The Packaging Industry 2021 Economic Impact Study

Methodology and Documentation

Prepared for

AMERIPEN

By

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Executive Summary

The AMERIPEN Packaging Industry Economic Impact Study estimates the economic contributions made by the packaging industry to the U.S. economy in 2021. John Dunham & Associates conducted this research that was funded by the AMERIPEN. This work used standard econometric models first developed by the U.S. Forest Service, and now maintained by the Minnesota IMPLAN, Inc. Data came from industry sources, government publications and DataAxle.

AMERIPEN – the American Institute for Packaging and the Environment – is a coalition of packaging industry entities dedicated to improving packaging and the environment. We are the only material neutral packaging policy association in the United States and our membership represents the entire packaging supply chain, including materials suppliers, packaging producers, consumer packaged goods companies and end-of-life materials managers. Its Vision is for packaging to be recognized for all its benefits, including preventing waste and driving a circular economy and its Mission is to be the leading voice for the packaging industry, using science to inspire, create and advocate for sustainable solutions for the packaging value chain.

The study defines the packaging industry as those firms involved in the production of plastic, aluminum/steel, pulp/paper/fiber, multi-material1 (composed of two or more materials joined together), polystyrene, urethane, glass, and packaging products using for food service. Product packaging labels, packaging envelopes, packaging material (packing peanut, bubble wraps etc.) manufacturers are also included in the definition of the industry. Additionally, impacts created from packaging products in the retail and manufacturing sectors are included in the study. The study measures the number of jobs, the wages paid to employees, total output as well as taxes paid by the industry and its employees.

Industries are linked to each other when one industry buys from another to produce its own products. Each industry in turn makes purchases from a different mix of other industries, and so on. Employees in all industries extend the economic impact when they spend their earnings. Thus, economic activity started by the packaging industry generates output and jobs in hundreds of other industries, often in sectors and states far removed from the original economic activity. The impact of supplier firms, and the induced impact created by employees spending their earnings, is calculated using an input/output model of the United States. The study calculates the impact of the industry for the direct, supplier and induced (jobs, wages, and economic outputs) at the national and state level.

The study also estimates taxes paid by the industry and its employees. Federal taxes include industry-specific excise and sales taxes, business and personal income taxes, FICA, and unemployment insurance. State and local tax systems vary widely. Direct retail taxes include state and local sales taxes, license fees, and applicable gross receipt taxes. The packaging industry pays real estate and personal property taxes, business income taxes, and other business levies that vary in each state and municipality. All entities engaged in business activity generated by the industry pay similar taxes.

The packaging industry is a dynamic part of the U.S. economy, accounting for about $537.91 billion in total economic output or roughly 2.50 percent of GDP.2 Packaging products manufacturers directly or indirectly supported approximately 1,689,811 American jobs in 2021. These workers earned over $117.73 billion in wages and benefits. Members of the industry, and their employees, paid $43.46 billion in direct federal, state and local taxes, not including state and local sales taxes imposed on packaging products.

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1 Multi-Material packaging products are packages with unique barrier and mechanical properties that are composed of two or more materials joined together. For example, this includes flexible packaging created by layering different materials together, sealed packaging etc.

2 Based on GDP of $21,542.54. See: Gross Domestic Product, 1st Quarter 2021 (Second Estimate); Corporate Profits, 1st Quarter 2021 (Preliminary Estimate), US Department of Commerce, Bureau of Economic Analysis, May 27, 2021.
Summary Results

The AMERIPEN Packaging 2021 Industry Economic Impact Study measures the impact of the packaging industry, as defined by the production of packaging products, product packaging labels, packaging envelopes, and packaging material on the entire economy of the United States. The industry contributes about $537.91 billion in economic output or 2.50 percent of GDP and, through its production and distribution linkages, impacts firms in all 544 sectors of the US economy.

Packaging is defined by this study to comprise a wide range of packaging products including: containers, boxes, box boards and partitions, molded pulp products, packaging using for food service, cans, bottles, bags, foam packaging, products labels, packing material, and packing envelopes.

The packaging industry includes not only manufacturers that directly produce packaging products, but also the packaging of products by companies in other industries, which is the fulfillment impact. Examples of fulfillment would be someone assembling and filing a box for shipment of on-line order or filling a can with product at a petfood manufacturer. All told, these firms, large and small, employ 489,440 and create $242.66 billion in economic output. Among these direct impacts, 46.12% of the packaging industry’s economic output can be attributed to the companies that manufacture with compostable or/and reusable materials.

Other firms are related to the packaging industry as suppliers. These firms produce, sell and provide a broad range of items and services including raw material, tools or machinery used in the production process, transportation, warehousing, logistics or sales. In addition, supplier firms provide a broad range of services, including personnel services, financial services, advertising services, or consulting services. Finally, a number of people are employed in government enterprises responsible for the regulation of the packaging industry. All told, we estimate that the packaging industry is responsible for 540,554 supplier jobs. These firms generate about $175.66 billion in economic activity.

An economic analysis of the packaging industry will also take additional linkages into account. While it is inappropriate to claim that suppliers to the supplier firms are part of the industry being analyzed, daily spending by employees of the packaging industry, and those of supplier firms whose jobs are directly dependent on packaging product sales and production, should surely be included. This spending on everything from housing, to food, to educational services and medical care makes up what is traditionally called the “induced impact” or multiplier effect of the packaging industry. In other words, this flow of money, and the jobs it creates, is induced by the production and distribution of containers, boxes, cans, bottles, bags, packing envelopes and other related products included in the definition of the packaging industry. We estimate that the induced impact of the industry is nearly $119.59 billion, and generates 659,817 jobs, for a multiplier of 0.49.

An important part of an impact analysis is the calculation of the contribution of the industry to the public finances of the community. In the case of the packaging industry, the traditional direct taxes paid by the firms and their employees provide nearly $43.46 billion in revenues to the federal, state and local governments. These figures do not include state and local sales taxes paid on packaging goods purchases themselves.

Economic sectors are based on IMPLAN sectors.

The following was excluded from the study: industrial and transport packaging i.e., pallets and drums, foodservice utensils (forks, spoons, etc.) as well as napkins and bags, foodservice converters (workers), general packing paper, letter envelopes, envelope labels (i.e., Avery Label Sheets), grocery bags.

These firms would more appropriately be considered as part of the supplier firms’ industries.

Often, economic impact studies present results with very large multipliers – as high as 4 or 5. These studies invariably include the firms supplying the supplier industries as part of the induced impact. John Dunham & Associates believes that this is not an appropriate definition of the induced impact and as such limits this calculation to only the effect of spending by direct and supplier employees.
The table below presents a summary of the total economic impact of the industry in the United States. Summary tables for each state are included in the Output Model discussed in the following section.

### Economic Contribution of the Packaging industry

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Supplier</th>
<th>Induced</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>$242,657,224,900</td>
<td>$175,663,491,200</td>
<td>$119,591,615,500</td>
<td>$537,912,331,600</td>
</tr>
<tr>
<td>Jobs</td>
<td>489,440</td>
<td>540,554</td>
<td>659,817</td>
<td>1,689,811</td>
</tr>
<tr>
<td>Wages</td>
<td>$37,974,486,100</td>
<td>$41,832,640,100</td>
<td>$37,918,402,200</td>
<td>$117,725,528,400</td>
</tr>
<tr>
<td>Taxes</td>
<td></td>
<td></td>
<td></td>
<td>$43,459,983,300</td>
</tr>
</tbody>
</table>

### Output Model

John Dunham & Associates, Inc. produced the economic impact study for AMERIPEN. The analysis consists of a number of parts, each of which will be described in the following sections of this document. These include data, models, calculations, and outputs that are presented in output sheets and tables. As such, there is no book – no thick report – outlining the impact of the industry, but rather a system of models and equations that can be continuously updated.

### Economic Impact Modeling – Summary

The Economic Impact Study begins with an accounting of the direct employment in the domestic manufacture of packaging products and packaging fulfillment activities. The data come from a variety of government and private sources.

It is sometimes mistakenly thought that initial spending accounts for all of the impact of an economic activity or a product. For example, at first glance it may appear that consumer expenditures for a product are the sum total of the impact on the local economy. However, one economic activity always leads to a ripple effect whereby other sectors and industries benefit from this initial spending. This inter-industry effect of an economic activity can be assessed using multipliers from regional input-output modeling.

The economic activities of events are linked to other industries in the state and national economies. The activities required to produce a cardboard boxes for example, from shipping the rolls of kraft paper from the paper mill to custom design of the product generate the direct effects on the economy. Regional (or indirect) impacts occur when these activities require purchases of goods and services such as kraft paper or electricity from local or regional suppliers. Additionally, induced impacts occur when workers involved in direct and indirect activities spend their wages. The ratio between the induced economic impact and direct impact is termed the multiplier. The framework in the chart above illustrates these linkages.

This method of analysis allows the impact of local production activities to be quantified in terms of final demand, earnings, and employment in the states and the nation as a whole.

Once the direct impact of the industry has been calculated, the input-output methodology discussed below is used to calculate the contribution of the supplier sector and of the re-spending in the economy by
employees in the industry and its suppliers. This induced impact is the most controversial part of economic impact studies and is often quite inflated. In the case of the AMERIPEN model, only the most conservative estimate of the induced impact has been used.

**Model Description and Data**

This analysis is based on data provided by Data Axle, AMERIPEN and the federal government. The analysis utilizes the Minnesota IMPLAN, Inc Model in order to quantify the economic impact of the packaging industry on the economy of the United States. The model adopts an accounting framework through which the relationships between different inputs and outputs across industries and sectors are computed. This model can show the impact of a given economic decision — such as a factory opening or operating a sports facility — on a pre-defined, geographic region. It is based on the national income accounts generated by the US Department of Commerce, Bureau of Economic Analysis (BEA).

Every economic impact analysis begins with a description of the industry being examined. In the case of the AMERIPEN model, the packaging industry is defined as the production of a wide range of products including: containers, boxes, box boards and partitions, molded pulp products, packaging using for food service, cans, bottles, bags, foam packaging, product labels, packing material, and packing envelopes. In addition, product fulfillment/converter companies in other industries are also analyzed in the study. Industrial and transport packaging i.e., pallets and drums, foodservice utensils (forks, spoons, etc.) as well as napkins and bags, foodservice converters (workers), general packing paper, letter envelopes, envelope labels (i.e., Avery Label Sheets), grocery bags are not included in the analysis.

The IMPLAN, Inc model is designed to run based on the input of specific direct economic factors. It uses a detailed methodology (see IMPLAN Methodology section) to generate estimates of the other direct impacts, tax impacts and supplier and induced impacts based on these entries. In the case of the AMERIPEN Economic Impact Model, direct employment in the packaging industry is a base starting point for the analysis. Direct employment is based on data provided to John Dunham & Associates by Data Axle as of January 2021, data from AMERIPEN, and United States census data. Data Axle data is recognized nationally as a premier source of micro industry data. Their database contains information on over 15 million businesses in the United States. It is used extensively for credit reporting, and according to the vendor, encompasses about 98 percent of all business enterprises in the country. This data is gathered at the facility level; therefore, a company with a manufacturing plant, warehouse and sales office would have three facilities, each with separate employment counts. Since the Data Axle data are adjusted on a continual basis, staff from John Dunham & Associates scanned the data for discrepancies.

Once the initial direct employment figures have been established, they are entered into a model linked to the IMPLAN database. The IMPLAN data are used to generate estimates of direct wages and output. Wages are derived from data from the U.S. Department of Labor’s ES-202 reports that are used by IMPLAN to provide annual average wage and salary establishment counts, employment counts and payrolls at the county level. Since this data only covers payroll employees, it is modified to add information on independent workers, agricultural employees, construction workers, and certain government employees. Data are then adjusted to account for counties where non-disclosure rules apply. Wage data include not

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7 The model uses 2018 input/output accounts.
8 RIMS II is a product developed by the U.S. Department of Commerce, Bureau of Economic Analysis as a policy and economic decision analysis tool. IMPLAN was originally developed by the US Forest Service, the Federal Emergency Management Agency and the Bureau of Land Management. It was converted to a user-friendly model by the Minnesota IMPLAN, Inc in 1993.
9 Data Axle is the leading provider of business and consumer data for the top search engines and leading in-car navigation systems in North America. Data Axle gathers data from a variety of sources, by sourcing, refining, matching, appending, filtering, and delivering the best quality data. Data Axle verifies its data at the rate of almost 100,000 phone calls per day to ensure absolute accuracy.
only cash wages, but health and life insurance payments, retirement payments and other non-cash compensation. It includes all income paid to workers by employers.

Total output is the value of production by industry in a given state. It is estimated by IMPLAN from sources similar to those used by the BEA in its RIMS II series. Where no Census or government surveys are available, IMPLAN uses models such as the Bureau of Labor Statistics Growth model to estimate the missing output.

The model also includes information on income received by the Federal, state and local governments, and produces estimates for the following taxes at the Federal level: Corporate income; payroll, personal income, estate and gift, and excise taxes, customs duties; and fines, fees, etc. State and local tax revenues include estimates of: Corporate profits, property, sales, severance, estate and gift and personal income taxes; licenses and fees and certain payroll taxes.

While IMPLAN is used to calculate the state level impacts, Data Axle data provide the basis for legislative district level estimates. Publicly available data at the county and congressional district level is limited by disclosure restrictions, especially for smaller sectors of the economy. Our model therefore uses actual physical location data provided by Data Axle in order to allocate jobs – and the resulting economic activity – by physical address or when that is not available, zip code. For zip codes entirely contained in a single congressional district, jobs are allocated based on the percentage of total sector jobs in each zip. For zips that are broken by congressional districts, allocations are based on the percentage of total jobs physically located in each segment of the zip. Physical locations are based on either actual address of the facility, or the zip code of the facility, with facilities placed randomly throughout the zip code area. All supplier and indirect jobs are allocated based on the percentage of a state’s employment in that sector in each of the districts. Again, these percentages are based on Data Axle data.

FULFILLMENT

Fulfillment in this study represents packaging occurring within a retail or manufacturing setting. It captures the impact of employees whether they are wrapping products in plastic, folding boxes or designing and creating the packaging. Fulfillment translates any money spent at a company on packaging related goods and services into full-time equivalent jobs. Companies involved in producing or retailing most packaged consumer products are included in the analysis. Any shipping packaging in this impact is not related to the bulk transport or wholesale of goods, nor are retail shopping bags included, but only packaging related to the shipping of products directly to consumers.

The economic impact of fulfillment is derived from the IMPLAN input tables associated with each product category - these come from the 2018 input/output tables. The NAICS codes for each of the industries are bridged to the related IMPLAN code (there are 544 different IMPLAN codes). The use tables provide information on the percentage of a products’ value as related to the packaging materials used in its manufacture (or in the case of retailers its shipment to consumers). For example, they document the value

\[ \text{NAICS codes included in this study fall in the manufacturing and retailing industries – 311111; 311119; 311230; 311313; 311314; 311340; 311351; 311352; 311411; 311412; 311421; 311422; 311423; 311513; 311514; 311511; 311512; 311520; 311813; 311615; 311612; 311710; 311811; 311812; 311821; 311824; 311830; 311911; 311912; 311919; 311920; 311930; 311941; 311942; 311991; 311999; 312111; 312112; 312113; 312120; 312130; 312140; 312230; 312250; 312520; 312520; 312520; 312520; 312520; 325411; 325412; 325510; 325520; 325561; 325612; 325613; 325992; 326111; 326112; 326113; 326120; 326140; 326160; 327121; 327215; 327320; 327910; 327991; 332215; 332216; 332431; 332439; 332510; 332613; 332618; 332721; 332722; 332911; 332912; 332919; 332913; 332991; 332992; 332993; 332994; 333112; 333414; 333415; 333515; 333914; 333912; 333991; 333992; 333993; 334111; 334112; 334118; 334210; 334220; 334290; 334310; 334417; 334613; 334614; 335110; 335121; 335122; 335129; 335210; 335220; 335220; 335520; 335591; 335912; 336390; 336991; 337121; 337122; 337124; 337125; 337125; 337910; 337920; 339910; 339920; 339930; 339940; 339991; 339992; 339993; 339994; 445110; 445120; 445210; 445220; 445230; 445240; 445291; 445292; 445310; 446110; 446120; 446130; 446191; 446199; 561910; 561920; 561990. \]
of metal cans that go into the production of pet food. The following inputs were used in the development of this model:

- Textile bags and canvas
- Paperboard containers
- Paper bags and coated and treated paper
- All other converted paper products
- Printed materials
- Plastics packaging materials and un laminated films and sheets
- Polystyrene foam products
- Urethane and other foam products (except polystyrene)
- Plastics bottles
- Other plastics products
- Glass containers
- Metal cans

Based on these input coefficients, it is possible to calculate the percentage of the value of each product related to packaging materials. In the pet food example, 7.7 percent of the manufacturing cost of pet food is due to the use of metal cans.

Since manufacturing and retailing jobs are directly associated with output, knowing the total output created from the use of packaging materials can be translated to jobs at the manufacturing plant or retail fulfillment facility. Therefore, if 7.7 percent of the manufacturing cost of pet food is from metal cans, then the same percentage of jobs, in this case about 2,000 FTE jobs, are associated with the packaging of pet food into metal cans. Summed across all packaging materials, there are 3,117 jobs in the pet food manufacturing industry that are directly associated with packaging the product.

Once the direct jobs are calculated for each industry, the associated wages, output and taxes are calculated using the IMPLAN input/output model. Supplier impacts are not included in these calculations since they are already included in the calculation of the economic impact of packaging production. In effect, the input of the metal can is not counted twice, only the impact of the use of the can in the manufacturing plant. However, induced impacts associated with the direct (packager/fulfillment) impacts are included because they are created when employees packaging products in each industry spend their wages in the general economy. Only the induced impacts of these employees are included in the model.

**IMPLAN Methodology**

Francoise Quesnay one of the fathers of modern economics, first developed the analytical concept of inter-industry relationships in 1758. The concept was actualized into input-output analysis by Wassily Leontief during the Second World War, an accomplishment for which he received the 1973 Nobel Prize in Economics.

Input-Output analysis is an econometric technique used to examine the relationships within an economy. It captures all monetary market transactions for consumption in a given period and for a specific geography. The IMPLAN model uses data from many different sources – as published government data series, output differs depending on the industry being measured. In the case of manufacturing, output is similar to gross sales. For wholesalers and retailers, output does not represent sales, but rather is similar to the accounting measure of gross margin. One way to look at it is the output is total sales revenue minus its cost of goods sold. This is similar to the wholesale or retail markup on a product.

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unpublished data, sets of relationships, ratios, or as estimates. The Minnesota IMPLAN, Inc gathers this data, converts it into a consistent format, and estimates the missing components.

There are three different levels of data generally available in the United States: Federal, state and county. Most of the detailed data is available at the county level, and as such there are many issues with disclosure, especially in the case of smaller industries. IMPLAN overcomes these disclosure problems by combining a large number of datasets and by estimating those variables that are not found from any of them. The data is then converted into national input-output matrices (Use, Make, By-products, Absorption and Market Shares) as well as national tables for deflators, regional purchase coefficients and margins.

The IMPLAN Make matrix represents the production of commodities by industry. The Bureau of Economic Analysis (BEA) Benchmark I/O Study of the US Make Table forms the bases of the IMPLAN model. The Benchmark Make Table is updated to current year prices, and rearranged into the IMPLAN sector format. The IMPLAN Use matrix is based on estimates of final demand, value-added by sector and total industry and commodity output data as provided by government statistics or estimated by IMPLAN. The BEA Benchmark Use Table is then bridged to the IMPLAN sectors. Once the re-sectoring is complete, the Use Tables can be updated based on the other data and model calculations of interstate and international trade.

In the IMPLAN model, as with any input-output framework, all expenditures are in terms of producer prices. This allocates all expenditures to the industries that produce goods and services. As a result, all data not received in producer prices is converted using margins which are derived from the BEA Input-Output model. Margins represent the difference between producer and consumer prices. As such, the margins for any good add to one. If, for example, 10 percent of the consumer price of a can is from the purchase of raw aluminum, then the aluminum margin would be 0.1.

Deflators, which account for relative price changes during different time periods, are derived from the Bureau of Labor Statistics (BLS) Growth Model. The 224 sector BLS model is mapped to the 544 sectors of the IMPLAN model. Where data are missing, deflators from BEA’s Survey of Current Businesses are used.

Finally, one of the most important parts of the IMPLAN model, the Regional Purchase Coefficients (RPCs) must be derived. IMPLAN is derived from a national model, which represents the “average” condition for a particular industry. Since national production functions do not necessarily represent particular regional differences, adjustments need to be made. Regional trade flows are estimated based on the Multi-Regional Input-Output Accounts, a cross-sectional database with consistent cross interstate trade flows developed in 1977. These data are updated and bridged to the 544 sector IMPLAN model.

Once the databases and matrices are created, they go through an extensive validation process. IMPLAN builds separate state and county models and evaluates them, checking to ensure that no ratios are outside of recognized bounds. The final datasets and matrices are not released before extensive testing takes place.