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- 288 -

COMPOSITES AS A WAY TO ADD
VALUE TO THE TIMBER RESOURCE

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SUMMARY

Many local, regional, and national economies are dependent on the forest resource for a substantial amount of income and employment. Too often, however, the timber resource is harvested and exported without capturing the economic benefits obtainable from further processing, which adds value to the product. This paper presents a method of ranking the relative contribution of major primary timber processing operations to the economy. The method uses existing indicators of economic activity within each of the primary processing industries. These indicators include the total value of products shipped, the value added to the resource through the manufacturing process, and the ratio of value-added to value of shipments. This ratio of value-added to value of shipments provides a means of comparing the relative increase in the value of the timber resource across all primary processing operations. I applied this method of ranking values of shipments and value-added to primary processing industries in the United States. My results indicate that the further processing of timber into composite wood panel products will add more value to the *resource*, and hence to the economy, than the manufacture of *primary* wood products. Because the magnitude of the economic activity indicators used here are specific to conditions in the U.S. economy, this analysis must be performed for each country or producing region of interest.

Keywords: Wood composites, value-added, industry shipments, timber resource

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INTRODUCTION

The wise use of the resources of the world's forests can provide both direct and indirect economic benefits to national, regional, and local economies. Activities such as the harvesting and processing of timber, leasing of water and grazing rights, and development of tourism and other outdoor recreational activities all help stimulate the economy. For example, timber harvesting, including stumpage payments made to landowners and payments for transporting roundwood to processing sites, represents both employment and income. Forest-related activities that increase economic benefits to the economy, while retaining the integrity of both the forest resource and other forest-related activities, are beneficial and should be encouraged.

This paper examines the economic benefits derived from the timber resource in the United States. Of particular interest is the contribution made by the solid-wood primary timber processing industries. This includes both the harvesting of the timber resource and its conversion into lumber, plywood, composite wood panel products, and treated wood products. Aggregate indicators of economic activity in each primary processing industry will be presented, and economic benefits will be evaluated using a value-added method developed in this analysis. Finally, recommendations are made for stimulating local, regional, and national economies through additional processing of the timber resource. Of particular interest is the role the production of composite wood panels can play in increasing economic benefits derived from the timber resource.

Data and analyses presented for timber-based manufacturing in the United States are based primarily on information collected by the United States Department of Commerce, Bureau of the Census, in its quinquennial Census of Manufactures (U.S. Department of Commerce 1985, 1989). Although specifics will vary, the concepts developed here have general applicability to other forest resources and countries.

U.S. TIMBER PROCESSING INDUSTRIES

Timber harvesting and manufacturing supports employment and income in many sectors of the economy. Roundwood provides raw material for many different manufacturing industries. For example, sawmills and paper mills process roundwood directly into lumber, newsprint, and other marketable primary wood products. Some industries purchase these products to manufacture more highly finished secondary goods, such as cabinets, furniture, pallets, paper bags, and high-grade paper products. Producers of gum and wood chemicals also rely on timber for raw materials. All the wood manufacturing industries rely on the roundwood forest resource for income and employment (U.S. Department of Agriculture 1988).

There are several ways to measure the contribution of timber harvesting, and primary and secondary forest industry manufacturing to the economy. The number of timber-based establishments, level of employment, payroll expended, value added in the manufacturing process, and value of shipments all indicate how the forest industries affect local, regional, and national economies.

Value of shipments, as defined by the Bureau of the Census, is "the received net selling values of all products shipped, both primary and secondary, as well as all miscellaneous receipts such as receipts for contract work performed by others, installation and repair receipts, sale of scrap, and sale of items bought and resold without further processing. Included are all items made by or for the establishment from materials owned by it whether sold, transferred to other plants of the same company, or shipped on consignment" (U.S. Department of Commerce 1989). Value-added "is derived by subtracting the cost of materials, supplies, containers, fuel, purchased electricity, and contract work from the value of shipments plus receipts or services rendered. The value is then adjusted by the addition of value added by merchandising operations plus the net change in finished goods and work-in-process inventories between the beginning and end of year" (U.S. Department of Commerce 1989). Thus, value-added is a net measure of an industry's contribution to the economy because the value of materials received from other firms and used in the manufacturing process is subtracted from the value of the products shipped.

The two-digit Standard Industrial Classification (SIC) code (Office of Management and Budget 1972) defines three major industry groups and one individual industry that primarily use or manufacture products from wood. The Bureau of the Census uses this classification system for data collection. These industries are Lumber and Wood Products (SIC 24), Furniture and Fixtures (SIC 25), Paper and Allied Products (SIC 26), and Industry 2861--Gum and Wood Chemicals. The data base of the Bureau of the Census includes the total activity of these industries, although timber is only one of the raw materials used. The data base does not include the economic importance of these forest industries as producers and consumers of goods and services provided by nontimber sectors of the economy. Nor does the data base measure the multiplier effects generated from income and employment in forest industries that spread throughout the economy.

Each two-digit major industry group consists of two or more individual four-digit industries. Individual manufacturing establishments are assigned to the industry that most closely reflects the principal product manufactured. However, many individual establishments manufacture products of more than one industry. Consequently, industry data do not fully reflect the activity required to manufacture the principal product. For example, a mill that produces pallets is assigned to Industry 2448--Wood Pallets and Skids. However, the mill may also produce a small amount of other products, such as wooden containers or cooperage. Ratios of industry specialization and coverage are reported for each industry: they define the levels at which nonprimary products are manufactured within the industry and at which primary products are manufactured outside the industry. In addition, economic data are reported in current U.S. dollars; the data reflect changes caused by industry activity and by inflation.

For this analysis, industry specialization and coverage ratios were used to convert industry economic data to data that more fully reflect total activity required to manufacture a given product; the Producer Price Index for all industrial commodities was used to deflate dollars to a common **base** year (1982). Finally, data for industries producing similar products were grouped. The actual groupings used here are included in the following analysis of each primary product type.

VALUE-ADDED METHOD FOR EVALUATING ECONOMIC BENEFITS

A relative measure of the contribution of the manufacturing process to the value of the final product is the ratio of the value added from manufacturing to the value of industry shipments. This ratio of value-added to value of shipments will always be between 0 and 1, and it can be used to compare activity within the industry over time or activity between industries. A high ratio (close to 1.00) indicates that the manufacturing process contributes more to the value of the final product than the cost of the raw materials. A low ratio indicates that the cost of the raw materials, not the manufacturing process, largely determines the value of the products. Thus, the higher the ratio, the larger the relative contribution of the industry to the economy--a larger proportion of the value of shipments is derived from the actual manufacturing process.

The ratio of value-added to value of shipments is developed for each primary product. This ratio is used to evaluate and recommend the product with the greatest potential for increasing the value of the timber resource.

PRIMARY TIMBER PROCESSING

Primary timber processing includes the harvesting and removal of timber from the forest, and the conversion of this timber into primary products. The primary timber processing activities considered here are (1) timber harvesting, (2) lumber manufacturing, (3) plywood and veneer manufacturing, (4) composite wood panel manufacturing, and (5) treated wood product manufacturing.

T i m b e r H a r v e s t i n g

The harvesting and removal of timber from the forest is the first step in utilizing the timber resource. In this report, timber harvesting includes SIC Industry 2411--Logging. In 1987, 11,721 establishments were primarily engaged in harvesting and removing timber from U.S. forests (Table 1). These establishments tended to be small; only 7 percent had 20 or more employees. Total employment was 87,000, with a payroll of \$1.5 billion (10⁹). Shipments were valued at \$11.1 billion; \$4.2 billion was value-added.

Over the last 15 years, the value of shipments has ranged from a low of \$6.8 billion in 1975 to the current high of \$11.1 billion; value-added has ranged from a low of \$2.5 billion in 1982 to the current high of \$4.2 billion. In fact, 1987 was the first year in that decade that shipments and value-added exceeded previously recorded highs.

In 1988, the ratio of value-added to value of shipments for timber harvesting was 0.38. From 1972 to 1987, the ratio averaged 0.39. Thus, stumpage and other costs accounted for over 60 percent of the value of the timber harvested; less than 40 percent was directly attributable to the actual harvesting process.

L u m b e r M a n u f a c t u r i n g

Lumber manufacturing includes SIC Industries 2421--Sawmills and Planing Mills, 2426--Hardwood Dimension and Flooring Mills, 2429--Special Product Sawmills, and 2439--Structural Wood Members. These industries all produce lumber and other related sawnwood products for sale. A total of 7,508 establishments produced lumber or related products in 1987 (Table 1). Like timber harvesting establishments, lumber manufacturing establishments tended to be small; only a third of these establishments had 20 or more employees. Employment was 203,100, and the payroll exceeded \$3.6 billion. Shipments were valued at \$20.6 billion; \$8.3 billion was value-added.

Lumber manufacturing, like timber harvesting, has fluctuated widely over the last 15 years. Shipments and value-added during the last decade did not reach record levels set in the late 1970s.

The ratio of value-added to value of shipments for lumber manufacturing in 1987 was 0.40. This has been the average ratio since 1972. Lumber manufacturing is very similar to timber harvesting in that about 60 percent of the value of the products manufactured is derived from the cost of the materials used in the manufacturing process, and just 40 percent is derived from the manufacturing process itself.

P l y w o o d a n d V e n e e r M a n u f a c t u r i n g

Plywood and veneer manufacturing includes manufacturers of all types of hardwood and softwood plywood panels and veneer (Industries 2435--Hardwood Veneer and Plywood, and 2436--Softwood Veneer and Plywood). It does not include nonveneered structural panels made from wood flakes, wafers, or strands, such as oriented strandboard or waferboard. These nonveneered, reconstituted wood panels are included in composite wood panels. Although there were only 540 plywood and veneer manufacturing establishments in 1987 (Table 1), these establishments tended to be large, and nearly 75 percent of them had 20 or more employees. Total employment in 1987 was 58,800, and the payroll was nearly \$1.1 billion. Plywood and veneer shipments were valued at \$6.2 billion, and value-added was \$2.4 billion.

As with other primary timber processors, wide fluctuations in value indicators have been experienced in plywood and veneer manufacturing. Record levels of shipments and value-added achieved in the 1970s have not yet been regained.

In 1987, the ratio of value-added to value of shipments for plywood and veneer manufacturing was 0.38, the same as the ratio for timber harvesting. The average ratio for plywood and lumber manufacturing since 1972 has been slightly lower--0.36. Thus, plywood and veneer manufacturing is similar to timber harvesting and lumber manufacturing in the relative contribution of the manufacturing process to the economy.

C o m p o s i t e W o o d P a n e l s M a n u f a c t u r i n g

Composite wood panels manufacturing is a newly formed industry in the SIC system (Industry 2493--Reconstituted Wood Products). It consists of a variety of composite panel products, including particleboard, waferboard and oriented strandboard, medium density fiberboard, hardboard, and insulation board. The growth in manufacturing in these products and the need to better classify establishments that produce these products resulted in the formation of the industry in the 1987 SIC revision. Data prior to 1987 for this group of products, except particleboard, are therefore not available.

In 1987, 253 establishments produced composite wood panels in the United States (Table 1). Nearly two-thirds of these establishments had 20 or more employees. Employment was 22,100, and payroll exceeded half a billion dollars. Shipments were valued at \$2.9 billion; value-added was \$1.4 billion.

In 1987, the ratio of value-added to value of shipments for composite wood panels manufacturers was 0.48, indicating that nearly half the value of the finished product was derived from the manufacturing process. From 1972 to 1982, the ratio for particleboard producers alone averaged 0.44.

T r e a t e d W o o d P r o d u c t s M a n u f a c t u r i n g

Treated wood products manufacturing includes establishments that preserve both roundwood and sawnwood with a variety of chemical treatments. A total of 526 establishments preserved wood in 1987 (Table 1). Of these, 199 establishments had 20 or more employees. Employment was 11,500, and the payroll exceeded \$200 million. Shipments were valued at \$2.1 billion; \$0.5 billion was value-added.

Treated wood manufacturing, unlike the manufacturing of many other primary products, has grown fairly consistently during the last 15 years in terms of the total value of industry shipments. Nevertheless, value-added peaked in 1978.

In 1987, the ratio of value-added to value of shipments for treated wood manufacturing was 0.25, considerably below the 15-year average of 0.32. This indicates that although products shipments have been increasing in value, the cost of raw materials has been increasing at a faster rate.

C O N T R I B U T I O N S O F P R I M A R Y T I M B E R P R O C E S S I N G T O T H E E C O N O M Y

In aggregate, the primary timber processing defined here is an important component of the U.S. economy. In 1987, the 20,548 establishments in operation provided 382,300 jobs, had a \$7.0 billion payroll, and produced products valued at \$43.3 billion. Value added in the manufacturing Process totaled \$16.8 billion. This information not only verifies the importance of

these manufacturers to the economy, but it also provides insight into ways to increase their contribution.

Many localities, regions, and nations, particularly developing nations, have abundant timber resources but limited processing facilities. Timber is harvested and exported directly to other localities or regions within the country or to other countries for further processing. Attempts to improve the economy often include increasing timber harvest to create jobs and to increase cash flow into the economy. The increased supply of logs resulting from increased harvesting may actually depress log prices, while at the same time reducing the resource base for future harvests. The net addition to the economy may be small and well below desired levels.

Another approach to stimulating a timber-based economy is to process the harvested timber into primary timber products before exporting to other localities, regions, or countries. This further processing will increase the value of the timber, provide new jobs, and help maintain the timber base. The ratio of value-added to value of shipments for primary timber processing in the United States in 1987 can be used to help guide the choice of which primary processing activities should be developed. The ratios for primary processing industries are as follows:

<u>Primary processing industry</u>	<u>Ratio of value-added to value of shipments</u>
Lumber	0.40
Plywood and veneer	0.38
Composite wood panels	0.48
Treated wood products	0.25

The further processing of timber into lumber, plywood, and veneer, reconstituted wood products, or treated wood would all substantially increase the value of the harvested timber. Although these ratios for primary processing industries are based on aggregate data and do not necessarily correspond to activity within individual establishments, they do indicate that the manufacturing of composite wood panels generally adds more value to the resource than does the manufacturing of other primary products. Nearly half the value of composite wood panels is directly attributable to the manufacturing process. Only a quarter the value of treated wood products is attributable to the manufacturing process. Lumber manufacturing and plywood and veneer manufacturing are intermediate in their addition of value to the resource. Thus, a mill producing \$10 million of composite wood panels annually would add \$4.8 million to the value of the resource, value which would be lost were the resource exported for further processing.

CONCLUSION

The wise use of the forest resource can provide employment and income to local, regional, and national economies. The processing of harvested timber into primary products, such as lumber, plywood, composite wood panels, or treated wood products, can further increase employment and income while

retaining the integrity of both the resource and other forest-related activities. Of the principal primary timber products, the manufacturing of composite wood panels adds substantially more value to the timber resource, and hence to the economy, than the manufacturing of other primary products. Composite wood panels manufacturing therefore provides the opportunity to add more value to the timber resource, on the average, than other types of primary processing. Thus, to improve the economy and better utilize the timber resource, the manufacturing of composite wood panels should be considered first when selecting a manufacturing process.

LITERATURE CITED

- Office of Management and Budget, 1987: Standard industrial classification manual. Washington, DC, Executive Office of the President, Office of Management and Budget, 703 p.
- U.S. Department of Agriculture, 1988: An analysis of the timber situation in the United States: 1989-2040. I. The current resource and use situation, II. The future resource situation. Draft. Washington, DC, U.S. Department of Agriculture, Forest Service.
- U.S. Department of Commerce, 1985: 1982 Census of manufactures. Industry Series MC82-I-24C, Washington, DC, U.S. Department of Commerce, Bureau of the Census.
- U.S. Department of Commerce, 1989: 1987 Census of manufactures. Industry Series Preliminary Reports MC87-I-24A(P) through MC87-I-24C(P), Washington, DC, U.S. Department of Commerce, Bureau of the Census.

Table 1.--Economic indicators for primary timber processing in the United States, 1972-87^a

Year	Manufacturing establishment				Value of products (x10 ⁶ US\$)		Ratio of value-added to shipment value
	Total number	Number with ≥ 20 employees	Number of employees (x10 ³)	Payroll (x10 ⁶ US\$)	Value added	Value of shipments	
TIMBER HARVESTING							
1987	11,721	818	87.0	1,548.6	4,163.4	11,064.9	0.38
1986	--	--	72.3	1,285.7	2,965.5	8,444.2	0.35
1985	--	--	76.3	1,248.7	2,918.8	8,445.0	0.35
1984	--	--	84.7	1,338.8	2,888.1	8,831.4	0.33
1983	--	--	83.5	1,313.0	2,785.7	8,746.0	0.32
1982	11,658	657	80.8	1,220.6	2,528.2	8,361.1	0.30
1981	--	--	85.8	1,242.5	2,698.9	8,405.5	0.32
1980	--	--	96.5	1,399.2	3,553.1	9,541.3	0.37
1979	--	--	90.4	1,490.2	4,105.2	9,881.9	0.42
1978	--	--	87.2	1,654.9	3,868.7	10,165.5	0.38
1977	15,469	708	83.3	1,604.3	3,845.8	9,905.9	0.39
1976	--	--	71.5	1,361.7	3,709.3	7,614.8	0.49
1975	--	--	67.2	1,199.0	3,092.8	6,837.2	0.45
1974	--	--	75.5	1,345.3	3,657.8	7,431.7	0.49
1973	--	--	85.9	1,443.7	3,850.8	7,982.3	0.48
1972	13,238	696	80.0	1,434.7	3,185.9	6,926.8	0.46
LUMBER MANUFACTURING							
1987	7,508	2,446	203.1	3,637.4	8,258.1	20,633.3	0.40
1986	--	--	187.0	3,287.6	7,082.5	18,075.6	0.39
1985	--	--	180.2	3,002.0	5,762.1	15,416.8	0.37
1984	--	--	185.8	2,951.0	5,839.5	15,481.3	0.38
1983	--	--	183.5	2,883.3	5,659.1	15,057.5	0.38
1982	8,107	2,099	170.0	2,536.4	4,151.0	12,207.2	0.34
1981	--	--	203.6	2,891.5	5,209.5	14,410.0	0.36
1980	--	--	223.2	3,204.8	6,285.1	16,602.0	0.38
1979	--	--	240.9	3,780.0	8,766.6	21,039.6	0.42
1978	--	--	228.3	3,782.1	9,046.7	21,318.8	0.42
1977	9,656	2,498	225.1	3,632.5	8,109.5	19,531.7	0.42
1976	--	--	219.7	3,365.5	7,317.3	16,860.3	0.43
1975	--	--	205.1	2,958.6	5,519.3	13,483.6	0.41
1974	--	--	233.3	3,362.0	7,275.0	16,125.2	0.45
1973	--	--	226.6	3,813.5	9,613.0	20,390.6	0.47
1972	10,129	2,363	217.1	3,904.6	8,468.4	18,950.2	0.45

Table 1.--Economic indicators for primary timber processing in the United States, 1972-87^a--ton.

Year	Manufacturing establishment				Value of products (x10 ⁶ US\$)		Ratio of value-added to shipment value
	Total number	Number with \geq 20 employees	Number of employees (x10 ³)	Payroll (x10 ⁶ US\$)	Value added	Value of shipments	
PLYWOOD AND VENEER MANUFACTURING							
1987	540	402	58.8	1,097.3	2,401.0	6,249.7	0.38
1986	--	--	52.9	1,010.0	2,134.9	5,528.9	0.39
1985	--	--	53.0	959.4	1,833.4	5,015.7	0.37
1984	--	--	55.8	973.6	1,697.7	5,062.8	0.34
1983	--	--	57.4	959.9	1,720.0	5,093.5	0.34
1982	556	412	52.7	834.7	1,179.6	4,169.3	0.28
1981	--	--	62.1	949.7	1,454.3	4,962.6	0.29
1980	--	--	65.5	1,021.6	1,723.5	5,470.7	0.32
1979	--	--	71.8	1,246.5	2,360.5	7,055.6	0.33
1978	--	--	70.2	1,316.1	3,128.2	8,017.0	0.39
1977	577	451	68.5	1,264.5	2,993.6	7,587.5	0.39
1976	--	--	66.9	1,144.5	2,601.1	6,586.9	0.39
1975	--	--	61.7	1,000.8	1,871.8	5,173.4	0.36
1974	--	--	68.2	1,108.8	2,072.0	5,650.0	0.37
1973	--	--	70.5	1,331.1	3,149.7	7,247.0	0.43
1972	598	479	68.8	1,413.2	3,170.8	7,263.3	0.44
COMPOSITE WOOD PANELS MANUFACTURING							
1987	253	157	22.1	513.8	1,395.1	2,919.3	0.48
1986	--	--	--	--	--	--	--
1985	--	--	--	--	--	--	--
1984	--	--	--	--	--	--	--
1983	--	--	--	--	--	--	--
Particleboard Only							
1982	54	50	5.6	105.6	195.3	553.1	0.35
1981	--	--	5.1	90.5	217.3	552.1	0.39
1980	--	--	5.4	96.9	245.5	583.7	0.42
1979	--	--	6.0	111.8	334.0	706.0	0.47
1978	--	--	6.7	135.0	493.1	938.2	0.53
1977	63	51	6.2	127.0	332.7	727.2	0.46
1976	--	--	5.6	105.7	211.8	540.1	0.39
1975	--	--	5.5	96.6	156.9	461.5	0.34
1974	--	--	7.5	127.5	315.7	684.8	0.46
1973	--	--	7.6	151.4	479.0	861.7	0.56
1972	68	64	7.7	161.0	355.3	726.2	0.49

Table 1.--Economic indicators for primary timber processing in the United States, 1972-87^a

Year	Manufacturing establishment			Value of products (x10 ⁶ US\$)		Ratio of value-added to shipment value	
	Total number	Number with \geq 20 employees	Number of employees (x10 ³)	Payroll (x10 ⁶ US\$)	Value added		Value of shipments
TREATED WOOD PRODUCTS MANUFACTURING							
1987	526	199	11.5	201.1	533.1	2,106.8	0.25
1986	--	--	11.1	184.5	513.7	1,807.7	0.28
1985	--	--	11.1	182.0	520.3	1,665.5	0.31
1984	--	--	10.7	169.0	487.5	1,600.3	0.30
1983	--	--	10.2	156.9	336.9	1,389.1	0.24
1982	524	184	10.9	162.7	391.7	1,388.5	0.28
1981	--	--	12.3	180.0	435.3	1,440.9	0.30
1980	--	--	13.2	192.3	507.0	1,575.5	0.32
1979	--	--	12.9	197.0	505.3	1,597.1	0.32
1978	--	--	12.9	204.3	554.1	1,676.1	0.33
1977	457	192	12.6	194.3	504.0	1,483.2	0.34
1976	--	--	9.7	155.6	377.1	1,159.8	0.33
1975	--	--	9.3	151.7	395.8	1,122.9	0.35
1974	--	--	10.6	178.2	621.3	1,449.4	0.43
1973	--	--	10.1	171.1	424.3	1,269.6	0.33
1972	399	168	11.3	193.0	455.5	1,232.8	0.37

Source: U.S. Department of Commerce (1985,1989).

(Page 3 of 3)

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