



Agriculture's Contribution to Hawaii's Economy

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There is much debate on the size and importance of agriculture in Hawaii's economy. Estimates of agriculture's contributions vary significantly, depending on what is defined as "agriculture" and on the methodology used to develop those estimates. In this publication, we examine four methods of estimating agriculture's economic activity.

First, the most common measure used historically in Hawaii has been the farmgate value of production agriculture. This has the advantage of being relatively easy to measure and readily available from statistics gathered by the state. However, it does not account for additional economic activity beyond the farm gate. Also, farmgate sales value does not provide a precise measure of the contribution of agriculture to the economy due to double-counting. For example, seeds purchased by vegetable growers are recorded as sales by the seed producers but are also reflected in the sales of the vegetable growers.

To avoid the limitations of the farmgate value method, economists use the concept of "value added" to measure the contribution of an industry. Value added by an industry is defined as the sum of employee compensation, proprietary and other property income, and indirect business taxes. Summing the value added by all industries in an economy gives us the gross state product (GSP), a commonly accepted measure of the size of a state economy.

Employment provides a third indicator for measuring the contribution of an industry to the economy. And fourth, economists often use economic input-output models to provide measures of linkages of an industry to the entire economy.

This publication assesses the contribution of agriculture to Hawaii's economy by summarizing and comparing the four measures described above: farmgate

sales, value added (or gross state product), employment, and linkages. Agriculture is defined to include production agriculture, fisheries, forestry, and agricultural services; agricultural input industries; and food and fiber processing (see Table 1).

Value of production agriculture and fisheries by farmgate sales

Figure 1 shows the trend of sales values of sugar, pineapple, other crops, livestock, and fisheries (i.e., aquaculture and marine fisheries) from 1982 to 1997. As shown in Figure 1 and Table 2, total sales of crops, livestock, and fisheries increased from \$521 million in 1982 to \$556 million in 1992. However, total crop and livestock sales declined slightly during the 15-year period from \$507 million to \$486 million. While total agricultural and fisheries sales did not change much, the composition of contributors to those sales changed drastically. Sugar sales declined from a share of 44.3% in 1982 to 15.4% in 1997. Pineapple declined slightly in sales to a share of 16.5% in 1997. Livestock sales also declined, its share decreasing to 12.2% in 1997. These declines are compensated for by a large increase in the value of other crops, such as seed crops, coffee, macadamia nuts, fruits, vegetables, flowers, and nursery products, and fisheries production.

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Table 1. Sectors making up Hawaii agriculture.

Sector number in 1992 Hawaii I-O table ^a		Sector	Standard industrial classification code
Farm production and input sectors			
1	1	Sugarcane	0133
2	2	Vegetables	0161
3	3	Tree nuts	0173
4	4	Pineapple	0179
5	5	Coffee	0179
6	6	Other fruits	Other 0170–0179
7	7	Flowers, ornamentals, and nursery plants	0180–0189
8	8	Dairy farm products	0240–0249
9	9	Poultry and eggs	0250–0259
10	10	Cattle and calves	0211, 0212
11	11	Hogs	0213
12	12	Misc. livestock (goats, sheep, etc.)	0214, Other 021
13	13	Aquaculture	0273
14	14	Other agricultural products	Other 01, 02
15	15	Forestry and forest products	0811, 0831
16	16	Commercial fishing	0912–0919
17	17	Agricultural, forestry, and fishery services	0711–0779, 0851
18	18	Landscape and yard care services	0780–0789
19	Part of 48	Farm machinery and equipment	3523
20	Part of 49	Nitrogenous and phosphatic fertilizers	2873, 2874
21	Part of 49	Fertilizers, mixing only	2875
Food and fiber processing sectors			
1	27	Pineapple processing	Part of 2030–2038
2	28	Other canned vegetables and fruits	2030–2038 (except pineapple)
3	29	Sugar processing	2061–2063
4	30	Confectionery products	2064–2067
5	31	Salted and roasted nuts and roasted coffee	2068, 2095
6	32	Meat products	2010–2019
7	33	Milk products	2021–2029
8	34	Grain and bakery products	2040–2059
9	35	Beverages	2080–2089
10	36	Other food products and tobacco products	Other 20, 2100
11	Part of 37	Textiles	2200–2399

^aFrom *The 1992 Hawaii state input-output study* by K.R. Sharma, X. Tian, A. Peterson, S. Nakamoto, and P.S. Leung, 1997; CTAHR, Economic Issues no. 1, 1997 (also published as *The Hawaii input-output study, 1992 benchmark report* by the Hawaii Department of Business, Economic Development and Tourism, 1998).

While these data show the trend of sales values of production agriculture and fisheries, comparable data are not readily available for the agricultural processing sector or total sales in the economy. Fortunately, data from the 1992 input-output model of the Hawaii economy pro-

vide a snapshot for comparison. In 1992, total farm production and input sectors (as defined in Table 1) amounted to \$861.8 million, while food and fiber processing totaled \$1,347 million. Together they made up 4.6% of the total sales in Hawaii's economy in 1992.

Table 2. Sales by Hawaii's production agriculture and fisheries, 1982–1997.

	1982	1987	1992	1997
Sales (\$ x 1,000)				
Total crops, livestock, and fisheries sales	520,647	584,039	582,743	556,086
Total crops and livestock	507,268	557,298	520,227	485,743
Total crops	428,860	469,565	431,958	418,016
Sugar	230,800	218,000	153,700	85,500
Pineapple	94,364	99,286	102,100	91,721
Other crops	103,696	152,279	176,158	240,795
Livestock	78,408	87,733	88,269	67,727
Fisheries (aquaculture and marine fisheries)	13,379	26,741	62,516	70,343
Percent of total crops, livestock, and fisheries sales				
Total crops and livestock	97.4	95.4	89.3	87.4
Total crops	82.4	80.4	74.1	75.2
Sugar	44.3	37.3	26.4	15.4
Pineapple	18.1	17.0	17.5	16.5
Other crops	19.9	26.1	30.2	43.3
Livestock	15.1	15.0	15.1	12.2
Fisheries (aquaculture and marine fisheries)	2.6	4.6	10.7	12.6
Average annual growth rate (%)				
Total crops, livestock, and fisheries sales	1982–1987	1987–1992	1992–1997	1982–1997
Total crops and livestock	2.3	0.0	-0.9	0.4
Total crops	1.9	-1.4	-1.4	-0.3
Total crops	1.8	-1.7	-0.7	-0.2
Sugar	-1.1	-6.8	-11.1	-6.4
Pineapple	1.0	0.6	-2.1	-0.2
Other crops	8.0	3.0	6.5	5.8
Livestock	2.3	0.1	-5.2	-1.0
Fisheries (aquaculture and marine fisheries)	14.9	18.5	2.4	11.7

Source: Hawaii Agricultural Statistics Service, *Statistics of Hawaii Agriculture*, various issues; Hawaii Dept. of Business, Economic Development and Tourism, *The State of Hawaii Data Book*, various issues.

Figure 1. Proportion of sales contributing to Hawaii's production agriculture and fisheries, 1982–1997.

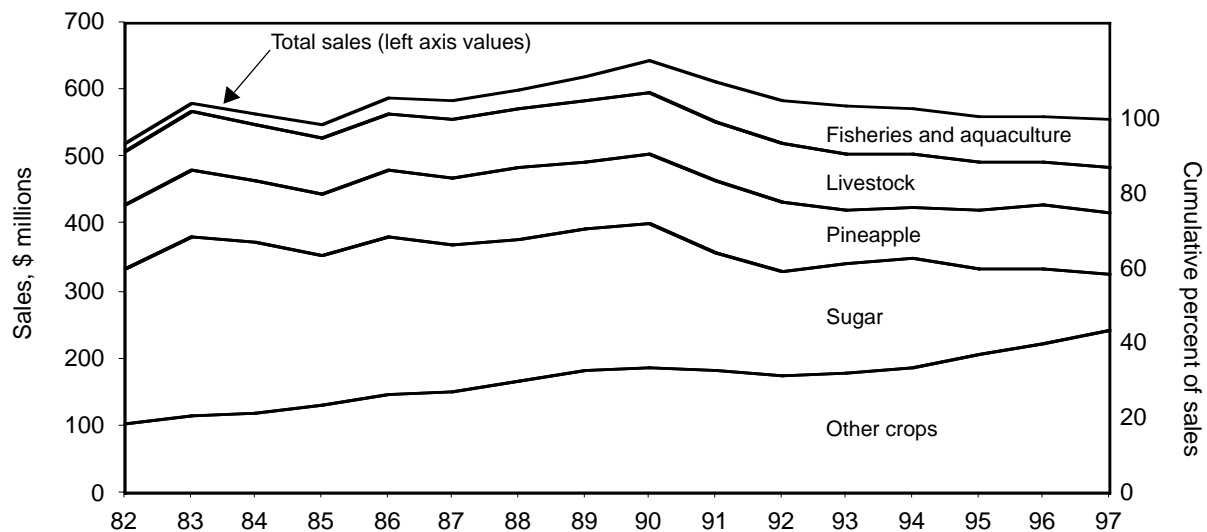
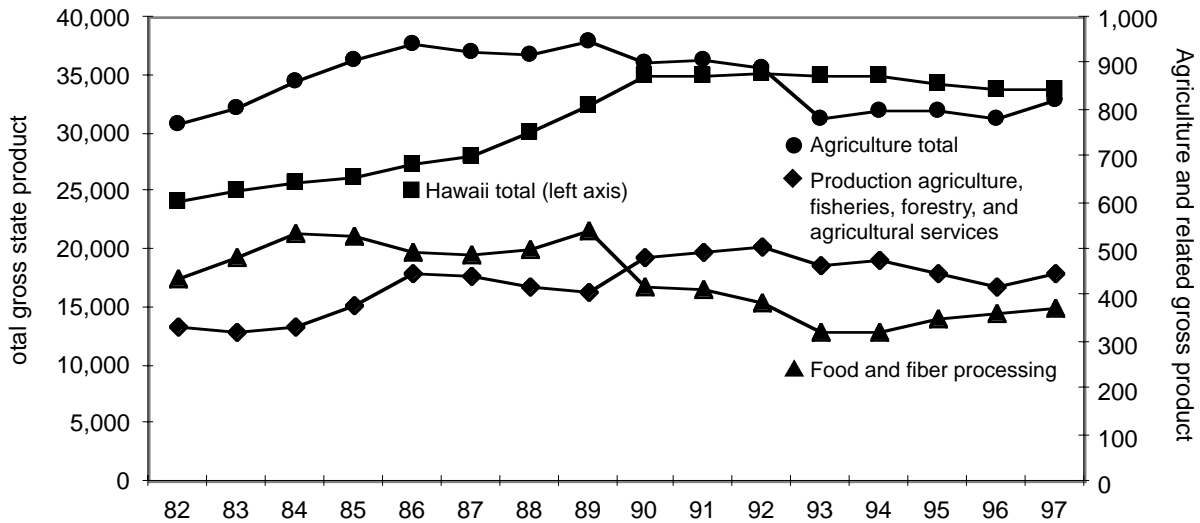


Figure 2. Total and agricultural gross state products in Hawaii, 1982–1997 (\$ millions).



Agriculture's contribution to the gross state product (GSP)

As alluded to above, value added by each industry provides a precise indicator of the contribution of that industry to the economy, or each industry's contribution to GSP. The U.S. Department of Commerce's Bureau of Economic Analysis (BEA) provides a consistent data series of the contribution of the various industry sectors to GSP. To account for inflation, a data series expressed in constant 1992 dollars is also made available by BEA. Figure 2 shows the trend of the contribution of agriculture and agricultural processing compared to total GSP since 1982, the earliest year that a consistent constant-dollar series is available. Hawaii's economy as measured by total GSP increased steadily from 1982 to 1990, when the economy became stagnant and even showed a slight decline. While Hawaii's economy increased about 2.3%

annually for the 15-year period from 1982 to 1997, agriculture increased only 0.4% during the same period (see Table 3), and it has declined since 1987. The share of agriculture also declined, from 3.2% of the total GSP in 1982 to 2.4% in 1997.

Table 3 shows that while agricultural processing decreased at an annual rate of 1% from 1982 to 1997, production agriculture, forestry, fisheries, and agricultural services increased at an annual rate of 2%. The increase can be attributed to the large increase in agricultural services, forestry, and fisheries, which increased at an annual rate of 8.6% during the 15-year period. In 1982, agricultural services, forestry, and fisheries accounted for only 0.2% of GSP but have since increased to 0.5% of GSP. On the other hand, farm production decreased from 1.2% of GSP in 1982 to 0.8% in 1997. Similarly, agricultural processing decreased from 1.8% of GSP in

Table 3. Agriculture's contribution to Hawaii's gross state product (GSP), 1982–1997.

	1982	1987	1992	1997
GSP (millions of 1992 \$)				
Total GSP	24,026	28,068	35,193	33,736
Total agriculture	770	927	890	823
Production agriculture, forestry, fisheries, and services	331	440	504	447
Farm production	281	344	310	275
Agricultural services, forestry, fisheries, and others	50	96	194	172
Food and fiber processing	439	487	386	376
Food and kindred products	398	420	317	297
Tobacco, textiles, and apparel	41	67	69	79
Percent of total GSP				
Total agriculture	3.2	3.3	2.5	2.4
Production agriculture, forestry, fisheries, and services	1.4	1.6	1.4	1.3
Farm production	1.2	1.2	0.9	0.8
Agricultural services, forestry, fisheries, and others	0.2	0.3	0.6	0.5
Food and fiber processing	1.8	1.7	1.1	1.1
Food and kindred products	1.7	1.5	0.9	0.9
Tobacco, textiles, and apparel	0.2	0.2	0.2	0.2
Average annual growth rate (%)				
Total GSP	1982–1987	1987–1992	1992–1997	1982–1997
Total GSP	3.2	4.6	-0.8	2.3
Total agriculture	3.8	-0.8	-1.6	0.4
Production agriculture, forestry, fisheries, and services	5.9	2.8	-2.4	2.0
Farm production	4.1	-2.1	-2.4	-0.1
Agricultural services, forestry, fisheries, and others	13.9	15.1	-2.4	8.6
Food and fiber processing	2.1	-4.5	-0.5	-1.0
Food and kindred products	1.1	-5.5	-1.3	-1.9
Tobacco, textiles, and apparel	10.3	0.6	2.7	4.5

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

1982 to 1.1% in 1997. Both the production agriculture, forestry, fisheries, and agricultural services and the agricultural processing sectors declined from 1992 to 1997.

Agriculture's contribution to employment

Figure 3 shows that the trends in employment have been similar to the corresponding value added trends for the overall economy as well as the two agricultural sectors (production agriculture, forestry, fisheries, and agricultural services, and agricultural processing). Total employment in the state increased at an annual rate of 1.8% from 568,185 jobs in 1982 to 744,564 jobs in 1997 (Table 4). However, total employment in agriculture decreased at an annual rate of 0.6% during that 15-year period. The decrease can be attributed primarily to decreases in the processing sector and on-farm production. Similar to the value added trend, employment for agricultural

services, forestry, and fishing has increased significantly at an annual rate of 5%.

In 1982, production agriculture, forestry, fisheries, and agricultural services and agricultural processing contributed to almost 6% of total employment in Hawaii, but this contribution subsequently decreased, and in 1997 it was only 4.1%. Employment in agricultural processing decreased from 2.6% of total employment in 1982 to 1.3% in 1997. Similarly, on-farm employment also decreased from 2.4% in 1982 to 1.5% in 1997. These decreases in employment have been partially offset by the increase in employment in agricultural services, forestry, and fisheries, whose share increased from 0.8% in 1982 to 1.3% in 1997. In 1997, employment in agricultural services, forestry, and fisheries was almost as large as on-farm employment and exceeded the employment of agricultural processing.

Table 4. Agriculture's contribution to employment in Hawaii, 1982–1997.

	1982	1987	1992	1997
Employment (number of jobs)				
Total employment	568,185	647,186	754,552	744,564
Total agriculture	33,294	34,130	34,004	30,377
Production agriculture, forestry, fisheries, and services	18,623	20,889	22,776	20,928
Farm production	13,900	14,599	14,072	11,089
Agricultural services, forestry, fisheries, and others	4,723	6,290	8,704	9,839
Food, and fiber processing	14,671	13,241	11,228	9,449
Food and kindred products	11,401	9,595	8,552	6,684
Tobacco, textiles, and apparel	3,270	3,646	2,676	2,765
Percent of total employment				
Total agriculture	5.9	5.3	4.5	4.1
Production agriculture, forestry, fisheries, and services	3.3	3.2	3.0	2.8
Farm production	2.4	2.3	1.9	1.5
Agricultural services, forestry, fisheries, and others	0.8	1.0	1.2	1.3
Food, and fiber processing	2.6	2.0	1.5	1.3
Food and kindred products	2.0	1.5	1.1	0.9
Tobacco, textiles, and apparel	0.6	0.6	0.4	0.4
Average annual growth rate (%)				
Total employment	1982–1987	1987–1992	1992–1997	1982–1997
Total employment	2.6	3.1	-0.3	1.8
Total agriculture	0.5	-0.1	-2.2	-0.6
Production agriculture, forestry, fisheries, and services	2.3	1.7	-1.7	0.8
Farm production	1.0	-0.7	-4.7	-1.5
Agricultural services, forestry, fisheries, and others	5.9	6.7	2.5	5.0
Food, and fiber processing	-2.0	-3.2	-3.4	-2.9
Food and kindred products	-3.4	-2.3	-4.8	-3.5
Tobacco, textiles, and apparel	2.2	-6.0	0.7	-1.1

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

Figure 3. Total and agricultural employment in Hawaii, 1982–1997 (number of jobs).

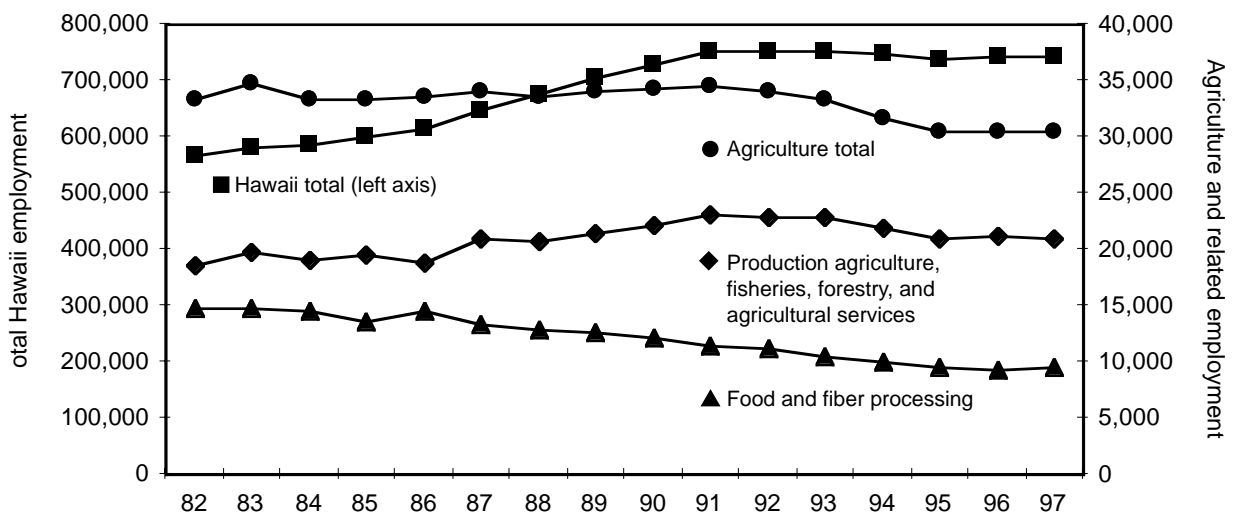


Table 5. The economic contribution of agriculture to Hawaii's economy, 1992.

Measure	Amount	Percent of Hawaii's economy
Output (business sales), \$ million	2,910.1	6.1
Value added, \$ million	1,416.6	4.6
Labor income, \$ million	917.2	4.5
Employment, number of jobs	42,273	5.6

Linkages of production agriculture and agricultural processing to Hawaii's economy

While the indicators discussed above measure the direct impact of agriculture and agricultural processing on the economy, they do not fully account for agriculture's linkages with other industries and the resulting economic activities generated. Production agriculture and agricultural processing need to be understood as primary industries in the economy that are vitally linked to other industries by producing outputs, purchasing inputs, and creating employment and income. These linkages can best be captured by an economic input-output model. Some argue that the food distribution system, including food retailing, wholesaling, warehousing, and transportation, exists to deliver the agricultural products to the final consumer and thus should be included as part of the total contribution of agriculture in the economy.

The following paragraphs summarize the results of a recent study* that utilized the 1992 state input-output model and included portions of the trade and distribution sectors dealing with production from Hawaii agri-

culture to arrive at the total contribution of agriculture using a final-demand approach. The final-demand approach is generally preferred by most economists in measuring the contribution of an industry using the input-output model because it alleviates the problem of double-counting.

In 1992, the final demand for locally produced agricultural products and their trade margins was \$1.98 billion, or nearly 4% of the total final demand in Hawaii of \$37 billion. These values represent goods and services that were either exported from or consumed in the state. This final demand required a corresponding amount of business sales or output from throughout the economy to satisfy consumption and exports.

In 1992, the final demand for agricultural products and their trade margins accounted for \$2.91 billion of output or business sales in the entire economy (Table 5). This was 6.1% of the total sales by Hawaii's economic sectors (\$47.55 billion). Final demand for agricultural products and related margins similarly accounted for \$1.42 billion of value added, about \$920 million of wages, salaries, and self-employment income, and 42,273 jobs. These were, respectively, 4.6% of total state value added, 4.5% of total state labor income, and 5.6% of the jobs statewide. (It should be noted that total GSP and employment as used in the 1992 input-output model differ from the BEA estimates due to different estimation methods.)

Summary

For 1992, estimates of the contribution of agriculture in Hawaii's economy range from 4.6% to 6.1% in terms of sales; 4.5% to 5.6% in terms of employment; and 2.5% to 4.6% in terms of value added. The higher values reflect the inclusion of the associated trade margins of locally produced agricultural products. Although similar estimates that include the trade margins are not available for 1997, it is safe to assume that they have declined slightly, as reflected by the general declining trends of sales, employment, and value added from 1992 to 1997 (Tables 3 and 4). Despite the recent demise of sugar, production agriculture, forestry, fisheries, agricultural services, and agricultural processing remain vital contributors to Hawaii's economy by providing a diversity of products and generating jobs and incomes.

*For details, see "Accounting for the linkages of agriculture in Hawaii's economy with an input-output model: a final demand-based approach" by Khem R. Sharma, PingSun Leung, and Stuart T. Nakamoto, *Annals of Regional Science* 33:123-140, 1999.