

SNAPSHOT *of the* AGRICULTURAL MANUFACTURING ECOSYSTEM IN THE SAN JOAQUIN VALLEY

MARCH 2014

In partnership with

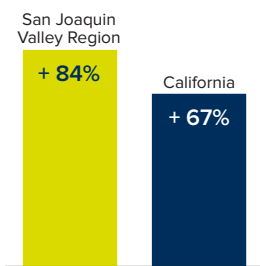
Office of Community and Economic Development at Fresno State • California Partnership for the San Joaquin Valley • California Central Valley Economic Development Corporation • Central California Workforce Collaborative • Kern Community College District and Merced College (on behalf of the California Community Colleges Central Region Consortium) • San Joaquin Valley Clean Energy Organization

EXECUTIVE SUMMARY

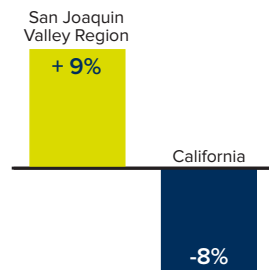
Agricultural manufacturing in the San Joaquin Valley is a large, specialized and diverse industry.

Foreign exports in the sector have nearly tripled over the past decade¹ and agricultural manufacturing employment in the San Joaquin Valley region alone exceeds employment in most U.S. states.² By processing, packaging, marketing and distributing agricultural products, the region has capitalized on its agricultural production expertise and natural resources to develop a robust value-added industry that complements its signature raw agricultural products. The agricultural manufacturing cluster is a diverse one, encompassing a range of sub-industries, such as Dairy Products and Beverages, as well as a broad value chain of activities from agricultural processing and packaging, to agricultural production, bioenergy and water technology. Considering the full value chain of agricultural manufacturing, employment was roughly 272,100 in 2012, nearly 20 percent of total employment in the region, and larger than sectors such as health care, construction & extraction and government.

Core Agricultural Manufacturing Export Growth
2003-2012



Core Agricultural Manufacturing Employment Growth
2002-2012



Companies in the sector are resilient, but have been slow to grow in the wake of the recession.

During the recent recession spanning late 2007 to 2009,³ nearly 90 percent of agricultural manufacturing companies maintained a steady level of employment, and 250 establishments actually opened their doors or added jobs. The broader San Joaquin Valley economy suffered greatly during this time, and annual regional unemployment rose above 17 percent.⁴

However, sector growth has been slow to rebound in the post-recession period in the San Joaquin Valley. Overall, the number of jobs in agricultural processing and packaging firms fell by over 10 percent between 2010 and 2012, largely from business closures. Smaller firms in particular struggled to maintain operations. Seven of the top ten largest sub-industries shed jobs between 2010 and 2012, though began hiring again in late 2012 and into the present.⁵

Agricultural Manufacturing Employment
2002-2012



Entrepreneurship and investments in innovation are increasing competitiveness and expanding employment.

Agricultural manufacturing companies in San Joaquin Valley have been adapting to changing markets, investing in innovating new products and continuously improving processes to increase productivity and resource efficiency. Patenting activity has increased in the region, and commercialization supports such as the Water and Energy Technology Center of Fresno State are helping to develop new technologies and companies. New companies opening their doors drove the majority of employment growth in the region between 2010 and 2012, even though net employment declined. The number of “smart” agriculture, bioenergy and water technology firms in the Valley increased by 13 percent to more than 1,050 between 2002 and 2012.

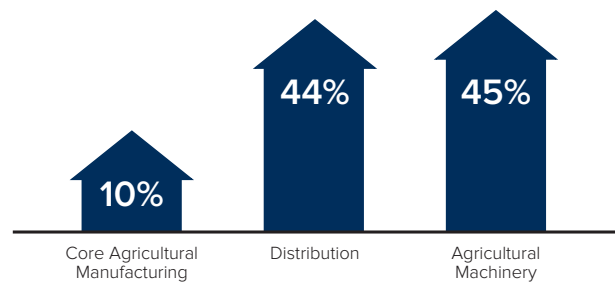
Agricultural Cluster Patents
2002-2012



Restructuring is occurring within the cluster; additional supply chain is developing.

Agricultural manufacturing sub-industries have been recovering at different rates in San Joaquin Valley; some sub-industries, such as fruit & vegetable canning, have remained flat or declined since the recession, while others, such as animal slaughtering and frozen fruit & vegetables, have rebounded rapidly. At the same time, several supporting sub-sectors within the agricultural manufacturing cluster, such as agricultural machinery, packaging materials and bioenergy, have increased employment. The number of firms in the cluster also grew by 25 percent between 2002 and 2012, led by expansion in agricultural manufacturing, distribution and agricultural machinery establishments.

Cluster Establishment Change
2002-2012



Enhancing regional assets, such as talent, supply chain and infrastructure, can help to strengthen growth in the cluster.

Shifting industry dynamics present a lens to examine underlying industrial assets and weaknesses in the region, in order to prioritize actions that agricultural manufacturing cluster companies and community partners can collaboratively undertake to overcome barriers to growth and capitalize on emerging opportunities. For example, action to expand the skilled labor pool, insource more of the industrial supply chain within the region and bolster goods movement infrastructure could potentially enhance the region’s competitiveness and accelerate growth. Through the Investing in Manufacturing Communities Partnership project, the San Joaquin Valley has an opportunity to develop a long-term strategy to address these needs and enhance agricultural manufacturing in the region, as well as compete for additional federal funds to execute the plan.

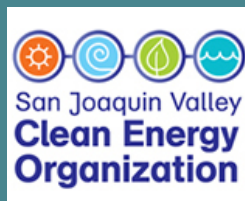
PROJECT BACKGROUND

The *Investing in Manufacturing Communities Partnership* (IMCP) project is a multi-stage federal initiative working to accelerate the resurgence of manufacturing and job creation in cities and regions across the country. The San Joaquin Valley was awarded one of forty-four IMCP Phase I planning grants to develop an investment strategy that will enhance manufacturing growth in the region. Though currently in the planning stage, if the region is successful in crafting an innovative, compelling strategy, it has the potential to apply for additional federal dollars to implement it within the region. The San Joaquin Valley IMCP effort is championed by the Office of Community and Economic Development at Fresno State, California Partnership for the San Joaquin Valley, California Central Valley Economic Development Corporation, Central California Workforce Collaborative, Kern Community College District and Merced College (on behalf of the California Community Colleges Central Region Consortium) and San Joaquin Valley Clean Energy Organization.

By highlighting industry dynamics and local assets such as talent, capital and infrastructure, this report seeks to create a snapshot of the agricultural manufacturing cluster in the San Joaquin Valley, in order to advance the regional conversation around key questions, including the following:

- What is driving growth in agricultural manufacturing cluster companies within the region?
- What are the barriers or limitations to growth?
- What can be done to increase manufacturers' success in the Valley?

A strong, connected cluster fosters innovation, employment growth and continued sector resilience. To help evaluate the cluster's strengths and gaps, this report compares the San Joaquin Valley to other leading agricultural manufacturing regions along an array of measures that integrate existing research. The IMCP team will host discussions with businesses, and workforce, education and community partners throughout the spring of 2014 in order to expand, elaborate and prioritize action themes for moving forward, which will ultimately be rolled into the overarching strategy to enhance agricultural manufacturing in the San Joaquin Valley.



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AGRICULTURAL MANUFACTURING DYNAMICS IN THE SAN JOAQUIN VALLEY

Agricultural manufacturing transforms raw agricultural goods (such as fruits, vegetables, livestock, grains, cotton, timber) into products that can be sold to consumers at a higher value.

Core agricultural manufacturing activities include processing, food manufacturing, and creation of value-added agricultural products along a range of sub-industries, such as Dairy Products, Poultry & Meat and Beverages. The full agricultural manufacturing cluster includes core agricultural manufacturing, along with a value chain of affiliated activities or “sub-sectors”, such as agricultural production, packaging materials and distribution. These sub-sectors are interdependent, and although there are unique drivers and influences in each, the full value chain is affected by successes and challenges of the component sub-sectors. Figure 1 defines the sub-sectors of the agricultural manufacturing cluster used in this report. Figure 2 illustrates some of the relationships between sub-sectors throughout the value chain.

Figure 2
Value Chain Interacts to Form Full Agricultural Manufacturing Cluster

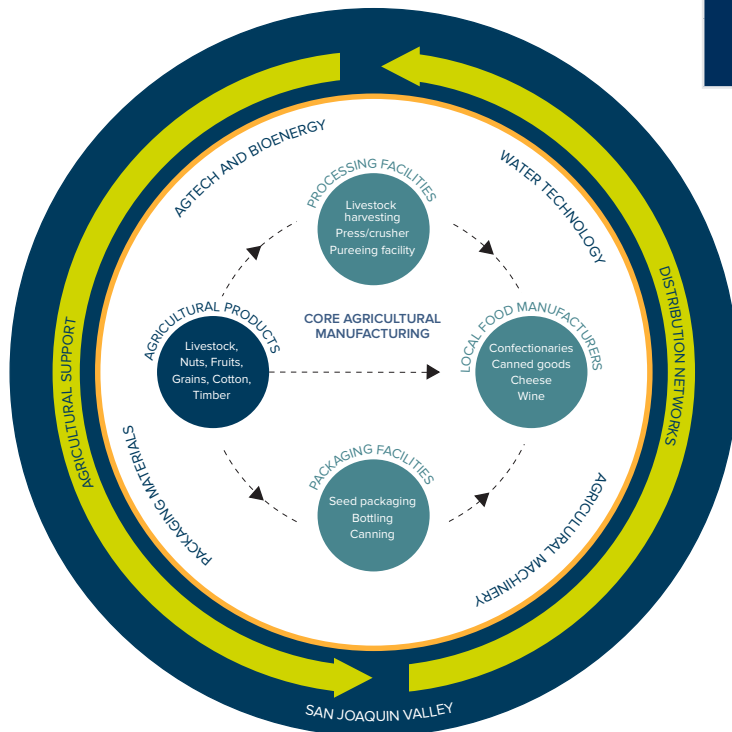


Figure 1
Agricultural Manufacturing Cluster Defined

CORE AGRICULTURAL MANUFACTURING	<p>Agricultural Processing & Packaging: Involves food and beverage processing, development of cereals and other grain products, sawmills, basic textiles, and packaging of raw and processed foods</p>
CORE AGRICULTURAL MANUFACTURING	<p>Agricultural Production: Includes cultivation and harvest of crops, livestock, timber, oilseeds, cotton, as well as post-harvest crop activities</p>
	<p>Packaging Materials: Includes production of packaging materials such as glass and plastic bottles, aluminum cans, sanitary containers and pallets, as well as labeling services</p>
	<p>Distribution: Includes warehousing, goods movement and wholesaler networks</p>
	<p>Supporting Services: Includes marketing, finance, education programs</p>
	<p>Agricultural Machinery & Equipment: Includes the production and sales of agricultural equipment</p>
	<p>AgTech & Bioenergy: Incorporates R&D activities, chemical and seed companies, "smart" agriculture such as monitoring software, waste to energy and biofuels</p>
	<p>Water Technology: Involves irrigation, pumps, water management systems</p>

LEADING THE U.S. IN EMPLOYMENT SPECIALIZATION AND LONG-TERM GROWTH

The San Joaquin Valley region is home to one of the most prominent core agricultural manufacturing sectors in the nation. In the San Joaquin Valley, the sector grew roughly nine percent in the last decade (2002 to 2012), and ranked among the Top 15 agricultural states (let alone regions) in terms of employment levels in 2012 (Figure 3). Many leading states experienced employment cut backs over the same period.

In addition to high and growing levels of employment, the San Joaquin Valley’s concentration of employment in this sector also ranked above all of the leading agricultural manufacturing states. In 2012, the region’s employment concentration (location quotient) was 2.5, meaning the region had more than twice the number of jobs in agricultural manufacturing relative to its size compared to the national average (Figure 4). An employment concentration larger than 1.0 suggests the area is relatively specialized in that sector compared to the nation, and frequently suggests strong exports. Of the top 15 largest agricultural manufacturing states, the next most concentrated states were Indiana (2.3) and Minnesota (2.2). Although it is possible that regions within these states would demonstrate higher employment concentration than the state overall, it remains that the San Joaquin Valley exhibits comparatively higher levels of specialization.

Regional Employment is Higher than Most States

Figure 3

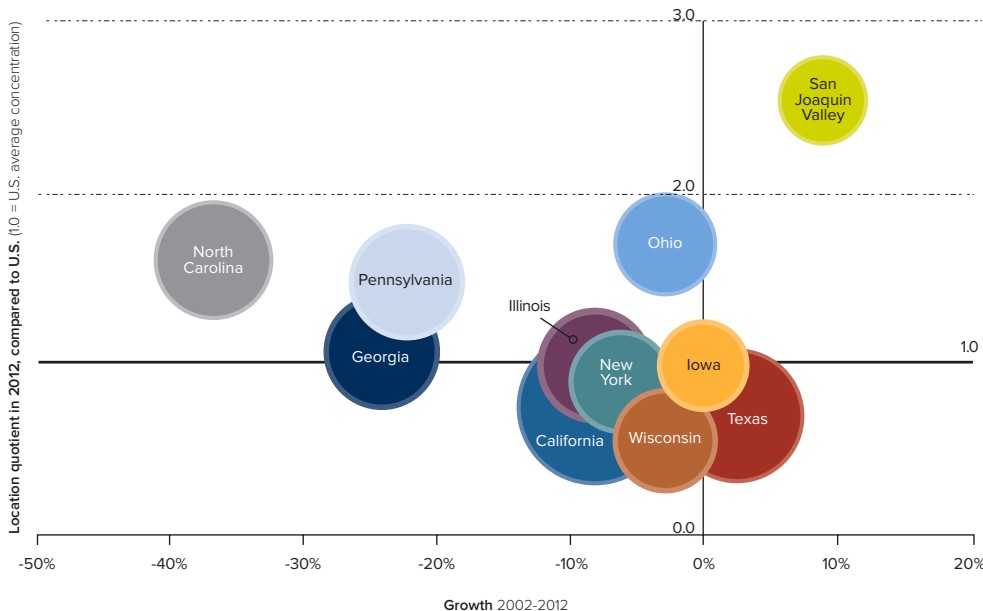
Agricultural Manufacturing Employment
Top 15 Agricultural Manufacturing States

	Employment Ranking 2012	Core Agricultural Manufacturing Employment 2012	Employment Growth 2002-2012
California	1	155,514	-8%
Texas	2	103,150	3%
North Carolina	3	86,485	-37%
Georgia	4	82,368	-24%
Pennsylvania	5	78,527	-22%
Illinois	6	77,214	-8%
Wisconsin	7	65,784	-3%
Ohio	8	63,550	-3%
New York	9	62,369	-6%
Iowa	10	51,313	0%
Arkansas	11	48,834	-19%
San Joaquin Valley Region		45,665	9%
Minnesota	12	45,656	-7%
Missouri	13	42,009	-2%
Indiana	14	36,355	9%
New Jersey	15	32,901	-12%

Figure 4

Long-Term Growth and Employment Concentration

Top 10 Leading Agricultural Manufacturing States & San Joaquin Valley



San Joaquin Valley is Comparatively Specialized

Data Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Private sector employment for NAICS 311, 3121, 3122, 3131, 3132, 3161, 3211

Analysis: Collaborative Economics

FOREIGN EXPORTS EXPANDING RAPIDLY

Foreign exports have surged in recent years and represent a key opportunity for the San Joaquin Valley. Figure 5 illustrates that core agricultural manufacturing accounted for the second highest level of exports (in inflation adjusted terms) of all industries in the region in 2012, and roughly 40 percent of all regional exports derive from the agricultural manufacturing cluster when combined with other cluster sub-sectors (e.g. agricultural production).

The San Joaquin Valley’s core agricultural manufacturing exports have grown at faster rate compared to the majority of leading agricultural manufacturing export states, in both the long and short term (Figure 6). Between 2003 and 2012, exports nearly doubled in the region (+84%), the second highest growth rate in the top ten export states, behind only New York.* In the post-recession period, the San Joaquin Valley’s exports increased 17 percent, faster than eight of the top ten export states. The San Joaquin Valley’s core agricultural manufacturing sector has gained ground on competitor regions around the United States, and ranked the equivalent of the 13th state by value of goods exported.

San Joaquin Valley Exports are Expanding Faster than Leading Export States

Figure 5
San Joaquin Valley Exports
Top 5 Regional Export Industries in 2012

Industry	Exports 2012 (Millions)	Share of Total SJV Exports 2012	Exports Growth 2010-2012
Total SJV Exports	\$18,767	100%	6%
Agriculture Production (NAICS 111, 112)	\$4,696	25%	-13%
Core Agricultural Manufacturing*	\$2,356	13%	17%
Petroleum & Coal Products (NAICS 3241)	\$2,010	11%	30%
Forestry & Fishing (NAICS 113, 114)	\$1,202	6%	5%
Oil & Gas Extraction (NAICS 2111)	\$461	2%	28%

Agricultural Manufacturing Cluster Leads Exports in the Region

*Core Agricultural Manufacturing includes NAICS 311, 3121, 3122, 3131, 3132, 3161, 3211

Figure 6
Core Agricultural Manufacturing Exports
Top 10 States and San Joaquin Valley

	Exports Growth 2010-2012	Exports Growth 2003-2012	Exports 2012 (Millions)
Ohio	19%	79%	\$3,198
Texas	18%	51%	\$4,366
San Joaquin Valley Region	17%	84%	\$2,356
California	13%	67%	\$6,726
Georgia	11%	23%	\$5,794
New York	11%	90%	\$2,877
Pennsylvania	8%	18%	\$2,948
Illinois	5%	49%	\$5,045
North Carolina	5%	22%	\$8,704
Virginia	4%	36%	\$4,534
Iowa	0%	58%	\$3,541

Data Source: Brookings Export Nation 2012, Real Dollars
Analysis: Collaborative Economics

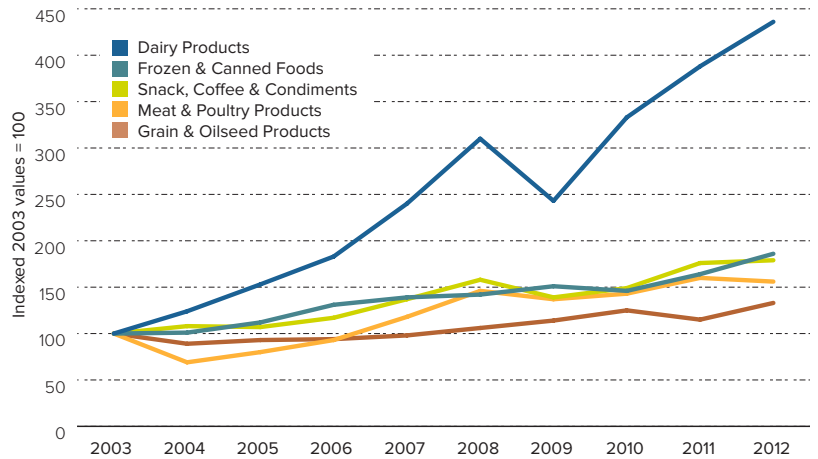
* Brookings Export Nation data reflect “origin of production”, rather than the “origin of movement” estimates. In contrast to Federal Census Bureau and International Trade Administration goods trade data, which track origin of movement, meaning exports are attributed to the locations from which goods depart the U.S., Brookings calculates origin or production export levels based on county output for each exported product.

The region's top five core agricultural manufacturing export sub-industries rose substantially in the long term. Exports of dairy products more than quadrupled since 2003, while Snacks & Condiments and Frozen & Canned foods nearly doubled (Figure 7).

Because core agricultural manufacturing employment declined in the 2010 to 2012 period and exports increased, the export value generated per worker rose during this time. Although not a true measure of labor productivity (which is the total output generated per worker) this represents a simplified proxy for a trend towards increasing productivity of the San Joaquin Valley's agricultural manufacturing workforce.

Dairy Products Lead Export Growth, though Major Sub-industries also Rise

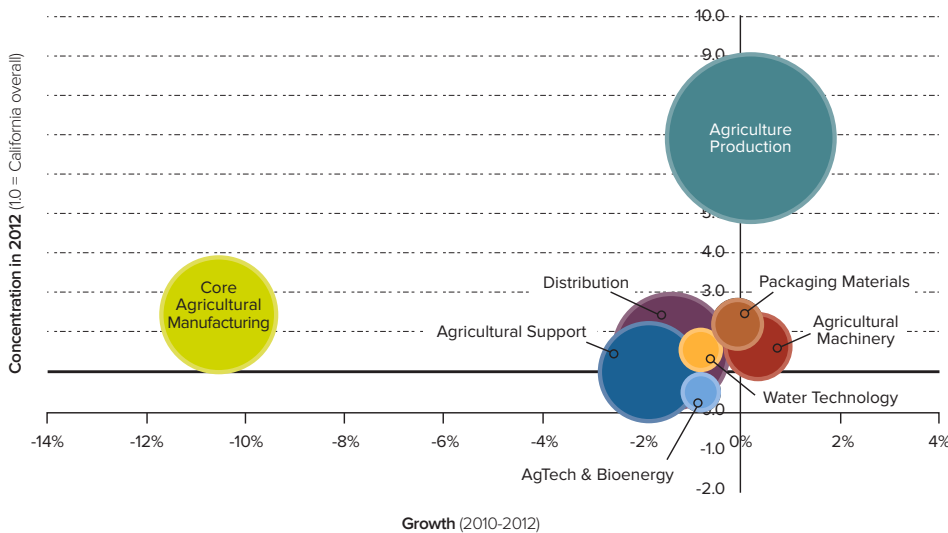
Figure 7
Exports Growth
Top 5 Agricultural Manufacturing Export Sub Industries
San Joaquin Valley Region and California, 2003-2012



Data Source: Brookings Export Nation, 2012
Analysis: Collaborative Economics

INDUSTRIES RECOVERING SLOWLY FROM THE RECESSION, AND AT DIFFERENT PACES

Figure 8
Long-Term Growth and Employment Concentration
San Joaquin Valley Region, 2010-2012



While the San Joaquin Valley has increased employment in core agricultural manufacturing in the last decade, as well as in the cluster overall, employment growth has been uneven in recent years. In the January 2010 and January 2012 period following the worst of the Great Recession, core agricultural manufacturing employment fell by nine percent (Figure 8).** Other sub-sectors were largely flat over the same period, though packaging, agricultural machinery and bioenergy increased employment.

Post-Recession Employment Growth is Uneven within the Full Cluster

Concentration is calculated as (San Joaquin Valley Cluster Emp/San Joaquin Valley Total Emp)/(California Cluster Emp/California Total Emp).
Bubble size = Employment size.
Data Source: National Establishment Time-Series Database (NETS)
Analysis: Collaborative Economics

** Several agricultural manufacturing cluster sub-sectors do not neatly correspond to federal industry classification codes, and the authors of this report leveraged the National Establishments Time Series Database (NETS), which enables analysis at the company level. Employment levels for each sub-sector differ slightly from public data estimates because NETS data reflect employment as of January of each respective year, rather than the average of the full year which incorporates seasonal growth and company hiring in the region later in the year. Anecdotal reports suggest that late 2012 saw an increase in company hiring in the region.

However, the overall decline in core agricultural manufacturing between 2010 and 2012 obscures strong growth in several prominent sub-industries within the sector, as well as different speeds of recovery. Figure 9 details the ten largest sub-industries by employment. Although nearly all industries declined in employment in the January 2010 to January 2011 period, wineries, dehydrated food, animal slaughtering and frozen fruit and vegetable manufacturing all grew between January 2011 and January 2012. These different paces of recovery within core agricultural manufacturing, along with stronger growth in sub-sectors such as agricultural machinery, suggest some restructuring is occurring within the agricultural manufacturing cluster.

Figure 9

Change in Employment

Core Agricultural Manufacturing Sub-Industries
San Joaquin Valley Region, 2002-2012

Employment Rebounding at Different Rates in Core Agricultural Manufacturing Sub-Industries

Core Agricultural Manufacturing by Sub-Industry	Employment 2012	Concentration 2012	Pre-Recession	Recession	Post-Recession	
			% Change 2002-08	% Change 2008-10	% Change 2010-11	% Change 2011-12
Fruit and Vegetable Canning (311421)	7,982	8.1	16%	-3%	-1%	0%
Wineries (312130)	5,400	3.1	-12%	0%	-17%	3%
Poultry Processing (311615)	3,602	10.2	37%	-7%	-14%	0%
Cheese Manufacturing (311513)	2,393	7.1	34%	-6%	-8%	-4%
Dried and Dehydrated Food Manufacturing (311423)	2,153	7.1	-23%	-5%	-33%	26%
Animal (except Poultry) Slaughtering (311611)	2,096	4.8	45%	3%	-4%	9%
Frozen Specialty Food Manufacturing (311412)	1,918	3.2	72%	0%	-1%	-8%
Frozen Fruit, Juice, and Vegetable Manufacturing (311411)	1,723	7.0	19%	0%	-9%	19%
Soft Drink Manufacturing (312111)	1,504	1.9	17%	2%	0%	0%
Other Snack Food Manufacturing (311919)	1,471	4.6	-6%	0%	-15%	0%

Data Source: National Establishments Time Series, reflects January 2012
Analysis: Collaborative Economics

GROWTH FROM OPENING COMPANIES, THOUGH SMALL BUSINESSES STRUGGLE

While the majority of core agricultural manufacturing companies in the region maintained a steady level of employment during the recession, many have also been cautious to expand employment in the post-recession period. From 2010 to 2012, 86 percent of companies maintained the same level of jobs.

Instead, the majority of growth between 2010 and 2012 occurred from new establishments opening in the region. Roughly 275 establishments opened for business, which exceeded the number of establishments that perished, and resulted in a net gain of over 65 establishments (Figure 10). Establishment relocations were fairly minimal; between 2010 and 2012, only three companies opted to leave the region, moving to Alabama, Arizona and the Bay Area. Over the same period, the San Joaquin Valley attracted seven establishments into the region, coming from the Bay Area, Los Angeles and Sacramento.

The fall in jobs between 2010 and 2012 largely resulted from more than 200 establishment closures (Figure 11), with roughly 80 percent of these closures occurring at establishments with less than 50 employees.

Business Closures drove Post-Recession Declines

Openings & Expansions Partially Offset Employment Losses

Establishments Rose Slightly from 2010-2012

Figure 10
Establishments Churn
San Joaquin Valley Region, 2001-2011

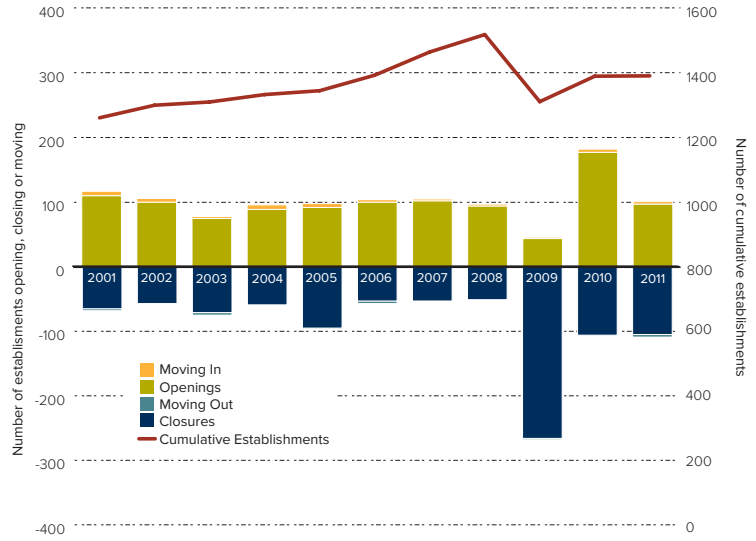
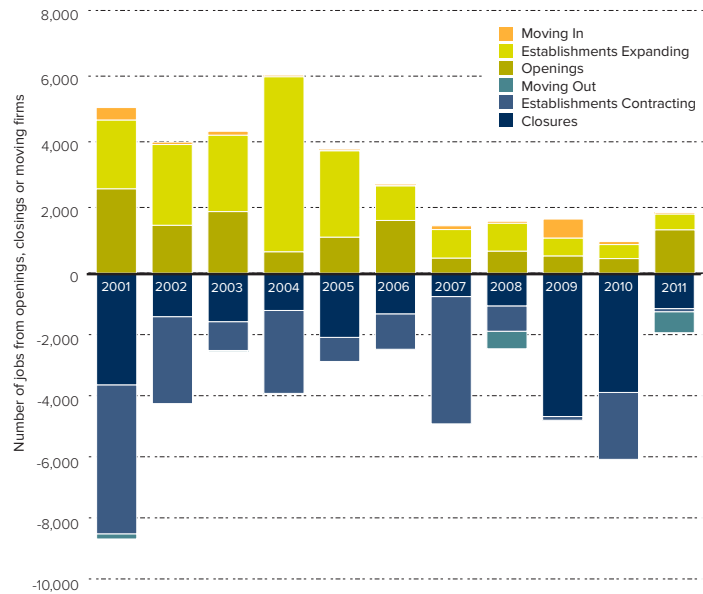


Figure 11
Employment Changes by Firms
San Joaquin Valley Region, 2001-2011



Data Source: National Establishments Time Series Data
Analysis: Collaborative Economics

AGRICULTURAL MANUFACTURING ASSETS AND ECOSYSTEM

While employment and export dynamics offer a glimpse of trends occurring in the core agricultural manufacturing cluster, it is important to understand the underlying industrial “ecosystem” in the region that influences those trends. An industrial ecosystem is comprised of interactions between a region’s economic assets (such as research & development capacity, talent, and supply chain), and its businesses, workforce & educational institutions, community organizations and public sector (Figure 12). This section focuses on agricultural manufacturing assets and interactions within the ecosystem that affect the cluster’s progress to help identify opportunities to strengthen manufacturing in the region.

An effective industrial ecosystem is one that promotes growth, innovation and competitiveness of businesses within the region, ultimately resulting in more jobs in the cluster and a more resilient regional economy. Coordination and collaboration between businesses, the education system and community and public partners, as well as alignment of resources and policies can help to achieve these aims. A well-functioning ecosystem fosters several major business environment conditions, such as the following:

- Workforce skills match industry needs;
- Local workers have access to training and education;
- New technologies and improved processes are developed and deployed in the region;
- Access to financial capital exists to start or expand business;
- Businesses are able to source the majority of their needed components and materials from within the region;
- Roads, railways, water systems, ports, the electrical grid, broadband networks, and other infrastructure are adequate to enable companies to conduct business and grow; and
- Public policies encourage or are neutral towards cluster growth.

The following sections offer snapshots of the San Joaquin Valley’s progress along each of these conditions, to advance conversation about opportunities for improvement in the region.

WORKFORCE & TRAINING

The local labor force is a crucial component for the health of an industry cluster. Experienced, skilled workers bring knowledge and capabilities that increase the efficiency of operations. Therefore, it is important to develop a pipeline of trained workers to expand operations, as well as replace retiring workers, to enable industry growth in the region. On the flip side, high levels of turnover, attrition, and limited numbers of incoming workers with appropriate skills can represent key challenges for growth. The San Joaquin Valley has a range of occupations involved in the agricultural manufacturing cluster, which can provide a glimpse of future workforce opportunities. These occupations encompass many income levels, and educational and experiential requirements (Figure 13).

Figure 12

Agricultural Manufacturing Ecosystem



Snapshot of the Agricultural Manufacturing Ecosystem

Figure 13

Example Occupations in Agricultural Manufacturing Cluster

	Occupation Title	Regional Average Annual Wage (Q1 2013)	Regional Employment (May 2012)	Projected Growth (2010-20)	General Education	On-the-job Training Required
Processing & Packaging	Industrial Production Managers	\$90,363	1,430	17%	●●●	▶▶▶▶
	First-Line Supervisors of Production and Operating Workers	\$57,812	4,520	9%	●●●	▶▶▶▶
	Industrial Machinery Mechanics	\$50,820	4,050	31%	●	▶▶▶
	Separating, Filtering, Machine Setters, Operators, and Tenders	\$41,845	910	20%	●	▶▶
	Machinists	\$40,017	1,400	14%	●	▶▶▶
	Inspectors, Testers, Sorters, Samplers, and Weighers	\$36,220	3,710	13%	●	▶▶
	Packaging and Filling Machine Operators and Tenders	\$32,180	8,640	9%	●	▶▶
	Maintenance Workers, Machinery	\$37,886	940	13%	●	▶▶
	Food Batchmakers	\$31,969	2,290	8%	●	▶
	Team Assemblers	\$28,529	3,280	21%	●	▶▶
	Bakers	\$26,715	1,290	13%	●	▶▶▶
	Packers and Packagers, Hand	\$21,849	10,720	18%	●	▶
	Production	Farmers, Ranchers, and Other Agricultural Managers	\$93,789	150	-3%	●
Buyers and Purchasing Agents, Farm Products		\$69,875	60	25%	●	▶▶▶
First-Line Supervisors of Helpers, Laborers, and Material Movers		\$48,263	2,290	33%	●	▶▶▶▶
Farmworkers, Farm and Ranch Animals		\$25,352	350	1%	●	∅
Agricultural Equipment Operators		\$23,096	1,180	8%	●●	▶▶▶▶
Farmworkers and Laborers, Crop, Nursery, and Greenhouse		\$18,737	93,980	10%	●	∅
R&D	Food Scientists and Technologists	\$67,158	300	10%	●●●	∅
	Soil and Plant Scientists	\$67,288	160	16%	●●●	∅
	Chemists	\$74,360	380	13%	●●●	∅
	Agricultural and Food Science Technicians	\$34,400	530	18%	●●	∅
Distribution	Transportation, Storage, and Distribution Managers	\$85,357	1,030	19%	●	▶▶▶▶▶
	Logisticians	\$74,717	740	30%	●●●	▶▶▶▶
	Network and Computer Systems Administrators	\$67,365	1,500	32%	●●●	∅
	Computer Support Specialists	\$49,279	2,780	19%	●●	▶▶▶▶
	Bus and Truck Mechanics and Diesel Engine Specialists	\$43,156	2,290	18%	●	▶▶▶
	Computer Operators	\$40,245	350	-3%	●	▶▶
	Truck Drivers, Heavy and Tractor-Trailer	\$39,630	22,470	23%	●	▶ + Experience
	Shipping, Receiving, and Traffic Clerks	\$31,520	6,000	10%	●	▶
Support	Marketing Managers	\$129,861	560	22%	●●●	▶▶▶▶
	Sales Managers	\$103,879	3,060	17%	●●●	▶▶▶▶
	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	\$66,355	7,090	18%	●●	▶▶
	Farm Equipment Mechanics	\$39,132	1,230	15%	●	▶▶▶
	Veterinary Technologists and Technicians	\$32,117	510	50%	●●	∅
	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	\$27,131	1,590	17%	●●●	▶

General Education

- HS Diploma or less
- Post-HS Training or Associate's Degree
- Bachelor's Degree or higher

On-the-job Training Required

- ∅ None
- ▶ Short Term
- ▶▶ Moderate
- ▶▶▶ Long-term
- ▶▶▶▶ 1 to 5 years
- ▶▶▶▶▶ More than 5 years

Broad Range of Occupations in Agricultural Manufacturing Cluster

Note: Regional data is for Metropolitan Statistical Areas within the region.
 Data Source: California Employment Development Department, Labor Market Information Department, U.S. Bureau of Labor Statistics, and O*NET Online
 Analysis: Collaborative Economics

San Joaquin Valley’s core agricultural manufacturing sector (processing and packaging), requires experienced and highly skilled workers to operate, maintain and supervise industrial machinery. Although many of these roles do not require college education, processing and packaging professions do entail substantial on-the-job and/or experiential training, especially for machine operators and other electrical, pneumatic and hydraulic equipment-related occupations. Many distribution-related occupations also require substantial post-education training.

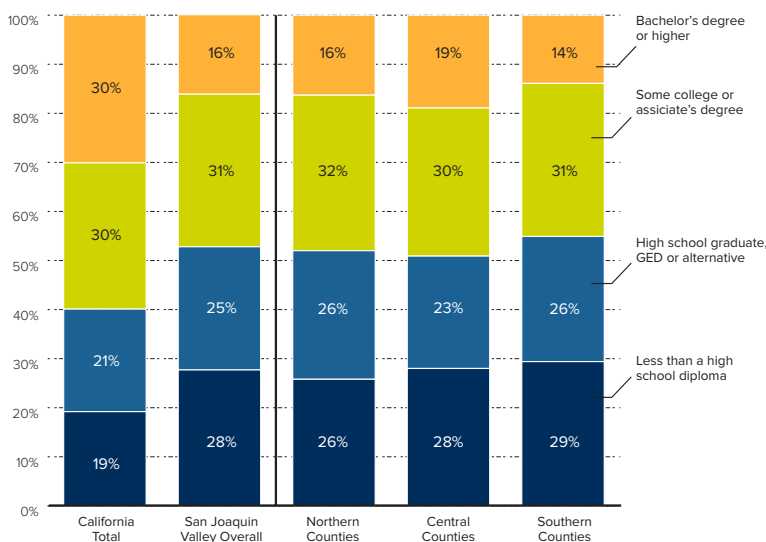
Because of the cluster’s emphasis on experienced labor, a key challenge facing the agricultural manufacturing cluster is replacing its retiring workforce and meeting future growth demands. Regional growth projections to 2020 for core agricultural manufacturing occupations suggest that roughly 60 percent of hiring will be to replace retirees.⁶ Coupled with expanding operations, many companies in the region are finding that there is a shortage of workers available to fill high-skill positions, which is driving up wages. An engineering manager of an agricultural manufacturing cluster company in the San Joaquin Valley explained that because competition is high for skilled labor in the San Joaquin Valley right now, labor costs are rising, which is encouraging workers to move around between industries. This presents a workforce challenge because by transferring between industries and broadening their experiences, these workers are not amassing as deep of knowledge in particular industries as their retiring counterparts, though they are also comparatively more expensive to employ.

Although many of these high-skill positions require fewer years of formal education than a bachelor’s degree, some companies are finding that the technical skills and work expectations of prospective entry-level workers (gathered from vocational training at the high school and post-high school training levels) are below necessary thresholds to work in their facilities. Though the majority of residents in the San Joaquin Valley possess at least a high school diploma (Figure 14), this suggests that there may be a qualitative gap in technical and vocational skills training and student enrollment.

Educational institutions in the San Joaquin Valley are already working with industry to address these skill challenges. For example, as a part of the Central California Community Colleges Committed to Change (C6) initiative, a consortium of community colleges including Merced College, College of the Sequoias, West Hills Colleges, Reedley College along with several others in the region collaborated with food manufacturers across the Valley to develop Skill Standards for Maintenance Mechanics, which benchmarked necessary skills for this occupation in order to align training curricula around industry needs.⁷ Central California community colleges have also aligned around the statewide “Doing What Matters” campaign, and have been working to enhance training around entrepreneurship, manufacturing and agricultural technology. In addition, some high schools in the region, such as Ceres High School have implemented a technical pathway, in which students study a wide range of manufacturing vocational concepts, including computer aided design, robotics and electricity.⁸

A range of career technical and vocational programs also exist throughout the region, including programs at Merced College and College of the Sequoias.⁹ Despite these efforts, talent challenges remain and opportunities exist for additional collaboration between education, business and community partners on workforce issues.

Figure 14
Educational Attainment
 San Joaquin Valley Region, 2011



While the majority of residents possess a high school diploma, there is a gap in technical and vocational skills

Data Source: U.S. Census Bureau, American Community Survey
 Analysis: Collaborative Economics

RESEARCH, DEVELOPMENT & CAPITAL

Companies in the San Joaquin Valley are both creating technologies and products, as well as finding innovative ways to apply them to improve competitiveness, and resource efficiency. Research & development in the region involves a range of private organizations and university institutions. Many large companies in the region, such as Hilmar Cheese and EJ Gallo, have in-house research laboratories and process-related engineering departments to internally develop new products and increase efficiency of production. There are also strong research efforts occurring at colleges and universities in the area including at the California Agriculture Research Institute (CATI), Jordan College of Agriculture and the University Center for Advancing Manufacturing (UCAM) within Fresno State and the University of California, Merced. The Water and Energy Technology Center and Center for Irrigation Technology at Fresno State are other development-oriented assets for cluster sub-sectors. Strong research and

development resources also exist slightly farther north up the Central Valley of California such as at University of California - Davis, Chico State and the industry-led Blue Diamond Innovation Center.

Start-up company investment levels offer one lens to view a cluster's technology development activity. The San Joaquin Valley outperforms the majority of U.S. states in terms of securing investment in start-up companies in agricultural technology, which includes bioenergy, water technology, "smart" agricultural technology (such as monitoring and sensor products), agriculture-related chemicals and agricultural product distribution (Figure 15). The majority of the Valley's investment in the cluster has been in Bioenergy, with roughly \$191 million from 2007 to 2013. However, San Joaquin Valley accounts for only seven percent of total investment in California start-up companies in this industry, lagging the Bay Area, San Diego Region, and Greater Los Angeles.

Agricultural Manufacturing Cluster Investment in San Joaquin Valley is Stronger than Many States

Figure 15

Agricultural Technology Start-Up Investment Levels

Top 10 Highest States and San Joaquin Valley, 2007-2013

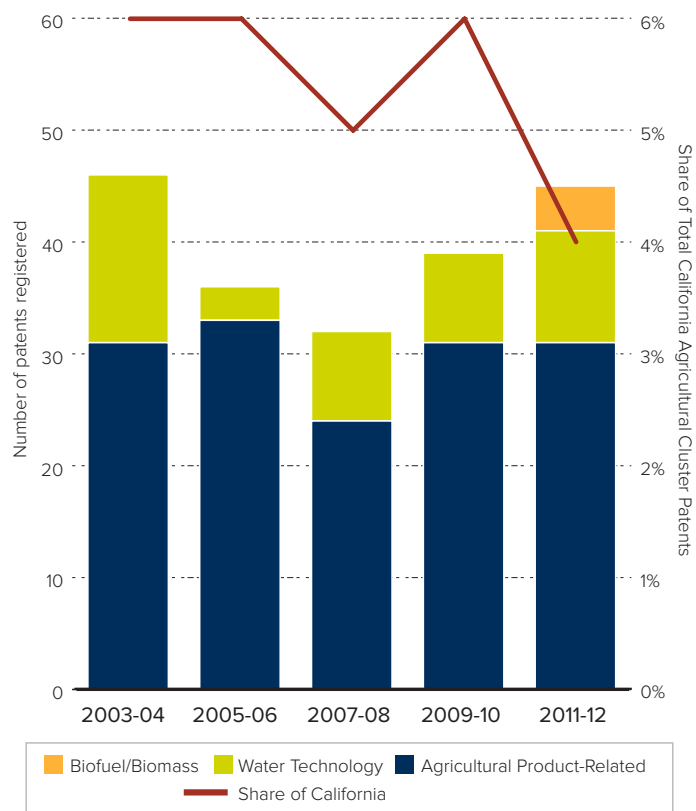
State	Investment Levels (Millions)	Investment deals
California Overall	\$2,990	317
Colorado	\$484	27
San Joaquin Valley	\$217	18
New York	\$161	30
Illinois	\$94	19
Washington	\$73	14
Ohio	\$56	12
Maryland	\$47	16
Massachusetts	\$47	16
Michigan	\$44	16
New Mexico	\$42	9

Deals Types include: VC, Corporate-Involved VC, Grants and Debt, excludes Private Equity
 Companies Sectors include: Bioenergy, Water Technology, Smart Agriculture Technology, Agriculture-related Chemical and Agricultural Distribution
 Data Source: CB Insights
 Analysis: Collaborative Economics

Figure 16

Agricultural Cluster Patents

Registration Levels and Share of California San Joaquin Valley, 2003-2012



Data Source: US Patent and Trade Office Custom Data Extracts, 1790 Analytics
 Analysis: Collaborative Economics

Patents represent intellectual property developed within the region that can be applied to create new value and improve efficiency. Patenting activity in San Joaquin Valley's agricultural cluster*** has increased over the past five years, though levels remained on par with a decade prior (Figure 16). Agricultural product patents increased 30 percent between the 2007-2008 period to 2011-2012, with water technology patents also rising 25 percent. Biofuels and biomass emerged as an area of successful patent registration for the first time in 2011. These patents were registered to a range of companies, inventors and sub-industries. For example, 23 patents were registered by independent inventors in the 2011-2012 period, along with companies such as Dow Agrosciences' (Bakersfield), Exact Corp (Modesto, maker of nut harvesting equipment) and Sun-Maid Growers of California (Kingsburg), and academic institutions such as Fresno State. Though increasing, San Joaquin Valley's patent registrations represent a fairly small share of agriculture-related patenting activity in California (4% in 2011-2012).

While many companies (particularly large companies in the Valley) are investing in innovation, the San Joaquin Valley has lower concentration of employment in emerging technology sectors such as precision agricultural technology and bioenergy than average in California, given the size of the regional economy, even though many of the target customers for those technologies are located in inland counties of California, including the San Joaquin Valley. Given strong research activities in the region, there is an opportunity to source a larger part of the value chain within the region with additional commercialization and capital.

CASE STUDY

Hilmar Cheese Company, Inc. – Hilmar, Turlock

Hilmar Cheese Company, Inc. is one of the leading natural cheese, whey protein and lactose product manufacturers in the United States, supplying roughly 20 percent of the natural American cheese market. The company employed roughly 860 people in the San Joaquin Valley in early 2014, and has plans to open a new plant in Turlock with an additional 40 workers.

Investing in research and development and process improvements is one of the company's most important growth strategies, according to Denise Skidmore, Director of Public Relations and Education. The company completed a new LEED platinum certified Headquarters and Innovation Center in 2013. The Innovation Center features a food applications center and pilot plant. The facility also has a Research and Development Laboratory with PhD-level researchers, to ensure the company continues to develop and refine high quality products.

In addition, Hilmar has adopted resource efficient processes and pursues sustainability measures. For example, Hilmar installed a water reclamation project that treats, recycles and irrigates with reclaimed water from dairy product manufacturing, has a biogas capture system to fuel boilers, and has high-efficiency motors in its facilities.

CASE STUDY

JBT FoodTech - Madera

JBT Corporation operates its FoodTech plant in the San Joaquin Valley. At this plant, JBT fabricates, services and supports integration of custom industrial food manufacturing sterilization equipment and parts. As of early 2014, the plant employed 50 full-time fabricators and roughly doubles its workforce with part-time help during high demand seasons. Pat Gordon, HR Manager, noted "we've seen high demand all year for the last year," and the company plans to hire for more than 20 new jobs by the end of 2014, its largest expansion in many years.

JBT has developed a dedicated, skilled workforce; the average JBT fabricator has 25 years of experience at the plant and some staff have been with the company for up to 45 years. This deep reservoir of knowledge is an asset to the company at present, but also represents a challenge going forward as the aging workforce retires.

JBT is working on a number of internal and community initiatives to bolster its incoming workforce pipeline. Internally, for example, the facility is developing succession plans for its full-time staff, and documenting skills of specialized personnel to proactively address potential knowledge gaps. In addition, JBT supports initiatives championed by Madera COMPACT, a public-private effort to improve education and quality of life in Madera County, such as to improve mathematics outcomes for K-12 students. Gordon notes, "Schools, districts, and community colleges are making great efforts, but there remains a gap in technical trade schools in the area."

*** While the agricultural cluster includes a wide range of value chain activities, this analysis of patent registrations in San Joaquin Valley focuses on agricultural products, defined to include food product and processing innovations, harvesting equipment, seeds and fertilizers, as well as water and biofuels/biomass technology.

SUPPLY CHAIN

While the San Joaquin Valley’s agricultural manufacturing supply chain is another asset for the cluster, there is also significant opportunity for greater integration and insourcing. More than 30,700 business establishments were involved in the agricultural manufacturing cluster in 2012, with nearly 1,400 in core agricultural manufacturing. While there are a high number of supply chain companies within the cluster, research conducted by Dr. Antonio Avalos of Fresno State suggested that only 15 percent of the value of inputs for agricultural packaging and processing activities for the San Joaquin Valley were sourced from within the region in 2010,¹⁰ the lowest of all agricultural value chain sub-sectors. Although agricultural production is very specialized in the region, accounting for 12,600 establishments and 33 percent of all of California’s agricultural producers, other value chain elements are less robust. For example, suppliers of agricultural and industrial equipment account for only roughly 10% of California’s equipment establishments.

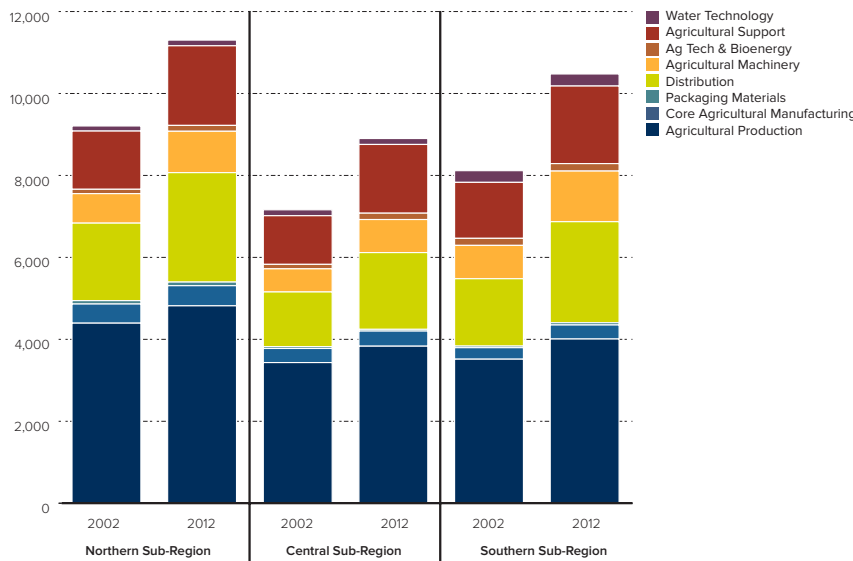
Companies have been capitalizing on the opportunity to supply the agricultural manufacturing value chain. The number of agricultural machinery establishments (including related industrial machinery) grew fastest of any sub-sector in the region between 2002 and 2012, rising by more than 45 percent. This trend was led by the Southern San Joaquin Valley, including Kern, Kings and Tulare counties, where the number of agricultural

machinery establishments increased by more than 50 percent between 2002 and 2012, growing to more than 1,230 facilities (Figure 17). Distribution companies also saw strong growth in the Southern sub-region over the same period rising to 2,460 establishments.

The Northern San Joaquin Valley, including San Joaquin, Stanislaus and Merced counties, has consistently led the region with the highest number of core agricultural manufacturing businesses and jobs, accounting for nearly 500 establishments and roughly 21,100 core jobs in 2012. Though the number of establishments in core agricultural manufacturing increased by 5 percent between 2002 and 2012, employment in core agricultural manufacturing declined by 19 percent over the same period; this is a substantial drop in employment compared to the other two sub-regions. In contrast, other sub-regional supporting segments expanded, led by the agricultural support, machinery and distribution sub-sectors (adding 37%, 40% and 43% more establishments, respectively). These shifts suggest businesses and entrepreneurs are identifying opportunities to participate in the agricultural manufacturing cluster in different ways as market and business conditions have changed within the Northern sub-region.

Fresno and Madera counties, forming the Central San Joaquin Valley, experienced the second highest establishment growth of the three sub-regions, on strong expansion in the agricultural machinery and

Figure 17
Cluster Establishment Growth by Sub-Region
 San Joaquin Valley, 2002 and 2012



Supply Chain Strengths Vary Across the Region

Data Source: National Establishments Time Series Database
 Analysis: Collaborative Economics

“smart” agriculture technology (including bioenergy) sub-sectors (adding 43% and 42% more establishments, respectively). Though the Central sub-region is home to the highest concentration of agricultural production establishments in the San Joaquin Valley (with four times as many production locations than average in California, given the size of the economy) and extremely robust vegetables, fruit & nuts sub-industries, the number of packaging materials establishments actually declined 7 percent from 2002 to 2012.

Working to better connect the region’s networks are a multitude of intra-industry collaborations and public-private collaborations occurring across the supply chain. For example, in the Northern San Joaquin Valley, the Manufacturer’s Council of the Central Valley specializes in policy and technical assistance on issues affecting all manufacturers, such as water, air quality and regulation. The region-wide Regional Industry Clusters Initiative championed by the California Partnership for the San Joaquin Valley resulted in organizing businesses and community partners in the agricultural production, renewable energy and water technology sub-sectors.¹¹ Similarly, the CalValleyTech iHub, offers a state-designated resource for the region on agricultural manufacturing in the Central San Joaquin Valley.

Although these collaborations exist, a key challenge in the San Joaquin Valley is sustaining cluster organization efforts in the long term,¹² and aligning related efforts. The geographic spread of the region, limited financial and staffing capacity, and employer fatigue with many collaborative efforts represent hurdles for long-term initiatives.

CASE STUDY

Betts Company - Fresno

Betts Company is a family-owned manufacturing and distribution business, operating in California since 1868. The company fabricates and distributes a range of products, including parts for heavy duty vehicles and its signature high-tensile springs and component parts for industrial, transportation, commercial and energy applications. In 2008, the Company opted to move its headquarters and its spring manufacturing operations from San Leandro (East Bay) to Fresno. President Mike Betts notes, “Our decision to move was a good one; we are operating more efficiently than we ever have.”

While positive overall, Betts Company’s relocation experience to the Central Valley was challenging from several perspectives, creating opportunity to support more effective recruiting, relocation and retention of business. Environmental regulations in the Central Valley are particularly difficult to navigate for manufacturers. Betts Company would have benefitted from stronger consult provided by local and state authorities in defining its requirements. Cost of electric power is substantially more expensive in Fresno than elsewhere in the Central Valley, creating a competitive disadvantage. Betts Company was also very disappointed by the recent decision to eliminate state income tax credits for enterprise zone employers, a long standing tax incentive for business retention and growth in California.

The Company has made an effort to connect with local suppliers when possible, believing in the value of partnering within the community. For example, Betts has connected with local financial, legal, human resources, insurance, scientific and estate planning service providers to meet its business requirements. However, raw material, specialty manufacturing equipment and related repair parts/service personnel have been difficult to procure from within the region. In particular, the Betts Company’s engineering team looked globally to find best available technology for the significant capital equipment upgrades it has made since moving to Fresno.

Betts Company has been involved in a number of efforts to improve the manufacturing environment in both California overall and within the Fresno region. At the state level, Betts is participating in the Advancing Manufacturing workgroup which spun out of the California Summit, hosted by the California Stewardship Network and California Forward. The Advancing Manufacturing effort focuses on improving and synchronizing communication about manufacturing in California, harmonizing state-level regulations and improving the overall health and connectivity of the manufacturing sector. In Fresno, Betts is involved in the Fresno Business Council’s efforts to strengthen vocational education by developing stronger employer engagement, mapping and coordinating efforts across school districts and implementing German-style apprenticeship system. Betts has partnered extensively with local educators, including Clovis and Fresno Unified School Districts, “CART” Center for Advanced Research & Technology, California State University Fresno, Fresno City College and Reedley Community College, to strengthen the connection between business and academia to align and develop the pipeline of skilled technical and managerial resources joining the Central Valley workforce.

INFRASTRUCTURE & NATURAL RESOURCES

Infrastructure underlies all industries' ability to develop, produce and distribute goods, and has potential to facilitate or inhibit cluster expansion. When a region chooses to make strategic investments in transportation infrastructure, water distribution and treatment systems, energy grids/pipelines, broadband networks, or other infrastructure it can create competitive advantages for its local industries.

Transportation infrastructure planning involves a sophisticated mix of demand, cost and socio-political considerations, and the San Joaquin Valley has supported infrastructure planning efforts such as the San Joaquin Valley Interregional Goods Movement Plan to grapple with these issues. The Goods Movement Plan identified the region's top 50 transportation infrastructure upgrade and development priorities through extensive research, projections and community discussions.¹³ The priorities focused around several themes, including widening and upgrading highways, supporting stronger East and West linkages, enhancing local access to roadways, reinforcing and expanding freight oriented rail, air and highway capacity and strategic projects, such as electrification of truck stops. The Goods Movement Plan offers an example for how planned infrastructure upgrades could potentially be implemented to help agricultural manufacturers in the region better connect to suppliers, customers and the workforce.

Enhancing high-speed broadband internet access has also been an area of focus within the San Joaquin

Valley in recent years, which has direct ties to the agricultural manufacturing cluster, especially for deployment of "smart" agricultural technology. Reliable and geographically inclusive internet service, along with high rates of use, can help businesses to realize efficiencies and spur growth; in agriculture, broadband enables use of monitoring and control technology to increase resource efficiency and crop yield. While broadband access rates have increased to roughly 90 percent in the San Joaquin Valley,¹⁴ various initiatives continue to work towards increasing access and utilization across underserved communities, and in various industries including health, education and agriculture. For example, in 2013, the San Joaquin Valley Broadband Consortium, a work group of the California Partnership for the San Joaquin Valley began working with the City of Fresno and the local Strong Cities, Strong Communities group to identify and launch a pilot agricultural production site that would leverage broadband to promote water-efficient farming and enhance crop yield.¹⁵

Natural resources present an important and uncertain element of the future of the San Joaquin Valley's industrial ecosystem. The long term sustainability of water, for example, is unknown, and will have a direct effect on the agricultural manufacturing cluster. While companies are adapting to natural resource challenges by innovating new products in water management, irrigation and monitoring, and adapting their operations to incorporate water reuse systems, there remains substantial uncertainty around how natural resources will affect the cluster moving forward.

CASE STUDY

E & J Gallo Winery – Modesto, Livingston, Fresno and Others

E & J Gallo Winery is a Fortune 500 company^a and the 35th largest food manufacturer in the world by annual sales.^b The company employs more than 2,200 people in the San Joaquin Valley across its headquarters, manufacturing facilities, glass plant and wineries.

E&J Gallo has a deeply-rooted culture of innovation and continuous improvement, which is apparent in its environmental practices. The company is a leader in sustainability practices and was the first winery to receive ISO 14001 certification, which is awarded to companies implementing practices to reduce their environmental impact. The company has launched a number of creative sustainability initiatives to naturally control pests, support wildlife and preserve habitat, such as installing nesting boxes for birds of prey at its wineries to naturally control rodents and investing in restoration of wetland/riparian habitat in the San Joaquin Valley.^c In addition, E&J Gallo has invested in enhancing energy and water efficiency, such as through a cogeneration project in Livingston which captures waste heat and anaerobic digestion of waste biomass to generate electricity.^d

a. Forbes. "E&J Gallo". <http://www.forbes.com/companies/ej-gallo-winery/>

b. "Food Processing's Top 100." 2013. <http://www.foodprocessing.com/top100/top-100-2013/>

c. "E&J Gallo Winery's Commitment to Sustainability". <http://ejgallo.com/PDFs/Environmentalbrochure.pdf>

d. "Project Release: E&J Gallo Winery in Livingston, California." PEECO, Inc. Q3 2013. <http://www.peecoenergy.com/currentnews.asp>

CONCLUSIONS

The San Joaquin Valley is home to a specialized, innovative and diverse agricultural manufacturing cluster. Though employment growth declined between 2010 and 2012, the industrial ecosystem underpinning the cluster in the region is strong in many ways. High levels of research, ample fora for industry collaboration, and industry-leading adoption of water and energy efficient processes all represent strengths that have helped to position the region as a national leader.

However, there are also weaknesses within the industrial ecosystem, which must be overcome to increase growth in agricultural manufacturing and capture a broader part of the value chain within the San Joaquin Valley. First, there is a clear need in the region to develop a larger talent pool of skilled manufacturing workers. Next, although there is a high number of raw agricultural producers in the agricultural

manufacturing cluster supply chain in the region, the ability for companies to source industrial supplies, such as machines, parts and associated services, is limited. In addition, commercialization of “smart” agricultural technologies is occurring on the California coast, rather than inland near agriculture production, despite the region’s research assets. Last, investment in infrastructure remains an ongoing requirement for industry expansion in the future.

All of these ecosystem weaknesses affect the health of the cluster as a whole, and for the most part cannot be addressed by a single company acting alone. Moving forward, there will be a need for industry and community partners to collaborate to identify and implement solutions on these issues.

APPENDIX Agricultural Manufacturing Cluster - NAICS Code Definitions

Core Agricultural Manufacturing

31111	Dog and Cat Food Manufacturing
31119	Other Animal Food Manufacturing
31121	Flour Milling
31122	Rice Milling
31123	Malt Manufacturing
311221	Wet Corn Milling
311222	Soybean Processing
311223	Other Oilseed Processing
311225	Fats and Oils Refining and Blending
311230	Breakfast Cereal Manufacturing
31131	Sugarcane Mills
31132	Cane Sugar Refining
31133	Beet Sugar Manufacturing
311320	Chocolate and Confectionery Manufacturing from Cacao Beans
311330	Confectionery Manufacturing from Purchased Chocolate
311340	Nonchocolate Confectionery Manufacturing
31141	Frozen Fruit, Juice, and Vegetable Manufacturing
31142	Frozen Specialty Food Manufacturing
311421	Fruit and Vegetable Canning
311422	Specialty Canning
311423	Dried and Dehydrated Food Manufacturing
31151	Fluid Milk Manufacturing
31152	Creamery Butter Manufacturing
31153	Cheese Manufacturing
31154	Dry, Condensed, and Evaporated Dairy Product Manufacturing
311520	Ice Cream and Frozen Dessert Manufacturing
31161	Animal (except Poultry) Slaughtering
31162	Meat Processed from Carcasses
31163	Rendering and Meat Byproduct Processing
31165	Poultry Processing
31171	Seafood Canning
31172	Fresh and Frozen Seafood Processing
31181	Retail Bakeries
31182	Commercial Bakeries
31183	Frozen Cakes, Pies, and Other Pastries Manufacturing
311821	Cookie and Cracker Manufacturing
311822	Flour Mixes and Dough Manufacturing from Purchased Flour
311823	Dry Pasta Manufacturing
311830	Tortilla Manufacturing
31191	Roasted Nuts and Peanut Butter Manufacturing
311919	Other Snack Food Manufacturing
311920	Coffee and Tea Manufacturing
311930	Flavoring Syrup and Concentrate Manufacturing
311941	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing

311942	Spice and Extract Manufacturing
311991	Perishable Prepared Food Manufacturing
311999	All Other Miscellaneous Food Manufacturing
312111	Soft Drink Manufacturing
312112	Bottled Water Manufacturing
312113	Ice Manufacturing
312120	Breweries
312130	Wineries
312140	Distilleries
312210	Tobacco Stemming and Redrying
312221	Cigarette Manufacturing
312229	Other Tobacco Product Manufacturing
313111	Yarn Spinning Mills
313112	Yarn Texturizing, Throwing, and Twisting Mills
313113	Thread Mills
313210	Broadwoven Fabric Mills
313221	Narrow Fabric Mills
313230	Nonwoven Fabric Mills
313241	Weft Knit Fabric Mills
316110	Leather and Hide Tanning and Finishing
321113	Sawmills

Agriculture 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, field and seed production
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 Noncitrus Fruit Farming
111411	Mushroom Production

11419	Other Food Crops Grown Under Cover
11421	Nursery and Tree Production
11422	Floriculture Production
11910	Tobacco Farming
11920	Cotton Farming
11930	Sugarcane Farming
11940	Hay Farming
11991	Sugar Beet Farming
11992	Peanut Farming
11998	All Other Miscellaneous Crop Farming
12111	Beef Cattle Ranching and Farming
12112	Cattle Feedlots
12120	Dairy Cattle and Milk Production
12130	Dual-Purpose Cattle Ranching and Farming
12210	Hog and Pig Farming
12310	Chicken Egg Production
12320	Broilers and Other Meat Type Chicken Production
12330	Turkey Production
12340	Poultry Hatcheries
12390	Other Poultry Production
12410	Sheep Farming
12420	Goat Farming
12511	Finfish Farming and Fish Hatcheries
12512	Shellfish Farming
12519	Other Animal Aquaculture
12910	Apiculture
12920	Horses and Other Equine Production
12930	Fur-Bearing Animal and Rabbit Production
12990	All Other Animal Production
15115	Farm Labor Contractors and Crew Leaders
15116	Farm Management Services
15210	Support Activities for Animal Production
15310	Support Activities for Forestry
15112	Soil Preparation, Planting, and Cultivating
15113	Crop Harvesting, Primarily by Machine
13110	Timber Tract Operations
13210	Forest Nurseries and Gathering of Forest Products
13310	Logging
14111	Finfish Fishing
14112	Shellfish Fishing
14119	Other Marine Fishing
14210	Hunting and Trapping
15111	Cotton Ginning
15114	Postharvest Crop Activities (except Cotton Ginning)

Packaging Materials

561910	Packaging and Labeling Services
322215	Nonfolding Sanitary Food Container Manufacturing
321920	Wood Container and Pallet Manufacturing
322211	Corrugated and Solid Fiber Box Manufacturing
322212	Folding Paperboard Box Manufacturing
322223	Plastics, Foil, and Coated Paper Bag Manufacturing
322224	Uncoated Paper and Multiwall Bag Manufacturing
322225	Laminated Aluminum Foil Manufacturing for Flexible Packaging Uses
322226	Surface-Coated Paperboard Manufacturing
322291	Sanitary Paper Product Manufacturing
339991	Gasket, Packing, and Sealing Device Manufacturing
326160	Plastics Bottle Manufacturing
327213	Glass Container Manufacturing
332431	Metal Can Manufacturing

Distribution

481112	Scheduled Freight Air Transportation
481212	Nonscheduled Chartered Freight Air Transportation
482111	Line-Haul Railroads
483211	Inland Water Freight Transportation
484110	General Freight Trucking, Local
484121	General Freight Trucking, Long-Distance, Truckload
484122	General Freight Trucking, Long-Distance, Less Than Truckload
484220	Specialized Freight (except Used Goods) Trucking, Local
484230	Specialized Freight (except Used Goods) Trucking, Long-Distance
488111	Air Traffic Control
488119	Other Airport Operations
488190	Other Support Activities for Air Transportation
488210	Support Activities for Rail Transportation
488310	Port and Harbor Operations
488320	Marine Cargo Handling
488330	Navigational Services to Shipping
488390	Other Support Activities for Water Transportation
488510	Freight Transportation Arrangement
488991	Packing and Crating
493120	Refrigerated Warehousing and Storage
493130	Farm Product Warehousing and Storage
493190	Other Warehousing and Storage
541614	Process, Physical Distribution, and Logistics Consulting Services
424410	General Line Grocery Merchant Wholesalers
424420	Packaged Frozen Food Merchant Wholesalers

424430	Dairy Product (except Dried or Canned) Merchant Wholesalers
424440	Poultry and Poultry Product Merchant Wholesalers
424450	Confectionery Merchant Wholesalers
424460	Fish and Seafood Merchant Wholesalers
424470	Meat and Meat Product Merchant Wholesalers
424480	Fresh Fruit and Vegetable Merchant Wholesalers
424490	Other Grocery and Related Products Merchant Wholesalers
424510	Grain and Field Bean Merchant Wholesalers
424520	Livestock Merchant Wholesalers
424590	Other Farm Product Raw Material Merchant Wholesalers
424810	Beer and Ale Merchant Wholesalers
424820	Wine and Distilled Alcoholic Beverage Merchant Wholesalers
424910	Farm Supplies Merchant Wholesalers
424930	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers
423860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers

Agricultural Machinery

333294	Food Product Machinery Manufacturing
333111	Farm Machinery and Equipment Manufacturing
333924	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing
423820	Farm and Garden Machinery and Equipment Merchant Wholesalers
333993	Packaging Machinery Manufacturing
326291	Rubber Product Manufacturing for Mechanical Use
332311	Prefabricated Metal Building and Component Manufacturing
332420	Metal Tank (Heavy Gauge) Manufacturing
423830	Industrial Machinery and Equipment Merchant Wholesalers
423840	Industrial Supplies Merchant Wholesalers
532490	Other Commercial and Industrial Machinery and Equipment Rental and Leasing
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
532412	Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing

AgTech & Bioenergy

541710	Research and Development in the Physical, Engineering, and Life Sciences
325311	Nitrogenous Fertilizer Manufacturing
325312	Phosphatic Fertilizer Manufacturing
325314	Fertilizer (Mixing Only) Manufacturing
325320	Pesticide and Other Agricultural Chemical Manufacturing
541360	Geophysical Surveying and Mapping Services
541370	Surveying and Mapping (except Geophysical) Services
541380	Testing Laboratories
325411	Medicinal and Botanical Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing
	BIOENERGY List From Green Establishments Database (Without Overlap)
	NEXTGEN AGTECH Manual List From Green Establishments Database (Without Overlap)

Agricultural Support

444210	Outdoor Power Equipment Stores
444220	Nursery, Garden Center, and Farm Supply Stores
541940	Veterinary Services
561710	Exterminating and Pest Control Services
561730	Landscaping Services
541613	Marketing Consulting Services
541820	Public Relations Agencies
541840	Media Representatives
541850	Display Advertising
541870	Advertising Material Distribution Services
541890	Other Services Related to Advertising
561320	Temporary Help Services
561310	Employment Placement Agencies
562920	Materials Recovery Facilities
522292	Real Estate Credit
551111	Offices of Bank Holding Companies
551112	Offices of Other Holding Companies
523130	Commodity Contracts Dealing
523140	Commodity Contracts Brokerage
924110	Administration of Air and Water Resource and Solid Waste Management Programs
924120	Administration of Conservation Programs
926140	Regulation of Agricultural Marketing and Commodities

Water Technology

221310	Water Supply and Irrigation Systems
237110	Water and Sewer Line and Related Structures Construction
333911	Pump and Pumping Equipment Manufacturing
	Water Technology Manual List from Green Establishments Database (Without Overlap)

ENDNOTES

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