

Manufacturers and Distributors in the U.S. Hardwood Lumber Supply Chain: Perceptions of Industry Trends

Omar Espinoza^{1*}, Urs Buehlmann², Matthew Bumgardner³, and Bob Smith²

¹Department of Bioproducts and Biosystems Engineering
University of Minnesota
St. Paul, MN 55108 USA

²Department of Wood Science and Forest Products
Virginia Tech
Blacksburg, VA 24061 USA

³Northern Research Station
USDA Forest Service
Princeton, WV 24740 USA

ABSTRACT

Global competition, a slowing housing market, and shifts in the customer base have contributed to reduced demand for hardwood lumber and have increased the need for specialized services by suppliers of hardwood lumber such as sawmills or distributors. Customers of hardwood lumber suppliers also have started initiatives to reduce internal costs dramatically, frequently shifting inventories upstream of the supply chain. Given these trends, U.S. hardwood lumber suppliers face the challenge of adapting their offerings to the demand of their customers. There is a widely-held perception that hardwood lumber distributors are well equipped to supply smaller, customized orders and value-adding services. To investigate how the industry is adapting, U.S. hardwood lumber manufacturers and distributors were surveyed in 2008 and 2009. This manuscript compares the supply chain perceptions and practices of hardwood lumber manufacturers and distributors. Results demonstrate a shift to smaller order sizes and customers and a restructuring of the customer base, with hardwood sawmills selling a higher portion of their production to distributors. Also, the importance of external factors on respondents' businesses was assessed. The slowing housing market and rising energy costs were rated highly by both lumber manufacturers and distributors. Hardwood sawmills perceive hardwood lumber distributors as very selective customers who expect short lead times and a high level of flexibility.

1. INTRODUCTION

The U.S. hardwood products industry has faced significant challenges over the last two decades. Among the challenges, the globalization of competition has caused considerable market share losses to this industry, which in turn resulted in plant closures and lay-offs (Buehlmann and Schuler 2009, Quesada and Gazo 2006, Schuler et al. 2001, The Economist 2007). This exodus of manufacturing capacity from the U.S. has shifted hardwood lumber demand from high value-added products (furniture, kitchen cabinets) to lower-value products (railroad ties, pallets, Hardwood Market Report 2009). Additionally, the sharp downturn in the housing industry that started in 2006 has reduced demand for hardwood products (Espinoza et al. 2011, Buehlmann et al. 2010a), with hardwood lumber output declining more than 40% between 2004 and 2009. Figure 1 shows U.S. hardwood lumber production from 2004 to 2009, as well as U.S. housing starts for the same period.

The decline of high value-added hardwood products manufacturing and the decline in the demand of hardwood products in the U.S. have changed the industry. Notably, small producers of customized hardwood products serving niche markets have performed better in this environment (Buehlmann et al. 2007, Buehlmann et al. 2010a), and their importance as hardwood lumber consumers is growing (Luppold and Bumgardner 2008). However, the production of customized products in small quantities demands different sourcing strategies compared to mass-produced, uniform items. Customized products call for smaller, more diverse orders and specialized services (e.g., planing, dimension sorting, color sorting, or custom grading) than do orders for mass-production. Distribution yards, commonly defined as enterprises that buy, store, and resell lumber, are often able to provide the aforementioned services more efficiently than sawmills, perhaps a reason why the importance of lumber distributors has been increasing for furniture and cabinet manufacturers (Kozak et al. 2003, Cumbo et al. 2006, Espinoza 2009). Also, consolidation has been occurring in the industry to leverage the resources that larger firms can make available for technology and management and to achieve

* Corresponding author: Tel.: (001) 612.624-0770; Fax: (001) 612.625-6286; E-mail: espinoza@umn.edu

larger negotiating power with suppliers (Luppold and Bumgardner 2009, Luppold, 2005, Manchester et al. 2009).

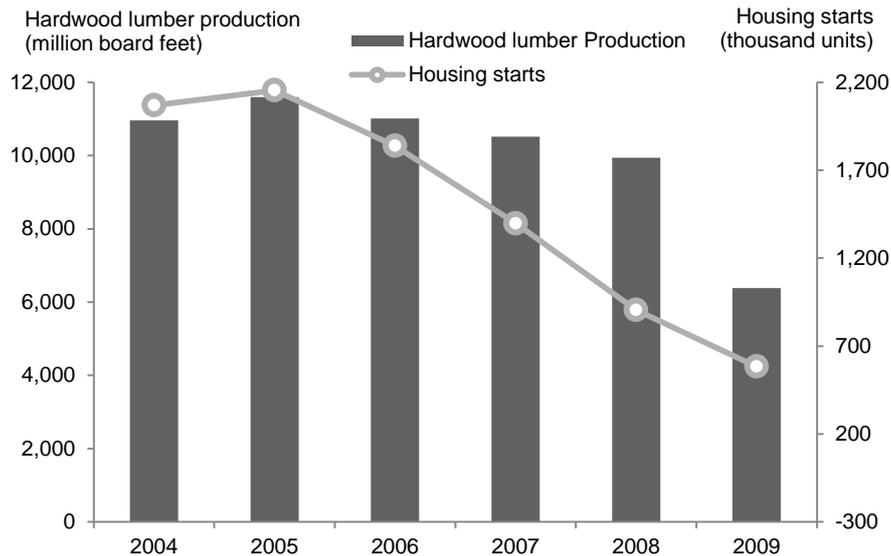


Figure 1. Hardwood lumber production and housing starts, from 2004 to 2009 (Howard 2006, Howard and McKeever 2010, Howard and Westby 2009, and U.S. Census Bureau 2010).

With the purpose of identifying changes in the U.S. hardwood lumber market and its supply chain (Espinoza 2009), hardwood lumber manufacturers and distributors were surveyed in 2008 and 2009. Results from both studies have been reported separately (Buehlmann et al. 2010b, Espinoza et al. 2011). This manuscript discusses the differences and similarities in supply chain practices and perceptions between hardwood lumber manufacturers and distributors. General company characteristics also are compared, such as species distribution, lumber sales, and markets served. Hopefully, the information presented here will lead to a better understanding of the role of distributors and manufacturers in the evolving U.S. hardwood supply chain.

2. MATERIALS AND METHODS

To understand the changing roles of U.S. hardwood lumber manufacturers and distributors, two mail surveys were conducted in 2008 and 2009. One survey targeted all known U.S. hardwood lumber distributors (Buehlmann et al. 2010b) and the second one targeted all known U.S. hardwood lumber manufacturers (Espinoza et al. 2011). Data from these studies were used to compare characteristics of both industry segments and to identify industry changes that might be occurring.

2.1. QUESTIONNAIRE DESIGN

Drafts of the surveys were developed and pre-tested by academia and industry specialists. The final version of the questionnaire for hardwood lumber manufacturers included six sections: company characteristics, production characteristics, markets served, and services provided, shifts in customer and orders, perceptions about the business environment, and a section about the role of hardwood lumber distributors. The questionnaire for lumber distributors had five sections: firm characteristics, business operation, customer base, suppliers, and perceptions about the industry. Different types of questions were asked, including scaled (seven-point Likert scale), open-ended, close-ended (multiple choice and yes/no), and partial open-ended (multiple-choice with “other” option). Since identifying trends was one of the central objectives of the study, some questions required participants to report data for two points in time, 4 years apart. In the case of hardwood lumber manufacturers, this period ran from 2004 to 2008, and 2003 to 2007 for hardwood lumber distributors. The difference is due to the fact that both surveys were not implemented simultaneously.

2.2. SAMPLE FRAME

Hardwood lumber producers (NAICS code 3211131) and hardwood lumber distributors (NAICS code 423310-Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers, and NAICS code 4441901-Lumber Retailing) were surveyed in 2008 and 2009, respectively. Sources consulted to compile the mailing list for hardwood lumber manufacturers were Virginia Tech's Center for Forest Products Business address database, which represented 17.8% of total U.S. hardwood lumber production in 2008 (Howard and McKeever 2010). For the survey of hardwood lumber distributors, lists from the National Hardwood Lumber Association (NHLA), the North American Wholesale Lumber Association (NAWLA), and the Hardwood Distributors Association (HDA) were consulted to compile the mailing list.

2.3. SURVEY EXECUTION

Dillman's (2009) Total Design Method was used to implement the surveys, including, for each survey, two questionnaire mailings and two reminder postcards after each questionnaire mailing, totaling two months for each survey. The questionnaires were sent inside an envelope along with a cover letter explaining the purpose and potential benefits of the study. As an incentive, companies were offered a summary of the study's results. Table 1 lists the response analysis and the geographical distribution of respondents. The response rate for lumber distributors was higher than for lumber manufacturers (17.8% compared to 13.9%).

Table 1. Sample size and adjusted response rate.

	Hardwood lumber manufacturers	Hardwood lumber distributors
<i>Response analysis</i>		
Initial mailing	1,216	424
Usable responses	137	69
Adjusted response rate*	13.9%	17.8%
<i>Geographical distribution of respondents</i>		
South	43.4%	41.1%
Midwest**	30.2%	8.6%
Northeast	22.5%	22.4%
West**	0.8%	13.8%
Two(or more) U.S. regions	3.1%	13.8%

* After accounting for wrong addresses, companies no longer in business, and companies not from target population.

** Significant difference ($\alpha=0.05$), Z-test of proportions.

2.4. NONRESPONSE BIAS ASSESSMENT

In order to ensure that the sample represented the target population, a nonresponse bias assessment was carried out for both surveys. The methods used were different in each case and are explained below.

Surveys of hardwood lumber producers -- Responses were divided into four "waves," according to the time in which questionnaires were received. Then, early and late respondent's responses were compared. This practice uses late respondents as a proxy of non-respondents (Dalecki et al. 1993, Etter and Perneger 1997, Lahaut et al. 2003). Two dimensions were compared: lumber sales volume and whether respondents sold to lumber distributors. No significant differences were found in the two dimensions compared.

Survey of hardwood lumber distributors -- A representative sample of non-respondents were contacted after the closing of the survey and inquired on four dimensions: whether distribution was their sole business, species distribution, markets served, and lumber input. Responses were then compared with those of the responding firms (Etter and Perneger 1997). No significant difference was found in all four dimensions.

2.5. STUDY LIMITATIONS

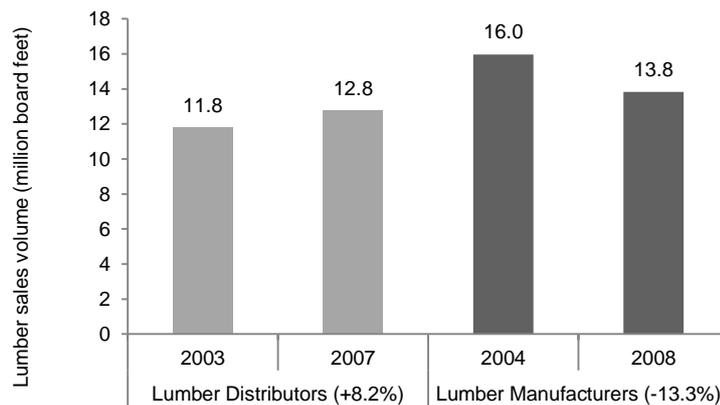
This study has limitations typical of mail surveys, such as accuracy issues from ability of respondents to recall an event after a long time (especially for trend-related questions) or inadequate knowledge of respondents, or respondents' willingness to report on a sensitive topic (Alderman and Salem 2010). Also, low response rates can lead to low representativeness, especially when nonprobability sampling methods are used

(Krosnick 1999). Additionally, answers provided by the person filling out the survey form may not necessarily reflect the viewpoints of other decision-makers in the company or the company itself. The study also is limited by the timing of its execution. Being conducted in 2008 (hardwood lumber distributor survey) and 2009 (hardwood manufacturer survey) and asking for data from 2003 and 2007 (distributor survey) and 2004 and 2008 (manufacturing survey) does not only separate the answers by one year, but the financial crisis may have affected the answers for one survey differently than for the other. Thus, results published in this manuscript need to be used carefully.

3. RESULTS AND DISCUSSION

3.1. LUMBER SALES

Lumber sales volume (in million board feet or MMBF) for both manufacturers and distributors was asked in the surveys. The average responses are summarized in Figure 2. Average sales volume for lumber manufacturers and distributors in the last year of the relevant period was 13.8MMBF and 12.8MMBF, respectively. For both hardwood lumber manufacturers and distributors there were no significant differences in the average lumber sales between the first and last year of the period in consideration ($\alpha=0.05$), although lumber sales for manufacturers were 13.3% lower in 2008 than in 2004. This might reflect the start of the U.S. economy downturn, with the worst recession in decades starting in December of 2007 (National Bureau of Economic Research 2010). The total lumber sales for respondent sawmills was 1.8 billion board feet (2008) and for distributors was 0.6 billion board feet (2007).



(*) In parenthesis the percent change in the 5-year period

Figure 2. Average hardwood lumber sales for lumber manufacturers and distributors. No significant difference in sales by year for either manufacturers or distributors ($\alpha=0.05$, Mann-Whitney U test).

3.2. SPECIES DISTRIBUTION

Table 2 lists the species distribution for hardwood lumber manufacturers' production and distributors' sales for the periods of study and the percent change for each species. Species distribution is fairly similar for both groups, with oak (red and white), yellow-poplar, and maple (soft and hard) making up 70.3% and 66.2% of sawmills' and distributors' sales, respectively. Hardwood lumber distributors, however, seem to have more variety with "other" species making up 5 percentage-points more of their species mix compared to sawmills. Regarding change in species distribution during the last 5 years to the time of the study, red oak has decreased its share by 10.6% for lumber manufacturers and 33.1% for distributors. Yellow-poplar and soft maple have gained market share in the lumber manufacturers' mix (by 14.0 and 15.7%, respectively), in accordance with a shift in fashion (Luppold and Bumgardner 2007). Also, lumber distributors have been selling 88.4% more ash and walnut during the 5 years researched (2003 to 2007, Table 2).

Table 2. Species distribution and change over 5 years.

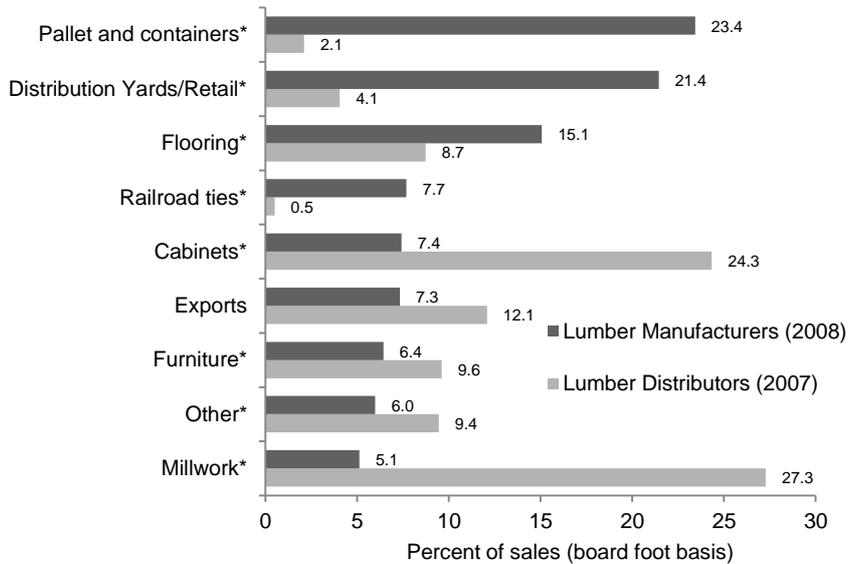
Species	Lumber manufacturers			Species	Lumber distributors		
	2004	2008	Change		2003	2007	Change
		----- % -----				----- % -----	
Red oak	27.6	24.7	-10.6	Red oak	16.9	17.9	5.7
White oak	15.0	14.7	-2.3	White oak	25.1	16.8	-33.1
Yellow-poplar	11.6	13.2	14.0	Yellow-poplar	12.4	13.4	7.7
Hard maple	10.5	10.8	3.6	Hard maple	9.2	9.1	-0.4
Soft maple	5.9	6.9	15.7	Soft maple	9.2	9.1	-1.7
Ash	4.5	4.5	1.9	Ash	3.6	6.9	88.4
Cherry	5.4	4.5	-17.0	Cherry	6.3	6.1	-2.7
Hickory	3.5	3.9	11.4	Hickory	1.8	3.4	88.0
Gum	2.0	3.0	44.9	Gum	1.6	2.2	36.7
Black walnut	2.0	2.6	30.4	Black walnut	1.6	1.5	-6.2
Others*	11.4	11.6	1.6	Others*	12.2	16.8	37.7

* Includes: Basswood, birch, aspen, beech, cypress, elm, and cottonwood.

** Includes: basswood, beech, gum, aspen, cypress, alder, and imported species.

3.3. MARKET DISTRIBUTION

Companies were asked to report markets served and their share of total sales. Figure 3 shows the results for this market share question for the latest year in the period of study. Significant differences in almost all markets served exist. About three fifths of hardwood lumber manufacturers sales are aimed at pallet and container manufacturers (23.4%), distribution yards and retailers (21.4%), and flooring manufacturers (15.1%). Lumber distributors sell mostly to kitchen and bath cabinet manufacturers (24.3%), millwork producers (27.3%), and to export markets (12.1%).



* Denotes significant difference (alpha=0.05, Mann-Whitney U test).

Figure 3. Market segments served by lumber manufacturers and lumber distributors.

Changes in markets served are listed in Figure 4. The loss of domestic furniture manufacturing (Grushecky et al. 2006) may be the most obvious observation, with both sawmills and lumber distributors reducing the participation of their sales to furniture manufacturers by 40.7% and 37.3%, respectively. Results also suggest that millwork and flooring manufacturers are increasingly sourcing their raw materials through lumber distributors, since the latter reported gains in sales to these markets compared to total sales (13.6% and 33.7% for millwork and flooring, respectively), whereas sawmills reported a decrease for millwork (-11.3%) and a very small increase for flooring (1.9%). Sales for railroad ties by distributors have more than doubled (increase of 103.3%) relative to other markets during 2003 to 2007; similarly this percentage for sawmills was 32.7%.

However, it should be noted that the share of railroad ties on total sales for distributors is very small (0.5%, Figure 3) compared to sawmills (7.7%, Figure 3). “Other” markets for sawmills increased sales by 122.7% and included blocking, caskets, crane mats, frame stock, custom sawing, and pulp. For distributors, “other” markets increased their share on total sales by a more modest 23%.

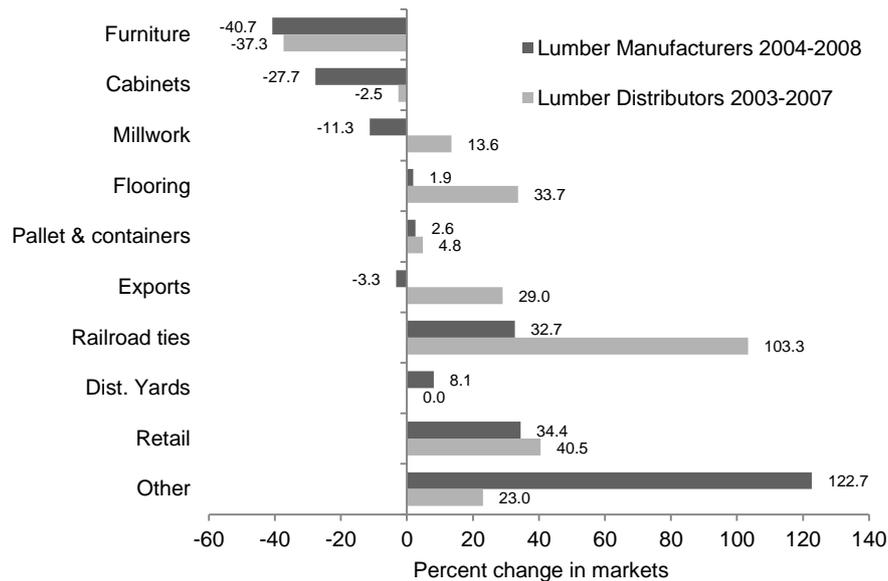


Figure 4. Change in markets for lumber manufacturers and distributors.

3.4. BUSINESS FACTORS

To learn about the perceptions of companies regarding factors that most affect their businesses, respondents were asked to rate the importance of a list of factors on a Likert scale from 1 (no effect) to 7 (major effect). Results are listed in Table 3. The order in which factors were rated was similar for both lumber manufacturers and distributors. For example, both groups rated the “slowing housing market,” “fuel costs,” and “energy costs” highly (Table 3). Factors that were rated relatively low in the scale were “lumber branding,” “carrier required backhauls,” “E-commerce,” “truck/driver availability,” and “certified lumber.” Regarding differences between sawmills and distributors, sawmills rated the following factors significantly higher: “energy costs,” “labor costs,” and “increasing imports.” Distributors rated “truck/driver availability” significantly higher.

Table 3. Perceptions about factors affecting respondents' businesses. 1=No effect, 7=Major effect.

Factor	Lumber manufacturers	Lumber distributors
Slowing housing market	6.2	6.0
Fuel costs	5.6	5.4
Energy costs for production*	5.2	4.6
Changing customer demand	5.1	4.7
Labor costs*	4.9	4.4
Globalization	4.4	4.4
Increasing lumber imports*	4.4	3.9
Changing raw material base	4.4	3.9
Interest rates	3.8	4.0
Lack of skilled workers	3.3	3.1
Certified hardwood lumber	3.2	3.4
Truck/driver availability*	3.1	3.7
E-Commerce	3.0	3.3
Carrier required backhauls	2.6	2.5
Lumber branding	2.4	2.6

* Denotes significant difference (alpha=0.05, Mann-Whitney U test).

3.5. PERCEPTIONS ABOUT THE HARDWOOD DISTRIBUTION BUSINESS

Successful supply chains require close collaboration between partners (Simatupang and Sridharan 2008). Lumber manufacturers and distributors were asked about their perceptions about hardwood distributors. Results are listed in Table 4. Although differences in perceptions were identified between manufacturers and distributors for most of the answers, there was a positive correlation (Spearman’s coefficient of $r=0.84$) between the ranked means of the two groups. Thus, any differences in absolute terms should be tempered with the point that there was general agreement in relative terms. In general, hardwood lumber manufacturers rated the statements higher in the scale than distributors. Statements with the highest scores were related to distributors being very selective in their purchases, their demand for short lead times, and their demand for products with high turnover. On the lower end of the scale were late payment of bills and the use of foreign suppliers (Table 4).

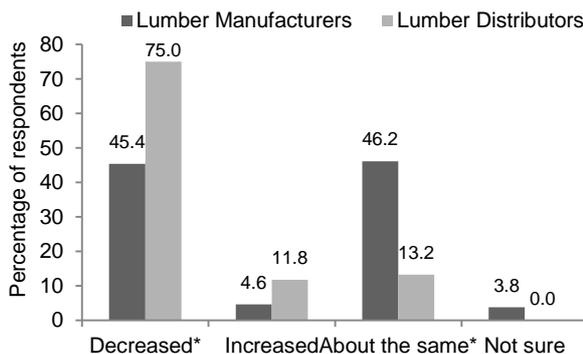
Table 4. Perceptions about the hardwood lumber distributor’s business. Answers from lumber manufacturers and lumber distributors. 1=Not true, 7=Very true.

Statement about lumber distributors	Lumber manufacturers	Lumber distributors
Very selective in purchasing materials*	5.8	4.0
Expect short lead times*	5.4	3.9
Purchasing only high demand products*	5.2	4.2
Have many other suppliers*	5.1	3.8
Expecting high flexibility in order volumes*	5.0	4.0
Inconsistent buying*	4.8	3.3
Not willing to pay for premium services*	4.8	3.3
Pay bills late*	3.3	2.0
Utilizing foreign suppliers extensively	3.1	2.7

* Denotes significant difference (alpha=0.05, Mann-Whitney U test).

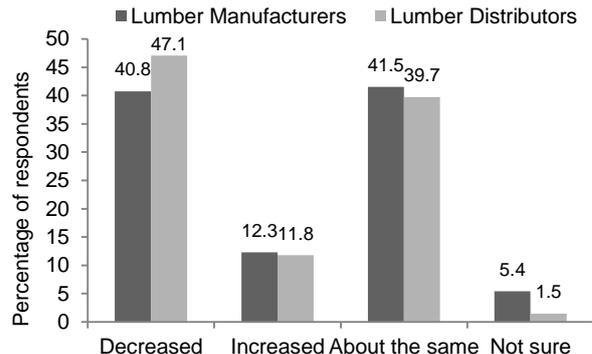
3.6. CHANGES IN THE CUSTOMER BASE

Companies surveyed were asked about their perceptions of changes regarding customer and order size over the 5 years prior to the study. Results are shown in Figures 5 and 6. Three quarters of all responding distributors agree that order size has decreased. This response differed significantly with that from lumber manufacturers (45.4% of respondents indicated that order size has decreased). This may be an indication that distributors are more likely to serve the growing number of small, specialized wood products manufacturers (Luppold and Bumgardner 2008). However, responses did not differ significantly regarding customer size, with 47.1% of distributors and 40.8% of sawmills indicating that customer size has decreased over the last five years.



* Significant difference in perceptions between lumber manufacturers and distributors (alpha=0.05, Z-test of proportions).

Figure 5. Perception about order size.



No difference in perceptions between lumber manufacturers and distributors (alpha =0.05, Z-test of proportions).

Figure 6. Perceptions about customer size.

3.7. SERVICES

Respondents in both the distribution and sawmill population were asked what services they offered to their customers. Table 5 lists the results. A higher proportion of hardwood lumber distributors than manufacturers reported offering almost any given service. The largest differences were found for “break bundles,” “S2S,” “S4S,” and “custom moulding,” “custom flooring,” and “certified products.” Table 5 also shows the percent change in services offered by distributors over the period of study (2003-2007). The number of distributors offering the services listed has increased for all except one (“width sorting”). The largest changes were found for “custom moulding” (+100.0%), “certified products” (+262.5%), “custom flooring” (+91.7%), “priming” (+100.0%), and “finishing” (+133.3%).

Table 5. Services provided by hardwood lumber distributors and lumber manufactures.

Service offered/requested	Lumber manufacturers Provided in 2008	Lumber distributors	
		Provided in 2007	Change from 2003
		----- % -----	
S2S	48.9	75.6	5.4
Quick delivery	77.2	73.1	14.0
Break bundles	31.5	71.8	21.7
Just in-time delivery	58.7	71.8	9.8
Special grading	56.5	62.8	28.9
Double end trim	71.7	60.3	20.5
Color sorting	56.5	59.0	27.8
Width sorting	69.6	51.3	-28.6
S4S	20.7	50.0	34.5
Custom moulding	12.0	38.5	100.0
Certified products	19.6	37.2	262.5
Custom flooring	12.0	29.5	91.7
Priming	1.1	12.8	100.0
Profile sanding	2.2	12.8	42.9
Finishing	2.2	9.0	133.3
Embossing	0.0	9.0	75.0

4. SUMMARY

U.S. hardwood lumber manufactures and distributors were surveyed in 2009 and 2008 to identify trends in the hardwood lumber market and supply chain. Results were reported separately in previous publications (Buehlmann et al. 2010b, Espinoza et al. 2011). This paper compared business practices and perceptions of hardwood sawmills and hardwood lumber distributors.

Lumber manufacturers reported average lumber sales figures for 2008 compared to 2004, which was 13.3% lower at 13.8 and 16.0 million board feet, respectively, suggesting that the effects of the recession had started to affect the industry by 2008. Both hardwood lumber manufacturers and distributors reported a decrease in red oak sales, while closed-grain species such as yellow-poplar and hard and soft maple gained in the percentage of manufacturers’ hardwood lumber mix. Sawmills are selling a larger part of their production to distributors, retailers, railroad ties, and “other” markets, whereas distributors are increasing their sales to flooring and millwork manufacturers, as well as exports and “other” markets. Both sawmills and distributors have decreased their sales to furniture manufacturers, probably as a result of the ongoing realignment of the domestic household furniture industry. When asked about events affecting their businesses, hardwood lumber manufacturers and distributors rated the slowing housing market and rising fuel and energy costs the highest. A large majority of sawmills and distributors share the perception that customer and order size have either remained the same or decreased. Particularly, three quarter of lumber distributors indicated that order size has decreased during the last five years (to 2007), likely a function of the primary markets served by distributors (cabinets and millwork), and the connections to housing.

The results from this study suggest that the hardwood lumber industry is adapting to changes in markets and the business environment. This ability to adapt is demonstrated by the growth in the number of companies offering customized services (e.g., special grading), value-added products (e.g., priming), and rapid delivery.

Results also confirm the notion that hardwood lumber distributors seem well positioned in the market to provide services to hardwood users, as seen in the growth of sales of distributors, with corresponding increases in sales from distributors to secondary manufacturers.

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