



Universitatea
Transilvania
din Braşov

HABILITATION THESIS

SUMMARY

Title: UTILIZATION AND CAPITALIZATION OF THE LOCAL WOOD
RESOURCE IN FURNITURE INDUSTRY

Domain: FORESTRY ENGINEERING

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Summary

This thesis represents a natural extension of the author's doctoral thesis, entitled "*Contributions to the optimization of alder wood processing by milling and sanding to achieve its capitalization in furniture manufacturing*", defended at Transilvania University of Brasov in 2008. The topic of that thesis focused on promoting a fast-growing species, black alder (*Alnus glutinosa*), known primarily for its traditional uses. The objective of the thesis was to promote this wood species and attract the interest of specialists in wood processing and forestry for its cultivation, growth, and optimized processing.

The directions of a new future research approach established in the doctoral thesis included investigations into various heat-treatment schedules to control the colour of alder wood, suitable finishing technologies that respect the natural colour of wood, as well as other research on bonding properties. These research directions were successively addressed by the author and the experimental research for each direction was carried out in international collaboration at various research centers in Europe, Asia, and the USA from 2014 to 2023. A synthesis of the results of these scientific studies is presented in the current work.

The habilitation thesis, entitled "*Utilization and capitalization of the local wood resource in furniture industry*", is structured into four chapters, each one dedicated to a research direction.

Chapter 1 is entitled "*Experimental research on heat-treated wood*". The experiments in this chapter were conducted in international research teams through two post-doctoral research fellowships received by the author: the Fulbright Senior Award in 2013-2014, performed at Oklahoma State University, and the Asia Bridge Fellowship in 2014-2015, performed at Shizuoka and Nagoya Universities in Japan. The research topics included the influence of heat treatment on the properties of solid wood and veneers from different wood species. The research results showed that wood species with low commercial value, after thermal treatment, can be used effectively in areas where they previously had little potential. Heat treatment deserves to be considered suitable and applied to improve the surface quality of wood, with applications in furniture where smooth surfaces are ideal. This treatment can help to increase the potential for efficient use of wood material, both in furniture manufacturing and restoration work. The results presented in this chapter were disseminated in **1 international book chapter**, **3 ISI articles with IF 1.268, 3.170, and 4.972**, respectively, with a total of **109 citations in Web of Science**, and **9 papers in Proceedings at International Conferences**.

Chapter 2, entitled "*Experimental research on plywood obtained from veneers with and without densification*", presents experimental research carried out in Romanian-Ukrainian mixed research teams. This research was supported by the author's Transilvania Fellowship

received in 2016 and a short-term scientific mission (STSM) under the COST Action FP1407 in 2018, and took place at the National Forestry University of Ukraine (UNFU) in Lviv, along with another successful Romanian-Ukrainian collaboration performed during summer 2018 at the Faculty of Furniture Design and Wood Engineering. The chapter includes experimental research on the properties of plywood obtained from densified, non-densified and mixed veneers of fast-growing species such as black alder, birch, but also beech. The results of the research pointed out that densified veneers can be an excellent choice in the manufacture of plywood for construction purposes, being a material with improved properties and reduced costs, when compared to plywood manufactured traditionally. Such an approach in the manufacture of plywood can lead to low emissions of toxic compounds and at the same time, the cost of the final product can be reduced. On the other hand, due to their low roughness, densified veneers do not require sanding and their attractive color allows the use of transparent finishing products, appreciated for furniture manufacturing. The results presented in this chapter have been published in **1 international book chapter, 3 ISI articles with IF 2.221, 3.169, and 3.379**, respectively, with a total of **60 citations in Web of Science**, and **5 papers in Proceedings at International Conferences**.

Chapter 3 is entitled "*Experimental research on finishing of wood*" and presents experimental research conducted in Romanian-Polish mixed research teams. This research was supported by the author's Transilvania Fellowship received in 2015 which took place at the University of Life Sciences in Poznan and Remmers Company in Poland. The chapter includes experimental research on the finishing properties of black alder wood based on the quality of the sanded surface, the finishing product, the finishing system and various tests for coatings. The results of this study may have practical applications in the furniture industry, for the production of furniture or other special interior purposes. The results presented in this chapter have been published in **1 international book chapter, 4 ISI articles with IF 1.334, 2.175, 3.320, and 4.972**, respectively, with a total of **74 citations in Web of Science**, **1 ISI Proceedings paper**, and **2 papers in International Conference Proceedings**.

Chapter 4, entitled "*Experimental research on wood-based panels*", presents experiments carried out in mixed research teams with researchers from the USA, Ukraine and Romania. The chapter comprises experimental research on the properties of melamine panels exposed to high-humidity conditions, wood-straw composites and OSB panels. The results presented in this chapter have applicability in the improvement of production techniques for the manufacture of furniture and for the subsequent use of melamine composite panels, they show the potential of agricultural waste for the manufacture of mixed boards from wood shavings and wheat straw and emphasize the potential of poplar, willow and birch species, as individual raw material in the production of OSB boards. The results presented in this chapter have been published in **1 international book chapter, 2 ISI articles with IF 1.409** and

2.436 with a total of **13 citations in Web of Science**, **1 International Conference paper**, and **1 BDI article**.

Since **2008**, the author's research and professional activity have been supported by numerous publications, including **course materials (2)**, **international book chapters (5)**, **articles indexed in ISI Thompson (24)**, **articles with CABI indexation (16)**, **ISI Thompson Proceedings (5)**, **CABI indexed Proceedings (3)** and **contributions to international conferences (37)**. The author has coordinated an international scientific research grant and a scientific topic through a national competition and has been involved in other four research projects. The author's international visibility is proved by the **256 citations in Web of Science** of his ISI publications. Looking ahead, the author's scientific and academic career will focus on two main directions: **continuing investigations in international research teams** regarding heat treatment, densification and finishing technologies, as well as using these results **to improve the teaching material for educational activities**.