STATEWIDE REPORT: FOREST PRODUCTS INDUSTRIES' ECONOMIC CONTRIBUTIONS TO MICHIGAN'S ECONOMY - 2017 UPDATE

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EXECUTIVE SUMMARY

At the Governor's 2013 Forest Products Summit, the Michigan Department of Natural Resources (MDNR) and the Governor-appointed Timber Advisory Council developed five goals to encourage growth of the industries by 2018:

- Increase the economic impact of the timber industry to $20 billion.
- Increase international exports of value-added forest products by 50 percent.
- Increase forest products jobs by 10 percent.
- Support existing industry.
- Encourage regionally based industry development.

This report updates the assessment of industries' contributions using 2015 Impact Analysis for Planning (IMPLAN) data and the latest U.S. Department of Commerce data on domestic and international trade. The report is the third in a series designed to help monitor progress toward the first three goals.

Progress Toward Five-Year Goals

The numeric targets for the first three goals are listed in the table below. Significant progress was made in 2015 on two goals – compared to 2012 values, total output (or sales) and number of direct jobs increased by 21 percent and 15 percent, respectively.

GOAL	2012 BASELINE	2015 NOMINAL	2018 TARGET
Increase economic impacts to $20 billion (total output)	$17.5 billion	$21.2 billion	$20.0 billion
Increase Int'l value-added exports by 50% (direct output)	$484 million	$505 million	$726 million
Increase forest products jobs by 10% (direct jobs)	34,204 jobs	39,417 jobs	37,624 jobs

**2015 dollar values are not adjusted for inflation*

- The 2018 goals for increasing the forest products industry total output and the number of direct forest products industry jobs have been met.
- International value-added exports have increased little since 2012; however, the current strong U.S. dollar hampers efforts to increase international exports.
- Forest products industries provided 5.9 percent of manufacturing jobs in Michigan in 2015.
- In the Upper Peninsula (UP), over one-third of manufacturing jobs were in these industries.

Among Industries:

- Wood furniture had the largest number of direct jobs (10,283) in 2015 and the third-largest direct output ($2.04 billion).
- Secondary paperboard and other paper products had the second-highest number of direct jobs (8,472), and the highest direct output ($4.04 billion).

At the Individual Sector Level:

- The most jobs were in the paperboard container manufacturing, commercial logging, wood office furniture manufacturing, and sawmill mill sectors, respectively. Combined, they had over 17,800 direct jobs in 2015.
- Michigan's wood office and institutional furniture manufacturing sectors were among the top sectors in all United States (U.S.) states in number of jobs and annual wages.
- The top four sectors in output (or sales) were paperboard container manufacturing, paper mills, wood office furniture, and sawmills with $6.5 billion in direct output.

International Trade Flows:

U.S. Department of Commerce data on international and domestic trade was used to assess Michigan forest products import and export trends:

- Forest products were about 2 percent of Michigan's total international exports, valued at $54.7 billion in 2016, up from $54.0 billion in 2015.
- International exports totaled about $1.02 billion from the wood furniture, wood products, paper, and paper product sectors in 2016, down slightly from $1.05 billion in 2015, and $1.15 billion in 2014.

- International imports were about twice the value of exports for these sectors. Notably, furniture imports have increased the most since 2009.
- Michigan's largest international export markets are Canada, Mexico and China.
- Canada accounted for about 53 percent of our forest products exports in 2016, and 56 percent in 2015.
- Exports to China had the fastest growth in recent years.
- Compared to other states' international trade, Michigan ranked 3rd nationally in furniture exports, 17th in wood products exports, and 20th in paper products.
- All three sectors have shown modest growth over the past five years.
- Notably, Michigan was a net importer in all three industries for 2016.

SECTOR	INTERNATIONAL (2016)	
	EXPORTS	IMPORTS
NAICS* 321 – Wood Products	$161.4	$529.4
NAICS 322 - Paper	$321.9	$408.8
NAICS 337 – Furniture & Fixtures	$541.2	$1,097.2
Total	$1,024.5	$2,035.4

**North American Industry Classification System*

Domestic Exports:

- Domestic exports in wood product and paper industries are a much larger portion of Michigan's output than international exports.
- In 2012 (the most recent data available), Michigan was a major exporter of wood products and paper to domestic markets: $1,445 million was exported in wood products and $3,745 was exported in paper products.

Comparison of the Forest Products Industry with Other Michigan Industries:
The forest products industries provide more direct employment and value added than: (1) commercial fishing, hunting and trapping; (2) mining and oil and gas production; and (3) agricultural production. That is, they contributed the most to Michigan's gross state product.

Inferences:
The Governor's Summit goals of increasing forest products industry output to $20 billion and number of direct jobs by 10 percent have been met.

Import substitution provides another opportunity for expanding Michigan's forest products industries (e.g., replacing imported products with local products).

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1.0 INTRODUCTION

Forests and forest products industries are central for the transition to a greener and more sustainable economy. And a green goods and services economy relies on the sustainable use of natural resources. Of course, Michigan's forest products industries are tightly bound to forests and the goods and ecosystem services that they provide (e.g., wildlife habitat, watershed protection, etc.).

The contributions of Michigan's forests can increase with expanded emphasis on the use of wood-based products, adoption of modern wood energy technology, and clear linkages to ecosystem services. On April 23, 2013, the Governor's Forest Products Summit was convened to explore ideas and options for growing the state's forest products industries (http://www.michigan.gov/dnr/0,4570,7-350-79136_79237_80943_81067-302604--,00.html). The Michigan Department of Natural Resources (MDNR) and the Governor-appointed Timber Advisory Council (TAC) developed five-year (2018) goals related to the industries; they are:

- Increasing the economic impact of the timber industry on state and regional economies from $14 billion to $20 billion;
- Increasing the export of value-added forest products by 50 percent;
- Increasing forest products-related careers by 10 percent;
- Supporting existing industry; and
- Encouraging regionally based industry development.

The purpose of this report is to provide circa 2015-16 data and information to update earlier assessments (MDNR 2015, 2016) on progress toward meeting the first three goals above (i.e., increasing economic impact, exports and jobs). This report is organized into five sections. The Introduction is followed by the Methods section, which broadly describes the approach used in developing this report. Third, recent data reflecting the economic contributions of the forest products industries for 2015 are presented. Fourth, international trade flows are examined using the most recent data available (2016); national trade data are from 2012. And finally, an assessment of progress toward the five-year (2018) goals is made.

2.0 METHODS

This report is based on compiling data published by the federal government and from commercially available Impact Analysis for Planning (IMPLAN) data (IMPLAN Group LLC, www.implan.com). The report and related documents provide a documented approach that can be used to update this assessment as needed in future years.

The section on the economic contributions of Michigan's forest products industries relied on 2015 IMPLAN software and data. The IMPLAN is a widely used economic input-output model that focuses on the interdependence among various producing and consuming sectors in the economy. The IMPLAN data are compiled and linked by the IMPLAN software (Version 3.1.1001.12); data come from various government agencies including the U.S. Census Bureau, the U.S. Bureau of Labor Statistics, and the U.S. Bureau of Economic Analysis. Economic measures in IMPLAN include employment, labor income, value added, output or sales and others. The economic values are reported in nominal dollars except when deflated to make them comparable to previously reported 2012-2014 data (in Table 12).

The IMPLAN was used to examine the current status of the forest products industry and to provide a basis for estimating progress in meeting several goals of the 2013 Governor's Forest Products Summit. For this report, thirty-one IMPLAN sectors were identified as forest products sectors. They were aggregated into seven larger industries for ease of communication and analysis. The industries are: Forestry, Logging, Primary Solid Wood Products and Wood-based Power, Secondary Solid Wood Products, Wood Furniture, Pulp, Paper and Paperboard, and Secondary Paperboard and Other Paper Products.

The section on international and national trade flows was based on International Trade Administration data (tse.export.gov) and the U.S. Census Bureau's Commodity Flow Survey. Commodity flow data are from 2012. Next year's update will have 2015 data, if published. The importance of domestic and international exports in economic growth warrants a separate report section, and it is directly linked to one of the goals of the Governor's Forest Products Summit.

The final section of the report focuses on progress toward three goals of the Governor's Forest Products Summit: increasing economic impacts to $20 billion, increasing value-added exports by 50 percent, and increasing forest products-related employment by 10 percent. Previously reported IMPLAN data from 2012

were used as the base year for this section, and 2018 was used as the target year for achieving the Summit's goals. The first goal of $20 billion in economic contributions (in terms of output or sales) was monitored by estimating total contributions using IMPLAN multipliers applied to direct contributions of all forest industries. The second goal related to increasing value-added (international) exports by 50 percent was evaluated based on published export data from forestry and logging, wood product manufacturing and paper industries. The third goal of increasing employment by 10 percent was calculated using IMPLAN-based estimates of direct employment in all forest industries.

3.0 Economic Contributions of the Forest Products Industries to Michigan's Economy

There has been concern over the status and future of the forest products industries in Michigan and throughout the U.S. This concern has been driven, in part, by the significant economic downturn during the recession of 2007 to 2009 (Woodall et. al. 2012). Global competitiveness with related offshoring of production, an increase in use of electronic media and a decline in U.S. housing markets are seen as causes of the long-term decline in wood products and paper manufacturing industries.

In Michigan, there have been significant declines in employment in the forest products industries since 1990 (Table 1, Figure 1). The Forestry and Logging industry has fared best, with an increase of 30 percent since 2010. The Wood Products Manufacturing has increased 20 percent, but the Paper Manufacturing industries have declined 1 percent over the same period. Although not presented in Table 1 due to the mix of wood and non-wood subsectors, the Furniture industry, with a sizable wood furniture component, has increased 11 percent since 2010.

Table 1 - Total Full-Time and Part-Time Employment in Selected Forest Products Industries, 1990-2015

Year	Industry			TOTAL
	Forestry and logging	Wood product manufacturing	Paper manufacturing	
1990	3,953	13,374	20,596	37,923
1995	4,416	15,613	21,017	41,046
2000	4,272	15,677	19,704	39,653
2005	4,426	13,463	14,687	32,576
2010	3,497	9,565	11,582	24,644
2011	3,730	9,908	11,380	25,018
2012	4,423	10,147	11,334	25,904
2013	4,486	10,903	11,158	26,547
2014	4,415	11,210	11,204	26,829
2015	4,530	11,492	11,469	27,491

Source: Bureau of Economic Analysis, Regional Economic Accounts, Table SA25N.

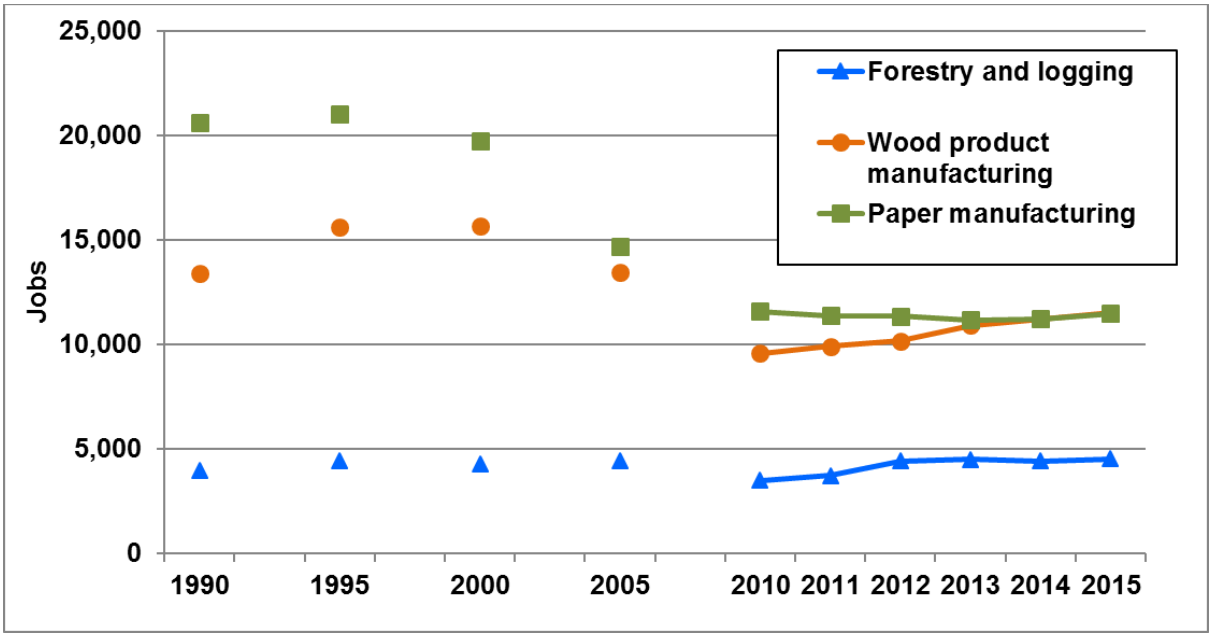

Figure 1 - Total Full-Time and Part-Time Employment in Selected Forest Products Industries, 1990-2015.

Two goals related to the forest products industries' economic contributions emerged from the 2013 Governor's Forest Products Summit: increasing the economic impact of the timber industry on state and regional economies to $20 billion and increasing forest products-related careers by 10 percent. This report section provides a more detailed examination of the structure of the forest products industries in Michigan using recent IMPLAN and government data, mostly from 2015. Descriptive statistics regarding the economic contributions of the forest products industries to Michigan's economy are presented.

3.1 Economic Contributions Defined

The economic contributions of the forest products industries is a snapshot of direct economic activity associated with given industries and other economic activities linked to those industries. An introduction to some economic terminology is helpful in describing the concept of economic contributions.

Economic contributions are defined as "the changes in a region's existing economy that can be attributed to a given industry" (Watson et. al. 2007). Hence, economic contributions define the role of an industry within a state or region. Several terms are used to describe economic effects (Table 2).

Table 2 - Terms Used to Describe Economic Contributions.

Term	Description
Output	The dollar measure of production within an area; it is also viewed as sales.
Employment	The number of full-time and part-time jobs associated with an industry.
Labor income	The dollar total of employee compensation and proprietor income; the latter is associated with self-employed individuals.
Indirect business taxes (IBT)	In general terms, IBT can currently be considered the combination of excise, sales and property taxes, as well as fees, fines, licenses and permits.
Value added	The sum labor income, other property income (e.g., rents and profits) and indirect business taxes (e.g., excise and sales taxes). It is the difference between an industry's total output and the cost of its intermediate inputs. The sum of value added for all economic sectors within the state equals the Gross State Product.
Direct effects	The economic activities (e.g., output, employment, labor income, and value added) associated with an industry or sector in the study area. These can describe the current economic sectors or changes to those sectors.
Indirect effects	The impact of local industries purchasing goods and services from other industries leading to others' outputs, employment and labor income.

Term	Description
Induced effects	The impact of labor income (employee compensation and proprietor income) via goods and services purchased due to the direct and indirect spending by industries.
Total effects	Sum of direct, indirect and induced effects.
Social Accounting Matrix (SAM) multipliers	These multipliers are derived by dividing the sum of direct, indirect and induced effects by the direct effects. The social accounts include payments made between households, households and government, etc. These are available for output, employment, labor income, and value added and are used to assess effects of changes in industry activity (i.e., "ripple effects").

Source: www.implan.com/

Contributions can be in terms of value added, output, employment and/or labor income. Value added is commonly used to describe the economic contributions of an industry. It is a conservative measure of economic contributions. Value added is the difference between an industry's output or sales and the costs of intermediate inputs. When a sawmill sells a board, the value of the log and other inputs is not counted in value added because they were counted when produced by loggers and others. Thus, only new additions to value (e.g., labor income, etc.) are included. Labor income is the major component of value added and includes employee compensation and proprietor income. Value added, summed across all sectors, is equal to the gross state product. Another measure of economic contribution is industry output or sales. For example, if a log is sold to a sawmill and the sawmill sells boards, both sales are counted as part of the overall region's sales or output—they are important economic activities. Another measure, employment, includes both full-time and part-time jobs. As the number of sectors in an analysis increase, there can be overlap in the number of part-time jobs across sectors. Summit goals focused on output and employment, which are the main statistics reported in this section.

3.2 Using IMPLAN to Estimate Economic Contributions

Impact Analysis for Planning (IMPLAN) was used to estimate economic contributions of the forest products industries (IMPLAN Group, LLC 2013). It is a widely used input-output model comprised of economic data and software. Input-output (IO) models characterize financial linkages among industries, households and institutions. Within IO models, various industries have production functions which show the value of inputs used in production of industry outputs. Michigan's economy was represented by 426 sectors or industries in 2012, the base year for analysis. The number of sectors increased to 536 in 2013 with a change in the North American Industrial Classification System (NAICS). Economic values for 2015 were used, except when deflated to 2012 dollars using producer price index deflators (total manufacturing industries – PCUOMFG) (see Table 12).

Counties provide the building blocks for a state, and Michigan's 83 counties were included in IMPLAN modeling for this report. Given IMPLAN's structure, sub-state analyses have been developed for MDNR regions and counties.

To more compactly describe the economic contribution of the forest products industries, 31 economic sectors were aggregated into seven broad industries (Table 3): Forestry, Logging, Primary Solid Wood Products and Wood-based Power, Secondary Solid Wood Products, Wood Furniture, Pulp, Paper and Paperboard, and Secondary Paperboard and Other Paper Products. Detailed descriptions of the sectors are presented in Appendix 1.

Several sectors included wood and non-wood products (e.g., institutional furniture manufacturing); output and other measures were reduced to better reflect the wood-only component (Appendix 1). Primary industries (e.g., sawmills, OSB [reconstituted wood product], and power plants) use wood directly from the forest, including roundwood, chips or similar forms. Secondary industries (e.g., trusses and furniture) use one or more primary forest products (e.g., lumber and paper) in their manufacturing processes.

Table 3 - Aggregated Forest Products Industries and IMPLAN Component Sectors

IMPLAN Sector	SECTOR NAME
	Forestry
15	Forestry, forest products, and timber tract production
19	Support activities for forestry*
	Logging
16	Commercial logging
	Primary Solid Wood Products and Wood-based Power
47	Electric Power Generation - Biomass
134	Sawmills
135	Wood preservation
136	Veneer and plywood manufacturing
138	Reconstituted wood product manufacturing
	Secondary Solid Wood Products
137	Engineered wood member and truss manufacturing
139	Wood windows and doors manufacturing
140	Cut Stock, resawing lumber, and planing
141	Other millwork, including flooring
142	Wood Container and Pallet Manufacturing
143	Manufactured home (mobile home) manufacturing
144	Prefabricated wood building manufacturing
145	All other miscellaneous wood product manufacturing
	Wood Furniture
368	Wood kitchen cabinet and countertop manufacturing
369	Upholstered household furniture manufacturing
370	Nonupholstered wood household furniture manufacturing
372	Institutional wood furniture manufacturing*
373	Wood office furniture manufacturing
374	Custom architectural woodwork and millwork manufacturing
376	Showcase, partition, shelving, and locker manufacturing*
	Pulp, Paper and Paperboard
146	Pulp mills
147	Paper mills
148	Paperboard mills
	Secondary Paperboard and Other Paper Products
149	Paperboard container manufacturing
150	Paper bag and coated and treated paper manufacturing
151	Stationery product manufacturing
152	Sanitary paper product manufacturing
153	All other converted paper product manufacturing

Note: Sectors with an "" indicate that only a portion of the sector is included in the forest products industries.*

3.3 Economic Contribution Results

A number of IMPLAN-based studies across the U.S. have examined the economic contributions of the forest products industries and forest-based outdoor tourism for states or regions, including studies in Illinois, Minnesota, Texas, Virginia, and the southern U.S. (Deckard and Skurla 2011, Henderson and Munn 2012, Rephann 2013, Joshi et. al. 2014, Brandeis and Hodges 2015, and Poudel et. al. 2016, 2017). Some similar work has been completed in Michigan (Chappelle et. al. 1986, Pedersen and Chappelle 1990, Potter-Witter et. al. 2000, Leefers 2007, and Leefers et. al. 2015). Results presented in this section expand and update these earlier efforts. Recently, several authors have summarized approaches to economic contribution analysis used in the southern U.S. (Henderson et. al. 2017 and Joshi et. al. 2017).

The direct contributions of Michigan's forest products industries in 2015 were $12.0 billion in output (2015 dollars), 39,417 jobs and $2.5 billion in labor income (Table 4). Total contributions, including direct, indirect and induced effects, were $21.2 billion in output, 99,234 jobs and $5.5 billion in labor income. All of these measures exceeded the 2012 estimates (see report section 5.0) and highlight positive growth in aggregate. Detailed contributions for the 31 economic sectors are presented in Appendix 2 (Direct).

Multipliers can be used to assess expected changes in total impacts associated with changes in direct effects. For example, if output (i.e., change in final demand) for the Secondary Paperboard and Other Paper Products industry increased by $1 million, the total contribution would be $1.60 million in output (i.e., the original $1 million multiplied by 1.60). On average in the forest products industries, one new job creates 1.52 additional jobs (multiplier = 2.52). The Pulp, Paper and Paperboard industry had the highest employment and second highest labor income multipliers; the Forestry and Logging industries had the lowest employment multipliers.

The Secondary Paperboard and Other Paper Products had the highest direct output and second highest direct employment contributions (Figures 2 and 3). Two sectors within the industry provided the highest level of employment and output: (1) Paperboard Container Manufacturing, and (2) Paper Bag and Coated and Treated Paper Manufacturing (see Appendix 2). The Wood Furniture industry had the largest direct jobs and labor income contributions, but third largest contribution in direct output (Figure 4). The Wood Office Furniture sector is the largest component of this industry. The Forestry industry, which includes nurseries, consulting foresters, and other forestry support establishments, had the lowest level of output and jobs. At the aggregate level, there is little indication of heavy economic concentration across industries. However, at the individual sector level, the highest numbers of jobs were in the Paperboard Container Manufacturing, Commercial Logging, Wood Office Furniture Manufacturing, and Sawmill sectors, respectively; combined they had over 17,800 direct jobs in 2015 (Appendix 2). The top four sectors in terms of output or sales were the Paperboard Container Manufacturing, Paper Mills, Wood Office Furniture and Sawmill sectors, respectively; combined they had over $6.5 billion in direct output.

Table 4 - Direct Contributions, Total Contributions and SAM Multipliers For Seven Aggregated Forest Products Industries, 2015.

Forest Products Industries		Employment	Output	Labor Income
		(Jobs)	(Millions of 2015 Dollars)	
Direct Contributions				
	Forestry	684	46.6	21.5
	Logging	4,491	336.9	170.0
	Primary Solid Wood Products and Wood-based Power	5,096	1,663.0	292.6
	Secondary Solid Wood Products	7,305	1,345.8	375.0
	Wood Furniture	10,283	2,039.7	648.2
	Pulp, Paper and Paperboard	3,086	2,547.2	327.8
	Secondary Paperboard and Other Paper Products	8,472	4,036.0	615.1
	Grand Total	**39,417**	**12,015.3**	**2,450.2**
Total Contributions				
	Forestry	997	82.4	34.0
	Logging	7,214	626.2	268.8
	Primary Solid Wood Products and Wood-based Power	17,496	3,384.1	886.0
	Secondary Solid Wood Products	15,476	2,592.5	787.1
	Wood Furniture	20,443	3,611.1	1,158.9
	Pulp, Paper and Paperboard	14,558	4,475.1	946.6
	Secondary Paperboard and Other Paper Products	23,051	6,454.8	1,396.2
	Grand Total	**99,234**	**21,226.3**	**5,477.6**
SAM Multiplier		**Ratios (Total Contributions/Direct Contributions)**		
	Forestry	1.46	1.77	1.58
	Logging	1.61	1.86	1.58
	Primary Solid Wood Products and Wood-based Power	3.43	2.03	3.03
	Secondary Solid Wood Products	2.12	1.93	1.92
	Wood Furniture	1.99	1.77	1.40
	Pulp, Paper and Paperboard	4.72	1.76	2.89
	Secondary Paperboard and Other Paper Products	2.72	1.60	2.27
	Grand Total	**2.52**	**1.77**	**2.24**

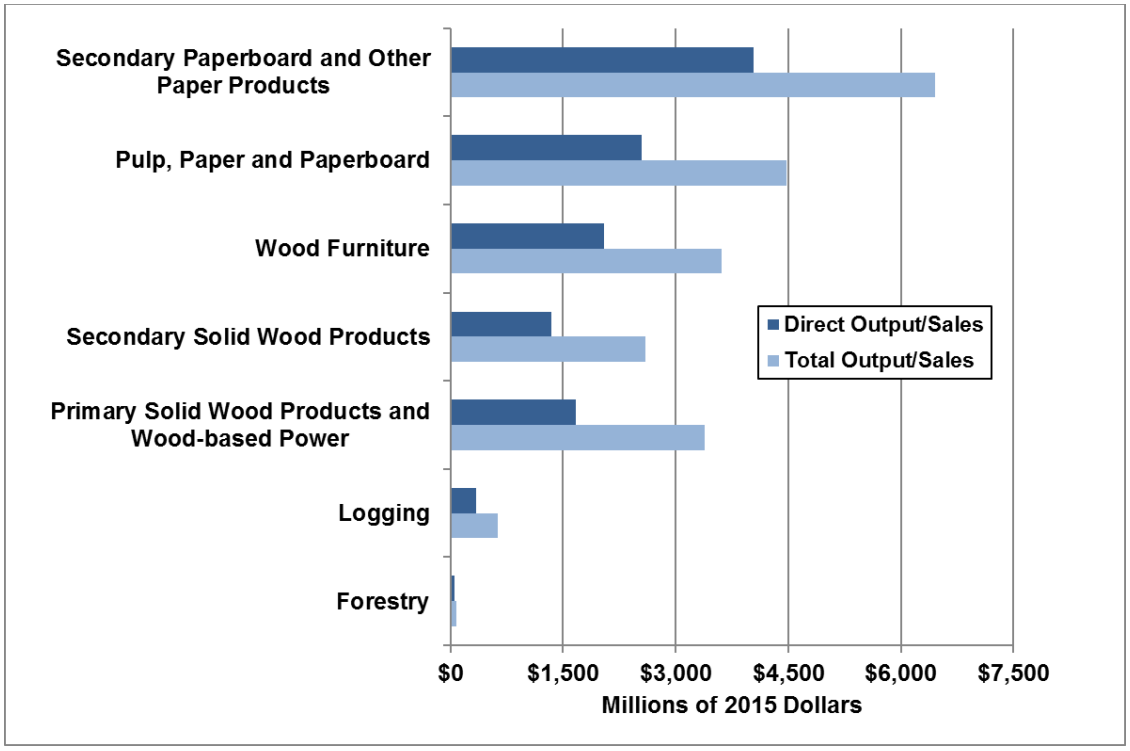

Figure 2 - Michigan direct and total output (in millions of 2015 dollars) by forest products industry, 2015.

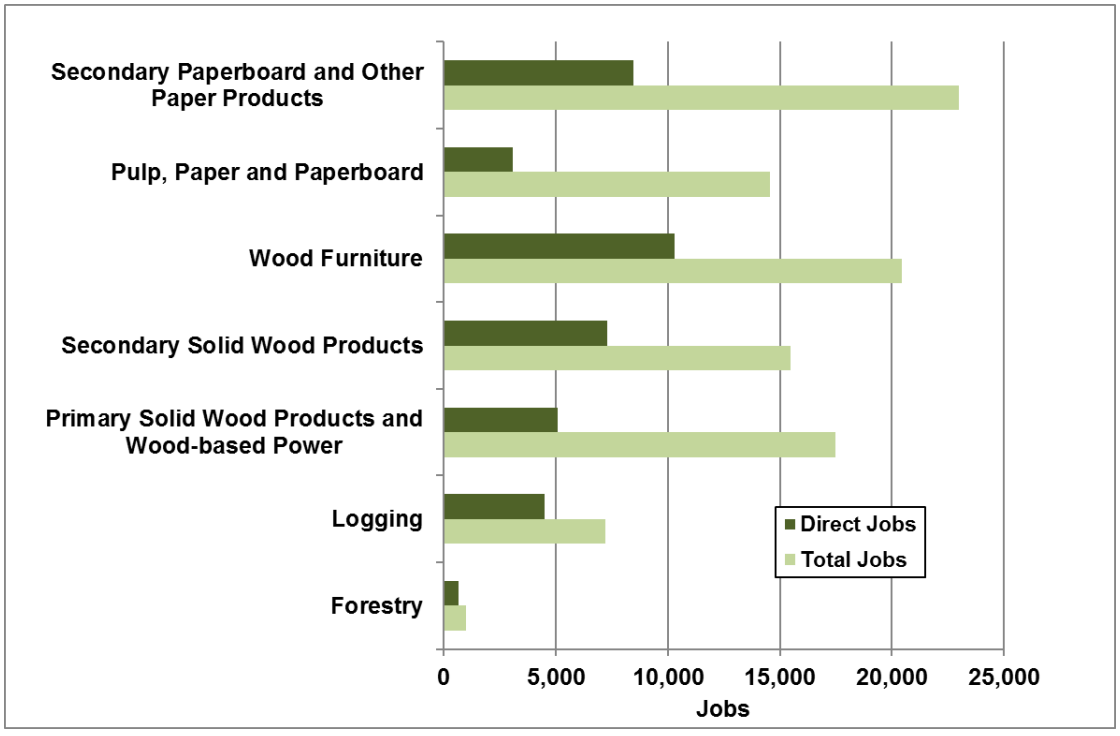

Figure 3 - Michigan direct and total employment by forest products industry, 2015.

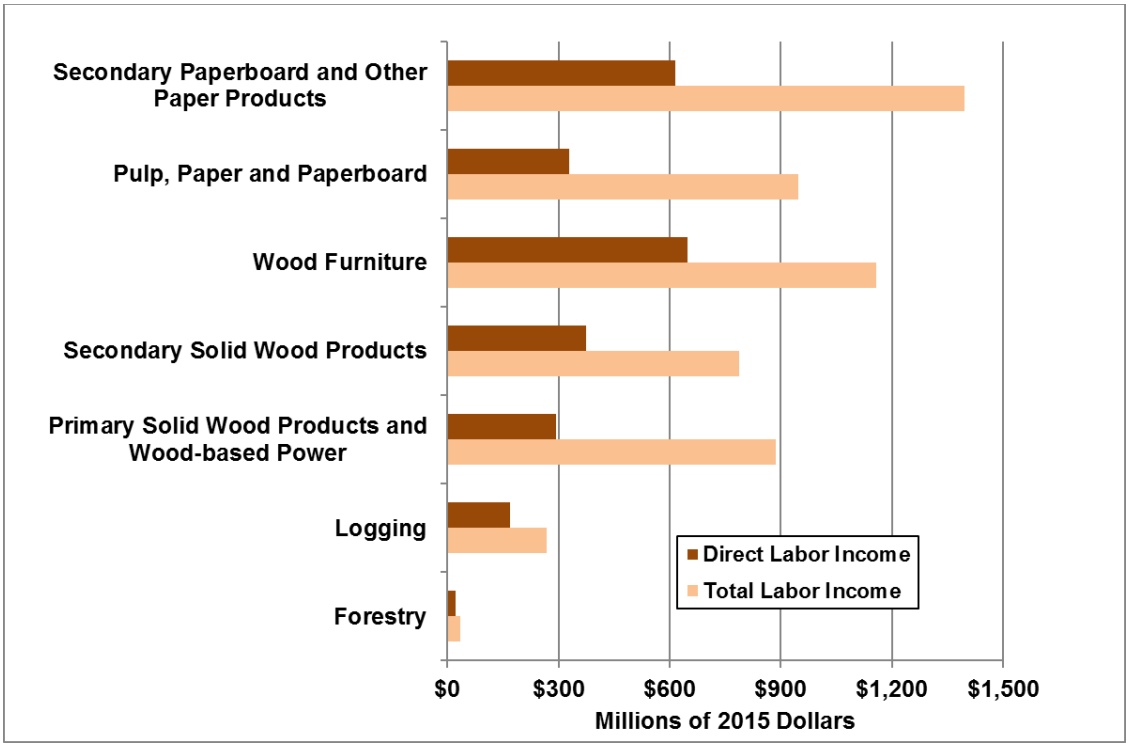

Figure 4 - Michigan direct and total labor income (in millions of 2015 dollars) by forest products industry, 2015.

To provide a broader context, it is useful to examine the relative importance of various forest industry sectors within Michigan and relative to other states (Table 5, Appendix 2). The Bureau of Labor Statistics tracks employment and annual wages for all sectors across the U.S. The highest ranked sectors in Michigan relative to other states are the Wood Office Furniture, the Institutional Furniture Manufacturing, and the Showcase, Partition, Shelving, and Locker Manufacturing sectors. Though these sectors are below their historic highs, they are still important sectors within Michigan and nationally.

It is also useful to compare the contribution of Michigan's forest products industries with other industries. Natural resources and agricultural industries make important contributions to the diversity of economic activities within Michigan's $480.1 billion Gross State Product (Figure 5). The forest products industries provide more direct employment and value added than the (1) commercial fishing, hunting and trapping, (2) mining and oil & gas production, and (3) agricultural production [plant crop and animal] industries (Figure 5). Michigan's forest products industries comprised 0.7% of the Gross State Product (GSP) in 2015. In a recent study of forest sector contributions in the southern U.S., the percent of value added relative to GSP ranged from less than 1% in Florida, Oklahoma and Texas to more than 4% for Alabama, Arkansas and Mississippi (Brandeis and Hodges 2015). In general, larger economies, such as Michigan's, had lower percentages of GSP associated with forest products industries. Although not examined for this report, food processing and manufacturing industries and forest-based outdoor tourism industries (such as in southern U.S. by Poudel et. al. 2016, 2017) add considerably to the economic contributions of natural resources and agriculture in Michigan.

Table 5 - Forest Industry Sector Rankings by Employment (Top 11 Listed) and Sales Within Michigan and by Employment and Output Within the US, 2015.

Sector Name	Within Michigan Ranking in:		U.S. Ranking in:	
	Employment	Labor Income	Employment	Annual Wages
Paperboard Container Manufacturing	1	1	7	9
Commercial Logging	2	4	14	14
Wood Office Furniture Manufacturing	3	2	1	1
Sawmills	4	5	15	14
Wood Container and Pallet Manufacturing	5	6	13	13
Paper Mills	6	3	9	9
Institutional Furniture Manufacturing	7	7	3	2
Wood Kitchen Cabinet and Countertop Manufacturing	8	9	27	24
Other Millwork, including Flooring	9	12	15	15
Showcase, Partition, Shelving, and Locker Manufacturing	10	11	4	1
Veneer and Plywood Manufacturing	11	14	11	11

Source: Appendix 2 and Bureau of Labor Statistics (www.bls.gov/blb/)

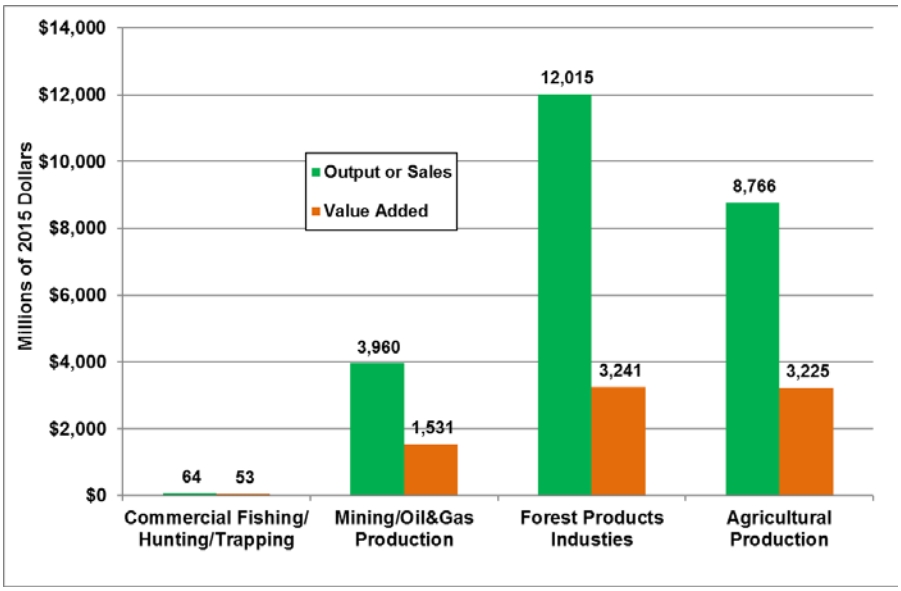

Figure 5 - Michigan direct output and value added (in millions of 2015 dollars) for selected industries, 2015.

3.4 SUMMARY

Employment in Michigan's forest products industries has declined in recent decades, but has rebounded since 2010. The U.S. and Michigan economic recovery provides opportunities for continued growth in these industries. Moreover, policies aimed at encouraging existing firms to remain and grow in Michigan and new firms to locate in Michigan will provide additional growth in the forest products industries.

Total direct contributions for 2015 were $12.0 billion in output, over 39,000 jobs, $2.5 billion in labor income, and $3.2 billion in value added. Using a simple Social Accounting Matrix (SAM) multiplier analysis, total contributions (includes "ripple effects") were estimated. Total contributions were $21.2 billion in output, over 99,000 jobs, $5.5 billion in labor income and $8.0 billion in value added.

Michigan's Wood Office Furniture sector had the highest employment and annual wages of any state in 2015. The Showcase, Partition, Shelving, and Locker Manufacturing sector ranked first in annual wages nationally. Similarly, the Institutional Furniture Manufacturing sector was estimated to be the third largest in the U.S. in terms of employment and second in annual wages. One-half of Michigan's top-ten sectors rank between 10th and 15th nationally.

A detailed examination of forest products sectors highlights the relative economic contributions each sector provides. However, a broader analysis of the economic contributions of natural resources is beyond the scope of this report. Nonetheless, the forest products industries compare favorably to the commercial fishing, hunting and trapping industries and the mining, oil, and gas production industries.

4.0 INTERNATIONAL AND NATIONAL TRADE FLOWS

One goal set by the MDNR and the Governor's Timber Advisory Council was to increase "the export of value-added forest products by 50 percent" by the end of 2018. This section provides a more detailed examination of trends in international and domestic trade in wood products (NAICS 321) and paper (NAICS 322).

The phrase "value added" has different interpretations. In regional economics (and IMPLAN), it is the sum of wages, rents, interest and profits. In more common discourse, it refers to higher stages in the production process (e.g., wooden tables are further along in the production process than lumber). For purposes of this goal, the focus is on products beyond the logging stage of production; value is added to the logs as they are processed. Lumber, pallets, medium density fiberboard, cardboard, paper and wood furniture are examples of value-added products. Notably, the furniture and fixtures industry (NAICS 337) is addressed initially in this section, but dropped from later discussions due to the difficulty of separating exports of wood-based furniture from other furniture component materials (e.g., metal and plastic) under the 3-digit NAICS classes (e.g., NAICS 337). Regardless, it remains an important part in Michigan's diverse forest products industries. So, the principal focus in this section is on solid wood products and paper.

For policy makers and others, the term "export" evokes the notion of international markets. However, economists consider any products shipped out of Michigan to be exports, whether they are going to international or domestic markets. In fact, domestic wood products and paper exports far exceed international exports. Exports sold outside of Michigan bring revenues to the companies within the state and support employment in them.

Much of Michigan's forest products industries' economic output is shipped out of state (Figure 6). The most recent (2012) commodity flow survey data from the U.S. Census Bureau and international trade data from the U.S. Department of Commerce provided an output estimate for wood products and paper of $7.8 billion in Michigan. The IMPLAN-based combined output in solid wood and paper products (excluding furniture, forestry and logging) in 2012 was similar, at $7.97 billion (Figure 6). The Department of Commerce data distribution was skewed more toward solid wood products, however. Approximately 70 percent of this value was shipped out of Michigan to international and domestic markets in 2012.

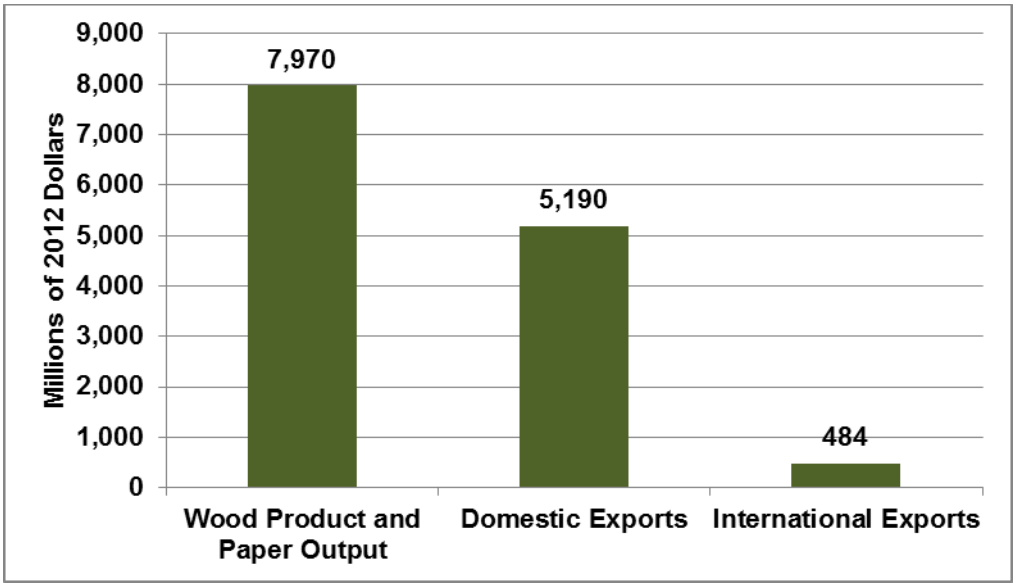

Figure 6 - Michigan direct wood product and paper output, domestic exports and international exports (in millions of 2012 dollars), 2012.

Source: 2012 IMPLAN data; US Department of Commerce, International Trade Administration; and US Census Bureau, Commodity Flow Survey.

4.1 INTERNATIONAL EXPORTS

The U.S. Department of Commerce estimated the value of Michigan's 2016 total international exports at $54.7 billion. Forest products exports were a small part of this total. Historic export data are published in nominal dollars (not adjusted to reflect inflation). Although producer price inflation for forest products industries was about 2 percent per year from 2008 through 2016, no adjustment is made for this report given the focus on 2016 exports, the most recent year available.

With an annual forest products international export value of $541.2 million in 2016, Michigan ranked 3rd to the top states of California and Texas in furniture exports (Table 6, Figure 7). However, Michigan has not fared well in exporting other forest products—wood products and paper. In 2015, Michigan's exports of wood products were valued at $161.4 million (ranked 17th among the states), which came close to achieving the export level of 2008, considering inflation, before the economic recession. The recession hit the housing industry particularly hard, and this in turn depressed the wood products industry across the U.S. Michigan's export of paper products in 2016 was $321.9 and ranked 20th in the country. All three industries have shown growth and decline over the past five years.

Table 6 - Value of International Exports from Michigan for NAICS 321, 322 And 337, in Millions of Nominal Dollars, 2008-2016.

	NAICS 321 - Wood Products	NAICS 322 - Paper	NAICS 337 - Furniture & Fixtures
Year	Millions of Dollars (Nominal)		
2008	159.8	343.4	502.9
2009	113.0	279.3	399.4
2010	138.2	341.4	469.6
2011	129.6	367.7	536.9
2012	146.4	337.6	654.5
2013	154.4	365.4	650.7
2014	166.6	349.4	636.5
2015	165.9	339.2	549.5
2016	161.4	321.9	541.2

Source: U.S. Department of Commerce, International Trade Administration (tse.export.gov/). Downloaded 10/12/17.

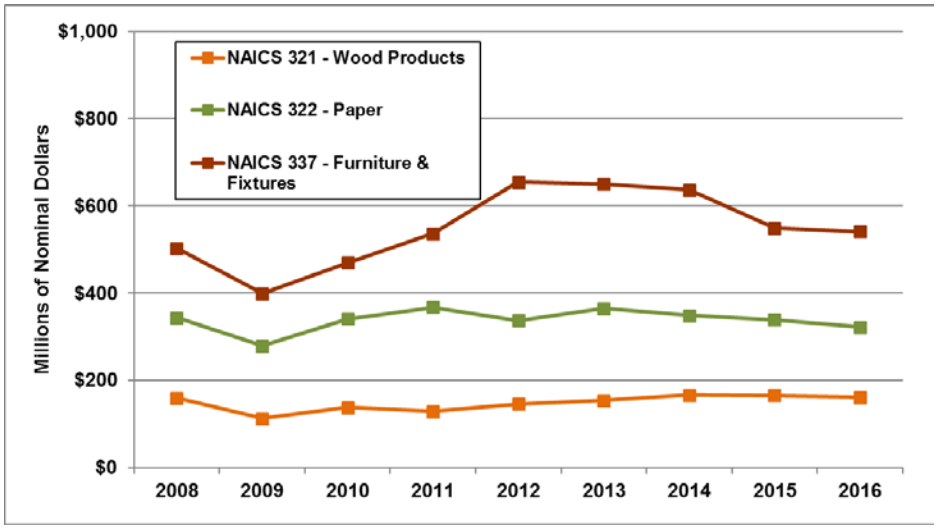

Figure 7 - Value of International Exports from Michigan for NAICS 321, 322 and 337, in Millions of Nominal Dollars, 2008-2016.

Like exports, imports have fluctuated. Furniture imports, however, have mostly increased. Specifically, imports of wood products, paper and furniture were, respectively, $529.4 million, $408.8 million and $1,097.2 million in 2016 (Table 7, Figure 8). Notably, the state is a net importer of wood products, paper and furniture.

Table 7 - Value of international imports to Michigan for NAICS 321, 322 and 337, in millions of nominal dollars, 2008-2016.

	NAICS 321 - Wood Products	NAICS 322 - Paper	NAICS 337 - Furniture & Fixtures
Year	Millions of Dollars (Nominal)		
2008	385.4	633.4	536.8
2009	279.1	422.8	426.9
2010	339.4	519.5	540.8
2011	314.2	567.4	621.5
2012	392.0	498.9	790.0
2013	489.2	540.9	842.9
2014	554.7	505.1	908.9
2015	496.6	479.7	1,032.4
2016	529.4	408.8	1,097.2

Source: U.S. Department of Commerce, International Trade Administration (tse.export.gov/stateimports/). Downloaded 10/12/17.

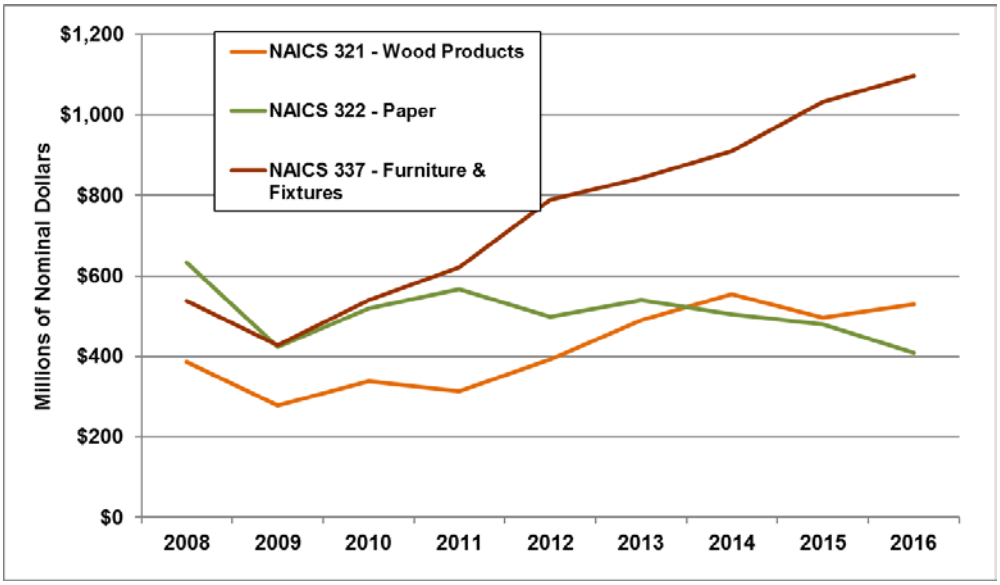

Figure 8 - Value of International Imports from Michigan for NAICS 321, 322 and 337, in Millions of Nominal Dollars, 2008-2016.

Consequently, import substitution provides an opportunity for expanding Michigan's forest products industries. Goods produced in Michigan need to outcompete similar imported goods in terms of price, quality or cachet for import substitution to succeed.

In 2016, China was the largest exporting destination for wood products and paper combined after the U.S.'s two North American neighbors—Canada and Mexico (Tables 8 and 9, Figures 9 and 10). Exporting to China has shown the fastest growth in recent years. Similarly, imports from China are the largest other than Canada and Mexico, and importing from China has witnessed significant growth in recent years.

Table 8 - Value of International Exports from Michigan for NAICS 321-Wood Products in Total and for the Top Five Importing Countries, in Millions of Nominal Dollars, 2016.

Country	NAICS 321 - Wood Products	
	Millions of Dollars	% of Total
World	161.4	100
Canada	74.2	46
China	32.3	20
Germany	8.4	5
Japan	6.6	4
Mexico	5.0	3

Source: U.S. Department of Commerce, International Trade Administration (tse.export.gov/stateimports/). Downloaded 10/12/17.

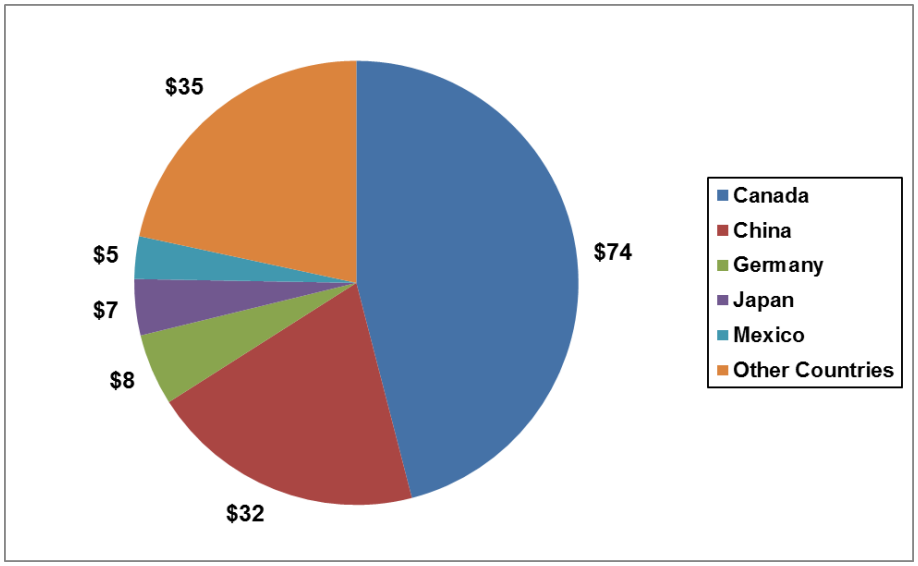

Figure 9 - Value of International Exports from Michigan for NAICS 321-Wood Products for the Top Five Importing Countries, in Millions of Nominal Dollars, 2016.

Table 9 - Value of International Exports from Michigan for NAICS 322-Paper in Total and for the Top Five Importing Countries, in Millions of Nominal Dollars, 2016.

Country	NAICS 322 - Paper	
	Millions of Dollars	% of Total
World	321.9	100
Canada	180.6	56
Mexico	57.2	18
China	26.8	8
U.K.	10.4	3
Germany	7.3	2

Source: U.S. Department of Commerce, International Trade Administration (tse.export.gov/). Downloaded 10/12/17.

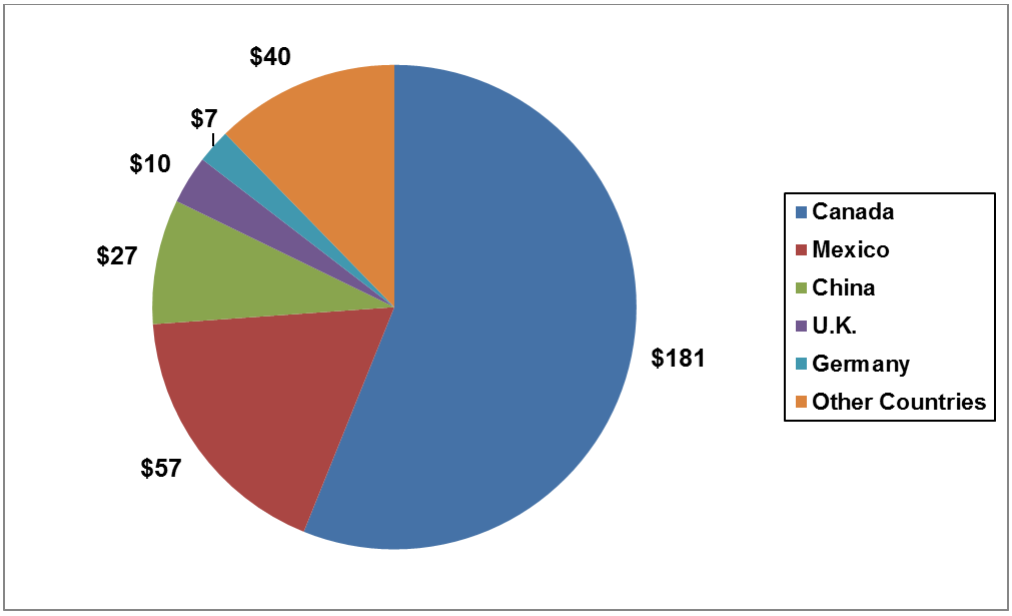

Figure 10 - Value of International Exports from Michigan for NAICS 322-Paper for the Top Five Importing Countries, in Millions of Nominal Dollars, 2016.

4.2 Domestic Exports

Domestic trade data are collected by the U.S. Census Bureau every five years; 2007 and 2012 are the most recent survey years. Based on the value of shipment data provided from the U.S. Census Bureau's 2012 Commodity Flow Survey, $1.4 billion in wood products and $3.7 billion in paper was sent to other states in 2012 (Tables 10 and 11, Figures 11 and 12). The top six states accounted for approximately 60 percent of domestic exports.

Table 10 - Value of Domestic Exports from Michigan for NAICS 321-Wood Products in Total and for the Top Six Importing States, in Millions of Nominal Dollars, 2007 and 2012

State	NAICS 321 - Wood Products (2007)		NAICS 321 - Wood Products (2012)	
	Million $	% of Total	Million $	% of Total
USA (excl. MI)	1,455	100	1,445	100
Indiana	182	13	282	20
Wisconsin	200	14	206	14
Illinois	160	11	178	12
Ohio	104	7	91	6
New York	38	3	66	5
Pennsylvania	54	4	38	3

Source: U.S Census Bureau, Commodity Flow Survey (www.census.gov/econ/cfs/).

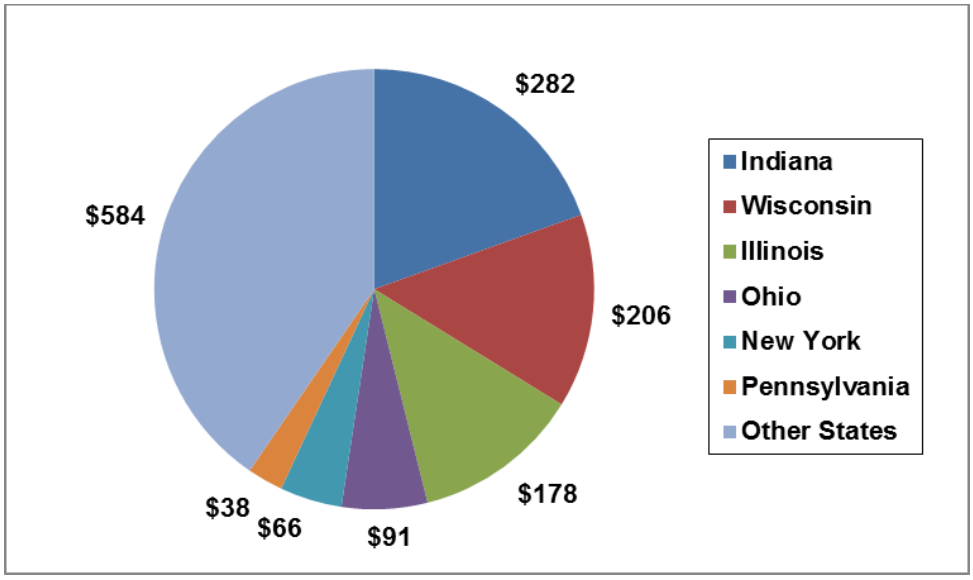

Figure 11 - Value of Domestic Exports from Michigan for NAICS 321-Wood Products for the Top Six Importing States, in Millions of Nominal Dollars, 2012.

The top six importing (or export-destination) states were mostly nearby states (i.e., Wisconsin, Illinois, Indiana and Ohio). Like Canada internationally, these are important markets. In 2012, the top importing state for each industry exceeded the total international exports for the industries. The economic impact in Michigan associated with $100 million in domestic exports or the same amount in international exports likely yields similar employment and sales impacts within Michigan, though the transportation industry impacts may be distributed differently. This reinforces the need to consider expanding domestic exports along with international exports.

Table 11 - Value of Domestic Exports from Michigan for NAICS 322-Paper in Total and for the Top Six Importing States, in Millions of Nominal Dollars, 2007 and 2012

State	NAICS 322 - Paper (2007)		NAICS 322 - Paper (2012)	
	Million $	% of Total	Million $	% of Total
USA (excl. MI)	3,432	100	3,745	100
Wisconsin	401	12	556	15
Ohio	383	11	462	12
Indiana	320	9	409	11
Illinois	342	10	331	9
Pennsylvania	111	3	195	5
Texas	187	5	179	5

Source: U.S Census Bureau, Commodity Flow Survey (http://www.census.gov/econ/cfs/).

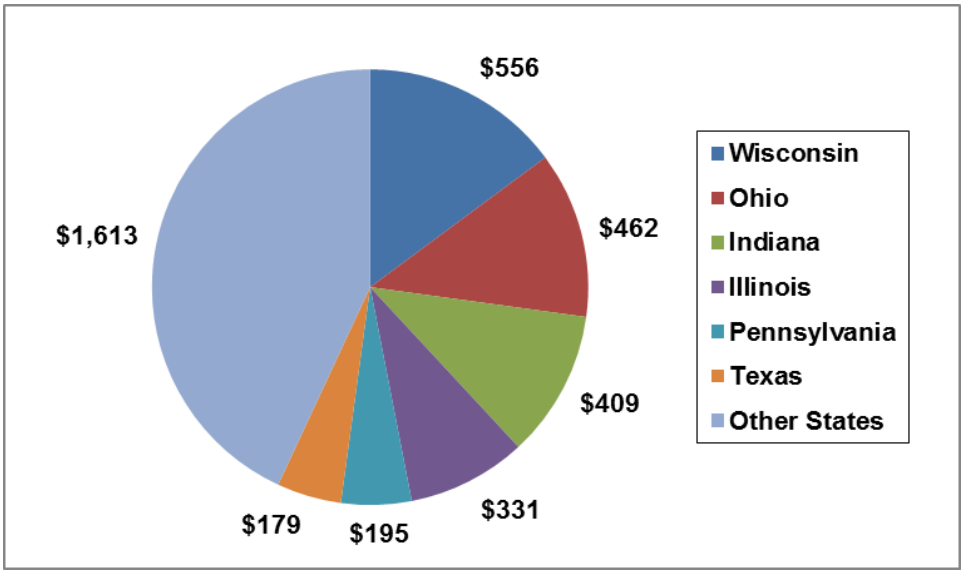

Figure 12 - Value of Domestic Exports from Michigan for NAICS 322-Paper for the Top Six Importing States, in Millions of Nominal Dollars, 2012.

4.3 Summary

Overall, forest products were a fairly small component of Michigan's 2016 total international exports valued at $54.7 billion. Nonetheless, forest products exports have increased since 2009, when the recession ended. Prospects for more exports will improve as the economies of U.S. and its trading partners continue to expand and as policies are implemented to encourage exports. The strong U.S. dollar currently slows the growth of exports, but the dollar may weaken if the U.S. government pursues policies that make other currencies more desirable.

Canada is clearly the largest international market for wood products and paper, accounting for about 46 percent of wood products exports and 56 percent of paper exports. The top five importing countries for each industry account for approximately 80 percent of the industries' exports. So, there are clearly established international markets for Michigan's forest products. Although not included in this analysis, the furniture and fixtures industry provides additional opportunities for value-added exports.

Discussion surrounding increasing exports traditionally implies international exports, but in fact, domestic exports exceed international exports significantly and may provide excellent opportunities for expansion as well. Michigan's forest products industries will thrive if domestic and international exports can be expanded. Given the high level of forest products imports, import substitution is another area that may yield markets for Michigan's forest products.

5.0 Five-Year (2018) Goals Revisited

The focus of this final section is on monitoring economic progress toward three goals set at the Governor's Forest Products Summit in 2013. Specifically, the goals are:

- Increasing the economic impact of the timber industry on state and regional economies to $20 billion;
- Increasing the export of value-added forest products by 50 percent; and
- Increasing forest products-related careers by 10 percent.

The other goals, supporting existing industry and encouraging regionally based industry development can be assessed over time by examining the public and private policies, programs and investments aimed at supporting the forest products industries.

5.1 Goal 1: Increasing Total Economic Impacts to $20 Billion

Prior to the Governor's Forest Products Summit, an initial estimate of the economic contributions by the forest products industries to Michigan's economy was $14.0 billion, based on 2011 IMPLAN data; the Wood Furniture industry was not included in the initial estimate. The estimate was increased to $17.5 billion using 2012 IMPLAN data and expanded forest industry sectors (Leefers et. al. 2015). The revised estimate provided the

baseline for assessing progress toward the goal of $20 billion (in 2012 dollars) in total contributions to Michigan's economy.

After accounting for inflation, the 2015 level of output contributions was considerably higher than the 2012 baseline level (Table 12). This estimate, consistent with the method used in previous reports, applied sectoral multipliers to each sector resulting in an estimate of $20.397 billion in impacts, after discounting to 2012 dollars. Thus, the $20 billion target has been reached. Underlying this increase were shifts between different industries. For example, pulp, paper and paperboard employment declined from 2014 to 2015, whereas primary solid wood products employment increased. Market opportunities and industrial policies will determine the growth or decline of industry sectors in the future.

An alternative approach for estimating total contributions is discussed in Appendix 3. For continuity with previous reports, this report continues to use the simple multiplier approach.

Table 12 - Progress Toward Five-Year Goals (2018) Set at the 2013 Governor's Forest Products Summit.

Goal	Unit	2012	2013	2014	2015	2016	2018 Target
Increasing economic impacts to $20 billion	Billions of 2012 $	17.487	17.475	19.602	20.397		**20.000**
Increasing international value-added exports by 50%	Billions of 2012 $	0.484	0.522	0.522	0.485	0.455	**0.726**
Increasing forest products-related employment by 10%	Number of Jobs	34,204	34,951	38,291	39,417		**37,624**

5.2 Goal 2: Increasing International Export of Value Added Forest Products by 50%

As with Goal 1, there are a number of options for monitoring progress towards the export goal. Exports from wood products (NAICS 321) and paper (NAICS 322) industries were used to calculate the 2012 baseline (Table 6). Across these two industries, there was a 6.0 percent decrease in exports over the 2012-16 period. This is significantly below the track needed to achieve a 50 percent increase by 2018. A strong U.S. dollar, among other factors, reduces opportunities for exports in the short run. Aggregate industry figures are used because export data does not differentiate between primary and secondary products. The Furniture and Fixtures industry was not included due to the lack of export details on wood-based furniture at this time.

For solid wood products, the 2012-16 export values combined output from Sawmills; Wood Preservation; Veneer and Plywood Manufacturing; Engineered Wood Member and Truss Manufacturing; Reconstituted Wood Product Manufacturing; Wood Window and Door Manufacturing; Cut Stock, Resawing Lumber, and Planning; Other Millwork, including Flooring; Wood Container and Pallet Manufacturing; Manufactured Home (Mobile Home) Manufacturing; Prefabricated Wood Building Manufacturing; and All Other Miscellaneous Wood Product Manufacturing. For paper products, export values combined output from Pulp Mills; Paper Mills; Paperboard Mills; Paperboard Container Manufacturing; Coated and Laminated Paper, Packaging Paper and Plastics Film Manufacturing; Stationery Product Manufacturing; Sanitary Paper Product Manufacturing; and All Other Converted Paper Product Manufacturing.

5.3 Goal 3: Increasing Forest Products – Related Careers by 10%

The third goal, increasing forest products-related employment, was derived by adding 3,420 jobs (10%) to the 2012 baseline level of 34,204, yielding a goal of 37,624 jobs. Employment estimates (Table 12) were derived from IMPLAN data in 2012-15; employment increased 15.2% from 2012 to 2015. The 2018 goal was exceeded in 2014 by 667 jobs.

5.4 Summary

The goals for expanding the forest products industries are interrelated. Changes in final demand or output drive economic activity yielding increased employment, labor income and total impacts on Michigan's economy. Goal 1 required additional total impacts of $2,513 million above the 2012 level. This translated into a needed increase of direct output (final demand) of approximately $1,653 million (using the 2.52 multiplier, Table 4). Goal 2 exports are below the 2018 target. It is likely that domestic exports increased considerably from 2012 to 2015. However, international exports were hindered by a strong U.S. dollar. Although they are not

perfectly correlated, increasing outputs for domestic and international markets have led to increases in employment, the focus of Goal 3.

The purpose of quantifying goals provides a basis for future comparisons regarding accomplishments associated with goals of the Governor's Forest Products Summit. Scenarios can be developed to describe more details about direct and total impacts of meeting these goals across various forest products industries in terms of output, employment and labor.

As summarized by Woodall and others (2012), "the high value forest resources of the northern region continue to mature and could provide more wood for an expanded wood products manufacturing industry. An opportunity exists to both improve the health and resiliency of these maturing forests while developing the local economies with improved competitiveness, capacity, and production of wood industries." They noted the positive opportunities for more paperboard production and increased international trade, biofuels and wood energy. These opportunities exist in Michigan; supportive policies and investments can make them a reality.

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APPENDIX 1

Table A 1. Description of Economic Sectors for Forest Industries, Including IMPLAN Industry Sectors and 2007 North American Industry Classification System (NAICS) Codes.

IMPLAN Sector	Description (NAICS Code): Detailed Description
15	Timber Tract Operations (113110): This industry comprises establishments primarily engaged in the operation of timber tracts for the purpose of selling standing timber. Forest Nurseries and Gathering of Forest Products (113210): This industry comprises establishments primarily engaged in (1) growing trees for reforestation and/or (2) gathering forest products, such as gums, barks, balsam needles, rhizomes, fibers, Spanish moss, ginseng, and truffles.
16	Logging (113310): This industry comprises establishments primarily engaged in one or more of the following: (1) cutting timber; (2) cutting and transporting timber; and (3) producing wood chips in the field.
19*	Support Activities for Forestry (115310): This industry comprises establishments primarily engaged in performing particular support activities related to timber production, wood technology, forestry economics and marketing, and forest protection. These establishments may provide support activities for forestry, such as estimating timber, forest firefighting, forest pest control, and consulting on wood attributes and reforestation. IMPLAN Sector 19 (NAICS 115) initial values were reduced to 3.9% of initial values based on the employment ratio between (1) Forestry Support Activities [NAICS 1153] and (2) Agriculture and Forestry Support Activities [NAICS 115] for MI in 2015 (Bureau of Labor Statistics). Applied to all economic aggregates for the sector.
47 (NA)	Biomass Electric Power Generation (221117): This U.S. industry comprises establishments primarily engaged in operating biomass electric power generation facilities. These facilities use biomass (e.g., wood, waste, alcohol fuels) to produce electric energy. The electric energy produced in these establishments is provided to electric power transmission systems or to electric power distribution systems. This was a new sector in 2013 IMPLAN datasets.
134 (95)	Sawmills (321113): This U.S. industry comprises establishments primarily engaged in sawing dimension lumber, boards, beams, timbers, poles, ties, shingles, shakes, siding, and wood chips from logs or bolts. Sawmills may plane the rough lumber that they make with a planing machine to achieve smoothness and uniformity of size.
135 (95)	Wood preservation (321114): This U.S. industry comprises establishments primarily engaged in (1) treating wood sawed, planed, or shaped in other establishments with creosote or other preservatives, such as alkaline copper quat, copper azole, and sodium borates, to prevent decay and to protect against fire and insects and/or (2) sawing round wood poles, pilings, and posts and treating them with preservatives.
136 (96)	Hardwood Veneer and Plywood Manufacturing (321211): This U.S. industry comprises establishments primarily engaged in manufacturing hardwood veneer and/or hardwood plywood. Softwood Veneer and Plywood Manufacturing (321212): This U.S. industry comprises establishments primarily engaged in manufacturing softwood veneer and/or softwood plywood.
137 (97)	Engineered Wood Member (except Truss) Manufacturing (321213): This U.S. industry comprises establishments primarily engaged in manufacturing fabricated or laminated wood arches and/or other fabricated or laminated wood structural members. Truss Manufacturing (321214): This U.S. industry comprises establishments primarily engaged in manufacturing laminated or fabricated wood roof and floor trusses.
138 (98)	Reconstituted Wood Product Manufacturing (321219): This U.S. industry comprises establishments primarily engaged in manufacturing reconstituted wood sheets and boards.

IMPLAN Sector	Description (NAICS Code): Detailed Description
139 (99)	Wood Window and Door Manufacturing (321911): This U.S. industry comprises establishments primarily engaged in manufacturing window and door units, sash, window and door frames, and doors from wood or wood clad with metal or plastics
140 (99)	Cut Stock, Resawing Lumber, and Planing (321912): This U.S. industry comprises establishments primarily engaged in one or more of the following: (1) manufacturing dimension lumber from purchased lumber; (2) manufacturing dimension stock (i.e., shapes) or cut stock; (3) resawing the output of sawmills; and (4) planing purchased lumber. These establishments generally use woodworking machinery, such as jointers, planers, lathes, and routers to shape wood.
141 (99)	Other Millwork, including Flooring (321918): This U.S. industry comprises establishments primarily engaged in manufacturing millwork (except wood windows, wood doors, and cut stock).
142 (100)	Wood Container and Pallet Manufacturing (321920): This industry comprises establishments primarily engaged in manufacturing wood pallets, wood box shook, wood boxes, other wood containers, and wood parts for pallets and containers.
143 (101)	Manufactured home (mobile home) manufacturing (321991): This U.S. industry comprises establishments primarily engaged in making manufactured homes (i.e., mobile homes) and nonresidential mobile buildings. Manufactured homes are designed to accept permanent water, sewer, and utility connections and although equipped with wheels, they are not intended for regular highway movement.
144 (102)	Prefabricated Wood Building Manufacturing (321992): This U.S. industry comprises establishments primarily engaged in manufacturing prefabricated wood buildings and wood sections and panels for prefabricated wood buildings.
145 (103)	All Other Miscellaneous Wood Product Manufacturing (321999): This U.S. industry comprises establishments primarily engaged in manufacturing wood products (except establishments operating sawmills and preservation facilities; establishments manufacturing veneer, engineered wood products, millwork, wood containers, pallets, and wood container parts; and establishments making manufactured homes (i.e., mobile homes) and prefabricated buildings and components).
146 (104)	Pulp Mills (322110): This industry comprises establishments primarily engaged in manufacturing pulp without manufacturing paper or paperboard. The pulp is made by separating the cellulose fibers from the other impurities in wood or other materials, such as used or recycled rags, linters, scrap paper, and straw.
147 (105)	Paper (except Newsprint) Mills (322121): This U.S. industry comprises establishments primarily engaged in manufacturing paper (except newsprint and uncoated groundwood paper) from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paper they make. Newsprint Mills (322122): This U.S. industry comprises establishments primarily engaged in manufacturing newsprint and uncoated groundwood paper from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paper they make.
148 (106)	Paperboard Mills (322130): This industry comprises establishments primarily engaged in manufacturing paperboard from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paperboard they make.
149 (107)	Paperboard Container Manufacturing (32221): This industry comprises establishments primarily engaged in converting paperboard into containers without manufacturing paperboard. These establishments use corrugating, cutting, and shaping machinery to form paperboard into containers. Products made by these establishments include boxes, corrugated sheets, pads, pallets, paper dishes, and fiber drums, and reels. Six-digit NAICS industries are: Corrugated and Solid Fiber Box Manufacturing (322211), Folding

IMPLAN Sector	Description (NAICS Code): Detailed Description
	Paperboard Box Manufacturing (322212), and Other Paperboard Container Manufacturing (322219).
150 (108, 109)	Paper Bag and Coated and Treated Paper Manufacturing (322220): This industry comprises establishments primarily engaged in one or more of the following: (1) cutting and coating paper and paperboard; (2) cutting and laminating paper, paperboard, and other flexible materials (except plastics film to plastics film); (3) manufacturing bags, multiwall bags, sacks of paper, metal foil, coated paper, laminates, or coated combinations of paper and foil with plastics film; (4) manufacturing laminated aluminum and other converted metal foils from purchased foils; and (5) surface coating paper or paperboard.
151 (110)	Stationery Product Manufacturing (322230): This industry comprises establishments primarily engaged in converting paper or paperboard into products used for writing, filing, art work, and similar applications.
152 (111)	Sanitary Paper Product Manufacturing (322291): This U.S. industry comprises establishments primarily engaged in converting purchased sanitary paper stock or wadding into sanitary paper products, such as facial tissues, handkerchiefs, table napkins, toilet paper, towels, disposable diapers, sanitary napkins, and tampons.
153 (112)	All Other Converted Paper Product Manufacturing (322299): This U.S. industry comprises establishments primarily engaged in converting paper or paperboard into products (except containers, bags, coated and treated paper, stationery products, and sanitary paper products) or converting pulp into pulp products, such as egg cartons, food trays, and other food containers from molded pulp.
368 (295)	Wood Kitchen Cabinet and Countertop Manufacturing (337110): This industry comprises establishments primarily engaged in manufacturing wood or plastics laminated on wood kitchen cabinets, bathroom vanities, and countertops (except freestanding). The cabinets and counters may be made on a stock or custom basis.
369 (296)	Upholstered Household Furniture Manufacturing (337121): This U.S. industry comprises establishments primarily engaged in manufacturing upholstered household-type furniture. The furniture may be made on a stock or custom basis.
370 (297)	Nonupholstered Wood Household Furniture Manufacturing (337122): This U.S. industry comprises establishments primarily engaged in manufacturing nonupholstered wood household type furniture and freestanding cabinets (except television, radio, and sewing machine cabinets). The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown).
372* (299)	Institutional Furniture Manufacturing (337127): This U.S. industry comprises establishments primarily engaged in manufacturing institutional-type furniture (e.g., library, school, theater, and church furniture). Included in this industry are establishments primarily engaged in manufacturing general purpose hospital, laboratory, and dental furniture (e.g., tables, stools, and benches). The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown). Bureau of Labor Statistics does not break this industry into wood and non-wood components. To estimate the amount of this industry is wood-based, the ratio of wood-based subsectors (337121 and 337122) and total household furniture subsectors (337121, 337122, 337124 and 337125) for Michigan in 2015 (Bureau of Labor Statistics) was calculated for employment (66.3%) and applied to adjust IMPLAN Sector 372 values. Applied to all economic aggregates for the sector.
373 (300)	Wood Office Furniture Manufacturing (337211): This U.S. industry comprises establishments primarily engaged in manufacturing wood office-type furniture. The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown). This was a new sector in 2013 IMPLAN datasets. Previously, IMPLAN Sector 300 included Non-Wood Office Furniture Manufacturing (337214).

IMPLAN Sector	Description (NAICS Code): Detailed Description
374 (301)	Custom Architectural Woodwork and Millwork Manufacturing (337212): This U.S. industry comprises establishments primarily engaged in manufacturing custom designed interiors consisting of architectural woodwork and fixtures utilizing wood, wood products, and plastics laminates. All of the industry output is made to individual order on a job shop basis and requires skilled craftsmen as a labor input. A job might include custom manufacturing of display fixtures, gondolas, wall shelving units, entrance and window architectural detail, sales and reception counters, wall paneling, and matching furniture.
376* (302)	Showcase, Partition, Shelving, and Locker Manufacturing (337215): This U.S. industry comprises establishments primarily engaged in manufacturing wood and nonwood office and store fixtures, shelving, lockers, frames, partitions, and related fabricated products of wood and nonwood materials, including plastics laminated fixture tops. The products are made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown). Establishments exclusively making furniture parts (e.g., frames) are included in this industry. Like Institutional Furniture Manufacturing, this sector includes both wood and nonwood components. To estimate the amount of this industry is wood-based, the ratio of wood-based custom and office furniture subsectors (337211 and 337212) and total office furniture subsectors (337211, 337212, and 337214) for Michigan in 2015 (Bureau of Labor Statistics) was calculated for employment (37.5%) and applied to adjust IMPLAN Sector 376 values. Applied to all economic aggregates for the sector.

Note: Sector numbers from 2012 IMPLAN sectorization scheme noted in parentheses, and sectors modified for this analysis denoted with "".*

APPENDIX 2

Table A 2. Detailed Forest Industry Sector Direct Contributions, 2015.

IMPLAN Sector	Forest Industry Sector	Direct Contributions, 2015		
		Employment (Jobs)	Output (2015 Dollars)	Labor Income (2015 Dollars)
15	Forestry, forest products, and timber tract production	388	29,553,944	12,630,839
16	Commercial logging	4,491	336,919,220	170,021,011
19	Support activities for forestry*	297	17,068,669	8,862,079
47	Electric power generation - Biomass	89	114,151,581	12,419,990
134	Sawmills	2,843	780,762,756	150,579,166
135	Wood preservation	202	93,201,126	8,797,153
136	Veneer and plywood manufacturing	1,118	298,249,115	56,842,939
137	Engineered wood member and truss manufacturing	813	176,127,914	43,276,798
138	Reconstituted wood product manufacturing	843	376,652,191	63,983,063
139	Wood windows and door manufacturing	778	63,467,270	44,463,309
140	Cut stock, resawing lumber, and planing	591	148,174,449	29,679,133
141	Other millwork, including flooring	1,320	261,106,812	66,217,769
142	Wood container and pallet manufacturing	2,254	323,578,583	109,325,901
143	Manufactured home (mobile home) manufacturing	141	31,068,224	11,457,483
144	Prefabricated wood building manufacturing	424	80,030,380	23,241,422
145	All other miscellaneous wood product manufacturing	984	162,250,534	47,288,488
146	Pulp mills	62	46,741,142	7,278,047
147	Paper mills	2,178	1,786,106,079	237,315,240
148	Paperboard mills	846	714,318,848	83,229,074
149	Paperboard container manufacturing	6,397	2,904,480,713	450,907,743
150	Paper bag and coated and treated paper manufacturing	1,088	537,936,646	92,907,397
151	Stationery product manufacturing	189	70,287,064	11,060,570
152	Sanitary paper product manufacturing	574	445,746,979	43,515,462
153	All other converted paper product manufacturing	225	77,586,334	16,689,566
368	Wood kitchen cabinet and countertop manufacturing	1,637	227,046,707	83,606,978

IMPLAN Sector	Forest Industry Sector	Direct Contributions, 2015		
		Employment (Jobs)	Output (2015 Dollars)	Labor Income (2015 Dollars)
369	Upholstered household furniture manufacturing	265	51,025,730	10,663,579
370	Nonupholstered wood household furniture manufacturing	702	88,843,773	28,049,319
372	Institutional wood furniture manufacturing*	1,657	311,284,178	98,045,747
373	Wood office furniture manufacturing	4,126	993,654,602	311,306,123
374	Custom architectural woodwork and millwork	726	117,718,895	45,249,887
376	Showcase, partition, shelving, and locker manufacturing*	1,171	250,147,653	71,314,254
		39,417	**12,015,268,110**	**2,450,225,528**

Note: sectors modified for this analysis denoted with "".*

APPENDIX 3

Input-output modeling approaches change over time as new methods are developed and implemented. For example, recent articles in the *Journal of Forestry* (Henderson et. al. 2017, Joshi et. al. 2017) highlighted similarities and differences in forest industry modeling in the southern U.S. Forestry and agricultural researchers have not settled on standard methods or sectors for defining their industries. The method for calculating total economic contributions in this and previous reports relied on the use of sectoral multipliers. This approach, while simple and straightforward, overestimates total contributions due to backward linkages between forest industry sectors and purchase of forest products commodities locally. The magnitude of this overestimation is unknown without more detailed analyses.

A more detailed analysis method recommended by IMPLAN staff is called Multi-Industry Contribution Analysis (https://implanhelp.zendesk.com/hc/en-us/articles/115009542247-Multi-Industry-Contribution-Analysis). It simplifies commodity production within each sector by eliminating inter-sectoral linkages and modifying trade flows by stopping local purchases from forest products industries beyond the amounts specified as direct outputs. Analyses using the multi-industry approach produce estimates that are lower than the simple multiplier approach. For continuity, this report continues to rely on the simple multiplier approach, however the multi-industry may be considered for future reports.