AN INVESTIGATION OF HARDWOOD PLYWOOD MARKETS. PART 1. ARCHITECTURAL WOODWORKERS

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ABSTRACT

This is the first part of a two-part study investigating markets for hardwood plywood. North American architectural woodworkers were surveyed to better understand the structure and use of wood-based panels in the industry. A questionnaire was mailed to a sample of U.S. and Canadian architectural woodworkers. The sample consisted of members of the Architectural Woodwork Institute (AWI) and the Woodwork Institute of California (WIC). The response rate, adjusted for bad addresses, was 31 percent. The average architectural woodworker purchased $283,000 of panel materials in 1997, and $111,000 of hardwood plywood. Of total panel purchases, hardwood plywood (including all substrates covered with a hardwood veneer) represented 37 percent, followed by melamine-coated board (21%), raw particleboard (17%), and high-pressure laminate (8%). The Northeast region represented 38 percent of total hardwood plywood purchases by architectural woodworkers followed by the Midwest (20.4%); the Southeast (14.9%); the West (9.1%); and the South Central (8.3%). Of the hardwood plywood purchased, 37 percent was particleboard core, 33 percent veneer core, and 24 percent medium density fiberboard core. Sixty-three percent of total hardwood plywood was premium grade, followed by custom (25%), and paint grade (7%). Red oak was the predominant face species used (31%), followed by maple (17%), cherry (16%), birch (10%), and mahogany (9%). Eighty-two percent of the faces were constructed of sliced veneer. Nearly 4 percent of total hardwood plywood purchases were of pre-finished plywood. This number was expected to increase to nearly 7 percent by the year 2000. The most important hardwood plywood attribute as perceived by architectural woodworkers was absence of delamination of veneers, followed by absence of defects showing through face, on-time delivery, absence of warp, and orders shipped correctly.

Over the past few decades, the hardwood plywood industry has seen many changes. Mergers and acquisitions have led to fewer but larger stock panel (standard sizes such as 4 ft. by 8 ft.) producers while the smaller cut-to-size (custom sizes) panel manufacturers have decreased in number as mills lose competitive position. Competition in the industry has greatly intensified with the development of quality substitute products and the threat from imports. Available manufacturing technology has rapidly improved in the past decade and is currently advancing at a rate never before seen in this industry.

For a firm to remain competitive in such an environment, the implementation of a successful marketing strategy becomes essential. The heart of any successful marketing strategy is knowing the customer (14,19). It is important to understand the structure of the customer's industry as well as the desires and needs of the customer. Recently, research was conducted that provided such information about the hardwood plywood distribution industry (8,9). Although the information provided by these studies was very useful, it was limited in that it only addressed the hardwood plywood distribution industry. Further research was needed to better understand the distributors' customers.

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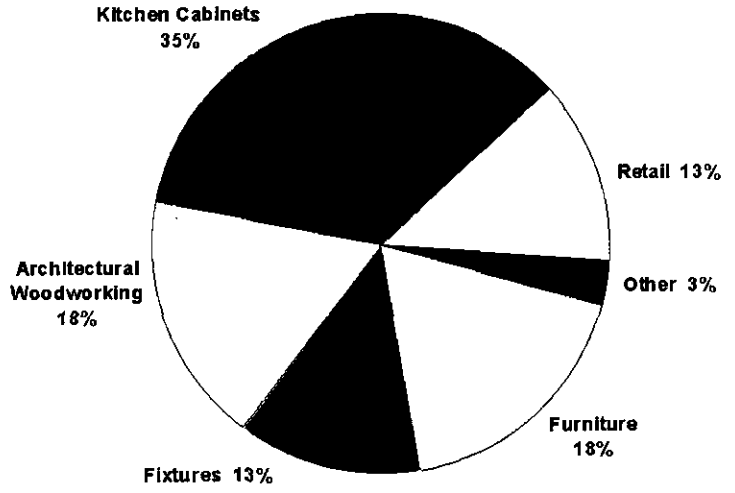

Figure 1. — Distributors' 1995 sales of hardwood plywood by end-use category.

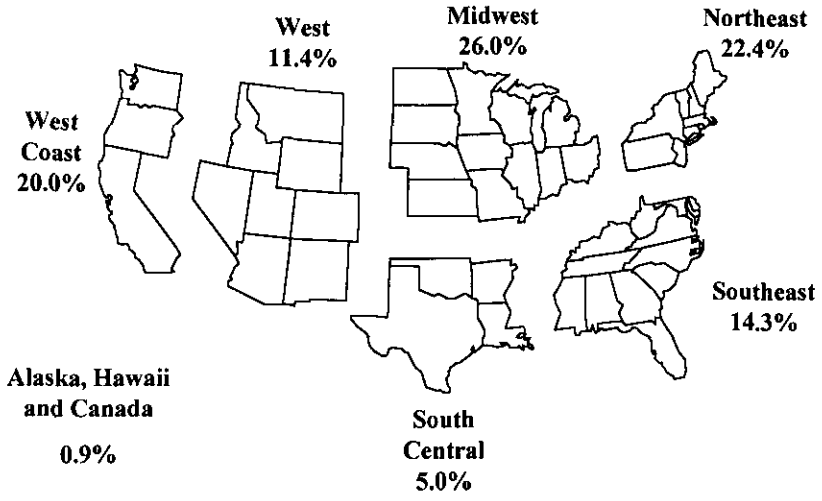

Figure 2. — Breakdown of 1997 North American architectural woodworking sales by geographic region.

Figure 1 shows the distribution of 1995 hardwood plywood sales by end-use category (8). Since the industries presented in **Figure 1** are the end-users of hardwood plywood, it is easy to see why it would benefit both hardwood plywood distributors and manufacturers to know more about these markets. The purpose of this study was to provide such information for the architectural woodworking industry. The specific objectives were to: 1) investigate the structure of the architectural woodworking industry; 2) determine the relative importance of hardwood plywood product and supplier attributes as perceived by architectural woodworkers; and 3) investigate plywood use trends.

The architectural woodworking industry may be defined as a fragmented industry. The industry is comprised of approximately 3,100 firms throughout the United States, with no single firm holding a large share of the market (16-18). Generally, firms are small, family-held businesses consisting of 20 employees or less (16-18). Firms typically generate jobs by bidding against competing firms within their region. Such a bidding process encourages strong competition between firms.

In the face of strong competition, it is important that a firm know and understand the industry in which it competes. Such information allows the firm to position itself relative to its competition and assists in strategy development and managerial decision making.

METHODS

North American architectural woodworkers were surveyed to investigate the structure of the architectural woodworking industry and plywood use trends, and to determine the relative importance of hardwood plywood product and supplier attributes as perceived by architectural woodworkers. Data was collected via a mail survey over a 6-week time frame.

POPULATION SURVEYED

The population of interest to this study was North American architectural woodworkers.

Mailing lists for architectural woodworking firms were obtained from the Architectural Woodworking Institute (AWI) and the Woodworking Institute of California (WIC). Association membership lists were believed to be the best source given the fragmented nature of the subject industries. To test for bias in these lists (i.e., are association members different from non-members with regard to the data collected?), comparisons were made between firms that were association members and a sample of non-member firms. The entire memberships of the AWI and the WIC were surveyed. A random sample of 200 non-member firms also were surveyed. The final survey sample frame consisted of 845 architectural woodworkers.

DATA COLLECTION

Data were collected via a structured questionnaire. The survey instrument was designed with the assistance of a panel of experts comprised of hardwood plywood distributors, architectural woodworkers, association executives, and others knowledgeable of the architectural woodworking industry. The survey addressed the structure of the industry and collected data related to wood panel product and service attributes. Before administering the survey, the questionnaire was evaluated by this panel for content validity. Content validity refers to the adequacy with which the instrument measures what it is intended to measure (5). After adjustments, the questionnaire was pretested on a random sample of firms ($n = 20$). Appropriate changes were made to the questionnaire before mailing.

RESPONSE RATE AND NON-RESPONSE BIAS

When collecting data via survey, subjects have the option to refuse to provide information. A lack of sufficient data due to non-response is potentially problematic. To reduce the likelihood of non-response, the AWI and the WIC mailed pre-notification letters to subjects explaining the purpose of the study and asking for cooperation. This letter not only served as a pre-notification, but also added credibility to the study from the perspective of the manufacturers. Within 2 weeks of the pre-notification letter, a questionnaire was mailed, followed a week later by a postcard reminding firms to respond. Two weeks after mailing the postcard, a second survey was mailed to non-respondents. Such methods have been shown to improve response rates (6,7). The final response rate, adjusted for bad addresses, was 31 percent.

When the response rate of a survey is less than 100 percent, the potential for non-response bias exists. The lower the response rate, the greater the potential. Since the response rate for this study was 31 percent, non-response was a concern. To test for non-response bias, telephone calls were made to a random sample of non-respondents, and subjects were asked to answer a few of the most pertinent questions on the questionnaire. Variables included in the non-response bias survey included value of sales, number of employees, percent of total sales represented by hardwood plywood, and attribute ratings of the most important attributes. Mean scores of the responses to these questions were compared to determine if biases existed between association member firms and non-member firms, and between responding firms and non-responding firms. No bias was detected ($\alpha = 0.05$), inferring that the results of this study apply to the population of all architectural woodworking firms, and not just responding firms or association member firms.

DATA ANALYSIS

Attribute importance was determined by asking architectural woodworkers to rate on a scale of 1 (not at all important) to 7 (extremely important) how important certain hardwood plywood product and service attributes were to their companies. Woodworkers were then asked to rate on a scale of 1 (poor) to 7 (excellent) how their suppliers performed with respect to these attributes. Average importance and performance scores were then calculated for each attribute. Similar methods have been utilized in previous marketing research to assess importance of attributes (1-4,10,12,15).

Multivariate analysis of variance (MANOVA) was used to test for differences in importance and performance scores. Three comparisons were used: 1) suppliers with different ratios of hardwood plywood sales to total sales; 2) suppliers with different levels of total sales volumes; and 3) suppliers selling to different price point categories. Where differences were detected ($\alpha = 0.05$), Tukey's multiple-range test was used to determine the source.

Tests for violations of assumptions were performed to assess the appropriateness of utilizing MANOVA for this data set (11,13). No evidence of violations was detected ($\alpha = 0.05$) by Bartlett's test for sphericity, and Box's M. Examination of box plots and normality plots indicated no violations of multivariate normal distribution assumptions.

RESULTS

THE STRUCTURE OF THE ARCHITECTURAL WOODWORKING INDUSTRY

The average North American architectural woodworker had total sales in 1997 of $3,200,000. The average facility was 26,200 ft.^{2} and employed 28 full-time employees. The average firm purchased $283,000 of panel materials; $110,000 of this was hardwood plywood.

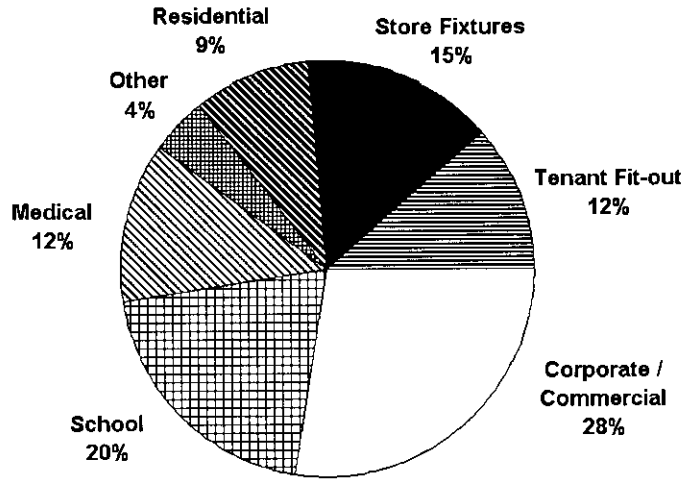

Figure 3. — Architectural woodworkers' 1997 sales by market-segment category.

Figure 2 provides a breakdown of architectural woodworker sales by geographic region. As shown, the Midwest was the largest region representing 26 percent of total sales, followed by the Northeast (22%), the West Coast (20%), the Southeast (14.3%), and the West (11.4%). Eighty-five percent of responding firms expected sales to increase by the year 2000, 12 percent expected a decrease, and 3 percent expected no change.

The largest market segment for architectural woodworkers was corporate/commercial representing 28 percent of total sales (**Fig. 3**). This segment includes architectural woodwork in new or remodeled commercial office buildings contracted by the owners of the building. School fixtures, or architectural woodwork in educational institutions represented 20 percent of total sales. Store fixtures, which includes display stands, clothing racks, and other woodwork contracted by retailers to help display their products, represented 15 percent of total sales. Medical, which includes woodwork in hospitals, nursing homes, and other medical institutions, represented 12 percent of total sales. Tenant fit-out, woodwork contracted by tenants of commercial property, represented 12 percent of total sales, and residential 9 percent.

Figure 4 provides a breakdown of 1997 architectural woodworking sales by product category. As shown, the largest product category was laminated plastic casework, representing 31 percent of total sales. This segment utilizes

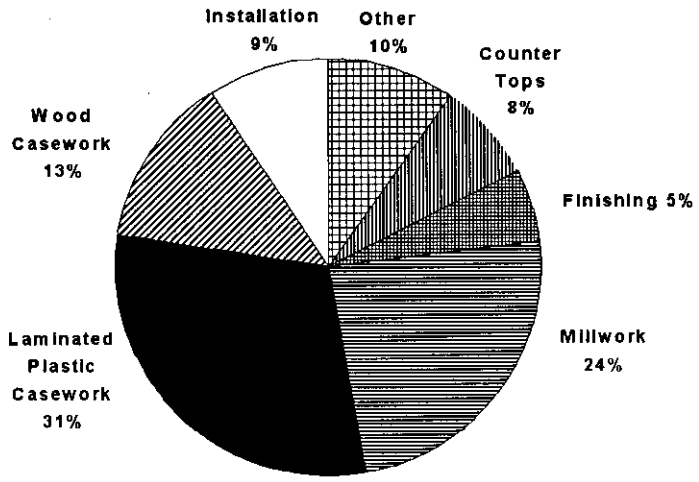

Figure 4. — Breakdown of total 1997 architectural woodworking sales by product category.

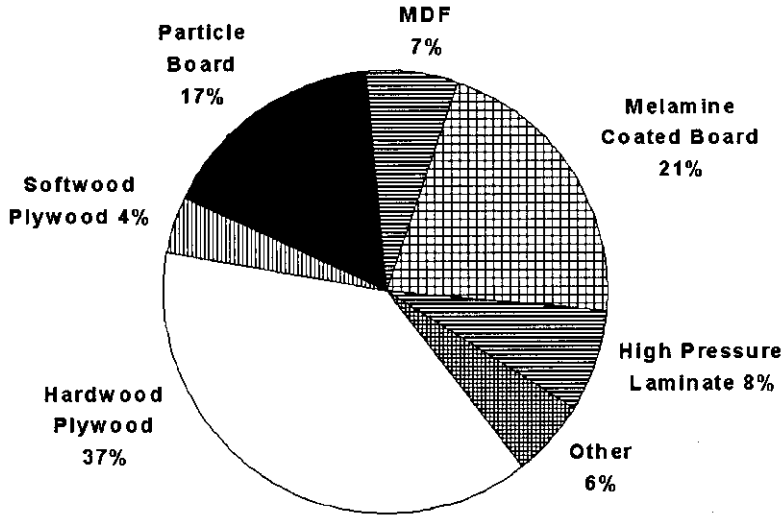

Figure 5. — Breakdown of architectural woodworkers' 1997 panel purchases by panel type.

plastic laminates, particleboard, and some medium density fiberboard (MDF) in its manufacture. Twenty-four percent of sales was millwork. The millwork segment, which uses primarily solid lumber as a raw material, can be segmented further as follows: 22 percent wood doors, 14 percent standing and running trim, 2 percent stairwork, 2 percent windows, and 60 percent other millwork. Thirteen percent of total architectural woodworking sales was wood casework. This segment utilizes significant levels of hardwood plywood in manufacturing its products. Eight percent of architectural woodworking sales was counter tops, another consumer of plastic laminates and particleboard.

Forty-seven percent of 1997 architectural woodworking sales exhibited a non-wood finish. This category includes all plastic laminate work. Forty percent of 1997 architectural woodwork exhibited a wood finish (transparent or stained wood finish) and 13 percent exhibited an opaque or painted finish. All categories utilize wood products in their construction; however, the transparent/stained segment uses more high grade hardwood plywood and solid lumber.

HARDWOOD PLYWOOD USE IN THE ARCHITECTURAL WOODWORKING INDUSTRY

The architectural woodworking industry is a significant user of wood panel products. In fact, 18 percent of all hardwood plywood sales by distributors in 1995 was to architectural woodworkers (8). **Figure 5** shows a breakdown of 1997 panel purchases by architectural woodworkers. As shown, hardwood plywood represents 37 percent of total panel purchases. Other significant panel purchases include melamine-coated board (21%), particleboard (17%), high pressure laminate (8%), and MDF (7%). Wood-based panels and panels utilizing wood-based cores represented 84 percent of total panel purchases.

Architectural woodworkers were asked to predict anticipated panel use for the year 2000. Hardwood plywood use was predicted to increase to 38 percent, while particleboard and high-pressure laminate use were predicted to decrease to 16 percent and 7 percent, respectively.

The distribution of 1997 hardwood plywood sales to architectural woodworkers by geographic region is shown in **Figure 6**. The largest user of hardwood plywood was the Northeast region (38%), followed by the Midwest (20%), the Southeast (15%), and the West (9%). The fact that the distribution of architectural woodworkers' total sales (**Fig. 2**) and hardwood plywood purchases (**Fig. 6**) do not coincide illustrates regional preferences in finishes. The respondents' opinions regarding this point may have been influenced by aesthetic preference, market demand, cost, and product availability.

Of the hardwood plywood purchased by architectural woodworkers in 1997, 37 percent was particleboard core (**Fig. 7**). Veneer core and MDF were also significant substrates representing 33 percent and 24 percent of total purchases, respectively. Architectural woodworkers predicted an increase in the use of MDF and combination core (a combination of veneer plies and particleboard, MDF, or other engineered wood products as the substrate for the panel) by the year 2000, to 26 and 3 percent, respectively. Particleboard core was predicted by architectural woodworkers to decrease to 36 percent of total purchases, while veneer core and lumber core were predicted to decrease to 32 and 3 per-

cent, respectively. Seventy-five percent of all 1997 hardwood plywood purchased by architectural woodworkers was 3/4 inch thick; 10 percent was 1/4 inch thick. Eighty-two percent of 1997 hardwood plywood purchased by architectural woodworkers possessed sliced face veneers; 18 percent possessed rotary faces.

Figure 8 provides a breakdown of architectural woodworkers' 1997 hardwood plywood purchases by face veneer grade. As shown, 63 percent of the hardwood plywood purchased possessed premium (AA)[1] grade face veneer, 25 percent custom grade (A), 3 percent economy grade (B), and 7 percent paint grade.

Figure 9 shows a breakdown of architectural woodworkers' 1997 hardwood plywood purchases by face veneer species. Red oak was the predominant species used, representing 31 percent of hardwood plywood purchases. Other important face veneer species included maple (17%), cherry (16%), birch (10%), and mahogany (9%). Use of red oak was predicted to increase by the year 2000 to 33 percent and white oak to 4 percent, while birch, maple, and mahogany were predicted to decrease to 9, 16, and 8 percent, respectively.

Forty-three percent of 1997 hardwood plywood purchased by architectural woodworkers was made-to-order (custom face veneer, lay-up, panel size, or thickness). This percentage was predicted to increase to 45 percent by the year 2000. Nearly 4 percent of 1997 hardwood plywood purchases was prefinished plywood. Purchases of prefinished plywood were predicted by architectural woodworkers to increase to 7 percent of total purchases by the year 2000.

ANALYSIS OF HARDWOOD PLYWOOD PRODUCT AND SERVICE ATTRIBUTES

An effective marketing strategy begins with understanding the needs and desires of the customer. The purpose of this portion of the study was to provide

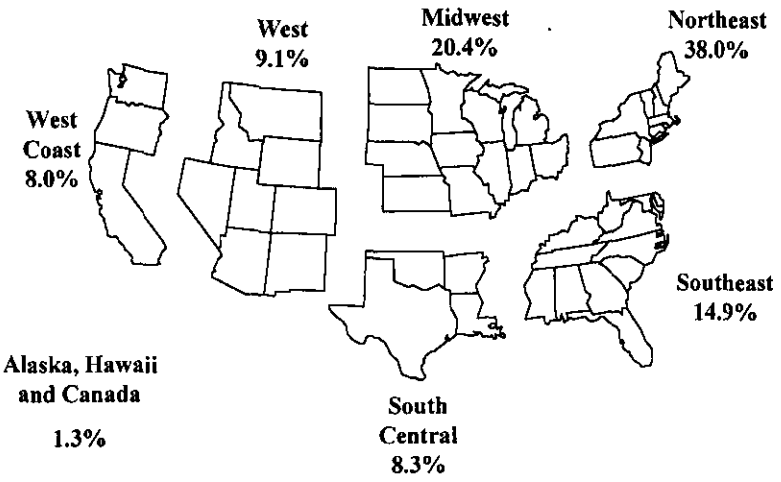

Figure 6. — Distribution of 1997 hardwood plywood sales to architectural woodworkers by geographic region.

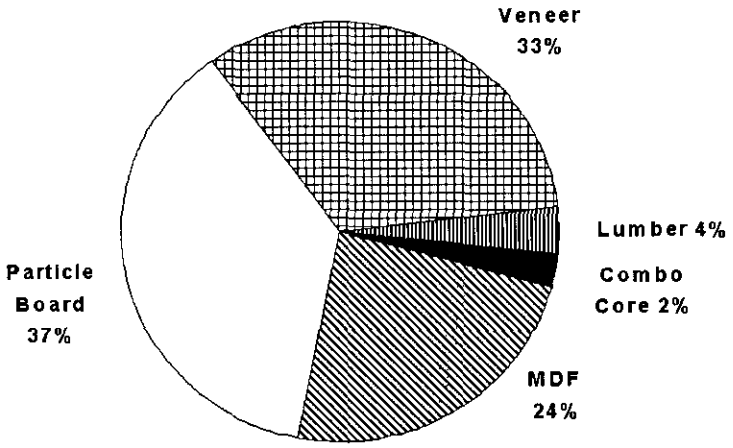

Figure 7. — Architectural woodworkers' 1997 purchases of hardwood plywood by core type.

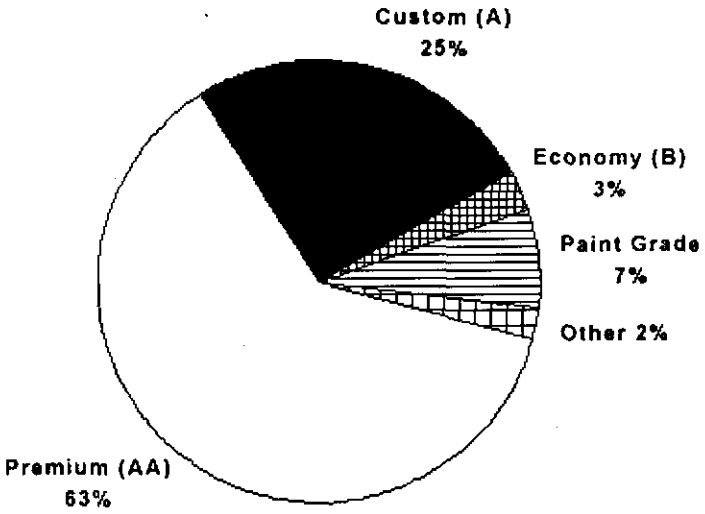

Figure 8. — Architectural woodworkers' 1997 hardwood plywood purchases by face grade.

[1] Premium, custom, economy, and paint grades refer to Architectural Woodwork Institute face veneer grades and this is the nomenclature most often used between architectural woodworkers and distributors. AA, A, and B grades refer to Hardwood Plywood and Veneer Association face veneer grades and these designations are used between manufacturers and distributors.

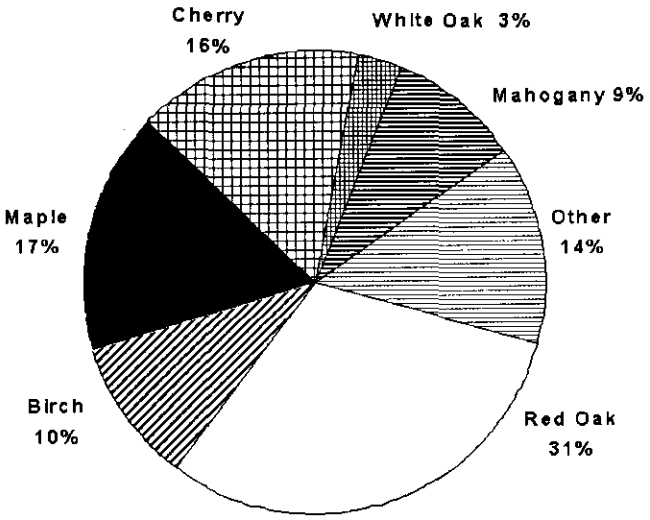

Figure 9. — Breakdown of architectural woodworkers' 1997 hardwood plywood purchases by face veneer species.

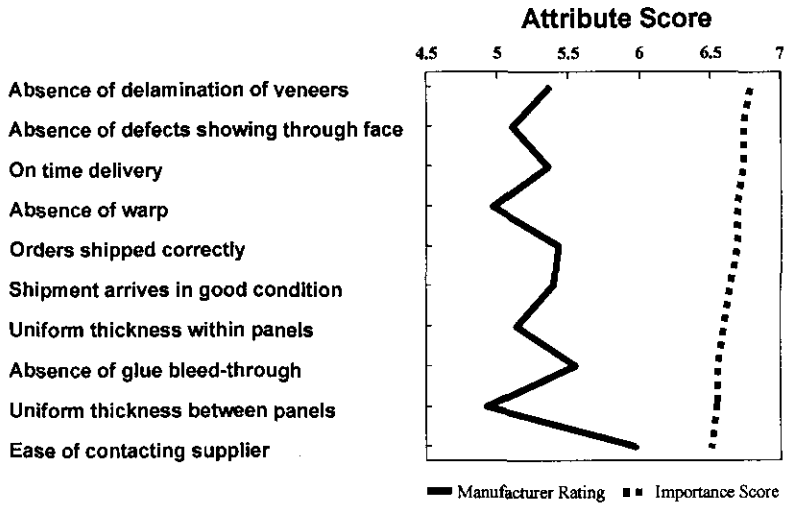

Figure 10. — Importance and supplier performance ratings of the most important hardwood plywood product and service attributes.

hardwood plywood manufacturers and distributors with insight as to the needs and desires of architectural woodworkers. To accomplish this, a list of important hardwood plywood product and service attributes was developed. Architectural woodworkers were asked to rate how important these attributes were to their companies. They were also asked to rate how well suppliers (distributors) performed with respect to these attributes. The architectural woodworkers' responses were combined to calculate average importance scores and their ratings of suppliers for each of the attributes. An importance score is simply a measure of the relative importance of an attribute while a suppliers' rating is a relative measure of how well distributors (and in some instances, manufacturers) in general are performing with respect to that attribute.

Importance scores for the attributes were high overall, ranging from 3.6 to 6.8 (based on a scale from 1 to 7 with 7 being most important); this is not surprising since the list of attributes was designed to include only the most important attributes. What is important is the relative rank of attributes; higher ranked attributes are more crucial in the purchase decision than lower ranking attributes. However, since all attributes were high in importance, manufacturers should not ignore attributes with lower rankings.

Average suppliers' performance ratings ranged from 3.8 to 5.3 (on a scale of 1 to 7 with 7 representing the best performance). This indicates that architectural woodworkers overall rate suppliers relatively high with respect to these attributes. However, in a marketing sense, the supplier that consistently receives the highest performance ratings (relative to competitors) for the attributes most important to the architectural woodworker will eventually become the supplier of choice for those woodworkers. In other words, suppliers should strive for excellence in the areas most important to architectural woodworkers.

Figure 10 shows the top 10 attributes ranked by importance, and their respective importance and supplier performance ratings. Absence of veneer delamination was the most important attribute, followed by absence of defects showing through face, on-time delivery, absence of warp, and orders shipped correctly. It is interesting to note that competitive pricing is not in the top 10 attributes when ranked by importance. In fact, competitive pricing ranked 24 out of 46 attributes, implying that architectural woodworkers may be willing to pay a little more if they can get more of the product and service attributes they desire. Of the most important attributes, suppliers were rated lowest for uniform thickness within and between panels and absence of warp.

Table 1 provides the complete attribute list along with the corresponding importance and supplier rating scores. The "importance score" list appears in descending rank order. It is interesting to note that the lowest manufacturer performance ratings were often service-related attributes. These included: distributor provides product training, presence of grade stamp, pre-finished panels are offered, supplier follows up to see that the product meets or exceeds expectations, and distributor stocks complimentary items.

DIFFERENCES IN ATTRIBUTE SCORES ACROSS DIFFERENT CUSTOMER GROUPS

When targeting a product to a certain customer group, it is important to know how the needs and desires of that group

differ from the rest of the market. With such knowledge, a supplier can adapt its marketing strategy to best target the particular group, giving that supplier a competitive advantage over other suppliers. To help distributors and manufacturers better understand differences in perceptions across customer groups, comparisons were made in attribute scores across different types of architectural woodworkers. Specifically, comparisons were made across 1) architectural woodworkers of different sizes (based on sales volume); and 2) architectural woodworkers specializing in clear wood finishes versus non-wood finishes.

Architectural woodworking firms were divided into thirds based on sales volume. The largest firms were then compared to the smallest firms with respect to attribute scores. Small firms rated credit terms and screw-holding capability of the panel higher in importance than larger firms. Neither of these results are surprising considering smaller firms tend to rely more on credit to make ends meet, and the fact that smaller firms in general do not utilize new fastener technology to the same degree as larger firms and rely more on screw performance.

Larger firms rated on-time delivery, thickness of face veneer, and absence of delamination higher in importance than did small firms. Larger firms typically run tighter schedules than do small firms. This explains why on-time delivery is more important to larger firms. Also, larger firms tend to be more automated. The downside of automation is that it is less forgiving of thin faces, and also, because of reduced handling, it is more difficult to identify defects, especially hidden defects such as delamination. Thus, it is easy to see why these attributes were more important to larger firms.

Architectural woodworkers were also categorized by their percentage of wood finishes versus non-wood finishes. For a firm to be categorized as a wood finish firm, at least 60 percent of their product possessed a wood finish. All other firms were categorized as non-wood finish. Firms with 60 percent or more wood finish rated uniformity of face veneers (color and grain), thickness of face veneer, promptly provides price quotes, and on-time delivery higher than did non-wood firms. Since the aesthetic quality of the wood is important to clear wood finishes, it is obvious why wood finish firms rated uniformity of face veneers higher in importance. Likewise, sand-through and defects showing through the face can ruin a panel, therefore thickness of face veneer is important.

TABLE 1. — Importance and supplier rating scores for hardwood plywood attributes.

Attribute	Importance score[a]	Manufacturer's rating[b]
Absence of delamination of veneers	6.80	5.38
Absence of defects showing through face	6.74	5.12
On-time delivery	6.74	5.36
Absence of warp	6.71	4.98
Orders shipped correctly	6.68	5.43
Shipment arrives in good condition	6.63	5.40
Uniform thickness within panels	6.60	5.14
Absence of glue bleed-through	6.57	5.55
Uniform thickness between panels	6.55	4.94
Ease of contacting supplier	6.50	5.97
Product availability	6.48	5.27
Promptly provides price quotes	6.45	5.69
Sound core	6.45	5.25
Ability to fill rush orders	6.41	5.16
Uniformity of face veneers (color and grain)	6.39	4.74
Promptness of handling customer complaints	6.37	5.31
Absence of visible splice lines	6.36	4.88
Supplier's knowledge of their products	6.36	5.35
Fairness of handling of customer complaints	6.28	5.42
Plywood face "on-grade"	6.25	4.99
Machinability of panel	6.24	5.50
Consistency of panel quality between orders	6.24	4.88
Distributor's awareness of customer's needs	6.15	5.19
Competitive price	6.09	5.23
Thickness of face veneer	6.05	4.76
Quality of sanding on face and back	5.98	4.92
Distributor's ability to provide speciality items	5.88	4.93
Personal relationship with supplier	5.87	5.57
Distributor's ability to provide samples, literature, or other support material	5.83	5.10
Screw-holding capability of panel	5.76	5.41
Credit terms	5.66	5.54
Reputation of distributor	5.65	5.59
Ease of unloading delivered products	5.64	5.52
Strength of panel	5.64	5.48
Supplier follows up to see that the product meets or exceeds expectations	5.44	4.44
Squareness of panel	5.18	5.19
Plywood back "on-grade"	5.12	5.01
No odor from core stock	4.87	5.13
Distributor stocks complimentary items	4.75	4.54
Weight of panel	4.71	4.86
Low formaldehyde content in panels	4.65	4.63
Location of distributor	4.63	5.10
Distributor provides product training	4.43	3.79
Presence of grade stamp	4.10	4.30
Pre-finished panels are offered	3.98	4.42
Brand name of panel or core (e.g., manufacturer)	3.69	4.62

[a] Scale of 1 (not at all important) to 7 (extremely important).
[b] Scale of 1 (poor) to 7 (excellent).

Wood finish firms use many exotic species that range greatly in price. It is hard for these firms to estimate costs and bid on jobs without price quotes from their suppliers. Likewise, since jobs are so specific, there are few substitute products and few, if any, last minute alternative sources for their raw materials. This explains the higher importance placed on prompt price quotes and on-time delivery.

CONCLUSIONS

The information presented in this paper is intended to assist architectural woodworkers and the suppliers and manufacturers of their raw materials. The results presented offer information about the structure of the architectural woodworking industry, future trends in the industry, as well as information about the needs and desires of the industry. Such knowledge can give suppliers and manufacturers a better understanding of their customers, and offers them the opportunity to better serve architectural woodworkers. Likewise, this knowledge may be used by architectural woodworkers to better understand the industry in which they compete. Such information is useful in strategic planning and management decision making.

The next step for suppliers to the architectural woodworking industry is to evaluate how well they are satisfying their customers' needs. In today's competitive environment, it is imperative that suppliers strive to be their customers' "first choice." To reach this goal, suppliers must identify their own strengths and weaknesses and adapt their manufacturing and marketing strategies accordingly. Architectural woodworkers can help by advising their suppliers as to how well they are meeting needs and discussing how architectural woodworkers and suppliers can work best together.

For architectural woodworkers, the next step is to determine where they fit relative to the architectural woodworking industry and to evaluate their current and future position. Architectural woodworkers must identify their individual strengths and weaknesses and determine how to use their strengths to gain competitive advantage, while minimizing the negative influences of their weaknesses.

The purpose of this paper was to provide insight on major hardwood plywood distributors' customer segments. This research represents part one of a two-part study. Part two investigates the fixtures industry to better understand this customer segment.

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