

**Federal-State Marketing Improvement Program**  
**Final Performance Report**  
**For the Period of [September, 30 2015 – September, 29 2017]**

**Date:** *October 31st*  
**Recipient Name:** *University of Minnesota*  
**Project Title:** *Development of a Strategic Marketing Plan for Thermally-Modified Wood*  
**Grant Number:** *15FSMIPMN0004*  
**Project Location:** *Minnesota*  
**Amount Awarded:** *\$59,373.00*  
**Match Amount:** *\$59,388.00*

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**An Outline of the Issue or Problem:** Provide enough background information for the reader to understand the importance or context of the project. This section may draw from the background and justification contained in the approved project proposal.

The forest products industry is vital to maintaining many rural economies in the United States. However, the industry has faced significant challenges during the last two decades. Increased low-cost imports have taken market share away from domestic producers, with subsectors such as household furniture, flooring, and millwork particularly affected. Substitute materials are also threatening the market position of products such as siding, decking, and pallets. The economic downturn that started in 2007 and the slow recovery of the housing market has caused great job losses. This decreased activity in the forest products sector has resulted in timber harvest volumes remaining well below sustainable levels. Lack of harvest can lead to poor forest management by negatively impacting tree species diversity, making forests more susceptible to attack by pests and invasive species, and can lead to increased wildfire risk.

Thermal modification technology has the potential to create and expand forest products markets, particularly for traditionally underutilized and low-value species. This emerging, chemical-free technology produces sustainable, value-added wood products with improved dimensional stability, resistance to biodegradation and weathering, extended service-life, and reduced environmental impacts.

Thermal-modification treatments for wood have been investigated since the early twentieth century, but despite this long history, product development and commercial success of thermally-modified wood (TMW) was only achieved in Europe in the 1990s, and the TMW market in the U.S. is still in its early stages of development. Despite shifts in consumer preferences for more environmentally-friendly products, this fledgling technology has not taken hold in the U.S. on a substantial scale due to insufficient marketing efforts. Market growth of TMW in Europe was driven in part by regulations limiting the use of toxic chemical treatments to protect wood from biological attack and biodegradation. In the U.S., potential demand for domestically-sourced TMW products may originate from, among other things, consumer demand for chemical-free treatments, and regulations preventing imports of illegally-harvested timber. These factors may allow TMW to become a leading substitute for imported tropical hardwood species and pressure treated lumber for some applications.

TMW can be utilized to create a variety of products, but it is particularly suited for exterior decking, due to its high performance in outdoor applications and aesthetic qualities. The U.S. decking industry is substantial, and there is potential for TMW to capture a niche of that market, particularly for environmentally conscious consumers with less price sensitivity than the general market.

The technical modification process of TMW heats wood to much higher temperatures than traditional wood drying, sometimes in a reduced oxygen environment and over a relatively shorter period. Ultimately, thermal-modification alters the chemical composition of the 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, allowing it to be suitable for many exterior applications such as decking and siding. However, thermal treatment causes a loss in weight and mechanical strength during the process so it cannot be used in applications where structural performance is critical, such as support beams.

Thus, the Eastern Region has a pressing need to identify the barriers impeding the market success of TMW products. Identification of these barriers and development of a Strategic Marketing Plan to overcome them –as proposed in this project – will support the growth of this industry. If expanded, thermal modification can help enhance forest health, create much-needed jobs (many in rural areas), and increase the competitiveness of the forest products industry through development of high value-added products. The proposed Strategic Marketing Plan will help entrepreneurs and potential adopters of this technology make well-informed and data-driven messaging, product placement, and product development decisions.

**Goals and Objectives:** Describe the goals and objectives of the project and how the work was accomplished.

The main goal of this project was to develop a Strategic Marketing Plan that increases production and sales of thermally-modified wood (TMW) products from hardwood and softwood timber in the U.S. Eastern Region, ultimately leading to new jobs and increased economic output by forest products manufacturers. The project objectives and how they were accomplished are described below.

1. Identified potential professional adopters' product priorities and perceptions of TMW and competing materials. This was accomplished by conducting data collection at an industry trade show and online using decking products, then analyzing the data.
2. Identified current marketing practices and the challenges that producers and distributors encounter when marketing TMW. This was accomplished through semi-structured interviews with current U.S. producers and distributors of TMW.
3. Developed a Strategic Marketing Plan for TMW in the U.S. Eastern Region. This was accomplished by combining results from previous studies, priorities and perceptions data from this project, and TMW producer and distributor interviews.
4. Communicated results to industry and other stakeholders. This was accomplished by producing a Strategic Marketing Plan, an industry-focused summary of results published in the FPMDI Spring 2017 Newsletter, a webcast, and presentations at one scientific event (IUFRO/SWST Conference in Vancouver, BC), and one industry event (The Great Lakes Kiln Drying Association Meeting).

**Contribution of Project Partners:** Identify the project partners and briefly describe their contributions to the project.

Project partners included:

1. Dr. Omar Espinoza, FPMDI chair and Assistant Professor at the University of Minnesota in the Department of Bioproducts and Biosystems Engineering. Contributions to the project included: general management of project, reporting, delegation of tasks, search and hiring of graduate student, design of survey instrument, data collection and analysis, writing and reviewing of industry report, final strategic marketing plan, and peer reviewed journal article.

2. Shelby Lynn Gamache, Graduate research assistant at the University of Minnesota in the Department of Bioproducts and Biosystems Engineering. Contributions to the project included: design of survey instrument, logistical planning for the testing event and data collection, data analysis, a master's thesis on the project, interviews with industry members for evaluation of the project and feedback, writing of an industry report, final strategic marketing plan, and peer reviewed journal article. NOTE: We used additional funding to pay for Shelby's salary and tuition, which was not included in the project's budget. This funding was provided by the University of Minnesota.
3. Matthew Aro and Patrick Donahue at the NRRI in Duluth, Minnesota. Contributions to the project included building six deck samples from various materials, including two made from TMW, for data collection. Mr. Aro also helped organize a testing event for the survey instrument before data collection and reviewed and contributed to all output documents. The NRRI contributed their extensive technical knowledge of thermal modification of wood.

### **Results, Conclusions, and Lessons Learned:** Summarize the project results and conclusions.

Lessons learned during the project may have influenced the direction/decisions, helped to improve the process, and/or optimized the results. Sharing these experiences may be helpful to other states seeking to learn from your experience. If applicable, some questions to consider when discussing lessons learned include:

### **Results and Conclusions**

Significantly, more research has been conducted on the technical and performance aspects of TMW compared to its market potential. This research sought to address some of these gaps by identifying decking industry member perceptions of TMW using conjoint analysis, a marketing research tool used to understand how consumers make product selection decisions. A survey was administered to decking industry members using a computer-based questionnaire containing demographic, user perceptions, and conjoint analysis questions at a trade show event called the "Deck Expo" and online. This primary data was then analyzed and used along with secondary data from previous research to compile the recommendations in this marketing plan.

In general, respondents currently utilize a wide range of decking materials for their projects, but the two materials most frequently used are wood-plastic composites (WPCs) and pressure treated lumber. Over half of respondents are "Very familiar" or "Somewhat familiar" with TMW, but a considerable number also reported little to no familiarity with TMW, which suggests an opportunity for educating and informing this professional audience about TMW.

This research found *Durability* and *Aesthetics* to be the two most important attributes to professional consumers at this time, with *Cost of Materials* and *Environmental Performance* being less important. Overall, professional consumers surveyed for this research currently demonstrate a preference for WPCs and tropical hardwoods, and seem to have mixed perceptions of TMW. This is likely the result of unfamiliarity with TMW due to insufficient marketing efforts.

Three market segments were identified based on the results from this research. One of these segments is unlikely to readily adopt TMW but the other two segments have the potential to adopt TMW if effective marketing strategies are utilized to position the material correctly. The first of these two potential adopter segments is comprised of wholesalers, architects, and designers. They have the highest current familiarity with TMW and prefer tropical hardwoods more than all the other decking materials considered in this study. For this segment, it will be important to differentiate TMW as a more environmentally-friendly alternative to tropical hardwoods that has similar aesthetics and price attributes. The second of the two segments with potential for TMW adoption is comprised of remodelers who currently use pressure treated lumber for many of their projects, but show dissatisfaction with it compared to other decking materials. This segment currently has the lowest familiarity with TMW, so a positioning statement focused on this segment should aim to increase awareness of TMW while first emphasizing the similarities between pressure treated lumber and TMW, such as TMW's solid-wood nature and its enhanced resistance to degradation as a result

of treatment. TMW can be differentiated from pressure treated lumber by its potential sourcing from domestic forests and its improved dimensional stability.

Specific recommendations for positioning TMW were made, as well as suggestions on specific strategies for product, price, promotion, and distribution. An industry situational examination resulted in a SWOT Analysis for TMW (Strengths, Weaknesses, Opportunities, and Threats).

The data collection methods of this research had limitations, including the potential for self-selection and regional bias. In addition, the data set used was not based on a randomized sample of the population of interest, which means that the conclusions from this study cannot be statistically generalized to the entire target population of professionals in the decking industry. Finally, this marketing plan is intended to benefit the U.S. TMW industry and its communities and does not make recommendations specific to individual companies.

## Lessons Learned

An unanticipated challenge of this research was collecting enough responses from the target audience. While this is a challenge of any survey research, some actions can help to ameliorate this limitation. We used a combination of tools to recruit participants, such as the deck samples and an Amazon gift card. Participants were also offered a summary of the results.

Future iterations of this research (or similar research) could expand the data collection to other regions of the country, as the responses may have contained some regional bias, given the location of the data collection event (Baltimore, Maryland).

Unexpectedly positive results from this project included segmentation data from the conjoint analysis section of the survey. Conjoint analysis is a great tool to understand how different groups within the target population perceive the product of interest. I would certainly recommend using conjoint analysis for research looking at similar questions with other products.

**Evaluation:** Include a discussion of how the project was evaluated and whether or not it met project objectives. To the extent possible, include measurable results. If applicable, include at least one quantifiable metric that reflects the change in status of the project from initiation to completion.

Below the project's objectives are listed, followed by an explanation on how (andf) those objectives were met, including some metrics:

1. *Identify potential professional adopters' product priorities and perceptions of TMW and competing materials.* This was achieved by surveying professional adopters about their perceptions on TMW and other decking materials. In total, **102 professional adopters** were surveyed. All of the research instruments were evaluated by academic experts and also members from the intended audience. Modern marketing techniques were used, and the information gathered and analysis of implications was published in several outlets (see "Additional Information" section).
2. *Identify current marketing practices and the challenges that producers and distributors encounter when marketing TMW.* **10** U.S. producers and distributors of thermally modified wood were interviewed and asked about their marketing practices. Results were published in a peer reviewed journal and presented. Results were incorporated in the Strategic Marketing Recommendations for industry.
3. *Develop a Strategic Marketing Plan for TMW in the U.S. Eastern Region.* Using the data collected, **Strategic Marketing Recommendations** were formulated and put into a written format and a webcast; which was disseminated to the industry and other audiences. Omar Espinoza presented at two events with more than 100 attendees estimated (see "Additional Information" section). The strategic marketing recommendations were shared with all of the U.S. manufacturers and distributors of TMW (**13 in total**) and they provided their evaluation and expressed satisfaction with the work.
4. *Communicate the Strategic Marketing Plan to industry and other stakeholders.* Several methods were used to reach the intended audience with the results from this study, including presentations, publications, and a webcast. Details at the end of this report.

**Current or Future Benefits/Recommendations for Future Research:** Describe the current and/or future benefits resulting from this project. If applicable, outline next steps or recommend new research ideas that might advance the project goals.

Results from this research can help entrepreneurs and established industries create effective marketing plans for TMW products. Results were used to create publicly available and industry-focused documents, with strategic marketing recommendations. Lastly, outcomes from this study can be used to identify opportunities for employment creation in rural areas, as well as find value-added and sustainable uses for U.S. forest resources.

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.

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 geographical scope to include other regions and wider audience. Finally, the focus of this study included professional adopters, namely decking professionals, because these 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.

**Project Beneficiaries:** Describe the groups that have benefitted from the project including the number, type and scale of producers, processors, businesses, consumer groups, etc.

The groups who have benefitted from this project include current producers and distributors of TMW in the U.S.; and maybe more importantly, entrepreneurs interested in entering this industry can use the results from this research for product development and marketing planning. The forest products industry is an important sector of the U.S. economy, is among the top 10 manufacturing employers in most U.S. states. Knowledge of customer preferences and priorities is essential to formulate marketing strategies. In addition, wholesale businesses may benefit from increased TMW sales and economies in rural areas that are reliant on forest products would benefit from a growing TMW industry. Other stakeholders that benefit from this study are organizations supporting the forest products industry, such as state and federal agencies, educational institutions, and others.

**Additional Information:** Include publications, presentations, websites and other materials or information generated by the project. Provide as attachments or Internet links.

- Strategic Marketing Plan, **attached** and available at <https://goo.gl/1h7DQG>
- FPMDI Spring 2017 Newsletter, PDF **attached**, and available at: <http://fpmdi.bbe.umn.edu/>
- Master's Thesis by Shelby Gamache, available at: <https://conservancy.umn.edu/handle/11299/188802>
- Peer-reviewed journal, BioResources, **attached** and available at <https://goo.gl/2a6ujm>
  - Espinoza, O., Buehlmann, U., & Laguarda-Mallo, M. F. (2015). Thermally Modified Wood: Marketing Strategies of U.S. Producers. BioResources. 2015, 10(4), 6942-6952.
- Peer-reviewed journal article, BioResources, **attached** and available at
  - Gamache, S., Espinoza, O., & Aro, M. (2017). Professional Consumer Perceptions about Thermally Modified Wood. BioResources 12(4), 9487-9501.
- Webcast for download "Professional Consumer Perceptions of Thermally-Modified Wood," available at <https://z.umn.edu/webcastfpmdi>
- Presentations at Conferences:

- Espinoza, O. and Gamache, S. (2017). Consumer Perceptions of Thermally Modified Wood. Great Lakes Kiln Drying Association's 2017 Spring Meeting. Woodruff, WI. October 12-13, 2017. [Program **attached**]
- Espinoza, O., Gamache, S., and Laguarda-Mallo, M.F. (2016). Consumer Perceptions of Thermally Modified Wood. 2017 IUFRO Division 5 Conference and the 60th Society of Wood Science and Technology International Convention. Vancouver, British Columbia, Canada, June 12-16. [Program at <https://goo.gl/RLS7NS>]