



Economic Contributions of Monterey County Agriculture

Leading the Field Through Diversity and Technology



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Monterey County Agricultural Commissioner

The Honorable Board of Supervisors of Monterey County

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ERIC LAURITZEN
Agricultural Commissioner

After more than 80 years of publishing traditional Crop Reports, we published a new kind of report in April 2012. Instead of merely looking at crop production values and acreage, we quantified agriculture’s total economic contribution through food production, local food processing, employment and economic “multiplier effects.” In short, we asked the question “What role does agriculture play in sustaining a healthy local economy?”

The response to our report was overwhelming. Within Monterey County, policy makers, the public and others saw the clearest picture yet of agriculture’s economic role. Outside the county, the idea spread along the Central Coast with four other counties quickly commissioning similar studies. Section 2279 of the California Food and Agriculture Code requires all county agricultural commissioners to report the “value” of agriculture. This typically occurs each year via the required Crop Report. Thanks to twenty-first century economic tools we are providing this report to highlight agriculture’s greater value to our community.

I am pleased to share **Economic Contributions of Monterey County Agriculture: Leading the Field through Diversity and Technology**. This updates our 2012 report while also highlighting the special economic roles that diversity and technology play. This report demonstrates that agriculture generates \$8.1 billion annually to the local economy. It highlights the comprehensive economic contribution agriculture makes, informing various stakeholders such as our board of supervisors, supporting industry and the general public on the importance of the agricultural industry in sustaining this region’s economy. The continued emergence of technological innovations chronicled in this report highlights the ongoing vibrancy of the agricultural industry as a whole. Please do not hesitate to contact us with any feedback or questions. We hope you find this report valuable.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Eric Lauritzen'. The signature is fluid and cursive, written over a white background.

Eric Lauritzen
Agricultural Commissioner



COUNTY OF MONTEREY AGRICULTURAL COMMISSIONER

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Monterey County Agriculture

...contributes a total of \$8.1 billion to the local economy, including:

- \$5.7 billion in direct economic output, which represents 18.5% of the county's total direct economic output.
- \$2.4 billion in additional economic output in the form of expenditures by agriculture companies and their employees.

...provides 76,054 jobs in Monterey County, including:

- 55,702 direct employees, which is 23.7% of all jobs in the county or nearly one out of every four workers.
- 20,352 additional jobs made possible through expenditures by agricultural companies and their employees.

...has exceptional diversity that provides critical economic stability within agriculture and to the wider county economy.

...is investing in future economic prosperity and sustainability through an ambitious new technology innovation effort.



Introduction

In April 2012, we published a new kind of Crop Report that discussed not just crop production values, but also wider economic contributions such as local food processing, employment and multiplier effects. The report generated a tremendous positive response, providing the most detailed picture yet of agriculture's role in sustaining

a healthy local economy. This document updates and expands upon that original report.

We used multiple data sources and advanced economic modeling techniques to analyze agriculture's total contribution to the Monterey County economy. In addition, this report breaks new ground by

providing the first-ever quantitative assessment of economic diversity within Monterey County agriculture. It also includes a special section on technological innovation and its economic implications. On the whole, the findings offer important information for policy makers, the public and anyone who values a vibrant and resilient local economy.



Our Approach

When it comes to economic analysis, it's important to examine the fullest possible range of economic contributions. This report does that by focusing not just on direct economic effects such as farm production and employment, but also on *multiplier effects*. *Multiplier effects* are ripples through the economy. These ripples include inter-industry "business to business" supplier purchases as well as "consumption spending" by employees. The **Multiplier Effects** section on page 7 explains this further.

It's appropriate to calculate *multiplier effects* when analyzing what

economists call a *basic industry*. A *basic industry* is one that sells most of its products beyond the local area and thus brings outside money into local communities. Agriculture is a basic industry in Monterey County so this report includes *multiplier effects* when describing agriculture's total economic contribution.

Our analysis only examines agriculture's economic contributions. To understand agriculture's full economic impact, one would also need to assess agricultural-related costs to society, for example net impacts on water and other natural resources. These impacts are

important but lie beyond the scope of this study.

Our calculations draw from local and national data sources. Local sources include annual Crop Reports and industry experts. National data sources include federal government statistics and a widely used economic modeling program called IMPLAN®. Where data judgments were required, we used the most conservative (lowest) numbers. Except where otherwise noted, all figures are from the year 2013, the most recent IMPLAN® dataset available. Please contact the authors for additional details on the methods used.

“Direct Effects” of Monterey County Farm Production

This section focuses on the simplest measures of economic output: production and employment. It describes total farm production as well as the number of agriculture jobs.

Figure 1 shows the various categories that made up Monterey County farm production value in 2013 according to that year’s Crop Report. Vegetable Crops were the single largest production category by dollar value, comprising 65% of the county total. Lettuce dominated this category (\$1.2 billion), followed by broccoli (\$427 million), celery (\$217 million), and spinach (\$123 million). Fruit & Nut Crops represented the second largest category (26%) and consisted mostly of strawberries (\$869 million) and wine grapes (\$227 million).

Together, these two major categories accounted for 91% of the county’s direct farm production values, which were \$4.38 billion. This gross value does not reflect net profit or loss experienced by individual growers or by the industry as a whole. Interested readers are encouraged to consult the 2013 Crop Report for additional details as well as the 2014 update to be published in mid-2015.

Figure 1: Distribution of Monterey County Agriculture by Production Value

Source: 2013 Monterey County Crop Report

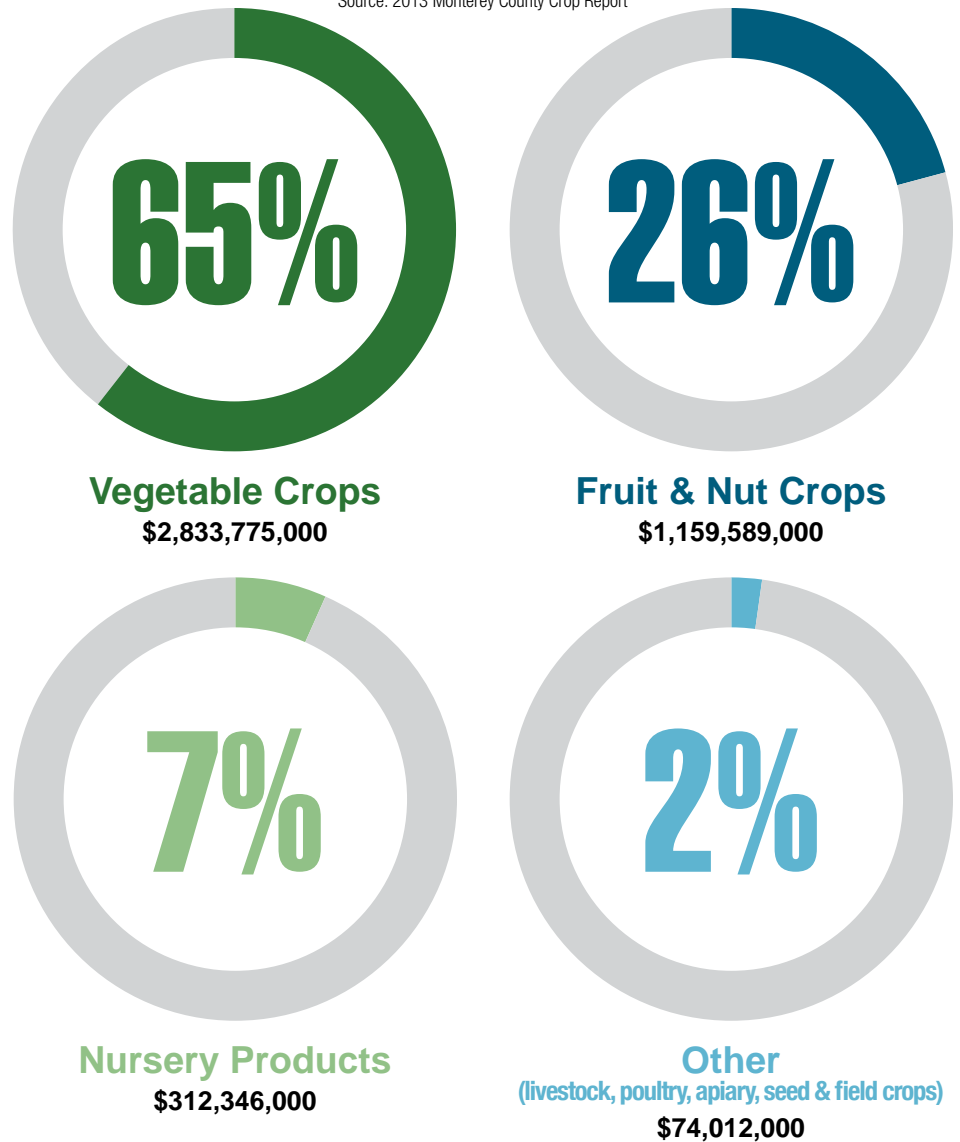
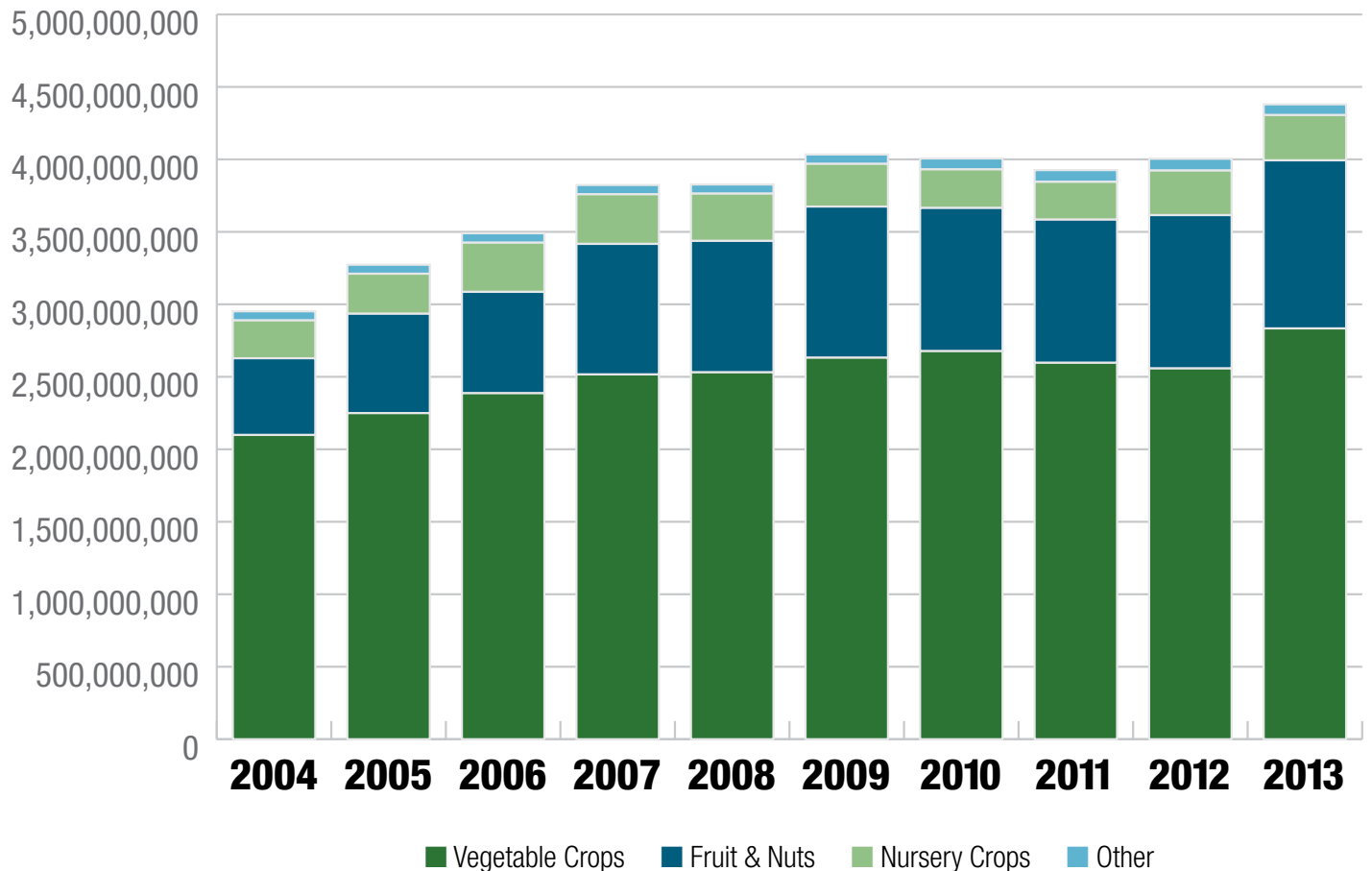


Figure 2: Ten-Year Trends in Gross Production Values

Source: Monterey County Crop Reports



How has farm production changed over time? **Figure 2** shows ten-year production trends for major categories. Production values grew 48.5% overall, from \$2.95 billion in 2004 to \$4.38 billion in 2013. Such growth is especially impressive given that this period included one of the worst economic recessions in U.S. history and a national food-borne illness outbreak linked to Central Coast agriculture.

Based on the Consumer Price Index, inflation totaled 23.9% over the decade with an average of 2.4% per year. This means that the “real” (inflation-adjusted) production value increase was about half the 48.5% figure mentioned above: 24.6%. Growers made more revenues than ever in 2013 but they also paid nearly 24% more for fertilizer, transplants,

fuel and everything else compared to a decade prior. On an inflation-adjusted basis, Vegetable Crops and Fruit & Nut Crops rose a total of 11.1% and 95.3% over the decade, respectively. Nursery Products (-4.3%) and “Other” (-5.9%) both declined.

Proportions represented by each category have remained mostly constant. Nursery Products, for example, provided 8.8% of revenues in 2004 and 7.1% ten years later. The “Other” category – including animals, apiary, seed crops and field crops – went from 2.1% to 1.7% during that time. The key exception was Fruit and Nut Crops. Buoyed by a 174% increase in strawberry production, Fruit & Nut Crops grabbed share from all three categories, including 6.4% from

the still dominant Vegetable Crops category.

Employment

How many people work in agricultural production? For 2013, agricultural production directly employed 53,550 people in Monterey County. The figure encompasses a wide range of production-related jobs, including not just growing and harvesting, but also sales, marketing and many other roles. It does not include food processing jobs, which we discuss below, nor does it include employment attributable to other natural resource-based activities such as commercial fishing (478 jobs) and forestry (160 jobs). The comparable figure in our 2012 study (based on 2009 data) was 42,176. Thus, farm production directly added 11,374 jobs (27%) in the last four years.

“Multiplier Effects” of Monterey County Farm Production

This section quantifies the economic “ripples” that farm production creates in the local economy. Ripples take two forms: *indirect effects* and *induced effects*. The first consist of “business to business” supplier purchases. For example, when a grower buys farm equipment, fertilizer, seed, insurance, banking services and other inputs, the grower creates *indirect effects*. The second ripple type, *induced effects*,

consist of “consumption spending” by agriculture business owners and employees. They buy housing, healthcare, leisure activities and other things for their households. All of this spending creates ripples in the economy.

Figure 3 shows agriculture’s *direct*, *indirect* and *induced* economic effects for major production categories.

The numbers use IMPLAN® data and multipliers for each sector, which are rooted in U.S. Bureau of Economic Analysis production data and other sources. Note that category names and production data in **Figure 3** differ from the County’s annual Crop Reports. They follow a standard classification system used nationwide called the North American Industrial Classification System (NAICS). Each NAICS category has an explicit definition. For example, “**Support activities for agricultural production**” refers to soil preparation, planting, cultivating, harvesting, labor contracting, post-harvest crop activities and various other farm management services not reflected in annual Crop Reports.



Figure 3: Economic Effects of Farm Production

FARM PRODUCTION SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL
	OUTPUT EFFECT (\$ MILLIONS)			
Grain farming	\$3.1	\$1.5	\$0.4	\$5.0
Vegetable and melon farming	\$1,666.1	\$182.0	\$472.2	\$2,320.4
Fruit farming	\$1,097.1	\$147.9	\$379.6	\$1,624.5
Tree nut farming	\$6.7	\$0.8	\$2.2	\$9.7
Greenhouse, nursery and floriculture products	\$143.5	\$15.4	\$44.0	\$203.0
All other crop farming	\$4.6	\$1.0	\$1.5	\$7.1
Cattle and other animal production	\$67.9	\$18.9	\$11.4	\$98.2
Support activities for agricultural production	\$1,899.4	\$80.5	\$721.6	\$2,701.6
TOTAL ECONOMIC OUTPUT:	\$4,888.5	\$448.2	\$1,632.8	\$6,969.4
EMPLOYMENT EFFECT (# JOBS)				
TOTAL EMPLOYMENT:	53,550	4,555	13,244	71,349

Dollar values are in millions. Figures are for 2013 and come from IMPLAN® and the U.S. Bureau of Economic Analysis.

Agricultural production created \$6.97 billion in total economic output within Monterey County, of which \$2.08 billion were multiplier effects. Indirect and induced spending supported an additional 17,799 jobs within the county, bringing agriculture-related production’s total employment to 71,349.

Locally Sourced, Value Added Food Processing

Farm production tells only part of the story. Monterey County is home to several food processors that play a key role in the local economy. Some of these local processors are household names not just in California, but across the U.S. and even overseas. This section captures the economic value of local food processing. It is neither an exact science nor a full assessment, but rather gives the reader a basic overview of the topic.

Like the previous study, we avoid overstating the numbers by only including food manufacturers and sectors that fit two strict criteria: 1) they use mostly local agricultural inputs; and 2) they are unlikely to exist here without the presence of the associated agricultural sector. Many

processing facilities would not exist in Monterey County were it not for the abundant supply of leafy greens, berries, wine grapes and other raw agricultural products. In an opposite example, we did not include the county's \$44.7 million beer brewing industry because local breweries get most of their barley, hops and other key ingredients from the Pacific Northwest and Germany. The same applies to the county's \$4.7 million tortilla manufacturing sector, which sources most tortilla ingredients (corn and wheat) outside the county.

We also took precautions to avoid double-counting. For example, we did not factor wine grape production into this section because the **Farm Production** section already captures

the dollar value of wine grapes. We only calculated the dollar value that wineries add to wine grapes by producing wine.

Figure 4 shows the economic effects of locally sourced, value added food processing. Like the previous section, category names follow a standard classification system used nationwide called the North American Industrial Classification System (NAICS). Each NAICS category has an explicit definition. For example, the NAICS category "**All other food manufacturing**" includes processed leafy greens, peeled or cut vegetables, and other perishable prepared foods. We selected and validated the categories and numbers in consultation with local experts.

Figure 4: Economic Effects of Locally Sourced, Value Added Food Processing

SELECTED FOOD PROCESSING SECTORS	DIRECT	INDIRECT	INDUCED	TOTAL
	OUTPUT EFFECT (\$ MILLIONS)			
Other animal food manufacturing	\$12.0	\$1.9	\$0.8	\$14.7
Frozen fruits, juices and vegetables manufacturing	\$68.0	\$28.5	\$9.2	\$105.7
Canned fruits and vegetables manufacturing	\$7.5	\$1.8	\$0.8	\$10.1
Rendering and meat byproduct manufacturing	\$9.1	\$4.2	\$1.2	\$14.6
All other food manufacturing	\$379.7	\$117.6	\$53.6	\$550.8
Wineries	\$310.6	\$90.5	\$51.9	\$453.1
TOTAL ECONOMIC OUTPUT:	\$786.9	\$244.6	\$117.5	\$1,149.0
EMPLOYMENT EFFECT (# JOBS)				
TOTAL EMPLOYMENT:	2,152	1,601	952	4,705

Sources: IMPLAN® and U.S. Bureau of Economic Analysis data, validated by local industry experts.

Local food processing produced an estimated \$787 million in direct output. Multiplier effects bring the total value to \$1.15 billion. The sector directly employed 2,152 workers. These workers and their employers spent enough money in the local economy to support an additional 2,553 jobs, bringing Monterey County's total food processing employment effect to 4,705.

Total Economic Contribution of Monterey County Agriculture

The previous sections have provided key pieces to an economic puzzle. This section combines those puzzle pieces into a final picture showing the overall economic effect of Monterey County agriculture.

As **Figure 5** shows, the total economic contribution of Monterey County agriculture was \$8.12 billion. This consists of \$5.68 billion in direct output

from production and processing, plus \$2.44 billion in multiplier effects.

The total nearly matches the \$8.26 billion total from the previous study despite a 19.9% rise in direct farm production. Two factors offset the farm production increase: reduced food processing output and lower indirect multipliers for berries and vegetable crops.

For perspective, agriculture pumped *nearly a million dollars per hour* into the county economy (\$926,757 to be exact). Total employment was 76,054. This includes 55,702 jobs directly in agriculture, plus another 20,352 employees supported by agriculture sector spending.

Putting the numbers in context, agriculture's \$5.68 billion in direct output made it the largest economic sector in Monterey County, accounting for 18.5% of all direct economic output. Meanwhile, the 55,702 jobs also made agriculture the county's top employer, with 23.7% of the county's 235,425 jobs. Government was the county's second largest economic sector in terms of economic output (\$4.55 billion) and employment (34,380 jobs). Among other things, government includes public safety, education, military, and social services, and even agricultural agencies. The real estate industry was the third largest industry at \$3.56 billion. The hospitality industry, including accommodations and food, was the third largest employer at 20,153 jobs.



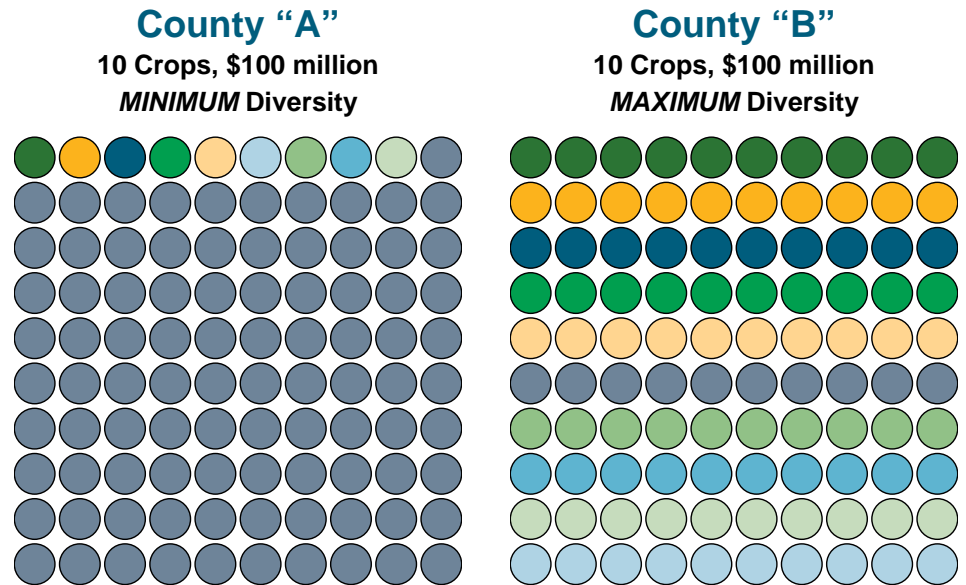
Figure 5: Overall Economic Effect of Monterey County Agriculture

TYPE OF EFFECT	DIRECT	INDIRECT	INDUCED	TOTAL
FARM PRODUCTION SECTOR				
Output Effect (\$ Millions)	\$4,888	\$448	\$1,633	\$6,969
Employment Effect (# Jobs)	53,550	4,555	13,244	71,349
LOCALLY SOURCED, VALUE ADDED FOOD PROCESSING SECTOR				
Output Effect (\$ Millions)	\$787	\$245	\$117	\$1,149
Employment Effect (# Jobs)	2,152	1,601	952	4,705
TOTAL VALUE OF AGRICULTURAL SECTOR				
Output Effect (\$ Millions)	\$5,675	\$693	\$1,750	\$8,118
Employment Effect (# Jobs)	55,702	6,156	14,196	76,054

The Value of Agricultural Diversity

Economists disagree on many things but there's one thing they all can agree on: a diverse economy is a resilient economy. Any region that depends on a large number of economic sectors reduces the risk of catastrophic shocks. This important economic principle applies to agricultural diversity too. For example, a county with just one or two main crops faces higher vulnerability to shocks in the form of price drops, disease outbreaks, new regulations, new competitors, spikes in the cost of key inputs and other unpleasant surprises. Meanwhile, a county with a diverse agricultural industry can withstand shocks to certain crops without unraveling the entire agricultural economy. Bottom line: having "all your eggs in one basket" is never a good idea, especially when it comes to economics. Agricultural diversity is like a valuable insurance policy against economic calamity.

Figure 6: Agricultural Economic Diversity is More Than Just the Number of Crops



Unfortunately, robust measures of Monterey County agricultural diversity do not exist, let alone descriptions of the economic value of such diversity. Local residents see assorted crops growing in well-tended fields. They see farmers markets overflowing with

different kinds of food. But no one has attempted to quantify that diversity or its economic value. Part of the reason is that measuring diversity is a complex job. It requires more than just counting the different things for sale at farmers markets or listed in



The Value of Agricultural Diversity (continued)

the annual Crop Report. Measuring diversity includes the number of different crops grown and assessing their relative economic abundance.

For example, imagine two California counties where the annual farm production value is \$100 million each. Both counties grow ten different kinds of crops. In County “A,” a single crop contributes 91% of the revenue and the nine other crops make up 1% each (see **Figure 6**). In County “B” the ten crop types all contribute equally, at 10% each. *Both counties have the same number of crops and total revenues, but County “B” is much more diverse.* Thus, we could expect County “B” to be much more resilient to economic shocks than County “A”.

Because economic diversity is so important, economists have developed sophisticated tools for measuring it. The most popular one

is a statistic called the Shannon-Weaver Index. The index is based on the Shannon-Weaver entropy function, which was created in 1949 and is widely used in both ecology and economics. Economists and ecologists use the formula to calculate the Shannon-Weaver Index, which we share here and can explain further to interested readers:

$$SW_t^k = - \sum_{n=1}^k p_n * \ln (p_n)$$

The lowest possible index score is 0.00. Zero represents an extreme case where all economic output occurs in only one sector. In ecology, this would be a rain forest with only one species. In agriculture, it would be a county with just one commercial crop. The other extreme – an open system where potential diversity is unlimited – would have a much higher score. The higher the score, the greater the diversity.

To measure agricultural diversity in Monterey County, we started by creating a list of specific crops mentioned in Crop Reports. We only used crops for which specific production values were consistently reported over the past decade. A careful review of historic Crop Reports resulted in 108 such crops. Next, we applied the list of crops and production values to the formula above. This resulted in a 2013 Shannon-Weaver Diversity Index score of 3.09.

By itself, the index score says little. Where it comes in handy is making external and internal comparisons. Internally, the agricultural community can track the score over time to ensure that overall agricultural economic diversity remains high. Maintaining high economic diversity in agriculture will minimize the risk of significant economic shocks. It’s an insurance policy against economic earthquakes.

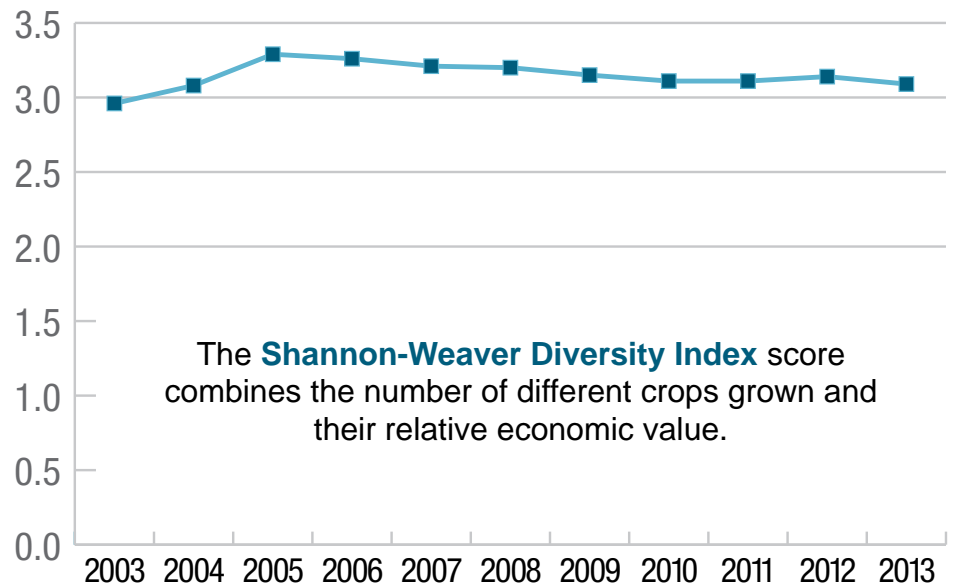


The Value of Agricultural Diversity (continued)

Speaking of earthquakes, note that equation above includes a logarithmic function (“ln”) similar to the Richter Scale for measuring earthquakes. Many Californians understand that a 7.4 earthquake releases twice the energy of a 7.2 earthquake even though the numbers are not far apart. The same principle applies to Shannon-Weaver Diversity Index scores. A tiny numeric difference represents a big change.

Figure 7 shows how the Shannon-Weaver Diversity Index score has fluctuated over the past decade. The overall change has been positive (+4.4%), suggesting increased economic diversity within agriculture. Note that the diversity index was 2.96 in 2003, then climbed for a couple years to a peak of 3.29. The climb reflects rising balance among the relative economic contributions of different crops. The eight years since then have mostly seen a slow tapering, down 6.1% from the 2005 peak. This does not mean that fewer crop types are being grown in the county. In fact, Monterey County probably has more crop types today than ever before. It means that a small number of crops have grown to represent larger pieces of the economic pie. Strawberries, for

Figure 7: How Economically Diverse is Monterey County Agriculture?



The **Shannon-Weaver Diversity Index** score combines the number of different crops grown and their relative economic value.

example, accounted for 10.7% of the county’s overall production value in 2004 but expanded to 19.9% a decade later.

Externally, the index score can allow useful comparisons to other industries within Monterey County, for example real estate, manufacturing and tourism. It also allows comparisons between Monterey County agriculture and agriculture in other California counties and beyond. Although the number of external comparisons remains limited at this time, we have produced index scores for agricultural

commissioners in three other Central Coast counties. Using 2011 as the common year, Monterey County’s agricultural diversity score of 3.11 makes it much more diverse than San Luis Obispo (2.92), Santa Barbara (2.49) and Santa Cruz (2.01).

Potential comparisons will no doubt grow over time as more counties adopt this innovative and important measurement. In the meantime, Monterey residents can take pride in having one of the most economically diverse agricultural industries anywhere, with numbers to prove it.



The Value of Technology Innovation

Monterey County growers have long occupied the forefront of technological advances. From precision irrigation to bagged products to food safety, local agricultural companies have a proud history of innovation. A rapidly changing world, however, requires that Monterey County not only continue innovating but also accelerate it for long-term sustainability and prosperity.

A new and unprecedented effort intends to make that happen. The goal is not just to solidify the area's role as global leader for fresh produce, but to strengthen it further through technology innovation. Just as Hollywood dominates the movie industry and Silicon Valley dominates information technology, the new effort seeks to solidify Salinas Valley as the world's fresh agriculture capital. Key to accomplishing this ambitious goal is assembling a critical mass of resources and competencies in a single location so they can create critical synergies. Over time, these synergies can lead to a decisive competitive advantage.

Unfortunately, the local effort to accomplish world excellence in fresh agriculture technology is so new and rapidly evolving that few people grasp what it really entails. Who's driving this effort? What are they doing? How will we know if it's working? This section starts to answer these questions and focuses on three things. First, it summarizes the key players in the technology innovation effort. Second, it describes how the key players work together in terms of roles and relationships. Third, it describes economic implications of this effort, including recommended

measures for evaluating its impact. By the end of the section, readers should know what's happening, who's doing it, why it matters and how to measure its success.

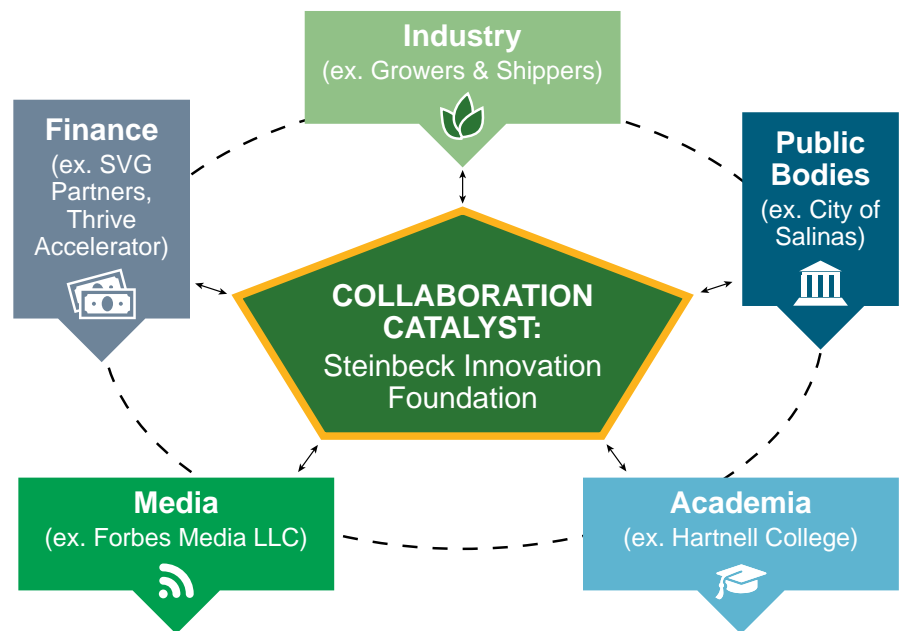
The Technology Innovation Ecosystem

What components, niches and relationships make up what has been dubbed the Salinas Valley Fresh Agriculture Innovation Cluster? **Figure 8** shows five major categories of organizations driving the Salinas Valley technology innovation push.

umbrella. The following paragraphs describe how the Steinbeck Innovation Foundation works with each of the five major sectors and also mentions connections across sectors:

1. **Academia.** The Steinbeck Innovation Foundation works with academia on multiple fronts. A key flagship project is the foundation's "CoderDojo" program at Hartnell College. The program provides free computer-coding training to youth between ages 8 and 17, developing a future

Figure 8: The Salinas Valley Ag-Tech Innovation Cluster



It also shows how they collaborate around central catalyst organization that provides "glue" for the group.

The **Steinbeck Innovation Foundation** (www.steinbeckinnovation.org) is the physical center and major catalyzing organization for the overall effort to strengthen Salinas Valley ag-tech innovation. A 501(c)3 nonprofit entity, the foundation works with all five sectors in **Figure 8** under its "Steinbeck Innovation Cluster"

workforce that is homegrown and tech-savvy. Dr. Willard Lewallen, President of Hartnell College, also serves on the foundation's Board of Directors. Meanwhile, the foundation's advanced research program links researchers from several local universities with funders and real-world users of potential "smart farm" technologies. "Smart farm" research collaborations thus far include scientists from area

The Value of Technology Innovation (continued)

schools such as Moss Landing Marine Laboratories, Cal State Monterey Bay (CSUMB), UC Santa Cruz, and the Stanford Design School.

- 2. Media.** The Steinbeck Innovation Foundation works with a variety of news media partners old and new. Traditional partners include local publications *The Salinas Californian*, the *Monterey Herald*, and the *Monterey County Weekly*. An exciting new partner is Forbes Media LLC, which chose the Salinas Valley as the venue for a major conference in 2015.

In a conference press release at Forbes.com, Forbes Media COO Mike Federle explained the “Ag-Tech Summit” conference goal: to “find innovative solutions to some of the world’s most critical farming

challenges.” He also provided a rationale for the summit location, noting that “there’s no better place for this event than in the Salinas Valley, where tech entrepreneurs from Silicon Valley and experts from the global hub of agriculture intersect.”

- 3. Finance.** The Steinbeck Innovation Foundation works to catalyze public and private funding for technological innovations. The key partner thus far has been a Santa Clara investment and advisory firm called Silicon Valley Global Ventures, or SVG Partners for short (www.svgpartners.com). Led by CEO and long-time Salinas advocate John Hartnett, SVG Partners has been the driving force for connecting Silicon Valley finance to Salinas Valley agriculture.

The most recent and ambitious example is SVG Partners’ business incubator called the Thrive Accelerator (www.thriveaccelerator.com). The Thrive Accelerator is a highly selective mentorship and investment program for technology-enabled startups in the “Precision Agriculture” space. More than 40 Ag-Tech companies from Peru, Israel, Switzerland, Panama, France, UK, Ireland and the USA pitched their “smart” farm technology projects at the Thrive Accelerator Seed Camp earlier this year. Ten startup companies have been selected as finalists. Among other things, each finalist receives: 1) mentor support from key industry, investors and entrepreneurs; 2) dedicated working space at the Steinbeck Innovation Center in Salinas; and



The Value of Technology Innovation (continued)

3) access to the top R&D staff from the largest fresh agriculture companies in the world. Finalists also have a chance to land \$5 million in funding and opportunities to deploy their solutions with major fresh agriculture companies in the Salinas Valley.

4. Industry. Private agriculture companies and their umbrella organizations have been the driving force behind the ag-tech innovation effort. For example, major corporate donors that make the Steinbeck Innovation Foundation's work possible include Taylor Farms, JV Smith Companies, Mann Packaging Company, Don Chapin Company and Scheid Vineyards. At the time of writing, major supporters of the Thrive Accelerator included Taylor Farms, JV Smith Companies, Chiquita Brands, Dole, Mann Packaging Company and Rocket Farms. Local agriculture companies also sponsored the flagship Forbes Ag-Tech Summit mentioned above.

In addition to individual companies, various industry groups have also been active. Key examples include the Grower-Shipper Association and the Monterey County Farm Bureau. The Western Growers Association has been especially active, for example by committing several million dollars for SVG Ventures to invest in promising ag-tech startups. Finally, the list of Thrive Accelerator volunteer "mentors" includes senior executives from prominent agricultural companies, including several listed above.

5. Public Bodies. Government agencies and officials at all levels

Figure 9: Potential Performance Indicators for the Ag-Tech Innovation Cluster

CATEGORY	INDICATOR #1	INDICATOR #2	INDICATOR #3
Economic Impact	Household Income	Employment	Wages
Research	Industry R&D expenditures	Academic R&D expenditures	Patents
Technology Development	Technology licensing	Federal Innovation Grants ("SBIR")	Federal Tech-Transfer Grants ("STTR")
Business Development	New business formation	Mergers & Acquisitions	Initial Public Offerings
Capital	Venture capital	Industry funding of university R&D	Government funding of university R&D
Talent	Education levels	Talent flow & attraction	Housing affordability

Source: based on multiple sources, especially the Massachusetts Innovation Economy (index.masstech.org).

support the effort through various means. A U.S. naval officer, Captain Wayne Porter, was first to suggest that the Salinas Valley could meet the criteria for a successful regional innovation cluster. Dennis Donohue, former Salinas mayor, co-founded the Steinbeck Innovation Foundation. Members of the Steinbeck Innovation Committee (precursor and supporter to the Foundation) include elected officials such as a county supervisor (Simón Salinas), an economic development director (Jeff Weir) and the manager of the local solid waste management authority (Patrick Matthews).

Numerous federal and state officials provide ongoing support to Salinas Valley agriculture through University of California Cooperative Extension services, tax policies, research grants and infrastructure projects, as well as courts that enforce contracts and intellectual property. These and other government efforts provide critical support for a flourishing private sector.

Economic Implications of the Ag-Tech Cluster

What are the economic implications of this Ag-Tech Cluster effort? Ample literature exists on "regional innovation clusters" of varying kinds. The approach has been around since Harvard economist Michael Porter first described the concept in 1990. Economic benefits typically fall into three broad categories: 1) increasing the productivity of companies in the cluster; 2) driving innovation in the field; and 3) stimulating new businesses in the field. Overall, evidence strongly suggests that regional innovation clusters like the evolving Ag-Tech cluster can become long-term economic engines that produce a wide range of benefits.

What indicators could help track performance of the Salinas Valley Ag-Tech Cluster? How will we know if it's producing the desired results? **Figure 9** proposes 18 specific indicators to consider, based on monitoring programs at other regional innovation clusters.

Conclusion

This report has documented Monterey County agriculture's powerful role in sustaining the local economy. Agriculture remains the county's largest sector in terms of economic output and the single biggest employer. High economic diversity within agriculture has provided insurance against economic shocks and should continue to do so in the future. Finally, a major effort is underway to produce long-term economic benefits through unprecedented technology innovation.

Agriculture is one of Monterey County's economic pillars and represents a vital link to both the county's cultural past and competitive future. Although the report has presented many facts and figures, it has barely begun to fill key information gaps about agriculture's economic role. Future research should dive deeper into economic impacts. With respect to "diversity," future research should examine not just crop types but also trends in operation sizes (small, medium,

large), production types (conventional and organic acres), and export destinations (local, USA, overseas). For the Ag-Tech Innovation Cluster, the key research priority is to establish benchmark (baseline) against which future successes can be measured. Other research priorities will no doubt arise over time. Meanwhile, the findings here provide the clearest picture yet of Monterey County agriculture's economic role and should be of interest to a wide range of stakeholders.



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