# ECONOMIC IMPACT OF THE FIRMS ASSISTED BY THE OKLAHOMA FOOD AND AGRICULTURAL PRODUCTS RESEARCH AND TECHONOLGY CENTER

Ann Zimmerschied

Mike Woods

Charles Willoughby

Rodney Holcomb

Daniel Tilley*

*  Graduate Student, Professor and Extension Economist, Business and Marketing Specialist, Associate Professor, Professor Respectively
Department of Agricultural Economics and Oklahoma Food and Agricultural Products Research and Technology Center, Oklahoma State University

# ECONOMIC IMPACT OF THE FIRMS ASSISTED BY THE OKLAHOMA FOOD AND AGRICULTURAL PRODUCTS RESEARCH AND TECHONOLGY CENTER

Ann Zimmerschied
Graduate Student

Mike Woods
Professor and Extension Economist

Charles Willoughby
Business and Marketing Specialist

Rodney Holcomb
Associate Professor

Daniel Tilley
Professor

## ABSTRACT

An economic impact study of the Oklahoma Food and Agricultural Products Research and Technology Center was conducted to analyze the impact of the firms the Center has assisted and the impact of services provided by the Center. The economic impact of the firms assisted was calculated using an IMPLAN model.

**Oklahoma Food and Agricultural Products Research and Technology Center**


The Oklahoma Food and Agricultural Products Research and Technology Center, better know as the Oklahoma Food and Agricultural Products Center (FAPC), was established in 1995 and staffed in 1997 to help local and regional entrepreneurs as well as established firms compete in the current marketplace. The purpose of the Center was to help Oklahoma's economy bridge the gap between agricultural production of raw commodities and finished products. The Center targets clients that are potential of existing value-added agricultural processing firms in the state of Oklahoma. The clearly defined customer based helps the Center allocate time and resources in a way to best serve the needs of clients.

The Center's faculty and staff are made up of 32 individuals. The director and administrative staff account for six, there are nine faculty that represent eight different specialty areas, ten professional staff and seven technical staff. The wide variety of the Center's faculty and staff allow them to better meet the needs of the clients. The faculty and staff also work closely with other faculty at the university to best serve the clients.

The Center works to provide clients with a wide variety of services. Currently, the Center offers four main categories of services. These services include: Business and Marketing Assistance, Educational and Quality Programs, Technical Assistance and Research.

The Business and Marketing Assistance Programs help address each firms unique business needs. The Center can help the firm develop a business plan. Working with the firm to identify and evaluate possible markets, pricing and promotion of existing and

future products, and potential financing options are valuable services that the Center has to offer.  The Center can also help the firm comply with state and federal regulations or locate possible co-packers for the firm's products.

Educational and Quality Programs include a number of workshops designed by the Center to meet the needs of their clients.  Most of the workshops are offered at a small fee to the client to help cover the costs of materials and meals that are provided.  Currently there are seven workshops offered by the Center.  The workshops consist of an Entrepreneurial Workshop, Food Industry Roundtable Discussions, Hazard Analysis and Critical Control Point (HACCP) Workshop including a back to the basics and advanced session, Master Canner's Workshop, Better Process Control School, and Deep Fat Frying Workshop.

Aiding customers with a variety of projects involving compliance with new regulations, process optimization, and product development and improvement is the main focus of the Technical Assistance area.  There are approximately 20 faculty and staff in the Center that encompass a wide variety of assistance areas.  The areas include: food microbiology, food chemistry, food engineering, horticultural processing, meat science, cereal and oilseed processing, quality control and economics.

The final service area is Research.  The research usually takes place in the Center's pilot processing facilities.  The facilities are available to perform all levels of agricultural product processing.  Facilities can accommodate meat, cereal, dairy, fruit and vegetable products.  The up-to-date equipment allow for thermal processing, drying, freezing, packaging, milling and fermentation of various products.  The flexibility of the processing plant, allows the Center to meet the needs of the clients in terms of developing

new products, evaluation of ingredients, testing new equipment, and creating new manufacturing techniques. (OFAPRTC)  The main objective of the study was to assess the economic impact of the Center on the state of Oklahoma.  This paper outlines the economic impact analysis used to measure the impact of all of the firms that the Center has assisted.

**Data Source and Methodology**

A telephone survey was conducted by the Bureau for Social Research at Oklahoma State University to gather the necessary data for the analysis.  The telephone survey included questions about the services received from the Center and firm demographics.  The firm demographic questions consisted of 2001 full- and part-time employment, payroll and sales.  A portion of the survey also looked at 1997 firm demographics to determine growth over the five-year period.  The population for the telephone survey included all firms and contact names that were currently in the Center's project database.  There were three project status categories that are utilized by the Center.  The first was "Active."  This category was for projects that are currently being pursued by both the firm and the Center.  A large number are labeled "Complete."  The Center has assisted the firm in acquiring all of the information that was requested on that particular project.  The final category is "Inactive Pending Client Input."  A firm has requested help from the Center, but no further information was given to the Center about the assistance the firm desired.  The firm name and contact information was taken from

the project database and complied into a form that was desirable for the Bureau for Social Research to conduct the telephoning survey.

A complete list of all firms in the Center's database was provided to the Bureau for Social Research at Oklahoma State University. This list included 405 firm names, a contact person for each firm and a corresponding telephone number. The Bureau was hired to do all of the phone surveying. This was done to help ensure a more scientific data collection process. The random sample of the firms was drawn by the Bureau's sampling manager software. A random sample indicated that all persons in the database had the same chance of being selected as a part of the survey. The sampling manager randomly selected a name and telephone number and provided it for the interviewer. A random sample was chosen so that the researchers could get a better idea of the population. However, since there was such a small population a random sample was drawn until all numbers were attempted. Every firm that was in the Center's project database was contacted to participate in the telephone survey. Once the person agreed to participate in the survey, the interviewer script software was activated. The interviewers were able to enter the responses directly into the script software. At the conclusion of the survey, the data were cleaned by the Bureau and given to the researchers. If for any given question the interviewee had a response to the question or a comment, the interviewer had a chance to enter that information into the software as well. At the conclusion of the survey the staff at the Bureau noted the comments and incorporated that into the database if possible. In order to maintain confidentiality, two data sets were received from the Bureau. The first data set contained the firms name, contact person and phone number of all firms that indicated that they would be willing to participate in

the case study portion of the study.  The second data set contained responses about employment, sales and payroll that were to be used in the economic impact analysis.  The firms participating in the telephone survey covered all areas of agriculture processing sector.  The majority of the firm produced prepared and specialty items like barbecue sauces, jams, jellies, salsa, and other goods.  A number of firms are involved in meat processing producing such items as jerky, sausage and chicken products.  Firms also indicated that they were involved in producing organic vegetables, breads and bakery products, grains for food and feed and oil processing.  Based on the results of the telephone survey a 72% response rate was achieved.

**Survey Results**

Employment

The number of current employees working for the firms was asked as part of the survey.  Employees were divided into two categories full-time and part-time.  Full-time employees are persons who work a 40 hour week at the firm and part-time employees are defined as persons who work less than a 40 hours a week at the firm.  The respondents to the survey indicated that there was total full-time employment of 7,883 workers.  Based on the response to the question the mean number of full-time employees was 57.  The quartile percentages found at the bottom of Table 1 provide a better picture of the distribution of employees.  The quartiles indicated that 25% of the firms, which is 35 firms, have one or fewer full-time employees, 50% have 3 or fewer employees and 75% have 13 or fewer employees.  This suggests that the majority of the firms that responded to the question were small firms, 50% have at most three full-time employees.

The number of current part-time employees of the firm was gathered and is presented in Table 2. There were a total of 937 total part-time employees working for the firms in 2001. The mean number of part-time workers is 7. The quartile percentages indicate that 25% of the firms do not employ part-time workers, 50% employ one or fewer part-time personnel and 75% employ four of less.

Annual Payroll

The total amount of annual payroll paid to employees in 2001 was gathered in the telephone survey. The data are presented in Table 3. The data indicate that there is a wide variation in the size of firms in the study. The total value paid to employees in 2001 by firms assisted by the Center was over $44 million. The minimum amount of payroll received by employees was zero and the maximum was $20 million.

Annual Sales

Sales figures for 2001 were collected in the telephone survey. The figures were based on total value of sales that each firm experienced for the year 2001, summarized in Table 4. Total value in sales for the firms that the Center has assisted accounted for over $542 million of the states total sales. There were 37 contacts that did not know sales and 15 contacts that refused to answer the question. Based on the valid responses the mean sales was almost 6 million. The quartile percentages showed that 25% of the firms had sales of $14,250 or less, 50% had sales of $145,000 or less and 75% had sales of $1 million or less.

# Input-Output Models

Input-output models are used to estimate economic impacts on a regions current output, total amount of value-added through processing, number of jobs, employee compensation and proprietors' income due to a change in the regions business activity (Stallmann et al.). The input-output model is based on two basic assumptions. The first is that the direct coefficients are fixed. The fixed coefficients imply that technology is constant, there are not external economies or diseconomies of scale, and no substitution occurs in the market place due to changes in prices of availability of relevant goods. The second assumption is that there are no errors in the aggregation of summing industries into a sector (Doeksen and Schreiner).

The flow table includes a processing section in the upper-left hand portion of the table. This includes sectors that produce goods and services from the other sectors. The final demand portion of the flow chart is located on the right hand side of the table. Sectors that purchase goods and services from the processing sectors for final use are located in this part of the table. This portion of the table is usually made up of households, government, exports, inventory change and capital formation. The primary input section of the table consists of imports, households, governments and depreciations. The row figures indicate the amount of goods and services that are sold by the sectors in the processing and final demand sectors on the table (Doeksen and Schreiner). The column figures specify the amount of goods and services that are purchased from the industry in the specific column to the row sectors.

Figure 1. Flow Chart with Mathematical Notation

|  | Purchasing Sectors | | | | Final | Total |
|  | (1) | (2) | (3) | (4) | Demand | Output |
|---|---|---|---|---|---|---|
| Producing Sectors |  |  |  |  |  |  |
| (1) | $X_{11}$ | $X_{12}$ | $X_{13}$ | $X_{14}$ | $Y_1$ | $X_1$ |
| (2) | $X_{21}$ | $X_{22}$ | $X_{23}$ | $X_{24}$ | $Y_2$ | $X_2$ |
| (3) | $X_{31}$ | $X_{32}$ | $X_{33}$ | $X_{34}$ | $Y_3$ | $X_3$ |
| (4) | $X_{41}$ | $X_{42}$ | $X_{43}$ | $X_{44}$ | $Y_4$ | $X_4$ |
|  |  |  |  |  |  |  |
| Primary Inputs |  |  |  |  |  |  |
| (1) Households | $Y_{h1}$ | $Y_{h2}$ | $Y_{h3}$ | $Y_{h4}$ | $Y_h$ | $R_h$ |
| (2) Other Primary Inputs | $Y_{o1}$ | $Y_{o2}$ | $Y_{o3}$ | $Y_{o4}$ | $Y_o$ | $R_o$ |
|  |  |  |  |  |  |  |
| Total | $X_1$ | $X_2$ | $X_3$ | $X_4$ | $Y$ |  |

(Doeksen and Schreiner)

The creation of a new firm or the expansion of an existing firm can have a large impact on a region's economy. The impacts can be broken down into three categories, direct, indirect and induced effects. Direct impacts or direct effects are the changes in economic activity that result from the production and processing of a product. The new firms or expanded firms are considered to be direct industries (Piewthongngam 2002. et al. and Stallmann et al.). A direct coefficient is used to measure the direct effect and indicates the total amount of inputs that are required per dollar of output for the sector. Indirect effects occur when the new or expanded firms purchase goods and services from other sectors to produce more of the product. The indirect impact also includes the hiring of additional labor for production of the final product. These firms, supporting industries, are the industries from which the direct industries purchase inputs. The indirect effects are a result of the increased business spending that occurs by the basic industry. The increase in wages paid to employees in the direct and supporting industries are available

for employees to purchase additional goods and services. The additional wages spent by employees create an induced effect on the region's economy (Piewthongngam 2002 et al. and Stallmann et al.). The direct and indirect coefficients are used to measure the indirect effect. It is the total amount of change in input required for a one-dollar change in final demand (Doeksen and Schreiner). To measure the total effect that a new firm or expanded industry has on a regions economy; direct, indirect and induced effects must be summed.

Employment multipliers indicate the total change in employment numbers throughout the region resulting in a one-unit employment change in a given sector. There are three basic steps to calculating the employment multipliers. The direct employment effect is found by dividing the total amount of employment in the given sector by the total output of the sector. Then the direct and indirect coefficient matrix is transposed and multiplied by a vector of the direct income effect. This will provide a vector of the direct and indirect employment effect in each sector. The final step in calculating the employment multiplier is to divide the direct and indirect employment effects by the direct employment effect to acquire the employment multiplier for each sector.

The output or sales multiplier represents the total amount of sales generated by a one dollar change in final demand of a given sectors goods or services. The sales multiplier is calculated by adding the column of direct and indirect coefficients for the given sector. The sales multiplier is interpreted for every one-dollar increase in a sectors sales, there is an increase equal to the sales multiplier throughout the region.

**Economic Impact Analysis**

IMPLAN Model

The data collected in the telephone survey was used to create an economic impact analysis. IMPLAN, a computer software program and regional database, was used to conduct the analysis. The IMPLAN database contains economic data for every county in the United States. Since 1990 the database has been updated annually (Holland et al). IMPLAN is used to determine how local changes affect a region's or state's economy (Maki et al). The database includes 528 industrial sectors (Piewthongngam August 2002 et al). IMPLAN can divide industrial sectors by one or two digit SIC codes. When sorted by two digit SIC codes, agricultural codes range from 1 to 27 and manufacturing from 58 to 432. A state model was used to determine the economic impact of all of the firms that the Center has assisted. The firms were broken down into nine industry sectors based on responses to a question on the telephone survey asking the type of products produced. The nine categories included, meat processing, fruits and vegetables, bakery and confectionary goods, grain processing for food, prepared and specialties food, grains and other processing for feed, fats and oils processing and other. After close analysis of the state model, the multiplier used in the Impact of Agriculture on Oklahoma's Economy: 2000 will be the same ones utilized in this analysis. The multipliers were calculated based on the 1998 industrial relationships. This was the most up-to-date figures at the time that the report was written (Piewthongngam 2002 et al). There was no other category in the report so the average of all industries were used to create an "other" category to be used in this study. The economic values and outputs used in this study were from 2001.

Results of Analysis

  The first economic factor analyzed was employment. In the study employment was broken down into two categories, full-time and part-time. The impact of full-time employment by the firms assisted by the Center is summarized in Table 5. Part-time employees were included in the full-time employment category. For every two part-time employees in a given sector a full-time employee was added to the total number of full-time employees in that sector. An employment multiplier represents the change in employment in the state from a one-unit change in the number of employees in a given sector. The direct employment (the total number of people employed of the firms assisted by the Center) of the meat processing industry was 6,616 and based on the calculated multiplier, the sector accounted for 18,684 jobs in the state. There were 8,383 total full-time employees of Center assisted firms that directly and indirectly account for approximately 22,000 full-time positions in the sate of Oklahoma.

  The sales values for 2001 were used to determine the economic impact that the firms sales had on the state. Table 6 summarizes the total direct and indirect and induced sales figures for 2001. An income or sales multiplier measures the total change in the state's economy from a one-dollar change in income or sales by a given sector. The firms assisted by the Center account for nearly $545,000,000 in direct sales in the state, which accounts for approximately $2 billion in annual sales.

## Summary and Conclusions

The results of the telephone survey and the IMPLAN analysis indicate that the Center and its services have a impact on the states economy. Based on the study by Piewthongngam 2002 et el, in 2000 there was a gross state products for agricultural processing industry of $1,349,602,000 and 39,609 direct processing jobs in the state of Oklahoma. The firms that the Center has assisted account for $544,915,000 in annual sales, which is 40 percent of the states 2000 gross state product for the agricultural processing industry. Firms assisted by the Center account for 8,383 in direct full-time employment in 2001. This represents 21 percent of direct employment. Based on the results of this study the Center assists a wide variety of firms that play a major role in Oklahoma's state economy. For a complete copy of the study including the case study analysis, five-year comparison of firms and final conclusions please contact the authors.

# References

Doekson, Gerald A. and Dean F. Schreiner. "Interindustry Models for Rural Development Research." Agricultural Experiment Station, Oklahoma State University 1974.

Holland, W. David, Hans T. Geier and Ervin G. Schuster. "Using IMPLAN to Identify Rural Development Opportunities." United States Department of Agriculture, General Technical Report INT-GTR-350, May 1997.

Maki, Wilbur, Doug Olson, Scott Lindall, David Senf and Con Schallau. "IMPLAN Model Applications in State and Regional Development." Staff Paper P89-15, Department of Agricultural and Applied Economics, University of Minnesota, April 1989.

Oklahoma Food and Agricultural Products Research and Technology Center (OFAPRTC), *http://www.okstate.edu/ag/fapc/*, page updated June 26, 2000.

Piewthongngam, Goi, Mike Woods, Rodney Holcomb and Stan Ralstin. "The Economic Impact of Value Added Cooperative on the Economy of Woods County, Oklahoma." AE-02147, Food and Agricultural Products Research ad Technology Center, Oklahoma State University, August 2002.

Piewthongngam, Goi, Mike D. Woods, Rodney Holcomb, and Chuck Willoughby. "Impact of Agriculture on Oklahoma's Economy: 2000." Department of Agricultural Economics, Food and Agricultural Research and Technology Center Oklahoma State University, 2002.

Stallmann, Judith I., Garen Evans, Bud Schwart, Lonnie Jones, and John Siedert. "The Economic Impacts of a Cheese Plant and Diaries in the Panhandle of Texas." Faculty Paper Series 01-07, Department of Agricultural Economics, Texas A&M University System, May 2001.

Table 1. Number of Current Full-Time Employees

|  |  | Number of Full-Time Employees (N=140)[1] |
|---|---|---|
| Total |  | 7,883 |
| Mean |  | 57 |
| Median |  | 3 |
| Mode |  | 1 |
| Minimum |  | 0 |
| Maximum |  | 3500 |
|  |  |  |
| Quartile Percentages | 25 | 1 |
|  | 50 | 3 |
|  | 75 | 13 |

[1]Three firm contacts did not know the number of full-time employees and one contact refused to answer.

Table 2. Number of Part-Time Employees

|  |  | Number of Part-Time Employees (N=138)[1] |
|---|---|---|
| Total |  | 937 |
| Mean |  | 7 |
| Median |  | 1 |
| Mode |  | 0 |
| Minimum |  | 0 |
| Maximum |  | 400 |
|  |  |  |
| Quartile Percentages | 25 | 0 |
|  | 50 | 1 |
|  | 75 | 4 |

[1]Five firm contacts did not know the number of part-time employees and one contact refused to answer.

Table 3. Total Amount of Annual Payroll to Current Employees for 2001 in Dollars

| | | Annual Payroll to Employees (N=87)[1] |
|---|---|---|
| Total | | $44,457,304.00 |
| Mean | | $817,516.87 |
| Median | | $25,000.00 |
| Mode | | 0 |
| Minimum | | 0 |
| Maximum | | $20,000,000.00 |
| | | |
| Quartile Percentages | 25 | 0 |
| | 50 | $25,000.00 |
| | 75 | $127,000.00 |

[1]Fifty-one firm contacts did not know annual payroll and nine contacts refused to answer.


Table 4. Total Annual Sales for 2001 in Dollars

| | | Total Annual Sales (N=92)[1] |
|---|---|---|
| Total | | $542,165,000.00 |
| Mean | | $5,922,989.00 |
| Median | | $145,000.00 |
| Mode | | 0 |
| Minimum | | 0 |
| Maximum | | $300,000,000.00 |
| | | |
| Quartile Percentages | 25 | $14,250.00 |
| | 50 | $145,000.00 |
| | 75 | $1,000,000.00 |

[1]Thirty-seven contacts did not know the total value of sales and 15 contacts refused to answer.

Table 5. Full-Time Employment – Direct, Indirect and Induced Effects on Oklahoma's Economy in 2001

| Industry Sector | Direct Employment[1] | Indirect and Induced Employment | Total Related Employment |
|---|---|---|---|
| Meat Processing | 6,166[2] | 12,518 | 18,684 |
| Fruits and Vegetables | 24[3] | 1 | 25 |
| Bakery and Confectionary Goods | 165[4] | 127 | 292 |
| Grain Processing for Food | 20[5] | 5 | 25 |
| Prepared and Specialties Food | 1,646[6] | 247 | 1,893 |
| Grain and Other Processing for Feed | 14 | 4 | 1,819 |
| Fats and Oils Processing | 60 | 423 | 483 |
| Other | 288[7] | 248 | 536 |
| Total | 8,383 | 13,574 | 21,957 |

[1]Direct Employment includes full-time employment and part-time employment (calculated two part-time employees equal one full-time employees)
[2]Includes 463 part-time employees
[3]Includes 36 part-time employees
[4]Includes 27 part-time employees
[5]Includes 6 part-time employees
[6]Includes 389 part-time employees
[7]Includes 16 part-time employees

Table 6.  Impact of Total Sales on Oklahoma's Economy 2001

| Industry Sector | Total Sales | Indirect and Induced Sales | Total Related Sales |
|---|---|---|---|
| Meat Processing | $411,143,500 | $1,424,827,093 | $1,835,970,593 |
| Fruits and Vegetables | 0 | 0 | 0 |
| Bakery and Confectionary Goods | $1,869,000 | $997,633 | $2,866,633 |
| Grain Processing for Food | $1,833,000 | $380,547 | $2,213,547 |
| Prepared and Specialties Food | $81,739,500 | $10,060,920 | $91,800,420 |
| Grain and Other Processing for Feed | 0 | 0 | 0 |
| Fats and Oils Processing | $30,000,000 | $132,702,813 | $162,702,813 |
| Other | $18,330,000 | $15,770,861 | $34,100,861 |
| Total | $544,915,000 | $1,584,739,871 | $2,129,654,871 |