea that education is reserved for youth will soon become indefensible, even counter-productive. Continuous professional development and skill acquisition will be necessary to serve older, multi-career individuals.

Industries in knowledge creation have undergone a technological transformation that has forever changed the way broadcasting and publishing will be accessed and personalized by the consumer. Broadcasting and publications — their media production and business, perhaps more than any other industries — have been disrupted by the Internet. Television, radio, newspapers, magazines, and books have become more decentralized and personalized for the consumer.

As media is converted into digital forms, how information is accessed — news and entertainment — has radically changed. Today's media industry provides consumers with an overwhelming number of options for on-demand news and information, powered by broadband or wireless networks. Consumers are now able to self-direct how they interact with media and selectively control the type of content they access. These shifting consumer preferences are stifling traditional knowledge creation industries. Some of the recent trends include:<sup>20</sup>

- **Television Broadcasting:** As increasing number of viewers are opting for Internet streaming options. Companies which make changes to meet consumer preferences by offering interactive and customized services will be more successful.
- **Radio Broadcasting:** Digital media platforms like podcasts, MP3 players and streaming radio have inundated the radio industry for the past five years, providing stiff competition. As with television broadcasting, many traditional radio broadcasters are integrating online and customized access.
- **Newspaper Publishing:** Digital versions of newspapers have become the go-to source of news for many consumers. Adopting technological innovations using Internet and mobile platforms will help publishers to expand real-time reporting while cutting traditional printed publication's labor, printing and distribution costs.
- **Book Publishing:** The shift in technology and consumer preferences for mobile reading devices such as e-readers, iPads and tablets, and e-book publications have created restructuring in the publishing industry, leading to a decline in book publishing and its revenue. As consumers have products and reading materials easily available online, book publishers are developing new products such as e-books and generating additional revenue from the demand for college textbooks as college enrollments increase.

<sup>19</sup> [online.stanford.edu](http://online.stanford.edu) and [www.edX.org](http://www.edX.org)

<sup>20</sup> [IBISWorld.com](http://IBISWorld.com)

# OCCUPATION DEMAND

Twelve (12) occupations were selected for inclusion in the study based on the following criteria:

- Annual job openings were significant.
- The minimum education requirement is a high school diploma plus on-the-job training, postsecondary award, associate degree or bachelor's degree.

Exhibit 13 displays the employment demand for the Education and Knowledge Creation cluster occupations selected for inclusion in the study. Over the next five years (2014–2019), these occupations are projected to grow by 4%, adding about 1,200 new jobs and 3,800 replacement jobs.<sup>21</sup> Sacramento Capital region employers will need to fill as many as 1,000 openings annually to keep pace with cluster growth, retirements and other separations.

Elementary school teachers is the largest occupation in the group with the most annual openings over the next five years. Secondary school teachers and middle school teachers are also large occupations with significant annual openings created by new job growth and replacement needs. For each occupation, replacement estimates include retirements and general separations, but not turnover within the occupation. As such, replacements and new job growth combined is a good measure of demand for workers.

## Exhibit 13: Employment Outlook, Education and Knowledge Creation Occupations, Sacramento Capital Region, 2014–2019<sup>22</sup>

Description	2014 Jobs	2019 Jobs	2014–2019 Change	2014–2019 % Change	Total Replacements	Total Openings	Annual Openings
Elementary School Teachers	10,226	10,662	436	4%	1,265	1,701	340
Secondary School Teachers	5,191	5,308	117	2%	777	894	179
Middle School Teachers	3,082	3,250	168	5%	370	538	108
Teachers and Instructors, All Others	2,625	2,844	219	8%	236	455	91
Education, Training, and Library Workers	1,843	1,900	57	3%	86	143	29
Kindergarten Teachers	1,707	1,766	59	3%	266	325	65
Training and Development Specialists	1,616	1,789	173	11%	158	331	66
Writers and Authors	915	906	(9)	(1%)	114	114	23
Library Technicians	802	847	45	6%	225	270	54
Advertising Sales Agents	778	735	(43)	(6%)	147	147	29
Editors	550	501	(49)	(9%)	75	75	15
Producers and Directors	410	423	13	3%	81	94	19
<b>Total</b>	<b>29,747</b>	<b>30,931</b>	<b>1,186</b>	<b>4%</b>	<b>3,802</b>	<b>5,089</b>	<b>1,017</b>

<sup>21</sup> This study excludes occupations that require more than a bachelor's degree. As such, postsecondary instructors were not selected for inclusion in the study.

<sup>22</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

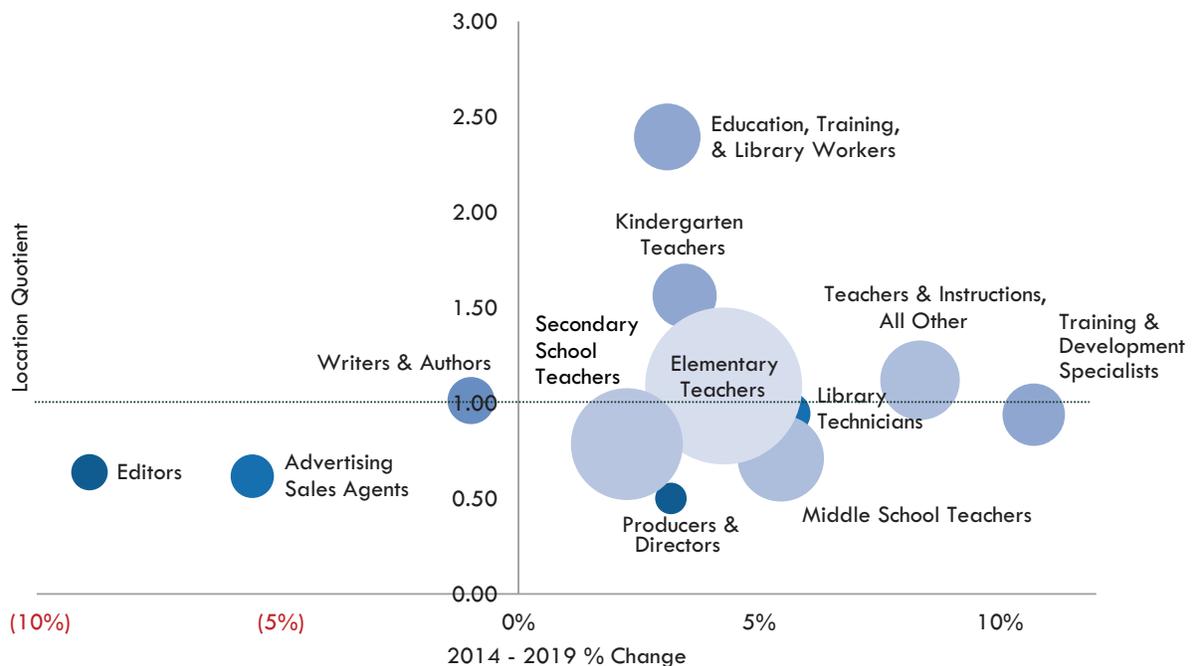
# OCCUPATION DEMAND



In addition to industry analysis, location quotient can also be applied to occupations. In this case, the location quotient compares an occupation’s total employment in a region relative to the state’s total employment for that occupation. A location quotient of less than one indicates a lower concentration of employment for that occupation in the region than in the state overall. A location quotient of more than one indicates a higher concentration of employment for the occupation than in the state overall.

The bubble chart below compares the concentration of occupation employment to the projected five-year growth rate in the region, where the size of the bubble indicates the total number of jobs for each occupation. As shown below, elementary school teachers is the largest occupation, with average concentration in the region and a moderate projected growth rate. Education, training and library workers have an above average location quotient and a moderate projected growth rate. Training and development specialists is projected to grow faster than any other occupation in the group, with an average concentration of employment in the region. Editors and advertising sales agents, two of the smallest occupations in the group, are projected to decline, with below average employment concentrations.

**Exhibit 14: Growth Rate vs. Occupation Concentration, Education and Knowledge Creation Occupations, Sacramento Capital Region<sup>23</sup>**

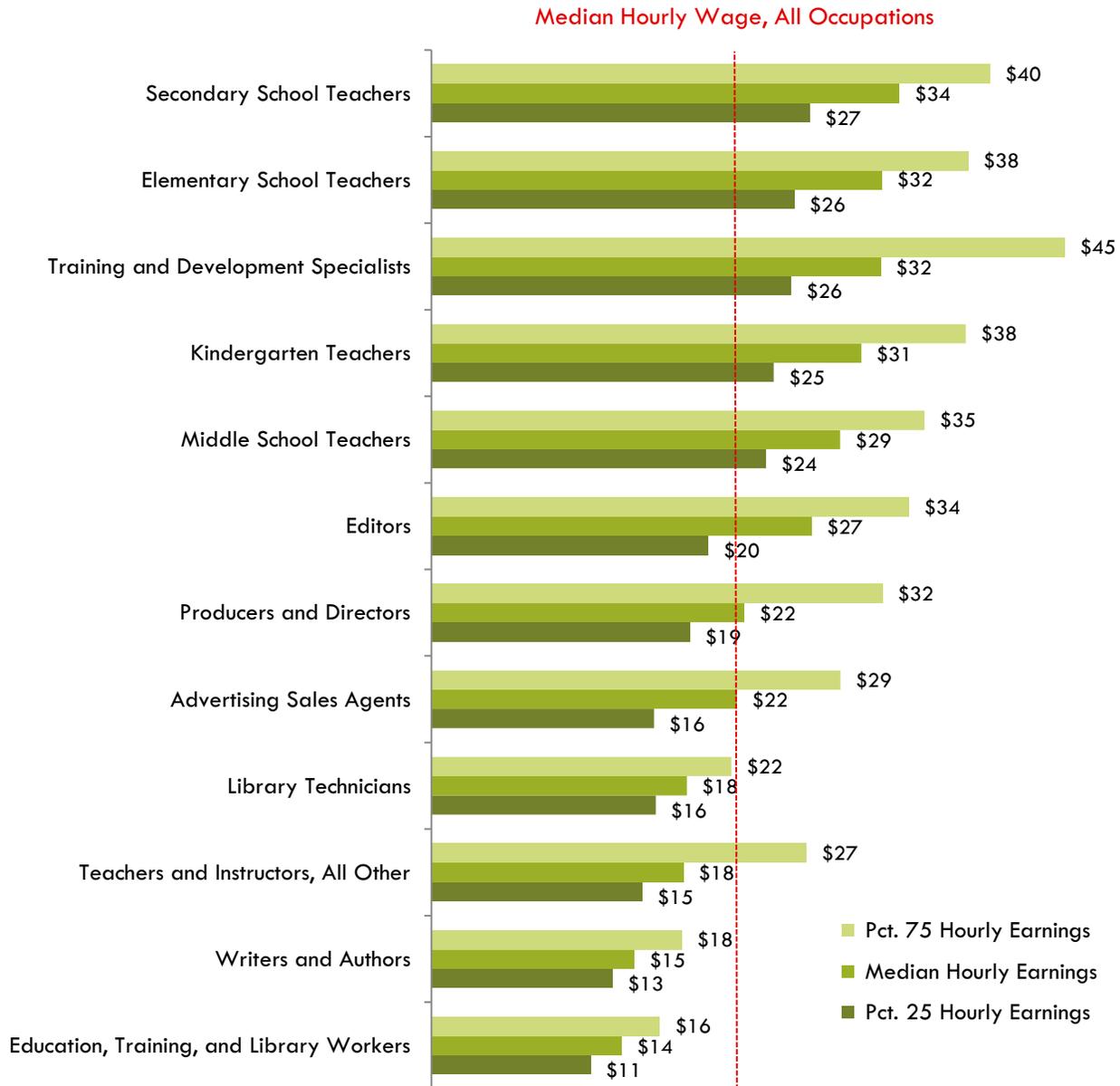


<sup>23</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# OCCUPATIONAL WAGES

About half of occupations in the Education and Knowledge Creation cluster earn wages that are close to or above the regional median wage across all occupations. Secondary school teachers is the highest paid occupation (based on median hourly earnings), followed by elementary school teachers and training and development specialists. The lowest paid occupations in the group include teachers and instructors, all other, writers/authors and education, training and library workers. The median hourly earnings across all occupations in the Sacramento Capital region is \$22.69 per hour.

**Exhibit 15: Hourly Wages, Education and Knowledge Creation Occupations, Sacramento Capital Region, 2015<sup>24</sup>**



<sup>24</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EDUCATION ASSESSMENT

This section provides a review of the training and education supply programs supporting the Education and Knowledge Creation cluster for the occupations selected for inclusion in this study. Exhibit 16 identifies the minimum education requirements for the Education and Knowledge Creation cluster occupations. The minimum education requirement for the majority of occupations is a bachelor's degree.

## Exhibit 16: Minimum Education Requirements, Education and Knowledge Creation Occupations

Description	Entry Level Education	Typical On-The-Job Training
Advertising Sales Agents	High school diploma or equivalent	Moderate on-the-job training
Editors	Bachelor's degree	None
Education, Training, and Library Workers	Bachelor's degree	None
Elementary School Teachers	Bachelor's degree	Internship
Kindergarten Teachers	Bachelor's degree	Internship
Library Technicians	Postsecondary non-degree award	None
Middle School Teachers	Bachelor's degree	Internship
Producers and Directors	Bachelor's degree	None
Secondary School Teachers	Bachelor's degree	Internship
Teachers and Instructors, All Other	Bachelor's degree	Internship
Training and Development Specialists	Bachelor's degree	None
Writers and Authors	Bachelor's degree	Moderate on-the-job training

Exhibit 17, on the following page, lists the colleges with certificate and degree programs that provide a workforce pipeline to the Education and Knowledge Creation cluster. The table includes an estimate of the certificate and degrees conferred each year by program, based on a three-year historical average.

In the Sacramento Capital region, there are 25 training programs supporting the Education and Knowledge Creation cluster occupations. These programs confer an average of 749 degrees and certificates annually. Based on a high level assessment of supply and demand, there could be gaps in the workforce pipeline in two areas: teaching occupations and library workers. The supply and demand data also suggests that there could be a significant oversupply of writers, authors and editors.

The total certificates and degrees conferred provide some information about the supply of workers to an industry or cluster. However, it is limited in that there are several unknown variables that impact the supply, such as migration trends, employer preferences, worker preparedness, qualified unemployed labor force, and graduate/completion duplication. Therefore, it is necessary to conduct additional research to verify potential training shortages in the region.

# EDUCATION ASSESSMENT

## Exhibit 17: Educational Programs & Awards, Education and Knowledge Creation Occupations, Sacramento Capital Region<sup>25&26</sup>

Category	College	Program	Award Type	3-Year Average
Teaching	California State University-Sacramento	Teaching Credential	Postbaccalaureate Certificate	No Data
	California State University-Sacramento	Child Development	Bachelor's degree; Master's degree	231
	California State University-Sacramento	Teacher Education	Master's degree	178
	Rudolf Steiner College	Waldorf Teacher Education	Postbaccalaureate Certificate	24
	University of California-Davis	General Education	Master's degree	42
	University of California-Davis	Teaching Credential	Postbaccalaureate Certificate	143
	University of Phoenix-Sacramento Valley Campus	Elementary Education and Teaching	Master's degree	6
	University of Phoenix-Sacramento Valley Campus	Secondary Education and Teaching	Master's degree	8
	William Jessup University	Elementary Education and Teaching	Bachelor's degree	21
	William Jessup University	Teacher Education	Master's degree and Postbaccalaureate Certificate	8
Library Workers	Sacramento City College	Library & Information Technology	Associate degree; Certificate	12
Writers, Authors & Editors	American River College	Journalism & Mass Communication	Associate degree	5
	American River College	Technical Communication	Associate degree; Certificate	5
	Cosumnes River College	Broadcast Journalism	Associate degree	0
	Cosumnes River College	Journalism	Associate degree	4
	Sacramento City College	Journalism	Associate degree; Certificate	3
	Sierra College	Journalism	Associate degree	1
	California State University-Sacramento	Journalism	Bachelor's degree	40
Producers/Directors	Cosumnes River College	Television Production	Associate degree; Certificate	3
	Cosumnes River College	Radio Production	Associate degree; Certificate	1
	Cosumnes River College	Radio, Television & Film Production	Associate degree	3
	Yuba College	Mass Communications	Associate degree; Certificate	5
Advertising Agents	American River College	Advertising and Sales Promotion	Associate degree	0
	Sacramento City College	Advertising	Associate degree	1
	Cosumnes River College	Advertising/Public Relations Program	Associate degree	No Data

<sup>25</sup> California Community College Chancellor's Office Data Mart. National Center for Education Statistics (NCES). Higher education institutions are required to report completion data to NCES if they participate in any federal financial assistance program authorized by Title IV of the Higher Education Act. Completion data not reported to the NCES or CCCCO Data Mart were not included in the estimate.

<sup>26</sup> The 3-year average is based academic years 2011-12, 2012-13 and 2013-14 for private education institutions and public four-year universities and 2012-13, 2013-14, and 2014-15 for community colleges.

# SKILLS ASSESSMENT

Exhibit 18 displays the top skills and professional credentials for the Education and Knowledge Creation cluster occupations selected for inclusion in this study. The data is based on analysis of job posting data, aggregated by Burning Glass. This online tool uses intelligent “spidering” to search the Internet for job listings, removes duplication, and aggregates the data into a search database. As shown below, most of the skills/knowledge areas are specialized and require specific training and skills.

## Exhibit 18: Skill and Professional Credential Preferences, Education and Knowledge Creation Occupations<sup>27</sup>

Occupation	Top Skill/Knowledge Areas	Top Certifications/ Professional Credentials
Advertising Sales Agents	Advertising, sales, marketing, persuasion, management training, cold calling, business development, and account management	None listed
Editors	Editing, journalism, social media, Adobe Photoshop, copy editing, video editing, proofreading, content management and blogging	None listed
Education, Training, and Library Workers	Troubleshooting technical issues, faxing, personnel management, office equipment, workshops, record keeping and data management	None listed
Elementary School Teachers	Lesson planning, curriculum development, maintaining student records, group instruction, assessment data, managing student data, child cognitive development and record keeping	First Aid CPR AED, Certified Testing Expert Level, Certified Teacher
Kindergarten Teachers	Lesson planning, child development, curriculum development, group instruction, record keeping and first aid	None listed
Library Technicians	Repair, record keeping, office equipment, word processing, library reference, inventory maintenance, data entry, library resources, and scheduling	Typing Certification
Middle School Teachers	Child development, lesson planning, child supervision, first aid, training programs, record keeping, workshops and curriculum development	First Aid CPR AED, Certified Teacher
Producers and Directors	Broadcasting, social media, Adobe Photoshop, video production, journalism, scheduling, collaboration, video editing, content management, and concept development	Project Management Certification
Secondary School Teachers	Lesson planning, curriculum development, record keeping, group instruction, tutoring, workshops, educational programs, maintaining student records, and report writing	Certified Teacher
Teachers and Instructors, All Other	Tutoring, record keeping, lesson planning, screening, scheduling, faculty training, mentoring, first aid, child development and workshops	First Aid CPR AED
Training and Development Specialists	Training programs, training materials, technical training, instructional design, sales scheduling, onboarding, collaboration, workshops and learning management systems	None listed
Writers and Authors	Copy writing, journalism, social media, technical writing/editing, blogging, proofreading, concept development, content management, concise and creative writing	None listed

<sup>27</sup> Burning Glass, 2015.

# SUMMARY



The Education and Knowledge Creation cluster represents a range of industries and establishments that provide systematic information or instruction for the purpose of knowledge creation or learning. The cluster is comprised of two categories: education (private and public institutions and support services) and knowledge creation (publishing and broadcasting establishments).

In 2014, the Education and Knowledge Creation cluster employed 105,600 workers, 10 percent of the Sacramento Capital region's total workforce. The majority of the cluster's workforce is employed by public education institutions. In the Sacramento Capital region, there are several environmental and market conditions that are impacting the Education and Knowledge Creation cluster.

- **Education.** The Sacramento Capital region's educational workforce rebounded after the recession to employ more teachers and administrators funded by additional tax revenues and driven by new state guidelines. This swell of recent employment has created optimism among students and other professionals interested in entering the teaching profession as evidenced by an increase in university teacher preparation enrollments. However, it could take a few years for students in the pipeline to become credentialed and qualified for employment.
- **Knowledge Creation.** Broadcasting and publications—their media production and business, perhaps more than any other industries, have been disrupted by the Internet. Television, radio, newspapers, magazines, and books have become more decentralized and personalized for the consumer. As consumer preferences shift, many traditional publishers and broadcasters struggle to keep pace with the changing environment, causing a decline in revenues and subsequently staffing levels. These declines are projected to continue in the short-term future.

Twelve (12) occupations were selected for inclusion in the study based on the total number of job openings and minimum education requirements, including:

## Education-Related Occupations

- Education, Training, and Library Workers
- Elementary School Teachers
- Kindergarten Teachers
- Library Technicians
- Middle School Teachers
- Teachers and Instructors, All Other
- Training and Development Specialists
- Secondary School Teachers

## Broadcasting and Publication-Related Occupations

- Advertising Sales Agents
- Editors
- Producers and Directors
- Writers and Authors

# SUMMARY

Over the next five years, occupations in the Education and Knowledge Creation cluster are projected to grow modestly, adding about 1,200 new jobs and 3,800 replacement jobs. All of the education-related occupations are projected to add new positions, while most of the broadcasting and publication-related occupations are projected to decline. However, annual demand for replacement workers is strong across the cluster. About half of occupations in the Education and Knowledge Creation cluster earn wages that are close to or above the regional median wage. The minimum education requirement for the majority of occupations in the Education and Knowledge Creation cluster is a bachelor's degree.

In the Sacramento Capital region, there are 25 training programs supporting the Education and Knowledge Creation cluster occupations. These programs confer an average 749 degrees and certificates annually. Based on a high level assessment of supply and demand, there could be gaps in the workforce pipeline in two areas: teaching occupations and library workers. The supply and demand data also suggests that there could be a significant oversupply of writers, authors and editors.

Valley Vision, along with the Center of Excellence and other partners, will be conducting forums with Education and Knowledge Creation employers to review the cluster findings, high priority occupation and skills gaps that can be addressed through a concerted cluster workforce action plan. Priorities that may be elevated based on this analysis include:

1. Conduct additional research on the supply and demand of teaching occupations to identify areas in short supply (such as academic and CTE disciplines).
2. Expand library technician programs to meet the projected labor market needs.
3. Develop articulation agreements among community colleges and universities to strengthen the teacher training pipeline.



# APPENDIX A: EDUCATION AND KNOWLEDGE CREATION CLUSTER DEFINITION

The Education and Knowledge Creation cluster is comprised of the following NAICS codes.

## Private Education Institutions

- 611110 Elementary and Secondary Schools
- 611210 Junior Colleges
- 611310 Colleges, Universities, and Professional Schools
- 611410 Business and Secretarial Schools
- 611420 Computer Training
- 611430 Professional and Management Development Training
- 611511 Cosmetology and Barber Schools
- 611512 Flight Training
- 611513 Apprenticeship Training
- 611519 Other Technical and Trade Schools
- 611610 Fine Arts Schools
- 611620 Sports and Recreation Instruction
- 611630 Language Schools
- 611692 Automobile Driving Schools
- 611699 All Other Miscellaneous Schools and Instruction

## Public Education Institutions

- 902611 Elementary and Secondary Schools (State Government)
- 902612 Colleges, Universities, and Professional Schools (State Government)
- 903611 Elementary and Secondary Schools (Local Government)
- 903612 Colleges, Universities, and Professional Schools (Local Government)

## Education Support Services

- 519120 Libraries and Archives
- 611691 Exam Preparation and Tutoring
- 611710 Educational Support Services
- 902619 All Other Schools and Educational Support Services (State Government)
- 903619 All Other Schools and Educational Support Services (Local Government)

## Publishing

- 323117 Books Printing
- 511110 Newspaper Publishers
- 511120 Periodical Publishers
- 511130 Book Publishers
- 511199 All Other Publishers
- 519110 News Syndicates
- 519190 All Other Information Services

## Broadcasting

- 515111 Radio Networks
- 515112 Radio Stations
- 515120 Television Broadcasting
- 519130 Internet Publishing and Broadcasting and Web Search Portals

# MORE ABOUT...

## More About The Centers of Excellence

The Centers of Excellence (COE) for Labor Market Research deliver regional workforce research and technical expertise to California 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.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the leading source of regional workforce information and insight for California community colleges. More information about the Centers of Excellence is available at [www.coecc.net](http://www.coecc.net).

For more information on this study, contact:

Theresa Milan, COE Director  
Northern California Region  
(916) 563-3221  
[milant@losrios.edu](mailto:milant@losrios.edu)

This study was conducted with the support of JPMorgan Chase & Co. In addition, this study was supported by Economic and Workforce Development funds awarded by the Chancellor's Office, California Community Colleges. It was produced pursuant to grant agreement number 15-305-001.

## More About Valley Vision

Since 1994, Valley Vision's work has driven transformative change and improved lives across Northern California. An independent social impact and civic leadership organization headquartered in Sacramento, Valley Vision strengthens our communities through unbiased research, boundary-crossing collaboration and change leadership. Our work improves overall quality of life and creates the conditions for economic prosperity and community health and vitality.

## More About Burris Service Group

The Burris Service Group (BSG) is a full-service consulting practice providing expertise in economic development, strategic economic research, real estate site strategy, management, and institutional growth. The company was established based on the clear need that advisory services be delivered in an "action-oriented" form. The founder of BSG, Robert Burris, brings to his clients an active local and international network of professionals, as well as 20 years of experience in economic development, market and economic analysis, commercial real estate information, corporate sales, and consulting.



**Burris Service Group**

JPMORGAN CHASE & CO.

[www.coecc.net](http://www.coecc.net)

**FIND US ON LINKEDIN GROUPS:**

 <http://linkd.in/1EUU9wM>



C·O·E

CENTERS OF EXCELLENCE  
Inform Connect Advance

SERIES: 5 OF 6

# FOOD AND AGRICULTURE: CLUSTER AND WORKFORCE NEEDS ASSESSMENT SACRAMENTO CAPITAL REGION



April 2016

**Principal Researcher:**

Sacramento Area Council of Governments (SACOG)

**Supporting Authors:**

Centers of Excellence, Los Rios Community College District

Valley Vision

JPMORGAN CHASE & CO.



# TABLE OF CONTENTS

<b>Introduction</b> .....	<b>3</b>
<b>Overview of the Food and Agriculture Cluster</b> .....	<b>4–6</b>
<b>Part 1. Food and Agriculture Cluster Current Conditions</b> .....	<b>7</b>
<b>Employment</b> .....	<b>7</b>
<b>Establishments</b> .....	<b>8</b>
<b>Concentration of Employment: Regional and Subsector Concentration</b> .....	<b>9–10</b>
<b>Concentration of Employment: Geographic Concentration</b> .....	<b>11–17</b>
<b>Economic Impact</b> .....	<b>18</b>
<b>Part 2. Recent Trends</b> .....	<b>19</b>
<b>Employment Change</b> .....	<b>19–20</b>
<b>Economic Impact Change</b> .....	<b>21–23</b>
<b>Part 3. Looking Forward</b> .....	<b>24</b>
<b>Employment Trends and Projections</b> .....	<b>24</b>
<b>Alternative Cluster Trajectories: RUCS Case Study</b> .....	<b>25–29</b>
<b>Part 4. Workforce &amp; Training</b> .....	<b>30</b>
<b>Occupation Demand</b> .....	<b>30–31</b>
<b>Occupation Wages</b> .....	<b>32</b>
<b>Education Assessment</b> .....	<b>33–34</b>
<b>Skills Assessment</b> .....	<b>35</b>
<b>Conclusion</b> .....	<b>36–37</b>
<b>Appendix A: Food and Agriculture Cluster Definition</b> .....	<b>38–39</b>

## ***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.

© 2016 Chancellor’s Office California Community Colleges  
Economic and Workforce Development Program

*Please consider the environment before printing. This document is designed for double-sided printing.*

# INTRODUCTION

Across the Sacramento Capital region, including the six counties of El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba, approximately 75 percent of land is agricultural, forest, or other open space.

Agriculture in the Sacramento Capital region is not only highly productive and diverse, it is a major economic driver. However, agriculture is often overlooked due to a poor understanding of how the industry’s economic impacts reverberate throughout the larger regional economy.

In response, the Sacramento Area Council of Governments (SACOG) has shifted the planning paradigm to more explicitly include agriculture and rural areas. Through cutting-edge technical work and stakeholder engagement, SACOG’s Rural-Urban Connections Strategy (RUCS) project strives to bring the region’s understanding of rural issues on par with those in urban settings and has demonstrated how policies and strategies impact both parts of the region.

SACOG, the principal researcher for this report, has partnered with Valley Vision and Los Rios Center of Excellence to explore connections among the Food and Agriculture cluster, the labor force, and the larger regional economy. The report draws on recent employment and other data to begin to quantify the substantial economic contribution of the regional food system.

Given the broad nature of the cluster, however, these data sources don’t capture the full network of economic impacts associated with the food system, thus providing only a partial picture of the role of food and agriculture in the regional economy. To address this data limitation, the report also draws on a RUCS impact analysis to further illustrate food system components that cannot be quantified through other data sources. The full findings of this larger impact analysis will be available in July 2016.

This report is part of a series covering the six Next Economy identified clusters, including the areas of Advanced Manufacturing, “Clean Economy,” Education and Knowledge Creation, Information and Communications Technologies, and Life Sciences and Health Services. Each report provides an overview of the characteristics, industry trends and projections, and economic impact of the clusters. These research reports will be used to develop cluster-based workforce action plans that set priorities and recommend strategies for addressing critical workforce gaps. More information about these Sacramento Capital region workforce action plans can be found at [www.valleyvision.org](http://www.valleyvision.org).



SACOG is an association of local governments in the six-county Sacramento area that provides transportation planning and funding and serves as a forum for regional issues, including linking land use, transportation, and air quality.

**RUCS** is the region’s rural economic and sustainability strategy, which is complementary to the **Blueprint**—the region’s overall growth strategy.

## RUCS Topical Areas

	<b>The Infrastructure of Agriculture</b>
	<b>Regulations</b>
	<b>Land Use and Conservation</b>
	<b>Economic Opportunities</b>
	<b>Forest Management</b>

# OVERVIEW OF THE FOOD AND AGRICULTURE CLUSTER

This report moves beyond the farm to analyze the economic contributions of the larger Food and Agriculture industry cluster in the Sacramento Capital region. An industry cluster is a group of interdependent firms and related institutions that are linked through strong relationships and transactions. The full range of inputs and outputs in the Food and Agriculture cluster include various types and scales of production, markets, and value-added processing in addition to the work on farms, ranches, and fields. Related food industries provide resources and equipment for growing or harvesting crops and processing, packaging, or using crops or animal products to prepare other food products (e.g., bakeries). In this analysis, SACOG divided industries within the Food and Agriculture cluster into the following four subsectors:

Cluster research is a widely accepted practice for developing regional prosperity strategies for sustained job creation and growth that leverage unique regional strengths. Industry clusters increase firm competitiveness through shared infrastructure and a concentrated workforce; reduce operating costs with shorter supply chains; increase the flow of information regarding new business opportunities; and foster innovation with informal collaboration and heightened competition. Economic clusters often serve as the driving force of many regional economies.



**Food and Agricultural Production** – These firms produce, farm, and harvest crops or animal products. Food and agricultural production firms include grain, seed, nut, vegetable, and fruit farming and harvesting; cotton, hay, and tobacco farming and harvesting; pre- and post-harvest activities; nursery production; dairy production; animal ranching, farming, and production; feedlots; aquaculture; apiculture; farm labor contractors; and farm management services.

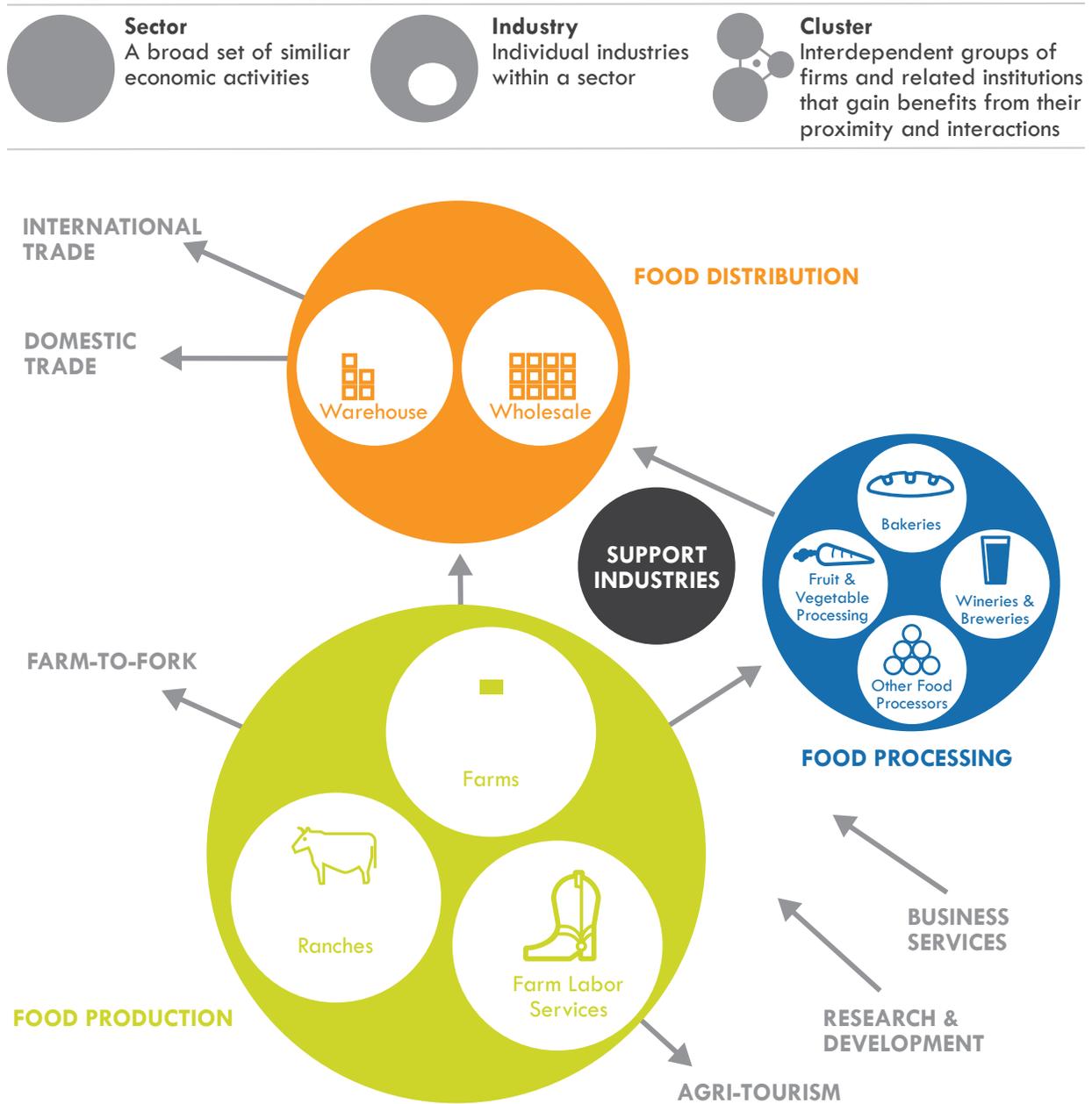
**Food and Agricultural Processing** – Firms in this segment of the cluster process, mill, manufacture, package, and/or prepare other food products using crop or animal production as inputs. Food and agriculture processing firms include flour, rice, and corn milling; fat and oil processing; meat processing and/or rendering; specialty canning; creameries; bakeries and other prepared food manufacturing; and breweries, wineries, and distilleries.

**Food and Agricultural Distribution** – These firms store, transport, or sell crop or animal products in bulk quantities as merchant wholesalers. Food and agriculture distribution firms include grocery, meat, dairy, grain, fruit and vegetable, confectionary, and alcohol merchant wholesalers; refrigerated and farm product warehousing and storage; and food service contractors.

**Food and Agricultural Support** – These firms support agricultural production by providing resources and equipment for growing and harvesting crop and animal products. Food and agriculture distribution firms include animal production support, fertilizer manufacturing, pesticide manufacturing, farm and food machinery and equipment manufacturing, farm supply merchant wholesalers, and nursery and florist merchant wholesalers.

# OVERVIEW OF THE FOOD AND AGRICULTURE CLUSTER

**Figure 1: Cluster Components: Food and Agricultural Cluster**



The Food and Agriculture cluster impacts many elements of the Sacramento Capital region’s economy. This study quantifies employment in the cluster’s core production, support, processing, and distribution activities (represented by the colored circles above). Due to data limitations, however, the study does not quantify employment in related industries, such as those in gray text in the above graphic.

# OVERVIEW OF THE FOOD AND AGRICULTURE CLUSTER

In keeping with other food system studies, SACOG's cluster definition incorporates the direct economic activity resulting from food that is grown, processed, and distributed in the Sacramento Capital region. Further associated economic impacts—such as businesses indirectly providing agriculture or ecosystem services stemming from food production—are not captured in this cluster definition due to data limitations. Notably, the analysis does not quantify the (substantial) employment and impact of food at the point of consumption, such as restaurants, grocery stores, events, institutions, or other business entities. The analysis also does not quantify the effect of agritourism, environmental services, or research and development (R&D), as these elements cannot be isolated out of the aggregate data sets. So while the subsequent cluster analysis does provide an updated investigation into the core activities connected to the food system in the Sacramento Capital region, its data and job figures do not represent the full network of associated economic impacts and employment.

As part of the Next Economy efforts to better understand how the Sacramento Capital region has emerged from the global recession, this report delves into the regional Food and Agriculture cluster, quantifying employment and other data points for its four subsectors. The data analysis begins by describing **current conditions** in the cluster, then explores recent trends as the cluster continues to support the region's economic rebound, and concludes with a look forward to key **challenges and opportunities** in sustaining this recent growth. Consistent with other efforts to update the six Next Economy clusters, this report draws on recent data from the EMSI data series<sup>1</sup> for the year 2014. The work also incorporates other RUCS datasets, analyses, and insights to complement the EMSI data and illustrate areas not quantified in the base data series.



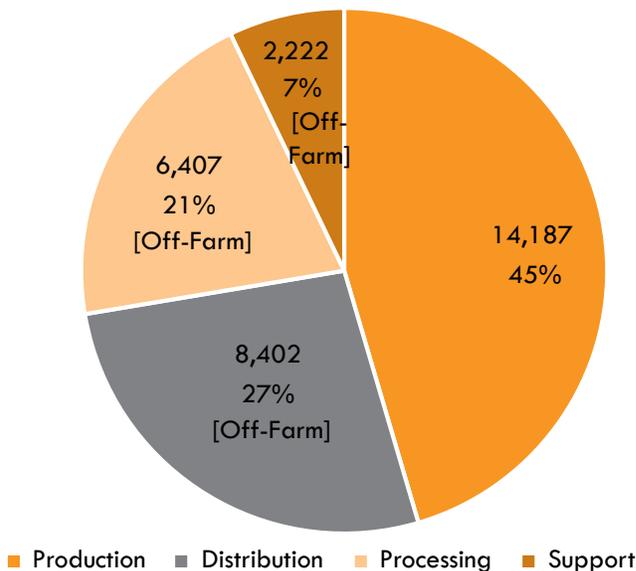
<sup>1</sup> The Economic Modeling Specialists Intl. (EMSI) dataset aggregates over 90 data sources into a unified look at wages, employment, firm concentration and other indicators. The Los Rios Center of Excellence provided the EMSI data for this project; cluster analysis was conducted by SACOG, and all conclusions are SACOG's alone. The Center of Excellence conducted the workforce and training analysis, Part 4 of this report. The geography of the study is the six-county Sacramento Capital region and the study year is 2014 (unless otherwise noted). The report's EMSI data rollup includes estimates for self-employed and sole proprietor workers.

# PART 1. FOOD AND AGRICULTURE CLUSTER CURRENT CONDITIONS

## EMPLOYMENT

The Food and Agriculture cluster is an important part of the Sacramento Capital region’s economy. In 2014, the measured subsectors of the cluster included more than 31,200 jobs, which is about 3 percent of total employment in the six-county region. As shown in Figure 2, the largest concentration of these jobs (45 percent) was in food production, specifically the crop production industry. Remaining employment was spread across the distribution (27 percent), processing (21 percent), and support (7 percent) subsectors respectively. Notably, these “off-farm” industries together made up the majority of employment in the Food and Agriculture cluster (55 percent), showcasing how food system job opportunities extend beyond the farm, ranch, and field into other facets of the regional economy. While the support subsector included the lowest number of jobs overall, the region contained a significantly greater proportion of support employment compared to California as a whole.

**Figure 2: 2014 Food and Agricultural Employment by Subsector<sup>2</sup>**



A survey conducted by the California Farm Bureau in 2012 found that many growers in the SACOG region experience labor shortages, and reported a statewide shortage between 10 percent and 30 percent. If the issue persists, this challenge could inhibit further growth in the cluster.



<sup>2</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

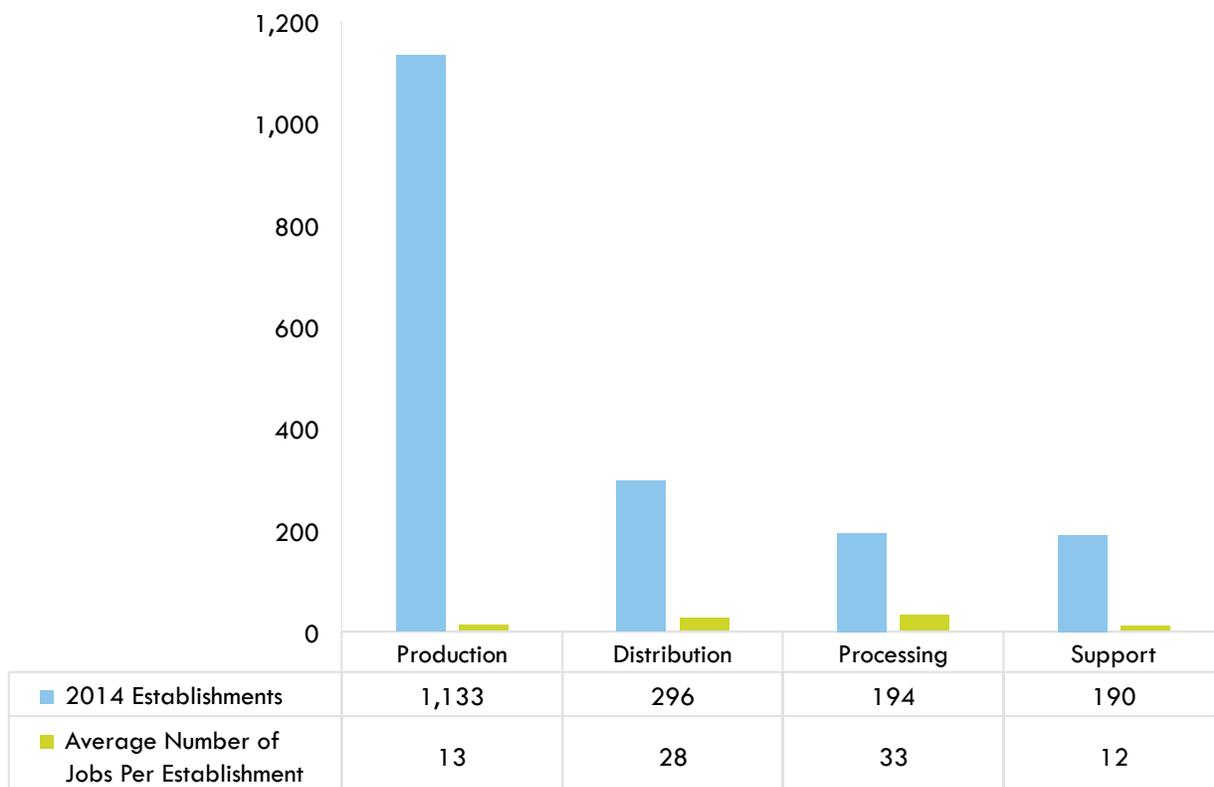
# ESTABLISHMENTS

Overall there are more than 1,800 establishments in the regional Food and Agriculture cluster. Figure 3 displays the total number of establishments and the average number of jobs per establishment for the four cluster subsectors. As shown, the production subsector has the most firms, yet also has one of the lowest averages of workers per establishment compared to other subsectors in the region. This stems from the unique nature of agricultural production compared to many other industries. For example, farmers often draw on off-farm labor contractors at various points in the year. These farm labor contractor establishments each average around 100 employees in the region.

The processing subsector has a smaller number of total establishments, but has the highest average number of workers per establishment. (This total of around 200 processing establishments does not include the components of food processing that occur on farms.) Larger processing facilities in the region—such as fruit and vegetable canning or soft drink manufacturing—on average employ more than 100 workers per establishment. Recent RUCS work has centered on the market opportunity to complement regional food processing activities with a focus on mid-scale facilities, such as food hubs.

An **establishment** is a business providing goods and/or services within an industry, generally engaging in a single type of economic activity and operating from a single physical location. Most employers have only one establishment; however, larger employers may have several.

**Figure 3: Establishments and Average Employment by Subsector, 2014<sup>3</sup>**



<sup>3</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# CONCENTRATION OF EMPLOYMENT: REGIONAL AND SUBSECTOR CONCENTRATION

Location quotient (LQ) analysis provides a useful tool to identify regional economic specializations (see box at right). Compared to the state as a whole, the Sacramento Capital region's Food and Agriculture cluster contains many areas of specialization, yet also is less concentrated in several key industries. As shown in Figure 4, the production and processing subsectors in the region have a location quotient that is less than 1, indicating a lower concentration of employment in these areas compared to the state average. Conversely, the distribution and support subsectors in the region have a location quotient higher than 1, highlighting regional concentrations in these industries. The support sector has a particularly high location quotient, as jobs within this subsector are almost twice as concentrated in the region compared to the state average.

Within the cluster subsectors, individual industries with regional location quotients significantly above the state average include:

- **Processing** – rice milling (4.37 LQ), rendering and meat byproduct processing (3.63 LQ), dried and dehydrated food manufacturing (3.19 LQ), flour milling (2.88 LQ), roasted nuts and peanut butter manufacturing (2.87 LQ), and soft drink manufacturing (1.79 LQ);
- **Distribution** – farm product warehousing and storage (5.46 LQ); and,
- **Support** – farm machinery and equipment manufacturing (2.19 LQ).

Subsector industries with location quotients significantly below the state average include:

- **Processing** – animal (except poultry) slaughtering (0.20 LQ), tortilla manufacturing (0.20 LQ), perishable prepared food manufacturing (0.25 LQ), and wineries (0.28 LQ);
- **Distribution** – packaged frozen food merchant wholesalers (0.15 LQ), refrigerated warehousing and storage (0.17 LQ), and wine and distilled alcoholic beverage merchants (0.24 LQ); and,
- **Production** – farm management services (0.09 LQ).

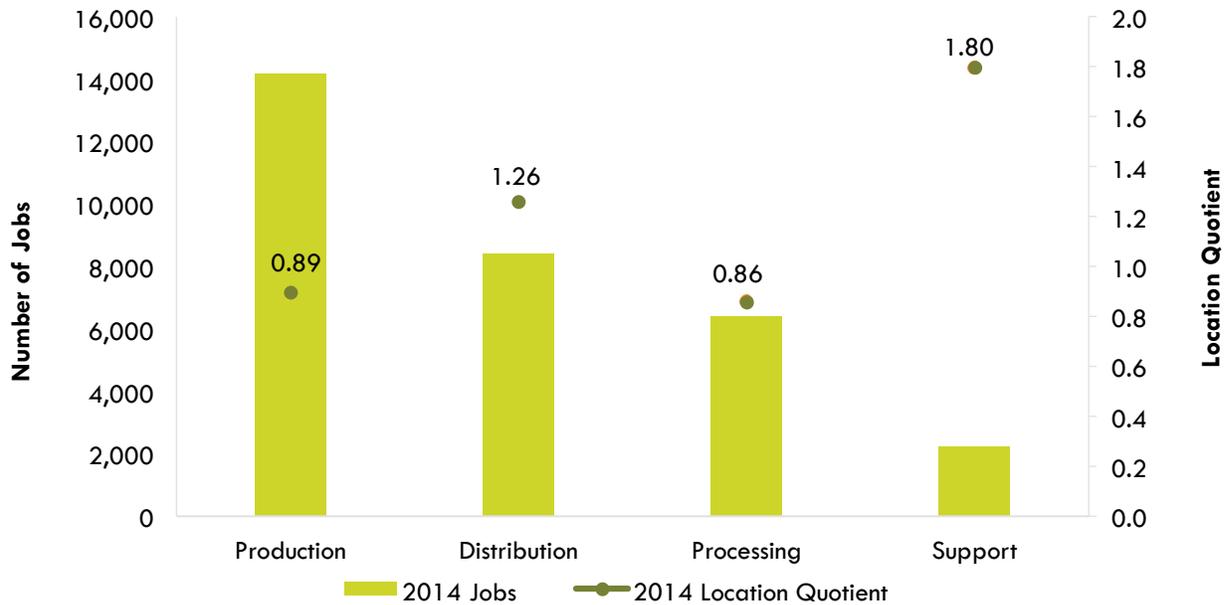
While the processing sector includes many of the industries with the highest location quotients (as indicated above), it also includes the most industries with the lowest location quotients. This is why processing in aggregate has the lowest relative concentration of employment compared to the other cluster sectors, even though it includes many individual industries with high location quotients.

A **location quotient** is a ratio that compares regional employment in a particular industry to employment in that same industry at a larger geography (in this case, California). A location quotient of less than 1 indicates a lower proportion of employment for that industry in the Sacramento region than in the state overall. A location quotient of more than 1 indicates a regional industry with a higher concentration of employment compared to the state average.



# CONCENTRATION OF EMPLOYMENT: REGIONAL AND SUBSECTOR CONCENTRATION

**Figure 4: Total Employment and Location Quotient by Subsector, 2014<sup>4</sup>**



<sup>4</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# CONCENTRATION OF EMPLOYMENT: GEOGRAPHIC CONCENTRATION

Firms in a cluster draw a productive advantage from their geographic concentration. In addition to co-location, firms in a cluster share common resources and technologies and rely on a similar labor pool and institutions. Figure 5a illustrates where employees in the Food and Agriculture cluster are most concentrated in the region, using SACOG's Draft 2015 Employment Inventory.<sup>5</sup> Overall, the largest concentrations of cluster employees are located in the cities of West Sacramento, Sacramento (especially downtown and southeast), and Woodland. Additionally, there is a significant grouping of employees in the Live Oak and Marysville areas and some lesser concentrations of employees in Davis, Rocklin, Galt, and near the community of Courtland in Sacramento County. The hotspot mapping analysis measures where cluster employment is most concentrated; the results show how Food and Agriculture cluster employment extends far beyond the farm. By design, the hotspot analysis does not visually display all areas of activity, just those with distinct co-location. As such, the following maps do not depict all the various food system employment that occurs throughout the entire six-county Sacramento Capital region.

The regional nature of the Food and Agriculture cluster becomes particularly apparent when paired with the RUCS crop map showing acres of agricultural production. Figure 5b provides a simplified version of the crop map. (The full map includes data at the individual field and crop level.) While the production component of the cluster is more dispersed in terms of employment, its substantial agricultural output supports the additional economic activity and jobs found in the other subsectors of the cluster. In other words, without this corresponding agricultural production the cluster's contribution to the regional economy would be severely limited. Future RUCS work under the Food System Multiplier project will show how a decrease in agricultural production would lead to economic contraction throughout the cluster, and throughout the economy as a whole.

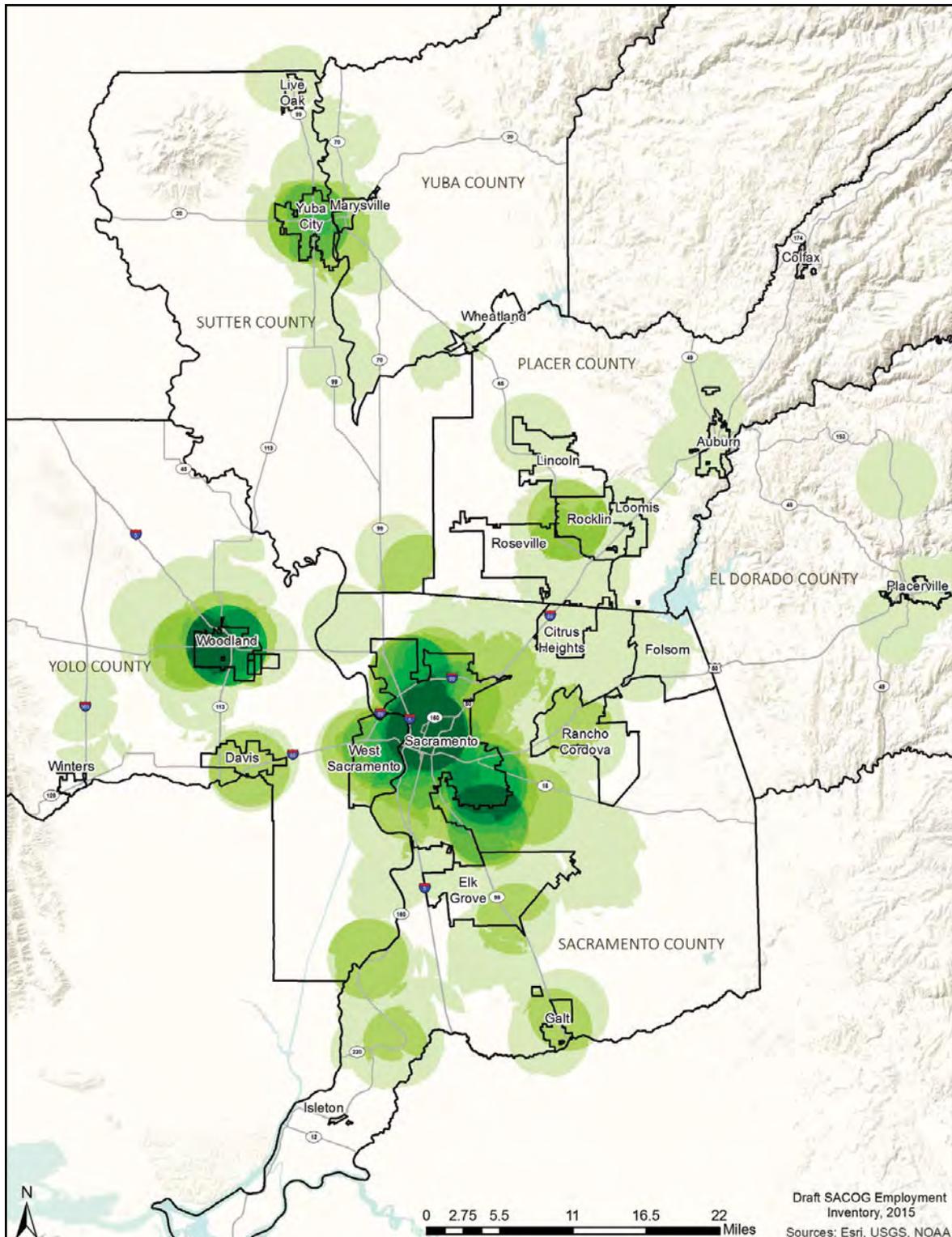
Employment concentrations vary when broken out by cluster subsector, as shown in Figure 5c–5f. Jobs in the production subsector are concentrated around Galt; western Woodland; and the area of Sacramento County between the cities of Sacramento, Rancho Cordova, and Elk Grove. Areas near Marysville and Yuba City, Davis, the communities of Ryde (Sacramento County), and Norton (Yolo County) also include significant concentrations of production jobs. This finding stems from the inclusion of farm labor contractor firms in the production segment of the cluster. These firms may be incorporated in a single facility, but supply labor to farms across the region. Thus, in the production map below, the mapping emphasizes the physical location of farm labor supply firms, not necessarily how this labor spreads throughout the region.

Distribution jobs are more spread out across the region, but are generally concentrated in the cities of Yuba City and Sacramento (north, downtown, and southeast), with some groupings in Rocklin and Courtland. Processing is characterized by large employment concentrations in Woodland, eastern West Sacramento, central Sacramento, and Sacramento County between the cities of Sacramento and Elk Grove. Finally, the support subsector follows a similar concentration pattern to the cluster average (main concentrations in Yuba City, west of Woodland, and southeast Sacramento, plus significant groupings in Davis and central Sacramento). However, for this subsector Rancho Cordova includes one of the greatest concentrations in employment, with additional significant groupings near Live Oak, Auburn, McClellan Airfield, West Sacramento, and the community of Walnut Grove.

<sup>5</sup> SACOG's Draft 2015 Employment Inventory was developed using data from the Employment Development Department. The information is in draft form, as SACOG is currently reviewing and editing the data for final release later this year. While employment estimates may change on a smaller scale, the location and total of employees at the cluster level provides useful information about employment concentration. The employment concentration maps use the spatial analyst function in GIS to calculate "densities" of employment by standard deviation from the mean to show where employment is clustered geographically.

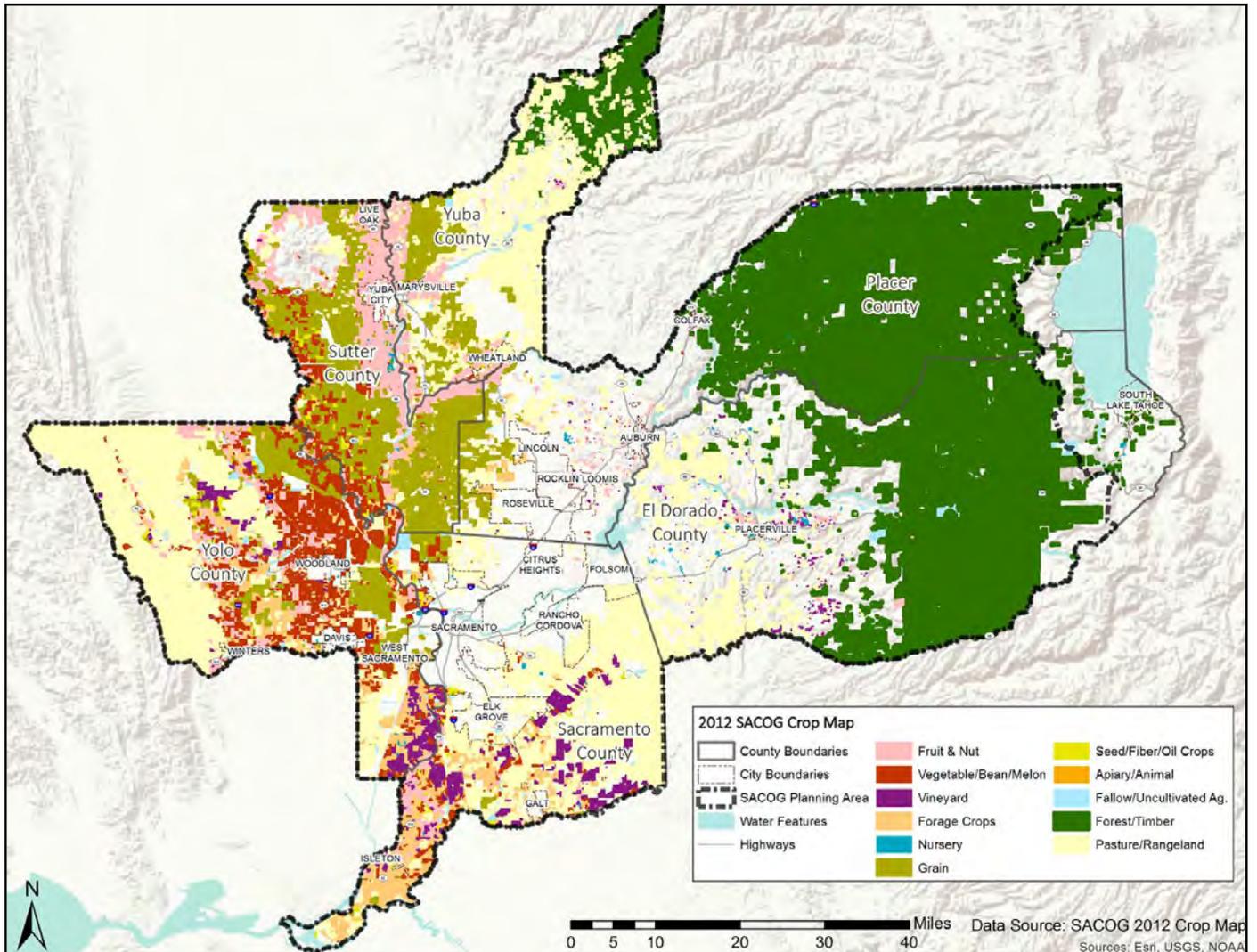
# CONCENTRATION OF EMPLOYMENT: GEOGRAPHIC CONCENTRATION

Figure 5a: Food and Agriculture Cluster Employment Concentration



# CONCENTRATION OF EMPLOYMENT: GEOGRAPHIC CONCENTRATION

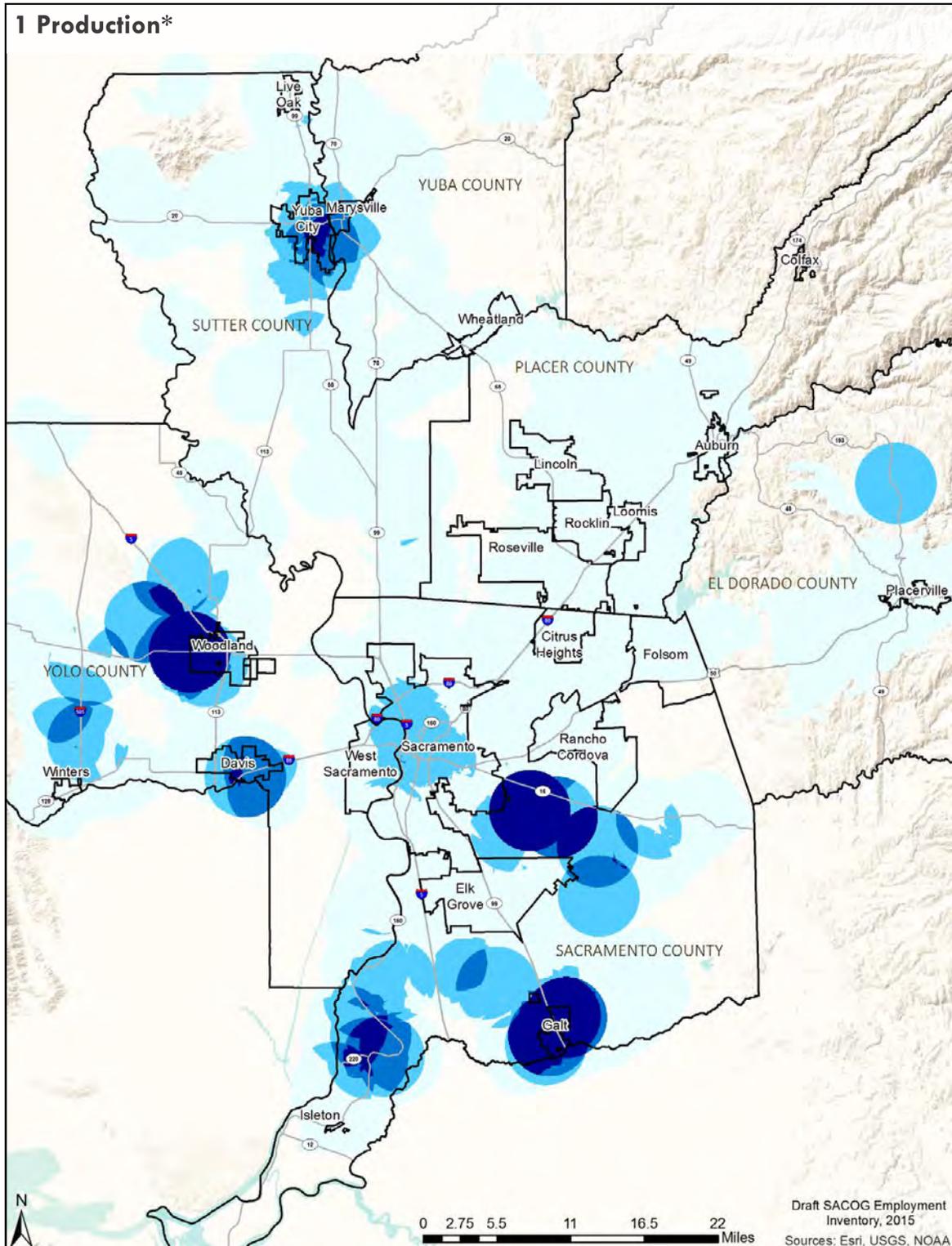
Figure 5b: RUCS 2012 Crop Map



\* Farm labor contractor firms in the production segment of the cluster may be incorporated in a single facility, but may supply labor to farms across the region. The map emphasizes the physical location of farm labor supply firms, but not necessarily how this labor spreads throughout the region. All maps show areas of particular concentration, not each subsector's full economic activity.

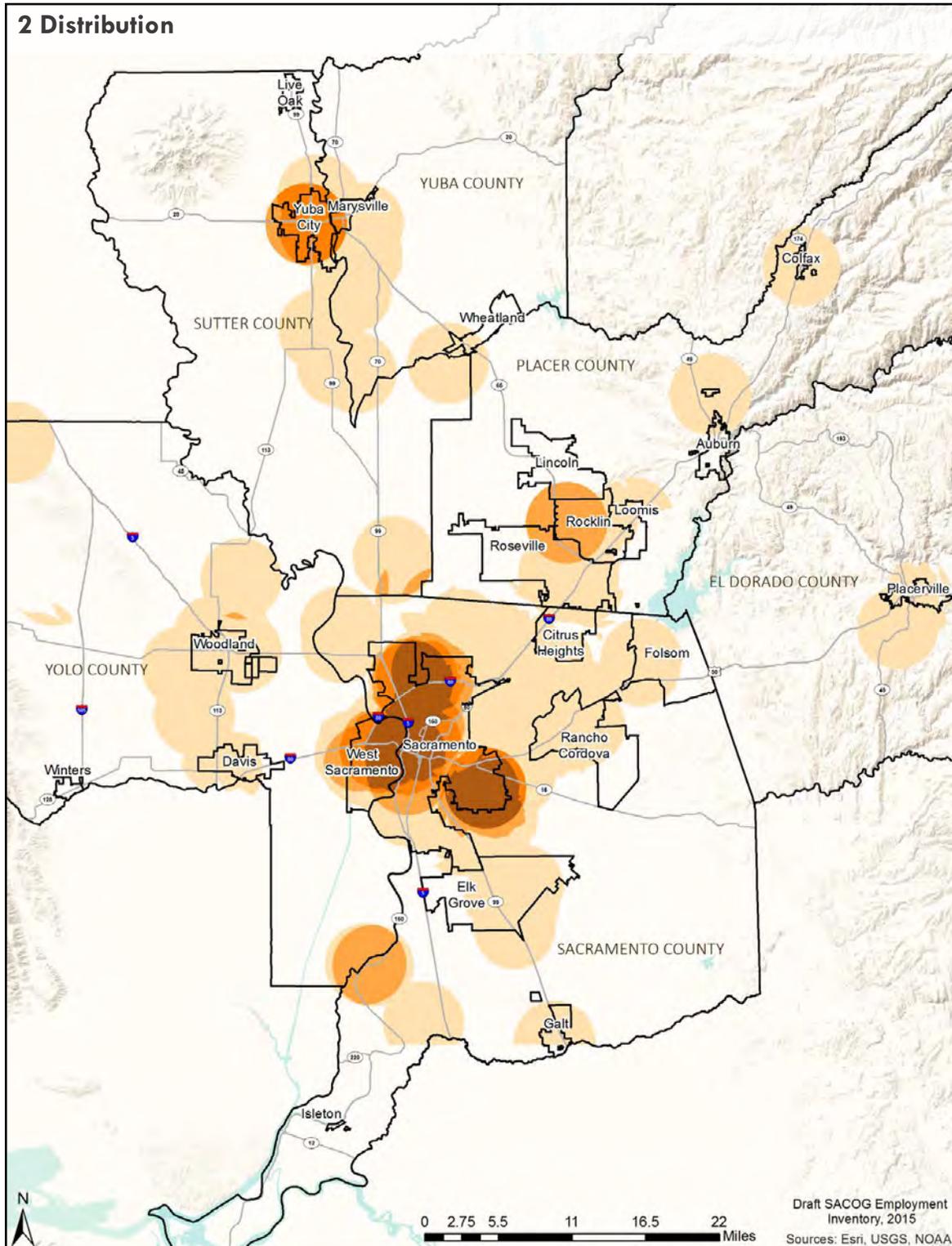
# CONCENTRATION OF EMPLOYMENT: GEOGRAPHIC CONCENTRATION

Figure 5c: Employment Concentration by Cluster Subsector



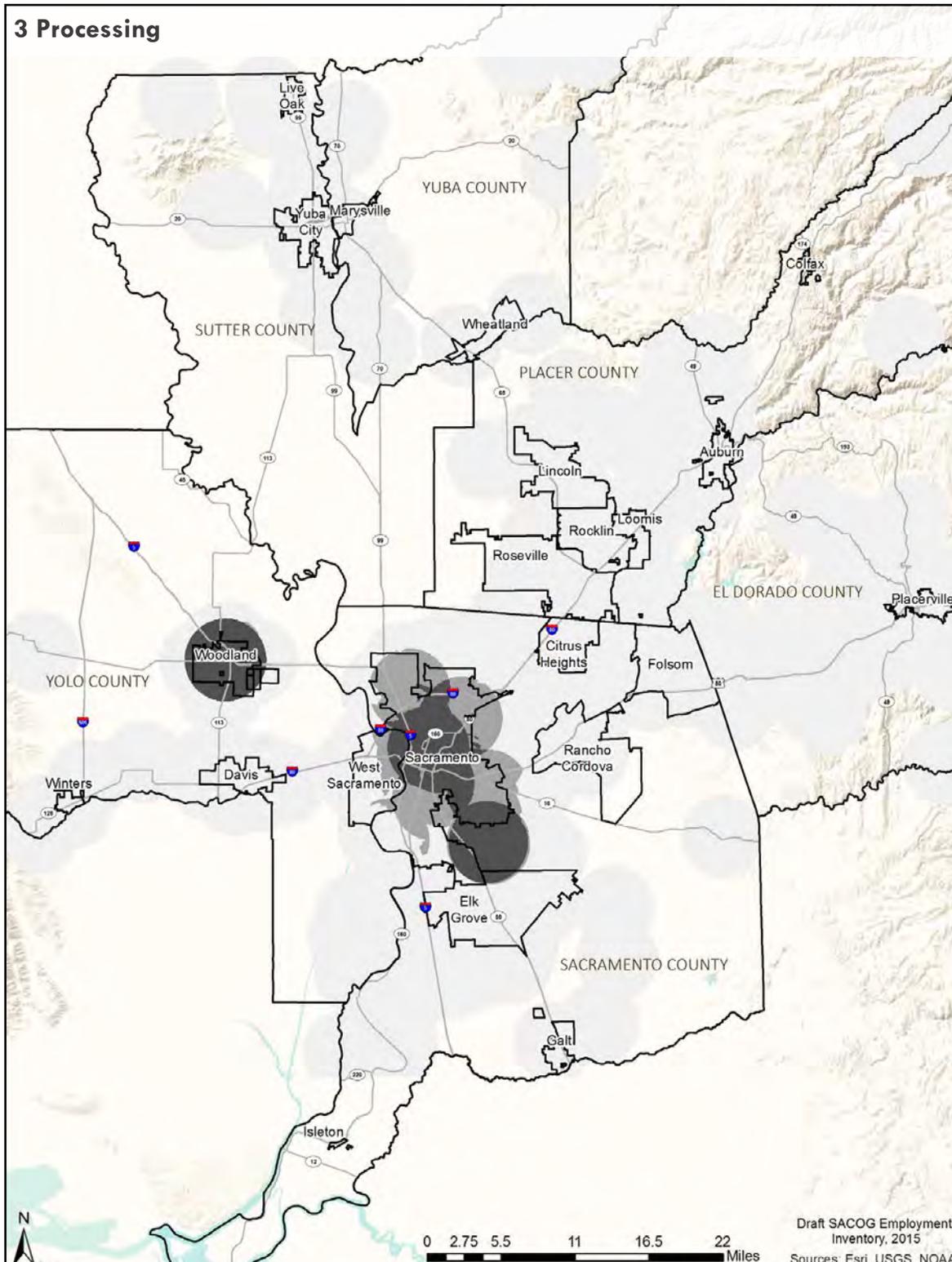
# CONCENTRATION OF EMPLOYMENT: GEOGRAPHIC CONCENTRATION

Figure 5d: Employment Concentration by Cluster Subsector



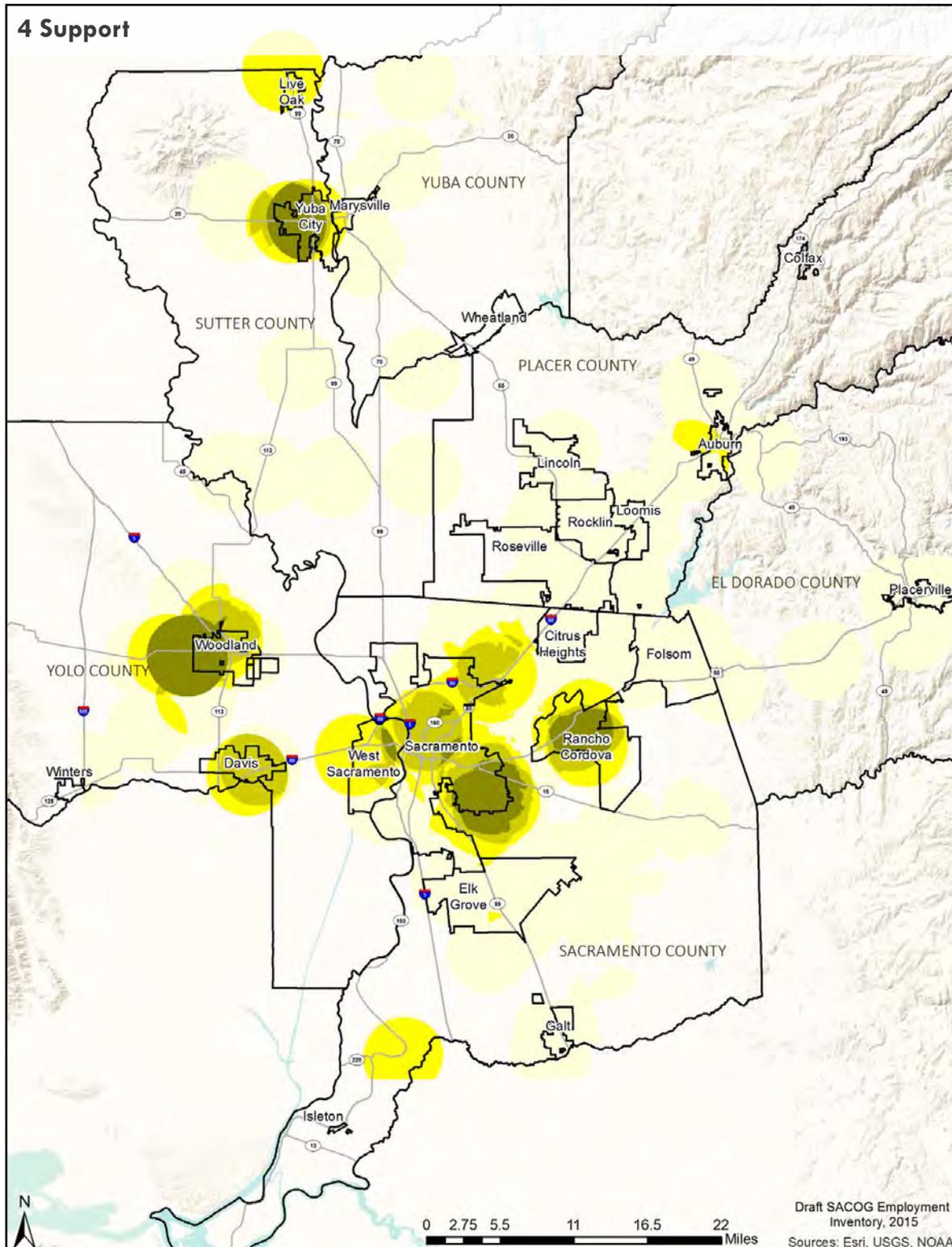
# CONCENTRATION OF EMPLOYMENT: GEOGRAPHIC CONCENTRATION

Figure 5e: Employment Concentration by Cluster Subsector



# CONCENTRATION OF EMPLOYMENT: GEOGRAPHIC CONCENTRATION

Figure 5f: Employment Concentration by Cluster Subsector





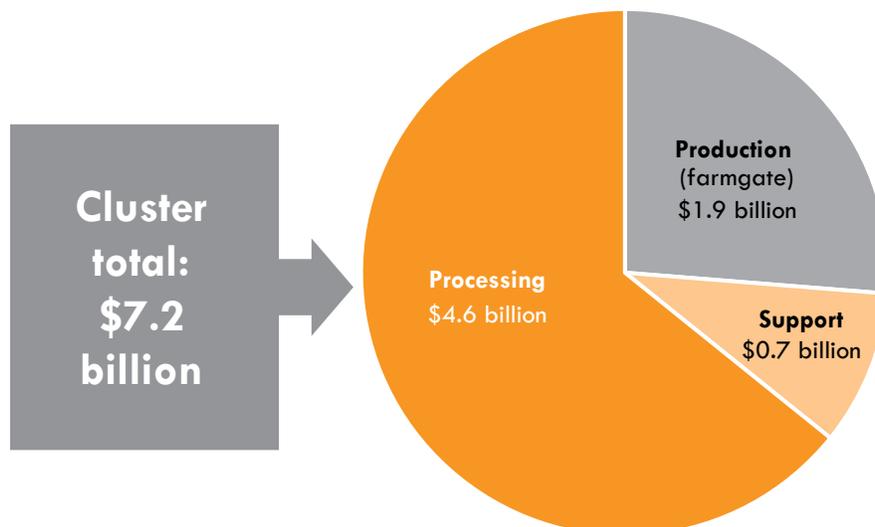
In addition to providing jobs both on and off the farm, the Food and Agriculture cluster also plays an important role in the region’s overall economic output. Consistent with other Next Economy cluster updates, this report uses the IMPLAN model to measure the direct economic impacts of the Food and Agriculture cluster.

As shown in Figure 6, the Food and Agriculture cluster directly contributes over \$7.2 billion<sup>6</sup> to the regional economy, or about 4 percent of total output in the Sacramento Capital region. However, this output total does not include the contribution of the distribution component of the cluster, due to data limitations in the base model. As such, this initial measure underestimates the full economic contribution of the cluster, but provides a starting point for comparison. Forthcoming RUCS work in the Food System Multiplier project will provide further output detail by segment, including how the cluster’s overall direct economic activity leads to additional economic activity through a multiplier effect.

Of the three segments measured in the model, the processing subsector contributes the highest direct output, a total of \$4.6 billion, followed by the production sector, \$1.9 billion of farmgate value in 2013. (The farmgate value is the net value of the product after it leaves the farm.) The support sector estimate accounts for the smallest share of the cluster’s total economic impacts at less than \$1 billion. Farmgate value increased to \$2.4 billion in 2014 in spite of the drought.

According to the 2012 USDA Census of Agriculture, the majority of the region’s farms (83 percent) are smaller than 180 acres, and 64 percent of farms earn less than \$25,000 per year. Larger operations with higher revenues are seen throughout the region. Yet, as with the rest of the state, our region is made up of mostly smaller family farm operations that rely heavily on off-farm income.

**Figure 6: Food and Agriculture Cluster Output, 2013<sup>7</sup>**



<sup>6</sup> The IMPLAN analysis uses data for the year 2013 (a year earlier than the 2014 employment and firm data).

<sup>7</sup> IMPLAN, 2013. The economic contribution of the distribution segment of the cluster cannot be determined from the base model.

## EMPLOYMENT CHANGE

Like all areas of the economy, the Food and Agriculture cluster was heavily impacted by the recent recession. Yet, in the last several years the cluster has rebounded, adding jobs at a rate faster than the regional economy. This section of the report explores some recent trends in how the Food and Agriculture cluster has rallied from the recession to better compete locally, nationally, and globally.

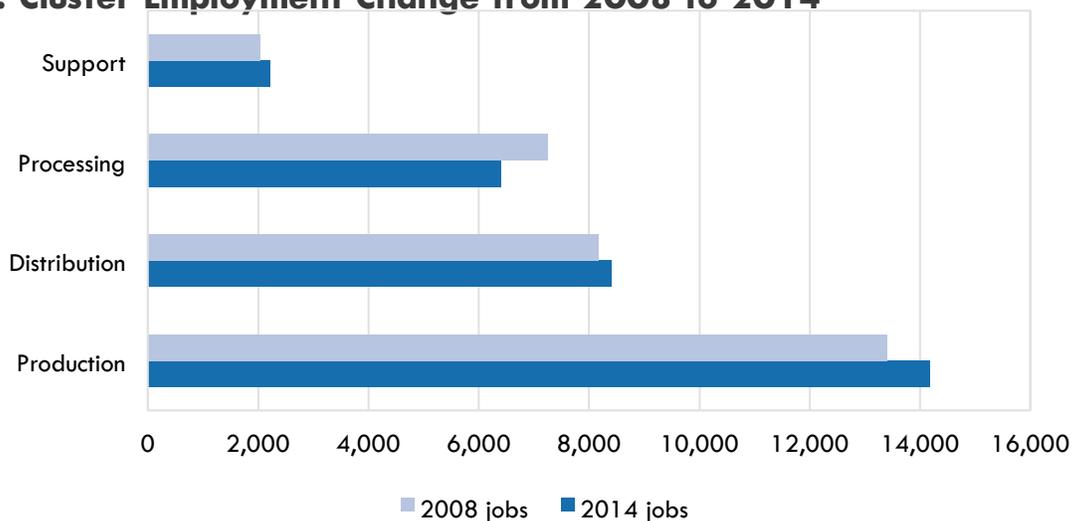
Between 2007 and 2008, the Food and Agriculture cluster lost almost 400 jobs and continued to decline until 2010 for a total loss of more than 1,100 jobs. However, unlike other clusters, by 2011 the cluster had already started to recover, adding almost 800 jobs. By 2014, employment in the cluster had returned to its pre-recession high. Indeed, while the region as a whole in 2014 still had not recovered all jobs lost in the recession, the distribution segment of the Food and Agriculture cluster increased employment by 3 percent, with a 6 percent increase in agricultural production employment and 9 percent in the support segment compared to 2008.

While the other segments of the cluster have added jobs since 2010, processing was the only sector to actually lose jobs during the previous five years, continuing a downward trend that predates the recession reflecting in part the impact of technological innovations. As processing is an important value-adding segment of the cluster, this contraction in employment is a key challenge. However, this overall trend masks some momentum for individual processing industries, such as wineries (27 percent employment growth over the last five years) or nut processing (18 percent employment growth over the last five years).

The Food and Agriculture cluster has outpaced the region at large in economic recovery.



**Figure 7: Cluster Employment Change from 2008 to 2014<sup>8</sup>**



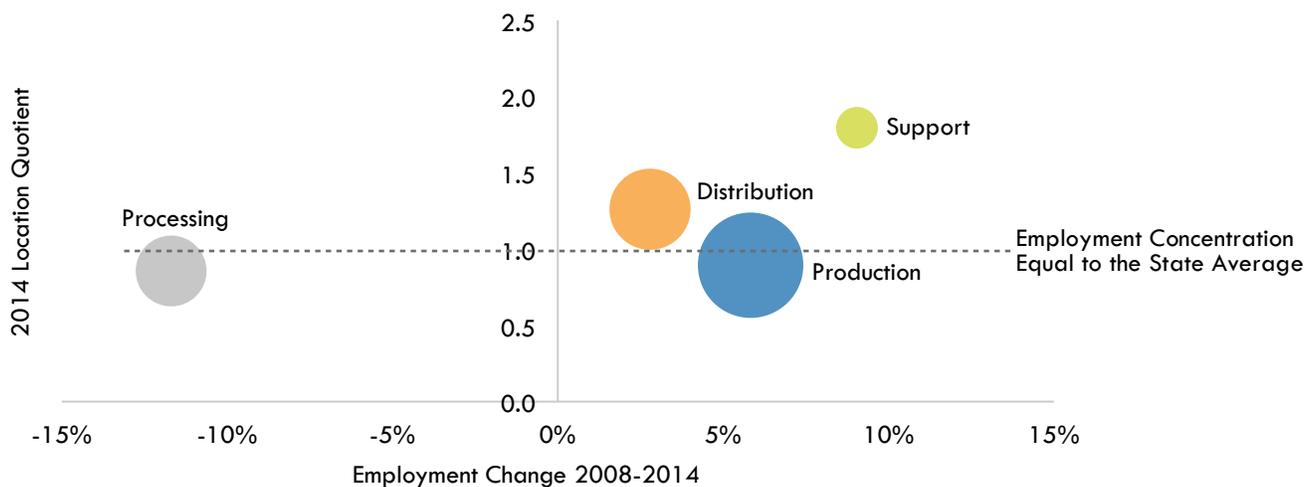
<sup>8</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# EMPLOYMENT CHANGE



Figure 8 below incorporates current conditions and recent trends in the cluster into a single graphic. The bubble chart compares regional employment growth from 2008 to 2014 (on the x axis of graph) to the current concentration of employment in the region (y axis), with the size of the bubble indicating the current total number of jobs for each segment of the cluster.<sup>9</sup> The graphic substantiates the findings of the above section. Production and processing sectors in the Sacramento Capital region have a lower concentration of employment than the statewide average, while the support and distribution segments have a higher concentration. While the support sector had the smallest overall number of jobs in 2014, it experienced the greatest increase in employment from 2008 to 2014 and had the highest concentration of employment relative to the state average. Conversely, the processing subsector had the lowest concentration of employment of any subsector and continues to lose jobs year over year.

**Figure 8: Cluster Employment Change and Concentration<sup>10</sup>**



<sup>9</sup> Location quotient is for year 2014 compared to the California average. Likewise, total employment is for 2014.

<sup>10</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

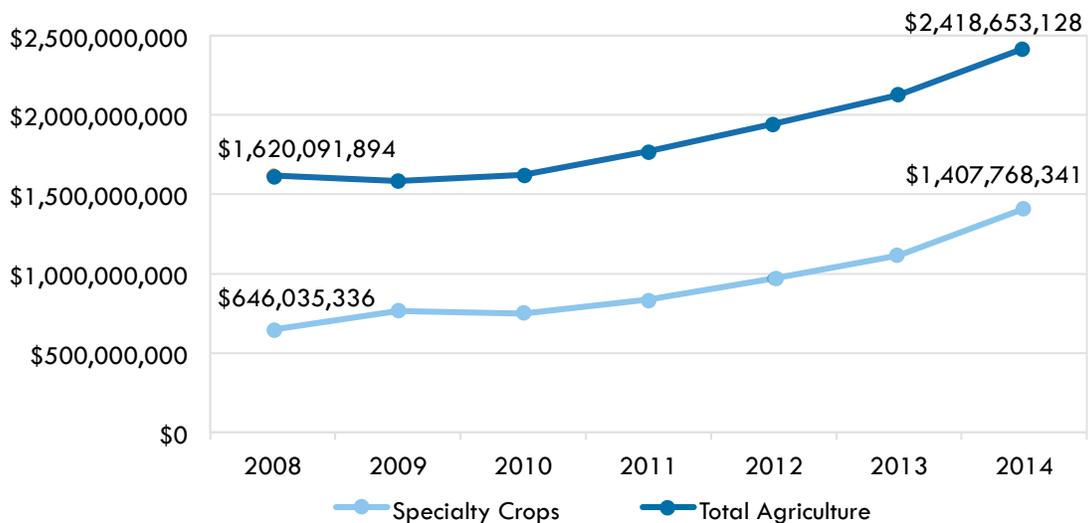
# ECONOMIC IMPACT CHANGE



In the past several years, the value of regional agricultural production has soared. As shown in Figure 9, the total value of agricultural production in the SACOG region rose from \$1.6 billion in 2008 to \$2.4 billion<sup>11</sup> in 2014, an increase of 49 percent. Even when adjusted for inflation this translates to an increase of 36 percent in real dollars, far outpacing the regional economy as a whole.<sup>12</sup> With a substantial increase of 118 percent in total value (98 percent when adjusted for inflation), specialty crops (including vegetables, fruits, and nuts) saw an increase in value from \$600 million to over \$1.4 billion from 2008 to 2014. To highlight this trend, the following section compares specialty crops to all agricultural crop production, showing how specialty crops accounted for 95 percent of the growth in value between 2008 and 2014.

The **RUCS** appendix of SACOG’s **MTP/SCS** demonstrates that while the value of agricultural commodities in the region had declined in near parallel with the decline in agricultural acres in past years, record commodity prices today have somewhat reversed this trend. It appears that some fallowed land has been brought back into production to take advantage of higher prices in the marketplace.

**Figure 9: Value of Agricultural Output, 2008–2014<sup>13</sup> (in nominal dollars)<sup>14</sup>**



<sup>11</sup> Note that this \$2.4 billion is for the year 2014, one year after the study’s 2013 IMPLAN estimate of \$1.9 billion, referenced in the economic impact section of this report.

<sup>12</sup> Values adjusted for inflation using the Consumer Price Index Inflation Calculator by the Bureau of Labor Statistics.

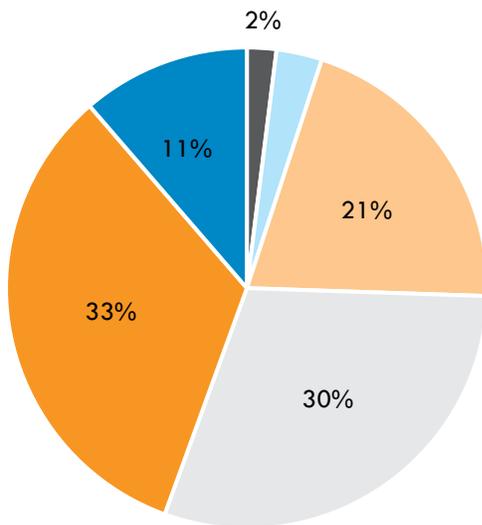
<sup>13</sup> *El Dorado and Alpine Counties Agricultural Crop and Livestock Report*, 2008, 2010, 2012, 2014; *Agricultural Crop Production Report for Placer County*, 2012, 2014; *Sacramento County Crop and Livestock Report*, 2008, 2010, 2012, 2014; *Sutter County Crop & Livestock Report*, 2014; *Yolo County Agricultural Crop Report*, 2008, 2011, 2014; and *Crop Report for Yuba County* 2008, 2010, 2012, 2014. The years of crop reports accessed vary among counties because some counties include more years in their past value comparisons than others.

<sup>14</sup> Nominal dollars are the value of the output in its given year and are not adjusted for inflation.

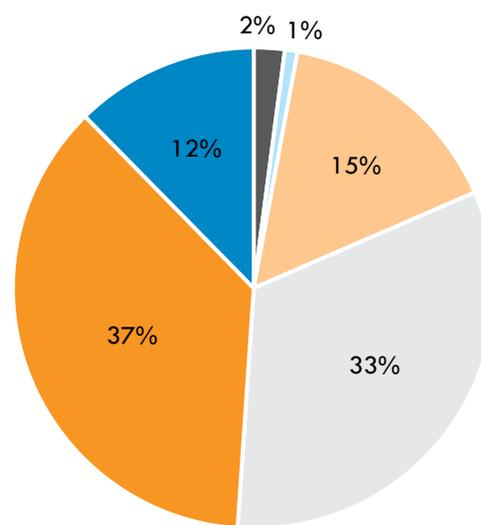
# ECONOMIC IMPACT CHANGE

As shown in Figures 10a and 10b respectively, 63 percent of total farmgate value and 70 percent of specialty crop farmgate value in the region were generated by Sutter and Yolo counties in 2014.<sup>15</sup> Conversely, El Dorado and Placer counties have the lowest agricultural and specialty crop values in the region, but this total does not include timber. El Dorado, Sutter, Yolo, and Yuba counties all have a similar proportion of specialty crop value as compared to total agricultural value (ranging from 61 percent to 64 percent), while Placer County has a far lower proportion of specialty crop value at 16 percent. The proportion of total agricultural value by county was very similar from 2008 to 2014, only shifting by about 1 percent. This trend was similar for specialty crops, except for a more significant decrease in Sacramento County (-7 percent) and increase in Sutter County (+5 percent) over the same period.

**Figure 10a: Total Agricultural Value, 2014<sup>16</sup>**



**Figure 10b: Specialty Crop Value, 2014<sup>16</sup>**



■ El Dorado   ■ Placer   ■ Sacramento   ■ Sutter   ■ Yolo   ■ Yuba



<sup>15</sup> While county agriculture reports generally categorize crop and livestock yields in a similar fashion, there is some variation in the type of crops rolled up into a given category which makes it difficult to truly normalize the reports for comparison across counties. Within this dataset these discrepancies occur in El Dorado County where the report includes data from Alpine County, Yolo County which includes an organic category encompassing some non-specialty crops, and Yuba County which includes some miscellaneous field crops in a vegetable crop category. However, these differences are minor overall, and the data still provides useful county comparisons.

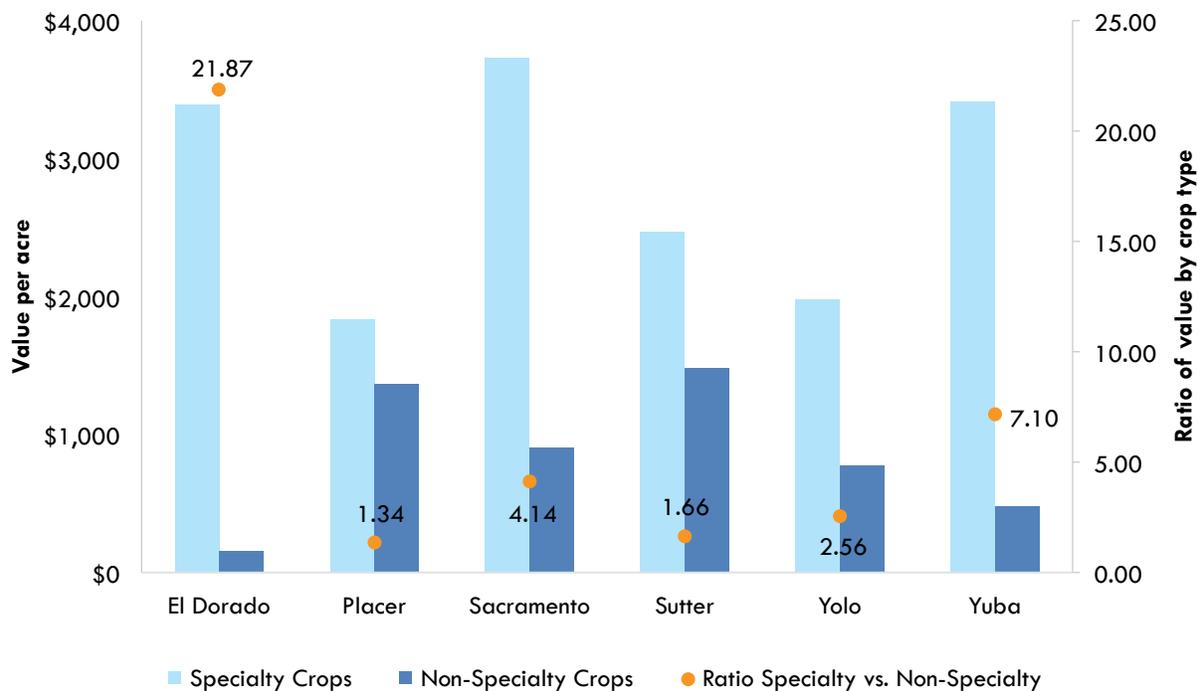
<sup>16</sup> *El Dorado and Alpine Counties Agricultural Crop and Livestock Report, 2008, 2010, 2012, 2014; Agricultural Crop Production Report for Placer County, 2012, 2014; Sacramento County Crop and Livestock Report, 2008, 2010, 2012, 2014; Sutter County Crop & Livestock Report, 2014; Yolo County Agricultural Crop Report, 2008, 2011, 2014; and Crop Report for Yuba County 2008, 2010, 2012, 2014.* The years of crop reports accessed vary among counties because some counties include more years in their past value comparisons than others.

# ECONOMIC IMPACT CHANGE



Within the region, specialty crops generated about three times the value per acre in 2012 compared to other agricultural products (Figure 11). Specialty crops in all counties generated a higher value per acre than non-specialty crops, although the difference was most pronounced in El Dorado (factor of 22) and Yuba (factor of 7) counties and least evident in Placer (factor of 1.34) and Sutter (factor of 1.66) counties. Sacramento County had the highest specialty crop value per acre (\$3,728), while Placer County had the lowest (\$1,832).

**Figure 11: Agricultural Value per Acre<sup>17</sup>**



<sup>17</sup> SACOG 2012 Crop Map.

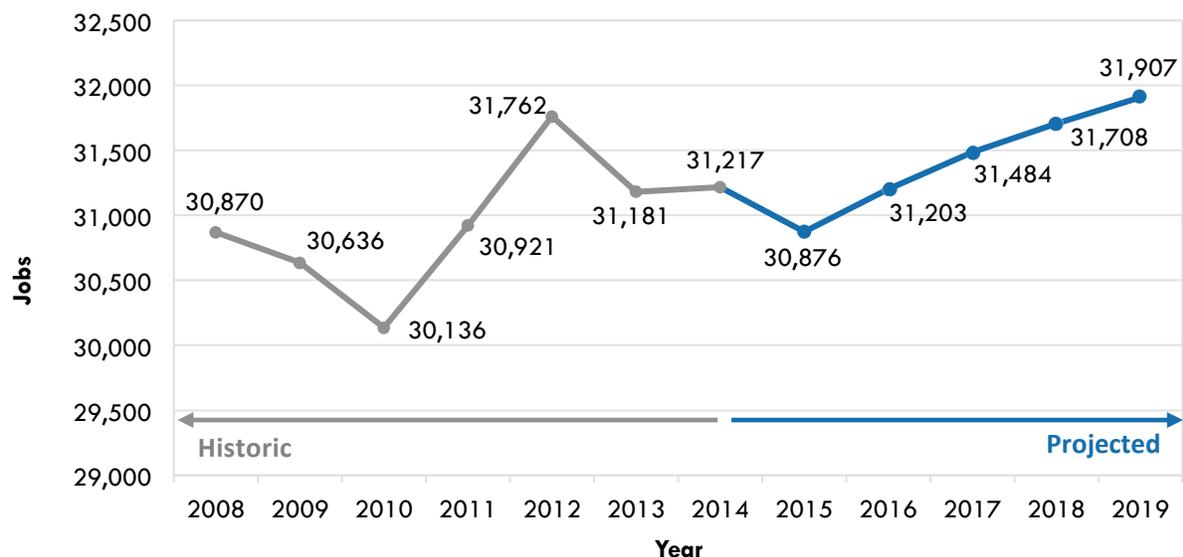
# PART 3. LOOKING FORWARD

## EMPLOYMENT TRENDS AND PROJECTIONS

This section uses employment projection estimates from EMSI to look out five years from the study base year of 2014, providing consistency with other Sacramento Capital region workforce reports. These estimates provide one possible indicator of future conditions if current trend lines continue. Yet, it is also important to recognize our potential to change this trajectory through the proactive strategies contained in the Food and Agriculture cluster action plan. The following section illustrates some other potential future outcomes in the cluster drawing on RUCS cases studies, food hub financial analyses, and other regional food economy initiatives including the Central Valley Ag Plus Food and Beverage Manufacturing Consortium managed by Valley Vision.

As shown in Figure 12, after a forecasted loss in employment of about 350 jobs between 2014 and 2015, the EMSI estimates project the cluster to recover and add an additional 700 jobs by 2019. By 2019, the region is expected to include 145 more jobs than the high in 2012.

**Figure 12: Employment Trends and Projections, 2008–2019<sup>18</sup>**



As shown in Table 1, the distribution subsector is projected to add both the greatest number and proportion of jobs (927 jobs, 11 percent), followed by the support subsector (203 jobs, 9 percent). The processing subsector is expected to experience job loss over the next five years, totaling more than 500 jobs (8 percent).

**Table 1: Employment Projections by Subsector, 2014–2019<sup>18</sup>**

Food and Agriculture Subsector	2014 Jobs	2019 Jobs	# Change	% Change
Production	14,187	14,251	64	<1%
Distribution	8,402	9,329	927	11%
Processing	6,407	5,902	-504	-8%
Support	2,222	2,425	203	9%
<b>Total Cluster Jobs</b>	<b>31,217</b>	<b>31,907</b>	<b>690</b>	<b>2%</b>

<sup>18</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2015.2

# ALTERNATIVE CLUSTER TRAJECTORIES: RUCS CASE STUDY



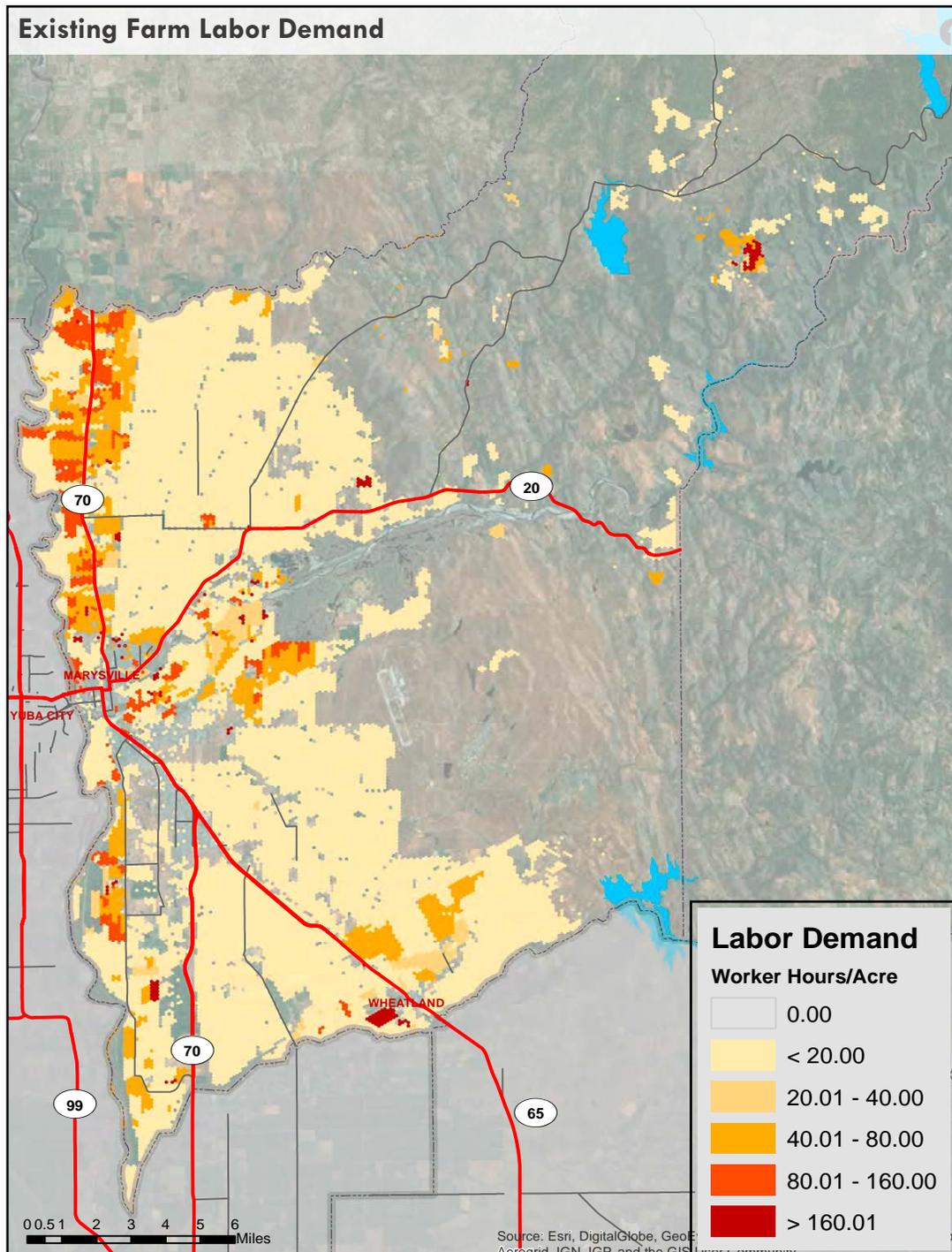
Emerging market opportunities coupled with the convening, priority setting, and strategy development that will result in the Food and Agriculture cluster workforce action plan for the Sacramento Capital region (among other efforts) have the potential to dramatically change the trajectory of this vital cluster into the future. Through its scenario planning efforts, RUCS has developed a suite of tools and models to test a range of changes in market demand and cost of production, illustrating alternative possible futures in the cluster that respond differently to market changes and supportive strategies. These scenarios model an increase in crop and value-adding activities that meet the rapidly increasing demand for locally grown food (including that at regional institutions such as schools, hospitals, or even the Sacramento Kings arena) to show how emerging market opportunities will result in employment, not only in the production component of the cluster, but across the entire supply chain. The Farm-to-Fork movement is also increasing demand.

One area of focus for RUCS has been on ways to internalize more of our food system, in turn reducing economic leakage out of the region. In particular, these scenarios test burgeoning local market opportunities that respond to consumer demand while offering growers a means to diversify. For example, one scenario conducted in a case study for Yuba County analyzed the effects of a major cropping pattern shift to specialty crops geared to local consumption. While the scenario represents an extreme boundary-setting example of possible future change, the subsequent mapping of its results show the potential for sustained economic return and food cluster employment opportunities as smaller shifts occur in the food system. Notably, the modeled scenario quadrupled overall production value in the study area, along with an increase in labor demand (and thus job opportunities). Other scenarios—such as those conducted in RUCS’ Sacramento Regional Agricultural Infrastructure Project—exhibit the potential to reverse the downward employment trend in regional processing through investments in mid-scale facilities, such as food hubs.

While the RUCS scenarios help demonstrate opportunities for agricultural-based economic development, they also showcase the need for the region to respond to key challenges that, if unaddressed, would inhibit future growth potential. Notably, to activate any of the economic opportunities illustrated through scenario planning requires—among other efforts—a sufficiently aligned workforce. This challenge is particularly relevant for a regional production sector that faces a constrained labor supply.

# ALTERNATIVE CLUSTER TRAJECTORIES: RUCS CASE STUDY

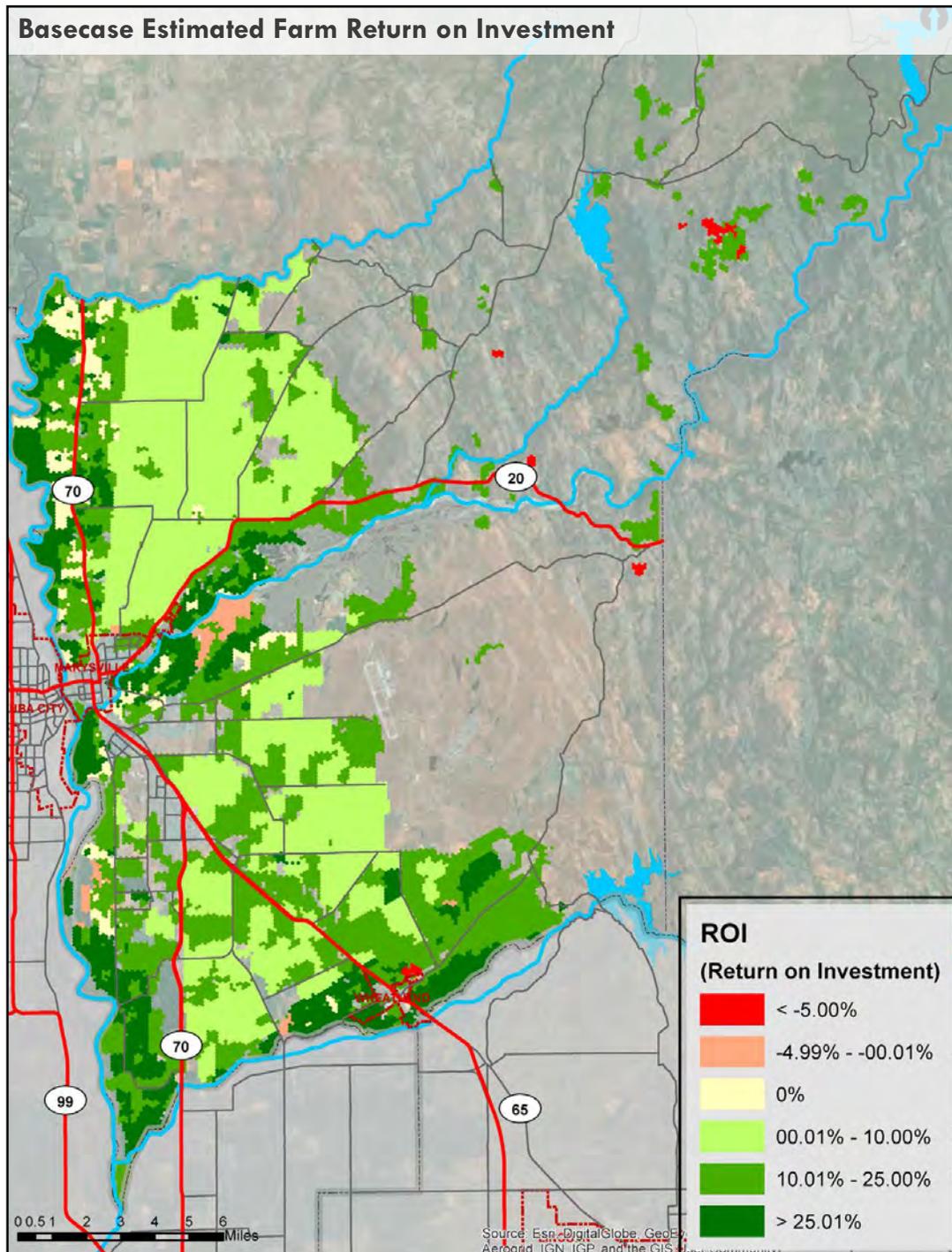
**Figure 13a: Yuba County Case Study Scenarios**





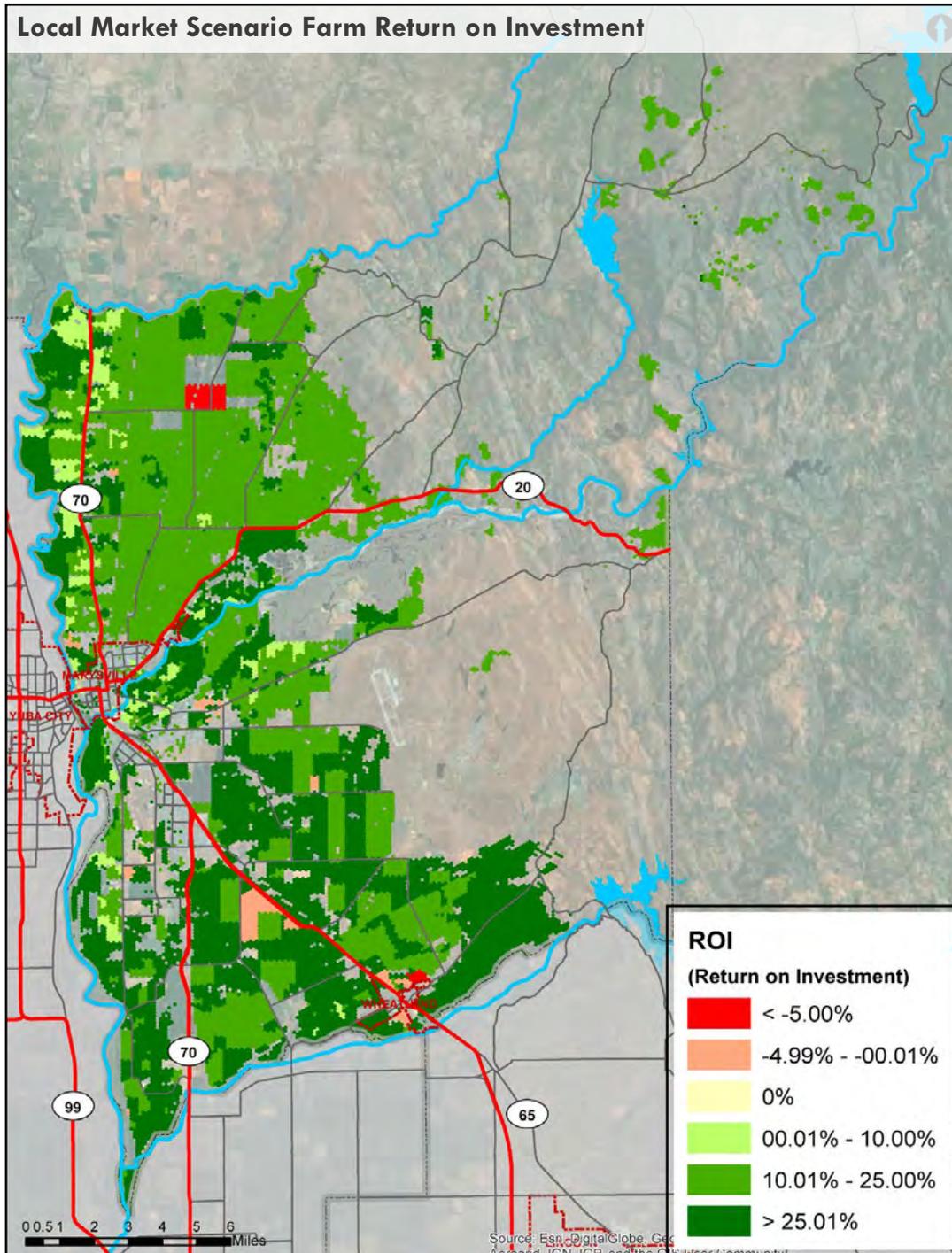
# ALTERNATIVE CLUSTER TRAJECTORIES: RUCS CASE STUDY

**Figure 13c: Yuba County Case Study Scenarios**



# ALTERNATIVE CLUSTER TRAJECTORIES: RUCS CASE STUDY

**Figure 13d: Yuba County Case Study Scenarios**



# PART 4. WORKFORCE & TRAINING

## OCCUPATION DEMAND

Ten occupations were selected for inclusion in the study based on the following criteria:

- Annual job openings were significant.
- The minimum education requirement is a high school diploma plus on-the-job training, postsecondary award, associate degree, or bachelor's degree.

Table 2 displays the employment demand for the Agriculture and Food cluster occupations selected for inclusion in this study. Five of these occupations are employed primarily by the cluster, while the other five are employed throughout the economy. Over the next five years (2015–2020), these occupations are projected to grow by 8%, adding nearly 2,400 new jobs and 3,000 replacement jobs for total openings of almost 5,400 jobs. Heavy and tractor-trailer truck drivers is the largest occupation with the most annual openings, followed by maintenance and repair workers. For the occupations specific to the cluster, soil and plant scientists is largest with the most annual openings, followed by farmers and ranchers.

**Table 2: Occupational Employment Outlook, Agriculture and Food Cluster, Sacramento Capital Region<sup>19</sup>**

Description	2015 Jobs	2020 Jobs	2015–2020 Change	2015–2020 % Change	Total Replacements	Total Openings	Annual Openings
Heavy and Tractor-Trailer Truck Drivers	10,694	11,934	1,240	12%	924	2,164	433
Maintenance and Repair Workers, General	7,694	8,159	465	6%	806	1,271	254
Market Research Analysts and Marketing Specialists	2,798	3,245	447	16%	212	659	132
Sales Managers	3,130	3,244	114	4%	345	459	92
Industrial Machinery Mechanics	1,176	1,286	110	9%	183	293	59
Soil and Plant Scientists	593	629	36	6%	102	138	28
Farmers, Ranchers, and Other Agricultural Managers	1,446	1,376	(70)	(5%)	192	122	24
Agricultural and Food Science Technicians	530	543	13	2%	99	112	22
Farm Equipment Mechanics and Service Technicians	320	326	6	2%	58	64	13
Food Scientists and Technologists	265	280	15	6%	47	62	12
<b>Total</b>	<b>28,647</b>	<b>31,022</b>	<b>2,376</b>	<b>8%</b>	<b>2,967</b>	<b>5,343</b>	<b>1,069</b>

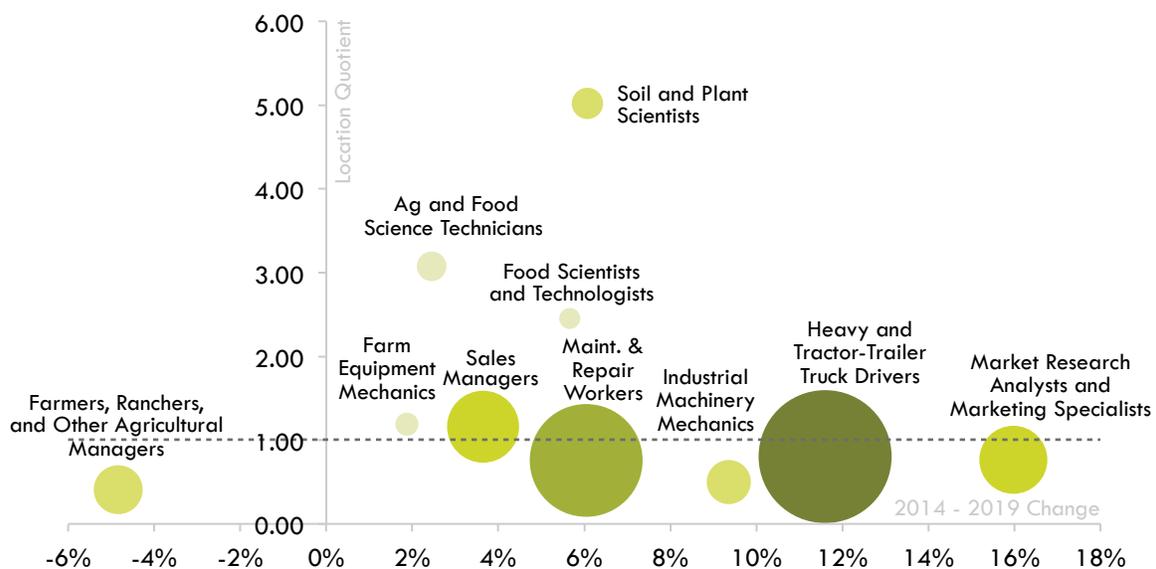
<sup>19</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2016.1



In addition to industry analysis, location quotients also can be applied to occupations. In this case, the location quotient compares an occupation’s total employment in the region relative to the state’s total employment for that occupation. A location quotient of less than 1 indicates a lower concentration of employment for that occupation in the region than in the state overall. A location quotient of more than 1 indicates a higher concentration of employment for the occupation than in the state overall.

The bubble chart below (Figure 14) compares the concentration of occupation employment to the projected five-year growth rate in the region, where the size of the bubble indicates the total number of jobs for each occupation. As shown below, three of the 10 occupations—soil/plant scientists, food science techs, and food scientists—have a high concentration of employment, but few jobs and moderate projected growth. The largest occupation—heavy and tractor-trailer truck drivers—has an average concentration of employment in the region, but strong projected growth.

**Figure 14: Growth Rate vs. Occupational Concentration, Food and Agriculture Cluster, Sacramento Capital Region<sup>20</sup>**

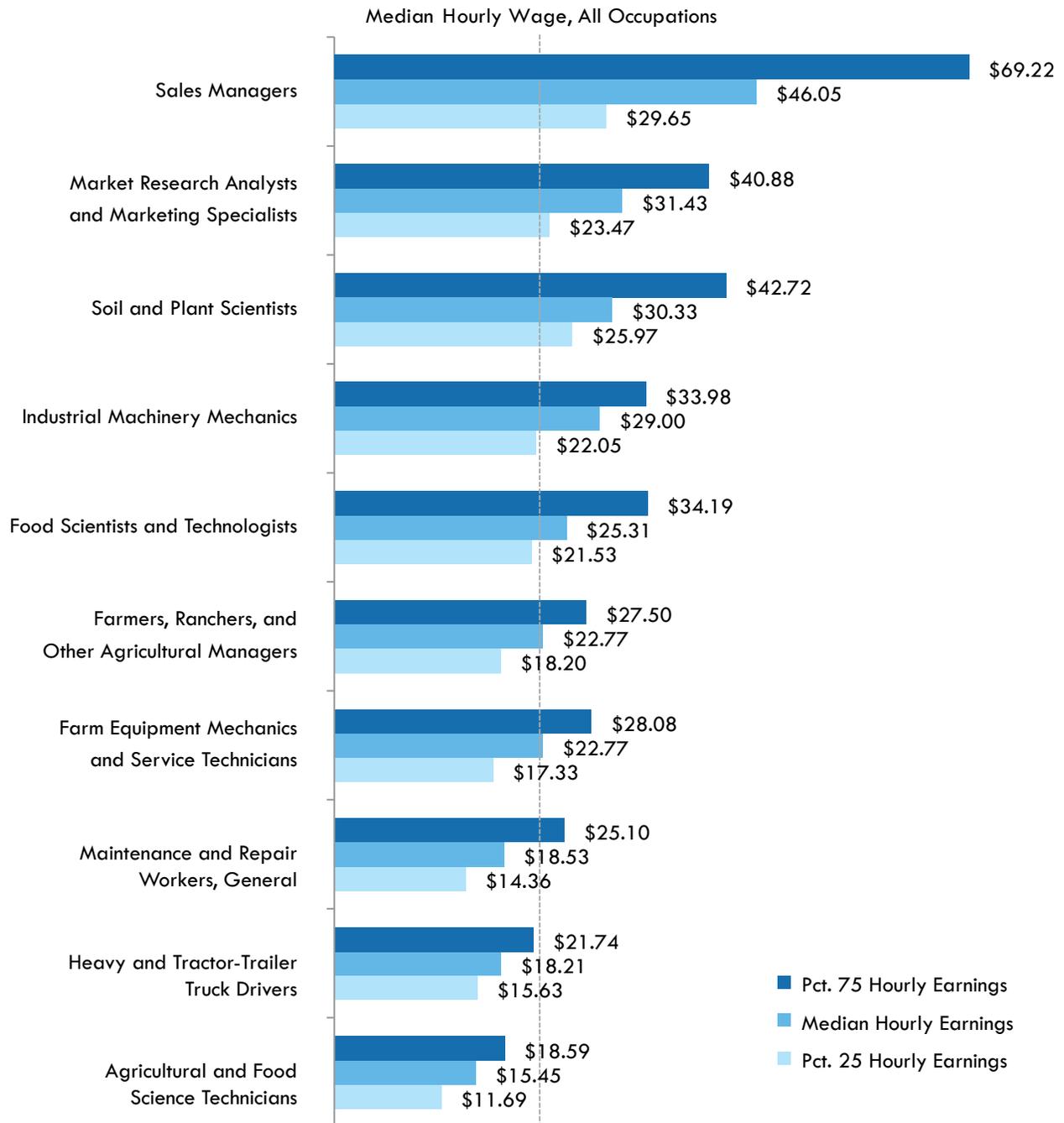


<sup>20</sup> EMSI: QCEW Employees, Non-QCEW Employees, and Self-Employed, 2016.1

# OCCUPATION WAGES

The majority of occupations in the Food and Agriculture cluster earn wages that are close to or above the regional median wage. Sales managers is the highest paid occupation, followed by marketing specialists and soil/plant scientists. The lowest paid occupations in the group include truck drivers and food science technicians. However, with the appropriate education and training, food science technicians may advance to food scientist positions and earn wages above the regional average. The median hourly wage across all occupations in the Sacramento Capital region is \$22.69 per hour.

**Figure 15: Hourly Wages, Food and Agriculture Occupations, Sacramento Capital Region**



# EDUCATION ASSESSMENT

This section provides a review of the training and education supply programs supporting the Food and Agriculture cluster for the occupations selected for inclusion in this study. Minimum education requirements are assigned to three categories:

- **Entry-level occupations** require a high school degree plus long-term on-the-job training. In this category, employers may prefer applicants if they have a formal education, such as a certificate or degree.
- **Mid-level occupations** require postsecondary training, certificate, or associate degree.
- **Advanced-level occupations** require a bachelor's degree. Some of these positions require related work experience in order to qualify for an open position.

## Exhibit 16: Minimum Education Requirements

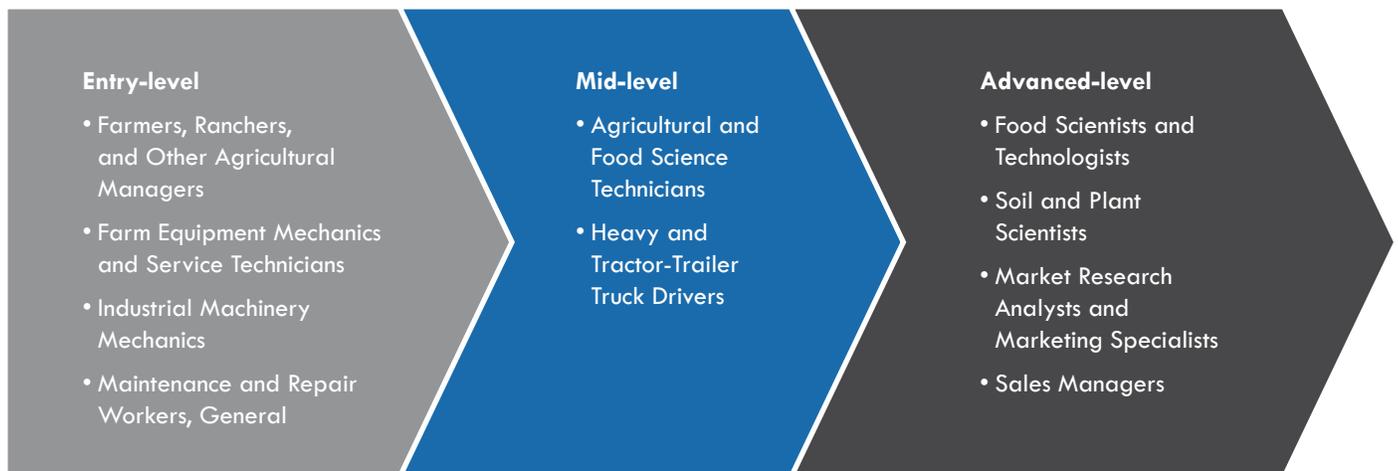


Table 3 displays the number of degrees conferred by educational program in the Sacramento Capital region. As shown, there are several programs providing a pipeline of skilled and qualified applicants for nearly all of the occupations selected for inclusion in this study. Based on an assessment between the supply (average number of degrees conferred annually) and the projected demand (number of job openings), the region is likely to experience the following:

- Significant shortage of industrial machinery mechanics since the demand is significantly outpacing average number of degrees conferred.
- Moderate shortage of farm equipment mechanics and service technicians. Because the demand is too small to justify investing resources in a new training program, local employers should consider partnering and recruiting graduates from the agriculture power equipment technology programs located at Butte College and Modesto Junior College.
- Competition for food technician/scientist graduates, since there is a statewide shortage for qualified graduates entering the field.

The data also suggests an oversupply of graduates for open farming and soil/plant science positions. More information is needed to assess if there is an oversupply, such as employer education preferences, graduate goals, migration trends, worker preparedness, and completion duplication. Many of the agriculture related degrees are conferred by UC Davis, and as students are drawn from outside the region, the perceived oversupply may be overstated.

# EDUCATION ASSESSMENT



**Table 3: Educational Programs & Awards, Food and Agriculture Occupations, Sacramento Capital Region<sup>21&22</sup>**

Educational Program	3-Year Average Certificate /Degrees Conferred	Number of Training Programs
Animal Science	1	1
Horticulture	21	4
Agriculture Business, Sales & Services	3	2
Nursery Technology	12	2
Agriculture Technology and Sciences	16	4
Equine Science	58	2
Agriculture, Agriculture Operations & Related Sciences	448	2
Agriculture Business & Management, General	2	1
Food Science	74	1
Plant and Soil Science	68	1
Mechatronics Technology	13	1
Truck and Bus Driver/Commercial Vehicle Operator	Not Available	Not Available
Marketing and Distribution	27	6
Business Administration, Marketing Concentration	Not Available	1
<b>Total</b>	<b>743</b>	<b>28</b>

<sup>21</sup> California Community College Chancellor's Office Data Mart. National Center for Education Statistics (NCES). Higher education institutions are required to report completion data to NCES if they participate in any federal financial assistance program authorized by Title IV of the Higher Education Act. Completion data not reported to the NCES or CCCCO Data Mart were not included in the estimate.

<sup>22</sup> The 3-year average is based on academic years 2011–12, 2012–13, and 2013–14 for private education institutions and public four-year universities and 2012–13, 2013–14, and 2014–15 for community colleges.

# SKILLS ASSESSMENT

Table 4 displays the top skills and professional credentials for occupations in the Food and Agriculture cluster. The data is based on analysis of job posting data, aggregated by Burning Glass. This online tool uses intelligent “spidering” to search the Internet for job listings, removes duplication, and aggregates the data into a search database. As shown, most of the skills/knowledge areas are specialized and require specific training and certifications.

**Table 4: Skill and Professional Credential Preferences, Food and Agriculture Occupations<sup>23</sup>**

Occupation	Top Skill/Knowledge Areas	Top Certifications/ Professional Credentials
Agricultural and Food Science Technicians	Food safety, food science, and inspection	Hazard Analysis and Critical Control Point (HACCP)
Farm Equipment Mechanics and Service Technicians	Equipment repair, schematic diagrams, welding, inspection and forklift operation	None listed
Farmers, Ranchers, and Other Agricultural Managers	Irrigation, biology, repair, scheduling, spreadsheets, farm management, data collection, budgeting, and supervisory skills.	None listed
Food Scientists and Technologists	Food science, product development, food safety, chemistry, experiments, biology, microbiology, labeling and packaging.	Certified Professional Food Safety
Heavy and Tractor-Trailer Truck Drivers	Inspection, commercial driving, HAZMAT, forklift operation, pre- and post-trip inspections, customer service, and repair	Commercial Driver's License
Industrial Machinery Mechanics	Repair, welding, machinery, inspection, schematic diagrams, programmable logic controller programming, and forklift operations	None listed
Maintenance and Repair Workers, General	Repair, plumbing, inspection, HVAC, painting, cleaning, carpentry, customer service, scheduling, and machinery	Environmental Protection Agency Certification
Market Research Analysts and Marketing Specialists	Marketing, social media, project management, budgeting, digital marketing, Adobe Photoshop, market research, building relationships, Facebook, customer service, marketing strategy, and email marketing	None listed
Sales Managers	Sales management, sales, building relationships, business development, budgeting, sales goals, customer service, business planning, prospecting, project management, and supervisory skills	None listed
Soil and Plant Scientists	Botany, agronomy	Non listed



<sup>23</sup> Burning Glass, 2016.

# CONCLUSION



The Food and Agriculture cluster has deep roots in the region's history and will be an essential component of the region's future. California is the fourth largest agricultural economy in the world, and the Sacramento Capital region is a vital part of that economy, with some of the most productive farmland on earth. In addition to productive farmland, the Sacramento Capital region boasts an unrivaled array of food system assets, including multi-generational farming and ranching knowhow, world-renowned agricultural institutions such as UC Davis, food entrepreneurs, favorable climate and water supply, and engaged policymakers, to name a few.

This cluster analysis in turn illustrates how these elements fit within the overall regional economy: the measured components of the cluster account for more than 30,000 jobs spread throughout the region and over \$7.5 billion in direct value. While production is the largest subsector in the cluster, there is also significant "off farm" employment (55 percent) in distribution, processing, and support. Recent employment and output trends suggest strong regional competitive advantages in the cluster. Indeed, the cluster has outpaced the overall regional economy in its recovery from the recession. The Food and Agriculture cluster analysis provides the following insight into opportunities for the regional economy:

- The region contains a significantly greater proportion of support employment compared to the state as a whole. Of all components of the cluster, the support subsector experienced the most job growth (as a percentage) between 2008 and 2014.
- The distribution subsector has a higher concentration of employment compared to the state as a whole and is projected to add the greatest number and proportion of jobs by 2019.

# CONCLUSION

Specialty crops have driven the region's agricultural production sector to record levels of economic output. Indeed, the value of the food and fiber produced by the region's farms and ranches grew by over a third in inflation-adjusted dollars since 2008 to reach an all-time high in 2014. In addition to highlighting regional strengths, the Food and Agriculture cluster analysis provides further insight into where challenges exist for the regional economy:

- The processing subsector has a lower concentration of employment compared to the state and actually experienced job loss from 2008 to 2014. The sector is projected to experience additional job loss by 2019, continuing a trend that predates the recession.
- The production sector has a lower concentration of employment relative to the state average, though California is the nation's leading agricultural state.
- The region faces a constrained labor supply for farm laborers, which can inhibit future growth. In addition, there is a projected training shortage for industrial machinery mechanics and farm equipment mechanics/service technicians.

The study's base modeling projects employment in the cluster to increase a modest 2 percent by 2019. However, when looking at new and replacement jobs, there are more than 5,000 total job openings over the next five years. The development of cluster action plans and other regional initiatives speak to the Sacramento Capital region's potential to proactively change this trajectory and capitalize on promising market developments, supporting further regional jobs and economic activity.

In short, this report demonstrates the direct contribution of Food and Agriculture industries to the regional economy and begins to illustrate how agricultural cultivation of food and fiber creates jobs and generates income, both on and off the farm. The full economic impact of an industry cluster extends throughout its entire value chain. Due to data limitations however, this cluster analysis does not include related food system elements such as retail and consumption establishments or other activity in R&D, environmental services, or agritourism. As such, the data and analysis contained in the report constitute an important initial—though still incomplete—examination of the cluster and its role in the Sacramento Capital region's economy. Future work will build upon this analysis, including SACOG's Food System Multiplier project that delves into the Food and Agriculture cluster's full ripple effect, modeling how the direct economic output of food and agriculture industries circulates throughout and contributes to the larger regional economy.





# APPENDIX A: FOOD AND AGRICULTURE CLUSTER DEFINITION

424940 Tobacco and Tobacco Product Merchant Wholesalers  
 493120 Refrigerated Warehousing and Storage  
 493130 Farm Product Warehousing and Storage  
 722310 Food Service Contractors

## Support

115210 Support Activities for Animal Production  
 325311 Nitrogenous Fertilizer Manufacturing  
 325312 Phosphatic Fertilizer Manufacturing  
 325314 Fertilizer (Mixing Only) Manufacturing  
 325320 Pesticide and Other Agricultural Chemical Manufacturing  
 333111 Farm Machinery and Equipment Manufacturing  
 333241 Food Product Machinery Manufacturing  
 423820 Farm and Garden Machinery and Equipment Merchant Wholesalers  
 424910 Farm Supplies Merchant Wholesalers  
 424930 Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers

## Production

111110 Soybean Farming  
 111120 Oilseed (except Soybean) Farming  
 111130 Dry Pea and Bean Farming  
 111140 Wheat Farming  
 111150 Corn Farming  
 111160 Rice Farming  
 111191 Oilseed and Grain Combination Farming  
 111199 All Other Grain Farming  
 111211 Potato Farming  
 111219 Other Vegetable (except Potato) and Melon Farming  
 111310 Orange Groves  
 111320 Citrus (except Orange) Groves  
 111331 Apple Orchards  
 111332 Grape Vineyards  
 111333 Strawberry Farming  
 111334 Berry (except Strawberry) Farming  
 111335 Tree Nut Farming

111336 Fruit and Tree Nut Combination Farming  
 111339 Other Non-Citrus Fruit Farming  
 111411 Mushroom Production  
 111419 Other Food Crops Grown Under Cover  
 111421 Nursery and Tree Production  
 111422 Floriculture Production  
 111910 Tobacco farming, Field and Seed Production  
 111920 Cotton Farming  
 111930 Sugarcane Farming  
 111940 Hay Farming  
 111991 Sugar Beet Farming  
 111992 Peanut Farming  
 111998 All Other Miscellaneous Crop Farming  
 112111 Beef Cattle Ranching and Farming  
 112112 Cattle Feedlots  
 112120 Dairy Cattle and Milk Production  
 112130 Dual-Purpose Cattle Ranching and Farming  
 112210 Hog and Pig Farming  
 112310 Chicken Egg Production  
 112320 Broilers and Other Meat Type Chicken Production  
 112330 Turkey Production  
 112340 Poultry Hatcheries  
 112390 Other Poultry Production  
 112410 Sheep Farming  
 112420 Goat Farming  
 112511 Finfish Farming and Fish Hatcheries  
 112512 Shellfish Farming  
 112519 Other Aquaculture  
 112910 Apiculture  
 112920 Horses and Other Equine Production  
 112930 Fur-Bearing Animal and Rabbit Production  
 112990 All Other Animal Production  
 115111 Cotton Ginning  
 115112 Soil Preparation, Planting, and Cultivating  
 115113 Crop Harvesting, Primarily by Machine  
 115114 Postharvest Crop Activities (except Cotton Ginning)  
 115115 Farm Labor Contractors and Crew Leaders  
 115116 Farm Management Services

# MORE ABOUT...

## More About The Centers of Excellence

The Centers of Excellence (COE) for Labor Market Research deliver regional workforce research and technical expertise to California 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.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the leading source of regional workforce information and insight for California community colleges. More information about the Centers of Excellence is available at [www.coecc.net](http://www.coecc.net).

For more information on this study, contact:

Theresa Milan, COE Director  
Northern California Region  
(916) 563-3221  
[milant@losrios.edu](mailto:milant@losrios.edu)

This study was conducted with the support of JPMorgan Chase & Co. In addition, this study was supported by Economic and Workforce Development funds awarded by the Chancellor's Office, California Community Colleges. It was produced pursuant to grant agreement number 15-305-001.

## More About Valley Vision

Since 1994, Valley Vision's work has driven transformative change and improved lives across Northern California. An independent social impact and civic leadership organization headquartered in Sacramento, Valley Vision strengthens our communities through unbiased research, boundary-crossing collaboration and change leadership. Our work improves overall quality of life and creates the conditions for economic prosperity and community health and vitality.

## More About Sacramento Area Council of Governments (SACOG)

The Sacramento Area Council of Governments (SACOG) is an association of local governments in the six-county Sacramento Region. Its members include the counties of El Dorado, Placer, Sacramento, Sutter, Yolo, Yuba and the 22 cities within. SACOG provides transportation planning and funding for the region, and serves as a forum for the study and resolution of regional issues. SACOG is the principal researcher for this report.



[www.coecc.net](http://www.coecc.net)

FIND US ON LINKEDIN GROUPS:



JPMORGAN CHASE & CO.

CENTERS OF EXCELLENCE  
Inform Connect Advance



<http://linkd.in/1EUU9wM>



C·O·E

CENTERS OF EXCELLENCE  
Inform Connect Advance

SERIES: 6 OF 6

# CLEAN ECONOMY CLUSTER: WORKFORCE NEEDS ASSESSMENT SACRAMENTO CAPITAL REGION



**May 2016**

Prepared by: Centers of Excellence,  
Los Rios Community College District

Valley Vision

Burris Service Group

This research was conducted with the generous  
support of JPMorgan Chase & Co.

JPMORGAN CHASE & CO.

**Burris Service Group**

VALLEY VISION  
  
Connect. Partner. Impact.

# TABLE OF CONTENTS

<b>Introduction.....</b>	<b>3</b>
<b>Cluster Definition .....</b>	<b>4</b>
<b>Analyzing the Clean Economy Cluster .....</b>	<b>5</b>
<b>Energy and Resource Efficiency .....</b>	<b>5–8</b>
<b>Renewable Energy.....</b>	<b>9–12</b>
<b>Sustainable Agriculture .....</b>	<b>13–14</b>
<b>Advanced Transportation .....</b>	<b>15–17</b>
<b>Environmental Compliance .....</b>	<b>18–21</b>
<b>Recycling and Waste Reduction .....</b>	<b>22–24</b>
<b>Summary .....</b>	<b>25</b>

---

## ***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.

© 2016 Chancellor’s Office California Community Colleges  
Economic and Workforce Development Program

*Please consider the environment before printing. This document is designed for double-sided printing.*

# INTRODUCTION



Starting in 2008, the six-county Sacramento Capital region (El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba counties) was rocked by the global recession, losing 10 percent of the region's jobs. In response, regional leaders initiated Next Economy, an action plan to accelerate job creation and new investment in six high-growth business (industry) clusters. Valley Vision, a regional civic leadership organization, managed the three-year Next Economy design, research, and implementation process on behalf of a wide range of private and public sector partners.

By the end of 2015, after a lagging recovery, the region's economy finally reached pre-recession job counts, with the unemployment rate decreasing while job growth is accelerating. Valley Vision received funding from the JPMorgan Chase Foundation to better understand how the region's key high growth industry clusters have changed since the original Next Economy research was conducted in 2012, and what new opportunities are emerging. Valley Vision is partnering with the Los Rios Center of Excellence and the Burris Service Group on this effort.

Cluster research is a widely accepted standard of practice for developing regional prosperity strategies to address multiple facets of a region's complex economy. Industry clusters reduce operating costs by shortening supply chains; increasing the flow of information regarding new business opportunities; concentrating workforce training needs in select occupations; and speeding up the identification of gaps in products or services.<sup>1</sup> Firms in identified clusters may also have a reduced risk of failure, as these firms are better supported by the supply chain and can respond more rapidly to shifts in the marketplace.

This report presents findings on the analysis of the Clean Economy cluster. It is one in a series of six reports covering Next Economy-identified clusters. The five other reports include Advanced Manufacturing, Education and Knowledge Creation, Food and Agriculture, Information and Communications Technologies, and Life Sciences and Health Services.<sup>2</sup> Each report, except the Clean Economy study, provides an overview of the cluster; industry trends and economic impact; overview of the top demand occupations in the cluster requiring postsecondary education or training; projected occupational demand; institutions providing related education and training; and possible workforce gaps. Due to data limitations, the Clean Economy does not include economic impact analysis or employment data for occupations that require postsecondary education. The report does include profiles of employers that represent the range of businesses in this evolving cluster. Visit [valleyvision.org](http://valleyvision.org) or [coecc.net](http://coecc.net) to access all of the Next Economy reports.

This research will be used to develop cluster-based workforce action plans. Valley Vision worked alongside regional education, workforce, and economic development partners to convene six cluster-based employer forums, setting priorities and developing strategies to address critical workforce gaps, better align education and workforce development resources to meet employer and workforce needs, and strengthen the regional economy overall.

<sup>1</sup> Cluster Manufacturing: A Supply Chain Perspective.

<sup>2</sup> Sacramento Area Council of Governments (SACOG) is the principal research for the Food and Agriculture Cluster study, which focuses primarily on industry trends.

# CLUSTER DEFINITION



According to the Brookings Institute, “The Clean Economy is economic activity—measured in terms of establishments and the jobs associated with them—that produces goods and services with an environmental benefit or adds value to such products using skills or technologies that are uniquely applied to those products.” For purposes of this study:

A **Clean Establishment** is an organization that provides products and/or services that are aimed at utilizing resources more efficiently, providing renewable sources of energy, lowering greenhouse gas emissions, or otherwise minimizing environmental impact.

A **Clean Job** is an occupation that 1) directly works with policies, information, materials, and/or technologies that contribute to minimizing environmental impact, and 2) requires specialized knowledge, skills, training, or experience in these areas.

The Clean Economy cluster comprises the following six subsectors:

**Energy and Resource Efficiency** includes establishments that focus on making new and existing buildings resource efficient and friendly to the environment. Establishments within this subsector range from the manufacturing of more efficient products and systems, construction of new “greener” buildings and retrofitting of existing ones, as well as installation and repair of energy- and resource-efficient equipment.

**Renewable Energy** includes establishments that focus on producing, distributing, and installing technologies, which harness, generate, store, and distribute renewable sources of energy. Industries in this subsector include solar, wind, waste-to-energy, biofuels/biomass, hydropower, and geothermal.

**Sustainable Agriculture** includes establishments that utilize agriculture practices that reduce negative impacts on the environment as well as conserve resources for future generations. Establishments within this subsector include organic farming, natural pesticides, and water conservation consultation.

**Advanced Transportation** includes establishments that focus on the technology, manufacturing, and servicing of vehicles that run on alternative fuels, as well as the “greening” of transportation infrastructure and logistics processes.

**Environmental Compliance** includes organizations and governmental agencies that plan, establish, execute, and control environmental quality standards, usually in regards to air, water, land, and other environmental resources. In addition this subsector includes private establishments that provide products or services that support compliance with environmental regulations and mandates.

**Recycling and Waste Reduction** includes organizations that collect and sort recycled materials, reuse or remanufacture recycled materials, and/or manufacture new products with recycled materials. In addition, the subsector includes establishments that reduce and divert food waste and bio-waste from landfills.

# ANALYZING THE CLEAN ECONOMY CLUSTER

The Clean Economy cluster encompasses businesses in six subsectors: Energy and Resource Efficiency, Renewable Energy, Sustainable Agriculture, Advanced Transportation, Environmental Compliance, and Recycling/Waste Reduction. Unfortunately, the North American Industry Classification System (NAICS), commonly used to define cluster activity, does not provide sufficient detail to analyze industry and employment trends in these subsectors. As a result, an adapted version of the Standard Industrial Classification (SIC) system, predecessor of the NAICS system, was used to identify industries within the Clean Economy cluster.

InfoUSA, a private business that maintains business and consumer data for research and marketing purposes, created an expanded SIC code system that can be applied to the classification of emerging industries. Using this expanded SIC code system, industries were selected for inclusion if they can be considered fully part of each subsector. **As such, this data does not represent a complete picture of the Clean Economy cluster, but rather only a small percentage of the total.** This report also relies on secondary research to evaluate the evolving nature of the Clean Economy cluster by assessing changes in the economy, emerging new technologies, environmental concerns, and policy drivers. In addition, this study highlights one organization from each subsector that is making a significant contribution to the region's economy to illustrate facets of this emerging and growing cluster.

## ENERGY AND RESOURCE EFFICIENCY

Energy and Resource Efficiency represents one of the greatest total employment opportunities for the Sacramento Capital region. This subsector consists of establishments that make new and existing buildings more resource efficient and friendly to the environment. Because buildings are such a significant consumer of energy and contributor to greenhouse gas emissions, they have become a focal point for potential solutions. In 2008 and 2013, California released building efficiency standards to require buildings to be built more efficiently.

In addition to state mandates, some local home owners have taken steps to lower energy usage by taking part in incentives offered by local utility companies, such as free to low-cost energy audits and rebates for energy-efficient appliances and systems. Energy audits, like the Home Energy Rating System (HERS), are used to identify costly inefficient HVAC systems, ducts/vents, and insulation. In some cases, the cost of fixing energy-inefficient defects is minimal compared to the potential cost savings.

Local businesses have also made substantial investments in retrofitting and building structures that meet stringent energy efficiency standards established by the U.S. Green Building Council. In the Sacramento Capital region, there are more than 560 Leadership in Energy and Environmental Design (LEED) certified buildings.<sup>3</sup> LEED certification recognizes new and existing buildings that meet rigorous energy efficiency, resource efficiency, and recycling standards. As a third-party nationally recognized organization, LEED is one of the most accepted certifying agencies of high performance, green buildings.<sup>4</sup>

Information and Communication Technologies (ICT) is expected to have a significant impact on the Energy and Resource Efficiency subsector. Many businesses and homes in the Sacramento Capital region have smart meters that are communicating energy data and performance information to utility companies. The next evolution is a mass adoption of smart buildings with communicating devices linked to lighting, chillers, fans, pumps, appliances, HVAC systems and other equipment. Cloud computing capabilities will further enhance remotely obtaining field data and enabling management and analysis of building systems to reduce overall energy usage and costs.<sup>5</sup>

<sup>3</sup> U.S. Green Building Council, [usgbc.org/projects](http://usgbc.org/projects). Accessed March 3, 2016.

<sup>4</sup> <http://www.usgbc.org/leed>. Accessed April 8, 2016.

<sup>5</sup> *How Information and Communications Technologies Will Change the Evaluation, Measurement, and Verification of Energy Efficiency Programs*. December 2015. American Council for an Energy-Efficient Economy (ACEEE).

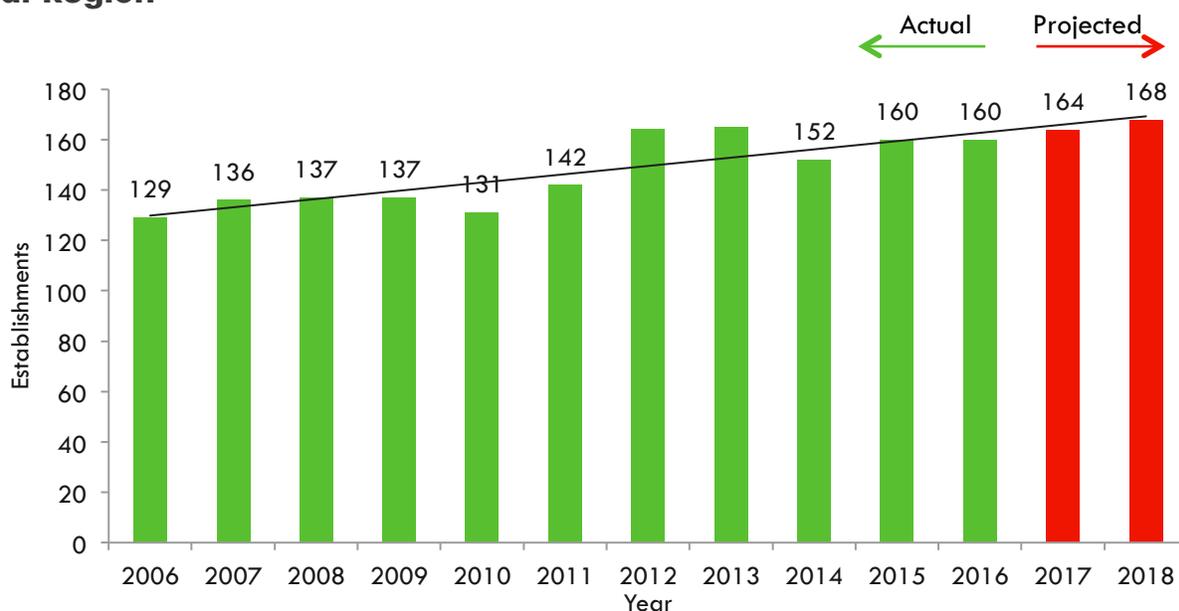
# ENERGY AND RESOURCE EFFICIENCY

Exhibit 1 displays establishment and employment data for the Energy and Resource Efficiency industries as classified by the expanded SIC code system developed by InfoUSA. Over the last five years, the region has added 19 new establishments and more than 1,000 new jobs. Most of this projected growth shown in Exhibit 2 may be attributed to the energy management systems and products industry, which is composed of building contractors that specialize in retrofitting or building energy- and resource-efficient structures.

## Exhibit 1: Energy and Resource Efficiency, Employment and Establishments, Sacramento Capital Region<sup>6</sup>

	2011 Jobs	2016 Jobs	2011–2016 Job Change	Percent Change	2016 Establishments
Energy Management Systems and Products	207	1,015	808	390%	63
Insulation Contractors-Cold & Heat	376	386	10	3%	27
Controls Control Systems/Regulators (Wholesale)	125	321	196	157%	11
Energy Conservation & Management Consultants	235	171	-64	-27%	34
Energy Conservation Products, Services, & Systems	147	150	3	2%	12
Water Conservation Products & Services	35	125	90	257%	5
Controls Control Systems/Regulators (Manufacturing)	61	43	-18	-30%	5
Energy Raters	2	4	2	100%	1
Leak Detecting Service	5	2	-3	-60%	2
<b>Total</b>	<b>1,193</b>	<b>2,217</b>	<b>1,024</b>	<b>86%</b>	<b>160</b>

## Exhibit 2: Energy and Resource Efficiency, Establishments, Sacramento Capital Region<sup>6</sup>



<sup>6</sup> ReferenceUSA: Business Database, 2016.

# ENERGY AND RESOURCE EFFICIENCY

There are a range of occupations that support the Energy and Resource Efficiency subsector. Classified by the Occupational Information Network (O\*NET), Exhibit 3 displays the occupations that conduct work activities that directly relate to the Energy and Resource Efficiency subsector. Significant research has been compiled about the tasks, skills, abilities, and knowledge requirements for these occupations. However, little data is available on employment estimates, replacement needs, and projections.

Occupations without O\*NET codes associated with Energy and Resource Efficiency businesses include: building performance/retrofitting specialists, Home Energy Rating System (HERS) raters, and acceptance test technicians. In addition, there are several occupations that work both within traditional and energy/resource efficiency establishments. These include: building operators, construction managers, electricians, plumbers, and other specialty trade contractors.

## Exhibit 3: Energy and Resource Efficiency Occupations<sup>7</sup>

ONET Code	Title	Description
13-1199.01	Energy Auditors	Conduct energy audits of buildings, building systems, or process systems. May also conduct investment grade audits of buildings or systems.
17-2199.03	Energy Engineers*	<b>Design, develop, or evaluate energy-related projects or programs to reduce energy costs or improve energy efficiency during the designing, building, or remodeling stages of construction. May specialize in electrical systems; heating, ventilation, and air-conditioning (HVAC) systems; green buildings; lighting; air quality; or energy procurement.</b>
49-9021.01	Heating and Air Conditioning Mechanics and Installers	Install, service, or repair heating and air conditioning systems in residences or commercial establishments.
47-4099.03	Weatherization Installers and Technicians	Perform a variety of activities to weatherize homes and make them more energy efficient. Duties include repairing windows, insulating ducts, and performing heating, ventilating, and air-conditioning (HVAC) work. May perform energy audits and advise clients on energy conservation measures.

\* Employers who participated in the Clean Economy forum indicated that they have experienced difficulty finding qualified applicants for this occupation.



<sup>7</sup> Occupation Information Network (O\*NET): [www.onetonline.org](http://www.onetonline.org). Accessed March 3, 2016.

# ENERGY AND RESOURCE EFFICIENCY

In the Sacramento Capital region, there are seven education institutions that offer training programs that support the Energy and Resource Efficiency subsector, as shown in Exhibit 4.

## Exhibit 4: Energy and Resource Efficiency Education Programs, Sacramento Capital Region

College/University/ Training Center	Name of Program	Award(s)
Center for Employment & Training (CET)	HVAC Technician & Green Technology	Certificate
Charles A. Jones Career and Education Center	HVAC&R Maintenance Technology/Technician	Certificate
Cosumnes River College	Construction, Building Performance and Energy Assessment	A.S. Degree, Certificate
Cosumnes River College	Green Buildings: Environmental Design, Energy Management and Performance Based Construction	Certificate
Sacramento City College	Commercial Building Energy Auditing and Commissioning Specialist	Certificate
Sacramento City College	HVAC Systems Design CADD	A.S. Degree, Certificate
Sacramento City College	Mechanical (HVAC/Plumbing Systems)	A.S. Degree, Certificate
San Joaquin Valley College	HVAC Technology	Associate Degree
Sierra College	Energy Technology	A.S. Degree
Sierra College	Energy Technology	Certificate
Twin Rivers Adult School	HVAC&R Maintenance Technology/Technician	Certificate
UC Davis Extension	Green Building and Sustainable Design	Professional Concentration
UC Davis Extension	Sustainability and the Built Environment	Certificate

### Business Spotlight: E3 CA, Inc.

E3 CA, Inc. provides all types of compliance inspections for LEED and other building code programs, as well as commissioning in the design and construction process for new buildings and diagnostic testing for commercial and multifamily/mixed-use buildings. The company has continued to grow since it was founded in 2007 from two to 14 employees today. In the past four years, E3 CA, Inc. has inspected nearly 1,000 buildings and 60,000 units.

According to the President/CEO of E3 CA, Inc., California building codes and standards are driving demand for their services. As California moves to net-zero energy requirements over the next 15 years, E3 CA, Inc. anticipates that there will be a shortage of energy auditors and building performance contractors. The company is eager to partner with the region's community colleges to develop a pipeline of qualified and trained applicants entering the field.<sup>8</sup>

<sup>8</sup> Interview with E3 CA, Inc., Tommy Young, President/CEO. [www.e3cainc.com](http://www.e3cainc.com). April 11, 2016.

# RENEWABLE ENERGY

Renewable Energy represents a substantial number of employment opportunities for the Sacramento Capital region. This subsector comprises establishments that are involved in renewable energy generation including solar, wind, geothermal, hydroelectric, and biomass. Solar is projected to have the largest number of jobs in the region with SolarCity, Sunrun and other solar-related businesses headquartered in the region.

The solar industry has expanded rapidly over the last few years due to the federal Investment Tax Credit (ITC) and improved quality of solar panels. The ITC has largely been responsible for the fast pace of solar installations in both residential and commercial projects. In December 2015, Congress extended the 30 percent ITC for project costs, with a multi-year phase down through 2023. The renewal of this policy is expected to continue to support revenue streams and job creation throughout California and the nation.<sup>9</sup>

New, improved technology for solar panels is producing greater efficiency gains. Many of today's solar panels have an aperture efficiency of 22 percent. In addition, there are prototype solar panels that have shown to be more than 40 percent efficient in a laboratory environment. As these new panels are introduced to the marketplace, the return on investment for commercial and residential consumers will be significantly improved.

Exhibit 5 displays establishment and employment data for Renewable Energy industries as classified by SIC codes at the eight-digit level. Unfortunately, this exhibit does not include data for biomass-related industries as there are not any SIC codes with biomass classification. Over the last five years, the region has added 31 new establishments and 290 new jobs. Most of this growth may be attributed to solar wholesale, solar heating contractors, and solar energy research and development (Exhibit 6).

In addition to a thriving solar industry, the region also has several bio-digesters. One of the largest economic drivers of waste diversion is AB 1826, the California Integrated Waste Management Act. A recent amendment to this bill requires business that generate a specified amount of organic waste per week to arrange for recycling services for that organic waste. This amendment will reduce food waste in landfills as well as create additional market opportunities for bio-digester establishments.

## Exhibit 5: Renewable Energy, Employment and Establishments, Sacramento Capital Region<sup>10</sup>

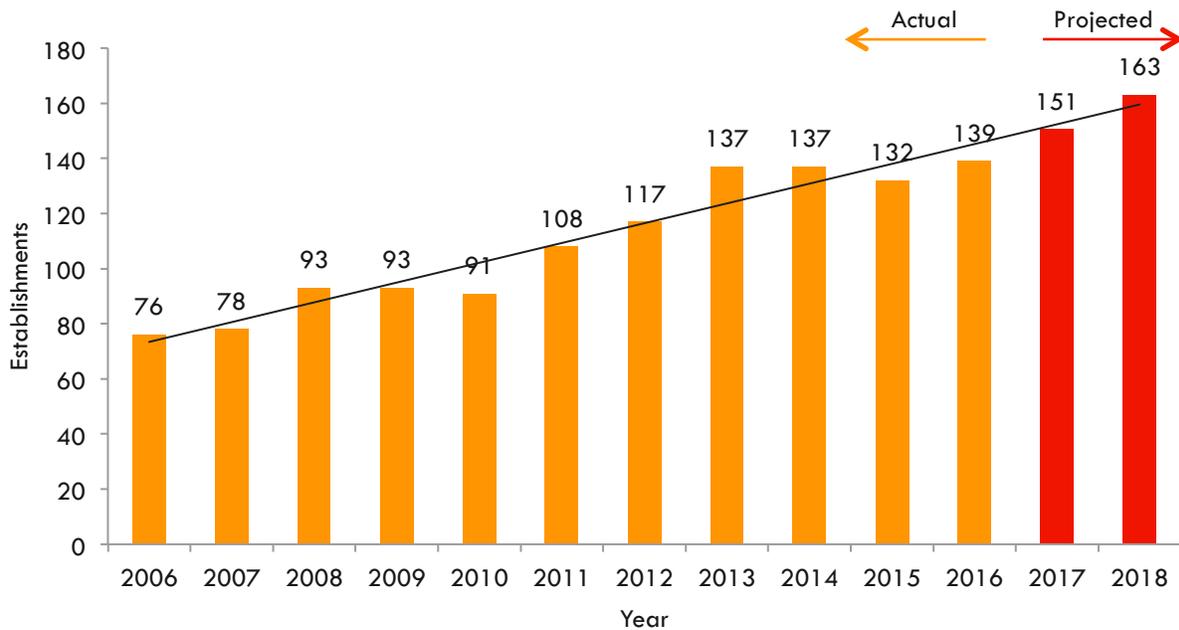
	2011 Jobs	2016 Jobs	2011–2016 Job Change	Percent Change	2016 Establishments
Solar Energy Equipment-Wholesale	246	403	157	64%	64
Energy Conservation & Mgmt Consultants	235	171	-64	-27%	34
Solar Heating Contractors	46	169	123	267%	19
Solar Energy Equipment-Manufacturers	109	102	-7	-6%	5
Solar Energy Research & Development	22	76	54	245%	9
Turbines-Manufacturers	0	27	27	n/a	2
Solar Heating Systems	3	8	5	167%	3
Solar Energy Equip & Systems-Svc & Rpr	0	5	5	n/a	2
Geothermal Htg/ Cooling Equip/Systs-Dlrs	5	1	-4	-80%	1
Wind Energy Systems (Whls)	4	0	-4	-100%	0
<b>Total</b>	<b>670</b>	<b>962</b>	<b>292</b>	<b>44%</b>	<b>139</b>

<sup>9</sup> California Solar Energy Industries Association, CalSEIA Annual Report 2015. [www.calseia.org](http://www.calseia.org).

<sup>10</sup> ReferenceUSA: Business Database, 2016.

# RENEWABLE ENERGY

**Exhibit 6: Renewable Energy, Establishments, Sacramento Capital Region<sup>11</sup>**



O\*NET has identified 19 renewable energy occupations (Exhibit 7, following page). Occupations that are most in-demand in the Sacramento Capital region include solar energy installation managers, solar photovoltaic installers, and solar sales representatives and assessors.



<sup>11</sup> ReferenceUSA: Business Database, 2016.

# RENEWABLE ENERGY

## Exhibit 7: Renewable Energy Occupations<sup>12</sup>

ONET Code	Title	Description
51-8099.01	Biofuels Processing Technicians	Calculate, measure, load, mix, and process refined feedstock with additives in fermentation or reaction process vessels and monitor production process. Perform, and keep records of, plant maintenance, repairs, and safety inspections.
11-3051.03	Biofuels Production Managers	Manage biofuels production and plant operations. Collect and process information on plant production and performance, diagnose problems, and design corrective procedures.
11-9041.01	Biofuels/Biodiesel Technology and Product Development Managers	Define, plan, or execute biofuels/biodiesel research programs that evaluate alternative feedstock and process technologies with near-term commercial potential.
51-8099.03	Biomass Plant Technicians	Control and monitor biomass plant activities and perform maintenance as needed.
11-3051.04	Biomass Power Plant Managers	Manage operations at biomass power generation facilities. Direct work activities at plant, including supervision of operations and maintenance staff.
17-2141.01	Fuel Cell Engineers	Design, evaluate, modify, or construct fuel cell components or systems for transportation, stationary, or portable applications.
17-3029.10	Fuel Cell Technicians	Install, operate, or maintain integrated fuel cell systems in transportation, stationary, or portable applications.
11-3051.02	Geothermal Production Managers	Manage operations at geothermal power generation facilities. Maintain and monitor geothermal plant equipment for efficient and safe plant operations.
51-8099.04	Hydroelectric Plant Technicians	Monitor and control activities associated with hydropower generation. Operate plant equipment, such as turbines, pumps, valves, gates, fans, electric control boards, and battery banks. Monitor equipment operation and performance and make necessary adjustments to ensure optimal performance. Perform equipment maintenance and repair as necessary.
11-3051.06	Hydroelectric Production Managers	Manage operations at hydroelectric power generation facilities. Maintain and monitor hydroelectric plant equipment for efficient and safe plant operations.
<b>47-1011.03</b>	<b>Solar Energy Installation Managers*</b>	<b>Direct work crews installing residential or commercial solar photovoltaic or thermal systems.</b>
17-2199.11	Solar Energy Systems Engineers	Perform site-specific engineering analysis or evaluation of energy efficiency and solar projects involving residential, commercial, or industrial customers. Design solar domestic hot water and space heating systems for new and existing structures, applying knowledge of structural energy requirements, local climates, solar technology, and thermodynamics.
<b>47-2231.00</b>	<b>Solar Photovoltaic Installers*</b>	<b>Assemble, install, or maintain solar photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics. May include measuring, cutting, assembling, and bolting structural framing and solar modules. May perform minor electrical work such as current checks.</b>
<b>41-4011.07</b>	<b>Solar Sales Representatives and Assessors*</b>	<b>Contact new or existing customers to determine their solar equipment needs, suggest systems or equipment, or estimate costs.</b>
47-4099.02	Solar Thermal Installers and Technicians	Install or repair solar energy systems designed to collect, store, and circulate solar-heated water for residential, commercial or industrial use.
17-2199.10	Wind Energy Engineers	Design underground or overhead wind farm collector systems and prepare and develop site specifications.
11-9199.09	Wind Energy Operations Managers	Manage wind field operations, including personnel, maintenance activities, financial activities, and planning.
11-9199.10	Wind Energy Project Managers	Lead or manage the development and evaluation of potential wind energy business opportunities, including environmental studies, permitting, and proposals. May also manage construction of projects.
49-9081.00	Wind Turbine Service Technicians	Inspect, diagnose, adjust, or repair wind turbines. Perform maintenance on wind turbine equipment, including resolving electrical, mechanical, and hydraulic malfunctions.

\* Employers who participated in the Clean Economy forum indicated that they have experienced difficulty finding qualified applicants for this occupation.

<sup>12</sup> Occupation Information Network (O\*NET): [www.onetonline.org](http://www.onetonline.org). Accessed March 3, 2016.

# RENEWABLE ENERGY

In the Sacramento Capital region, there are three education institutions that offer training programs that support the Renewable Energy subsector. Both provide training for solar-related occupations (Exhibit 8).

## Exhibit 8: Renewable Energy Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
American River College	Solar Energy Systems Design, Estimation, and Sales	Certificate
American River College	Solar Energy Technology	Certificate
Sierra College	Solar Photovoltaic	Skills Certificate
Sierra College	Solar Photovoltaic Advanced	Skills Certificate
UC Davis Extension	Renewable Energy	Professional Concentration

### Business Spotlight: Sacramento Municipal Utility District (SMUD)

SMUD is a publicly-owned utility providing electricity to Sacramento County and portions of Placer and Yolo Counties. Their power sources include hydropower, natural-gas-fired generators, solar and wind renewable energy, and electricity purchased from the wholesale market. The utility's long-term strategy is to increase the amount of power obtained from renewable energy to ensure a green, sustainable portfolio. Currently, their hydroelectric plants represent a large percentage of their renewable energy production with the lowest production costs.

SMUD is active in research and investments to achieve the state's mandated renewable energy goal: 33% of energy sources produced by renewable energy by 2020 (AB32). The availability of a qualified workforce is key to achieving this goal. SMUD needs workers with knowledge of the integration of energy systems, information technology, and operations. In addition, applicants need strong critical thinking, creativity, collaboration, and communication skills.<sup>13</sup>



<sup>13</sup> Interview with Susan Wheeler, Workforce Pipeline Planning and Education Relations Strategist, Organization and Workforce Development, Sacramento Municipal Utility District (SMUD). [www.smud.org](http://www.smud.org). April 13, 2016.

# SUSTAINABLE AGRICULTURE



The region's Sustainable Agriculture subsector is largely driven by agricultural philosophies, policies, and practices that promote healthy food production and preserve valuable working lands and natural resources. This subsector includes establishments that utilize agriculture practices that reduce negative impacts on the environment as well as conserve resources for future generations. Along with production, agriculture service providers, such as establishments that produce natural pesticides and safe soils, are included in this category.

Transitioning from conventional farming to sustainable farming practices is a slow and evolving process that requires advocacy, education, and public policy. To assist with this effort, the USDA's Agricultural Marketing Service's National Organic Program offers resources and education tools to growers who want to adopt organic farming practices. Their how-to manuals and support services help farmers understand and implement USDA organic standards, qualify for certification, and prepare for inspection.<sup>14</sup> The California Certified Organic Farmers organization offers additional resources to farmers who are transitioning to organic practices.<sup>15</sup> Farm to Fork, SACOG, California Department of Food and Agriculture, and other organizations are supporting the growth of local food systems which can have environmental benefits

In addition to organic agricultural practices, farms must adapt to changing weather patterns, microclimates, and water availability. In the future, energy producers and farmers may share or compete for the same land and water resources. In many cases, food and energy production will occur in tandem within agricultural centers. As science and technology innovations advance in the Sustainable Agriculture subsector, so will the need for tech-savvy farmers, agricultural workers and service providers.<sup>16</sup> Ecosystem services is another emerging aspect of sustainable agriculture.

Exhibit 9 displays the occupations identified by O\*NET that support the Sustainable Agriculture subsector. Occupations without O\*NET codes that work in sustainable agriculture include: policy analysts and scientists that conduct research in the area of sustainable farming standards and practices.

## Exhibit 9: Sustainable Agriculture Occupations<sup>17</sup>

ONET Code	Title	Description
19-1031.01	Soil and Water Conservationists	Plan or develop coordinated practices for soil erosion control, soil or water conservation, or sound land use.
11-9013.02	Farm and Ranch Managers	Plan, direct, or coordinate the management or operation of farms, ranches, greenhouses, aquacultural operations, nurseries, timber tracts, or other agricultural establishments.

In the Sacramento Capital region, there are three education institutions that offer training programs that support the sustainable agriculture subsector (Exhibit 10).

<sup>14</sup> *New Outreach and Education Tools Available to Support Organic Certification*. March 8, 2016. National Sustainable Agriculture Coalition. <http://sustainableagriculture.net/blog/sound-and-sensible/>

<sup>15</sup> California Certified Organic Farmers. <https://www.ccof.org/>

<sup>16</sup> Little data is available through SIC codes on the total employment and establishments of the Sustainable Agriculture subsector.

<sup>17</sup> Occupation Information Network (O\*NET): [www.onetonline.org](http://www.onetonline.org). Accessed March 3, 2016.

# SUSTAINABLE AGRICULTURE

## Exhibit 10: Sustainable Agriculture Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
Sierra College	Sustainable Agriculture	A.S. Degree; Certificate
UC Davis	Sustainable Agriculture and Food Systems	Bachelor of Science
Woodland College	Environmental Horticulture	A.S. Degree; Certificate
Woodland College	Sustainable Agriculture	Certificate

### Business Spotlight: California Safe Soil

California Safe Soil manufactures a certified organic liquid fertilizer and soil amendment made from food waste obtained from supermarkets and farms. The company co-locates with various distribution outlets for recovery of imperfect or unharvested food from farmers and spoilage from grocery retailers. Their products, Harvest-to-Harvest and Harvest-to-Harvest Organic, are made through a process of grinding, heating, and enzymatically digesting the food, then blending it to produce a complete plant-and-soil nutrient that can be used in conventional and organic agricultural crop production to promote soil fertility.

California Safe Soil is currently producing soil nutrients at several plants across the state. With increasing demand for fertilizers that use biological agents rather than chemicals, the company plans to open a new production facility in McClellan Park. To support operations at this facility, California Safe Soil will be recruiting applicants for plumbing and electrical positions, as well as sales and marketing.<sup>18</sup>



<sup>18</sup> Interview with California Safe Soil, Dan Morash, Founder. [www.calsafesoil.com](http://www.calsafesoil.com). April 12, 2016.

# ADVANCED TRANSPORTATION



The Advanced Transportation subsector includes establishments that focus on alternative vehicles, technologies, and fuels with the ultimate goal of reducing petroleum dependence and greenhouse gas emissions. To move forward the Advanced Transportation subsector, Governor Jerry Brown issued an executive order to put 1.5 million zero-emission vehicles (ZEV) on California's road by 2025.

To meet this mandate, California and the Sacramento Capital region need more public charging stations. Currently, there are fewer than 8,000 public charging outlets across the state.<sup>19</sup> While there has been significant growth in the installation of charging stations, the National Renewable Energy Laboratory estimates California will need as many as 51,000 public charging stations and 167,000 workplace charging units to achieve the Governor's goal.

The planning, permitting, and installation of electric vehicle charging stations is a complex process. In an effort to improve the process, the California Energy Commission has provided funding to regional multiagency coordinating councils around the state. In the Sacramento Capital region, the Sacramento Area Council of Governments (SACOG) is leading the effort to develop better ZEV deployment and infrastructure.

In addition to developing a strong electric vehicle infrastructure, the Sacramento Capital region is a major junction for train travel within the continental U.S..<sup>20</sup> Regional transit networks also offer bus, light rail, and streetcar transportation options. However, the Sacramento Regional Transit District has experienced a 20 percent drop in ridership after cuts in routes and an increase in fares during the recession; ridership has not yet recovered.<sup>21</sup> To compensate, the Agency may again raise fares or ask for a half-cent sales tax increase on a ballot measure to pay for transit improvements and alleviate traffic congestion.

In advance of the new sports and entertainment arena opening in October in Sacramento, Regional Transit is hoping to lure new ridership to the downtown area with expanded routes that are more convenient than traffic jams and expensive parking charges.

<sup>19</sup> <http://www.evchargernews.com/regions/ch-sac-all.htm>. This region includes the following counties: Butte, El Dorado, Fresno, Madera, Nevada, Placer, Sacramento, San Joaquin, Solano (Eastern portion), Sutter, Tulare, and Yolo.

<sup>20</sup> <http://www.up.com/index.htm>

<sup>21</sup> Sacramento RT Faces Critical Year for Ridership and Revenue. <http://www.sacbee.com/news/local/transportation/article65885202.html>. March 13, 2016.

# ADVANCED TRANSPORTATION

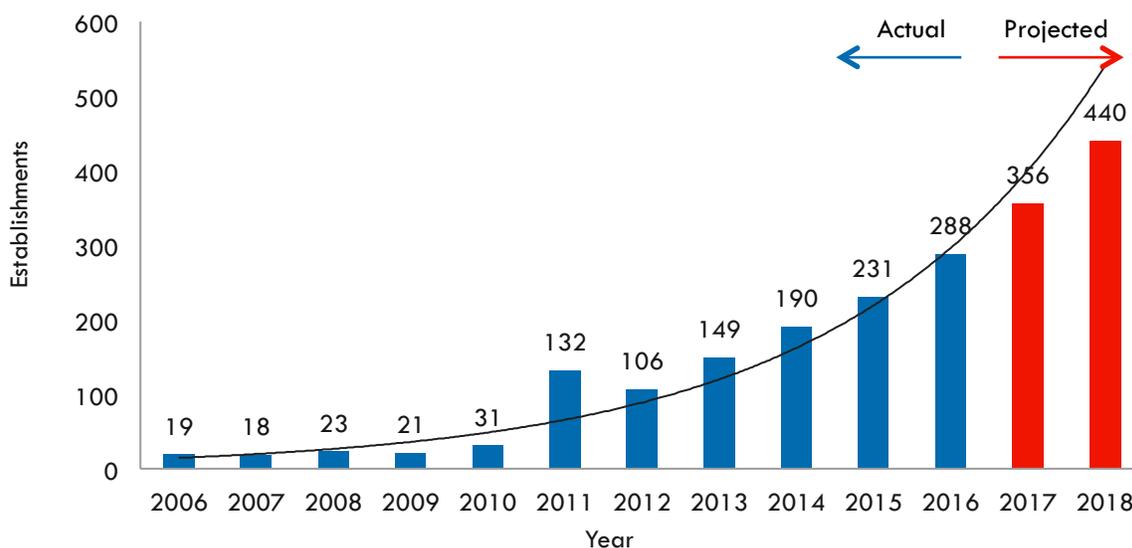
Exhibit 11 displays establishment and employment data for Advanced Transportation industries as classified by SIC codes at the eight-digit level. Over the last five years, the region has added 156 new establishments and 304 new jobs. Establishment growth is being driven by the installation of new public charging stations since each new station is counted as one establishment (Exhibit 12). However, because the stations are not staffed, no new jobs have been created from this exponential growth.

## Exhibit 11: Advanced Transportation, Employment and Establishments, Sacramento Capital Region<sup>22</sup>

	2011 Jobs	2016 Jobs	2011-2016 Job Change	Percent Change	2016 Establishments
Electric Cars-Automobile (Mfrs)	12	2	-10	-83%	1
Electric Charging Station	0	0	0	n/a	264
Railroads	148	528	380	257%	12
Trains	4	5	1	25%	1
Transit Lines	302	235	-67	-22%	10
<b>Total</b>	<b>466</b>	<b>770</b>	<b>304</b>	<b>65%</b>	<b>288</b>

Note. Siemens was not captured in this dataset due to the SIC classification structure. Siemens is an international company that designs and manufactures passenger trains, light rail cars, and high speed trainsets. More than 800 people are employed by Siemens at the South Sacramento facility.

## Exhibit 12: Advanced Transportation, Establishments, Sacramento Capital Region<sup>23</sup>



The rise in the number of advanced technology vehicles and alternative fuel vehicles has increased the demand for qualified workers with specialized knowledge and diagnostic skills. As a result, many employers operating fleets, dealerships, and automotive shops are now requiring supplementary certification or training. The planned expansion of the EV infrastructure may also result in additional employment opportunities, such as jobs for workers with knowledge and expertise in charging unit installation and maintenance.

<sup>22</sup> ReferenceUSA: Business Database, 2016.

<sup>23</sup> ReferenceUSA: Business Database, 2016.

# ADVANCED TRANSPORTATION



## Exhibit 13: Advanced Transportation Occupations<sup>24</sup>

ONET Code	Title	Description
49-3023.02	Automotive Specialty Technicians	Repair only one system or component on a vehicle, such as brakes, suspension, or radiator.

In the Sacramento Capital region, American River College offers several Advanced Transportation training programs (Exhibit 14). There are three programs with a focus on clean diesel and one with a broader focus on alternative fuels and advanced technologies.

## Exhibit 14: Advanced Transportation Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
American River College	Alternative Fuels and Green Vehicle Technology	Certificate
American River College	Clean Diesel Hybrid Technology	Certificate
American River College	Clean Diesel Management Systems	Certificate
American River College	Clean Diesel Technology	Certificate

### Business Spotlight: Phil Haupt Electric

Phil Haupt Electric offers full commercial and residential electrical services in the Sacramento region. Services include site analysis, engineering, and installation of electric vehicle charging stations at various multi-unit dwellings, commercial, retail, public, government, and residential locations. The company has installed nearly 700 charging stations throughout northern California.

As more electric vehicles with ranges of 200 miles or more become available to consumers, Phil Haupt Electric expects that the demand for EVs will significantly increase. Currently, the company is experiencing difficulty finding qualified workers in the electrical field who meet their minimum standards.<sup>25</sup>

<sup>24</sup> Occupation Information Network (O\*NET): [www.onetonline.org](http://www.onetonline.org). Accessed March 3, 2016.

<sup>25</sup> Interview with Phil Haupt Electric, Inc., Becky Haupt, Co-Owner. [www.philhauptelectric.com](http://www.philhauptelectric.com). April 27, 2016.

# ENVIRONMENTAL COMPLIANCE

Over the past few decades, state and federal agencies have implemented new laws, regulations, and standards designed to protect air, water, natural resources, wildlife, and public health. One of the primary goals of environmental regulations is to limit greenhouse gases entering the atmosphere.

The Sacramento Capital region is home to a number of government agencies that monitor and regulate environmental mandates and polices. Regulatory efforts include oversight and regulation of peak power usage, alternative storage for and use of chemicals, recycling of manufacturing waste, reducing amounts of hazardous waste, improving wastewater treatment processes, and switching to solid-state lighting, to name a few.

In addition, some companies and public sector institutions have gone further than required by law to reduce their companies' environmental impact. These companies have changed their business practices and systems to preserve natural resources and minimize the environmental impact of their daily activities. In the region, more than 500 organizations have been certified as a "Sustainable Business," a recognition conferred by the Business Environmental Resource Center, an entity established by the Sacramento County Board of Supervisors.<sup>27</sup>

Driven by both legislation and corporate responsibility, many organizations are adopting business practices that reduce their carbon footprint. This shift is driving demand for environmental and ecological consulting services that can provide solutions for business and government clients to comply with and implement sustainability programs.

Exhibit 15 displays establishment and employment data for Environmental Compliance industries as classified by SIC codes at the eight-digit level. Over the last five years, the region has added 32 new establishments and 110 new jobs. Most of the job growth can be attributed to environmental conservation organizations, environmental & ecological services, and state government environmental programs. City and county government programs reduced headcount during this same period.

## Exhibit 15: Environmental Compliance, Employment and Establishments, Sacramento Capital Region<sup>26</sup>

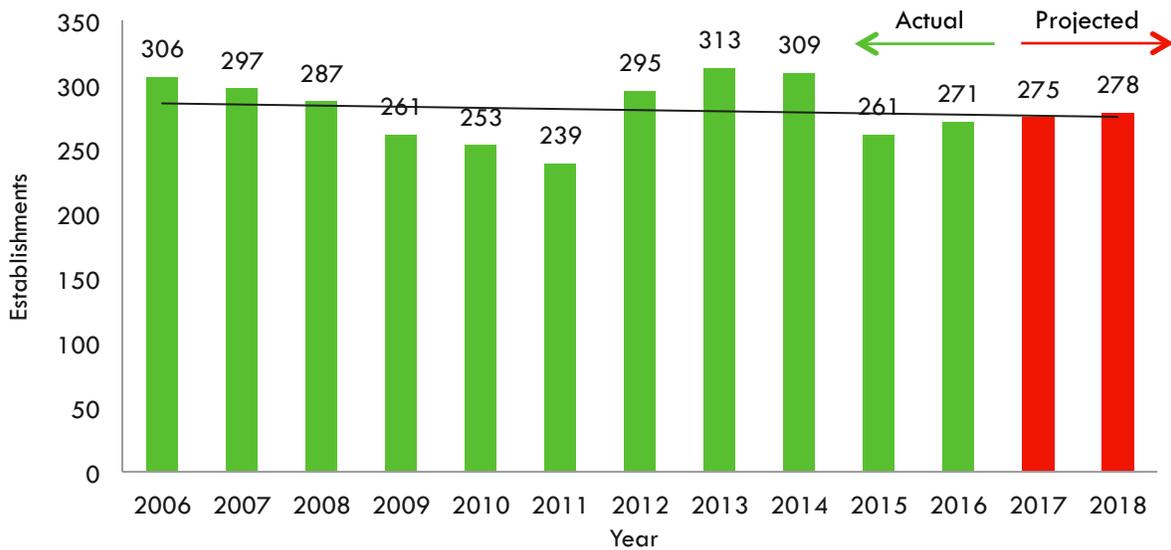
	2011 Jobs	2016 Jobs	2011–2016 Job Change	Percent Change	2016 Establishments
Air Pollution Control	5	3	-2	-40%	1
Air Pollution Measuring Equip (Whls)	4	4	0	0%	1
City Government-Environmental Programs	303	26	-277	-91%	3
County Government-Environmental Programs	222	61	-161	-73%	7
Environmental & Ecological Services	1870	2063	193	10%	206
Environmental Products & Supls (Whls)	19	22	3	16%	6
Environmental Conservation/Ecologcl Org	0	247	247	n/a	36
State Government-Environmental Programs	3959	4018	59	1%	10
Water Pollution Control	2	0	-2	-100%	0
Environmental Analysis Services	0	50	50	n/a	1
<b>Total</b>	<b>6,384</b>	<b>6,494</b>	<b>110</b>	<b>2%</b>	<b>271</b>

<sup>26</sup> <http://www.sacberc.org/>

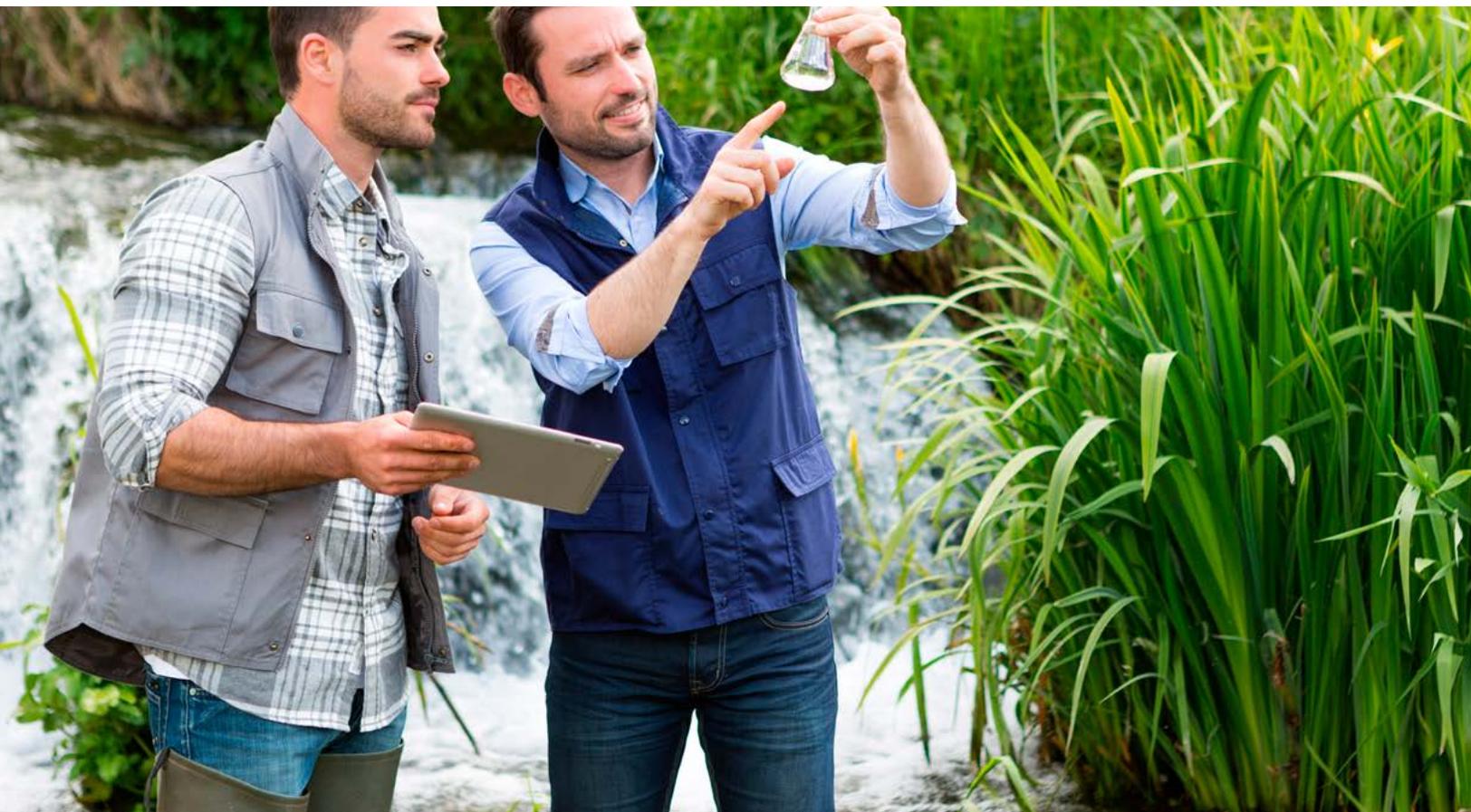
<sup>27</sup> ReferenceUSA: Business Database, 2016.

# ENVIRONMENTAL COMPLIANCE

**Exhibit 16: Environmental Compliance, Establishments, Sacramento Capital Region<sup>28</sup>**



The advancement of clean, sustainable organizations has created demand for skilled employees with knowledge of environmental compliance, sustainability goals, and performance outcomes. Below are some of the occupations that specialize in this area.



<sup>28</sup> ReferenceUSA: Business Database, 2016.

# ENVIRONMENTAL COMPLIANCE

## Exhibit 17: Environmental Compliance Occupations<sup>29</sup>

ONET Code	Title	Description
11-9199.11	Brownfield Redevelopment Specialists and Site Managers	Plan and direct cleanup and redevelopment of contaminated properties for reuse. Does not include properties sufficiently contaminated to qualify as Superfund sites.
11-1011.03	Chief Sustainability Officers	Communicate and coordinate with management, shareholders, customers, and employees to address sustainability issues. Enact or oversee a corporate sustainability strategy.
19-2041.01	Climate Change Analysts	Research and analyze policy developments related to climate change. Make climate-related recommendations for actions such as legislation, awareness campaigns, or fundraising approaches.
11-9199.02	Compliance Managers	Plan, direct, or coordinate activities of an organization to ensure compliance with ethical or regulatory standards.
13-1041.01	Environmental Compliance Inspectors	Inspect and investigate sources of pollution to protect the public and environment and ensure conformance with federal, state, and local regulations and ordinances.
19-3011.01	Environmental Economists	Conduct economic analysis related to environmental protection and use of the natural environment, such as water, air, land, and renewable energy resources. Evaluate and quantify benefits, costs, incentives, and impacts of alternative options using economic principles and statistical techniques.
17-3025.00	Environmental Engineering Technicians	Apply theory and principles of environmental engineering to modify, test, and operate equipment and devices used in the prevention, control, and remediation of environmental problems, including waste treatment and site remediation, under the direction of engineering staff or scientist. May assist in the development of environmental remediation devices.
17-2081.00	Environmental Engineers	Research, design, plan, or perform engineering duties in the prevention, control, and remediation of environmental hazards using various engineering disciplines. Work may include waste treatment, site remediation, or pollution control technology.
19-4091.00	Environmental Science and Protection Technicians, Including Health	Perform laboratory and field tests to monitor the environment and investigate sources of pollution, including those that affect health, under the direction of an environmental scientist, engineer, or other specialist. May collect samples of gases, soil, water, and other materials for testing.
19-2041.00	Environmental Scientists and Specialists, Including Health	Conduct research or perform investigation for the purpose of identifying, abating, or eliminating sources of pollutants or hazards that affect either the environment or the health of the population. Using knowledge of various scientific disciplines, may collect, synthesize, study, report, and recommend action based on data derived from measurements or observations of air, food, soil, water, and other sources.
13-1041.07	Regulatory Affairs Specialists	Coordinate and document internal regulatory processes, such as internal audits, inspections, license renewals, or registrations. May compile and prepare materials for submission to regulatory agencies.
13-1199.05	Sustainability Specialists	Address organizational sustainability issues, such as waste stream management, green building practices, and green procurement plans.
11-9121.02	Water Resource Specialists	Design or implement programs and strategies related to water resource issues such as supply, quality, and regulatory compliance issues.

<sup>29</sup> Occupation Information Network (O\*NET): [www.onetonline.org](http://www.onetonline.org). Accessed March 3, 2016.

# ENVIRONMENTAL COMPLIANCE

In the Sacramento Capital region, there are six education institutions offering training programs that support the Environmental Compliance subsector (Exhibit 18).

## Exhibit 18: Environmental Compliance Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
American River College	Environmental Conservation	A.S. Degree; Certificate
CSU Sacramento	Civil Engineering: Environmental/Water Quality Engineering	Master of Science
CSU Sacramento	Civil Engineering: Water Resources Engineering	Master of Science
CSU Sacramento	Environmental Studies	Bachelor of Science; Bachelor of Arts
CSU Sacramento	Water Quality	Certificate
CSU Sacramento	Water Resources Planning	Certificate
Folsom Lake College	Water Management	Certificate
Sierra College	Environmental Studies and Sustainability	A.S. Degree
UC Davis	Ecological Management and Restoration	Bachelor of Science
UC Davis	Environmental Policy Analysis and Planning	Bachelor of Science
UC Davis	Environmental Science and Management	Bachelor of Science
UC Davis	Environmental Toxicology	Bachelor of Science
UC Davis	Sustainable Environmental Design	Bachelor of Science
UC Davis	Civil and Environmental Engineering	Master of Science; PhD
William Jessup University	Environmental Science	Bachelor of Science; Bachelor of Arts

### Business Spotlight: California Air Resources Board (CARB)

The California Air Resources Board (CARB) is one of the lead regulatory agencies overseeing the Global Warming Solutions Act of 2016 (AB32). One of its key roles as a lead organization is the coordination of state agencies to establish and engage in efforts that reduce greenhouse gas emissions. As a member of the state's Climate Action Team, the CARB is working with more than 18 agencies to plan, direct, and measure state efforts to achieve the AB32 milestone goals required by 2020 through to 2050.

To ensure environmental compliance for organizations under AB32 regulations, the CARB has established a system of reporting, verifying, monitoring, and enforcement. To facilitate business compliance, CARB holds regular community meetings, provides information and processes written clearly and in simple language, and offers resources about incentives for early compliance and loans.

With the drive toward achieving the goals of 2030 climate stabilization, CARB is pressed to find qualified workers who have excellent project management, critical thinking, and communication skills, as well as the ability to collaboratively identify and solve problems. Knowledge of atmospheric and GIS systems are also highly valued.<sup>30</sup>

<sup>30</sup> Interview with California Air Resources Board (ARB), La Rhonda Bowen, ARB Ombudsman. [www.arb.ca.gov](http://www.arb.ca.gov). April 12, 2016.

# RECYCLING AND WASTE REDUCTION



Recycling and Waste Reduction encompasses a wide range of industries defined by a set of activities that involve collecting and sorting recycled materials, reusing or remanufacturing recycled materials, and/or manufacturing new products with recycled materials.

Businesses involved in recycling and the management of waste reduction often specialize in different areas. Some firms may focus on one particular process, such as cleaning, collecting, sorting, or preparing products for manufacturing or reuse. Others may manage the complete lifecycle of a product. Firms that oversee product lifecycles may collect and sort recycled materials, combine the recycled materials with other materials, and manufacture new products. They may also sell materials not needed for manufacturing to a broker.

In addition, many corporations and businesses are adopting sustainable practices to reduce production waste, create eco-friendly products, and embrace product stewardship that benefit consumers, businesses, and the planet's ecosystems. Some of the most common trends in recycling and waste reduction include:

- **Zero waste:** A philosophy that supports the elimination of all waste by recycling or reusing 100 percent of materials used in the production process. Zero waste not only has a positive impact on the environment, but it also contributes to the economy when it's used as a resource to support employment and business opportunities. Zero waste goals pose a wide range of implementation challenges to organizations and businesses. Composite materials and plastics found in commercial products and consumer packaging can make recycling difficult to separate and also jam sorting equipment. In the meantime, industry associations and recycling groups are trying to address these problems and find solutions to promote zero waste goals as a viable operating method for reducing operating costs and minimizing impacts on the environment.<sup>31</sup>
- **Circular economy:** The principles of the circular economy redefine recycling in terms of materials management, which involves the design of products and packaging, maximizing recycling and reuse objectives. Materials management includes the design, manufacture, and use of recycled and compostable packaging and materials, as opposed to wasteful one-time-use packaging. For example, Mushroom's Materials produce wine shipping materials made from agricultural waste and mushrooms. Their custom-designed and molded material is fully compostable and cost competitive with plastic foams.<sup>32</sup>
- **Product stewardship:** One of the major trends of product stewardship is better dissemination of information about disposal of hazardous waste, especially battery and e-waste recovery and recycling. This includes providing greater clarity about where to dispose waste and entry points into the waste management system. Through public campaigns, service announcements provide compelling information on the need to recycle and dispose of hazardous waste in a way that minimizes impacts to the environment.

Exhibit 19 displays establishment and employment data for Recycling and Waste Reduction industries as classified by SIC codes at the eight-digit level. Over the last five years, this subsector declined by 2 percent, losing about 80 jobs. Most of the job decline can be attributed to a decrease in recycling centers and waste reduction establishments (Exhibit 20).

<sup>31</sup> *Three Headaches for the Recycling Industry*. The New York Times. March 25, 2016. [http://www.nytimes.com/2016/03/29/science/three-headaches-for-the-recycling-industry.html?\\_r=0](http://www.nytimes.com/2016/03/29/science/three-headaches-for-the-recycling-industry.html?_r=0)

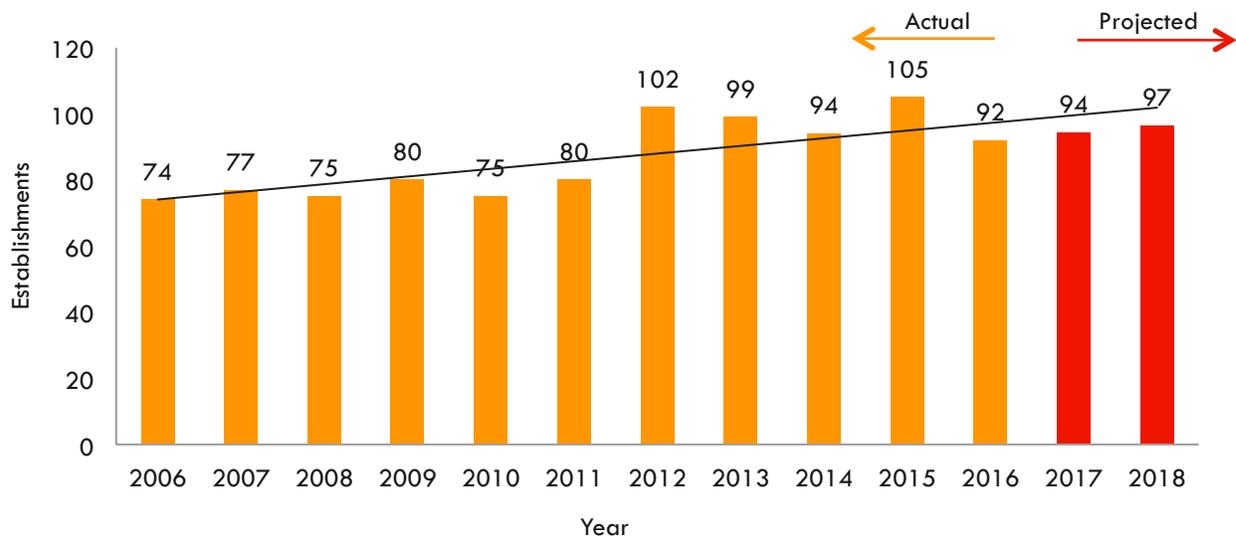
<sup>32</sup> <http://www.ecovatedesign.com/>

# RECYCLING AND WASTE REDUCTION

**Exhibit 19: Recycling and Waste Reduction, Employment and Establishments, Sacramento Capital Region<sup>33</sup>**

	2011 Jobs	2016 Jobs	2011-2016 Job Change	Percent Change	2016 Establishments
Automobile Dismantling/Recycling (Whls)	16	21	5	31%	2
Recycling Centers (Whls)	926	867	-59	-6%	77
CalRecycling (State Government)	2,000	2,000	0	0%	1
Recycling Equipment & Systems	65	73	8	12%	6
Scrap Metals-Processing/Recycling (Whls)	35	35	0	0%	1
Waste Rdctn Dspsl/Recycle Svc-Ind (Whls)	81	6	-75	-93%	2
Waste Reduction & Disposal Equip-Ind	79	120	41	52%	3
<b>Total</b>	<b>3,202</b>	<b>3,122</b>	<b>-80</b>	<b>-2%</b>	<b>92</b>

**Exhibit 20: Recycling and Waste Reduction, Establishments, Sacramento Capital Region<sup>33</sup>**



<sup>33</sup> ReferenceUSA: Business Database, 2016.

# RECYCLING AND WASTE REDUCTION

## Exhibit 21: Recycling and Waste Reduction Occupations<sup>34</sup>

ONET Code	Title	Description
19-2041.03	Industrial Ecologists	Apply principles and processes of natural ecosystems to develop models for efficient industrial systems. Use knowledge from the physical and social sciences to maximize effective use of natural resources in the production and use of goods and services. Examine societal issues and their relationship with both technical systems and the environment.
51-9199.01	Recycling and Reclamation Workers	Prepare and sort materials or products for recycling. Identify and remove hazardous substances. Dismantle components of products such as appliances.
53-1021.01	Recycling Coordinators	Supervise curbside and drop-off recycling programs for municipal governments or private firms.

In the Sacramento Capital region, there is one training program that supports the Recycling and Waste Reduction subsector (Exhibit 22).

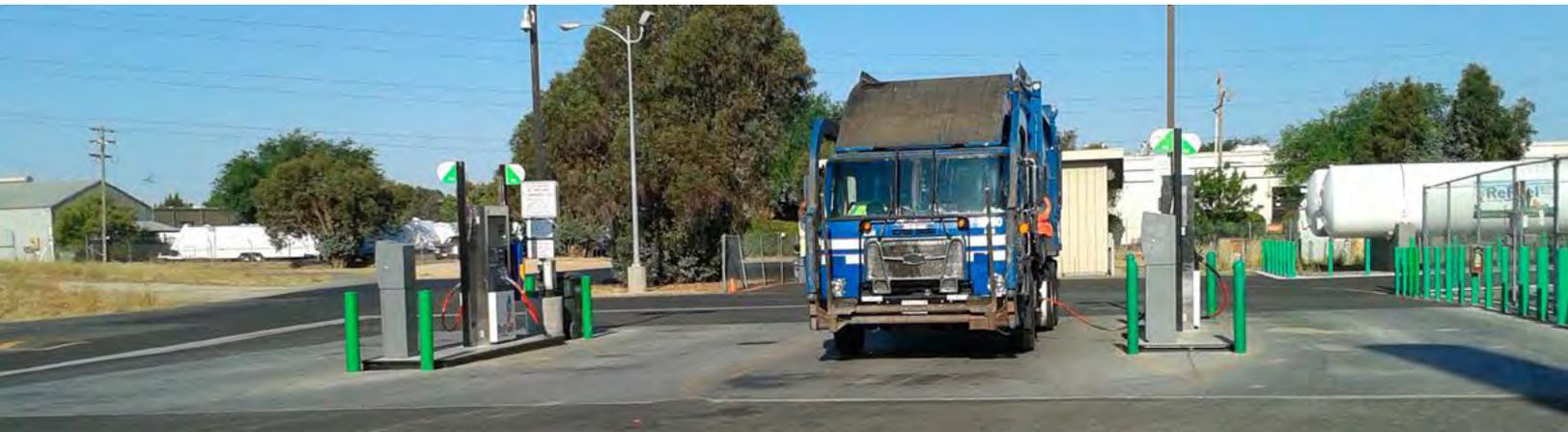
## Exhibit 22: Recycling & Waste Reduction Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
CSU Sacramento	Issues in Natural Resource Management	Certificate

### Business Spotlight: PackageOne

PackageOne manufactures corrugated packaging material that is produced from recyclable paper and renewable materials. Made from natural, plant-based materials, every product produced is recyclable. Their boxes and packaging are designed for and sold to the industrial wholesale market for displays, food service, agriculture, and shipping. The company also operates a bio-digester.

PackageOne expects to add as many as 70 new positions over the next few years to assist with collection, equipment operation, as well as research and development. Sought after skills include knowledge of electronic maintenance, knowledge of organic chemistry, and a solid understanding of good manufacturing practices.<sup>35</sup>



<sup>34</sup> Occupation Information Network (O\*NET): [www.onetonline.org](http://www.onetonline.org). Accessed March 3, 2016.

<sup>35</sup> Interview with Package One, Tom Kandris, CEO. [www.package1.com](http://www.package1.com). April 13, 2016.

# SUMMARY

The Bureau of Labor Statistic's current coding system does not provide sufficient detail to analyze industry trends in the Clean Economy cluster. As such, the data contained in this study is based on a private database of organizations. Because of inadequacies with the private database, the total number of establishments and jobs is likely undercounted.

Even with these inadequacies, this study paints a compelling picture of growth and opportunity in the Clean Economy cluster. Between 2011 and early 2016, the Clean Economy grew by 35 percent, adding more than 250 new organizations in the Sacramento Capital region. Job growth also has been aggressive with the addition of 1,700 new jobs over the last five years.

Within the cluster, employment in the Energy and Resource Efficiency, Renewable Energy, and Advanced Transportation subsectors has grown substantially, while Environmental Compliance and Recycling/Waste Reduction have experienced flat growth. There are several environmental, regulatory, and market trends that have impacted the stability and growth of each subsector in this cluster. These trends include:

- **Energy and Resource Efficiency** – Local businesses have made substantial investments to retrofit and build structures that meet stringent energy efficiency standards established by the U.S. Green Building Council. In the Sacramento Capital region, there are more than 560 Leadership in Energy and Environmental Design (LEED) certified buildings.
- **Renewable Energy** – The federal Investment Tax Credit (ITC) and improved solar panel efficiency is driving growth in residential and commercial solar markets. Incentives and greater efficiency gains improve the return on investment and give businesses and homeowners sufficient justification to invest.
- **Sustainable Agriculture** – Transitioning from conventional farming to sustainable farming practices is a slow and evolving process that requires education and policy support. To help with the transition and assist with the adoption, industry associations offer resources and education tools to answer questions and streamline processes.
- **Advanced Transportation** – In 2012, Governor Jerry Brown issued an executive order to put 1.5 million zero-emission vehicles (ZEV) on California's roadways by 2025. To accomplish this goal, the Sacramento Capital region will need to install thousands of public charging stations.
- **Environmental Compliance** – The Sacramento Capital region is home to a number of government agencies that monitor and regulate environmental mandates and polices. In addition to government mandates, many organizations are voluntarily adopting business practices that reduce their carbon footprint.
- **Recycling/Waste Reduction** – Zero waste is the goal to recycle or reuse 100 percent of all operating and production materials. Businesses that adopt this philosophy often experience both economic benefits as well as minimize their impact on the environment. New legislation is requiring the reduction of food waste into landfills which will further drive changes in recycling and waste reduction practices.

The overall intent of this research was to track the progress of the Clean Economy in the Sacramento Capital region and serve as a foundation for future research. In the next research phase, the goal is to develop a more robust estimate of establishments and employment. Valley Vision will also convene Clean Economy employers to identify next steps for identifying and validating the demand for high priority occupations and skills gaps that can be addressed through a concerted cluster workforce action plan.

# MORE ABOUT...

## More About The Centers of Excellence

The Centers of Excellence (COE) for Labor Market Research deliver regional workforce research and technical expertise to California 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.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the leading source of regional workforce information and insight for California community colleges. More information about the Centers of Excellence is available at [www.coecc.net](http://www.coecc.net).

For more information on this study, contact:

Theresa Milan, COE Director  
Northern California Region  
(916) 563-3221  
[milant@losrios.edu](mailto:milant@losrios.edu)

This study was conducted with the support of JPMorgan Chase & Co. In addition, this study was supported by Economic and Workforce Development funds awarded by the Chancellor's Office, California Community Colleges. It was produced pursuant to grant agreement number 15-305-001.

## More About Valley Vision

Since 1994, Valley Vision's work has driven transformative change and improved lives across Northern California. An independent social impact and civic leadership organization headquartered in Sacramento, Valley Vision strengthens our communities through unbiased research, boundary-crossing collaboration and change leadership. Our work improves overall quality of life and creates the conditions for economic prosperity and community health and vitality.

## More About Burris Service Group

The Burris Service Group (BSG) is a full-service consulting practice providing expertise in economic development, strategic economic research, real estate site strategy, management, and institutional growth. The company was established based on the clear need that advisory services be delivered in an "action-oriented" form. The founder of BSG, Robert Burris, brings to his clients an active local and international network of professionals, as well as 20 years of experience in economic development, market and economic analysis, commercial real estate information, corporate sales, and consulting.



**Burris Service Group**

JPMORGAN CHASE & CO.

[www.coecc.net](http://www.coecc.net)

**FIND US ON LINKEDIN GROUPS:**



<http://linkd.in/1EUU9wM>