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Leah English and Jennie Popp

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# Executive Summary

Agriculture and associated agricultural activities are major contributors to the Arkansas economy. Agriculture is defined as the sum of agricultural production and processing activities, unless otherwise specified, and includes crop and animal production and processing, agricultural support industries, forestry and forest products, and textile goods. Agriculture contributes to the economy through direct agricultural production and value-added processing, leading to economic activity in other parts of the economy.

This report is the fifteenth in a series that examines agriculture's economic contribution to the Arkansas economy. The total economic contribution of agriculture (direct, indirect, and induced effects) on value added, employment, and labor income was estimated with the Impact Analysis for Planning System (IMPLAN) for the most recent year available, 2020. Key findings of the IMPLAN analysis are as follows:

- Aggregate Agriculture contributed $19.0B in total value added to the state economy; this is $0.14 of every $1 in value generated in the state.

- Aggregate Agriculture accounted for 243,165 jobs, which is over 14.9% of all jobs in the state. Over one-half of these (144,358), or 8.9% of all state employment, are in the agriculture production, processing and agriculture-related industries.

- Aggregate Agriculture contributed $12.1B in labor income, or 14.6% of the state's total labor income, including agriculture payrolls, which totaled $10.2B, or 13.6% of total state wages.

- Aggregate Agriculture generates value added, employment, and income in all 20 of the 2-digit NAICS aggregated industries in the state. Almost half of agriculture's contribution to value added occurs in industries closely tied to agriculture but not defined as part of the agriculture sector, such as *Real Estate and Rental*, *Wholesale Trade*, and *Manufacturing*.

Including direct, indirect, and induced effects, agriculture generates one in seven jobs and almost 15% of value added in the state. The diversity of the state's agriculture helps mitigate the effects of low world market prices or trade embargoes on commodities. Crops, animal agriculture, and forestry production and processing are all major contributors to agriculture and to the state's economy. The large and diverse natural resource base of the state provides the opportunity for agriculture to change and develop new value added and bio-energy industries. The size and diversity of the state's agriculture contribute greatly to the well-being of Arkansans and to the stability of the state's economy.

**Note:** In some cases, numbers reported in this research report may be different than numbers reported in its companion document, the booklet *Arkansas Agriculture Profile: Pocket Facts 2022* (English and Popp, 2022) due to rounding.

# Definitions and Styles

## Agricultural Sectors

**Aggregate Agriculture** consists of the <u>Crops</u>, <u>Animal Agriculture</u>, and <u>Forestry Sectors'</u> production and processing industries, plus the <u>Agriculture-Related Sector</u>. See Appendix A, Tables A1–A4 for a complete listing of the sectors included.

    The **Crops Sector** comprises those industries directly involved in crop production and processing. See Appendix A, Table A1 for a complete listing of the industries included.

    The **Animal Agriculture Sector** comprises those industries directly involved in livestock production and processing. See Appendix A, Table A2 for a complete listing of the industries included.

    The **Forestry Sector** comprises those industries directly involved in forestry production and processing. See Appendix A, Table A3, for a complete listing of the industries included.

    The **Agriculture-Related Sector** comprises those industries that support the <u>Crops</u>, <u>Animal Agriculture</u>, and <u>Forestry Sectors</u>. See Appendix A, Table A4 for a complete listing of the industries included.

**Note:** Activities are counted in the year they happen. Meaning if a commodity is produced in year 1 but not processed until year 2, we don't see that processing in our values until year 2. No input providers (fertilizer, pesticide, and equipment manufacturers) or retail locations (restaurants, grocery stores, lawn and garden centers, etc.) are considered as direct contributors to the <u>Aggregate Agriculture Sector</u> in the contribution analysis. However, much or some of the economic activity in these firms is picked up as indirect and induced effects and reported as part of the total economic contribution.

## Economic Contribution

The **total economic contribution** of the <u>Aggregate Agriculture Sector</u> includes three areas of wealth and job generation:

1. **Direct Contributions** are the sum of the contributions of farm production and processing of farm and forestry products.

2. **Indirect Contributions** result when agricultural firms purchase raw materials and services from other Arkansas businesses to produce their products.

3. **Induced Contributions** result when employees of agricultural firms and employees of the raw material and service firms spend a portion of their income on local purchases.

These contributions are reported in terms of **Employment, Labor Income,** and **Value Added**:

1. **Employment** includes all wage and salaried employees, as well as self-employed workers (owner-operators) in a given sector.

2. **Labor Income** consists of two parts: proprietary income and wages. Proprietary income includes all income received by self-employed individuals, such as private business owners, doctors, lawyers, or other professionals. Wages include all worker salaries, payments, and fringe benefits paid by employers.

3. **Value Added** includes labor income plus indirect taxes and other property-type income such as payments for rents, royalties, and dividends. Value added and Gross Domestic Product (GDP) are equivalent measures in theory but are estimated using different methods and data sources.

## Style Notes

**Agricultural Sectors.** These comprise the areas of focus in our study. Previous reports break down the <u>Aggregate Agriculture Sector</u> into three areas of analysis: <u>Crops Sector</u>, <u>Animal Agriculture Sector</u>, and the <u>Forestry Sector</u>. However, due to inconsistencies in available data, these areas are no longer analyzed individually. In order to maintain the highest level of accuracy possible, only results for the <u>Aggregate Agriculture Sector</u> are presented in this report. These terms are capitalized and underlined throughout the text.

**NAICS Sectors.** The North American Industry Classification Scheme (NAICS) is "…the standard for use by Federal statistical agencies in classifying business establishments for the collection, tabulation, presentation, and analysis of statistical data describing the U.S. economy" (USCB, 2022). This report uses IMPLAN industry schemes, which are based on NAICS codes represented through varying levels of NAICS code rollups. Generally speaking, manufacturing industries are at the 4–5 digit NAICS detail, whereas agriculture and services are at the 3–4 digit NAICS detail (IMPLAN, 2022a). Agricultural activities are classified under, or can impact, multiple sectors. Throughout the document, capitalization of sectors is used when referring to NAICS sectors. Examples include Food Manufacturing, Paper Manufacturing, and Wood Product Manufacturing.

**Industries.** These are defined as individual IMPLAN industries that are defined by aggregating NAICS sectors into the larger IMPLAN industries used in our analysis. These industries are capitalized and italicized. Examples include *Poultry and Egg Production* and *Paperboard Mills*.

**General Descriptive Terms.** These are terms used throughout the text to describe agriculture areas that are not related to established industry classification schemes or specific agricultural sector titles used in this analysis. These terms are presented in lowercase. Examples include agricultural production and agricultural processing.

# 1: Direct, Indirect, and Induced Contributions of the Aggregate Agriculture Sector

## 1.1: Introduction

The total economic contribution of Arkansas' Aggregate Agriculture Sector is much more than the direct contribution of agricultural production and processing. To measure agriculture's total economic contribution, the indirect and induced contributions of agriculture must also be taken into consideration. Indirect contributions occur when the Aggregate Agriculture Sector purchases goods and services from local businesses. The production of fertilizers and certain farm machinery and equipment, for example, are indirect contributions of agricultural production. Agriculture's induced contributions

are measured by increases in economic activity due to personal consumption by employees of the Aggregate Agriculture Sector and by employees of firms that provide inputs to the Aggregate Agriculture Sector. The sum of direct, indirect, and induced agricultural effects provides a measure for the total economic contribution of agriculture. This report discusses the overall economic contribution of agriculture to Arkansas' economy, considering the direct, indirect, and induced effects of the Aggregate Agriculture Sector in 2020.

## 1.2: Methods

This report builds upon  previous reports (Goodwin et al., 2002; Popp, Vickery, and Miller, 2005; Popp, Kemper, and Miller, 2007; Kemper, Popp, and Miller, 2009; Popp et al., 2010; McGraw, Popp, and Miller, 2011; McGraw, Popp, and Miller, 2012; English, Popp, and Miller, 2013, 2014, 2017, 2019, 2020, and 2021) and utilizes data for 2020, the most recent year that relevant IMPLAN data were available.

As in our previous reports, the economic contribution of Arkansas' Aggregate Agriculture Sector was computed using data and input-output (I-O) modeling software (IMPLAN version 3.1) from IMPLAN Group, LLC; formerly Minnesota IMPLAN Group, Inc. (MIG). Data here are reported for 2020 (IMPLAN, 2022b). Contributions are reported in terms of employment, labor income, and value added (introduced previously and described in depth in section 1.3). The only sectors included as part of the Aggregate Agriculture Sector in the analysis are those directly producing agricultural products, processing raw agricultural products, or providing agricultural services to producers. Any sector less than 100% tied to agriculture (e.g., restaurants, grocery stores, fertilizer manufacturers, or distributors) is not included as part of the Aggregate Agriculture Sector.

Aggregate Agriculture is broadly defined as the sum of Crops, Animal Agriculture, Forestry, and the Agriculture-Related Sectors. Aggregate Agriculture includes all of the IMPLAN industries listed in Appendix A, Tables A1–A4. While

previous reports present individual contribution results for the Crops, Animal Agriculture, and Forestry sectors, inconsistencies in available data have limited the possibilities for accurately separating out these sectors. Therefore, the results of this study are presented only for the Aggregate Agriculture Sector.

The Aggregate Agriculture Sector, as defined in this study, is made up of three types of industries: agricultural production industries, agricultural processing industries, and agriculture-related industries. These industries are further defined in Appendix A. "Contribution analysis" typically describes that portion of a region's economy that can be attributed to an existing industry, event, or policy by identifying all the direct and backward linkages in the study area (Alward, 2012). This contribution includes the direct, indirect, and induced effects of agricultural production, processing, and agriculture-related activities, excluding the direct effect of the food services and drinking industry. Although these and other non-agricultural industries are excluded from direct analysis, the indirect and induced contributions of such sectors are included in the total contribution of agriculture results. These results are generally presented in terms of the Aggregate Agriculture Sector as a whole, but in some cases, may also be presented as individual production and processing contributions.

State-level IMPLAN data for Arkansas for 2020 (the most recent data available) were used to calculate all contributions

(IMPLAN, 2022b). The relevant employment, labor income, and value added contributions of agriculture are summarized below. All labor income and value added figures are reported in current (nominal) 2020 dollars unless otherwise noted.

## 1.2.1 General Procedures

For the economic contribution analysis of the agriculture sector, the entire measure of economic activity in the industries that make up the Aggregate Agriculture Sector (crop, livestock, and forestry production and processing industries, and ag-related activities) are considered to be 100% agriculture. There are several key considerations in the construction of the IMPLAN I-O models used to measure the economic contribution of the Aggregate Agriculture Sector. For each step of the analysis, careful consideration is taken to ensure that the analysis accurately reflects the Arkansas Aggregate Agriculture Sector. The main steps for constructing the model are baseline data analysis, setting up the model through the selection of a trade flows method, multiplier specification, modifying commodity production and trade flows, setting up activities, and analyzing the scenario (IMPLAN, 2022c).

The Aggregate Agriculture Sector is made up of three broad categories: agricultural production, agricultural processing, and agricultural-related industries. The IMPLAN 2020 Arkansas state data package is used as the basis for this analysis. While IMPLAN is widely regarded as the industry standard for contribution and impact analysis, agricultural production data in IMPLAN are sometimes unreliable for three reasons. First, output data for all industries outside of agriculture are estimated from a large number of sources, but data for agricultural production are derived entirely from the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS), the U.S. Department of Agriculture's Economic Research Service (ERS), and the most recent U.S. Census of Agriculture. Due to publication lags between sources, IMPLAN values may be based on preliminary estimates for a given year or otherwise derived from values published from previous years. A second data issue specific to agriculture is non-disclosure problems, particularly at the county level, which makes data reconciliation difficult. A third issue arises from the fact that employment and income data for the agriculture sectors are difficult to estimate. Employment and earnings data are currently only collected at an aggregate level, not on a commodity basis. Therefore, IMPLAN must employ methods to extrapolate these values from

the aggregate state-level figures. In addition to these ongoing challenges, occasional updates to IMPLAN's dataset development methodologies have been shown to cause large, unexplainable shifts in sector values between individual data years. While IMPLAN maintains that their datasets are developed through methods generating the highest accuracy possible, they do encourage analysts with access to better agricultural data to update the baseline dataset, where applicable.

In previous reports, IMPLAN values were adjusted using available USDA NASS and ERS data. However, the discontinuation of reporting of some values by NASS and ERS has made this task increasingly difficult. For example, prior to 2013, ERS reported an annual cash receipt value for the Arkansas greenhouse and nursery industry. This value could be directly compared to IMPLAN's greenhouse, nursery, and floriculture production industry (sector 6). As ERS has discontinued reporting of this value, there is no longer a means of comparison for sector 6. The same can be seen with other specialty crop industries as NASS's reporting for several commodities was discontinued beginning in 2016.

Upon analysis, it was concluded that, although there were unexplainable value shifts within IMPLAN's individual agricultural production sectors, changes found in the Aggregate Agriculture Sector appeared reasonable. This makes sense as some calculation methods used by IMPLAN involve the distribution of an aggregate value to the various agricultural production sectors. This is especially true for employment. For the sake of accuracy, only values for the Aggregate Agriculture Sector are presented in this report, with no adjustments made to IMPLAN's provided dataset.[1]

Outside of baseline data issues, estimating trade flows across regional boundaries is possibly the largest source of error in non-survey I-O models (Stevens and Trainor, 1980). In previous years, the Econometric RPC method was used to eliminate some of the errors. For this report, methods were updated to replace the Econometric RPC method with IMPLAN's National Trade Flows Model. The National Trade Flows Model is a doubly constrained gravity model that's balanced so that domestic imports and exports effectively "cancel out." In other words, all sources of supply and demand are accounted for in the analysis.

Multipliers describe the response of an economy to a change in economic activity and estimate changes in output, employment, income, and value added. When analyzing the economic contributions of the Aggregate Agriculture Sector, Type SAM (Social Accounting Matrix) multipliers are used to incor-

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[1] Researchers are currently working to address these and other issues related to the contribution of agriculture analysis. For more information about this ongoing research, please email cars@uark.edu.

porate household expenditures into the models and to calculate the indirect and induced contributions. Type SAM multipliers are the direct, indirect, and induced effects, where the induced effect is based on both study area data and additional information in the social account matrix. The SAM framework tracks both market and non-market flows. Non-market flows are transactions between non-industrial institutions such as households to government, government to households, and so on. These flows are called "inter-institutional transfers" (Alward and Lindall, 1996). The SAM multiplier approach enables the model to account for commuting, social security tax payments, household income tax payments, and savings; it accounts for income that is not normally re-spent immediately within the region, such as commuting workers who live outside the region and retirement benefits. I-O models built with Type SAM multipliers usually have results that are lower than an I-O model built with Type II multipliers (also available in IMPLAN). However, the Type SAM is viewed as the most appropriate choice for analyzing contributions of the agriculture sector.

Within Type SAM analysis, institutions such as households, state and local government, federal government, enterprises, capital, and inventory additions/deletions may be chosen for internalization within the model. In some previous reports, only the default "household" institutions were selected for analysis. Beginning in 2012, however, it was determined that state and local government should also be included. This addition serves to more accurately account for induced effects brought about through state and local government spending.

When conducting contribution analysis, IMPLAN allows the user to edit commodities produced by industries for the change in final demand. In this study, any byproduct commodity produced in an industry included in the Aggregate Agriculture Sector was set to zero so the industry production of the primary commodity is 100%. Therefore, the industry is solely responsible for the entire value of the product being sold (e.g., the *Oilseed Farming* industry is solely responsible for the entire value of soybeans produced; soybeans are not produced in any other sector). By specifying that each agricultural industry only produces its primary commodity, no byproducts exist and, therefore, no indirect or induced effects are calculated in the defined agricultural industries. In order to ensure that industry purchases do not exceed the amount specified, trade flows also must be modified. This is done by adjusting the Local Use Ratios (RSCs) for each agriculture sector to zero.

In order to measure the contribution of the Aggregate Agriculture Sector, an industry change activity must first be created. Within this activity, events for each agriculture industry within the Aggregate Agriculture Sector should be set. The year of each event is equal to the data year, and output values for each event should equal those provided for each sector by IMPLAN. When setting up events, it's possible to change the portion of activity that accrues to the local (in this case, the state) economy by editing the Local Purchase Percentages (LPPs) for each industry. Only the portion of an industry's value that is produced locally should accrue to the local economy. For instance, output in the *Oilseed Farming* industry (sector 1) involves the LPP being set to 100%, which means the entire output value of that industry is accrued to the region because the goods in the industry are produced within the study region. Alternately, an activity measuring spending by tourists on gasoline and oil would involve setting the LPPs to the SAM value, an estimate of the actual percent of expenditures made in the study area. Estimating the economic contribution of the Aggregate Agriculture Sector to the state involves ensuring that the LPPs for each industry considered part of the Aggregate Agriculture Sector are set to 100%.

## 1.2.2 Measures of Economic Contribution

Total economic contributions are made up of three separate components: 1) direct contributions: generated by farm production and processing of crops, poultry, livestock, and forest products; 2) indirect contributions: generated when agricultural firms purchase materials and services from other Arkansas businesses; and 3) induced contributions: result when employees of agricultural firms and their suppliers spend a portion of their income within Arkansas. Each of these contributions makes up an important part of the total economic contribution of the Arkansas agriculture sector. The overall definition of the Aggregate Agriculture Sector in this study is limited to only those sectors considered to be 100% tied to agriculture, as defined in Appendix A. However, the indirect and induced contributions measure the contributions of those industries that are linked to agriculture but may not be entirely defined as agriculture. These industries represent important economic bases of many communities across the state and contribute to the jobs, income, and value added in these communities due to their relationships with agriculture. Because sectors are interlinked throughout the state, expansion in activities in one sector may result in expansion in other sectors. Therefore, the contributions accruing in other sectors as a result of agricultural production and processing are included in the total economic contribution.

Economic contributions are often measured in terms of 1) total industry output, 2) wages and labor income (wages,

salaries, and proprietor income), 3) total value added, and 4) employment. I-O analysis can be used to assess the economic contribution of an existing sector. These measures are thought of as a sector's gross contribution to the regional economy. This is accomplished by "removing" the sector of choice from the I-O model and examining how this removal affects the economic activity in the region. This provides an estimate of the contribution of the sector by looking at the losses experienced (or activity generated) by the sector of interest.

Employment includes all wage and salaried employees, as well as self-employed jobs in a given sector. All jobs are not equal; they pay different wages, require different skills and different work hours, etc., which makes aggregate estimates or comparisons across regions and industries problematic. However, jobs as a measure of economic contribution are easily understood and an important component of economic activity. Labor income consists of two parts: first is proprietary income, which includes all income received by self-employed individuals, including private business owners, owner-operators, etc.; second is wages, which includes all worker salaries, payments, and fringe benefits paid by employers. Value added represents all payments to workers (labor income) plus indirect taxes and other property-type income, such as payments for rents, royalties, and dividends. Value added is comparable to GDP by State but is measured using different data sources and methods,

so the data may not be precisely equal. Value added is the income and indirect business taxes generated by the activity and offers a more complete examination of the total economic contribution of an activity in a region; therefore, economists generally prefer value added to output as the measure for assessing the contribution of a given industry or activity to a region's economy (Olson and Lindall, 2009). Income and value added are also relatively clear measures of economic contribution that can be directly compared across industries and regions that contain a range of different economic activities.

Measuring the economic importance of an industry using output can be misleading. Output represents the dollar value of an industry's total production but also can be thought of as the sum of the goods and services used to provide a product. Economic contribution analyses estimate the contribution of production (output) by including purchases from other industries to produce the inputs required to create this output; therefore, output includes the production of intermediate goods, which are included in another industry's output. Summing the output of all industries would include multiple counting of some goods and services. Gross sales receipts overestimate the economic size of an industry because the values of inputs are recounted at each succeeding stage of production. As a result, output should not be used as a measure of economic contribution and is not reported in this study.

# 1.3: The Aggregate Agriculture Sector

In 2020, agriculture made substantial contributions to the Arkansas economy in terms of employment, labor income, wages, and value added (see Box 1). The Aggregate Agriculture Sector provided 243,165 jobs, accounting for 14.9% of state employment. That is, one in seven Arkansas jobs can be attributed to agriculture. In that same year, agriculture paid $12.1B, or 14.6% of state labor income. Wages accounted for $10.2B, or over 84% of total labor income generated by agriculture. Additionally, the Aggregate Agriculture Sector added $19.0B of value to the state economy, or 14.3% of state value added. That is, $1 out of every $7 in value added can be attributed to agriculture (Box 1).

Agriculture generates employment in all 20 of the 2-digit NAICS sectors. Over 73% of all agriculture-generated jobs are in five sectors: *Manufacturing*; *Agriculture, Forestry, Fishing, and Hunting*; *Transportation and Warehousing*; *Healthcare and Social Assistance*; and *Wholesale Trade* (Box 2).

The far-reaching contributions of agriculture are seen in the distribution of agriculture-generated value added throughout the economy. Box 3 shows the five sectors that benefit most from value added generated by agriculture. Note that three of those sectors (*Wholesale Trade, Real Estate and Rental and Leasing, and Transportation and Warehousing*) lie outside of the agriculture sector as defined in this study. Although half of all agriculture-generated value added accrues outside agricultural sectors, these sectors are closely tied to agriculture. For instance, *Wholesale Trade* contains businesses such as grain and livestock wholesalers as well as farm supply wholesalers.

As with value added, much of the income attributable to agricultural activity is generated outside of agricultural sectors. Box 4 shows the five sectors that generate the most income as the result of agricultural activity in Arkansas. In 2020, $5.3B, or 56% of all labor income, went to workers in non-agricultural sectors.

**Box 1. Total Contribution of Arkansas Agriculture, 2020**

**Employment**
243,165 jobs
(1 out of 7 Arkansas jobs)

**Wages**
$10,178M
(13.61% of Arkansas wages)

**Labor Income**
$12,079M
(14.64% of Arkansas labor income)

**Value-Added**
$18,977M
($1 out of $7 Arkansas value added)

Source: IMPLAN (2022).
NOTE: Presented in current dollars.

**Box 2. Employment Generated by Agriculture, 2020 Top Five NAICS Industries[a]**

**Manufacturing**
81,040 jobs
(99% of the jobs are in agricultural processing)

**Agriculture, Forestry, Fishing and Hunting**
64,130 jobs
(83.45% of the jobs are in agricultural production)

**Transportation and Warehousing**
11,873 jobs

**Health Care and Social Assistance**
10,732 jobs

**Wholesale Trade**
10,643 jobs

**Top Five Total**
178,418 jobs
(73.37% of all jobs generated by Agriculture)

[a]Based on 2-Digit NAICS aggregation (USCB, 2022).
Source: IMPLAN (2022).
Note: presented in current dollars.

**Box 3. Value Added Generated by Agriculture, 2020 Top Five NAICS Industries[a]**

**Manufacturing**
$8,167M
(98.63% of value added is in agricultural processing)

**Wholesale Trade**
$1,900M

**Agriculture, Forestry, Fishing and Hunting**
$1,807M
(79.46% of value added is in agricultural production)

**Real Estate and Rental and Leasing**
$1,348M

**Transportation and Warehousing**
$897M

**Top Five Total**
$14,118M
(74.39% of all value added generated by Agriculture)

[a]Based on 2-Digit NAICS aggregation (USCB, 2022).
Source: IMPLAN (2022).
Note: Presented in current dollars.

**Box 4. Labor Income Generated by Agriculture, 2020 Top Five NAICS Industries[a]**

**Manufacturing**
$4,769M
(98.83% of labor income is in agricultural processing)

**Agriculture, Forestry, Fishing and Hunting**
$2,102M
(83.1% of labor income is in agricultural production)

**Wholesale Trade**
$881M

**Transportation and Warehousing**
$736M

**Health Care and Social Assistance**
$638M

**Top Five Total**
$9,127M
(75.56% of all labor income generated by Agriculture)

[a]Based on 2-Digit NAICS aggregation (USCB, 2022).
Source: IMPLAN (2022).
Note: Presented in current dollars.

Agriculture's direct contribution to the state economy is measured by the sum of the contributions of farm production, processing of farm products, and agriculture-related sectors. In 2020, there were 144,358 workers employed by the agricultural production, processing and agriculture-related sectors. The owners, operators, and workers of these farms and businesses received more than $6.8B in labor income; 69% of direct labor income went to workers and business owners in processing industries. Agricultural production, processing, and agriculture-related industries directly added value of $9.9B to the Arkansas economy; almost 82% was from processing industries (Table 1).

Indirect contributions result when agricultural firms purchase raw materials and services from other Arkansas businesses to produce their products. In 2020, there were 50,534 workers employed by industries supplying goods and services to the farm production and processing industries. The workers and owners of these establishments received $3.1B in labor income, and these industries added value of over $5.2B to the state economy (Table 1).

Induced contributions result when employees of agricultural firms and employees of the raw material and service firms spend a portion of their income on local purchases. There were 48,273 workers employed by businesses providing goods and services to the employees in agriculture and its supplying industries. These employees and the proprietors of these businesses received roughly $2.2B in labor income and added value of almost $3.9B to the Arkansas economy (Table 1).

# 1.4: Summary of the Contribution of Agriculture in 2019

In 2020, the Aggregate Agriculture Sector contributed 144,358 direct jobs, or 8.9% of state employment. In addition, the Aggregate Agriculture Sector contributed 98,807 indirect and induced jobs, for a total contribution of almost 15% of state employment. Indirect and induced jobs were created in all 20 of the 2-digit NAICS aggregated industries. This analysis indicates that the Arkansas Aggregate Agriculture Sector plays a significant role in generating jobs, income, and value added throughout the state's economy. World and domestic price stability and associated agricultural and food policies will continue to have a significant impact on Arkansas agriculture and its contribution to the Arkansas economy. The continued strength of agriculture is of paramount importance if the social and economic fabric of rural Arkansas communities is to be retained and if the essential infrastructure and services that translate into an acceptable quality of life for its residents are to be maintained.

| Table 1. The Aggregate Agriculture Sector's Contribution to Arkansas' Economy, 2020. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Employment[a] | | | Labor Income[b] | | | Value Added[c] | | |
| | Number of Jobs | % Total | % Total Arkansas Jobs | Million $ | % Total | % Total Arkansas Labor Income | Million $ | % Total | % Total Arkansas Value Added |
| Production[d] | 53,516 | 22.0 | 3.3 | 1,747 | 14.5 | 2.1 | 1,436 | 7.6 | 1.1 |
| Processing[e] | 80,228 | 33.0 | 4.9 | 4,714 | 39.0 | 5.7 | 8,055 | 42.4 | 6.1 |
| Ag-Related[f] | 10,614 | 4.4 | 0.7 | 355 | 2.9 | 0.4 | 371 | 2.0 | 0.3 |
| **Direct Contribution** | **144,358** | **59.4** | **8.9** | **6,816** | **56.4** | **8.3** | **9,861** | **52.0** | **7.4** |
| Indirect Effects | 50,534 | 20.8 | 3.1 | 3,105 | 25.7 | 3.8 | 5,245 | 27.6 | 4.0 |
| **Direct + Indirect Contribution** | **194,892** | **80.1** | **12.0** | **9,921** | **82.1** | **12.0** | **15,107** | **79.6** | **11.4** |
| Induced Effects | 48,273 | 19.9 | 3.0 | 2,159 | 17.9 | 2.6 | 3,870 | 20.4 | 2.9 |
| **Total Contribution** | **243,165** | **100.0** | **14.9** | **12,079** | **100.0** | **14.6** | **18,977** | **100.0** | **14.3** |

Source: Computed using the 2020 Arkansas database from IMPLAN (2022).
Note: Presented in current dollars. Numbers may not add up due to rounding.

[a] Equivalent to full- and part-time jobs (Day, 2014).
[b] Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (Day, 2014).
[c] Value added is the sum of employee compensation, proprietary income, other property type income, and indirect business taxes.
[d] Appendix A, Tables A1–A3 list sectors of direct agricultural production in terms of IMPLAN sectors.
[e] Appendix A, Tables A1–A3 list sectors of direct agricultural processing in terms of IMPLAN sectors.
[f] Ag-related sectors include agricultural sectors not categorized as agricultural production or processing. These sectors are Fishing, Hunting, and Trapping; Agriculture and Forestry Support Activities; and New Farm Housing Units and Additions and Alterations.

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# Appendix A
## *Description of IMPLAN Sectors and Aggregation Schemes*

**Table A1. Components of the Crops Sector as Defined by IMPLAN Sectors, 2020.**

| Aggregate Sector | Sector ID | IMPLAN Sector |
|---|---|---|
| CROPS PRODUCTION | 1 | Oilseed farming |
| | 2 | Grain farming |
| | 3 | Vegetable and melon farming |
| | 4 | Fruit farming |
| | 5 | Tree nut farming |
| | 6 | Greenhouse, nursery, and floriculture production |
| | 7 | Tobacco farming |
| | 8 | Cotton farming |
| | 9 | Sugarcane and sugar beet farming |
| | 10 | All other crop farming |
| CROPS PROCESSING | 65 | Flour milling |
| | 66 | Rice milling |
| | 67 | Malt manufacturing |
| | 68 | Wet corn milling |
| | 69 | Soybean and other oilseed processing |
| | 70 | Fats and oils refining and blending |
| | 71 | Breakfast cereal manufacturing |
| | 72 | Beet sugar manufacturing |
| | 73 | Sugar cane mills and refining |
| | 74 | Nonchocolate confectionery manufacturing |
| | 75 | Chocolate and confectionery manufacturing from cacao beans |
| | 76 | Confectionery manufacturing from purchased chocolate |
| | 77 | Frozen fruits, juices and vegetables manufacturing |
| | 78 | Frozen specialties manufacturing |
| | 79 | Canned fruits and vegetables manufacturing |
| | 80 | Canned specialties |
| | 81 | Dehydrated food products manufacturing |
| | 87 | Frozen cakes and other pastries manufacturing |
| | 93 | Bread and bakery product, except frozen, manufacturing |
| | 94 | Cookie and cracker manufacturing |
| | 95 | Dry pasta, mixes, and dough manufacturing |
| | 96 | Tortilla manufacturing |
| | 97 | Roasted nuts and peanut butter manufacturing |
| | 98 | Other snack food manufacturing |
| | 99 | Coffee and tea manufacturing |
| | 100 | Flavoring syrup and concentrate manufacturing |
| | 101 | Mayonnaise, dressing, and sauce manufacturing |
| | 102 | Spice and extract manufacturing |
| | 103 | All other food manufacturing |
| | 104 | Bottled and canned soft drinks & water |
| | 105 | Manufactured ice |
| | 106 | Breweries |
| | 107 | Wineries |
| | 108 | Distilleries |
| | 109 | Tobacco product manufacturing |

*Table continued on the next page.*

**Table A1. Continued.**

| Aggregate Sector | Sector ID | IMPLAN Sector |
|---|---|---|
| CROPS PROCESSING, cont. | 110 | Fiber, yarn, and thread mills |
| | 111 | Broadwoven fabric mills |
| | 112 | Narrow fabric mills and schiffli machine embroidery |
| | 113 | Nonwoven fabric mills |
| | 114 | Knit fabric mills |
| | 115 | Textile and fabric finishing mills |
| | 116 | Fabric coating mills |
| | 117 | Carpet and rug mills |
| | 118 | Curtain and linen mills |
| | 119 | Textile bag and canvas mills |
| | 120 | Rope, cordage, twine, tire cord and tire fabric mills |
| | 121 | Other textile product mills |
| | 122 | Hosiery and sock mills |
| | 123 | Other apparel knitting mills |
| | 124 | Cut and sew apparel contractors |
| | 125 | Mens and boys cut and sew apparel manufacturing |
| | 126 | Womens and girls cut and sew apparel manufacturing |
| | 127 | Other cut and sew apparel manufacturing |
| | 128 | Apparel accessories and other apparel manufacturing |

**Table A2. Components of the Animal Agriculture Sector, Defined by IMPLAN Sectors, 2020.**

| Aggregated Sector | Sector ID | IMPLAN Sector |
|---|---|---|
| ANIMAL PRODUCTION | 11 | Cattle ranching and farming |
| | 12 | Dairy cattle and milk production |
| | 13 | Poultry and egg production |
| | 14 | Animal production, except cattle and poultry |
| ANIMAL PROCESSING | 63 | Dog and cat food manufacturing |
| | 64 | Other animal food manufacturing |
| | 82 | Cheese manufacturing |
| | 83 | Dry, condensed, and evaporated dairy product manufac |
| | 84 | Fluid milk manufacturing |
| | 85 | Creamery butter manufacturing |
| | 86 | Ice cream and frozen dessert manufacturing |
| | 88 | Poultry processing |
| | 89 | Animal, except poultry, slaughtering |
| | 90 | Meat processed from carcasses |
| | 91 | Rendering and meat byproduct processing |
| | 92 | Seafood product preparation and packaging |
| | 129 | Leather and hide tanning and finishing |
| | 130 | Footwear manufacturing |
| | 131 | Other leather and allied product manufacturing |

**Table A3. Components of the Forestry Sector as Defined by IMPLAN Sectors, 2020.**

| Aggregated Sector | Sector ID | IMPLAN Sector |
|---|---|---|
| FORESTRY PRODUCTION | 15 | Forestry, forest products, and timber tract production |
| | 16 | Commercial logging |
| FORESTRY PROCESSING | 132 | Sawmills |
| | 133 | Wood preservation |
| | 134 | Veneer and plywood manufacturing |
| | 135 | Engineered wood member and truss manufacturing |
| | 136 | Reconstituted wood product manufacturing |
| | 137 | Wood windows and door manufacturing |
| | 138 | Cut stock, resawing lumber, and planing |
| | 139 | Other millwork, including flooring |
| | 140 | Wood container and pallet manufacturing |
| | 141 | Manufactured home (mobile home) manufacturing |
| | 142 | Prefabricated wood building manufacturing |
| | 143 | All other miscellaneous wood product manufacturing |
| | 144 | Pulp mills |
| | 145 | Paper mills |
| | 146 | Paperboard mills |
| | 147 | Paperboard container manufacturing |
| | 148 | Paper bag and coated and treated paper manufacturing |
| | 149 | Stationery product manufacturing |
| | 150 | Sanitary paper product manufacturing |
| | 151 | All other converted paper product manufacturing |
| | 365 | Wood kitchen cabinet and countertop manufacturing |
| | 366 | Upholstered household furniture manufacturing |
| | 367 | Nonupholstered wood household furniture manufacturing |
| | 369 | Institutional furniture manufacturing |
| | 370 | Wood office furniture manufacturing |
| | 371 | Custom architectural woodwork and millwork |
| | 373 | Showcase, partition, shelving, and locker manufacturing |

**Table A4. Components of the Agriculture-Related Sector as Defined by IMPLAN Sectors, 2020.**

| Aggregated Sector | Sector ID | IMPLAN Sector |
|---|---|---|
| AGRICULTURE RELATED | 17 | Commercial fishing |
| | 18 | Commercial hunting and trapping |
| | 19 | Support activities for agriculture and forestry |

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