



Forest Products Management Development Institute

Professional Consumer Perceptions of Thermally-Modified Wood

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Introduction

Thermal modification of wood is a chemical-free treatment that results in improved durability, enhanced resistance to rot and decay, and better dimensional stability. This emerging, chemical-free technology has the potential to create and expand forest products markets, particularly for traditionally underutilized and low-value species. Thermally-modified wood (TMW) produces sustainable value-added wood products with extended service-life, and reduced environmental impacts.

During thermal treatment, wood is heated to temperatures much higher than traditional wood drying, sometimes in a reduced oxygen environment and over a relatively short period. Ultimately, thermal-modification alters the chemical composition of wood by degrading cell wall compounds and extractives. As a result of thermal-modification treatment, wood's dimensional stability, moisture resistance, and resistance to rot and decay are improved. However, thermal treatment causes a loss in weight and mechanical strength during the process, thus it is not suitable for applications where structural performance is critical, such as support beams.

TMW can be utilized to manufacture a variety of products, such as decking, due to its high performance in outdoor applications and aesthetic qualities. The U.S. decking industry is substantial, and

there is potential for thermally-modified wood to capture a niche of that market, particularly for environmentally conscious consumers with less price sensitivity than the general market.

TMW has experienced commercial success in Europe for more than 20 years, but it is in the very early stages of market adoption in the United States. Despite shifts in consumer preference for more environmentally-friendly products, insufficient marketing efforts have kept U.S. consumer awareness of TMW very low. The Forest Products Management Development Institute (FPMDI) and the Natural Resources Research Institute (NRRRI) have partnered to identify the challenges and opportunities for TMW industry expansion in the U.S. market. To achieve this objective, the priorities and perceptions of professional users of decking products were investigated.

Methods

This study was carried out by conducting in-person and online surveys of professional users of decking products. The questionnaire contained demographic, perceptions, and conjoint analysis questions. Data collection was conducted at the trade show Deck Expo in Baltimore, Maryland in the Fall of 2016, and online through a link posted on Professional Deck Builder magazine's website. The two datasets were combined and results are presented in this report. When significant differences exist between the two data sets (Deck Expo and online surveys), it is noted

in the discussion. The product selected for this project was decking, because of its large market and suitable application of TMW. The questionnaire was created through an iterative process, in which feedback was received from members of the academic community and industry. In addition, a testing event was held for industry members to provide feedback on the questionnaire as well as the overall survey experience. To ensure respondent familiarity with all the wood-based decking materials included in the survey, five solid-wood deck samples were manufactured for participants to examine in-person at the trade show event. Materials for the deck samples included naturally durable softwood (Western red cedar), wood-plastic composite (WPC), pressure treated lumber, tropical hardwood (ipe), and thermally-treated ash and aspen.

Results

Demographics

The first question in the demographics section of the survey asked respondents to describe their profession and allowed for multiple responses. Respondents reported "Remodeling" (32%) and "Deck Specialist" (31%) to be the top two professional areas of work (Table 1).

The largest area of company business was in "Repair & Remodeling," where 82% of respondents reported at least some percentage of their company's business in this sector. "Single-family New Construction" followed, with 66% of respondents. Deck Expo respondents reported a statistically significant larger percent of their company's business in commercial projects, at 42% compared to 31% of Online respondents (35% combined) (Table 1).

When asked to describe the size of their company, the largest percentage of respondents indicated working for companies with 1-4 employees (46%), followed by 20-49 employees (17%) (Table 1). Participants were asked to indicate in which region(s) of the U.S. their

Demographic	Percentage
Respondent Profession*	
Repair & Remodeling	32%
Deck Specialist	31%
Manufacturing	16%
New Construction	14%
Other	12%
Wholesale, Retail, Distribution	11%
Architect/Design	8%
Type of Company Business*	
Remodeling	82%
Single-family New Construction	66%
Commercial	35%
Multi-family New Construction	30%
Institutional	15%
Other	13%
Company Size	
4 or fewer Employees	46%
5-9 Employees	10%
10-24 Employees	11%
25-49 Employees	17%
50-99 Employees	7%
100 or more Employees	11%
Company Location*	
Northeast	50%
Midwest	39%
South	32%
West	25%
Other	11%
Materials Used*	
WPCs	77%
Pressure Treated Lumber	54%
Naturally Durable Softwoods	42%
Tropical Hardwoods	40%
Plastic	29%
TMW	5%
Other	5%

Table 1. Respondent demographic information. N=103. Responses marked with an asterisk* denote questions where multiple responses were allowed.

company operated. Responses suggest an over-representation of companies operating in the Northeast, with 62% of Deck Expo respondents reporting having business in this region. This may be a result of the location of the Deck Expo event (Baltimore, MD). Online respondents reported a more even distribution of business location, which can likely be explained by the nationwide reach of the online magazine where the survey was advertised.

Respondents were also asked to specify what percentage of their company's projects used different decking materials. In general, respondents seem to use a wide range of decking materials for their projects. The top two materials used for respondents' projects are wood-plastic composites (WPCs), followed by pressure treated lumber. TMW was reported to be used for 5% of companies' projects (Table 1).

When asked about their familiarity with TMW, over half of respondents (63%) (Figure 1) indicated they are "Very familiar" or "Somewhat familiar" with TMW. However, a considerable number of respondents also reported little or no familiarity with TMW (37%) (Figure 1),

which suggests an opportunity for educating and informing this audience on TMW.

Perceptions

The next section of the questionnaire asked questions to understand respondents'

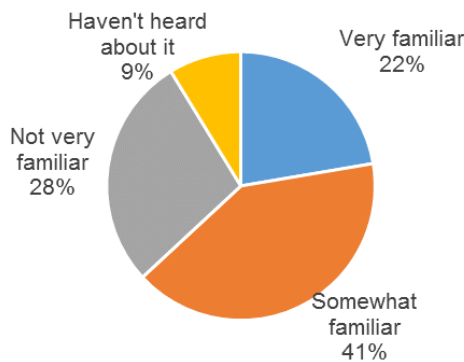


Figure 1. Respondent reported level of familiarity with TMW.

perceptions of various wood-based decking materials and their attributes. The first three questions asked participants to select their top two decking material choices for a project in three price ranges. Results indicated respondents prefer to use pressure-treated lumber and naturally durable softwoods for projects under \$5,000, with 41% and 27% of respondents selecting this material as first and second choice, respectively, for projects in the low-end price range (Figure 2). For mid-range projects between \$5,000 and \$15,000, respondents prefer to use WPCs. Tropical hardwoods were overwhelmingly preferred

for high-end projects over \$15,000, followed by WPCs. Thermally-modified wood was the second choice for 17% and 14% of respondents, in mid-range and high-end ranges, respectively.

Respondents were asked to rate the importance of six attributes when making decisions about decking materials. A six-point Likert scale from "Not at all important" to "Extremely important" was used. Figure 3 summarizes the answers to this question; the scale was modified to simplify the interpretation. Overall, the most important material attributes when designing, constructing, or remodeling a deck were Durability and Aesthetics, with 82% and 80% of respondents rating these attributes as very or extremely important, respectively (Figure 3). Need for Maintenance was also among the top attributes, with 68% of respondents considering it very or extremely important. Only a little over one-third of respondents reported that Environmental Performance had "High Importance" when making decisions about decking materials.

The next question asked respondents about their perceptions on the performance for five wood-based decking materials (naturally durable softwoods, pressure treated lumber, tropical hardwoods, WPCs, and TMW). Six attributes were included: Need for Maintenance, Cost of Materials, Durability, Aesthetics, Availability, and Environmental Performance (Figure 4). The scale for these questions included five choices,

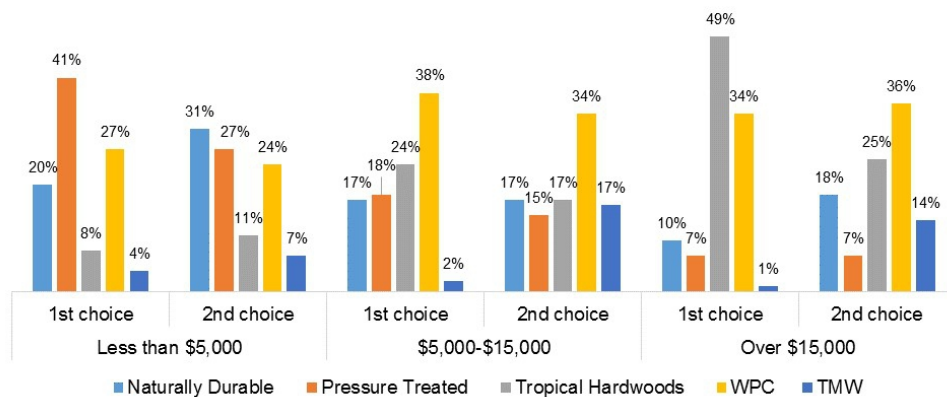


Figure 2. Percent of respondents selecting top two ranked choices for decking projects costing less than \$5,000, between \$5,000 and \$15,000, and over \$15,000.

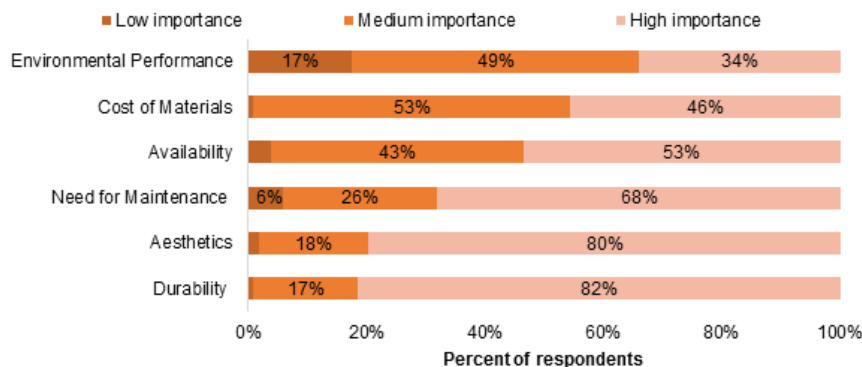


Figure 3. Perceived attribute importance among respondents when designing, constructing, or remodeling a deck. Original scale used in the questionnaire was modified.

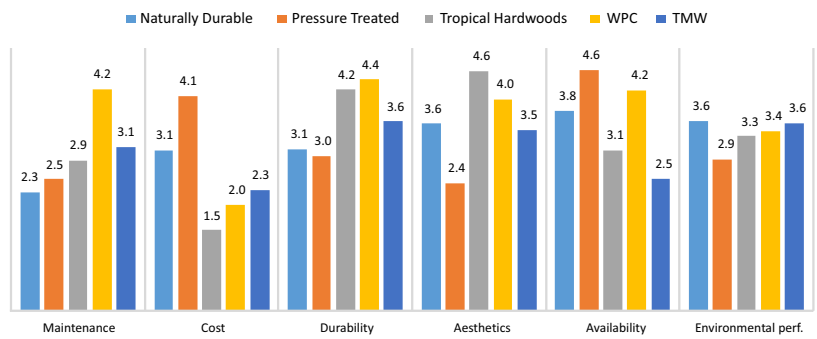


Figure 4. Comparison of perceived material performance among respondents for maintenance, cost, durability, aesthetics, availability, and environmental performance. Indexes were calculated as a weighted average of responses given on a 5-point scale from “very low” to “very high” performance.

from low performance to high performance, and a “Do not know” option if respondents were unfamiliar with any of the materials. To make the analysis and interpretation of the perceptions question simpler, a “perception index” was calculated, as a weighted average of the ratings selected (1 to 5) and the frequencies of responses. Thus, a perception index was calculated for each material, reflecting the respondents' perception of that material on the six attributes being evaluated; with values between 1 (for the lowest perceived performance) and 5 (highest performance). The perception indexes are summarized in Figure 4.

Conclusions

This study collected data on U.S. decking industry professional consumers' demographics, perceptions of wood-based decking products, and conjoint analysis responses to understand their purchasing behavior. The demographic information suggests most businesses in the target market work as remodelers or deck specialists at smaller companies, employing between one and four people. In general, respondents utilize a wide range of decking materials for their projects, but the two materials most frequently used were wood-plastic composites (WPCs) and pressure treated lumber. Over 60% of respondents indicated familiarity with TMW, but a considerable number of respondents also reported little to no familiarity with TMW (37%), which implies an opportunity for educating and informing this professional audience on this material.

Respondents' top choices for decking projects were pressure-treated lumber for projects in the low-price range, wood-plastic composites for projects in the mid-price range, and tropical hardwoods for projects in the high end of price. Thermally modified wood was the second choice in the mid and high price ranges for some respondents.

The three most important attributes professional consumers who participated in this study considered when selecting decking materials were Durability, Aesthetics, and Need for

Maintenance. Participants considered Environmental Performance as the least important attribute. In general, participants reported unfamiliarity with TMW's performance on several attributes. Overall, professional consumers in the decking industry surveyed for this research currently show a preference toward WPCs and tropical hardwoods, and seem to have mixed perceptions about TMW. This is likely the result of insufficient marketing by the TMW industry and professional consumers' lack of awareness about the material.

Final Remarks

The future success of the TMW industry in the U.S. is contingent upon professional consumer acceptance and purchase of TMW products. This study assessed the attributes industry members consider most important, as well as their perceptions of TMW's performance for those attributes. Successful and visible projects utilizing TMW, like the University of Minnesota's Bell Museum of Natural History in St. Paul, Minnesota, will contribute to increased awareness and appreciation of TMW.

Future research should address professional consumer willingness to pay for TMW and expand the geographic scope to include more industry members. Data was collected at one trade show and among the readership of an online magazine, so future research could expand the scope to include a wider audience. Finally, the focus of this study included professional adopters, namely decking professionals, because they are influential on decking material decisions. Future research could include other important actors in the decking materials supply chain, such as landscape architects; and ultimately end users, whose priorities and needs may differ from those included in this research.

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