

Understanding the United States S4S hardwood board market

Scott A. Bowe*

Robert L. Smith*

Michael D. LaBissoniere*

Abstract

A mail survey of retail lumberyards was conducted in 1999 to determine product characteristics and estimated volumes of surfaced-four-sides (S4S) hardwood boards. There were 188 questionnaires that were returned and usable for data analysis. The most common species of S4S hardwood boards stocked by retail lumberyards were red oak, yellow-poplar, and maple. Other species included birch, white oak, and cherry. The most common volumes in packages were 500 board feet (BF) and 250 BF. The most common widths were 1 by 4, 1 by 6, and 1 by 8 with a preferred thickness of 3/4 inches. More than 90 percent of the respondents wanted delivery within 2 weeks. Respondents rated important product characteristics for S4S hardwood boards. Product quality and board consistency were the highest-rated factors. These factors were followed by price, delivery time, and one-stop shopping. In the open-ended questions, the respondents indicated that uniform color and longer lengths were also important product features. We estimated that the lumberyards sell on average 23,500 BF of S4S hardwood boards per year. Red oak, yellow-poplar, and other species each sell on average 12,500 BF, 8,000 BF, and 2,800 BF per year, respectively. From these figures, the total estimated volume of S4S hardwood boards for 1998 was approximately 300 million BF or approximately 2 percent of the total hardwood lumber production.

The hardwood lumber market in the United States continued its growth trend in the 1990s, but suffered declines in recent years. Consumption estimates from 1997 show annual hardwood lumber usage at 13.2 billion board feet (BBF) (Hansen and West 1998). More recent estimates show a decline in consumption with annual estimates at 11.3 BBF in 2001 (USDC 2002). It has been suggested that these consumption declines were caused in part by the demise of the domestic furniture industry (Hardwood Review 2001). Whatever the cause, hardwood lumber volume is difficult to predict given the nature of hardwood production and the nature of hardwood use. The National Hardwood Lumber Association has approximately 740 hardwood sawmill members. They have also identified an additional 3,600 non-member hardwood sawmills. Larger mills can be

accounted for, but many hobby mills, small family run mills, and Amish mills go unidentified. Therefore, a simple survey of the known hardwood sawmills will undoubtedly underestimate the production volume.

Hardwood lumber market segments are diverse and include industries such as pallets, furniture, dimension and components, exports, millwork, cabinets, and flooring. Usage patterns by these indus-

tries are very complex. For example, the pallet, furniture, export, millwork, cabinet, and flooring industries all consume volume from the dimension and component industry. In addition, many of these industries produce their own hardwood board raw material. This overlap makes a simple volume tally very complex. Summing these volumes would likely lead to an overestimate in annual production.

The authors are, respectively, Assistant Professor/Wood Products Specialist, Dept. of Forest Ecology and Management, Univ. of Wisconsin-Madison (UW), 120 Russell Laboratories, 1630 Linden Dr., Madison, WI 53706-1598; Associate Professor/Extension Specialist, Center for Forest Products Marketing and Management, Dept. of Wood Science and Forest Products, Virginia Tech, Blacksburg, VA 24061; and Graduate Research Assistant, Dept. of Forest Ecology and Management, UW. The authors would like to thank Susy Rein Communications, Hawthorn Woods, IL, and the Center for Forest Products Marketing and Management, Blacksburg, VA, for project input and support. This paper was received for publication in November 2003. Article No. 9797.

*Forest Products Society Member

©Forest Products Society 2005.

Forest Prod. J. 55(2):21-27.

Of these industry segments, the export industry can boast reliable volume figures. Custom export declarations provided by the U.S. Department of Commerce and Canadian import data provide accurate statistics on hardwood exports. Exports represent 1.2 BBF (9%) of the estimated total U.S. hardwood production of 13.2 BBF (Hansen and West 1998).

S4S hardwood board market

The surfaced-four-sides (S4S) hardwood board market falls within the dimension and component segment of the hardwood market. This segment accounts for 2.4 BBF (18.2%) of the estimated total hardwood production of 13.2 BBF (Hansen and West 1998).

S4S hardwood boards, a value added product, have two major target markets: the new home construction market and the repair and remodeling market. Retail homecenters and lumberyards are the main conduit for distribution, with total homecenter sales reaching \$110 billion in 1996 (NHCN 1998). Professional contractors have always been major players in these markets, but the do-it-yourself customer (DIY) has become a large player over the past 15 years. Large home improvement stores such as Home Depot and Lowe's cater to the DIY customer and are an important outlet for S4S hardwood boards.

Cesa (1987) examined an array of hardwood products in homecenters including S4S hardwood boards. The findings showed that most of the larger homecenters were being serviced by suppliers of standard hardwood board products designed for the DIY customer. In contrast, many of the smaller homecenters were being serviced by local suppliers such as sawmills. Estimates of hardwood board sales were \$85,700 for typical homecenters and \$294,300 for larger homecenters. The study also identified the DIY customer as a target market for S4S hardwood boards but found that the typical DIY customer buys for smaller projects than the professional contractor.

Final sales estimates placed the 1986 hardwood board market sales at over \$338,000,000 for typical homecenters, with an additional \$23,800,000 for the top 100 homecenters. From these figures, the estimated total hardwood board sales from homecenters were more than \$361 million (Cesa 1987). It is important to remember that this total dollar figure

represents S4S, surfaced-two-sides (S2S), and other hardwood board types. Using an estimated \$2 to \$3 a board foot (BF), total volume sales can be approximated for 1986 between 121 to 181 million BF (MMBF).

To better serve the new home construction market and the repair and remodeling market, more recent S4S hardwood board market data are needed. Researchers at Virginia Tech and a large Lake States hardwood lumber manufacturer joined forces to examine the S4S hardwood board market in the United States. This paper reports the findings from this study.

Objectives

The goals of this study were to identify key product features for S4S hardwood boards and evaluate their distribution patterns. The following three objectives were identified to satisfy these goals: 1) identify key product features for S4S hardwood boards; 2) evaluate current distribution patterns for S4S hardwood boards; and 3) estimate 1998 purchase volumes of S4S hardwood boards.

Methodology

A mail survey was chosen for this market analysis. The design criteria for this survey are explained in four sections including questionnaire design, population, sample frame, and data collection.

Questionnaire design

A booklet-style questionnaire was designed for the survey. Each question was tailored to address one of the three key objectives. Once the questionnaire content and format were established, it was pre-tested with several S4S hardwood board retailers in Virginia. This pre-test identified minor format issues that were easily rectified.

Population

The primary scope of this analysis focused on hardwood retailers throughout the nation. The primary geographic focus, however, included the Lake States, Central, and Northeastern United States.

Sample frame

Two S4S hardwood board retailer mailing lists were used. The first mailing list consisted of 336 current customers of a major S4S hardwood lumber supplier in the Lake States. A second list, consisting of 662 companies outside of the current customer base, was used to escape possible bias that may exist

within the customer list. This second list was purchased from a national business list supplier.

Data collection

The mail survey was modeled after Dillman's Total Design Method and involved a series of three mailings (Salant and Dillman 1994). The first mailing was mailed on April 15, 1999 (sent in a 9-by-12-in. envelope) and included a personally signed cover letter and a questionnaire form. The cover letter explained the nature and importance of the survey and assured company anonymity for any information provided. The enclosed questionnaire contained business reply postage for no-cost return mailing. Two weeks after the first mailing, a second mailing consisting of a follow-up postcard was sent to all of the retailers, thanking them for their response or encouraging them to reply if they had not done so. Finally, 2 weeks after the second mailing, a third mailing, which included a cover letter and a second copy of the questionnaire form, was sent to those companies that had not responded.

Survey response rate

A total of 998 questionnaires were mailed (336 cooperator customers, 662 non-customers). Forty-eight questionnaires were returned due to bad addresses (39 customers, 9 non-customers). From the remaining 950 questionnaires, 280 questionnaires were returned. Of these, 190 purchased S4S hardwood boards (target group) and 90 did not purchase S4S hardwood boards. Two of the 190 target group questionnaires were unusable due to incomplete information, resulting in a final usable questionnaire total of 188 (65 customer, 123 non-customer). The adjusted response rate was 19.8 percent (21.9% customer, 18.8% non-customer).

Non-response bias

To compare the respondents to non-respondents, 30 non-respondents were contacted by phone and asked a series of questions from the mail questionnaire. The results from these 30 non-response phone calls were compared with the results of the original mail survey.

Three questions were examined using the Mann-Whitney nonparametric test. No significant difference was found between the respondents and non-respondents in the tested factors of quality and product consistency ($\zeta = 0.05$). A significant difference, however, was found

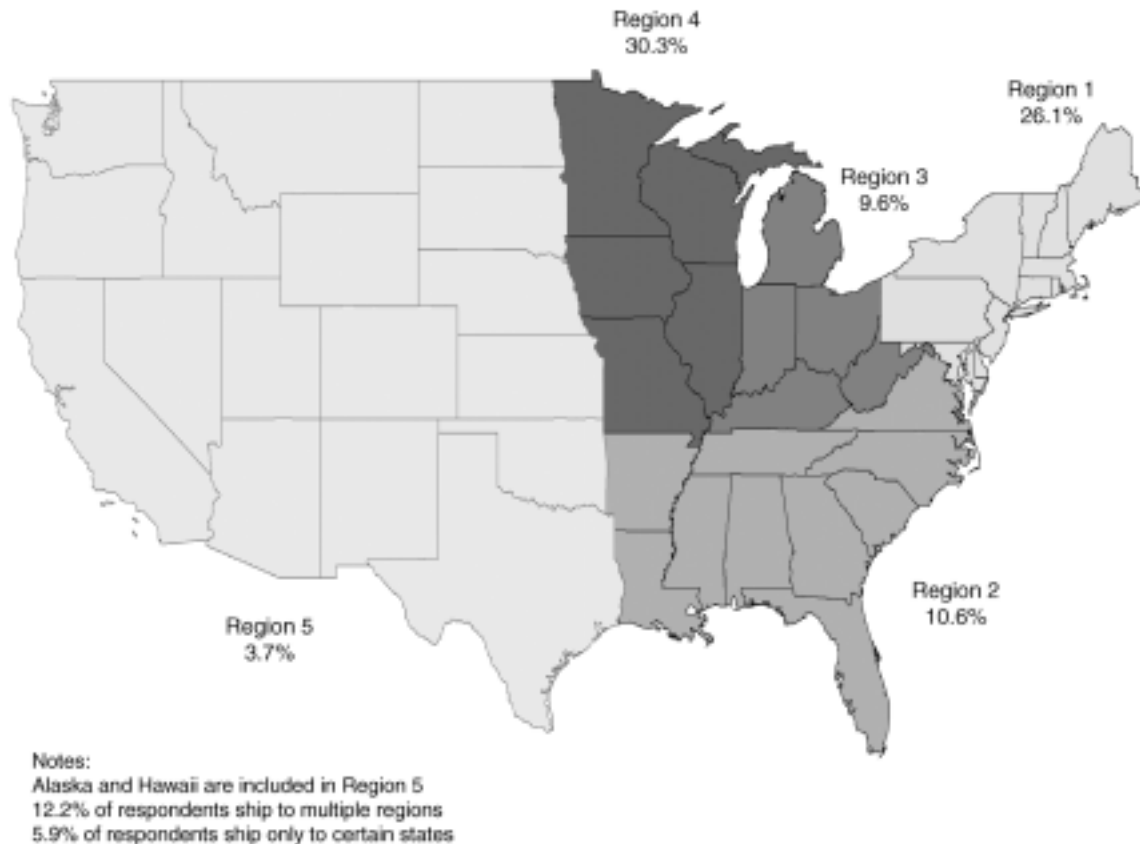


Figure 1. — National sales outlet regions.

between the factors price and packaging ($\zeta = 0.05$). This result could have been influenced by the methodology. Rating scale questions over the phone is much more difficult than seeing the rating scale questions on paper and should be considered when testing for non-response bias. No significant differences were found between hardwood volume and hardwood sales for the respondents and non-respondents ($\zeta = 0.05$).

Results

To examine the results of the survey, the questionnaire was broken into five general question categories, including questions concerning the *demographics* of the responding companies that purchase S4S hardwood boards, *product characteristics* of S4S hardwood boards, the *distribution* of S4S hardwood boards, a *market analysis* of the S4S hardwood board market, and *open-ended questions*.

Demographics

Demographics of the respondents' customers were the first topic to be addressed in the survey. Contractors were the largest customer segment, representing 83.0 percent of the market, followed by consumers and dealers with 9.0 and

7.4 percent of the market, respectively. Percent sales were also recorded, with contractor sales scoring the highest with an average of 70.7 percent. Consumers and dealers had average sales of 21.3 and 8.0 percent, respectively.

Responding firms were asked to describe their firm as an *independent* or *chain* operation. Of the 185 companies that responded to this question, 137 (74.1%) were independent companies and 48 (25.9%) were part of a larger chain. Further information was obtained on the number of stores the respondent's company operates. The mean number of stores was 15.9. There may have been some misunderstanding by respondents regarding the definition of chain versus independent status. Of the 137 respondents that claimed they were independent, at least 38 had four or more stores.

The regions in which the respondent's sales outlets were located were identified (**Fig. 1**). The larger percentage found in Region 4 was likely influenced by the study collaborator's headquarters in that region.

The state of origin for the respondents' suppliers' shipments was also ex-

amined (**Table 1**). Wisconsin had the highest frequency with 51 responses. Again, this was expected since the study collaborator's customer base was included in the survey. Pennsylvania had the second-largest frequency with 49 responses. This was also a reasonable result given the large hardwood resource and the existence of another large hardwood supplier in Pennsylvania.

The final demographic question collected information regarding the number of workers employed by a given respondent. This information was important for projecting hardwood market volumes. The mean number of employees was 30.0. The median and mode values were 21 and 20, respectively.

Product characteristics

Because the identification of product characteristics important to customers is an integral part of a market survey, several questions considered S4S hardwood board product characteristics.

Information was gathered on the respondent's understanding of the term S4S. The respondent had the choice of *sanded 4 sides*, *surfaced 4 sides*, or *other*. Of the 184 respondents, 75.0 percent believed that S4S means *surfaced 4*

Table 1. — State and frequency of S4S hardwood board shipment origin.

State	Frequency	State	Frequency	State	Frequency
WI	51	AL	6	NH	3
PA	49	MO	6	SC	3
KY	13	GA	5	TX	2
MN	12	IN	5	WV	2
OH	11	AR	4	AK	1
MA	10	IL	4	CO	1
IA	8	ME	4	ID	1
MI	8	NJ	4	KS	1
NC	8	VA	4	MD	1
NY	8	FL	3	OR	1
TN	8	LA	3	RI	1
CT	7	MS	3		

Table 2. — S4S hardwood board preferred thickness.

Thickness	Preferred		Acceptable		Unacceptable	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
3/4 in.	174	94.6	9	4.9	1	0.5
11/16 in.	3	2.9	49	47.6	51	49.5

Table 3. — S4S hardwood board features received and features preferred.

Feature	Received		Preferred	
	Frequency	Percentage	Frequency	Percentage
Sanded face	114	60.6	122	64.9
Sanded edge	85	45.2	98	52.1
Ripped edge	20	10.6	15	8.0
Moulded face	52	27.3	53	28.2
Moulded edge	64	34.0	60	31.9
Don't know	15	8.0	--	--

Table 4. — Price increases for S4S hardwood board features.

Feature	Avg. price increase (%)
Sanded edge	10.1
Sanded face	9.2
Moulded face	2.8
Moulded edge	2.2
Ripped edge	0.4

sides. Sanded 4 sides was selected 17.9 percent of the time and other selected 7.1 percent. None of the respondents that selected the other category chose to specify their perceived meaning of S4S.

Grade is a very important characteristic for S4S hardwood lumber. Information was collected on the percentage of two common S4S hardwood lumber grades that the respondent purchased: 1) clear 1 face, 2 edges; and 2) D and better. Of the 177 companies that re-

sponded to this question, 113 (63.8%) purchased clear 1 face, 2 edges exclusively. Thirty-eight companies (21.5%) purchased D and better exclusively. The remaining 26 companies (14.7%) purchased a mix of the two grade categories.

Species is another product characteristic critical for production and marketing. Not surprisingly, red oak was inventoried by 96.3 percent of the 188 respondents. 61.7 percent of the respondents stocked yellow-poplar in inventory. Maple, birch, cherry, white oak, and aspen were stocked by 34.0, 17.0, 3.7, 3.2, and 1.1 percent of the respondents, respectively.

Respondents were asked to rate their preferred S4S board thickness, with the categories being either 3/4-inch or 11/16-inch. Each thickness category could be designated as preferred, acceptable, or unacceptable. Table 2 summarizes the results. Overall, 94.6 percent of the respondents preferred

3/4-inch-thick material and 2.9 percent preferred 11/16-inch-thick material.

As with thickness, length is also an important product characteristic. The questionnaire delineated between 1-foot and 2-foot increments. Of the 185 companies that answered this question, 57 percent chose 6 to 16 foot in 1-foot increments as the S4S hardwood board length they purchased and 27.0 chose 6 to 16 foot by 2-foot increments. The remaining 15.1 percent purchased S4S hardwood boards in other lengths. Only two of the companies that selected the other category chose to describe their preferred lengths, 3 foot to 12 foot and 4 foot to 10 foot even.

Respondents were asked to report features commonly associated with S4S hardwood boards. The choices of features included moulded face, moulded edge, sanded edge, sanded face, ripped edge, and don't know. Table 3 summarizes the features that the respondents believed that they received. There may have been some misunderstanding by some respondents concerning the definition of sanded edge and sanded face. Even though the respondents believed they were receiving sanded features in their S4S hardwood board shipments, in many cases they most likely were receiving only S2S boards.

In a similar question, responding companies checked the product features that they preferred. Again, sanded face scored very highly, selected by 64.9 percent of the responding companies. Once again, the respondents may have mistakenly believed that the smooth surfaces on S4S hardwood boards are achieved by sanding and not by planing (Table 3).

The respondents were asked how much additional money companies would be willing to pay for selected S4S hardwood board features. As with the previous two questions, there may have been confusion with the sanded edge and sanded face terms. The respondents were willing to pay 10.1 percent and 9.2 percent more for sanded edge and sanded face, respectively. Table 4 shows the payment details for the other features.

UPC coding is important in the retail industry. When asked whether the respondents preferred UPC coding on S4S hardwood lumber, 15.4 percent of 188 companies responded yes, 51.1 percent responded no, and 33.5 percent were indifferent. It should be noted, however, that respondents preferred "big box"

Table 5. — Width and package sizes of S4S hardwood boards.

Width (in.)	250 BF		500 BF		Other	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1 by 2	24	12.8	13	6.9	17	9.0
1 by 3	24	12.8	12	6.4	16	8.5
1 by 4	50	26.6	83	44.1	24	12.8
1 by 6	47	25.0	104	55.3	26	13.8
1 by 8	51	27.1	97	51.6	24	12.8
1 by 10	59	31.4	73	38.8	17	9.0
1 by 12	63	33.5	84	44.7	21	11.2

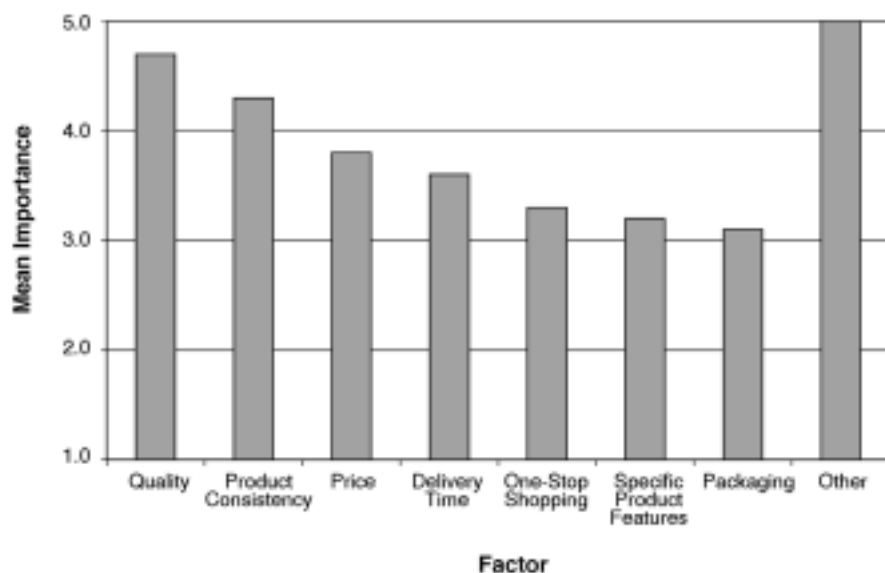


Figure 2. — Importance ratings of S4S hardwood board factors.

retailers to require UPC coding of their products. When asked whether the respondents preferred end-stamping on S4S hardwood lumber, 36.4 percent of 187 companies responded yes, 28.3 percent responded no, and 35.3 percent were indifferent.

Distribution

The third general question category concerned the distribution of S4S hardwood lumber. There were 186 companies that responded to the question regarding their preference of purchasing S4S hardwood lumber by the *unit*, *half-truckload*, *truckload*, or *other* volume. The greatest majority, 67.6 percent, purchased S4S hardwood lumber by the unit. Truckload and half-truckload were 5.3 and 7.4 percent, respectively. *Other* was indicated 18.6 percent of the time.

S4S hardwood boards can be purchased in an array of sizes. This section of the study examined the sizes of S4S hardwood boards and the BF volumes purchased by the respondents. Of interest is

the 1 by 6 in the 500 BF package, which had the highest number of responses at 55.3 percent. These results are summarized in **Table 5**. The *other* volume category can be summarized in two main segments including those that purchased in larger volume (1,000 BF or more) and those that purchased very small volumes and sizes (by the piece).

The types of suppliers from which the responding companies received their S4S hardwood boards were examined. The supplier types included *wholesale distributors* and *direct from manufacturers* and 55.6 percent of respondents reported *always* using wholesale distributors, with 39.3 and 5.2 percent indicating *sometimes* or *never*, respectively; 49.2 percent of respondents reported *always* sourcing direct from the manufacturer, with 43.0 and 7.8 percent indicating *sometimes* or *never*, respectively.

Delivery time plays an important role in the distribution process. We examined the acceptability or unacceptability of various delivery times ranging from

less than 1 week to more than 3 weeks. Overall, 63 percent of respondents were satisfied with delivery times less than 2 weeks, with 96 percent satisfied with delivery times of 1 week.

Market analysis

The final market analysis category examined the current status of the S4S hardwood board market. The respondents were asked to rate the importance of several S4S hardwood board factors on a scale of one to five (**Fig. 2**). *Quality* rated the highest followed by *product consistency*, with mean ratings of 4.7 and 4.3, respectively. The *other* category scored a mean rating of 5.0. It is important to note that only four companies responded to this category. If an *other* response was listed, they undoubtedly believed it was very important. Examples of the *other* category include *relationships with sales and specific lengths*.

In any market analysis, it is important to estimate future as well as current trends. We asked the respondents to predict whether their sales would increase or decrease over the next 5 years. Fifty-five companies (32.4%) predicted no change in their purchasing levels. Overall, 110 companies predicted their purchases of S4S hardwood boards would increase. Forty-three of these companies (25.3%) predicted a 10 percent increase in their purchases over the next 5 years. The average percent increase overall was slightly greater than 12 percent. Only five companies predicted that their purchases would decrease. The average decrease predicted by these five companies was 20 percent.

Information was collected on the major S4S hardwood board suppliers in the marketplace. The respondents checked the supplier from which they regularly purchased lumber and the species they most frequently purchased (**Table 6**).

Table 6. — S4S hardwood board suppliers and species.

Supplier	Oak	Poplar	Aspen	Other
	Frequency	Frequency	Frequency	Frequency
Babcock	4	2		
GP	43	30	1	2
Glen oak	54	27	1	5
Northland FP	33	14		9
Weaber	47	53	1	3
Weyerhaeuser	29	15	1	6
Other 1	59	40	3	22
Other 2	15	12		4

Table 7. — S4S hardwood board volume purchases (BF and frequency).

	Total	Oak	Poplar	Aspen	Other
Mean (BF)	23,512	12,737	12,525	11,000	7,253
Median (BF)	12,000	6,000	5,500	10,000	3,000
Frequency	101	100	65	3	35

Collecting data on S4S hardwood board volume is complex. Very often, large companies can skew the mean, resulting in inflated and skewed data. To address this problem, the median value is often reported with the mean value. During the data analysis, several companies with very large volume purchases were called to verify the validity of those values. **Table 7** summarizes species' purchase volumes from the responding companies.

Information was gathered on total sales dollars for S4S hardwood boards. Many companies, however, were reluctant to release this information. Seventy-six (40.4%) of the 188 respondents answered this question, but only 59 respondents' data were used to generate the following figures. The 59 respondents had reliable *number of employee* data, which was necessary for the market volume calculations. The mean sales figure for 1998 was \$70,569 and the median value was \$40,000.

Many of the respondents were also reluctant to reveal their total store sales. Of the 188 respondents, 104 (55.3%) revealed this figure. Of those, there were 76 respondents that had reliable *number of employee* data, which was necessary for the market volume calculations. The mean total sales volume was \$8,381,719 with a median value of \$6,000,000.

Open-ended questions

The final two questions in the questionnaire gave the respondents an opportunity to add additional information. These types of questions are not con-

strained by a limited number of answers. An overall theme for improvement was consistency, including better consistency in color, grading, packaging, and end trimming. A second theme for improvement was serving the customer, which included among other improvements, specific packaging, longer lengths, color uniformity, and packaging.

S4S product characteristics by region

S4S hardwood board market specifications may differ by region; therefore, a regional analysis was performed. Product characteristics including board thickness, board length, surfacing characteristics, UPC coding, and end-stamping were examined.

The 3/4-inch thickness was overwhelmingly preferred in all regions (89% to 100%) when compared to the 11/16-inch thickness. Multivariate statistical tests were used to compare the different regions. No significant differences in thickness preferences were found between regions ($\zeta = 0.05$). This indicates that board thickness preferences are similar by region.

Concerning length, retailers are showing an increasing interest in 1-foot increments as opposed to the traditional 2-foot increments. Roughly 51 percent of respondents favored the 1-foot increment lengths as compared to the 2-foot increment lengths. Multivariate statistical tests were used to compare the different regions. No significant difference in length preference was found between regions ($\zeta = 0.05$).

Preferences for characteristics such as *moulded face*, *moulded edge*, *sanded face*, *sanded edge*, and *ripped edge* were examined. The Chi-Square statistical test was used to compare each product characteristic across the different regions. No significant differences within product characteristics were found between regions ($\zeta = 0.05$). The confusion concerning the *sanded edge* and *sanded face* appeared across all regions. Even though the respondents perceived that they were receiving these features in their S4S hardwood board shipments, they were most likely receiving only surfaced boards.

Finally, we compared UPC coding and end-stamping across regions. It is important to understand these value-added features given their cost and manufacturing complexity. **Table 8** summarizes these results by region. In all regions, UPC coding was not preferred by a large margin. A Chi-Square statistical analysis was used to compare UPC coding response frequencies and significant differences were found between response categories in regions 3 and 4 ($\zeta = 0.05$).

End-stamping by region was checked for significant differences using the Chi-Square test (**Table 8**). Significant differences were found in the frequency of responses within region 4 ($\zeta = 0.05$).

S4S hardwood board market volume estimate

This study sought to estimate the volume of S4S hardwood boards. The survey collected information on number of employees and volume of S4S hardwood boards sold by the responding retailers. From this information, volume sold per employee was calculated and extrapolated over the population. The study respondents purchased a total volume of 2,374,701 BF of S4S hardwood lumber. The responding firms reported having a total of 3,034 employees. From this, each employee represents an average purchase of 783 BF of hardwood lumber. Estimates place 386,260 employees at SIC code 521, Lumber and Other Building Materials Dealers (USDC 1995). From this, S4S hardwood lumber volume purchases is estimated to be 302 MMBF. This represents approximately 12 percent of the 2.4 BBF dimension and components market or slightly more than 2 percent of total U.S. hardwood lumber production.

For red oak, a total volume of 1,273,719 BF was reported purchased

Table 8. — UPC and end-stamping preference.

Region ^a	Response	UPC		End-stamp	
		Frequency ^b	Percentage	Frequency ^c	Percentage
Region 1	Yes	11	22.4	17	34.7
	No	21	42.9	15	30.6
	Indifferent	17	34.7	17	34.7
Region 2	Yes	4	20.0	4	20.0
	No	11	55.0	5	25.0
	Indifferent	5	25.0	11	55.0
Region 3	Yes	1	5.6	3	16.7
	No	12	66.7	6	33.3
	Indifferent	5	27.8	9	50.0
Region 4	Yes	5	8.8	30	53.6
	No	30	52.6	13	23.2
	Indifferent	22	38.6	13	23.2
Region 5	Yes	1	14.3	2	28.6
	No	5	71.4	2	28.6
	Indifferent	1	14.3	3	42.9

^aRefer to Figure 1 for regional breakdowns.

^bSignificant differences exist in response frequencies within regions 3 and 4.

^cSignificant differences exist in response frequencies within region 4.

by respondents. Using the total employee number of 3,034, each employee represents 420 BF of hardwood lumber purchases. The volume of red oak purchased is estimated to be 162 MMBF.

For yellow-poplar, a total volume of 814,127 BF was reported purchased by respondents. Using the total employee number of 3,034, each employee represents 268 BF. This volume extrapolates to 104 MMBF nationwide.

For *other species* (including aspen), a total volume of 286,855 BF was reported across all respondents. Using the total employee number of 3,034, each employee represents 94 BF. This volume extrapolates to 36 MMBF nationwide.

Conclusions

This research was conducted to evaluate the marketing mix and to estimate volume of S4S hardwood lumber purchased by retail lumberyards in the United States. Based upon the research findings, we estimated that the lumberyards purchase an average of 23,500 BF of S4S hardwood boards per year. Red

oak and yellow-poplar are the major species purchased, with purchases averaging 12,500 and 8,000 feet per year, respectively. From these figures, the estimated total volume of S4S hardwood boards for 1998 was approximately 300 MMBF or approximately 2 percent of the total hardwood lumber production.

The most common species of S4S hardwood boards stocked by retail lumberyards were red oak, yellow-poplar, and maple. Other species included birch, white oak, and cherry. The most common volumes in package sizes were 500 BF and 250 BF. The most common widths were 1 by 4, 1 by 6, and 1 by 8, with a preferred thickness of 3/4 inches. Over 90 percent of the respondents wanted delivery within 2 weeks. Respondents indicated that on average they expect sales of S4S hardwood boards to grow approximately 12 percent over the next 5 years.

Respondents rated important product characteristics for S4S hardwood boards. Product quality and board con-

sistency were the highest rated factors. These product features were followed by price, delivery time, and one-stop shopping. Open-ended questions indicated that uniform color and longer lengths were also important product features.

There was some confusion concerning the *sanded edge* and *sanded face* product characteristic. Respondents perceived that they were receiving these features but were most likely receiving only surfaced boards. This demonstrates the buyers' lack of knowledge of the manufacturing process. This problem could be resolved through better communication between the S4S hardwood board suppliers and retailers. With that said, the end consumers' interest in smooth, square-edged boards is provided through surfacing alone.

Literature cited

- Building Materials Research Institute. 1998. The outlook for lumberyard sales. Prepared for the Northeastern Retail Lumber Assoc., Rensselaer, NY.
- Cesa, E.T. 1987. The home center market for hardwood specialty products. MS thesis. Dept. of Wood Sci. and Forest Prod, Virginia Tech., Blacksburg, VA.
- Hansen, B. and C. West. 1998. Trends in domestic/export hardwood markets. *In: Proc. Hardwood Symp. Hardwood Research Council, Memphis, TN.*
- Hardwood Review. 2001. New estimates of production and demand – Are we really headed for a lumber shortage? Charlotte, NC. June 29, 2001. 17(42).
- National Home Center News (NHCN). 1998. Institute predicts 4.5 percent annual industry growth through 2001. NHCN 23(20):10.
- Salant, P. and D.A. Dillman. 1994. How to conduct your own survey. John Wiley and Sons, Inc., New York.
- U.S. Department of Commerce (USDC). 1995. 1992 census of retail trade, establishment and firm size. RC92-S-1. U.S. Dept. of Commerce, Econ. and Statistical Admin., Bureau of the Census, Washington, DC.
- _____. 2002. Lumber production and mill stocks: 2001 - current industrial reports. Issued July, 2002. U.S. Dept. of Commerce, Economics and Statistical Admin., U.S. Census Bureau, Washington, DC.