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Architect perceptions of engineered wood products: An exploratory study of selected countries in Central and Southeast Europe

Manja Kitek Kuzman^a, Sanela Klarić^b, Andreja Pirc Barčič^c, Richard P. Vlosky^d, Marija M. Janakieska^e, Petra Grošelj^{f,*}

^aUniversity of Ljubljana, Department of Wood Science and Technology, Biotechnical Faculty, Jamnikarjeva 101, 1000 Ljubljana, Slovenia

^bInternational Burch University, Francuske revolucije bb, Ilidža, 71000 Sarajevo, Bosnia and Herzegovina

^cUniversity of Zagreb, Faculty of Forestry, Svetošimunska cesta 25, 10000 Zagreb, Croatia

^dCrosby Land & Resources Endowed Professor and Director, Louisiana Forest Products Development Center, Louisiana State University, Baton Rouge, LA 70803, USA

^eFaculty of Civil Engineering, Department on Concrete and Timber Structures, University "Sts. Cyril & Methodius", Skopje, Macedonia

^fUniversity of Ljubljana, Biotechnical Faculty, Jamnikarjeva 101, 1000 Ljubljana, Slovenia

HIGHLIGHTS

- Architect perceptions of engineered wood products in Europe countries were studied.
- A positive perception regarding the use of wood in general in all countries.
- A lack of knowledge of principles of design options with EWPs.
- The internet is the leading source of information used by architects.
- There is a need for more technical information to understand the potential of EWPs.

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ABSTRACT

The wood industries in Slovenia, Croatia, Bosnia and Hercegovina (BiH) and Macedonia have a long tradition of producing a wide range of products. BiH and Macedonia have similar forest sectors and both countries have experienced similar problems in the manufacturing, sale and use of wood-based products in recent years due to the global financial crisis and resulting national economic challenges. Despite having a long and prosperous history, over the past two decades, the wood products sectors in these four countries have faced a steady decline in profitability, the ability to add value through downstream manufacturing, and overall competitiveness.

Engineered wood products (EWPs) are structural building materials that have been used since the early 1980s as replacements for, or in conjunction with, concrete and steel. In this study, we compare architect attitudes, awareness and preferences regarding the use of EWPs between these four countries. The study is based on a sample of 373 architects using on-line surveys. Results suggest that there is a positive perception regarding the use of wood in general in all countries, with the majority of respondents believing that wood use will increase in the future. However, specific to EWPs, differences were found in familiarity and knowledge of potential applications in timber-based construction. Results provide indicators of knowledge gaps between respondents and, conversely, where awareness and willingness to use EWPs exist. These findings can have implications for market opportunities, identifying barriers to EWPs adoption, and content for workshops, seminars, and other outreach mechanisms for architects.

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1. Introduction

Growing environmental awareness presents one of the most important advantages of wood as a construction material, where the choice is motivated by the fact that wood is a renewable material and that its use reduces CO₂ emissions – provided that the raw material is harvested in forests where sustainable forestry is

* Corresponding author.

E-mail addresses: manja.kuzman@bf.uni-lj.si (M. Kitek Kuzman), sanela.klaric@ibu.edu.ba (S. Klarić), apirc@sumfak.hr (A. Pirc Barčič), RVlosky@agcenter.lsu.edu (R.P. Vlosky), petra.groselj@bf.uni-lj.si (P. Grošelj).

practiced including replanting and adoption of management plans [1]. The introduction of new products in the construction sector, however, is generally met with hesitation, low awareness, and high uncertainty in the marketplace; therefore, the communication of information is vital to market success [2–4]. There are demand stimulants: efficiency improvements in existing buildings and renovations; improved specialized training; efforts to make the sector more attractive in terms of research and innovation; and a greater active uptake of new technologies.

During the 2000s, pressure has increased at local, regional, and national levels to find a balance in using forest resources to enhance economic, environmental, social, and cultural benefits [5,6]. Simultaneously, the role of wood in the modern bioeconomy, and the global emphasis on enhancing sustainable development via increased renewable resource utilization has stimulated large-scale demand for wood products for many end-users, as well as specifying wood by architects [7,8]. In Europe, the wood products sector plays a pivotal role in the development of a sustainable society, where economic, environmental, social and cultural aspects of using natural resources are taken into account [9]. In this context, wood-based products are also the most preferred building materials in terms of energy-efficient construction [10,11]. Use of wood is increasingly being considered as a substitute for steel or concrete by contractors, architects and construction companies because wood is renewable and often results in lower installed costs.

The evolving preferences of those who specify the construction materials may be greatly affected by their own notions as to what drives value in terms of the consumption of wood products [12]. There are four key actor groups in the construction value chain that influence the construction process after a project has been commissioned by a person, organization, or an authority [13,14]:

1. *The developer organizes and manages* the process, and has the overall responsibility for design, specification, and economic conditions.
2. Mandated by the developer, consultants, including *architects, engineers,* and project managers offer expert services for the design and management of the project.
3. The *main contractor*, together with numerous *sub-contractors*, is responsible for the realization of the project.
4. Finally, *numerous material suppliers* are responsible for supplying all the materials, components, and machinery for the building project.

Many building material selection choices are guided by a desire to minimize their negative impacts, either on the occupants or on the environment [15]. There is no doubt that the process of learning about the actual options available in material selection has a tremendous bearing on the actions that professionals take, and the attitudes that they hold throughout their careers. This is no different in the field of design, where, among other subjects, architects and structural engineers are constantly acquiring knowledge about the use of various structural materials, products, and systems [16]. It is this information that forms the basis of most decisions pertaining to the specification of materials for use in structural building applications. To specifiers such as architects, new materials present both opportunities and risks. While opportunities derive from new or improved technical performance or aesthetic qualities, risks lie in the lack of design or manufacturing experiences [17].

1.1. Engineered wood products (EWPs)

In the past two decades, a new class of structural wood products has been developed to form the basis for a range of building

solutions that are increasingly functional, based on a combination of performance and sustainability characteristics. This has been possible because of new industrial processes that provide increased dimensions and superior engineering properties for structural products that can use manufacturing residues and lower-grade and smaller diameter trees as feedstock. The result is a category of products broadly known as engineered wood products (EWPs) which are increasingly being adopted in architectural design and building applications [12,18].

Much of the information in the literature on forest sector sustainability is grounded on a diverse set of data related to, for example, specific forest industry products, sustainability issues or stakeholder groups [19–22]. Less focus has been placed on uses of EWPs, generally in the context of structural applications from builder perspectives. In addition, some studies have been conducted on related topics such as consumer acceptance of wood-plastic composites [23], perspectives of use of wood-based products in green buildings [24], and success factors and barriers for innovation diffusion of new wood-based materials [25].

A number of studies have also been conducted on barriers and challenges of increased wood use in the non-residential sector, with a particular focus on wood as a structural material [3,16,26–29]. Generally, in Northern Europe, government building code, project developers, or building contractors were found to be the most important influencers regarding the choice of building material, while in the Alpine Region [30], South Central Europe [31] and Southern Europe, architects were identified as the most influential decision maker [32,33].

To date, the literature is lacking in studies that specifically examine a comprehensive understanding of architect perceptions related to EWPs. As such, we selected architects as the key target group in this research effort as they are key decision makers in the selection of materials in the construction sector. In addition, some studies found architects to be environmentally conscious specifiers of construction materials, and, as such, are an important target group for research particularly as environmental and sustainability issues are becoming more salient issues generally [34–36].

The construction industry is the consumer of EWPs. Some of the key products in this family of materials are shown in Table 1.

1.2. Study geographical countries

In Southeast European countries, including Slovenia, Croatia, BiH, and Macedonia, the wood sector has a very long tradition and has always been an important segment of each country's economy. To get a better picture of the importance of the forest sector in these countries, some additional information regarding relevant forestry statistics are presented in Table 2.

Unfortunately, in the last 2–3 decades these countries have experienced many economic and social changes that either directly or indirectly influenced the wood industry sector. These markets are attracting domestic as well as foreign investors. In recent years, particularly in Slovenia, there has been a concerted national effort to increase the level of wood used in residential construction, in part as a means to lower the carbon footprint of these buildings [10]. There are also initiatives in Croatia and BiH, but primarily at the local level, mostly related to wood-cluster development in Croatia, and initiatives by local architects who are willing to explore the advantages of using wood to develop unique designs for residential and tourist buildings in BiH. Wood construction in Slovenia is transitioning from a formative to a growth phase, while in Croatia, BiH and Macedonia it is still in the formative phase [33,37].

Timber for residential building structures has a market share of about 10% in Slovenia [31], but is almost non-existent in Croatia

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