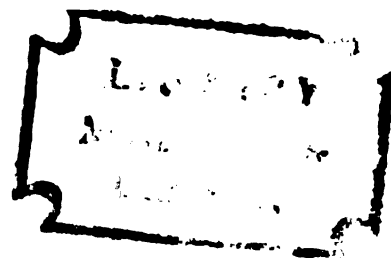


A STUDY OF THE HARDWOOD FACE VENEER AND
PLYWOOD INDUSTRY IN MICHIGAN AND WISCONSIN

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
LEWIS T. HENDRICKS

1967

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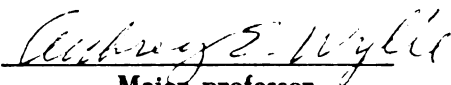
A STUDY OF THE HARDWOOD FACE VENEER
AND PLYWOOD INDUSTRY IN MICHIGAN
AND WISCONSIN

presented by

Lewis T. Hendricks

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Forest Products


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Date April 25, 1967

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ABSTRACT

A STUDY OF THE HARDWOOD FACE VENEER AND PLYWOOD INDUSTRY IN MICHIGAN AND WISCONSIN

by Lewis T. Hendricks

Since the end of World War II, the hardwood veneer and plywood industry in the northern Lake States (primarily northern Wisconsin and Michigan's Upper Peninsula) has undergone some significant changes. For the most part, the raw material resource for these mills has changed from old-growth hardwoods to stands which are predominately second-growth material. In other areas, there have been equally important developments. Employment in regional mills, for example, has either declined or remained static during a period in which domestic hardwood plywood consumption has increased dramatically. Imports have grown to the point where they now account for over 50 percent of the hardwood plywood consumed in the United States each year, and profit margins have become unrealistically low. Thus, it would appear that many new and unquantified variables are influencing the hardwood face veneer and plywood industry of the northern Lake States. The identification of these factors, a study of the interrelationship between them, and the effect they are having on the status of this important regional industry were among the more important objectives of this study.

This study of the hardwood veneer and plywood industry was divided into

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four segments: (1) An analysis of the factors contributing to the closure of mills in Michigan and Wisconsin since 1950, (2) an analysis of the veneer log resource available to the regional mills, (3) a general survey of the hardwood veneer and plywood industry in Michigan and Wisconsin, and (4) an analysis of raw material and production costs for selected regional and foreign mills.

Eight mill closures were found to have occurred over the past 15 years and were equally divided among Michigan and Wisconsin. No single factor, it seemed, was responsible for the closures. The competitive position of each firm appeared to be weakened by several external factors (imports, substitutes, raw materials). When these were combined with a series of inappropriate management decisions, the mill closed. The general decline that has occurred in the veneer log resource during recent years did not appear to be a major factor in any of the closures.

Hardwood face veneer and plywood mills in Michigan and Wisconsin utilize a number of species, with hard maple, birch and red oak being among the more important. Competition between sawmills and veneer mills for the available log resource has intensified in recent years and prices have risen proportionately. Regional resource data indicate that basswood and yellow birch are both in short supply, and that the future availability of red oak and elm are also in question at this time. Overall, it would seem that the industry must adopt a technology that would allow it to economically process logs of both small diameter (11-14 inches) and low quality.

In 1964, there were 24 hardwood face veneer and plywood firms in Wisconsin and 8 in Michigan. Executives interviewed during the course of the study

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cited many problems which they believed confronted the industry today. Among the more important were the low-cost imports entering the country, the decrease in quality of the raw material supply, the export of native log species such as walnut, the continued rise in labor costs, the lack of trained manpower, and the relative absence of a suitable supply of regionally manufactured veneer core stock.

Over 90 percent of the veneer produced by either the veneer or the veneer and plywood mills in Michigan and Wisconsin was the rotary type. Altogether, more than 600 million square feet (surface measure) of commercial-type veneer was produced by these mills in 1964. The investigation showed that 3-ply veneer plywood constituted a large portion of all plywood manufactured within the region and that this material was extensively used in prefinished hardwood plywood panels.

One of the most significant findings of the mill survey was related to the age of veneer and plywood machinery being used by regional manufacturers. Data collected during the study showed that veneer lathes, driers and plywood presses averaged 12 years or more in age. These results would seem to indicate that veneer and plywood manufacturers need to take a close look at their machinery, both in respect to age and capability.

The regional industry produces a multitude of veneer and plywood products, and the markets they serve are equally varied. A large portion of all veneer and plywood manufactured by mills in the survey was made-to-order, with wall paneling, doors and kitchen cabinet stock being among the more important products. Five basic distribution methods were identified as being commonly

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Lewis T. Hendricks

used by these mills: The agent or broker, the parent-firm, company salesmen, the house account and the wholesaler.

Although wall paneling, doors and kitchen cabinet stock comprised a major portion of the product-mix, specialty plywoods are becoming increasingly important. Among other products, curved or molded plywood for chairs, sofas, church pews, and wall paneling fall into this category. It is expected that further emphasis will be given to the production of specialty plywoods in future years.





**A STUDY OF THE HARDWOOD FACE VENEER
AND PLYWOOD INDUSTRY IN MICHIGAN
AND WISCONSIN**

By

Lewis T. Hendricks

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Forest Products

1967

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ACKNOWLEDGMENTS

It is said that knowledge crowns those who seek it. But the mere seeking of this knowledge is not enough; one must have good guidance in doing so.

During the course of this study, several men gave freely of their time and advice. Their efforts are deeply appreciated and deserve special recognition.

Dr. Aubrey Wylie - academic advisor, consulter, and friend, who guided this project to a successful completion at Michigan State University.

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Eugene W. Fobes - Forest Products Technologist and valued friend, whose candid remarks and broad experience gave pragmatism to the study.

The author is also indebted to the North Central Forest Experiment Station for providing the opportunity to complete this work.

A further note of appreciation is extended to my wife, Suzanne, whose encouragement and understanding made the task somewhat easier. Lastly, one cannot forget his parents, who really did make it all possible.

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CHAPTER I

A STATEMENT OF THE PROBLEM AND THE OBJECTIVES OF THE STUDY

The Problem

Since the end of World War II, the hardwood veneer and plywood industry in the northern Lake States (primarily northern Wisconsin and Michigan's Upper Peninsula) has undergone some significant changes. For the most part, the raw material resource for these mills has changed from old-growth hardwoods to stands which are predominately second-growth material. Although a number of mills have ceased operations during the past 20 years in the region, the total number remains essentially the same as that of the immediate post-war period. In many cases, new mills have sprung up to take the place of those closing out operations.

More significant than the number of mills, however, is the economic impact these operations have had on the regional economy of which they are a part. For example, even though the total number of veneer and plywood mills in Michigan remained constant between 1954-1958, the number of employees in this industry decreased by about 75 percent during this period. The value added by manufacture in Michigan in 1958 was only one-fourth of the 1954 level while new capital expenditures in 1958 were less than one-half of the

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1954 figure.¹ This decline in employment and value added by manufacture, and the ensuing loss of income earned through payrolls, has severely upset the economic equilibrium of those regions in which the mills were located. More recent figures show the Michigan industry to be more healthy than in 1958, but still operating at a level below that achieved in 1954. The current status of our regional veneer and plywood industry is a paradox when one considers the great increase that has taken place in the past decade in the domestic consumption of hardwood plywood.

On the national scene, foreign imports of hardwood veneers and plywood have changed considerably over the past two decades. From a total of less than 50 million square feet of hardwood plywood in 1945, these imports have risen to over 1.9 billion square feet in 1964. More significantly, imports have amounted to over 50 percent of the hardwood plywood consumed in the United States in recent years.

Thus, it would appear that many new and unassessed variables are influencing the hardwood face veneer and plywood industry of the northern Lake States. How these factors are interrelated, and how they affect the present and future status of this important regional industry is a subject of much conjecture. Some sources speculate about the suitability or inadequacy (both economic and physical) of the second-growth hardwood resources in the region, while other point at the apparent loss of domestic markets to foreign imports of hardwood

¹U. S. Department of Commerce, Bureau of the Census, "Area Statistics," Census of Manufactures, Volume III, 1954, 1958. (Washington: U. S. Government Printing Office). (Wisconsin figures for 1954 are known to be inaccurate, so no parallel comparison can be made.)

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plywood. Another conjecture, it appears, is that the domestic mills have failed to remain competitive because they lack efficiency in their operations. Whatever the causes of the situation--whether it be resource, import and/or production oriented--little is known about the manner in which these factors tend to influence this vital industry.

Study Objectives

Stated briefly, the study objectives include the following:

1. To ascertain the adequacy (both qualitatively and quantitatively) of the forest resource as it relates to sustaining and/or enlarging the hardwood veneer and plywood industry in the northern Lake States region.
2. To determine the reasons for the mill closures that have taken place in the study region during the past 15 years.
3. To determine and evaluate specific characteristics of the existing hardwood veneer and plywood industry within the study region, including type of product produced, origin of raw materials used, capacity, technological efficiency, management structures, and marketing patterns.
4. To obtain and compare detailed production cost data (raw material and manufacturing costs) on a selected number of Lake States veneer and plywood mills. In addition, production cost data of certain foreign plants will be obtained for comparative purposes.
5. To combine and interpret all research data collected during the course of the study so as to provide a comprehensive analysis of the present and probable future economic status of the hardwood veneer and plywood industry in the northern Lake States region.

CHAPTER II

LITERATURE

A Summary of the National Hardwood Plywood Industry

There are two major factors which are generally believed to have a controlling effect upon the national hardwood plywood industry. These factors include: (1) an increasing scarcity of quality wood as raw material; and (2) an increasing amount of hardwood plywood being imported into this country. Imports have increased from about 67 million square feet surface measure in 1951 to over 1.4 billion square feet in 1962.¹ For 1962, total imports exceeded domestic production and amounted to 54 percent of the hardwood plywood consumed in the United States in that year. The situation for domestic producers worsened slightly in 1965 when imports accounted for 55 percent of the total domestic consumption.

With the depletion of much of this country's virgin timber, the hardwood plywood industry has had to face the problem of an increasing scarcity of quality wood as raw material. Log diameters and log quality have both decreased to the point where many of the better No. 2 lumber logs are being used for veneer

¹U. S. Department of Commerce, Business and Defense Services Administration, Hardwood Plywood (Washington: Business and Defense Services Administration, Forest Products Division, 1963), p. 2.

and the average diameter seldom reaches above the 16-20 inch range. Production costs have risen sharply in the past decade for the industry, but competition from low priced imports has prevented increases in prices necessary to compensate for rising costs. Consequently, the ratio of net profit before taxes to net sales for hardwood plywood operations has dropped sharply from 7.8 percent in 1955 to about 2.4 percent in 1958.¹ Since the basic conditions that brought about this decline are still present, it is likely that the ratio of net profit to net sales is at the same level today (or lower) as that found in 1958.

Imports and the Controversy Surrounding Them

In addition to raw material resource problems, foreign imports appear to be causing a great deal of concern on the part of our domestic manufacturers. Over the past 35 years, tariffs on imported hardwood plywood have decreased considerably. The last major changes occurred in 1951 when the tariff rate (percent ad valorem) was either halved or nearly halved on most species of imported plywood. Under the General Agreement on Tariffs and Trade (Torquay) effective June, 1951, the tariff rate on birch was set at 15 percent, and that on most other hardwoods at 20 percent.² Significantly, it was in 1952 that imported hardwood plywood began accounting for an increasing percentage of

¹U. S. Tariff Commission, Hardwood Plywood: Report on Escape-Clause Investigation No. 77 Under Section 7 of the Trade Agreements Extension Act of 1951, as Amended (Washington: U. S. Tariff Commission, 1959), p. 42.

²U. S. Tariff Commission, The Production Importation and Marketing of Hardwood Plywood in the United States (Washington: U. S. Tariff Commission, 1955), p. 11.

domestic consumption. By way of comparison, imports represented about 8 percent of the total U. S. consumption of hardwood plywood in 1951 and about 55 percent in 1964.¹ On this basis, then, one might speculate that up until 1951 or 1952, domestic hardwood plywood was competitive with imports chiefly because of the tariff on imported hardwood plywood.

More recent developments related to hardwood plywood tariffs include a proposal to reduce the current tariff levels by 50 percent.² If such proposals are enacted, they would undoubtedly have a profound effect on the domestic industry. In the past, reductions in hardwood plywood tariffs have been accompanied by substantial increases in the flow of imported hardwood plywood into the United States. For each of the last several years, imports have exceeded domestic production of hardwood plywood (Table 1).

The United States imports plywood from several countries, but in past years, Japan has supplied over 3 times that of any other foreign country. Japanese exports of plywood to the U. S. in 1957 amounted to 41 percent of our domestic consumption. In 1962, this figure had shrunk to 30 percent, but overall imports (as a percentage of domestic consumption) remained fairly constant.³

It has largely been a matter of speculation whether or not the growth

¹Clark E. McDonald, "Hardwood Plywood: 1.5 MM," Forest Industries, LXXXXII (January, 1965), p. 46.

²Proposed at the Kennedy Tariff Round, Geneva, Switzerland.

³Figures reported by the Hardwood Plywood Manufacturers' Association and based on U. S. Bureau of Census data.

**TABLE 1.--U. S. market shipments, imports, exports, and consumption of
of hardwood plywood, 1951-1964
(In thousands of square feet, surface measure)**

Year	U. S. market shipments	Imports	Exports	Apparent U. S. consumption	Ratio of imports to U. S. consumption
					<u>Percent</u>
1950	752,908 (E)	57,835	365	810,378 (E)	7
1951	805,249 (E)	66,761	553	871,457 (E)	8
1952	794,857 (E)	84,931	260	879,528 (E)	10
1953	819,107	218,862	463	1,037,506	21
1954	755,464	426,064	431	1,181,097	36
1955	933,948	617,936	325	1,551,559	40
1956	886,640	695,515	496	1,581,659	44
1957	791,431	840,962	393	1,632,000	52
1958	803,572	907,165	1,129	1,709,608	53
1959	976,717	1,318,035	1,951	2,292,801	57
1960	944,028	1,014,853	1,845	1,957,036	52
1961	1,088,561	1,097,445	1,556	2,184,450	50
1962	1,230,502	1,438,964	2,707	2,666,759	54
1963	1,414,260	1,620,158	3,640	3,030,778	53
1964	1,598,007	1,946,697	3,156	3,541,548	55

(E) - Estimated

Source: Compiled from reports of the U. S. Bureau of Census and the
U. S. Tariff Commission.

in hardwood plywood imports has occurred at the expense of domestic manufacturers. The United States Tariff Commission, in a split decision, concluded in its report No. 77 on the Escape-Clause Investigation that hardwood plywood imported during the past decade has been supplemental to a significant extent to the domestic supply. The Commission also concluded that the great expansion in consumption of hardwood plywood in the production of flush doors would not have been possible if producers had been dependent entirely on domestic plywood. Door skins and wall panels, constructed chiefly of Philippine Mahogany (lauan), have constituted a substantial proportion of the hardwood plywood shipped to the United States in recent years.¹ One of the attractive features of lauan plywood has been its low cost relative to domestically produced hardwood plywood.

Domestic manufacturers have long argued that imports have succeeded in replacing many of their traditional markets, largely because of their price advantage over domestically produced plywood. The low cost of imported plywood, especially lauan, is thought to be due to the low cost of labor in producing it. Moreover, there appears to be considerable substitutability among the several species of hardwood plywood. Apparently, the Tariff Commission felt that lauan plywood was serving a market that domestic manufacturers could not enter without operating at a deficit. Thus, they felt that a curtailment of imports would by no means result automatically in an increased demand for domestic plywood.²

¹U. S. Tariff Commission, Hardwood Plywood: Report on Escape-Clause Investigation No. 77..., 1959, p. 18.

²Ibid, p. 34, for a more complete study on this point.

Consumption of Veneer Logs and Veneer

For a number of years, the Bureau of Census has compiled statistics on hardwood plywood production and shipments in the United States, but 1965 marks the first time producers have been requested to report consumption of logs and veneer (Table 2).

TABLE 2. --Consumption of logs and purchased veneer in the manufacture of hardwood plywood--1965

Logs consumed	Quantity	
	(1,000 bd. ft., log scale)	
Hardwood Logs:		
Domestic		245,559
Imported		16,937
Softwood Logs:		89,803
Total, Logs Consumed		352,299
Purchased veneer ^a	Quantity	
	1,000 sq. ft., surface measure	1,000 sq. ft., 1/4" basis
Hardwood Veneer:		
Domestic	3,023,932	643,737
Imported	1,297,877	356,303
Total, Hardwood Veneer	4,321,809	1,000,040
	(1,000 sq. ft., 1" basis)	
Total, Softwood Veneer		165,068

Source: Hardwood Plywood. Current Industrial Reports, U. S. Department of Commerce, Bureau of the Census. Series M24F(65)-1. January 6, 1967.

^aIncludes veneer transferred from other plants of the consuming company as well as veneer purchased from plants not affiliated with the consuming company.

• Note that roughly one-third of the hardwood veneer consumed in the U. S. in 1965 was imported (Table 2). This is somewhat less than the import-consumption ratio for hardwood plywood in recent years (Table 1). Softwood veneer has been included in the data because of its increased use and importance as a core material in the construction of many types of hardwood plywood.

Veneer and Plywood Uses

In a survey conducted by the Hardwood Plywood Manufacturers' Association, plywood manufactured in 1964 by mills throughout the nation fell into these major categories:

	<u>Percentage</u>
1. Wall paneling	
a. Prefinished	49
b. Unfinished	17
2. Cut-to-size	23
3. Mobile home	05
4. Container grade	02
5. Block flooring	03
6. Miscellaneous	<u>01</u>
	100%

Door skins, it appears, have not been included in the breakdown. Nearly 700 million square feet, surface measure, of domestically produced plywood was used in door manufacture in 1964. United States market shipments of hardwood plywood, excluding the door material, reached nearly 1.6 billion square feet in

the same year (Table 1). Although the exact use-patterns for imported hardwood plywood are not known, it is generally believed wall paneling and door material are among the most important.

The Hardwood Veneer and Plywood Industry of Michigan
and Wisconsin

Veneer Log Production and Consumption

A survey¹ completed in 1959 by the Lake States Forest Experiment Station* showed that veneer log production in the Lake States amounted to approximately 53 million board feet in 1958. This cut was about one-third less than in 1956 and was the smallest recorded since the mid-thirties. This declining veneer log production may have been partially due to mill closures in the Lake States region. According to the survey, 15 of the 90 mills in the region had closed down operations since the mid-fifties. However, only 3 of these 15 mills produced commercial, utility, and special type veneer. The other 12 were container veneer plants. Overall, the survey concluded that the mill closures, as well as the lower production of the active plants, appeared to be caused mainly by uncertain business conditions, stiff competition from other areas and products, and a short supply of quality timber.

Total production of hardwood veneer logs has remained fairly stable in Wisconsin in recent years (Table 3) while Michigan production has fallen off

¹A. G. Horn, Veneer Log Production Declines Sharply in Lake States as a Result of Mill Closures, 1958, Lake States Forest Experiment Station Technical No. 567 (St. Paul: U. S. Forest Service, 1959), p. 1.

*Currently the North Central Forest Experiment Station.

TABLE 3. --Veneer log production and consumption in Michigan
and Wisconsin for selected years
(thousand board feet - International 1/4-inch log rule)

Species	Michigan						Wisconsin									
	Production			Consumption			Production			Consumption						
	1958	1960	1963	1965	1958	1960	1963	1965	1958	1960	1963	1965				
Maple	5,346	6,199	4,800	7,818	3,040	2,955	1,212	3,937	6,188	6,401	7,050	6,219	8,998	12,837	12,412	11,128
Birch	8,839	8,228	5,050	8,427	4,589	5,719	4,554	4,487	2,968	3,876	3,220	2,466	12,562	12,978	8,998	9,779
Elm	1,885	1,061	1,410	966	1,832	1,085	763	915	5,272	2,564	2,990	3,991	7,189	4,984	4,137	5,308
Basswood	1,096	1,145	860	1,301	876	924	352	1,015	3,137	3,056	3,210	2,634	5,203	5,494	5,066	4,599
Oak	345	471	662	530	80	484	91	259	3,894	5,953	7,207	7,324	4,918	7,933	9,230	9,041
Other ^a	2,447	1,382	2,518	3,325	2,180	908	626	1,815	2,281	3,617	1,526	1,771	4,193	7,072	2,075	3,249
Total	19,958	18,486	15,300	22,367	12,597	12,075	7,598	12,428	23,740	25,467	25,203	24,405	43,063	51,298	41,918	43,104

Source: Compiled from North Central Forest Experiment Station data presented in numerous Research and Technical notes for the years indicated.

^a"Other" includes ash, aspen, beech, walnut, cottonwood, and small amounts of other species.

slightly. Wisconsin is a net importer of veneer logs while Michigan is a net exporter. About half of Michigan's export of veneer logs is shipped to Wisconsin mills with the remainder going to mills outside the Lake States region, primarily to Indiana. Even with this quantity of exports, however, mills operating in Michigan have annually imported as much as 3 1/2 million board feet of veneer logs from Canada and other nearby states.¹

At one time (1952) veneer log production in Michigan totaled over 40 million board feet annually. The 15.3 million board feet produced in 1963 represents a sizeable reduction in comparison to the 1952 figures. Wisconsin, too, has experienced a similar decline in veneer log production. The reasons leading to the relative static or declining condition of the regional veneer and plywood industry are speculative at this time. Perhaps the raw material supply has decreased over the years, thus making less logs available to the mills. There is also the possibility that there has been a decline in the quantity of logs demanded by regional mills, either due to closures or a change in business conditions. Undoubtedly, the influx of low-cost imports has caused a change in the marketing structure and product lines of the regional mills. It is not known whether these changes have resulted in lower demands for logs or whether some other combination of factors, such as increasing raw material costs and production inefficiencies, has led to the present situation.

¹V. E. Findell et al., Michigan's Forest Resources, Lake States Forest Experiment Station Paper No. 82 (St. Paul: U. S. Forest Service, 1960), p. 21.

Additional Considerations

With few exceptions, Michigan's hardwood veneer and plywood industry is very similar to the National industry. In 1961, the average annual wage in Michigan for a worker in the hardwood plywood and veneer industry was \$4,598.¹ By 1963, this figure had risen to \$4,705.² The 1961 average for the industry (covering 30 states, 390 plants, and 34,592 employees) was \$3,495. The difference between the Michigan annual wage and the National average reflects, to a certain degree, the industrialized base of Michigan's economy.

Veneer thicknesses produced depend on end-use requirements. For the most part, hardwood face veneers are 1/28 inches thick, but some woods are cut to thicknesses of 1/20, 1/24, and 1/36 inches. Principal species used include birch, maple, oak, elm, basswood, walnut, cherry, beech, and ash. Estimated veneer production for plants in Michigan during 1964 was about 100-110 million square feet surface measure, with nearly 60 million square feet of this amount being produced by a mill located in the Upper Peninsula.

In 1961, the average annual wage in Wisconsin for a worker in the hardwood plywood and veneer industry was \$3,827. The total annual payroll for all workers employed in this Wisconsin industry during 1961 totalled nearly \$14,000,000.³

¹Statistics provided by the Hardwood Plywood Manufacturers' Association, Arlington, Virginia.

²Ibid.

³Ibid.

By 1963, the average annual wage had risen to \$4,050, but the total annual payroll for the Wisconsin industry had dipped to approximately \$11,000,000. Census of Manufactures statistics show that there were 27 veneer and plywood mills located in Wisconsin in 1958 with 22 having 20 or more employees. Figures for 1963 show a slightly smaller number.¹ Estimated veneer and plywood production for 1964 totalled 500-525 million square feet (surface measure) and 225-250 million square feet, respectively. Prior to the initiation of this study, no information was available concerning the amounts and types of plywood manufactured although it was known that at least 5 mills had equipment for making prefinished hardwood plywood.

The latest (1963) Census of Manufactures statistics for the veneer and plywood industry of Michigan and Wisconsin are compared to the 1954 and 1958 figures in Table 4. According to these data, Wisconsin had 10 veneer and plywood mills in 1954 and 17 more, or 27, in 1958. In contrast, data collected by the Lake States Forest Experiment Station² show that there were 21 standard veneer mills³ in operation in 1954. Another 3 or 4 mills manufacturing plywood only were not included in this figure. Experiment Station data for 1958 show 25

¹U. S. Department of Commerce, Bureau of the Census, "Area Statistics," Census of Manufactures, Volume II, 1963 (Washington: U. S. Government Printing Office).

²Robert G. Knutson, Veneer Log Production in the Lake States Continues General Decline, 1963, Lake States Forest Experiment Station Research Note LS-54 (St. Paul: U. S. Forest Service, 1964), p. 1.

³This figure does not include mills which manufactured plywood only. The data also applies only to standard type veneer mills as opposed to container veneer mills.

TABLE 4. --Census of manufactures statistics for the veneer and plywood industry of Michigan and Wisconsin for 1954, 1958, and 1963

Veneer and plywood industry by state and year	Establishments number		All employees		Production workers		Value added by manufacture, adjusted (\$1,000)	Value of shipments (\$1,000)	Capital expenditures new (\$1,000)
	Total	With 20 or more employees	Number	Payroll (\$1,000)	Number	Man- hours (1,000)	Wages (\$1,000)		
Wisconsin 1954	10	10	1,923	6,091	1,727	3,704	5,017	20,857	326
Wisconsin 1958	27	22	3,713	12,439	3,183	6,435	9,629	42,226	504
Wisconsin 1963	21	19	2,656	10,758	2,386	5,350	9,018	40,500	1,403
Michigan 1954	6	4	861	3,080	695	1,445	2,258	9,938 ^a	91
Michigan 1958	7	3	227	873	191	353	689	3,053 ^a	40
Michigan 1963	11	6	546	2,569	461	1,001	1,886	10,324	500 ^b

Source: U. S. Department of Commerce, Bureau of the Census, "Area Statistics," Census of Manufactures, Volume III (Washington: U. S. Government Printing Office, 1954, 1958, 1963).

^aThis large difference between 1954 and 1958 is probably due to the closure of 4 mills in Michigan within this period.

^bThis figure represents a Census of Manufactures classification and should not be construed to mean actual capital expenditures were anywhere near the amount indicated.

veneer and/or plywood mills in operation rather than the 27 reported for Wisconsin in the Census of Manufactures bulletin for that year. Assuming that the Experiment Station data are a more accurate measure of the number of mills in Wisconsin for the years cited, the veneer and plywood industry in that state has remained more static than the Census of Manufactures data would lead one to believe.

Another interesting facet of the data presented in Table 4 is the apparent decline of the Michigan veneer and plywood industry between 1954 and 1958. At least part of this decline in Michigan was due to the closure of several veneer and plywood mills owned by the Atlas Plywood Corporation. The reasons behind these closures appear to be a matter of conjecture. However, the fact remains that these closures were economic hardships to those areas affected. Apparently, the Michigan industry has improved considerably since 1958 even though the majority of the 1963 figures are still less than the 1954 data.

CHAPTER III

HARDWOOD FACE VENEER AND PLYWOOD MILL CLOSURES IN MICHIGAN AND WISCONSIN SINCE 1950

Methodology

A listing of hardwood face veneer and plywood mill closures occurring in Michigan and Wisconsin since 1950 was formulated with the aid of data supplied by the North Central Forest Experiment Station.* The mill closure study was initially designed to investigate a total of five firms, but since only eight closures were found to have occurred over a period of 15 years, the experimental procedure (and subsequent survey) was altered to include the total population. These mills were equally divided among Michigan and Wisconsin.

One or two former officials associated with each of these firms were interviewed to learn the chief reasons behind these closures. A second interview served as a means of confirming opinions secured from the first interviewee. How available raw material resources affected the closures was a primary point discussed. Information pertaining to markets, products manufactured, affiliations with larger companies and reasons for closure was solicited. In addition, historical data on each company were recorded, including information

*Maintained by the Forest Service, U. S. Department of Agriculture at St. Paul, Minnesota, in cooperation with the University of Minnesota.

regarding disposal of plant equipment and resettling of employees after the mill closed. A sample questionnaire used in the closure study has been included in the appendix.

Historical Background

In recent years there has been a great deal of concern about the closure of numerous hardwood face veneer and plywood mills in Michigan and Wisconsin. As part of an overall study of that industry in the northern Lake States region, the basic reasons leading to the closure of these mills were investigated. In the past 15 years, there have been eight known mill closures¹ within the study area with an estimated total employment loss of 1,600 people. Presumably, each of these closures affected the economic equilibrium of the geographic areas in which they were located.

The products made by these firms did not fall into any special category, although each mill was primarily a hardwood plywood producer. Some produced a mixed line of door and wall paneling, whereas others manufactured cabinet and lumber core plywood. In one case, the product-mix included the fabrication of plywood boxes for certain specialty items. The products of these eight mills were marketed in a number of geographical areas, and some were even sent abroad for foreign consumption.

¹The number of closures was equally divided among Michigan and Wisconsin. The total number of hardwood face veneer and plywood mills in the region has varied little in the past 15 years, with the total population remaining at approximately 30 to 32 mills. This relatively narrow range is largely due to either the creation of totally new operations or reactivation of closed mills under new management.

All of the mills closed their operations within 10 years of one another; that is, between the years of 1953 and 1962. Four were owned by the same company and ended production within 4 years of one another. These four mills were part of a large-scale closure operation conducted by the parent company throughout the nation. Three of the other mills were independently owned by one or two individuals or by local stockholders. A fourth was absorbed by a large national firm and closed shortly thereafter. There appeared to be no correlation between the size of the firm (in terms of the number of employees) and closure inasmuch as some mills employed as few as 30 and others as many as 300 people.

Primary Problems of the Region's Mills

The interviews, plus study of data and literature on the industry, disclosed several problems that are of primary importance to mills in the region. These problems are discussed below, while specific reasons for each mill's closure are offered in the next section.

Raw Material Supplies

A study of the veneer log resource showed that there was a declining trend in the quality of the raw material supply available to regional mills.¹ As the quality becomes poorer, the mill manager is faced with numerous alternatives. He may find that veneers needed for various markets and operations can be obtained only by more intensively managing his manufacturing operations. Unit costs normally increase when such action is taken. On the other hand, the

¹For more information on this subject, see Chapter IV.

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mill operator can utilize the material from the poorer logs and expect his final products to be altered accordingly, but they must still be marketable.

The quantity of veneer logs available is also an important consideration. As this raw material supply dwindles, mills either seek new sources of logs or enter into stiff competition with one another for the available log supply. In either case, the result is higher unit costs.

Data on veneer log production and consumption in Michigan and Wisconsin show sharp declines in the 11-year period, 1952-1963 (Tables 5 and 6). At least part of this declining veneer log production may have been due to mill closures within the Lake States region, but even after the bulk of the closures had taken place (up through 1958) a decline was still evident. To further complicate matters, the downward trend in the region has occurred in a time when domestic consumption of hardwood veneer and plywood products has greatly expanded.

Competition from Imports and Substitute Materials

In 1951, a reduction in the tariff on imported hardwood plywood (Table 7) apparently resulted in an increased flow of low-cost foreign hardwood plywood into the United States, mostly in the form of wall panels, door material, and kitchen cabinet stock. Tariff rates for birch and "other" hardwood plywood were either halved or nearly halved between 1945 and 1951. Significantly, imported hardwood plywood began accounting for an increasing percentage of domestic consumption in 1952. By way of comparison, imports represented about 8 percent of the total U. S. consumption of hardwood plywood in 1951

and about 54 percent in 1964.¹

TABLE 5. --Annual veneer log production in Michigan and Wisconsin for selected years

Year	Veneer log production Thousand board feet, <u>Intl. 1/4" scale</u>		
	<u>Wisconsin</u>	<u>Michigan</u>	<u>Total</u>
1952	29,956	40,219	70,175
1954	27,109	34,499	61,608
1956	30,403	39,655	70,058
1958	23,740	19,958	43,698
1960	25,467	18,486	43,953
1963	25,203	15,300	40,503
1965	24,405	22,367	46,772

Source: Compiled from North Central Forest Experiment Station data presented in numerous Research and Technical notes for the years indicated.

In addition to the imports, the markets of hardwood veneer and plywood have been threatened by many types of substitute products. Steel, plastics, aluminum, and composition materials have captured many traditional wood markets. Their effect has been felt at one time or another by nearly every hardwood veneer and/or plywood manufacturer in the region.

¹Clark E. McDonald, "Hardwood Plywood: 1.5 MM," Forest Industries, LXXXXII (January, 1965), p. 46.

TABLE 6. --Annual veneer log consumption in Michigan and Wisconsin for selected years

Year	Veneer log consumption Thousand board feet, Intl. 1/4" scale		
	<u>Wisconsin</u>	<u>Michigan</u>	<u>Total</u>
1952	60,629	28,338	88,967
1954	59,572	21,872	81,444
1956	53,234	10,838	64,072
1958	43,063	12,597	55,660
1960	51,298	12,075	63,373
1963	41,918	7,598	49,516
1965	43,104	12,428	55,532

Source: Compiled from North Central Forest Experiment Station data presented in numerous Research and Technical notes for the years indicated.

Corporate Management Decisions and Policies

When profit margins diminish, corporate management decisions and policies take on added meaning. Most of the factors associated with mill closures mentioned thus far may be termed as "external to the firm." Corporate management decisions and policies, on the other hand, represent something entirely different. As the quality and quantity of the raw material resource decline, the mill manager and his associates must decide what action should be taken. When the company's product line falters, changes must be made. Undoubtedly, some corporations are better managed than others, and

TABLE 7. --Hardwood plywood: United States rates of duty under the Tariff Act of 1930, in specified years 1930 to 1955
(Percent ad valorem)

Item	<u>Tariff Rate</u>		
	<u>In 1930</u>	<u>On Jan. 1, 1945</u>	<u>In 1955</u>
Birch	50	25 ^a	15 ^b
Alder	50	50	25 ^c
Spanish Cedar	40	40	40
Other	50	40	20 ^b

Source: U. S. Tariff Commission. The Production, Importation and Marketing of Hardwood Plywood in the United States (Washington: U. S. Tariff Commission, 1955), p. 11.

^aTrade Agreement with Finland, effective November, 1936. Agreement terminated May 24, 1950, after Finland acceded to the General Agreement on Tariffs and Trade, pursuant to Annecy negotiations.

^bGeneral Agreement on Tariffs and Trade (Torquay), effective June, 1951.

^cGeneral Agreement on Tariffs and Trade (Annecy), effective April, 1950.

the degree to which they are effectively managed is of utmost importance. Of all the factors mentioned in regard to closure, management decisions and policies are perhaps the most important and yet, least subject to quantification.

Reasons for Each Mill Closure

In this investigator's opinion, no single factor was responsible for the closure of regional mills. The competitive position of each firm appeared to

be weakened by several external factors (imports, substitutes, raw materials). When these were combined with a series of inappropriate management decisions, the mill closed. One might question whether obsolete equipment may have been a factor in some of the closures. The investigation showed that the majority of the firms were either less than 10 years old at the time of closure or had some equipment and buildings renovated in a 5-year period preceding termination of operations. In many cases the equipment in these closed mills was quickly sold to other veneer and plywood manufacturers within the region.

Shortage of Quality Veneer Logs

The general decline in the veneer log resource during recent years did not appear to be a major factor in any of the closures investigated. Four of the firms made no mention of the raw material supply as being a factor in the decision to close down operations. The remaining firms, all part of a nationwide veneer and plywood complex, had access to considerable quantities of company-owned timber within their normal procurement areas. In the process of liquidation, this timber was sold on the market with the parent firm realizing a substantial profit.

Competition from Imports and Substitute Materials

All of the former executives interviewed believe that their firms were affected by competition from imports and substitute materials. An executive of the company that once operated four plywood mills within the region stated his belief that at least two of the mills would be in operation today if it were not

for competition from imports. In addition the plywood box line that these firms manufactured lost markets to domestically produced paper products which performed as substitutes. Another firm experienced competition from "fir" plywood as a construction material in the mobile home industry.

Our entire regional veneer and plywood industry almost certainly has been affected by the influx of imported hardwood plywood. But some mills, with their enlightened and informed management, have met this challenge quite adequately. Others have seen their profit margins diminish, but still remain in business. In the opinion of this investigator, the competition of imports with domestically produced hardwood veneer and plywood was but a contributing factor in the closure of some operations.

Management Oriented Decisions and Policies

In the previous section, mention was made of a situation in which a company official felt that imports were basically responsible for the closure of two mills. Closer examination of the circumstances surrounding these closures, however, proved interesting. The parent company had operated "in the black" for some 25 years, but personnel changes in the top management and the firm's auditors had produced an apparent loss of \$10 million during one year.¹ As it turned out, closure of the four regional mills was but a part of a liquidation policy set up by the new management of the parent company. Whether all four mills were operating at a loss at the time of closure is not known, but at least

¹"The Mess at Atlas Plywood," Fortune, LVII, No. 1 (January, 1958), p. 118.

one was having some difficulty maintaining acceptable quality standards.

In at least two of the other four mills, management decisions and policies appeared to play a major role in their closures. Heavy investment in capital equipment left one company short of funds to meet weekly payrolls and other short-term contractual agreements. In time, the company's financial status and credit rating deteriorated. The other mill faced a somewhat different problem. Apparently, the owner did not realize the extent to which imports were competing with his firm's products. Loss of markets and failure to alter the product-mix soon resulted in mill closure.

Over the past 5 years, mill managers have become increasingly aware of the advantages of sound management practices. They have come to accept the fact that wood raw material supplies and the flow of low-cost imports are, for the most part, factors which they do not control. These mill operators are now examining their production methods and management policies. Hopefully, small changes in these areas can substantially improve the overall profit picture.

CHAPTER IV

THE VENEER LOG RESOURCE AVAILABLE TO HARDWOOD FACE VENEER AND PLYWOOD MILLS IN MICHIGAN AND WISCONSIN

Methodology

The veneer log resource available to regional mills is a subject which might best be described both as problematical and vague. Forest surveys were last completed for Michigan and Wisconsin in 1955 and 1956, respectively. The data collected in these surveys were interpreted by the North Central Forest Experiment Station and 10-year projections of the forest resource were made. Basically, the projections provide a statistical estimate of the quantities and types of trees that may be safely harvested each year without excessive drain on the resource.

At the present time, a new forest inventory is being completed for Michigan while plans for a similar survey have been completed for Wisconsin. It is expected that when these new data become available, several major changes will have occurred since the last surveys in 1955 and 1956. These changes, in turn, may greatly affect the patterns of regional wood-use in future decades. In the absence of new survey data, it becomes necessary to depend quite heavily on the older surveys.

Publications by the North Central Forest Experiment Station (formerly

the Lake States Forest Experiment Station) were used extensively in this study. This organization, along with the Conservation Departments of Michigan and Wisconsin, collected the basic data for the 1955 and 1956 surveys. Unfortunately, little regional resource data make direct reference to veneer log volumes. To overcome this deficiency, certain assumptions were made on the percentages of veneer logs that one would normally find in given volumes and species of sawlogs. These assumptions will be discussed in greater detail in another section.

In order to examine present trends in the regional resource, national and state forest personnel were requested to furnish data on sawlog volumes. Although these state and federal lands account for a very small portion of the total sawlog volume harvested each year, their statistics can provide us with indications of how some individual species are faring on managed lands. As may be expected, the Forest Survey that is carried out by the state and federal agencies is based on a scientific sampling pattern.

Although sawtimber volumes are important indicators of the state of the forest resource, they need to be supplemented with statistics on poletimber trees. These trees are commercial species in which the diameters at breast height (d.b.h.) range from 5.0 to 10.9 inches (hardwoods only) and contain 40 percent usable volume. Including poletimber stands in this study is one way in which we can effectively measure the long-range potential of the forest resource. Substantial volumes of this stand-size class move into the sawtimber class each year. Historically, the hardwood veneer industry has utilized logs in the larger diameter classes, notably those 20 inches and larger. In recent years, the log situation has been such that the average hardwood

veneer log diameter has moved down into the lower sawlog classes and to some extent, into the higher ranges of the poletimber classes for certain species.

The National Hardwood Veneer Log Resource

Consumption

In the past few years hardwood veneer log consumption has risen rapidly, but domestic veneer log production has remained rather static. To be more precise, consumption of hardwood veneer logs, including the log equivalent of the net imports of plywood and veneer, has about doubled in the past decade.¹ In 1963, domestic hardwood veneer log production amounted to 972 million board feet (International 1/4-inch scale). Sweetgum, it is estimated, made up 25 percent of this cut. Yellow poplar contributed about 20 percent and hard maple, combined with yellow birch, added another 15 percent. The Southeastern portion of the United States accounted for nearly 50 percent of all domestic hardwood veneer log production in 1963. The Central and Lake States regions (which includes both Michigan and Wisconsin) produced about 115 million board feet of hardwood veneer logs in 1963. Although this amount represents somewhat less than 12 percent of the national total, these regions were important sources of yellow birch, cherry, hard maple, and walnut veneer logs.

In the future, the Forest Service predicts that hardwood veneer log consumption will gradually increase from a 1962 level of 1.8 billion board feet to

¹Dwight Hair, "Projected Demands for Hardwood Veneer Emphasize Research - Management Needs," Forest Products Journal, XVI (January, 1966), p. 28.

5.9 billion board feet in the year 2000--a rise of over 300 percent.¹ At least part of this projected increase in consumption is based on the expectation that per capita income will double during the period mentioned and as a result, a rising demand for hardwood veneer and plywood in fine furniture, paneling, and other products will occur.

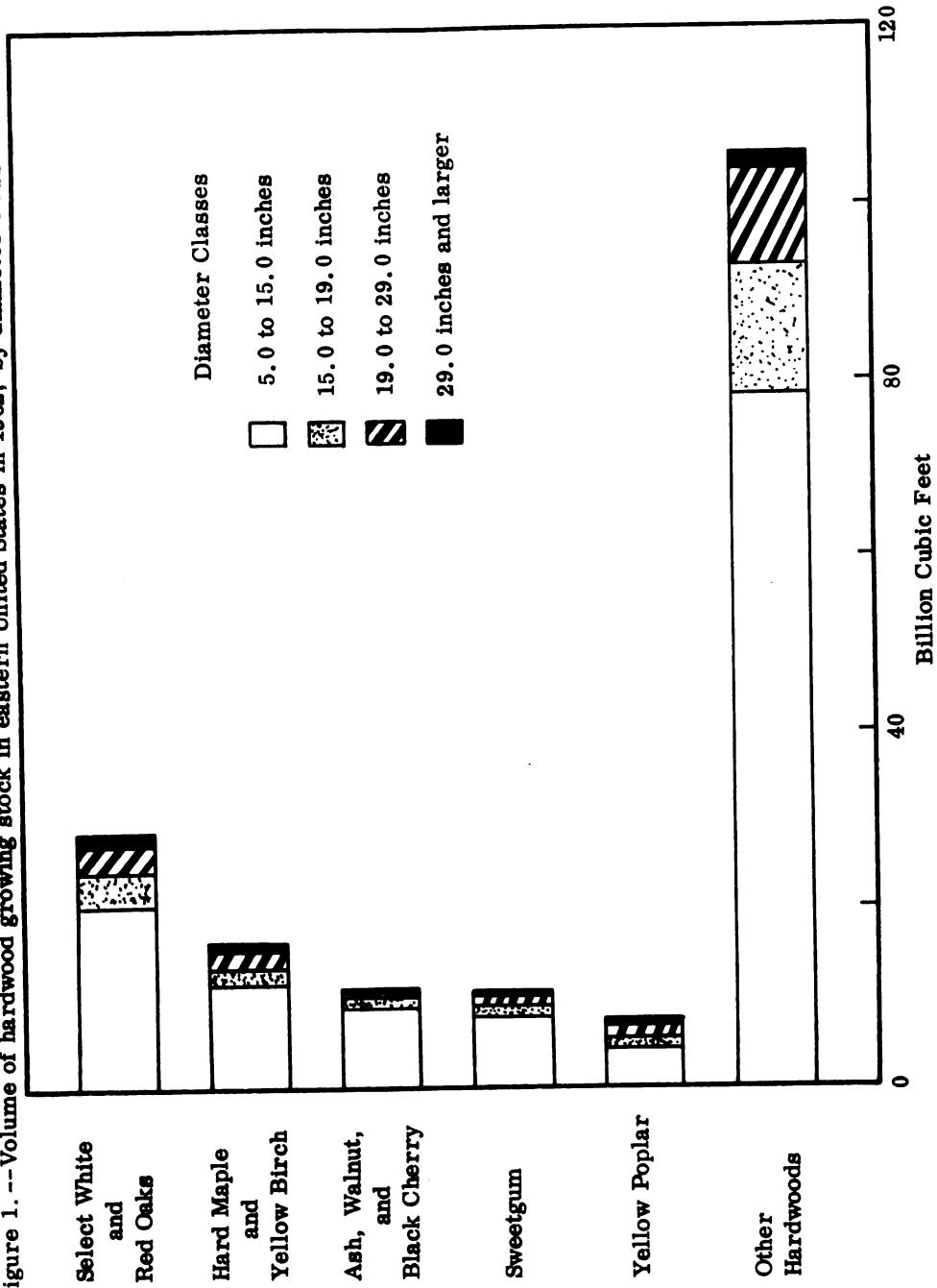
Sawtimber Volume and Quality

The volume of hardwood sawtimber in eastern forests was estimated to be about 430 billion board feet in 1962. Of this amount, about 185 billion board feet of the sawtimber was in the preferred veneer log species. Although these figures represent a considerable volume of timber, not all of it is available for utilization. Some is considered to be inaccessible while other quantities are found on private lands where cutting would be in conflict with certain land uses. It is estimated that roughly 75 percent of all the preferred veneer log species (oaks, maples, birch, ash, walnut, cherry, sweetgum, and yellow poplar) is in the diameter class below 19 inches.² Generally, the larger diameter veneer logs are sought because they are more economical to process, but their availability and quality frequently leaves something to be desired. Consequently, our national veneer industry is utilizing smaller diameter logs each year. This is especially true in the northern regions of our country where the majority of the veneer logs being processed are perhaps less than 17 inches in diameter. In the Lake States, this figure may run as low as 15 inches. Figure 1 illustrates

¹Ibid.

²Ibid. p. 29.

Figure 1. -- Volume of hardwood growing stock in eastern United States in 1962, by diameter class



Source: Dwight Hair, "Projected Demands for Hardwood Veneer Emphasize Research-Management Needs," Forest Products Journal, XVI (January, 1966), p. 29.

the volume of eastern hardwoods, classified by diameters and species, that was included in a survey of growing stock in 1962.

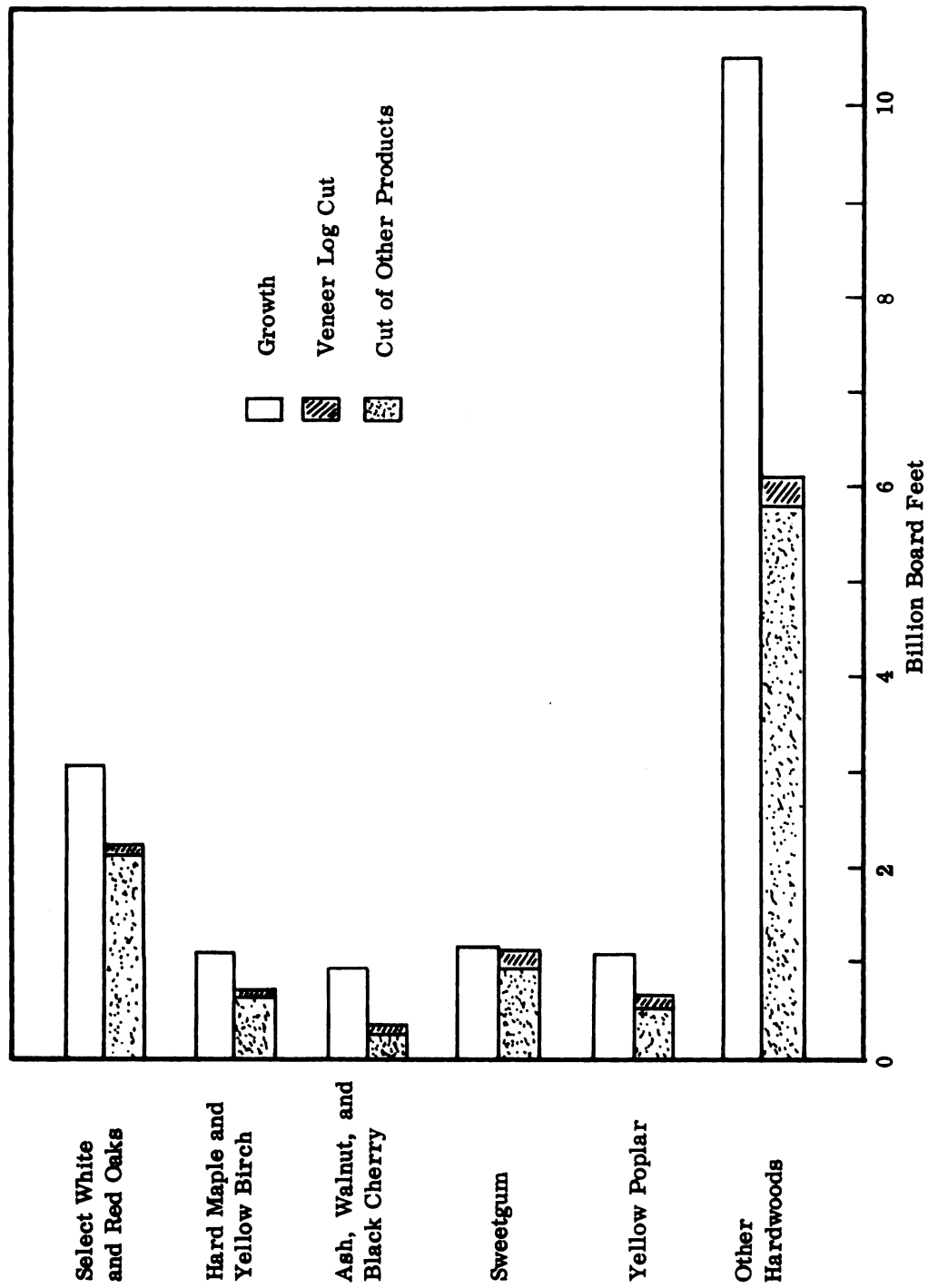
Growth-Cut Balance

For the most part, it is rather meaningless to measure our timber resource only in terms of growing stock or sawtimber volumes. An equally important aspect of this resource is the quantity of timber that is being harvested each year. In 1962, eastern sawtimber growth was somewhat greater than cut for most hardwood species, but a considerable amount of this growth occurred on the smaller diameter trees. In 1962, the total growth of all oaks 5.0 inches and larger was almost double the cut while the growth of oak sawtimber trees (11 inches and up) exceeded the cut by only 40 percent.¹ Unfortunately, nearly three-fifths of all hardwood timber growth in 1962 was concentrated in the less desirable species such as beech and hickory.

Figure 2 presents data on net annual growth and cut of eastern hardwood sawtimber. The veneer log cut has been separated from the growth and "other" products categories. Most of the logs cut in the latter grouping were sawlogs, but substantial volumes were also used for pulp, cooperage, piling, fence posts, charcoal, and fuelwood. Very small quantities of the total sawtimber cut in these eastern hardwoods were classified as veneer logs. It is a general consensus that further declines in tree size and quality will result in the next few decades if timber cut and growth follow the projections and management

¹ibid.

Figure 2. --Net annual growth and cut of hardwood sawtimber in eastern United States in 1962



Source: Dwight Hair, "Projected Demands for Hardwood Veneer Emphasize Research-Management Needs," *Forest Products Journal*, XVI (January, 1966), p. 29.

of the resource continues at recent levels.¹ To cite an example, it is estimated that the cut from hardwood trees above 15 inches in diameter will fall from 52 percent of the total cut in 1962 to 33 percent by 2000.

Meeting the Demand

There are several variables to be considered in discussing the national hardwood veneer log resource and its adequacy in meeting future demands. The first of these variables is the intensity with which our timber resources are managed. It is commonly believed that there is room for improvement in this area, both on public and private lands. A second variable concerns the technology that is being used to convert the log to veneer and/or plywood. The general thinking here is that our wood processing firms cannot remain static and still remain competitive with either imports or substitute products. For all practical purposes, improvement of timber management practices is a long-term solution in meeting projected demands for hardwood veneer and plywood.

In the next 5 to 15 years, our veneer and plywood producers will be faced with the prospect of utilizing log sizes that are considered as marginal in today's operations. The very fact that such a situation will exist creates a demand for improved technology. It takes three 12-inch logs to produce the same amount of veneer that can be cut from one 20-inch log. With the use of smaller veneer logs, our domestic mills will be faced with different log handling requirements. Another area which needs to be investigated is the use of some of our less desirable hardwood log species. This includes some of the hickories and

¹Ibid.

American beech. To a large extent, these less desirable species are not utilized because there are no markets for them as veneer and/or plywood. As was mentioned earlier, there are indeed many variables affecting our domestic veneer log resources.

The Veneer Log Resource in Michigan and Wisconsin

For all practical purposes, the veneer log resource in Michigan and Wisconsin is composed mainly of hardwood species. Trees of veneer log quality are located primarily in the western Upper Peninsula of Michigan and in northeastern Wisconsin. Sugar maple, yellow and white birch, basswood and aspen are the principal hardwood species found in these regions. In addition, oak, elm, maple, and other species of veneer log quality are found in the lower portions of both states. Unfortunately, raw material resource data seldom make any distinction between sawlogs and veneer logs. Instead, they are combined to form the tree classification known as "sawtimber."

Over the past few years, there has been a marked increase in the quantity of No. 1 sawlogs and veneer logs being harvested from managed stands.¹ At the present time, the breakdown by log grade from an average Northern hardwood timber stand (mixed species) may approximate 5 percent veneer, 10 percent No. 1 sawlog, 35 percent No. 2 sawlog, and 50 percent No. 3 sawlog.² In most instances, the No. 1 sawlog is considered a very suitable veneer log. The percentage of

¹Wisconsin Department of Resource Development, Wisconsin Forest Products Marketing Bulletin, No. 33 (Madison: Dept. of Resource Development, 1965), p. 1.

²Ibid.

veneer logs found in a given quantity of sawlogs may vary over a large range for different species. This percentage will also vary with the extent to which forest lands are managed. Discussions with log procurement men in the region indicate that as much as 40 percent of the yellow birch sawlogs in the area forests would yield suitable veneer logs. For hard maple, it would run from 15 to 20 percent. In addition basswood and red oak sawtimber volumes may contain 30-35 percent veneer logs.

Based on current information for veneer log use, it is reasonable to expect that at least 15 percent of the sawlogs harvested in the region each year would be available and suitable for veneer purposes. It is important to note, however, that this statement applies only to those species which are currently being commercially utilized for veneer in the northern Lake States region. Veneer mills and sawmills commonly compete with one another for the No. 1 logs marketed in the region. The lumber manufactured from these logs is mixed with that coming from the No. 2 and No. 3 grades. This gives the sawmills more flexibility in marketing their lumber and at the same time, somewhat reduces their operating costs. Veneer mills also find it more economical to utilize these larger and better grade logs.

In the future, we can expect a somewhat greater percent of the total sawlog volume to be classified as veneer logs. There are several reasons for this. In the past, there has been a gradual reduction in the specifications for veneer logs. This is largely due to the increasing demand being placed on the veneer log resource. There appears to be no reason why this will not continue into the future. Also, there is a somewhat greater value in converting a No. 1 sawlog into

veneer rather than lumber. As this investigator sees it, these trends will continue into the next decade.

Hard maple and yellow birch are the dominant veneer log species in the region today. The yellow birch cut has declined steadily over the past decade. Basically, these logs came from old-growth stands which once prevailed in the area. Natural regeneration of yellow birch has been hampered for several reasons. This species is a favored browse material for deer herds in the region. In addition, yellow birch seeds require certain site and climatic conditions before successful germination can take place. For the most part, these conditions do not occur as frequently today as they did in the original old-growth stands. Other veneer species found in the northern Lake States include basswood, elm, red oak, ash, soft maple, and aspen. Overall, the hard maples are expected to become the dominant hardwood veneer log species in the coming years. They are considered a tolerant* species and their presence in the region is widespread.

Consumption - Production

The subject of veneer log consumption in Michigan and Wisconsin was treated briefly in the literature section in an earlier chapter. Veneer log consumption in Wisconsin amounted to 41,918 thousand board feet in 1963. This was nearly 10,000 thousand board feet less than the last previously recorded year, 1960. Production in Wisconsin totaled 25,203 and 25,467 thousand board feet in 1963 and 1960, respectively. Wisconsin is a net importer of veneer logs,

*Characteristic of trees which can stand much shading and competition.

consuming more than it produced in each of the years mentioned. Michigan, on the other hand, is a net exporter of this commodity. In 1963, Michigan consumed 7,598 thousand board feet of veneer logs while producing nearly twice as much. The 1960 figures showed a consumption of 12,075 thousand board feet and production of 18,486 thousand board feet. Unpublished figures on veneer log production and consumption for Michigan and Wisconsin in 1964 are similar to those of 1963.

Earlier discussions on resource data for the region have pointed out the lack of up-to-date statistics on this subject. Nevertheless, the available data may be used to show approximate relationships. Presented below are figures on the annual cut of sawtimber in Michigan and Wisconsin for 1954 and 1956, respectively.

Note that the largest portion of the annual cut of sawtimber in both states is for sawlogs and saw bolts. Veneer logs and bolts accounted for 9.1 percent of the total hardwood sawtimber volume in Michigan and 10.9 percent in Wisconsin the years indicated. These percentages are somewhat misleading in that the pulpwood, fuel wood, piling, etc., included in total sawtimber cut are not suitable for use as veneer logs. They merely meet the diameter measurements for the sawtimber classification (11 inches and up). The primary source of veneer logs in the region is from sawlogs and saw bolts delivered to the sawmills. These sawlogs are sorted according to their size and quality and the potential veneer logs are usually removed. Hence, a better measurement of what one can expect in the way of veneer logs in a given quantity of sawtimber is obtained by expressing the hardwood veneer logs volumes of Table 8 as a

TABLE 8. --Annual cut of hardwood sawtimber for Michigan and Wisconsin in selected years, by product type
(thousand board feet, International 1/4-inch log rule)

Timber product	Annual cut of hardwood sawtimber in Michigan in 1954	Annual cut of hardwood sawtimber in Wisconsin in 1956
Sawlogs and Saw Bolts	280, 100	172, 286
Veneer Logs and Bolts	35, 387	30, 382
Pulpwood	20, 148	35, 549
Fuelwood	33, 644	25, 414
Piling	1, 606	411
Poles	0	0
Posts	90	2, 321
Miscellaneous Industrial Wood ^a	13, 149	11, 990
Mine Timbers	<u>5, 908</u>	<u>305</u>
Total	390, 032	278, 658

Source: Compiled from data presented in V. E. Findell et al., Michigan's Forest Resources, Lake States Forest Experiment Station Paper No. 82 (St. Paul: U. S. Forest Service, 1960), p. 43, and R. N. Stone and H. W. Thorne, Wisconsin's Forest Resources, Lake States Forest Experiment Station Paper No. 90 (St. Paul: U. S. Forest Service, 1961), p. 51.

^aIncludes hewn ties, chemical wood, cooperage logs and bolts, woodenware, handle stock, cabin logs, etc.

percentage of the sawlog and veneer log quantities combined (the first two items in the "Timber Product" column). When this is done, we find 11.2 (Michigan) and 15.0 percent (Wisconsin) were veneer logs in 1954 and 1956, respectively. Since the time of the Forest Surveys on which these figures were based, several changes have taken place that would cause an increase in these percentages. These changes were discussed in earlier portions of this chapter. Briefly, they include an increasing volume of quality second growth timber, and gradual lowering of veneer log specifications and the somewhat greater value of converting No. 1 sawlogs into veneer rather than lumber.

Sawtimber Volume and Quality

All too frequently, newspapers and other public media discuss our forest resources only in terms of the timber volumes growing or being cut each year. The casual observer is led to believe that if the annual cut is less than the growth, then the resource is quite capable of meeting the demands being placed on it. On the contrary, there are many factors involved in determining the adequacy of this forest resource. Although the overall growth-cut picture may be quite favorable, certain regional species are currently being over-cut. Also, some timber is either not accessible or occurs in such scattered amounts that it is not economically desirable to harvest it. The quality of the timber is another factor related to the sawlog resource. The veneer and plywood industry, for example, cannot economically utilize the lower grade sawlogs while these same logs may be quite satisfactory for some other wood-using industry. Consequently, this "quality" aspect of the sawtimber resource becomes quite important.

From time to time, the United States Forest Service issues an appraisal of the timber situation and outlook in this country. The most recent of these studies¹ was published in 1965 and reflects the situation of the forest resource as it appeared at the end of 1962. Unfortunately, much of the data in this report are based on broad regional classifications. These reports on the nationwide timber situation and outlook supplement the Forest Surveys of individual states that are conducted periodically by the Forest Service in cooperation with various state and private organizations.

The quality classes of Table 9 refer to forest survey classifications based on standard log grades. Quality classes 1, 2, and 3 correspond to No. 1, 2, and 3 Factory lumber logs, respectively. The 4th quality class includes logs which are of the very poorest quality and yet still have some usable portions. The veneer manufacturer, as has been mentioned earlier, is highly dependent upon the better grade logs for profitable operations. Examining Table 9, we see that hard maple, combined with the preferred² white and red oaks, accounted for nearly 40 percent of net volume of sawtimber on commercial forest land in the United States. Among these species, there is proportionately more hard maple in the first and second quality classes than is the case with the oaks. Overall, this large quantity of hard maple logs in the first and second quality classes in relation to other hardwood species has an important bearing on the

¹U. S. Forest Service, Timber Trends in the United States, U. S. Forest Service Resource Report No. 17 (Washington: U. S. Government Printing Office, 1965).

²For the white oaks, this includes Quercus alba and Quercus macrocarpa. For the red oaks, it includes Quercus rubra and Quercus palustris.

TABLE 9. --Net volume of hardwood sawtimber on commercial forest land in the Lake States^a, by species and quality class, January 1, 1963
(Million board feet, International 1/4 inch log rule)

Quality classes	Species							
	All hard-woods	Preferred white & red oaks	Other white & red oaks	Hickory	Yellow birch	Hard maple	Ash, walnut & black cherry	Other Hardwoods
1	4,866	813	99	39	423	1,119	266	2,107
2	9,269	1,496	168	30	597	2,077	489	4,412
3	19,550	3,882	482	124	836	2,998	1,074	10,154
4	6,465	2,001	417	36	130	747	350	2,784
Total	40,150	8,192	1,166	229	1,986	6,941	2,179	19,457

Source: U. S. Forest Service, Timber Trends in the United States, U. S. Forest Service Resource Report No. 17 (Washington: U. S. Government Printing Office, 1965), p. 170.

^aIncludes Minnesota, Michigan, and Wisconsin, only.

regional veneer log resource in the coming years.

Presently, the more important veneer log species in the region include the maples, yellow birch, walnut, cherry, ash, and some of the oaks. Yet, in examining Table 9 we find nearly one-half of the total net volume of hardwoods in the region has been classified as "other hardwoods." Such species as aspen, white birch, elm, basswood, butternut, and beech fall into this category. Aspen, of course, is one of the most under-utilized species in this

group and probably accounts for a large volume in the "other hardwoods" classification. White birch, a medium density hardwood, is sometimes cut for veneer and may be used interchangeably with yellow birch. One of the main problems with this species is that it is seldom found in the diameters most veneer producers would consider economical to process at the present time.

In earlier sections, some mention was made of the desirability of harvesting and processing large diameter logs for veneer. Log diameter is mentioned in nearly all hardwood log grading systems, and it is considered by many to be an important measure of log quality. Table 10 contains figures on diameter classes for the Lake States.

Examining Table 10 we see that nearly 25 billion board feet of the hardwood species are 15 inches and under in diameter. This is roughly 60 percent of the total volume of hardwood sawtimber in the region. Preferred red and white oaks represent the largest single group of species, followed by the hard maples. Although relatively small amounts of the oaks are currently being used for veneer, they will undoubtedly be utilized to a greater extent as supplies of yellow birch, walnut, and cherry diminish. There are already signs that the hard maples are becoming more and more important to the regional veneer and plywood industry. Their use continues to rise and promotional programs are being rapidly developed in order to gain market acceptance of products manufactured from hard maple veneer.

In presenting the tables in this section, no attempt is being made to predict any absolute amounts of veneer logs that would be available on an annual basis to regional veneer mills. Instead, the relative volume and quality of the various

TABLE 10. Net volume of hardwood sawtimber on commercial forest land in the Lake States, by species and diameter class, January 1, 1963
(Million board feet, International 1/4-inch log rule)

Region and diameter (inches)	Species						
	Total	Preferred white & red oaks	Other white & red oaks	Hickory	Yellow birch	Ash, walnut & black cherry	Other hardwoods
Lake States:							
9.0-11.0	--	--	--	--	--	--	--
11.0-13.0	14,394	2,696	415	86	487	1,918	7,789
13.0-15.0	10,120	2,153	331	91	480	1,585	4,921
15.0-17.0	6,583	1,393	173	28	376	1,286	2,997
17.0-19.0	4,411	977	131	14	218	925	1,887
19.0-29.0	5,643	1,033	110	10	400	1,167	2,744
29.0+	341	46	6	--	25	60	197
Total	41,492	8,298	1,166	229	1,986	6,941	20,535

Source: U. S. Forest Service, Timber Trends..., p. 167.

species are being examined. Even though the preferred oak and hard maple species look promising in future supply considerations, one cannot overlook the large volume of material in the "other hardwood" category.

A more detailed look at hardwood sawtimber volumes in Michigan and Wisconsin is presented in Table 11. Unfortunately, recent statistics are not available which define the quality of this resource on a state-by-state basis.

The preferred red and white oaks, along with the hard maples, are among the more prevalent species in these 2 states. As we have already seen in earlier tables, this is true of the Lake States in general. One of the desirable features of the above table is that we are able to see the relative importance of some of the species that were formerly included in the "other hardwoods" category. For example, beech, ash, aspen-cottonwood, and basswood are presented individually.

It was previously mentioned that new surveys of the timber resource are either currently underway or are being planned for Michigan and Wisconsin. In the absence of these new data, the Timber Trends report remains the latest information on the subject. Although the latter is quite general in many respects, there are occasions where statistics on individual states are presented. It seems appropriate to make comparisons between these Timber Trends figures and those of the 1955 and 1956 surveys of Michigan and Wisconsin where it is both appropriate and feasible. Shown below are data on the net volumes of live sawtimber on commercial forest land derived from the surveys of a decade or more ago.

A brief glance at Tables 11 and 12 shows that Michigan's hardwood sawtimber

TABLE 11. --Net volume of hardwood sawtimber on commercial forest land in Michigan and Wisconsin, by species, January 1, 1963
(Million board feet, International 1/4-inch log rule)

State	Hardwoods														
	All hard- woods	Pre- ferred white oaks	Pre- ferred red oaks	Other white oaks	Other red oaks	Hickory	Yellow			Soft maple	Ash	Cotton- wood and aspen	Bass- wood	Black walnut	Other Hardwoods
							birch	hard maple	Beech						
Michigan	19,096	1,062	1,677	--	571	127	1,290	4,562	1,628	1,100	553	1,445	870	41	4,170
Wisconsin	12,095	1,201	2,766	--	595	102	616	1,914	584	106	506	773	835	31	2,066

Source: U. S. Forest Service, Timber Trends..., pp. 161-162.

TABLE 12. --Net volume of live hardwood sawtimber on commercial forest land, by diameter class and species, Michigan, 1955
(Million board feet, International 1/4-inch log rule)

		Diameter class (inches)					
Species	Total	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0+
Hardwoods:							
Sugar Maple	4, 182	--	928	885	761	639	969
Yellow Birch	1, 194	--	224	292	216	130	332
Basswood	788	--	229	182	111	110	156
Beech	996	--	172	232	222	122	248
Elm	2, 598	--	489	498	344	314	953
Red Oak	2, 012	--	558	521	280	316	337
White Oak	972	--	238	267	196	129	142
Aspen	1, 174	--	775	243	109	18	28
Cottonwood	135	--	3	1	2	25	104
Paper Birch	460	--	226	118	69	37	10
Soft Maple	1, 474	--	438	330	209	214	283
Ash	503	--	148	136	95	74	51
Hickory	115	--	27	56	13	10	9
Black Walnut	37	--	8	7	8	5	9
Other Hardwoods	718	--	229	236	113	76	64
Total	17, 358	--	4, 692	4, 004	2, 748	2, 219	3, 695

Source: Findell et al., Michigan's Forest Resources, p. 40.

volume was somewhat larger in 1963 than it was in 1955 for some of the selected veneer log species. Overall, however, there appears to have been a decline in total net volume of hardwood sawtimber species in Michigan since 1955. Wisconsin, too, has shown a decline both among many of the selected veneer log species and the total hardwood sawtimber volume. (Table 13)

TABLE 13. --Net volume of live hardwood sawtimber on commercial forest land, by diameter class and species, Wisconsin, 1956
(Million board feet, International 1/4-inch log rule)

		Diameter class (inches)						
Species	Total	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0+
Hardwoods:								
Sugar Maple	1,922	--	436	448	310	245	182	301
Yellow Birch	619	--	139	126	104	76	54	120
Basswood	878	--	248	220	154	91	54	111
Beech	111	--	29	25	30	9	9	9
Elm	1,771	--	428	400	288	234	145	276
Red Oaks	2,780	--	713	670	497	335	233	332
Black Oaks	598	--	204	152	104	60	46	32
White Oaks	1,206	--	379	332	205	124	72	94
Aspen	813	--	550	180	69	10	4	0
Paper Birch	188	--	92	45	33	14	1	3
Soft Maple	615	--	220	144	91	56	42	62
Ash	508	--	213	145	82	44	17	7
Hickory	102	--	47	32	16	3	4	0
Cherry	50	--	30	11	6	3	0	0
Black Walnut	31	--	10	13	4	3	0	1
Other Hardwoods	162	--	50	40	37	16	7	12
Total	12,354	--	3,788	2,983	2,030	1,323	870	1,360

Source: Stone and Thorne, Wisconsin's Forest Resources, p. 44.

Growth-Cut Balance

By comparing net annual growth with annual actual and desirable cuts of sawtimber and growing stock, the researcher has available an important indicator of how the forest resource is faring. Net annual growth is the annual change in volume of sound wood in live sawtimber and poletimber trees on

commercial forest land and the total volume of trees entering these classes through ingrowth, less natural losses. The annual actual cut of growing stock is the net volume of sawtimber and poletimber trees harvested and includes that killed by logging damage, land clearing, and cultural operations during a specified year. In contrast, the annual desirable cut is the net volume of live sawtimber and poletimber trees that can be commercially harvested annually during the next 10 years while maintaining or building a high level of growing stock and a reasonably even distribution of age classes below the rotation age selected for each type.

The most recent growth-cut figures on hardwood growing stock for Michigan and Wisconsin are for the years 1954 and 1956, respectively. For Michigan, the annual actual cut of sugar maple and yellow birch growing stock exceeded the annual desirable cut in 1954 (Table 14). In Wisconsin, an overcut of sugar maple and oak occurred in 1956 (Table 15) while the desirable-actual cut balance of yellow birch remained favorable.

The annual desirable cut of yellow birch in both Michigan and Wisconsin exceeds the net annual growth for this species (Table 14 and 15) for the years indicated. This is largely because the forest survey indicated the presence of certain quantities of overmature timber in need of harvesting. The lack of recent comprehensive data on the growth-cut balance severely hampers an analysis of the veneer log resource. Yellow birch and sugar maple are heavily used veneer and sawlog species in the Lake States. Apparently, most of the old-growth birch has been cut and large sugar maple logs of suitable veneer quality are becoming increasingly difficult to obtain. Basswood, shown to be in

TABLE 14. --Net annual growth, annual actual and desirable cuts of hardwood growing stock on commercial forest land in Michigan, by species, 1954
(Million cubic feet)

Species	Net annual growth	Annual desirable cut	Annual actual Cut, 1954
Sugar Maple	50.8	24.5	30.2
Yellow Birch	5.9	8.7 ^a	9.7
Basswood	13.7	5.1	2.4
Beech	4.6	9.3	4.8
Elm	31.1	14.6	9.8
Red Oak	27.8	12.4	8.3
White Oak	18.6	5.7	1.8
Aspen	108.5	72.7	43.6
Cottonwood	0.4	1.1	0.5
Paper Birch	20.6	14.9	2.4
Soft Maple	40.8	13.9	6.7
Ash	14.3	4.0	1.9
Other Hardwoods	21.6	11.4	2.7
Total	358.7	198.3	124.8

Source: Findell et al., Michigan's Forest Resources, p. 45.

^aThe annual desirable cut for yellow birch exceeds net annual growth, thus reflecting the presence of overmature timber in need of harvesting.

TABLE 15. --Net annual growth, annual actual and desirable cuts of hardwood growing stock on commercial forest land in Wisconsin, by species, 1956
(Million cubic feet)

Species	Net annual growth	Annual desirable cut	Annual Actual Cut, 1956
Sugar Maple	22.2	12.8	19.5
Yellow Birch	3.6	5.1	4.7
White and Red Oaks	45.5	27.4	31.1
Hickory	2.6	1.4	0.3
Ash, Walnut, Black Cherry	15.9	6.2	3.6
Other Hardwoods	160.3	115.0	85.5
Total	250.1	167.9	144.7

Source: Stone and Thorne, Wisconsin's Forest Resources, p. 48.

relatively good supply in 1954 (Table 14) is perhaps now growing scarce. As we have seen earlier, the hard maples and oaks appear to offer future potential inasmuch as considerable volumes are currently concentrated in the lower diameters of the sawlog class.

In 1962, roughly 215 million board feet (Int. 1/4-inch log rule) of hardwood sawlog size timber was cut in Michigan. Approximately 10 percent of this cut was for veneer logs. Wisconsin forests, in contrast, yielded about 190 million board feet of sawlogs in 1962, of which 13 percent went for veneer. These percentages are somewhat misleading in that they include all species and not just those commonly used for veneer. Had non-veneer species been

excluded from the data, a somewhat greater percentage would have been veneer logs.

To this point in the discussion, little mention has been made about pole-timber volumes. For hardwoods, trees of commercial species in the d.b.h.¹ range of 5.0 to 10.9 inches with more than 40 percent usable volume are classified as poletimber. As such, they are the sawlogs of future decades. Large amounts of hard maple, oak, and aspen fall into this classification (Table 16).

The presence of relatively large quantities of oak and maple poletimber indicates that these species will play an important role in supplying future timber needs. Other species, such as aspen and paper birch, are also relatively plentiful. In 1955-6, roughly 40-50 percent of all hardwood poletimber growth in Michigan and Wisconsin occurred in aspen.² The ash, walnut, and cherry poletimber grouping appears to show promise, but mainly because of the presence of large quantities of ash in the data. The future of yellow birch as a sawlog and veneer species is quite doubtful due to both a declining supply and regeneration obstacles. Soft maple (now shown in Table 16) comprised between 9 and 12 percent of the total poletimber growth in Michigan and Wisconsin in 1955-6, and it is expected that demand for this species will increase in future years.

Statistics on the net annual growth and cut of hardwood sawtimber indicate that Michigan and Wisconsin share similar problems in regard to their forest

¹Diameter at breast height.

²See Findell *et al.*, Michigan's Forest Resources, Table 15, p. 42, and Stone and Thorne, Wisconsin's Forest Resources, Table 24, p. 47.

TABLE 16. --Net volume of hardwood growing stock on commercial forest land in the Lake States, by species and diameter class, January 1, 1963
(Million cubic feet)

Diameter class (inches)	Total	Preferred white and red oaks	Other white and red oaks	Hickory	Yellow birch	Hard maple	Ash, walnut, cherry	Other hardwoods
5.0- 7.0	5,770	461	92	32	71	365	290	4,459
7.0- 9.0	5,438	605	110	35	95	451	307	3,835
9.0-11.0	4,468	698	111	34	105	463	264	2,793
11.0-13.0	2,910	531	83	17	99	392	216	1,572
13.0-15.0	1,950	419	65	18	96	305	130	917
15.0-17.0	1,210	262	33	6	69	233	76	531
17.0-19.0	787	179	24	3	39	163	50	329
19.0-29.0	949	182	19	1	70	197	35	445
29.0+	64	6	1	-	4	11	1	41
Total	23,546	3,343	538	146	648	2,580	1,369	14,922

Source: U. S. Forest Service, Timber Trends..., p. 164.

resource (Table 17). Data based on the 1955 and 1956 surveys show overcutting occurring in both sugar maple and yellow birch. Although basswood and elm appeared to be in good shape in the mid-50's, it is now generally believed that logs of veneer quality are becoming scarce even among these species.

The net annual cut of sugar maple sawtimber exceeded the desirable cut by nearly 30 percent and the growth by over 70 percent in Michigan in 1955. Overcutting of this species also occurred in 1962 in the Lake States (Timber Trends . . . , Table 30). The yellow birch resource shared a similar position. No data were available on the status of basswood or elm.

Growth-cut relationships provide us with valuable information on how our resources have fared in the past and how they might provide for the future. As the supply of the more commonly used veneer species is depleted, our attention must necessarily focus on those species which are relatively abundant. Perhaps they are not now what are referred to as "desirable veneer species", but their presence in regional forests cannot be overlooked as a potential resource.

Meeting the Demand

How well will the regional forests meet the future demand for hardwood veneer logs? The lack of recent survey data, of information on current cutting practices and of certain economic data made this a difficult question to answer. The procedure used here in estimating hardwood veneer log volumes appears to be the most feasible one available at this time, but other possibilities and research will be discussed. You may recall that an earlier section made reference to discussions with log procurement men in the region regarding the

TABLE 17. --Net annual growth and cut of hardwood sawtimber on commercial forest land in Michigan and Wisconsin
(Million board feet, International 1/4-inch log rule)

Species	MICHIGAN (1955)			WISCONSIN (1956)		
	Net annual growth	Annual desirable cut	Net annual cut	Net annual growth	Annual desirable cut	Net annual cut
Sugar Maple	81.8	109.1	140.8	50.0	46.6	58.9
Yellow Birch	15.1	38.5	44.6	11.5	20.6	18.4
Basswood	42.4	21.0	12.6	44.7	19.7	20.6
Elm	126.2	62.0	37.8	61.5	32.9	27.5
Red Oak	92.6	47.7	33.4	113.0	63.7 ^a	75.5 ^a
White Oak	48.3	20.7	6.4	49.1	25.5	17.3
Aspen	146.6	76.0	43.7	169.7	68.8	44.6
Paper Birch	26.6	18.5	6.3	16.9	8.4	3.0
Soft Maple	82.3	40.4	26.9	30.6	17.4	13.6
Ash	30.9	10.5	6.8	26.6	10.1	7.5

Source: Selected tables in Findell et al., Michigan's Forest Resources, and Stone and Thorne, Wisconsin's Forest Resources.

^aOne of the interesting aspects of this table is that it shows the overcut of oak growing stock in Wisconsin indicated in earlier data (Table 15) may have been the result of an overcut in red oak sawtimber.

percentage of veneer logs found in given quantities of sawlogs. This will be the basis on which projections will be made.

For face veneers and plywood, the most widely used species in Michigan

and Wisconsin include sugar maple, yellow birch, basswood, walnut, cherry, elm, red oak, and ash. Walnut and cherry represent a very small volume of total production and consequently, are grouped in the "other hardwoods" category. A good estimate of the volume of a given species suitable for veneer can be determined by multiplying the annual desirable cut of the sawtimber in that species by the percentage factors mentioned in an earlier section (Table 18).

In recent years, roughly 40 million board feet (Int. 1/4-inch log rule) of veneer logs have been produced annually in Michigan and Wisconsin combined,¹ but no information is known as to the amount available. The latter is especially relevant in analyzing the future of the industry and is largely dependent upon market conditions for veneer logs. Determination of the timber volume available for the production of veneer involves two major adjustments to the total sawtimber volume statistics. The first of these is concerned with obtaining a reliable measurement of hardwood sawtimber volumes suitable for veneer logs. The second consideration is an adjustment of the suitable volume data to obtain the available volume. It seems reasonable to assume that not all of the sawlog volume suitable for veneer is available for veneer. Sawmills and veneer mills, for example, frequently compete with one another for their log supplies. Among other things, the available veneer log volume is a measure of the economic supply.

Implicit in the definition of annual desirable cut is the concept that the cut represents the net volume of live sawtimber and poletimber trees that can be commercially harvested annually during the next 10 years while meeting certain

¹Does not include the "other hardwoods" category.

TABLE 18. --Estimated volume of hardwood sawlogs suitable for veneer in Michigan and Wisconsin
(Based on annual desirable cut of sawtimber)

	Annual desirable cut of sawtimber ^a on commercial forest land (International 1/4-inch rule)		Percent of sawlog volume estimated to be suitable ^b for veneer	Total estimated quantity suitable for veneer (million board feet)
	<u>Michigan, 1955</u>	<u>Wisconsin, 1956</u>	<u>Total</u>	
Sugar Maple	109.1	46.6	155.7	15
Yellow Birch	38.5	20.2	58.7	40
Basswood	21.0	19.7	40.7	30
Elm	62.0	32.9	94.9	25
Red Oak	47.7	63.7	111.4	30
Ash	10.5	10.1	20.6	15
Total				
				119.3

^aMillion board feet, as presented in Findell et al., Michigan's Forest Resources, Table 22, p. 44, and Stone and Thorne, Wisconsin's Forest Resources, Table 25, p. 47.

^bAs experienced in regional mills and harvesting operations.

stocking requirements. Because this much time has already elapsed since the last surveys, predictions based on this data may prove misleading. The suitable veneer log volumes in Table 18 are only estimates, yet they represent the best data available at the present time.

The analysis of the regional hardwood veneer log supply was restricted by many factors. Although national forests in Michigan and Wisconsin have good records on timber growth and cut, they rarely separate figures on veneer log volumes. Of the two states, only Michigan has up-to-date information on sawlog volumes on state lands, and again, no specific mention is made of the veneer log resource. In addition to these classification shortcomings, public ownership of the net volume of live sawtimber on commercial forest land accounts for only 20-25 percent of all ownerships in either state. This means a large portion of the timber resource is in private hands, and relatively speaking, is not intensively managed.

Veneer log production figures for Michigan and Wisconsin in 1963 show that birch, hard maple, oak, and basswood made up nearly three-fourths of the volume cut (Table 19). The remainder was primarily made up of elm and walnut, with lesser amounts coming from other species. Most of the oak cut in the region came from Wisconsin while more than one-half of the yellow birch was cut in Michigan.

Resource Trends

This discussion of timber resources has now reached a point where likely future trends can be examined. It is expected that veneer mills will be

TABLE 19. --Veneer log production in Michigan and Wisconsin in 1963, by species
(Thousand board feet, International 1/4-inch log rule)

Species	Production by state		Total production
	<u>Michigan</u>	<u>Wisconsin</u>	
Aspen	344	196	540
Ash	75	418	493
Basswood	855	3,206	4,061
Beech	201	80	281
Birch	5,052	3,224	8,276
Cottonwood	137	99	236
Elm	1,413	2,990	4,403
Hard Maple	4,429	5,626	10,055
Soft Maple	366	1,424	1,790
Oak	662	7,207	7,869
Walnut	1,588	370	1,958
Misc. Species	178	363	541
All Species	15,300	25,203	40,503

Source: R. G. Knutson, Veneer Log Production in Lake States Continues General Decline, 1963, Lake States Forest Experiment Station Research Note LS-54 (St. Paul: U. S. Forest Service, 1964), p. 2.

able to compete favorably with sawmills for their log supplies in coming years. Veneer logs are currently bringing higher prices than sawlogs and there is little reason to believe this trend will not continue. The price differential may even increase (it varies with species) but veneer mills must concern themselves with the possibility that increasing raw material costs may push their unit costs to the point where substitute products would be able to capture traditional veneer markets. Undoubtedly, the size and quality of the average veneer log will decline in the next 10-15 years. The cutting of some second and third growth material toward the end of this period will improve quality somewhat, but veneer log size will probably center in the 11-15 inch d.b.h. range for the next 20 years. These conditions will necessitate the development of new production methods and efficiencies to cope with the smaller diameter logs.

It is likely that hard maple will maintain its dominant role in the veneer log resource (Table 19). The volume and growth of this species in poletimber stands is encouraging, but overcutting in sawtimber stands will probably continue. In the next 20 to 30 years, substantial quantities of the present poletimber class in this species will be reaching sawtimber size. Yellow birch, once the mainstay of the regional industry, will continue to decline. Certain quantities of white birch will be substituted for yellow birch, but the general absence of combined volume and quality in the former will probably limit its ability to meet the demand for birch.

Red oak will likely be second in importance only to hard maple in future years. It is present in sizable quantities in both poletimber and sawtimber stands. Although poletimber volumes in this species are formidable, their

growth--as a percentage of total poletimber growth for all hardwood species--is very small. There is the possibility that the growth of this species is retarded either by stand or soil conditions. If it is the latter, then the future of red oak will be very much in doubt after sawtimber volumes are logged off. White oak shares a similar situation.

Elm and basswood, popular species in the wooden container industry, also find important uses in the standard veneer industry. Basswood is commonly utilized for core and crossbanding material while elm is gaining widespread acceptance as a face veneer species. Elm, when correctly stained, closely resembles American black walnut in appearance. It is anticipated that the widespread occurrence of the Dutch-elm disease will speed the rate of cutting to the point that sawtimber volumes of this species will be very limited within 20 years. This accelerated cutting may mean that relatively large quantities of elm will reach the market in the next decade. In Wisconsin, basswood of suitable size and quality is becoming scarce. Some basswood stands in the Northern half of the Lower Peninsula of Michigan show promise, but their contribution to the total veneer log resource will be small. There appears to be no long-term significance developing in this species.

One of the most prevalent species in the region is aspen. It is available in large quantities, both as poletimber and sawtimber, but logs of large diameter (15 inches and up) are uncommon. Some standard veneer mills are currently cutting aspen for core material but future demand will depend on its ability to compete economically with imported core stock (luan, etc.). If pulpwood demand for this species continues at the present rate, the veneer log supply

will be appreciably affected in the coming years. At the present time in the Lake States, aspen is rarely used as a face species, but the introduction of some chemical process to alter its physical or mechanical properties could change this.

Soft maple, another favorite of the container industry, occurs all too infrequently in the quality or size needed for veneer. Growth in this species is relatively rapid and volumes are accumulating at a considerable rate. If quality can be improved by some silvicultural means not yet used, there is the possibility of increased acceptance of soft maple in the face veneer industry.

Summary

In the broadest sense, the United States is currently facing a shortage of quality hardwood sawtimber. There is keen competition among sawmills, veneer mills, and other types of hardwood processing firms for this hardwood raw material resource. Certain species such as walnut and cherry are currently in short supply, and if present cutting practices continue, other species will undoubtedly fall into the same category.

Hardwood face veneer and plywood mills in Michigan and Wisconsin utilize a number of species, with hard maple, birch, and red oak being among the more important. Competition between sawmills and veneer mills for the available log resource has intensified in recent years and prices have risen proportionately. Resource data indicate that many of the commonly used regional species are becoming scarce. This includes basswood and yellow birch. Then, too, the future availability of red oak and elm is also in question at this time.

Of all the species now in widespread use by the regional industry, only hard maple seems to be in relatively good supply. Other species, such as aspen and soft maple, are fairly abundant, but as yet there seems to be little demand for them, either as sawlogs or veneer logs. In the case of aspen, the log quality is generally poor and a major portion of the resource consists of small diameter material.

Overall, it would seem that the regional hardwood face veneer and plywood industry must adopt a technology that would allow it to economically process logs of both small diameter (11-14 inches) and low quality. Another key to the future of this industry will be its ability to compete with other wood processing industries for the available log resource. At the present time, many regional veneer mills are expanding their operations, and undoubtedly, at least some of their increased log needs are being met at the expense of local sawmills.

Future changes in consumer acceptability of various grades and types of veneer and plywood may also have an important effect on the resource available to the manufacturer. For example, if a substantial demand for face veneers with knots and other natural defects can be generated, the net effect could be both that of extending the supply of currently preferred veneer species as well as bringing into general use the under-utilized species. Presently, much of the veneer containing sound defects is used for backs, core or crossbanding material, but by placing more of this in the face ply, the veneer log resource could perhaps be increased considerably. The void created by moving some of the core and crossbanding plies to the face of the plywood panel might then best be filled by aspen or some other under-utilized species.

CHAPTER V

RESULTS OF A GENERAL SURVEY OF THE HARDWOOD FACE VENEER AND PLYWOOD INDUSTRY IN MICHIGAN AND WISCONSIN

Methodology

Each of the 32 veneer and/or plywood mills in the region were visited in order to obtain general information in a number of subject areas. Data were collected on the type of products manufactured, age and type of machinery being used, number of persons employed, marketing practices, production capacity, and the origin of raw materials used (veneer logs).

Prior to the initiation of the study, it was recognized that there would be considerable variation in the record keeping systems utilized among the various firms that would be part of the study. Such variation exists not only in the regional veneer and plywood industry, but also in the wood-using industries as a whole. Therefore, it was decided that estimates of production and marketing data supplied by management personnel would provide a suitable source of data and perhaps be the only method available in the absence of detailed record keeping systems.

A listing of hardwood face veneer and plywood firms in Michigan and Wisconsin was assembled from directories published by the Hardwood Plywood Manufacturers Association and other relevant sources. Over a two-month

period, key executives in each of the participating firms were interviewed and their responses recorded for detailed analysis at a later date. The general format on which these questions were based is presented in Appendix A.

In order to facilitate the analysis of the replies obtained in the interviews, mills were categorized according to the general type of product being produced at the time of the visit; namely, veneer, veneer and plywood, plywood, and specialty plywood. These categories are termed industry groupings and collectively constitute the hardwood face veneer and plywood industry in Michigan and Wisconsin.

General Characteristics of Industry Groupings

Veneer Mills

Eleven veneer mills were surveyed during the course of the study. Seven of these were located in Wisconsin and the remaining four were in Michigan. The average plant in this industry grouping contained 26,000 square feet or production area and employed an average 84 production workers. At least one-half of the mills have added to their physical plant in the past 15 years and over one-half have placed new lathes in operation in the past 12 years. Some of these lathes have replaced older equipment while others have served as additions to present equipment.

Production for these veneer mills is based primarily on orders for veneer, but a limited number of executives felt their firm's production was also being governed by the available supply of veneer logs and the market for various lengths of veneer. Most of the veneer mills surveyed engaged in cost analysis, but

there were extreme variations among the mills in this respect. Few carried out industrial engineering studies of any type and practically none were involved in any form of marketing analysis. Perhaps the latter was true because nearly two-thirds of the total amount of veneer produced by these mills was marketed through agents, brokers, house accounts or under a parent-firm arrangement.

Productivity patterns, measured in terms of output per man-hour, have shown gradual increases over the past 10 years. This is partially due to improvements which have occurred in veneer processing machinery during this period. New lathes, capable of reducing cores down to an approximate 4-inch diameter, have enabled these producers to utilize more of the log as well as efficiently peel the smaller diameter logs. Other developments in machinery include improved reeling systems, lathe chargers, and high speed clippers and driers.

Veneer mills in the region cut a variety of species, but yellow and white birch (Betula sp.) hard and soft maple (Acer sp.) red oak (Quercus sp.) basswood (Tilia americana) and American elm (Ulmus americana) are among the more important. In 1963, the maples and birches accounted for over 50 percent of all log receipts in Michigan and Wisconsin combined. Domestic manufacturers frequently expressed the opinion that large quantities of birch veneer coming from Canada tended to influence the price structure of that species in this country. In some instances, domestic veneer mills have ceased to manufacture birch veneer and have turned to other northern hardwood species. Because the birch veneer business is so competitive, domestic manufacturers must produce large volumes of this species in order to obtain suitable profits.

Several of the executives interviewed felt that low-cost plywood imports

have reduced the demand for domestic veneer. In addition, such veneer substitutes as plastic laminates and hardboard have also affected veneer sales of regional mills. Increasing raw material costs, competition on log purchases, decreasing log quality and labor shortages in some areas were also cited as problems confronting the hardwood face veneer industry.

Veneer and Plywood Mills

There are 11 mills in Michigan and Wisconsin which manufacture both veneer and plywood. In most instances, the veneer produced by these firms is consumed entirely by their plywood operations. Of these 11 mills, all but one are located within Wisconsin. A total of 10 mills were visited inasmuch as one firm did not wish to disclose information on its operations. The average plant in this industry grouping contained 122,444 square feet of production area and employed an average 226 production workers. All of the mills in this grouping reported major changes in plant facilities in the past 15 years, changes that ranged from new manufacturing operations to new warehouses. Five firms have added prefinishing operations in recent years, but only 3 are equipped to produce this type of panel on a volume basis.

The larger, integrated companies found in this industry grouping based their production of plywood on production quotas handed down to them by the parent firm. These same companies, as part of larger integrated firms, have access to research and development services provided by the parent company. In contrast to the veneer mill grouping, veneer and plywood mills are stronger overall in many categories. They are likely to have better record keeping systems, more advanced marketing programs and a better knowledge of what

their competitors are accomplishing.

Productivity patterns, measured in terms of output per man-hour, have increased up to 33 percent for some mills while others have recorded very little change in this area over the past decade. A few mills were found to be investing in new veneer lathes, driers, and plywood presses, but the majority of the firms were installing equipment that provided relatively short pay-off periods and depreciation schedules (materials-handling devices, small machines, etc.). Some uncertainty was expressed among regional mill managers that machines requiring large capital investments would pay for themselves if installed.

During the course of the interviews, executives cited many problems which they believe confront the industry today. Among the more important are the low cost imports entering the country, the decrease in quality of the raw material supply, the export of native log species such as walnut, the continued rise in labor costs and the lack of trained manpower. Also mentioned as a problem area was the competition being received from such plywood substitutes as printed board and plastic laminates. In addition, the executives contend that low-cost imported wall panels and door stock have been responsible for many mills switching from the profitable and traditional panel lines to various specialty plywood items.

Plywood Mills

This industry grouping included seven mills of which all but one were located in Wisconsin. The average plant contained over 132,000 square feet of production area and employed approximately 160 production workers. As was the

case with the veneer and the veneer and plywood industry groupings, the plywood mills based their production largely on orders already on hand. Nearly all of the operations investigated have added new buildings to their plants in the past 5 years and two firms reported having replaced or built all of their buildings since 1950. Many have relocated much of their machinery within present buildings in order to improve production processes and the flow of materials. Most of the seven plywood mills utilized some form of cost accounting although there was a large variation among the firms in accounting procedures and methods.

A number of executives who were interviewed expressed an awareness of the impact and importance of materials handling systems in their operations. Productivity, in terms of output per man-hour, has been generally upward with one firm noting a doubling in productivity over the past 10 years. Executives interviewed in this industry grouping generally felt that the level of activity experienced by their firms was directly proportional to the pace at which both the residential and non-residential building industries were moving. They also expressed the belief that the price and quality of their products were equally important determinants of their markets.

Apparently, the plywood industry in Michigan and Wisconsin is faced with many of the same problems commonly cited for the other industry groupings. Imports and raw material scarcity, both in the form of logs and core stock, were mentioned during the interviews. In addition, one plant manager stated that his firm was faced with increasing veneer prices and that due to competition, his firm could not proportionately raise the price of its finished plywood product to offset this increase.

Specialty Plywood Mills

Specialty plywood mills, taken as a group, account for a very small portion of the total plywood produced within the study region. Nevertheless, they may be regarded as forerunners to the establishment of other similar mills within the region. Altogether, there are 3 mills located in Michigan and Wisconsin which have been classified as specialty plywood mills by the Forest Industries magazine.¹ Two of these are located in Michigan and specialize in curved plywood material for various types of furniture, both upholstered and non-upholstered. A third specialty mill, located in Wisconsin, is operated in conjunction with a juvenile furniture plant.

Production for these plants is closely geared to the level of activity in the furniture industry and is based mainly on orders. All of the mills investigated conduct a limited amount of cost analysis and at least one has engaged in machine layout studies. The average firm in this industry grouping employs approximately 16 production workers and has an average wage of \$1.91 per hour.

In Michigan, specialty plywood mills are apparently having difficulty attracting and holding employees because of intensive competition from other industries for the available labor supply.

One of the basic differences between the standard hardwood plywood industry and the specialty mills is the use of high-frequency gluing machines by the latter. For the most part, these specialty plywood mills have experienced

¹Forest Industries (Portland, Oregon: Miller-Freeman Publications, January, 1965), p. 186.

rapid growth within the past 5 years and many new machines have been recently added. Two of these firms were formed within the past 15 years while the third has had a long family ownership pattern. It is reasonable to expect that this industry grouping will soon be joined by other mills, largely because it is a segment of the hardwood plywood industry in which low cost imports are not presently an important competitive factor.

Plant Production Characteristics of Industry Groupings

Prior to the time this study was initiated, there was little or no information available which accurately measured the total amount of veneer and plywood being produced in Michigan and Wisconsin in any given year. In fact, there has been very little information available on the production characteristics of the veneer and plywood industry in Michigan and Wisconsin. This is perhaps partially due to the absence of detailed record keeping systems within the regional industry and to some degree, a reluctance on the part of some mills to provide information on their operations. To overcome this handicap, the study was designed to solicit production data based on estimates provided by management personnel at each of the veneer and/or plywood mills visited during the course of the study. Information received during the study was handled in a confidential manner, and presented only as totals for industry groupings.

Veneer and Plywood Production

Historically, the bulk of the veneer produced in the Lake States region has been manufactured on the rotary-type veneer lathe. The study revealed

that this is much the situation today with over 90 percent of the veneer produced by either the veneer or the veneer and plywood mills in Michigan and Wisconsin being of this type. Altogether, more than 600 million square feet of veneer¹ was produced by mills in Michigan and Wisconsin in 1964. In 1963, United States production of face veneer totaled nearly 5.5 billion square feet.²

In relation to plywood production, the investigation showed that 3-ply veneer plywood constituted a large portion of all plywood manufactured within the region. Also, "other" types of veneer-core plywood accounted for substantial amounts of the total plywood production. This "other" type of plywood was generally found to be 7 or more plies in construction and was mainly utilized in specialty plywood items. On the other hand, the 3-ply material was extensively used in prefinished hardwood plywood panels. Figures on the estimated quantities of veneer and/or plywood manufactured in Michigan and Wisconsin in 1964 are presented in Table 20. A later portion of this chapter will be devoted to a discussion and identification of specialty plywood products which are manufactured in regional mills.

Overall, one might be interested in weighing the contribution of plywood produced in Michigan and Wisconsin to both the North Central States³ and to

¹Excludes container-type veneer.

²U. S. Department of Commerce, Bureau of the Census, "Area Statistics," Census of Manufactures, Volume III, 1963 (Washington: U. S. Government Printing Office, 1963), p. 13.

³The North Central States as defined by the U. S. Bureau of Census include Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas.

TABLE 20. --Estimated quantities of veneer and/or plywood manufactured in Michigan and Wisconsin in 1964, by industry groupings^a

	Industry Grouping					
	Veneer Mills		Veneer and Plywood Mills ^b		Plywood Mills	
	Estimated quantity in millions of sq. ft. surface meas.	Per-cent (%)	Estimated quantity in millions of sq. ft. surface meas.	Per-cent (%)	Estimated quantity in millions of sq. ft. surface meas.	Per-cent (%)
I. <u>Veneer</u>						
(a) Rotary Veneer	390.5	90.5	170.5	94.5		
(b) Sliced Veneer	41.0	9.5				
(c) Other Veneer			10.0	5.5		
II. <u>Plywood</u>						
All Veneer Plywood						
(a) 3-ply			16.75	32.0	149.18	87.8
(b) 5-ply			2.20	4.2	10.28	6.1
(c) Other			22.55	43.2	2.80	1.5
III. <u>Lumber-Core Plywood</u>			6.50	12.4	6.48	4.0
IV. <u>Particle Board Core Plywood</u>			3.78	7.3	1.06	0.6
V. <u>Fire-Core Plywood</u>			.49	0.9		
Total Amount	431.5	100.0	180.5	100.0	169.8	100.0
Average Per Mill	39.2		22.5	6.53	24.3	2.0

^aUnless otherwise noted, there were 11 veneer mills, 10 veneer and plywood mills, 7 plywood mills, and 3 specialty plywood mills included within the industry groupings.

^bAverages and percentages based on 8 mills since 2 mills did not have production figures available.

the entire nation. U. S. Bureau of Census statistics¹ show that nearly 2 billion square feet, surface measure, of all types of hardwood plywood were manufactured in the United States in 1964. The North Central region contributed about 320 million square feet of this amount. Data collected as part of this investigation show that Michigan and Wisconsin accounted for nearly 230 million square feet or roughly 16 percent of the national total and 71 percent of the North Central total.

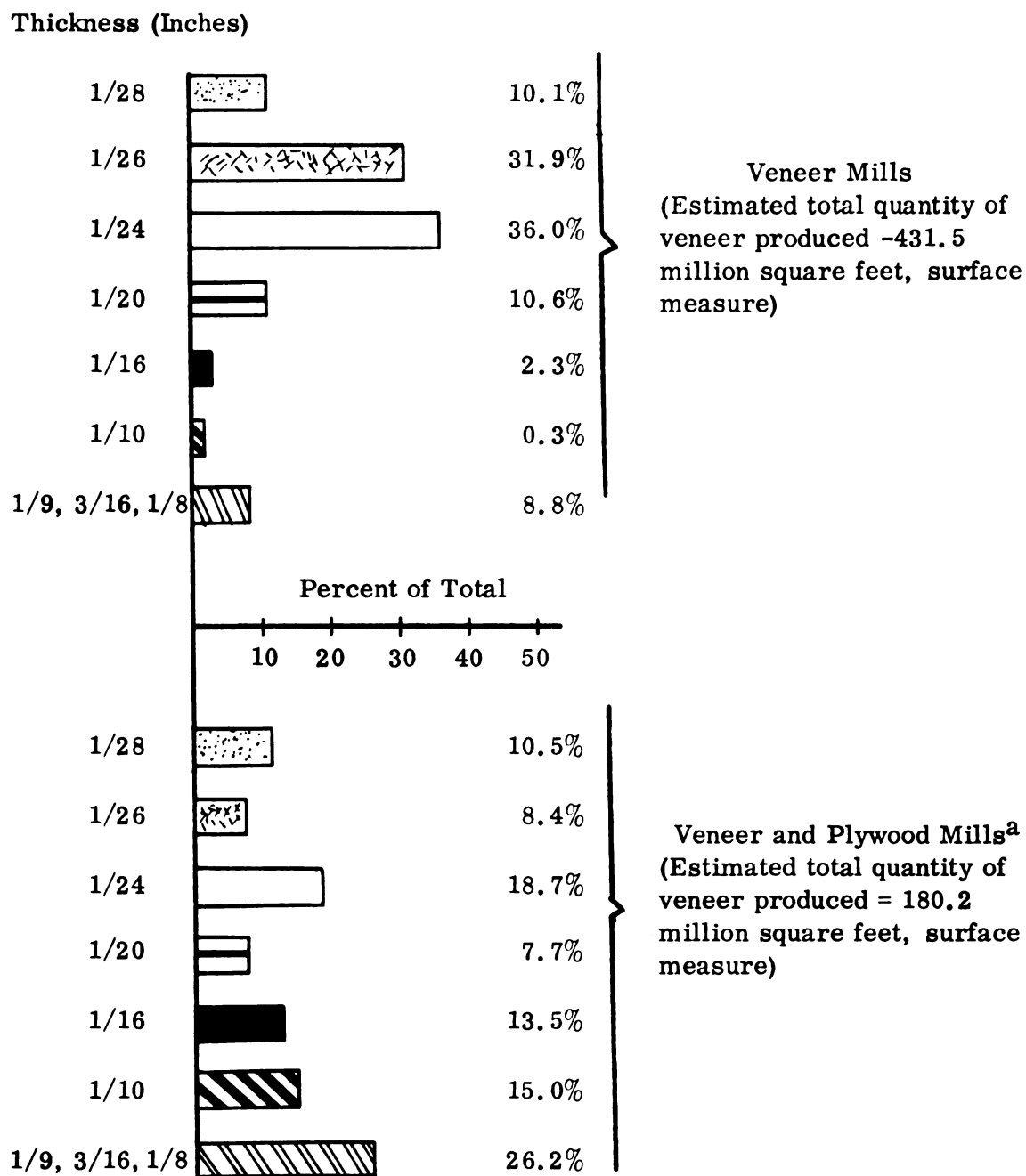
It may be noted that Table 20 makes reference to "fire-core plywood." This refers to plywood which is used in conjunction with fireproof material in the construction of certain types of doors. Also, under the veneer products, there appears a category designated as "other" veneer. Basically, this grouping includes veneers manufactured by the half-round process in which the cant or log is chucked off-center on a rotary lathe.

Veneer Thickness

A discussion of veneer production in Michigan and Wisconsin would be incomplete without some mention of the numerous thicknesses which are manufactured by various mills within the region. Veneer mills, as Figure 3 illustrates, apparently channeled their production efforts towards the manufacture of the thinner veneers in 1964. Generally, these thinner veneers (1/28 - 1/20 inch) are used for faces and backs in the manufacture of plywood. Thicker veneers, such as 1/16, 1/10, 1/9, 3/16 and 1/8-inch material, are

¹U. S. Department of Commerce, Bureau of the Census, "Hardwood Plywood 1964," Current Industrial Reports, Series M24F(64)-1 (Washington: U. S. Government Printing Office, 1965), p. 3.

Figure 3. --Estimated veneer production in various thicknesses manufactured in Michigan and Wisconsin in 1964, by industry groupings



^aFigures and percentages based on 8 mills since 2 mills did not have production data available.

used for cores and crossbanding.

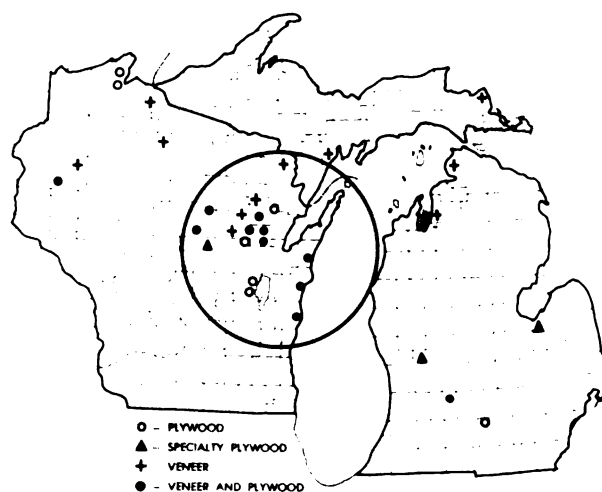
During the course of the many mill visits made as part of this study, a number of plywood manufacturers expressed concern over the lack of domestically manufactured core material available to their operations. The demand and supply situation has been such that imported core material is now being used by many of these regional mills. Veneer mills tend to concentrate their production in the more lucrative and profitable face veneers while veneer and plywood mills tend to produce a more uniform mixture of the various thicknesses. The latter situation gives the veneer and plywood mills a certain advantage over the plywood mills inasmuch as they are better able to cope with the problems associated with a core-veneer and crossbanding shortage. Presently, 1/6-inch core material that has been sorted for defects and edge-glued into sheets will cost the plywood manufacturer anywhere from \$45 to \$55 per thousand square feet, surface measure. These plywood mills frequently find themselves in a situation where rising veneer-core prices cannot be offset by increasing the price of the finished product. In other words, the competition is such in the plywood industry today that in many cases increased costs of production must be absorbed by the manufacturer rather than the ultimate consumer

Location of Mills

Geographically, the hardwood face veneer and/or plywood industry in Michigan and Wisconsin tends to be located within the central to northern portions of each state. In the early days, mills in this industry were often located within

heavily forested areas to take advantage of abundant natural resources. As time passed and the distance between mill and forest increased, truck and rail transportation played an important part in allowing these mills to continue operating profitably within the regions of their original establishment. Gradually a small nucleus of mills evolved within certain geographical areas and the formation of a skilled labor force soon followed. This pool of skilled and semi-skilled labor, familiar with processing of veneer and the manufacture of plywood, soon attracted other similar types of wood-using industries. Today, much of the veneer and/or plywood manufactured in the North Central States comes from an area in Wisconsin that lies within a 100-mile radius of Green Bay, Wisconsin (Figure 4). Many container-type veneer mills and millwork operations are also located within this area.

Figure 4.--Location of hardwood face veneer and/or plywood mills in Michigan and Wisconsin in 1964



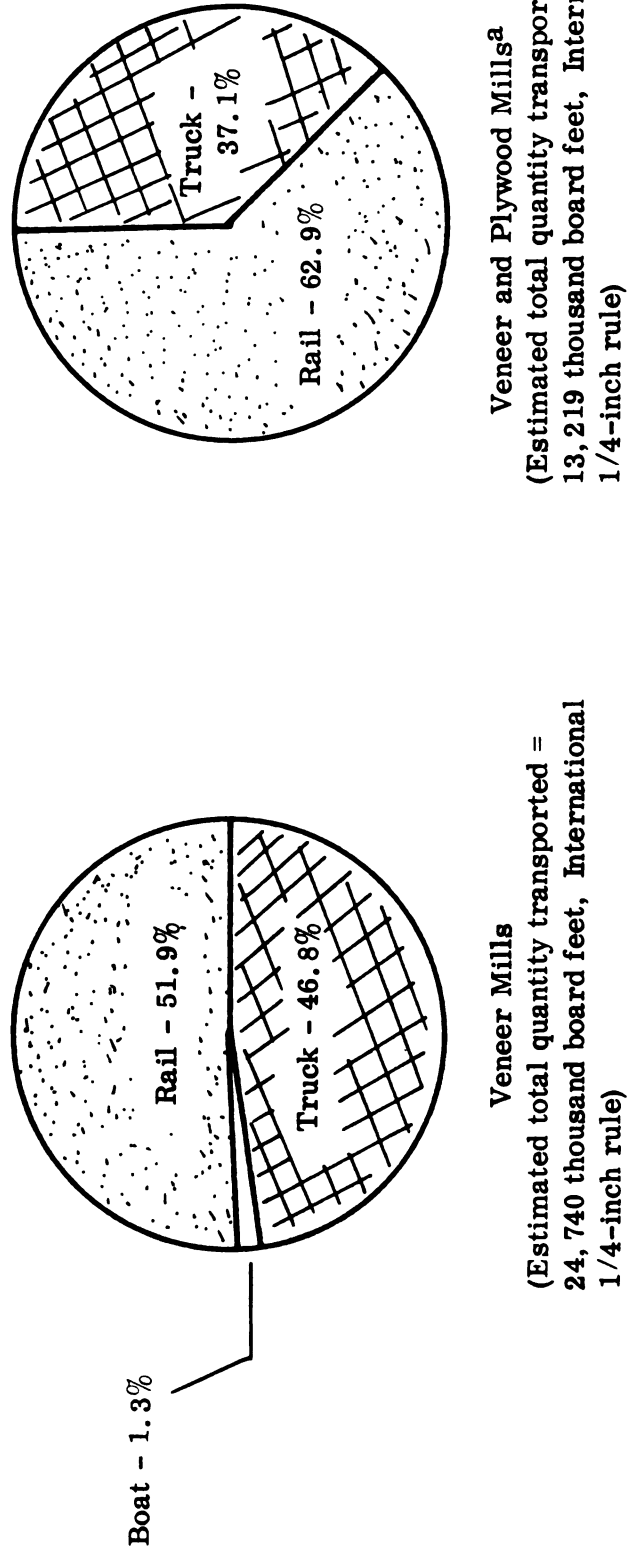
Veneer Log Transportation

Data collected during the study indicate that over 50 percent of the veneer logs received by mills in Michigan and Wisconsin in 1964 arrived by rail (Figure 5). Among the industry groupings, veneer and plywood mills received a larger percentage of their logs by rail than did the veneer mills. There were perhaps several reasons for this difference. First, veneer and plywood mills were generally found to be located further from the resource than were veneer mills. Beyond certain distances, veneer logs are more economically moved overland by rail transportation than by truck. Secondly, the veneer and plywood mills were frequently located in areas of greater population concentration than veneer mills. On the average, a mill in the veneer and plywood industry grouping in 1964 employed 3 times as many people as did the veneer mills. Under these conditions, the average veneer and plywood mill would probably be better serviced by railroads and hence, receive more of its raw materials and ship more of its finished inventories by this means than veneer mills would.

Wages and Employment

Wage and employment data for veneer and/or plywood mills in Michigan and Wisconsin in 1964 are presented in Table 21. Veneer and plywood mills, as an industry grouping, average more employees, both of the blue and white-collar variety, than do the other groupings shown. Another interesting result of this portion of the study was that plywood mills, both of the specialty and regular plywood type, offered higher average hourly wages than did either the veneer or the veneer and plywood mills. Perhaps part of this difference is

Figure 5. --Estimated quantities of logs transported to veneer and/or plywood mills in Michigan and Wisconsin by various modes of transportation in 1964, by industry grouping



^a Figures and percentages based on 7 mills since 3 mills did not have transportation estimates available.

TABLE 21. --Wage and employment data for veneer and/or plywood mills located in Michigan and Wisconsin in 1964, by industry groupings

Wage and Employment Data	Industry Grouping		
	Veneer Mills	Veneer and Plywood Mills	Specialty Plywood Mills
Average Number of Production Workers Per Plant	84	226	16
Average Number of Staff, Office, and Supervisory Personnel Per Plant	7.6	33.5	3.5
Average Weighted Hourly Wage ^a Per Plant	\$1.74	1.76	1.91

^aExclusive of fringe benefits and weighted to reflect the variation in total employment among plants in an industry grouping.

due to the fact that the average plywood mill requires a somewhat more skilled labor force (proportionately) than does the veneer or veneer and plywood mill. In addition, some plywood mills are located within geographic regions where there is strong competition for the available work force. Average hourly wage rates for plywood mills in these areas must be such that they are at least competitive with other opportunities available to the worker.

Production Capacity

In order to obtain some measure of the present level of activity in the regional veneer and/or plywood industry, data on the production capacity of each firm were solicited during the course of the study. Interestingly, this term "production capacity" has been subject to several interpretations. For the purposes of this study, it was defined as that amount of veneer or plywood a mill could produce within a 24-hour period (3 shifts) using existing plant facilities. This definition does not exclude the possibility that additional workers might be added in order to achieve production capacity. As Table 22 illustrates, veneer mills in Michigan and Wisconsin operated at an average 72.2 percent of production capacity in 1964. This closely approaches the 80 percent figure that some mill managers like to see their plants achieve. In contrast to the veneer mills, the plywood portion of the veneer and plywood mills were found to be operating at only 39 percent of production capacity. In fact, the plywood mills, as a group, were lower than the veneer operations. There are several possible explanations for this phenomenon. Mill managers have often expressed the view that low-cost hardwood plywood imports have replaced many of their

TABLE 22. --Estimated percent of total capacity which veneer and/or plywood mills in Michigan and Wisconsin achieved in 1964, by industry grouping

Industry grouping	<u>Estimated percent of capacity (%)</u>	
	<u>Veneer</u>	<u>Plywood</u>
Veneer Mills	72.2	-
Veneer and Plywood	66.6	39.0
Plywood Mills	-	60.0
Specialty Plywood	N.A. ^a	N.A. ^a

^aEstimates not available.

own markets, and in doing so, have caused and sustained this excess capacity problem. Still another view is that plywood manufacture involves many more machines than does veneer manufacture. Thus, the down time due to mechanical failures would probably be greater for the plywood mills.

Other factors responsible for excess capacity in plywood mills are related to the product-mix of these operations. Because hardwood plywood is basically a consumer good, it is subject to a much wider range of markets than is veneer. The heterogeneity of markets which results usually means that plywood mills must build flexibility into their production schedules. At times, efficiency must be sacrificed to meet customer orders and down time for machine change-overs often occurs.

Veneer and Plywood Machinery

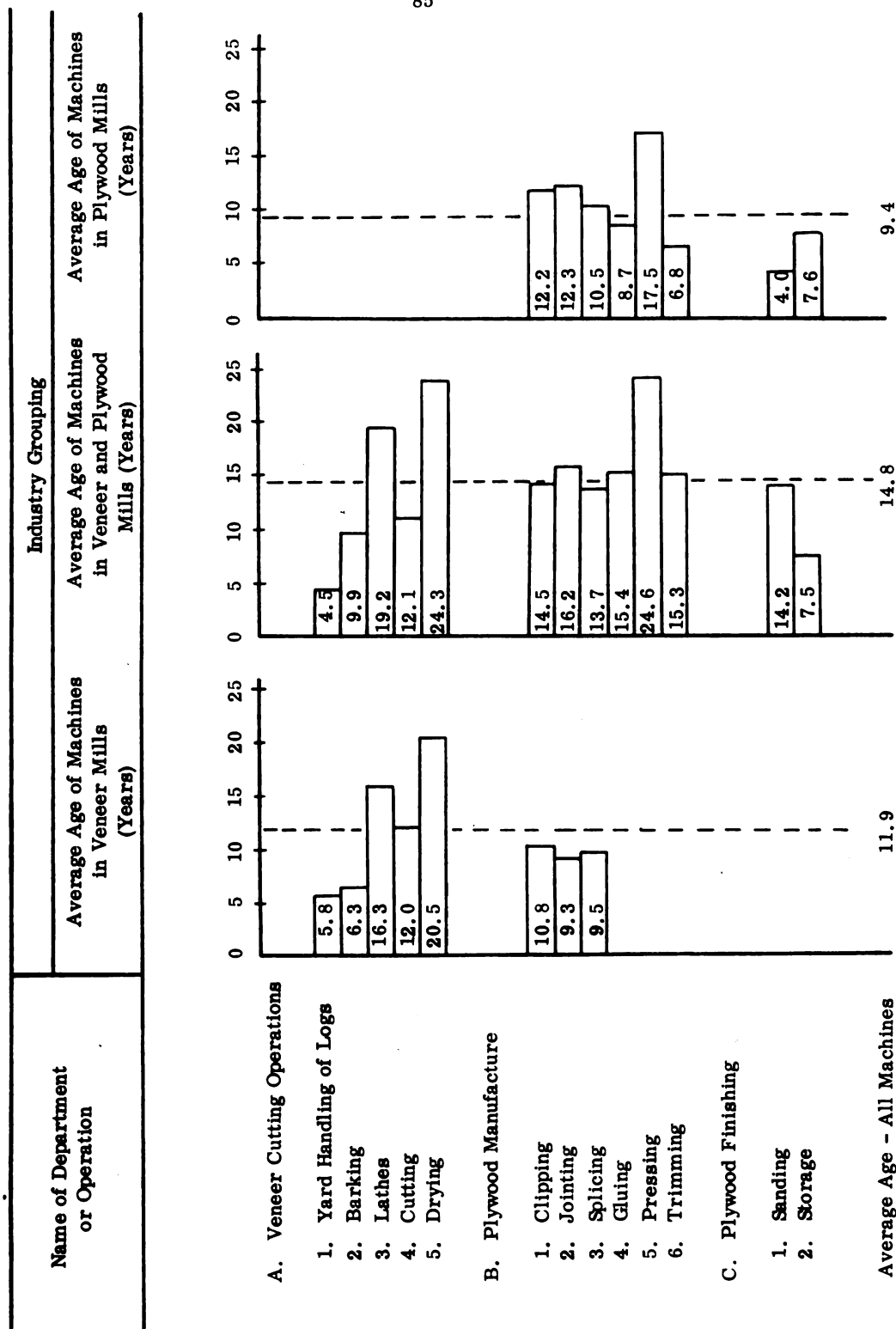
During the course of the mill survey, the age and type of machinery in



each of the veneer and/or plywood mills was measured and recorded. These data are presented in Figure 6 and, as in some of the preceding figures and tables, are based on industry groupings. The average age of machines in these industry groupings has been calculated and has been weighted to reflect the fact that many mills have more than one machine performing a given operation. Lathes and drying equipment found in veneer mills tended to be somewhat newer than their counterparts in the veneer and plywood mills. Overall, the average age of all machines in veneer mills was less than that of the veneer and plywood mills but greater than those in the plywood mills. The reason for these differences is probably due to a number of factors. For one thing, the plywood mills do not have any lathes or drying equipment in their operations. Secondly, the plywood industry in the Lake States does not have as long a history as the veneer industry. In addition, when new veneer mills are established, they frequently lean toward the purchase of used lathes, clippers, and driers. Plywood mills, on the other hand, often invest in new machinery. Apparently, there is a feeling among many veneer mill operators that these machines have changed little over the past 20 years and are a satisfactory substitute for new equipment.

Another process in which machines were found to be quite old was the plywood pressing operation. Again, the feeling of many mill operators was that newer machines do not have any distinct advantages over those now in use. Figure 6 also shows a large difference in the age of sanding machines among the veneer and plywood mills as opposed to the plywood mills. This is perhaps largely due to the types of products each manufacture. For the most part,

Figure 6.--Estimated average age of machinery found in veneer and/or plywood mills in Michigan and Wisconsin in 1964, by industry groupings



plywood mills located within the region manufacture wall paneling and door skins. These products require modern and efficient sanding operations in order to meet rigid product specifications. Sanders developed within the past 5 years seem to be best suited in meeting these demands. The product-mix for veneer and plywood mills contains much less paneling than plywood mills but considerably more of the "specialty" types of plywood. Women's shoe heel stock and golf club heads are examples of the latter. Products of this type require much less sanding than does paneling or door skin material.

In the preceding paragraphs, some mention was made of the age of veneer and plywood machinery used in the regional industry. This subject is quite important and deserves additional comment. Data presented in Figure 6 show that veneer lathes, driers, and plywood presses found in the regional veneer and/or plywood industry average 12 or more years in age. The question arises as to whether many of our regional mills are operating with outdated equipment. It is a situation somewhat similar and analogous to that of an individual who must decide whether it is economically desirable to replace an old automobile with a new one. The decision to buy must be made in light of the technological advances which have been made since the old machine was purchased. In addition, the variable costs associated with each alternative must be tabulated so that valid comparisons can be made between them. Overall, the decision to replace machines requires planning and economic cost data.

Technologically, there have been numerous improvements in veneer lathes in recent years. Two of the more noteworthy developments include the dual spindle lathe and the back-up roll. The incorporation of a second spindle

on the lathe enables logs to be cut to smaller diameters than was previously possible. The lathe is designed so that one spindle is telescoped within the diameter of a larger one. When a veneer log is placed in such a lathe, both spindles are dogged into the log. (Each end of the log is grasped in such a manner.) Initially, when a log is placed in the lathe, the outside spindle provides the necessary torque to turn the log. As the diameter of the log diminishes to about 8 inches, the larger spindle is retracted and the smaller spindle is used to reduce the core to about 4 inches. Prior to the development of this type of lathe, the log could only be safely turned to about 7 inches. Frequently, the log had more veneer on it, but the mechanical limitations of the machines restricted the final core diameter.

Used in conjunction with the dual spindle is the back-up roll. This device is basically a pressure bar that supports the log when the diameter reaches 10 inches and below. Logs six feet and longer frequently bow when the diameter of the core reaches a certain point. When this occurs, the veneer cut under such a condition is not uniform in thickness. The back-up roll largely eliminates this problem and when used with the dual spindles, allows the lathe operator to reduce the core to a uniform diameter of 4 inches.

Other improvements in veneer processing machinery include high-speed clippers which are capable of making several hundred cuts per minute. Under certain conditions, a much smoother flow of material from lathe to drier can be obtained with these clippers. Additional innovations include the "jet drier" which is gas fired and speeds the flow of veneer through the drying process without any appreciable degrade in the material. Also, between the basic

veneer manufacturing machines, one now finds numerous mechanical materials handling devices. These include a device for prepositioning logs at the lathe (lathe charger) and mechanisms for feeding veneer driers. There have also been new developments in plywood laminating presses which should not go unmentioned. Among the more important are improvements in press hydraulic systems which allow for faster closing and opening times. The former greatly reduces the possibility of pre-set in the glue lines while the latter keeps production moving at a quick pace. New presses also have an added advantage in that the platens have been designed to provide more uniform temperatures across their faces. This insures a more evenly cured glue line and a better quality product than obtainable with presses not having these features.

Overall, the mill manager should strive to utilize machinery which maximizes profits and minimizes costs for given units of production. The data presented in Figure 6 indicate that many mill managers need to look more closely at the capabilities of their machines. The external pressures on the regional veneer and plywood industry are such that this avenue of approach seems most logical. Veneer log quality and quantity are apparently decreasing and low-cost imports still account for over 50 percent of our national hardwood plywood consumption. This means that our industry will be turning to smaller logs and that these veneer logs need to be utilized more intensively. Likewise, our regional industry must become more competitive with foreign producers by becoming more efficient in its operations. Machinery plays an important part in either case.

Market Oriented Characteristics of Industry Groupings

Marketing may be looked upon as a process in which the demand for goods and services is: (1) anticipated or identified and (2) increased and satisfied through the creation, promotion and physical exchange of goods and services. At best, the marketing process may be thought of as a very broad function in which there are several levels of acceptable performance. Part of this performance, of course, is somewhat dependent on the type of product and the size of the firm. The mills in our regional veneer and/or plywood industry are really quite small in comparison to the giants of the steel or automobile industries, but their overall marketing goals are very similar.

Veneer and Plywood Manufactured for Stock and Order Purposes

Prudent business managers are keenly aware of the need to minimize the time that elapses between the receipt of an order for goods and the filling of that order. Frequently these managers attempt to analyze the market demand for their firm's products and build inventories which will meet potential orders. Generally speaking, the more homogeneous a given product line is, the greater the possibility that production will be geared to stock items rather than to items made for specific order. On the other hand, heterogeneity within a given line of products usually means that production is geared to orders which have been received from the firm's customers.

In general, our regional veneer and/or plywood industry manufactures products which are more heterogeneous than homogeneous. There are many

species and thicknesses of veneer which can be manufactured and the mill manager cannot possibly turn out large quantities of any given thickness or species without some assurance that he can sell it at a profit of some sort. This assurance usually comes in the form of orders for his firm's products. As veneer is processed into plywood, the number of variables associated with the product increase. Not only must species and thickness be considered, but sizes, shapes, glue types, finishes and core materials must be taken into account. Plywood is much closer to being an ultimate consumer good than veneer is and hence, the variety of possible products broadens considerably.

As Table 23 shows, the face veneer industry in Michigan and Wisconsin made more veneer for orders than for stock in 1964. Some of these mills are owned by large plywood companies which determine the type and amount of veneer to be produced. Other mills have written or oral agreements with plywood producers for specific quantities and types of veneers. Overall, the largest portion of veneer produced is made to order. Veneer manufactured in veneer and plywood mills is usually reserved for plywood production in these mills. Again referring to Table 23, note that over 95 percent of the veneer manufactured in regional veneer and plywood mills was made to order.

Plywood manufactured by the regional mills also was found to be produced on an order basis for the most part. Approximately 71 percent of the plywood made by the firms in the veneer and plywood industry grouping was based on orders while nearly 99 percent of the production of firms comprising the plywood industry grouping fell into this classification. The difference between the two groupings is perhaps due to the considerable amount of specialty plywood

TABLE 23. --Estimated quantities and percentages of veneer and plywood made for stock and order by mills in Michigan and Wisconsin in 1964, by industry groupings

Type of Production	Industry Grouping							
	Veneer Mills		Veneer and Plywood Mills ^a		Plywood Mills		Specialty Plywood	
			Veneer		Plywood			
	Estimated quantity in millions of sq. ft. surface meas.	Per- cent (%)	Estimated quantity in millions of sq. ft. surface meas.	Per- cent (%)	Estimated quantity in millions of sq. ft. surface meas.	Per- cent (%)	Estimated quantity in millions of sq. ft. surface meas.	Per- cent (%)
Made for Stock	142.35	33.0	7.7	4.4	15.0	28.6	1.83	1.1
Made to Order	289.15	67.0	166.3	95.6	37.5	71.4	167.97	98.9
Total Amount	431.50	100.0	174.0	100.0	52.5	100.0	169.80	100.0

^aAverages based on 8 mills since 2 mills did not have production figures available.

manufactured by the veneer and plywood mills. Many specialty items, like shoe heel stock and golf club heads can be manufactured for stock inasmuch as species and design vary little from order to order. The mills in the plywood industry grouping, on the other hand, manufacture very little specialty plywood and concentrate more on wall paneling and doors; products in which consumer demand is likely to vary quite frequently and where numerous product characteristics may be found.

Average Inventory of Veneer and/or
Plywood Mills

As part of the study on the regional veneer and/or plywood industry, mill managers were requested to furnish information on their inventories. This term "inventory" is taken to mean a list of goods on hand which may consist of stock and/or ordered items. The average veneer inventory of veneer and plywood mills was found to be somewhat larger than that of the veneer mills. Some of this difference was due to the fact that veneer and plywood mills utilize nearly all of the veneer they manufacture. These mills tended to carry higher inventories in order that their plywood operations might be adequately supplied. In regard to plywood inventories, it was noted that veneer and plywood mills carried inventories averaging nearly 3 times those of the plywood mills. The difference between these industry groupings is again due to the specialty products produced by the former. One might suspect that most of the plywood inventory carried by the veneer and plywood mills is in the form of stock specialty items. Inventory data for the industry groupings is presented in Table 24.

TABLE 24. --Estimated average inventory of veneer and/or plywood mills in Michigan and Wisconsin in 1964, by industry groupings

Product Type	Industry Grouping		
	Veneer Mills	Veneer and Plywood Mills ^a	Plywood Mills Specialty Plywood Mills
Average Veneer Inventory (sq. ft., surface measure)	3,439,000	5,020,000	
Average Plywood Inventory (sq. ft., surface measure)		620,000	235,570 31,500

^a Figures based on 5 mills since the remaining 5 mills did not have inventory data available.

Distribution Methods

Regional veneer and/or plywood mills use five basic distribution methods: The agent or broker, the parent-firm, company salesmen, the house account, and the wholesaler.

The agent or broker serves the smaller mills and charges a fee for his services, usually about 5 percent of the invoice valuation of the goods.

The parent-firm is a company that usually has a controlling interest in the veneer and/or plywood firm and takes all its production. The producing mills is frequently referred to as a "captive" operation under these conditions.

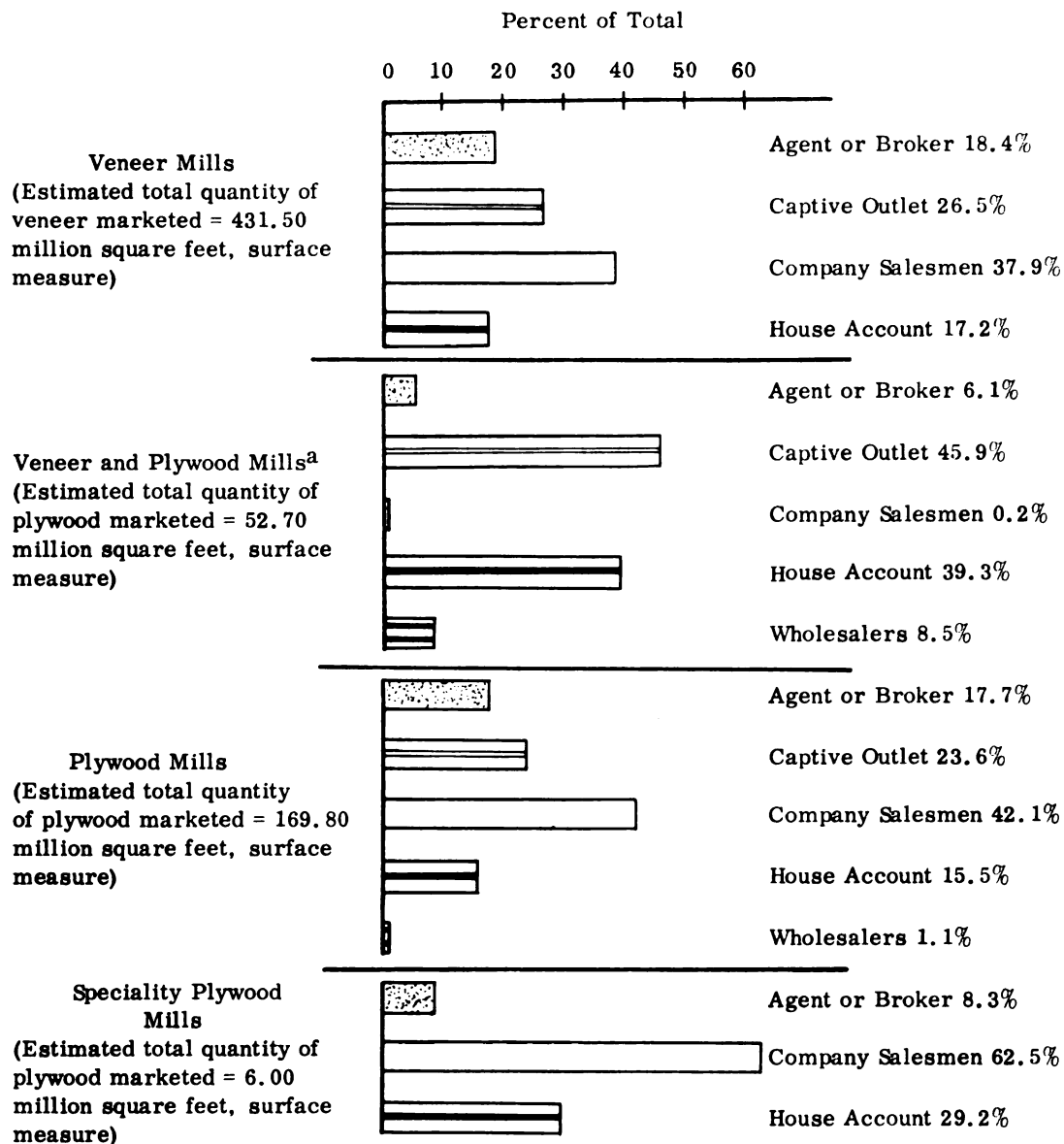
Company salesmen are employed by the producing firm to sell veneer and plywood.

In the house account method, no soliciting actually takes place. As a producing firm becomes well established in the business, it often finds that certain buyers become loyal to the firm. No salesmen need contact this type of customer to secure the order unless technical services are requested by the buyer.

The wholesaler buys plywood from the regional mills and redistributes it on a cost-plus basis. His markets are usually retail lumberyards or other market channels that sell directly to the ultimate plywood consumer.

Data on distribution methods for veneer mills show that company salesmen marketed nearly 40 percent of the total veneer produced in 1964 (Figure 7), and agents or brokers handled about 18 percent. The smaller veneer

Figure 7. --Estimated quantities and percentages of veneer and plywood marketed by mills in Michigan and Wisconsin through various market channels in 1964, by industry groupings



^aFigures based on 8 mills inasmuch as 2 mills did not have production data available. In addition, figures on veneer market channels are not shown for this industry grouping since all or most of the veneer manufactured by these mills was sent to their own plywood operations.

mills¹ frequently utilize brokers or agents because they provide a means of distributing veneer at a lower cost than is possible by other methods. Maintaining a sales staff can be a costly venture if the product volume is low.

For the veneer and plywood industry grouping, most of the plywood is handled through the house account (39 percent) and parent-firm (46 percent) arrangements. These data are substantially weighted by the output of 2 large mills that market through the parent-firm--that is, send their plywood directly to company-owned warehouses for further distribution. Because many of the regional veneer and plywood mills are large and well established, they also utilize the house account arrangement rather extensively.

Company salesmen market a considerable amount of the production of the firms making up the industry grouping for plywood mills. For the most part, these mills lack the marketing network that some of the larger veneer and plywood mills seem to have. Also, they are less likely to be part of a large integrated forest products company, although their plywood production may equal or surpass that of the veneer and plywood mills. Consequently, they rely heavily upon company salesmen to market their products. The smaller plywood mills, like the small veneer mills, lean toward the use of agents or brokers.

Specialty plywood mills in the region produce a variety of items that go

¹For the purposes of this study, mills are classified by size (annual production in million square feet, surface measure) as follows: Veneer mills (veneer production)--small, up to 15; medium, 16-50; large, more than 50. Veneer and plywood mills (plywood production)--small, up to 1; medium 1-9; large, more than 9. Plywood mills--small, up to 3; medium 3-35; large, more than 35.

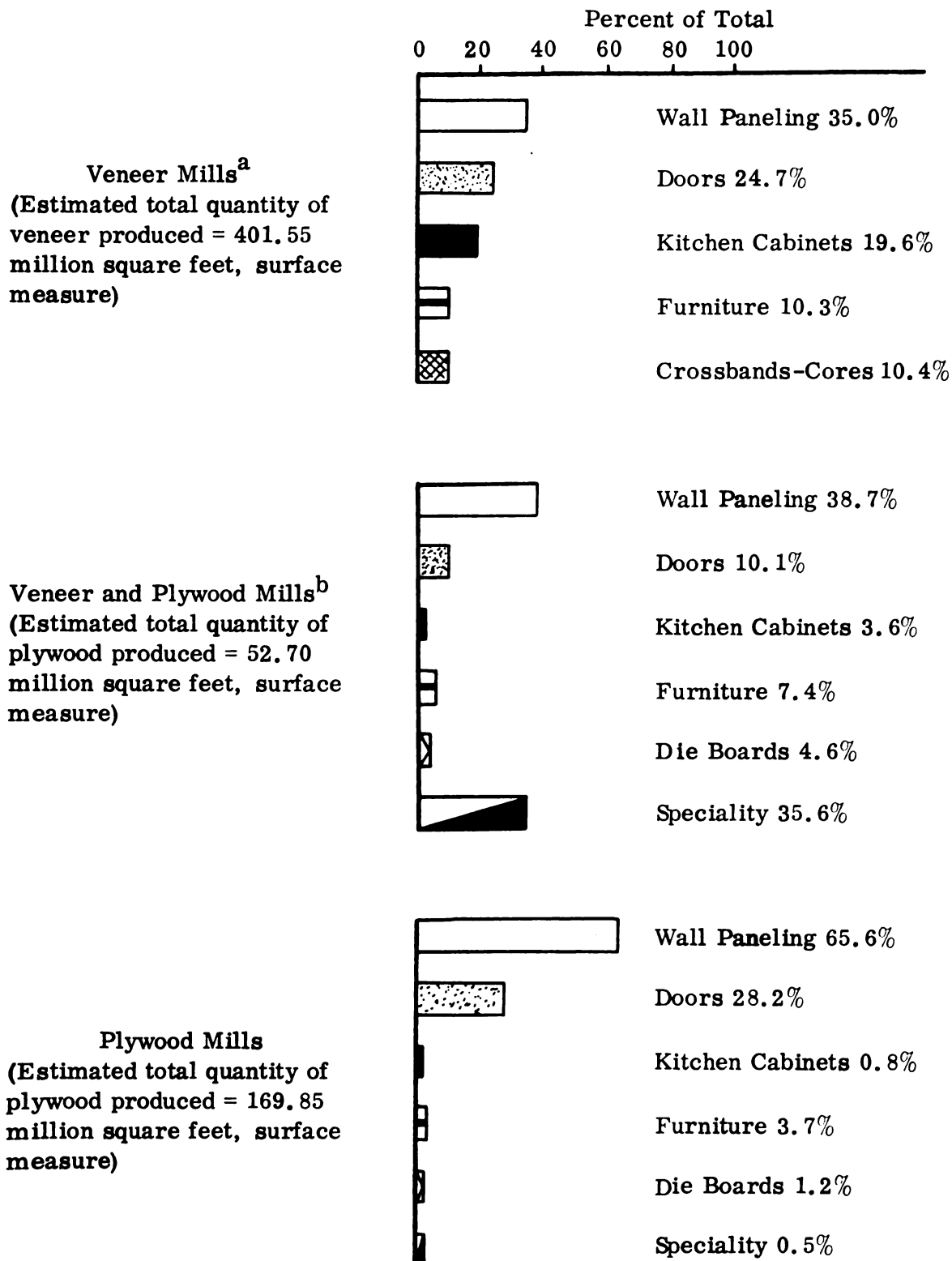
into the construction of both residential and nonresidential furniture. Most of this is in the form of curved or molded plywood for chairs and sofas. Among other products, they also manufacture church pews and curved wall paneling. These specialty mills account for only a small part of the total plywood manufactured in Michigan and Wisconsin. Company salesmen market most of the material produced by these mills; house accounts are also an important marketing method.

End-Uses for the Products

Hardwood veneer manufactured in the region is incorporated into many kinds of plywood. Wall paneling, doors, and kitchen cabinets are the more common uses (Figure 8). This veneer is consumed, to a large extent, by plywood operations in Michigan and Wisconsin, but some is shipped to firms outside the region.

Veneer and plywood mills have faced increasing competition from abroad in the form of low-cost plywood imports. In an attempt to minimize the effect of these imports, regional plywood mills have either customized some of their traditional products or have included many specialty items in their product lines. Wall paneling and door skins are being imported into the United States in considerable quantities and account for roughly 50 percent of all domestic hardwood plywood consumption. Whereas stock paneling, doors, and kitchen cabinets were once the mainstay of the regional veneer and plywood industry, they are now being replaced by specialty items or being modified to some extent. For example, some firms are currently manufacturing doors

Figure 8.--End-uses for products produced in veneer and/or plywood mills in Michigan and Wisconsin in 1964, by industry groupings



^aData and percentages based on 10 mills.

^bData and percentages based on 8 mills.

which are specially machined to allow direct placement into the opening for which they were intended. Prefinished-plywood manufacturers are using new coating techniques and materials on wall paneling and doors. The net effect is the creation and expansion of markets not served by the imports. Specialty products, such as shoe heels, golf club heads, and die boards (a form of plywood used by the printing industry) are also growing in popularity among the regional mills. Altogether, these specialty products accounted for nearly 25 million square feet (surface measure) of plywood in 1964.

Over 65 percent of the nearly 170 million square feet of plywood produced by plywood mills was in the form of wall paneling (Figure 8). The product-mix, however, is heavily weighted toward this particular product by one mill which manufactured only wall paneling and accounted for a large percentage of the total production of the seven mills in this industry grouping. Significantly, it was the only plywood mill exclusively engaged in the manufacture of wall paneling, one area in which low-cost imports have been most competitive and have accounted for large volumes of plywood. This same firm operates its own core and crossbanding mill in Africa and is geared to high-speed production techniques, both here and abroad. The face veneer used in this mill is mostly domestic, but some quantities are imported.

In future years, specialty items may comprise a greater percentage of the total plywood volume manufactured in the region. Kitchen cabinets will probably also grow in importance in the product-mix, largely because wood is again becoming the preferred material for this popular consumer item. The enactment of a proposed reduction in the tariff on hardwood plywood will place

increased pressure on regional mills manufacturing wall paneling and doors. Technological innovation and production efficiency will be needed to offset rising log and labor resource costs.

The region is also currently going through a phase of "expansion by acquisition" in which some veneer and/or plywood mills have been purchased by large national wood products firms. The net effect on the distribution methods is that more veneer and plywood will probably be marketed under the parent-firm arrangement in the future years. Undoubtedly, distribution methods and end-uses for hardwood face veneer and plywood will continue to shift.

Summary

In 1964, there were 24 hardwood face veneer and plywood firms in Wisconsin and 8 in Michigan. As part of a general survey of the industry, each firm was visited to obtain information in a number of subject areas. Mills were classified according to the general type of product being made at the time of the visit: There were 11 veneer mills, 11 veneer and plywood mills, 7 plywood mills, and 3 specialty mills.

Executives interviewed during the course of the study cited many problems which they believed confronted the industry today. Among the more important were the low-cost imports entering the country, the decrease in quality of the raw material supply, the export of native log species such as walnut, the continued rise in labor costs and the lack of trained manpower. Also mentioned as a problem area was the competition being received from such plywood substitutes as printed board and plastic laminates. In addition, the executives

contended that low-cost imported wall panels and door stock have been responsible for many mills switching from the profitable and traditional panel lines to various specialty plywood items.

Over 90 percent of the veneer produced by either the veneer or the veneer and plywood mills in Michigan and Wisconsin was the rotary type. Altogether, more than 600 million square feet (surface measure) of commercial-type veneer was produced by mills in Michigan and Wisconsin in 1964. In relation to plywood production, the investigation showed that 3-ply veneer plywood constituted a large portion of all plywood manufactured within the region. The 3-ply material was extensively used in prefinished hardwood plywood panels.

Perhaps one of the most significant findings of the mill survey was related to the age of veneer and plywood machinery being used by regional manufacturers. Data collected during the study showed that veneer lathes, driers, and plywood presses averaged 12 or more years in age. Technologically, there have been numerous improvements in veneer manufacturing machinery in recent years, especially among the lathes. The results of this study would indicate that veneer and plywood manufacturers need to take a close look at their machinery, both in respect to age and capability.

The regional industry produces a multitude of veneer and plywood products, and the markets they serve are equally varied. A large portion of all veneer and plywood manufactured by mills in the survey was made to order, with wall paneling, doors, and kitchen cabinet stock being among the more important products. Five basic distribution methods were identified as being commonly used by these mills: The agent or broker, the parent-firm, company salesmen,

the house account, and the wholesaler.

Although wall paneling, doors and kitchen cabinet stock comprised a major portion of the product-mix, specialty plywoods are becoming increasingly important. Among other products, curved or molded plywood for chairs, sofas, church pews, and wall paneling fall into this category. It is expected that further emphasis will be given to the production of specialty plywoods in future years.

It was also noted during the course of the study that the region is currently going through a phase of "expansion by acquisition" in which some veneer and/or plywood mills have been purchased by large national wood products firms. It appears that this trend will continue in future years inasmuch as the causal elements behind the acquisitions continue to remain. Among these elements is a general reluctance on the part of some mill managers to risk capital on needed improvements in plant facilities. This is especially true in the firm where there has been a pattern of family ownership, but for some reason, no member of the family is interested in continuing the operation. Then, too, profit margins have been quite low in the veneer and plywood industry in recent years. Undoubtedly, this has severely hampered many firms in their desire to implement capital improvement programs. Under these conditions, some regional mills have become susceptible to acquisition and generally speaking, all concerned have benefited.

CHAPTER VI

AN ANALYSIS OF RAW MATERIAL AND PRODUCTION COSTS FOR SELECTED REGIONAL AND FOREIGN HARDWOOD FACE VENEER AND PLYWOOD MILLS

A considerable amount of variation was found to exist among the costing methods used by hardwood veneer and plywood firms that were included in this study. There are perhaps several reasons for this, but the size and complexity of the firm are among the more important. It was generally observed in the study that firms producing 5 million or more square feet of hardwood plywood, annually, could be expected to make use of fairly detailed cost accounting systems.

The regional veneer and plywood industry, we have seen, is faced with a number of problems. Some are resource related while others appear to be caused by overaged equipment and loss of traditional markets. It is hoped that a study and comparison of costs associated with plywood manufacture will corroborate earlier observations made regarding the regional industry. A study of costs encompasses most of these problems and should prove valuable in further identifying specific areas where more research is needed.

Methodology

Statistics for 1964 indicate that 44 percent of all domestic hardwood plywood production was in the form of 1/4-inch veneer-core plywood and that 49

percent of this domestic production was manufactured into prefinished wall panels, the majority of which were standard 4' x 8' panels. On a volume and dollar basis, prefinished 4' x 8' wall panels of 1/4-inch veneer-core plywood represented one of the most important hardwood plywood product types produced in 1964. For this reason the above produce was initially selected for this portion of the overall analysis of the regional industry.

There are several reasons for including product cost data in an analysis of the regional veneer and plywood industry. First, there is the value of the data itself in determining the percentages of raw material, labor, fixed, variable, and administrative costs in the selling price of a given quantity of hardwood plywood. A second major reason for collecting this cost data is that it might be used in making a comparison of regional and foreign manufacturers. Thirdly, the costs of regional and foreign mills could then be compared to our national industry. Overall, the cost comparison study was designed to discover major areas of difference between regional, domestic and foreign producers of hardwood plywood. In doing this, perhaps some of the major problem areas of the regional manufacturers could then be substantiated and/or identified. Then, too, the validity of the methods used in conducting this type of research might also be tested.

In 1964, there were only 5 mills in Michigan and Wisconsin known to have produced prefinished hardwood plywood. Of this group, only 3 were found to have cost data that might be used in the study. But due to differences in species used in plywood manufacture and the preciseness of the cost data, only two regional mills could be compared in the final analysis. Even among these two

mills, there were wide diversities among the data. Total cost information on yellow birch and walnut wall paneling (1/4-inch, 3-ply, veneer-core, No. 1 Face and No. 4 back) were obtained from these two mills. Cost data were based on units of 1000 square feet, surface measure, and tabulated on prepared forms (see Appendix B).

A survey of the literature indicated that Japan, Canada, Finland and the Philippines account for a major segment of the hardwood plywood consumed in the United States each year. Our domestic producers, as a group, look upon hardwood plywood imports from these countries as a major concern, both in relation to their manufacturing operations and their plywood markets. The study was initially designed to include cost data on wall paneling from each of the 4 countries.

Two Canadian firms were visited as part of the study and cost data were collected on prefinished 1/4-inch walnut paneling. As in the case of the regional mills, data were tabulated on prepared forms. Neither of the two Canadian operations were able to provide cost figures on yellow birch.

Cost data on the production of 1/4-inch lauan wall paneling in the Philippines were obtained from a report on that industry. The cost classifications were very general, but proved useful in the analysis. Limited data on the Finnish plywood industry were obtained, and again, the cost classifications were general. There is no known cost data available on the Japanese industry and attempts to obtain it proved futile, both through the Imported Hardwood Plywood Association and the Japanese Hardwood Plywood Association.

After the cost data on the regional and foreign hardwood veneer and

plywood mills had been collected, the results were compared to a report on operating income factors for the national industry, the latter having been prepared by the accounting firm of Seidman & Seidman for the Hardwood Plywood Manufacturers Association.

Raw Material and Production Costs for Two Regional Mills

Two regional mills provided information on the cost of manufacturing 4' x 8' hardwood plywood wall paneling. This wall paneling was of 3-ply, veneer-core, 1/4-inch construction with a No. 1 face and a No. 4 back. Species included walnut and yellow birch. We shall refer to the two mills as merely "Mill A" and "Mill B".

Mill A is one of the largest veneer and plywood mills in Wisconsin, both in relation to its production and the number of people it employs. In 1964, there were 738 production workers and 110 staff members on the payroll. The average wage of the former was \$1.98 per hour. This figure includes fringe benefits which amounted to roughly 10 percent of the base salary. Although the firm had 4 rotary veneer lathes in use, no veneer production figures were available. The mill consumed 15 million square feet, surface measure, of rotary-cut veneer in 1964. Another 23 million square feet of sliced veneer was also used. Roughly 7.7 million square feet of all types of hardwood plywood was manufactured by Mill A in 1964 with about 36 percent of it in the 3-ply classification. Approximately 60 percent of all plywood production went into various types of doors, the remainder was used in the manufacture of plywood panels. The four lathes averaged 36 years in age while 2 driers and 3 presses averaged 23 and 33 years, respectively. Virtually all

plywood manufactured in the plant was made to fill orders already on hand.

Mill B employed 135 production workers and maintained a staff of another 25 people. The average hourly wage paid to production workers was \$1.87, including fringe benefits. The mill used 6.5 million square feet of rotary-cut veneer in 1964. An additional 2.5 million square feet of sliced material was also consumed. The firm produced 16 million square feet of rotary-cut veneer in the same year, the excess of production-over-consumption being sold to other plywood manufacturers. Plywood production totaled 2 million square feet, roughly 50 percent of it being 3-ply construction. About 5 percent of the total plywood production was in the form of standard 4' x 8' wall paneling. Another 15 percent of the plywood went into flush doors, the remainder being distributed among such products as desk tops, architectural panels and light shields. Mill B had two rotary lathes, one drier and two presses in operation. They averaged 17, 30 and 20 years in age, respectively. Ninety-five percent of all plywood was made-to-order.

Cost data for Mill A are presented first (Table 25). In all probability, it represents the most detailed cost accounting system used by any hardwood veneer and plywood firm in the region.

TABLE 25. --Average costs encountered by Mill A in manufacturing 1000 square feet (surface measure) of 1/4-inch hardwood plywood wall paneling (face veneers of either yellow birch or walnut, 3-ply, veneer-core construction, No. 1 face and No. 4 back)

Operation	Cost per thousand square feet (dollars)			
	1/28-inch birch face	1/28-inch walnut face	1/28-inch back (birch)	1/6-inch lauan center
Log Run Veneer	\$13.37	--	--	--
Conversion to Grade ^a	(68.92%)	--	--	--
Face Veneer	19.40	\$ 66.20	\$ 2.80	\$39.90
Mfg. Yield ^b	(57.7%)	(34.5%)	(70.4%)	(75.1%)
Finished Veneer	\$33.66	\$191.86	\$ 3.97	\$53.10
Tape	.49	--	.50	--
Glue (splicing)	--	.26	--	.26
I. Total Material	\$34.15	\$192.12	\$ 4.47	\$53.36
1 Peel Veneer ^c	\$10.51		\$ 5.91	--
Roller Dry Veneer	3.06		1.73	\$ 2.34
2 Redry Veneer	1.68		1.39	--
Dry Clip	2.81		1.99	3.10
Joint	1.92		--	1.87
Match	5.42		--	--
Splice	3.26		3.31	2.40
Inspect	4.03		2.06	2.54
Face Repair	2.26		--	--
Size Clip	1.20		.31	(Wide-belt (Sanding-2.37
Dept. Service ^d	.70		.70	.70
II. Total Labor	\$36.85	\$ 22.87	\$17.40	\$16.12
Variable Expense ^e				
1 Veneer Mill	\$ 5.43	--	\$ 3.06	--
Single Ply	6.98	--	2.93	\$ 5.89
Preparation and Mfg.				
III. Total Variable Exp.	\$12.41	\$ 6.86	\$ 5.99	\$ 5.89
Direct Cost (Sum of I, II, III)	\$83.41	\$221.85	\$27.86	\$75.37

TABLE 25--Continued

IV. Panel Fabrication Direct Cost (from separate sheet) = \$32.68 (birch or walnut)

V. Natural Finish (from separate sheet) = \$45.59 (birch or walnut)

VI. Wrapping-Bagging Direct Cost (from separate sheet) = \$4.35 (birch or walnut)

Total Direct Cost

(Sum of I, II, III, IV, V, VI) \$269.26 (birch); \$407.70 (walnut)

Fixed Expense^f (18% of Direct Cost) \$48.47 (birch); \$73.39 (walnut)

Total Cost (f.o.b. mill) - \$317.73 (birch); \$481.09 (walnut)

^aConversion to grade - that percent of log run veneer that is suitable for face veneer prior to green clipping operations.

^bManufacturing yield - the percentage of veneer that is intended for faces, backs or centers that is used in that manner after wet clipping operations take place. In the case of walnut, the veneer is purchased in a flitched and dried condition, the major loss occurring in the trimming of sapwood from the veneer. The lauan is also in a dry condition.

^cIncludes through green clip.

^dDepartmental Service - includes non-productive labor used in single ply preparation and manufacture from redry to size clip operations.

^eVariable expense - includes indirect labor, repair, and maintenance labor, operating supplies, purchased utilities and fuels, etc.

^fFixed expense - includes factory supervision, rentals of space and equipment, taxes, property insurance, depreciation of fixed assets, etc.

The panel fabricating cost (IV) of Table 25 consisted of the following costs:

	<u>Cost per thousand square feet of paneling</u>
A. Material (glue)	\$ 5.00
B. Labor:	
Line up	1.98
Mix glue	.59

Cost per thousand square
feet of paneling

B. Labor: (Cont.)

Spread glue	3.21
Hot press	1.54
Drum-sand back	2.50
Size panel	1.62
Patch	3.65
Speed polish & inspect	3.36

Total Labor	\$18.45
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C. Variable Expense	<u>9.23</u>
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Total Direct Cost of Fabricating	\$32.68
----------------------------------	---------

The natural finishing costs* (V) of Table 25 consisted of the following

Costs:

Cost per thousand square
feet of paneling

A. Material (lacquer finish)	\$11.30
------------------------------	---------

B. Labor	23.65
----------	-------

C. Variable Expense	<u>10.64</u>
---------------------	--------------

Total Direct Cost of Finishing	\$45.59
--------------------------------	---------

The wrapping cost (VI) of Table 25 consisted of the following costs:

Cost per thousand square
feet of paneling

A. Material (bags)	\$ 1.51
--------------------	---------

B. Labor	1.96
----------	------

C. Variable	<u>.88</u>
-------------	------------

Total Direct Cost of Wrapping	\$ 4.35
-------------------------------	---------

*Seal-sand-2 topcoats, back seal.

The costs for items IV, V, and VI are the same, regardless of whether the species is birch or walnut. The total costs for the backs and centers are also the same, even though the face species of the panel may be different. Direct costs (the sum of items I - VI in Table 25) are added to fixed expenses to arrive at the total cost, f.o.b. mill. A profit margin has been included in the fixed expense, probably accounting for just over one-half of the total figure.

When logs are turned on the lathe, not all of the veneer that is cut can be used. Furthermore, not all of this veneer can be used for faces. The cost accounting system of Mill A is designed to reflect these differences in uses. For example, the log run veneer cost for yellow birch was \$13.37 per thousand square feet. Experience with this species enable Mill A to arrive at the 68.92 percent figure for conversion to grade, or in other words, only 68.92 percent of the veneer coming from the lathe would be suitable for faces. The firm uses a residual costing system at this point which, in effect, says that the face material left must carry the cost of the material that is "lost".¹ The cost for this \$13.37 (per thousand square feet) log run veneer then becomes $\$13.37 / .6892$ or \$19.40. After wet clipping of the faces is completed, another loss of material occurs. This amounted to 57.7 percent of what remained after conversion to grade. The finished green veneer then cost $\$19.40 / .577$ or \$33.66 per thousand square feet based on the residual costing system.

Because Mill A does not cut walnut veneer, there are no log run figures. The walnut face veneer, as they purchase it, costs them \$66.20 per thousand

¹The material at this point is not really lost; at least a portion of it may be used for backs.

square feet, but a manufacturing yield of 34.5 percent pushes the ultimate cost of this veneer up to \$191.86 per thousand. This walnut veneer is purchased from a walnut manufacturer on a flitch basis. It has already been dried to a moisture content of 7 to 10 percent and needs to be trimmed and clipped to meet mill specifications. The low manufacturing yield for walnut is largely due to the characteristics of the wood and how it is being used. First, sapwood must generally be removed from the veneer before it can be used in the better paneling grades. This is certainly true where a No. 1 face is required. Secondly, walnut tends to split more easily than birch does and losses in jointing, splicing and clipping are somewhat greater. Nearly all of the \$22.87 labor cost for walnut (Table 25) can be attributed to these operations since the veneer was neither peeled (sliced) or dried by Mill A.

Core stock consisted of 1/6-inch lauan (philippine mahogany) for both the walnut and birch panels. As was the case with walnut, the material was purchased dry and must be reworked by the mill in order to suit its own needs. The finished core material cost the firm \$53.10 per thousand square feet. Glue costs added another \$.26.

Cost item III (Table 25) is a sum of variable expenses (outside of direct labor) associated with the manufacture of veneer. Variable expenses are also included in cost items IV, V, and VI. In the case of all four, these expenses may include all or part of the following:

- A. Repair and maintenance labor
- B. Other indirect labor (fireman, watchmen, sweepers, etc.)
- C. Allocated payroll costs (pension, compensation, insurance, etc.)

- D. Repair and maintenance materials, outside contracts
- E. Operating supplies
- F. Small tools
- G. Purchased utilities and fuels

Fixed costs, in contrast, include the following:

- A. Salaries and wages for
 - (1) factory supervision
 - (2) plant maintenance
- B. Rentals of space and equipment
- C. Taxes
- D. Insurance - property
- E. Depreciation of fixed assets
- F. General and administrative
 - (1) factory management
 - (2) production control
 - (3) purchasing
 - (4) personnel
 - (5) technical services
 - (6) accounting and payroll

The plywood output of Mill A goes directly to warehouse locations through the United States. One of these is located in Chicago where the birch described in the cost analysis is sold to wholesalers at \$450 per thousand square feet. Recommended retail price for this same material is \$675 per thousand. The

walnut, on the other hand, wholesales for \$520 per thousand square feet and retails at \$780 per thousand.

Mill B, in contrast to A, uses a much less sophisticated method of costing (Table 26). The products being compared are quite similar, with only the back species differing.

The only difference in the cost of the walnut and birch paneling produced by Mill B lies in the cost of material for the faces. Yet, Mill A notes a \$22.87 charge for labor in preparing its walnut. Part of the difference may be due to the fact that Mill B purchases walnut which needs little trimming or any other alterations prior to its use. Mill B, like A, also cuts its own yellow birch veneer.

The reader may readily note the lack of detail in Mill B's costing system. Unfortunately, such a system can do little more than give one a rough idea of how the costs are being allocated. Throughout the region, the efficient management of hardwood veneer and plywood mills is perhaps being hampered by inadequate cost accounting systems.

Cost item C (Table 26) is termed "overhead" and is figured at 80 percent of the total labor cost. Overhead is basically another name for fixed costs, the components of fixed cost for Mill B being the same as those listed for A. Administrative costs for Mill B were noted to be 8 percent of the total manufacturing costs. These costs, too, may be regarded as fixed and include all of those mentioned under General and Administrative costs for Mill A.

The selling prices, f.o.b., for panels manufactured by Mills A and B cannot be compared until two further modifications are made to the cost data

TABLE 26. --Average costs encountered by Mill B in manufacturing 1000 square feet (surface measure) of 1/4-inch hardwood plywood wall paneling (face veneers of either yellow birch or walnut, 3-ply, veneer-core construction, No. 1 face and No. 4 back)

Cost item	Cost per thousand square feet, surface measure
Material:	
Face - 1/28-inch birch	\$ 76
walnut	(\$250)
Back - 1/24-inch basswood or hard maple	15
Center - 1/6-inch lauan	56
Glue for panel fabrication	<u>5</u>
A. Total Material	\$152
Labor:	
Face	\$ 12
Back	6
Center Handling	1
Glue Application	3
Trim and Sand	<u>10</u>
B. Total Labor	\$ 32
C. Overhead (80% of total labor)	\$ 26
D. Total Manufacturing Cost (A+B+C)	\$210
E. Administrative Costs (8% of Mfg. Cost)	17
F. Selling Price with 10% Profit (\$227/.90)	252
G. Selling Price with 5% Insurance Added (\$252/.90)	265
Selling Price, f.o.b. for Birch	\$265
Selling Price, f.o.b. for Walnut	439

of B. First, Mill B does little prefinishing of plywood wall paneling and as a result, does not keep cost data on this process. Secondly, no protective wrapping costs were included for Mill B. Prefinishing costs for Mill A, we noted, were roughly \$45 per thousand square feet while protective bagging and wrapping added another \$4.35. More than likely, the prefinishing cost reported by A is considerably above average. This would appear to be the case since another mill (not used in this study because most of the cost data were not detailed enough) did report finishing costs of nearly \$25 thousand square feet. A conservative guess would be that prefinishing costs and protective wrapping would add another \$30 to the f.o.b. selling prices of both walnut and birch for Mill B.

A comparison of costs between Mills A and B reveals some interesting aspects of the costing system each uses (Table 27). The analysis is based on figures presented in Tables 25 and 26.

At first glance (Table 27) it would seem there are perhaps only a few comparable cost areas for Mills A and B. Total selling prices, for example, are very close to one another. The material costs for the centers are also very similar. However, each of the totals for all three major cost items (materials, labor, fixed costs) vary greatly. The basic differences are apparently the result of the costing systems employed by each. Mill A uses a very precise system that is capable of finely dividing its labor costs while Mill B chooses to use a much more simplified system. Undoubtedly, some of the labor costs of Mill B have been included in material costs, especially in the case of face and back material. This statement is based on the assumption that Mill A's costing system more adequately presents the true division of costs between labor,

TABLE 27. --A comparison of costs encountered by Mills A and B in manufacturing of 1/4-inch yellow birch hardwood plywood wall paneling

Cost item	Cost per thousand square feet (dollars)	
	Mill A	Mill B
Material:		
Face	\$ 34.15	\$ 76.00
Back	4.47	15.00
Center	53.36	56.00
Glue for Panel Fabrication	<u>5.00</u>	<u>5.00</u>
Total Material	\$ 96.98	\$152.00
Labor: (Direct & variable)		
	<u>Direct</u>	<u>Variable^a</u>
Faces	\$ 36.85	\$ 12.41
Backs	17.40	5.99
Center	16.12	5.89
Glue Application)	<u>18.45</u>	<u>9.23</u>
Trim and Sand)		<u>10.00</u>
Total "Labor"	\$ 88.82 +	\$ 33.52
Fixed Expenses	\$ 48.47	\$ 81.00
Total Selling Price, f.o.b.		
Less Prefinishing and Protective Wrapping	\$267.79	\$265.00

^aThe method of costing used by Mill A uses the variable cost concept. Most of this cost is for indirect labor, although some material costs are also included. For purposes of comparison, all were assumed to be labor costs.

material and other cost elements. Overall, the diversity of costing systems in Mills A and B tends to stymie further comparative analysis between the two operations.

Raw Material and Production Costs for Two Canadian Firms

Two Canadian hardwood veneer and plywood mills were included in the cost study. To preserve their identity, they will be referred to as Mills C and D. Mill C produced 66 million square feet of rotary-cut veneer in 1964, 65 percent of which was exported. It manufactured 15 million square feet of hardwood plywood the same year, and 75 percent of this was in the form of wall paneling. Most of the paneling was a 3-ply, veneer-core construction. Two rotary lathes and 2 driers were in operation. The average age of both the lathes and driers was 18 years. The firm also had 2 plywood presses (average age of 20 years). Approximately 400 production workers were employed and received an average hourly wage of \$1.80 per hour (U. S. dollars) fringe benefits included. Another 50 persons were classified as staff, office or supervisory personnel. In contrast to the two regional mills included in the study, only 20 percent of Mill C's plywood was made for orders on hand. All plywood was marketed through a company-owned warehousing system.

Mill D both rotary-cuts and slices veneer, manufacturing a combined total of roughly 60 million square feet in 1964. Plywood production totaled 13 million feet for the same period, 80 percent being manufactured with a particleboard core. Wall paneling accounted for 30 percent of the production while kitchen cabinet plywood and custom furniture stock each made up 35 percent. Two

rotary lathes and two slicers were being used by the firm at the time of the visit. The lathes were an average 10 years old while the slicers were but one-half that in age. Three driers and five presses averaged 3 and 5 years in age, respectively. Mill D employed 225 production workers and 48 staff members. The average hourly production wage was \$1.30 (U. S. dollars) including fringe benefits. All of the plywood was made-to-order with 80 percent of it being marketed through a warehouse system. The remainder, consisting of cut-to-size material, was sent directly to those firms utilizing it.

The product-type used in the cost comparison of Mills C and D is essentially the same as that used in the regional analysis--1/4" prefinished wall paneling. The species is restricted to walnut because one mill was unable to report cost figures on yellow birch (they did not manufacture any). Although Mill C utilized a veneer core material, Mill D did not. Instead, a hardboard center measuring 1/6-inch in thickness was used. The core species used by Mill C was 1/6-inch ceiba (*Ceiba pentandra* Gaertn.), a wood commonly called fuma and endemic to West Africa.

Cost data (Table 28) have been converted to U. S. dollars for purposes of comparison in a later section. The exchange rate used was 92 U. S. cents per Canadian dollar.

There is a significant difference between the costs of Mills C and D. Face material costs for the latter are \$25 less than those of Mill C. This may be partially due to the fact that Mill D slices its own walnut whereas the other one does not. Under these conditions, Mill D can utilize the shorter pieces of veneer cut at the lathe in other types of plywood construction (kitchen cabinet

TABLE 28. --Comparison of raw material and production costs for two Canadian hardwood veneer and plywood mills manufacturing 1/4-inch prefinished walnut wall paneling (No. 1 face and No. 4 back, 4' x 8' panel)

Cost item	Cost, in U. S. dollars, per thousand square feet	
	Mill C	Mill D
1. Face Material (1/28-inch)	\$101.85	\$ 76.85
2. Center Material (1/6-inch) (Fuma)	44.42 (Hardboard)	39.81
3. Back (1/28-inch)	15.85	16.67
4. Labor:		
Faces and Backs	25.13	25.00
Center	4.55	none
5. Glue	4.44	5.56
6. Variable Expense		
Faces and Backs	27.52	14.81
7. Prefinishing and Bagging	11.01	17.59
8. Fixed Expenses	22.76	21.30
Total Manufacturing Cost	\$257.53	\$217.59
Selling Price, f.o.b. Mill	\$351.85	\$287.04

and furniture stock). The net effect is that this mill can substantially reduce the cost it charges its wall paneling operation for the face material it receives. Mill C, on the other hand, must purchase its face veneer and has little or no shorts which can be used in its other plywood manufacturing operations.

Center material costs Mill D somewhat less than its counterpart, the difference being at least partially due to the material itself. Hardboard is not currently used to any great extent in panel construction, but there seems to be little reason why it will not gain wider acceptance in future years. The use of this material by Mill D enabled it to save labor costs on the center because it needed no further preparation before being used. Variable expenses for Mill D were also lower than those of Mill C. You will recall that repair and maintenance labor and other indirect labor costs are included in this cost category. In addition, certain payroll costs are also included. Mill D, with its newer machinery, might be expected to incur less of this type of cost than Mill C. Then, too, Mill D has achieved both a veneer and plywood production similar to that of Mill C, but employs 125 fewer production workers. This would almost certainly have an effect on all costs, but particularly the payroll costs.

You will note that the selling price, f.o.b., for the plywood produced by Mill D is considerably lower than that of Mill C. The buyer of Mill D's plywood, however, will be forced to absorb a greater freight cost than if he purchased from Mill C. This additional cost may vary between \$10 and \$20, depending on the market being served. It is due to the relative remoteness of Mill D to population centers and markets in comparison to Mill C.

Raw Material and Production Costs for Several Philippine Firms

Lauan or Philippine mahogany is the principal species¹ used by the Philippine veneer and plywood industry. Over 2,800 million board feet of logs

¹Technically, there are many species comprising the Philippine mahogany grouping and all are commonly called lauan.

of this species were cut in 1962, 46 percent of which was exported in log form to manufacturers of lumber, plywood and veneer in Japan, the United States, Italy, France, Korea, Taiwan and Australia. Japan, however, is by far the largest importer of lauan logs, consuming over 80 percent of the Philippine export of this species. In 1961, there were 9 veneer mills and 18 veneer and plywood mills in the Philippines.

Nearly all of the plywood mills concentrate on the manufacture of 3-ply veneer-core paneling of either 1/4- or 3/16-inch construction. The 1/4-inch panels are made from several combinations of veneer thicknesses such as 1/16-inch faces and backs and 1/7-inch centers or 1/20-inch faces and backs and 1/6-inch centers. Philippine mills are apparently equipped with some very modern equipment of American, German and Japanese make. American lathes, including such well-known names as Coe and Capital, are used by some operations. The 1961 plywood production for the Philippines totaled 260 million square feet with 111 million square feet of it being exported. Philippine mills manufacture very little prefinished plywood, preferring instead to allow this process to be done by the country importing their plywood.

Apparently, the veneer log resource in the Philippines is largely owned by the government, and logs are harvested on a concession basis. This technique closely resembles the same process by which our domestic mills buy timber from the U. S. Forest Service. The lack of a well developed transportation system for moving logs from forest to mill has created a sizeable difference in the raw material costs among the mills (Table 29). A mill close to a concession area would normally pay much less for its logs. Whether or not a

mill owns its own timber would also be an important factor in raw material costs. Although these same factors affect our domestic firms in a similar manner, they do not cause as pronounced a variation in material costs in the United States as they seem to in the Philippines. Some Philippine mills operate without concession timber at all and are forced to purchase their logs from exporters at export prices so as not to endanger their mill operations. In doing so, they pay a premium for their logs.

Unfortunately, the cost data in Table 29 are based on all different grades of export plywood, the most common one being the C grade. A comparable domestic panel (U. S.) would probably contain a No. 2 face and a No. 4 back. As one can readily see, there is considerable variation in production costs among the Philippine mills. Mill B's log cost is the lowest of the group while its direct labor cost is the highest. This would suggest that Mill B purchases a lower grade of log initially, either because it manufactures a lower grade of plywood or because it has no source of better material. In using the lower quality logs, more time must be spent in sorting, handling and cutting the veneer than if a better quality log has been used.

Glue costs, as a percentage of the total production costs, were quite high for some firms. It is likely that these mills used imported glues, the cost of these being over 30 percent higher than those of Philippine manufacture. Gross profitability¹ for Philippine plywood firms is notably high, averaging over 50 percent for most firms. Production cost figures in the Philippines are roughly

¹Gross profitability (%) = $\frac{\text{Total Sales} - \text{Cost Production}}{\text{Cost of Production}} \times 100$

TABLE 29. --Comparison of raw material and production costs for several Philippine hardwood veneer and plywood mills manufacturing 1/4-inch lauan wall paneling, 1962^a (merchantable plywood - all grades, 4' x 8' panel)

Cost item	Cost, in U. S. dollars, ^b per thousand square feet							
	Mill A		Mill B		Mill C		Mill D	
	Cost	Percent of total	Cost	Percent of total	Cost	Percent of total	Cost	Percent of total
1. Logs	\$23.80	65.0	\$13.17	33.9	\$24.59	61.1	\$18.70	44.4
2. Glue	4.39	12.0	7.73	19.9	6.32	15.8	5.53	13.1
3. Labor								
a. Direct	2.90	7.9	6.41	16.5	2.55	6.3	2.90	6.9
b. Indirect	1.49	4.1	.44	1.1	.97	2.4	.44	1.0
4. Administration, Fixed, Operating Cost, Miscellaneous Expenses	4.04	11.0	11.15	28.6	5.80	14.4	14.57	34.6
Total	\$36.62	100.0	\$38.90	100.0	\$40.23	100.0	\$42.14	100.0

Average export price, f.o.b. Philippines = \$63.00 per thousand square feet.

^aCalculated from: Armando A. Villafior, Analytical Study of Manufacturing Operations of Plywood and Veneer Mills in Mindanao (College, Laguna: University of the Philippines, College of Forestry, 1963), p. 29.

^bExchange rate, one U. S. dollar = 3.56 pesos in 1963, or \$.281/peso.

20 percent higher now than they were when the data for Table 29 were originally compiled.

Raw Material and Production Costs for Domestic Mills

At the request of the Hardwood Plywood Manufacturers Association of Arlington, Virginia, a study of operating costs for domestic mills was conducted in 1962 and 1963 by the accounting firm of Seidman & Seidman. A questionnaire and instruction sheet was sent to 57 companies in 1963, but only 26 of these submitted usable data. Certain data obtained in the study were summarized on a regional basis, using Department of Commerce geographical classifications. Seven firms in the East North Central region replied to the Seidman questionnaire; six were located in Wisconsin and the other was in Michigan.

A composite statement of income for 26 veneer and plywood companies in 1963 showed that net income before federal income taxes was only 1.94 percent of the value of net sales (Table 30). The East North Central States fared much better in this respect with a net income calculated to be 4.22 percent of net sales.

"Other income" in Table 30 consists of interest paid on debts and interest and dividends received on investments. The net difference between the two was a negative sum for the firms surveyed in 1963. Manufacturing overhead is made up of indirect labor (including supervision), depreciation of production equipment, and other fixed expenses.

The "cost of goods sold" is an intricate segment of the total production cost. It is comprised, as we have noted, of materials consumed, direct labor and manufacturing overhead. In the survey of 26 firms by Seidman & Seidman

TABLE 30.--A composite statement of income, based on net sales for 26 hardwood veneer and plywood firms in the United States in 1963

Sales, cost and income elements	Geographical region					All companies (26 firms)
	E. North Central (7 firms)	South Atlantic (10 firms)	E. South Central (4 firms)	Non-classified ^a (5 firms)		
Net Sales	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Cost of Goods Sold ^b	85.52	87.51	82.45	94.77	87.34	87.34
Gross Profit on Sales	14.48	12.49	17.55	5.23	12.66	12.66
General, Administrative and Selling Expenses	10.03	10.48	9.73	7.53	9.64	9.64
Operating Income (loss)	4.45	2.01	7.82	(2.30)	3.02	3.02
Other Income (deductions) - Net	(.23)	(.40)	(2.58)	(1.74)	(1.08)	(1.08)
Net Income (loss)	4.22%	1.61%	5.24%	(4.04)%	1.94%	1.94%

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Source: Seidman & Seidman, Certified Public Accountants, "Hardwood Plywood Institute Participant's Industry Data as to Operating Income Factors, 1963." Unpublished report presented to the Hardwood Plywood Institute, Arlington, Virginia, 1964, p. 3.

^aThe non-classified companies represent two Canadian three American firms that could not be grouped.

^bThe cost of goods sold is comprised of: (1) materials consumed, (2) direct labor, and (3) manufacturing overhead.

in 1963, the ratio of the cost of goods sold elements were as follows:

Materials consumed	55.91%
Direct labor	26.67
Manufacturing overhead	<u>17.42</u>
	100.00%

Overall, the combined cost of these 3 elements was 87.34 percent of sales.

The next step in the analysis of domestic costs is to combine dollar costs for each of the sales and income elements (Table 31).

Using the ratio of elements of cost of goods sold, the figure of \$36,551 thousand dollars in 1963 is comprised of the following:

(Thousands of dollars)		
Materials consumed	(55.91%)	\$20,436
Direct labor	(26.67%)	9,748
Manufacturing overhead	(17.42%)	<u>6,367</u>
		\$36,551

The addition of general, administrative and selling expenses to the cost of goods sold yields a cost figure that closely reflects the total costs of production for the 26 companies covered in the survey. Technically, selling costs should not be included in this figure, but there is little choice in the matter with the Seidman data.

TABLE 31. --A composite statement of operating income, based on net sales and measured in dollar costs, for domestic mills in 1962 and 1963

Sales, cost and income elements	1963 (26 firms)		1962 (24 firms)	
	Amount (thousands) of dollars)	Percent to sales (%)	Amount (thousands of dollars)	Percent to sales (%)
Net Sales (sales less returns and allowances)	\$41,851	100.00%	\$37,904	100.00%
Cost of Goods Sold	<u>36,551</u>	<u>87.34</u>	<u>32,526</u>	<u>85.81</u>
Gross Profit on Sales	5,300	12.66	5,378	14.19
General, Administrative and Selling Expenses	<u>4,033</u>	<u>9.64</u>	<u>3,078</u>	<u>8.12</u>
Operating Income	1,267	3.02	2,300	6.07
Other Income or (deductions) - Net	(453)	(1.08)	87	.23
Net Income Before Federal Income Taxes	<u>814</u>	<u>1.94%</u>	<u>2,387</u>	<u>6.30%</u>

Source: Seidman & Seidman, Certified Public Accountants, "Hardwood Plywood Institute Participant's Industry Data as to Operating Income Factors, 1963." Unpublished report presented to the Hardwood Plywood Institute, Arlington, Virginia, 1964, p. 7.

	1963 (26 firms)	
	Amount (Thousand of dollars)	Percent of total (%)
Materials consumed	\$20,436	50.35%
Direct labor	9,748	24.02
Manufacturing overhead	6,367	15.69
General, administrative and selling expenses	<u>4,033</u>	<u>9.94</u>
	\$40,584	100.00%

These percentages will be used in the next section for comparative purposes.

A Comparison of Production Costs Between Selected Domestic,
Regional, Canadian, and Philippine Hardwood Plywood Mills

You will recall that this cost comparison study was designed to discover major areas of difference between regional, domestic and foreign producers of hardwood plywood. Ideally, the products, species and cost accounting systems associated with the comparison should all be the same. But, as we have observed, such an accord is difficult to achieve.

In making this comparison of costs among manufacturers, the main emphasis will be on the percentages of materials, labor, etc., in the total product cost rather than on the absolute dollar value of these variables (Table 32).

Among the cost figures for Canadian and American mills in Table 32, Mill A's cost for materials (expressed as a percent of total cost) was lowest. Note, however, that this same mill had the highest labor costs of the four. Glue costs for Mills A, B, C, and D were surprisingly uniform while those

TABLE 32.--A comparison of production costs between selected regional, Canadian and Philippine hardwood plywood mills (per thousand square feet of 1/4-inch, 4' x 8' non-prefinished wall paneling)

Cost item	Regional mills (yellow birch)						Canadian mills (walnut)				Avg. of 4 Philippine mills (lauan)		Composite of 26 domestic mills, percent of total	
	A			B			C			D		Cost Percent (dollars) of total		
	Cost Percent (dollars) of total			Cost Percent (dollars) of total			Cost Percent (dollars) of total			Cost Percent (dollars) of total				
	Cost (dollars)	Percent of total	Percent of total	Cost (dollars)	Percent of total	Percent of total	Cost (dollars)	Percent of total	Percent of total					
Material (face, center, back)	\$ 91.93	38.2		\$147.00	64.8		\$162.12	65.8		\$133.33	66.7	\$19.84	50.4	50.4
Glue	5.00	2.1		5.00	2.2		4.44	1.8		5.56	2.8	5.97	15.2	
Labor: Direct	88.82	36.9		32.00	14.1		57.20	23.2		39.81	19.9	3.69	9.4	24.0
Indirect	33.52	13.9										.88	2.2	25.6
Administration, Fixed, Operating & Miscellaneous Expenses	21.53 ^a	8.9		43.00 ^b	18.9		22.76	9.2		21.30	10.6	8.96	22.8	
Total Production Cost	\$240.85	100.0		\$227.00	100.0		\$246.52	100.0		\$200.00	100.0	\$39.34	100.0	100.0

^aReduced by an amount equal to the assumed profit margin previously included as a fixed expense in Table 25.

^bReduced by an amount equal to the profit margin and insurance previously included as a fixed expense in Table 26.

of the Philippines were extremely high when considered as a percent of total production cost. Material costs for Mills B, C, and D were ahead of the composite figures for 26 domestic mills, but this might be expected because of the broad range of plywood products that the latter encompasses.

One of the most striking aspects of the cost figures is the very low production cost involved in manufacturing 1000 square feet of lauan plywood. It is little wonder that even after profit margins and marketing costs had been added, this species tends to dominate the American hardwood plywood market. The average productivity of the 4 Philippine mills amounts to about 1.8 panels per man per hour. In terms of plywood square footage, this is 58 square feet per man per hour or 17.2 man-hours per thousand square feet. If we divide this latter figure into the average direct labor charge of \$3.69 per thousand square feet for 4 Philippine mills, we see that the hourly wage for direct labor becomes approximately 22 cents per hour. The productivity of direct labor for Mill A, in contrast, was 44.9 man-hours (\$88.82/\$1.98) per thousand square feet. There are perhaps many reasons for a difference in productivity of this magnitude. Some of it may be due to the difference in species, but more than likely the quality of the final product and the machines used in manufacturing it are key factors. You will recall that we have priced a high quality yellow birch panel for Mill A while that of the 4 Philippine mills was a somewhat lower quality panel made of lauan. The Philippine mills are also using much larger diameter logs, thus realizing an economy in this respect. Overall, the problem of productivity merits further study.

Canadian mills were noted to have a fairly low percentage of total costs

assigned to the administration, operating and fixed expense category. These same costs for Mill B were appreciably larger, perhaps partially due to a greater depreciation expense at that mill. Note, too, that Mills C and D also experienced similar costs for each of the major categories (materials, glue, labor, etc.).

It would appear that the study of production costs among mills covered in the survey was limited by the variation in data. The method succeeded in identifying only the broader problem areas and differences existing between the firms. They include the following:

1. The absolute dollar costs for Philippine mills were significantly lower than either the American or Canadian firms. This was perhaps largely due to differences in wages paid to production workers.

2. For all mills, there seemed to be an inverse relationship between material costs and labor costs. The mills which paid less for their logs invariably ended up paying more for their labor.

3. Productivity differences apparently exist between domestic and foreign mills, but no one factor appears to be entirely responsible. Differences in machinery, species and product-types are all important considerations.

4. Profit margins for domestic mills were found to be quite low, especially when compared to alternate investment opportunities. These margins also vary widely from region to region, and were somewhat dependent upon the species being used.

5. Canadian Mill D had lower center or core costs than did either American mill or Canadian Mill C. Part of this difference may have been due to the type of material (hardboard) used by Mill D. In view of the shortage of core material

existing in regional mills and the current low profit margins, the use of hardboard and particleboard as a core material merits further consideration.

6. Raw material costs made up a significant portion of the total cost of producing a 1000 square feet of 1/4-inch wall paneling, averaging 50.4 percent for 26 domestic mills. Further study should be made of the factors influencing raw material costs so that areas of possible savings might be identified within this cost category.

CHAPTER VII

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The hardwood face veneer and plywood industry of Michigan and Wisconsin has undergone some significant changes in the past 15 years. An influx of low-cost plywood imports, declining margins of profitability, a shortage of quality timber, and the failure to participate fully in the growth of the hardwood plywood industry are but a few of the many developments that have unfolded during this period. Included in this chapter are: (1) a presentation of the results of the study (summary), (2) an interpretation and assessment of the results in regard to their significance (conclusions), and (3) identification of areas where further research would prove beneficial in studying the hardwood face veneer and plywood industry (recommendations).

Summary

Mill Closures

Eight mill closures were found to have occurred over the past 15 years and were equally divided among Michigan and Wisconsin. No single factor, it seemed, was responsible for the closures. The competitive position of each firm appeared to be weakened by several external factors (imports, substitutes, raw materials). When these were combined with a series of inappropriate

management decisions, the mill closed. The general decline that has occurred in the veneer log resource during recent years did not appear to be a major factor in any of the closures. Similarly, the influx of low-cost imported plywood could not be considered a major cause of closures, either.

Veneer Log Resources

Hardwood face veneer and plywood mills in Michigan and Wisconsin utilize a number of species, with hard maple, yellow birch, and red oak being among the more important. Regional resource data indicate that both basswood and yellow birch are in short supply. Red oak, although seemingly plentiful at this time, may be in short supply within the next 20 years unless management of this species is improved. The future availability of American elm is also in question at this time because of the devastating effect the Dutch elm disease is having on this species. Of all the species now in widespread use by the regional industry, only hard maple seems to be in relatively good supply. Aspen and soft maple are fairly abundant, but as yet there is little demand for them as veneer logs.

The veneer and plywood industry in Michigan and Wisconsin has annually consumed 50 to 60 million board feet of logs in recent years. The resource appears to be capable of adequately meeting a sustained demand of this magnitude well into the next decade if present use patterns are maintained. Roughly twice as much material was judged to be suitable for use as veneer logs as was being used. It is this investigator's opinion that if the regional hardwood face veneer and plywood industry adopts a technology that would allow it to

economically process logs of both small diameter (11-14 inches) and low quality, it then could expand considerably in the next 20 years. If this technology is not fully developed, then any desire for future expansion (in regard to the resource) would be more directly related to the ability of the veneer industry to compete with other wood processing industries for the available log resource.

Survey of Hardwood Veneer and Plywood Mills

In 1964, there were 24 hardwood face veneer and plywood firms in Wisconsin and 8 in Michigan. Executives interviewed during the course of the study cited many problems which they believed confronted the industry today. Among the more important were the low-cost imports entering the country, the decrease in quality of this raw material supply, the export of native log species such as elm and walnut, the continued rise in labor costs, a shortage of regionally manufactured core material, and the lack of trained manpower.

Over 90 percent of the veneer produced by either the veneer or the veneer and plywood mills in Michigan and Wisconsin was the rotary type. Altogether, more than 600 million square feet (surface measure) of commercial-type veneer was produced by these mills in 1964. The investigation showed that 3-ply veneer plywood constituted a large portion of all plywood manufactured within the region and that this material was extensively used in prefinished hardwood plywood panels.

One of the most significant findings of the mill survey was related to the age of veneer and plywood machinery being used by regional manufacturers. Data collected during the study showed that veneer lathes, driers, and plywood

presses averaged 12 years or more in age. The results of the study would indicate that veneer and plywood manufacturers need to take a close look at their machinery, both in respect to age and capability.

The regional industry produces a multitude of veneer and plywood products, and the markets they serve are equally varied. A large portion of all veneer and plywood manufactured by mills in the survey was made-to-order, with wall paneling, doors, and kitchen cabinet stock being among the more important products. Five basic distribution methods were identified as being commonly used by these mills: The agent or broker, the parent-firm, company salesmen, the house account, and the wholesaler.

Although wall paneling, doors, and kitchen cabinet stock comprised a major portion of the product-mix, specialty plywoods are becoming increasingly important. Among other products, curved or molded plywood for chairs, sofas, church pews, and wall paneling fall into this category. It is expected that further emphasis will be given to the production of specialty plywoods in future years.

Conclusions

It has generally been established that the hardwood veneer and plywood industry of Michigan and Wisconsin has remained static during a period in which domestic consumption and production of hardwood plywood has increased markedly. Several factors seemed to have caused this situation. It is this investigator's belief that there has been:

- (1) Complacency on the part of manufacturers within the region.
- (2) A problem of obtaining an economically suitable supply of

regionally manufactured core and crossbanding material.

- (3) A lack of desire or inability on the part of regional mills to participate fully in the product-area where greatest national growth has occurred - prefinished 1/4-inch wall paneling.

The first of these factors is difficult to measure. It appears that several regional firms have been in family ownership for a number of years, and that there has been some reluctance to incorporate new machinery and ideas into the manufacturing process. The lack of a suitable supply of core material may have been responsible for the loss of a portion of the region's stock panel industry to the West Coast where eastern hardwood face veneers are placed on lauan and fir core and crossbanding materials. In recent years, a great deal of the growth which has occurred in the domestic hardwood plywood industry is directly the result of a surge in the market for prefinished 1/4-inch wall paneling. The northern Lake States region, for some unknown reason, never fully participated in this market. A large percentage of all the plywood produced by the plywood industry grouping came from one mill which specialized in prefinished wall paneling. But, other than this one mill, the regional industry has not followed the national pattern. A general observation has been that those firms which do specialize in the manufacture of wall paneling are alike in two respects - they make only wall paneling and they seem to have access to an economically suitable supply of core and crossbanding material. The one regional mill which specialized in the manufacture of wall paneling, you recall, operated its own crossbanding and core mill in Africa.

Although the importation of hardwood plywood has had some effects on the

regional industry, this investigator believes that the impact has not been as great as some trade associations and mill managers would have one believe. It is my feeling that the domestic hardwood plywood industry could have met only a small segment of the demand that has developed for hardwood wall paneling in recent years. The imports have been largely centered in the low-cost panel lines. It would seem that these imports have given the American public an opportunity to economically panel rooms which, because of cost factors, could not be previously done with domestically manufactured material. Our own manufacturers responded to the import situation with a greater variety of panel products constructed of both wood and wood-base materials. The net effect was the creation of many new markets for domestic firms.

The importance of cost accounting systems and management decisions cannot be overlooked. It is this writer's opinion that regional firms (as a group) lack the proper information needed to make machine replacement decisions. Furthermore, it would seem that few of these firms have a sufficient knowledge of their own production costs. I suspect that management is being severely handicapped by the lack of this information and that it is one of the main problems of the regional industry today.

The suitability and availability of the veneer log resource will have an important bearing on the future of the regional veneer and plywood industry. It is generally believed that the average diameter of veneer logs will continue to grow smaller while competition for the resource increases. The lower diameter logs, in turn, will create increased labor and production costs. Because of this, regional mills will need to make thorough studies on the

efficiency and capability of all production machinery. Major machine categories, such as the lathes, veneer driers, and plywood presses, should be among the first to be scrutinized, but most firms will find that they have very little cost data on which they can base decisions regarding machine replacements.

In other areas regarding the resource, I feel that future changes in consumer acceptability of various grades, types, and species of veneer and plywood may have an important effect on the raw material supply available to the manufacturer. For example, if a substantial demand for face veneers with knots and other natural defects can be generated, the net effect could be both that of extending the supply of currently preferred veneer species as well as bringing into general use the under-utilized species.

The region, we have noted, is currently undergoing a phase of "expansion by acquisition" in which some veneer and plywood mills have been purchased by national wood products firms. There is little reason to believe that this trend will not continue over the next 5-10 years. Profit margins in regional mills have declined in recent years, and undoubtedly, this has severely hampered many firms in their desire to implement capital improvement programs. Some mill managers have grown reluctant to risk capital on needed improvements in plant facilities because of the uncertainty involved. Under these conditions, some mills have become susceptible to acquisition.

The market for plywood specialty products will increase and regional mills should participate in this growth. Profit margins on these products, however, will diminish for regional manufacturers because low-cost imports will penetrate this market much in the same manner as they did those for

paneling and door skins. The market for hardwood plywood sheathing will expand dramatically in the next decade, and it is believed that several new mills designed to manufacture this product will be opened within the region. Overall, the number of commercial face veneer and plywood will remain fairly constant.

Recommendations

This writer believes that there are several areas in which further research would greatly benefit the regional veneer and plywood industry. They include the following:

- (1) A study of core and crossbanding material requirements in the industry. This would include an investigation regarding the suitability and acceptance of hardboard and particleboard in plywood manufacture.
- (2) A study of machine capabilities in the regional industry, determining under what conditions each should be used and the effects each has on various manufacturing processes. For example, is the quality of the regional resource such that it is economical to reduce core diameters to 3 1/2 - 4 inches? Can fly-clipping be suitably used on high-quality northern hardwood veneers?
- (3) A study which determines the economic supply of veneer logs within given procurement areas for groups of regional mills.
- (4) A study of cost accounting needs in the hardwood face veneer and plywood industry and the development of a system that will adequately reflect the information needed to make decisions at all levels of

management.

- (5) A study of productivity within regional mills, aimed at discovering areas where manufacturing efficiency can be improved and costs reduced.
- (6) A measurement of hardwood plywood production trends in the national industry and the significance of these trends to regional manufacturers.
- (7) A study of the effect that building codes are having on hardwood plywood markets.

BIBLIOGRAPHY

A SELECTED BIBLIOGRAPHY

- Findell, V. E., Pfeifer, R. E., Horn, A. G., and Tubbs, C. H. Michigan's Forest Resources. Lake States Forest Experiment Station Paper No. 82. St. Paul: U. S. Forest Service, 1960.
- Fleischer, H. O. "Our Changing Veneer and Plywood Industry," Forest Products Journal, VI (February, 1956), 50-53.
- Fleischer, H. O. Use of Small Logs for Veneer. Forest Products Laboratory Research Note FPL-0101. Madison: U. S. Forest Service, 1965.
- Guilkey, Paul C. "Hardwood Resources in Michigan and Their Current and Potential Uses," Forest Products Journal, VII (November, 1957), 23A-25A.
- Hair, Dwight. "Projected Demands for Hardwood Veneer Emphasize Research-Management Needs," Forest Products Journal, XVI (January, 1966), 28-30.
- Hair, Dwight and Ulrich, Alice. The Demand and Price Situation for Forest Products--1963. Forest Service Miscellaneous Publication No. 953. Washington: U. S. Forest Service, 1963.
- Harrar, E. S. Defects in Hardwood Veneer Logs: Their Frequency and Importance. Southeastern Forest Experiment Station Paper No. 39. Asheville: U. S. Forest Service, 1954.
- Haskell, Henry H. Using the FPL Hardwood Veneer Grades. Forest Products Laboratory Research Note FPL-025. Madison: U. S. Forest Service, 1963.
- Henley, John W., Woodfin, Richard O. Jr., and Haskell, Henry H. Recommended Veneer Grades for the Development of Hardwood Veneer Log Grades. Forest Products Laboratory Research Paper FPL-9. Madison: U. S. Forest Service, 1963.
- Horn, A. G. Veneer Log Production Declines Sharply in Lake States as a Result of Mill Closures, 1958. Lake States Forest Experiment Station Technical Note No. 567. St. Paul: U. S. Forest Service, 1959.

Knutson, Robert G. Veneer Log Production in the Lake States Continues General Decline, 1963. Lake States Forest Experiment Station Research Note LS-54. St. Paul: U. S. Forest Service, 1964.

Lord, William B. "Performance and Structure of Major Log Markets in the North Central States." Unpublished Ph.D. dissertation, School of Natural Resources, University of Michigan, 1964.

Mayhew, Wayne E. "A New and Revolutionary Method of Allocating Costs to Veneer by Grades," Forest Products Journal, VIII (April, 1958), 27A-31A.

McDonald, Clark E. "Hardwood Plywood: 1.5 MM," Forest Industries, LXXXXII (January, 1965), 46-47.

McDonald, Clark E. "Hardwood Plywood Production Up 12 Percent," Forest Industries, LXXXXI (January, 1964), 42-43.

Seidman & Seidman, Certified Public Accountants. "Hardwood Plywood Institute Participants' Industry Data as to Operating Income Factors, 1963." Unpublished report presented to the Hardwood Plywood Institute, Arlington, Virginia, 1964.

Stone, R. N., and Thorne, H. W. Wisconsin's Forest Resources. Lake States Forest Experiment Station Paper No. 90. St. Paul: U. S. Forest Service, 1961.

"The Mess at Atlas Plywood," Fortune, LVII, No. 1 (January, 1958), 118-119, 234, 236.

Toole, A. W. "The Lake States Forest Resource," Forest Products Journal, X (January, 1960), 51-54.

Truax, T. R., and Fleischer, H. O. "Trends in the Veneer and Plywood Industry of the North Central States," 1954 Proceedings--Society of American Foresters Meeting (Milwaukee, Wis., 1954), 97-101.

U. S. Department of Commerce, Bureau of the Census. "Area Statistics," Census of Manufactures, Volume III, 1954. Washington: U. S. Government Printing Office.

U. S. Department of Commerce, Bureau of the Census. "Area Statistics," Census of Manufactures, Volume III, 1958. Washington: U. S. Government Printing Office.

U. S. Department of Commerce, Bureau of the Census. "Area Statistics," Census of Manufactures, Volume III, 1963. Washington: U. S. Government Printing Office.

- U. S. Department of Commerce, Bureau of the Census. "Hardwood Plywood 1964," Current Industrial Reports. Series M24F(64)-1. Washington: U. S. Government Printing Office, 1965.
- U. S. Department of Commerce, Business and Defense Services Administration. Commercial Standard CS35-61 for Hardwood Plywood. Washington: U. S. Government Printing Office, 1961.
- U. S. Department of Commerce, Business and Defense Services Administration. Hardwood Plywood. Washington: Business and Defense Services Administration, Forest Products Division, 1963.
- U. S. Department of Labor, Bureau of Labor Statistics. Case Study Data on Productivity and Factory Performance--Veneer and Plywood. BLS Report No. 37. Washington: U. S. Government Printing Office, 1953.
- U. S. Forest Service. Estimating the Weight of Plywood. Forest Products Laboratory Technical Note No. 260. Madison: U. S. Forest Service, 1956.
- U. S. Forest Service. Timber Trends in the United States. U. S. Forest Service Forest Resource Report No. 17. Washington: U. S. Government Printing Office, 1965.
- U. S. Forest Service. Veneer Log Production and Receipts in Eastern United States, by State and Species, 1963. U. S. Forest Service Research Note W0-6. Washington: U. S. Forest Service, 1964.
- U. S. Tariff Commission. Hardwood Plywood: Report on Escape-Clause Investigation No. 77 Under Section 7 of the Trade Agreements Extension Act of 1951, As Amended. Washington: U. S. Tariff Commission, 1959.
- U. S. Tariff Commission. Hardwood Plywood: Report on Escape-Clause Investigation No. 39 Under the Provisions of Section 7 of the Trade Agreements Extension Act of 1951. Washington: U. S. Tariff Commission, 1955.
- U. S. Tariff Commission. The Production, Importation and Marketing of Hardwood Plywood in the United States. Washington: U. S. Tariff Commission, 1955.
- Villaflor, Armando A. Analytical Study of Manufacturing Operations of Plywood and Veneer Mills in Mindanao. University of Philippines: College of Forestry, Department of Forest Utilization Engineering, 1963.

Wisconsin Department of Resource Development. Wisconsin Forest Products Marketing Bulletin. Number 33. Madison: Department of Resource Development, 1965.

APPENDIX A

QUESTIONNAIRES USED FOR INTERVIEWS

Date of Interview _____

Name of Company _____

Location _____

Interviewee _____ Title _____

Address of Interviewee _____

1. Historical Background

(a) Date of founding _____ Date of closure _____

(b) Last president or general manager _____

(c) Chief products (percentages) (species)

(d) Principal markets

(e) Affiliations with larger companies

(f) Number of production workers _____ Other _____

(g) What was done with plant equipment, site, and workers after closure?

2. Reasons for Closure

What, in your opinion, were the chief reasons for the mill's closure? Rank according to importance.

3. Additional Comments

Parent Company _____ Address _____

Plant Name _____ Address _____

Name of officials interviewed:

1. _____ Title _____

2. _____ Title _____

3. _____ Title _____

Survey made by _____ Date _____

PART I. PLANT PRODUCTION INFORMATION

A. Type of Products Manufactured.

- 1.1 Enter below the estimated quantity of each type of veneer and plywood manufactured in the plant in 1964. Mark "none" for any products not manufactured in the plant.

Veneer		Plywood	
Product	Estimated Quan. (Sq. ft. of surface meas.)	Product	Est. Quan. (Sq. ft. s.m.)
a. Rotary veneer		a. All veneer	
b. Sliced veneer		Plywood	
c. Half-round veneer		1. 3-ply	
d. Other veneer (specify)		2. 5-ply	
		3. Other (specify)	
		b. Lumber-core Plywood (specify # of ply)	
		c. Particleboard core	
		d. Other	

1.2 What percentage of the total veneer production or inventory is used for manufacturing 4x8 plywood panels? What percentage is used for flush doors?

1.3 Enter below what percent of total veneer production each thickness constituted and indicate by check mark whether commercial or figured face veneer, or core veneer.

Thickness (inches)	Est. % of Total Prod.	Face		Back, Core and Crossband Veneer
		Comm.	Fig.	

1.4 List below finished products manufactured in this plant in 1964.

Veneer Products

Plywood Products

B. Other Production Information

1. Enter below the types of wood used in this plant and approximate origin, 1964.

<u>Species</u>	<u>Origin</u> (Region and State)	<u>Method of Transportation</u>
----------------	-------------------------------------	---------------------------------

2. Enter below the estimated production capacity of this plant, 1964.

<u>Product</u>	<u>Amount (Surface measure)</u>
----------------	---------------------------------

3. For each of the Factory Operations listed below, give a brief description of the machinery used.

Name of Department or Operation	Machinery Used		No. of Units
	Manufacturer's Name,	Est. Age of Each Machine	
a. Veneer Cutting Operations			
1. Yard handling of logs			
2. Barking			
3. Lathe			
4. Clipping			
5. Drying			
b. Plywood Manufacturing			
1. Clipping			
2. Jointing			
3. Splicing			
4. Gluing			
5. Pressing			
6. Trimming			
c. Plywood Finishing			
1. Sanding			
2. Storage			

PART II. GENERAL PLANT INFORMATION

A. Plant Employment

Number of production workers _____ Average hourly wage _____
 Number of staff, office, and supervisory personnel _____

B. Marketing Practices

1. Enter below the estimated size (surface measure) of the minimum, average, and maximum order for 1964.

Size of Order	Veneer (Sq. ft.)	Plywood (Sq. ft.)
Minimum order		
Average order		
Maximum order		

2. Enter below the percent of total production of the reported product made for stock and the percent made to individual order.

Size of Order	Veneer (Sq. ft.) 1964	Plywood (Sq. ft.) 1964
Made for stock (% of product)		
Made to order (% of product)		

3. Enter below the estimated average inventory for 1964 by product type:

<u>Product Type</u>	<u>Quantity (Sq. ft.)</u>
---------------------	---------------------------

4. By what means does this plant market its products?

5. What are the marketing channels used by this plant?

Product	Type of Market Channel	% of Product Marketed in this Channel
a. Veneer (specify types)		
b. Plywood (specify types)		

6. Below list the various end-uses for this plant's production if such information is available.

Product	Use	% of Product Used in this Manner
a. Veneer (specify types)		
b. Plywood (specify types)		

7. In management's opinion, what factors determine the markets for this plant's production?

PART III. NARRATIVE REPORT

1. Production Planning

What is the basis (business forecast, orders, etc.) on which the production of the reported products of the plant was planned for in 1964?

2. Engineering and Research

If this plant (or parent company) has a special department to conduct research for the improvement of the product, plant layout, production methods, cost analysis, time and motion study, or for marketing analysis, describe the nature of their activities and state the number employed.

3. Buildings and Equipment

a. Describe the size and type of construction of the buildings. (Obtain the square footage of the production area, if possible.)

b. Describe any major changes that have been made in the plant's buildings since 1950 and give approximate year in which the changes were made.

c. Describe any major changes that have been made in machinery and equipment for the past 15 years. Give the approximate year in which each change was made.

4. Describe the factors which in management's opinion contributed the most to changes in productivity in this plant during the past 15 years. What has been the productivity pattern in this plant for the past 10 years?
5. In management's opinion, what are the major problems confronting the veneer and plywood industry today?

APPENDIX B

FORMS FOR COST DATA

PRODUCT - 3 PLY 1/4-INCH PREFINISHED PLYWOOD (GIS)

Operation	FACE	BACK	Center
	(probably 1/28")	(probably 1/28")	(1/6")
Cost Per Thousand Square Feet			
<u>Log Run Veneer</u>			
<u>Conversion to Grade^{1/}</u>			
<u>Face Veneer</u>			
<u>Mfg. Yield^{1/}</u>			
<u>Finished Veneer</u>			
<u>Tape</u>			
<u>Glue (splicing)</u>			
I. Total Material			
1 (Peel Veneer ^{2/}			
(			
(Roller Dry Veneer			
2 (Redry Veneer			
(			
(Dry Clip			
(			
(Joint			
(			
(Match			
(			
(Splice			
(			
(Inspect			
(			
(Face Repair			
(			
(Size Clip			
(			
(Dept. Service ^{3/}			
II. Total Labor			

Operation	FACE	BACK	CENTER
	Cost Per Thousand Square Feet		
Variable Expense ^{4/}			
1 * Veneer Mill			
2 Single Ply Preparation & Mfg.			
III. Total Variable Exp.			
Direct Cost (Sum of I, II, III)			

IV. Panel Fabrication Direct Cost (from separate sheet) =

V. Natural Finish (from separate sheet) =

VI. Wrapping-Bagging Direct Cost (from separate sheet) =

Total Direct Cost
(Sum of I, II, III, IV, V, VI)

Fixed Expense ^{5/} _____

Total Cost (f.o.b. mill)

+ (add marketing costs where available - per M. sq. ft. basis)

*Refers to combined operations on previous page.

PANEL FABRICATION
(Cost per thousand square feet)

Glue (Urea or other)
Line up
Mix Glue
Glue Spread
Hot Press
Drum Sand Back
Size
Patch
Speed Polish & Inspect

A. Total Labor

B. Variable Expense

IV. Direct Cost
(Sum of A and B)

NATURAL FINISH (LACQUER)
(Seal-sand-2 topcoats, Back seal)
(Cost per thousand square feet)

Material
Labor
Variable Expense

V. Total Direct Cost -
Finishing

PROTECTIVE WRAP (6 per bag)
(Cost per thousand square feet)

Bag
Labor
Variable Expense

VI. Total Direct Cost
Bagging

Footnotes

- 1/ a. Conversion to grade - that percent of log run veneer that is suitable for face veneer.

b. Manufacturing yield - the percentage of veneer that is intended for faces, backs, or centers that is used in that manner after wet clipping operations take place.
- 2/ Includes through green clip.
- 3/ Departmental Service - includes non-productive labor used in single ply preparation and manufacture from redry to size clip operations.
- 4/ Variable expense - includes indirect labor, repair, and maintenance labor, operating supplies, purchased utilities and fuels, etc.
- 5/ Fixed expense - includes factory supervision, rentals of space and equipment, taxes, property insurance, depreciation of fixed assets, etc.

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