

The Role and Perception of Architects and Engineers on Timber-Based Architecture – Case of Kosovo

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Abstract

Wood is the only naturally renewable and recyclable building material, consequently wood-based construction is becoming everyday more and more popular due to sustainability advantages that it embraces as well as the new technological innovations which develop high technical performances and new ways of application of timber in architecture.

The study investigates the role of building community, respectively, architects and engineers involved in design, construction, research and public institutions toward the use of timber as structural material in low-rise architecture (implying timber-based buildings up to four storeys high). Research elaborates the results derived by the conducted quantitative approach, through web-based survey of the targeted group in order to provide an overview on the influence and perception of the building community towards the use of timber in construction with regard to different timber attributes. Subsequently, the level of professionals' interest on acquiring more information on timber application and identifying perceived barriers for using timber are indicated.

The study confirms a perceived lack of confidence in timber application, partially due to identified barriers such as lack of experience and technical knowledge, national building code, fire safety etc. However, aspects such as architectural expression, structural performance, flexibility, construction time, environmental impact etc. are perceived highly both by architects and engineers.

1. Introduction

Wood is the only naturally renewable and recyclable building material. It is able to store carbon and as long as it is utilized the longer it stores carbon within, providing the environment with oxygen. In terms of long-term environmental advantages compared to other structural materials, woods renewability, relatively low energy consumption during manufacture, carbon storage capability and flexibility / recyclability has proven to be the most considerable potentials [1-4]. The major factors which influence selection of building materials are usually economic and aesthetic, however environmental impact by using wood products proves to comprise and increasingly important effect on the process [5].

Traditional wooden architecture is a valuable heritage of Kosovo; however, the use of wood has significantly declined with the development of construction industry and the introduction of clay brick and concrete as modern materials. Today, no significant tendency toward wood-based application is noticed and very few contemporary low rise buildings can be found in different urban and rural areas. There are several large-span constructed buildings with laminate wood technology during '80s and only one large-span building constructed in 2001. Since then, no significant tendency toward wood-based application is noticed. Wood industry is an important sector in Kosovo economy being dominated by micro and small enterprises [6], producing mainly joinery carpentry products, doors and windows, wooden furniture and varieties of wooden panels.

Even in countries with the highest share of structural timber in construction, wood-based products are yet perceived to be relatively underutilized when compared to other structural materials such as concrete. It is estimated that there are still some perceptions and barriers that contribute to slow down the development of timber structure market [7]. The process of material

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selection during the design phase is complex, as many participants are involved, e.g. architects, structural engineers, contractors and end-users [8]. In different countries the role of participants on the choice of material differs. Contractors possess increased capacity to influence the design and selection of material in "design and build" type of contracts which usually imposes architects to adapt the design of the buildings to the chosen construction materials [9, 10 cited in 11]. This type of contract is the most common type adapted in Kosovo due to high requirement for residential buildings and the lack of role of local public authorities in the process of design and construction.

This study aims to assess the role and perception of architects and civil engineers on the choice of construction material during design phase and the attributes of timber and its products as main construction material in low-rise buildings, subsequently, the relation between professionals' experience on timber application, their interest on acquiring more information about timber technical performance and the barriers they perceive as present.

2. Methodology

The research was carried out through a quantitative method using a web-based questionnaire for the targeted professionals. The survey criterion was developed based on previous researches [11-13] conducted on the use of timber among engineers, architects and builders. Experienced architects and civil engineers in design, research and construction were chosen randomly and the survey was conducted anonymously. Approximately 3,000 architects and civil engineers are estimated to be professionally active in Kosovo [14]. Around 120 surveys were delivered to potential individuals or companies through e-mails. Contacts were acquired mainly through social networks, such as forums, and similar. The survey provided the respondents with the information on the author's background and the purpose of the research. In total, 47 architects and engineers engaged on different professional activities responded. As shown in the Table 1, 29 or 61.70% of the respondents were architects and 18 or 38.3% were engineers. The questions of the questionnaires were categorized by a five-point Likert-scale (1- lowest scale and 5- the highest scale).

The questions are focused on timber performance as a main construction material. Considering the fact that timber, as a structural material is an underutilised material in Kosovo construction industry, previous experience with wood of the contacted professionals has not been particularly considered. Aspects investigated were focused on:

Table 1: The number of surveyors and their occupation

	Architects	Civil Engineers
Designer / Consultant	18	8
Contractor		5
Academic Institution	5	2
Public Institution	6	3
Total	47	

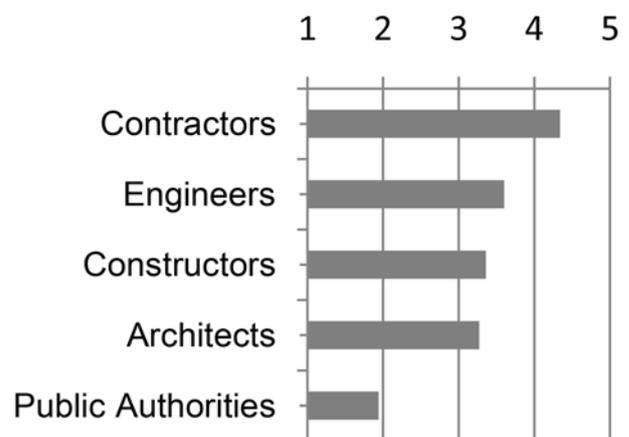


Figure 1. The level of influence by involved professionals on the choice of construction material, expressed in mean values (1-no influence; 5-high influence)

- The role and influence of architects and engineers, as key-role players on the choice of construction material
- Their perception on the different attributes of timber as main structural material such as: technical performance, environmental impact, energy and cost efficiency, fire safety, thermal and sound insulation, comfort and durability etc.
- The level of their professional interest on acquiring more information on timber application in architecture
- Their perceived barriers for using timber as a main construction material

3. Results

The results gathered from the questionnaires are presented graphically categorized by a five-point Likert scale (1- lowest scale and 5- the highest scale) and are given in mean values of the responds for each attribute.

Asked on the level of their experience working with timber as construction material (low, moderate and high), 34% of the respondents declared not to have experience at all while the rest declared to have moderate experience, showing that timber in general is an underutilised material in construction.

The influence on the choice of construction material – Figure 1 present the level influence, in mean values, of different actors when choosing construction material (both structural and non-structural). Contractors and engineers are perceived to be most influential, while architects and constructors is shown to have moderate influence. Public authorities are perceived to have very low influence on the choice of construction material.

Experience working with timber as construction material – Figure 2 provides an idea on the level of different categories of domestic and non-domestic construction by timber. It is obvious that timber has almost no use as the main structural material. It is used moderately in facades of non-domestic low-rise buildings, while more on non-supportive building elements. However the highest use of timber as technical material is in domestic pitched roof structures. It is worth mentioning that technical timber utilized in roof structures, is mainly locally produced while other categories are mostly executed with imported timber elements.

Different attributes of timber, steel and concrete as main construction material – Figure 3 shows the perceived performance of three main construction materials in relation to construction attributes presented below. Concrete is the most used structural material which is also rated very high with reference to durability, structural performance, availability of technical information and product supply, fire safety as well as architectural expression. Most poorly rated attributes regarding concrete structures are recyclability, energy efficiency, insulation properties and environmental impact. Respondents ranked very high timbers aesthetics, energy efficiency, cost, recyclability, flexibility and time of construction. Additionally, aspects such as flexibility, aesthetics, and insulation are ranked almost equally amongst timber and concrete. Steel is perceived positive regarding construction time, durability and recyclability.

Different attributes of timber as main construction material – Figure 4 shows the perceived performance, in mean values ranked in decreasing order. The building community perceives the construction time and energy efficiency along with design expression, flexibility and structural performance as most positive with regard to utilizing timber as structural material. The cost, energy consumption, insulation properties and recyclability are ranked as moderate (mean values 2.8 – 2.36). The less perceived attributes according to the respondents are

product supply, fire safety, availability of technical information, durability and environmental impact.

Professionals' interest on acquiring more information on timber application – In general, when compared to building with concrete and steel, it is perceived a lack of information with regard to timber application in construction, therefore high demand for almost all aspects of timber as technical material, as shown in Figure 5. Architects declared the need for information on design, building systems, fire safety at the highest rank, while almost all categories were rated higher than 3.0. Engineers expressed the interest mostly on technical aspects, such as building systems, structural performance, fire safety and durability.

Barriers for using timber as structural material – surveyors were asked to identify barriers they do perceive to be the most indicative regarding the lack of timber presence as a structural material in Kosovo. The most common barriers listed among actors' perceptions as main obstacles to apply and promote construction using timber as main building material are categorized below:

- Building Code
- Timber products availability
- Lack of experience and technical details
- Lack of professional gain during education associated with timber application
- Durability
- General perception that wood is sensitive to fire and not as reliable as concrete main construction material

4. Discussion and conclusion

The main objective of this study was to understand the role of architects and engineers on the choice of main construction materials and their perceptions on different attributes of building with timber. The processed results reflected the low perceived influence of architects in the choice of construction materials when compared to engineers and contractors. The high influence of contractors may be due to lack of role of local public authorities in the process of design and construction.

The study indicates the lack of experience working with wood as structural material in contemporary architecture. Very few respondents declared to have used timber as structure in non-domestic typology. Timber is moderately used in facades and mostly in supporting pitched roof of individual housing.

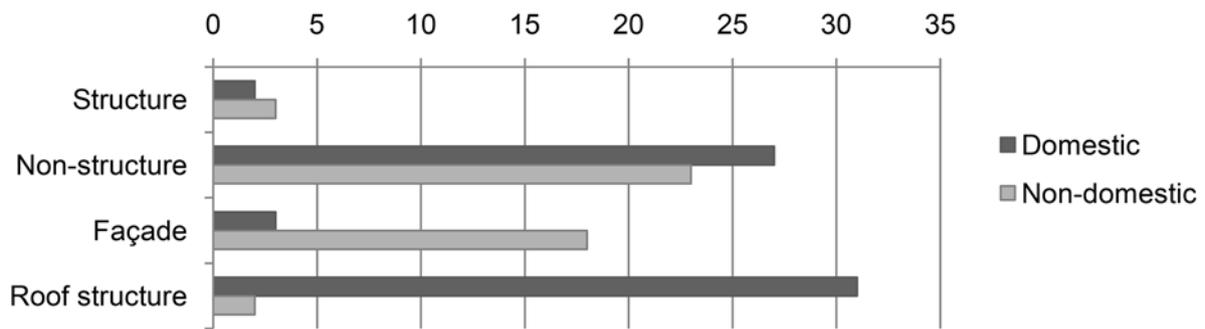


Figure 2. Professionals' experience using timber as construction material in domestic and non-domestic buildings, expressed by the number of respondents

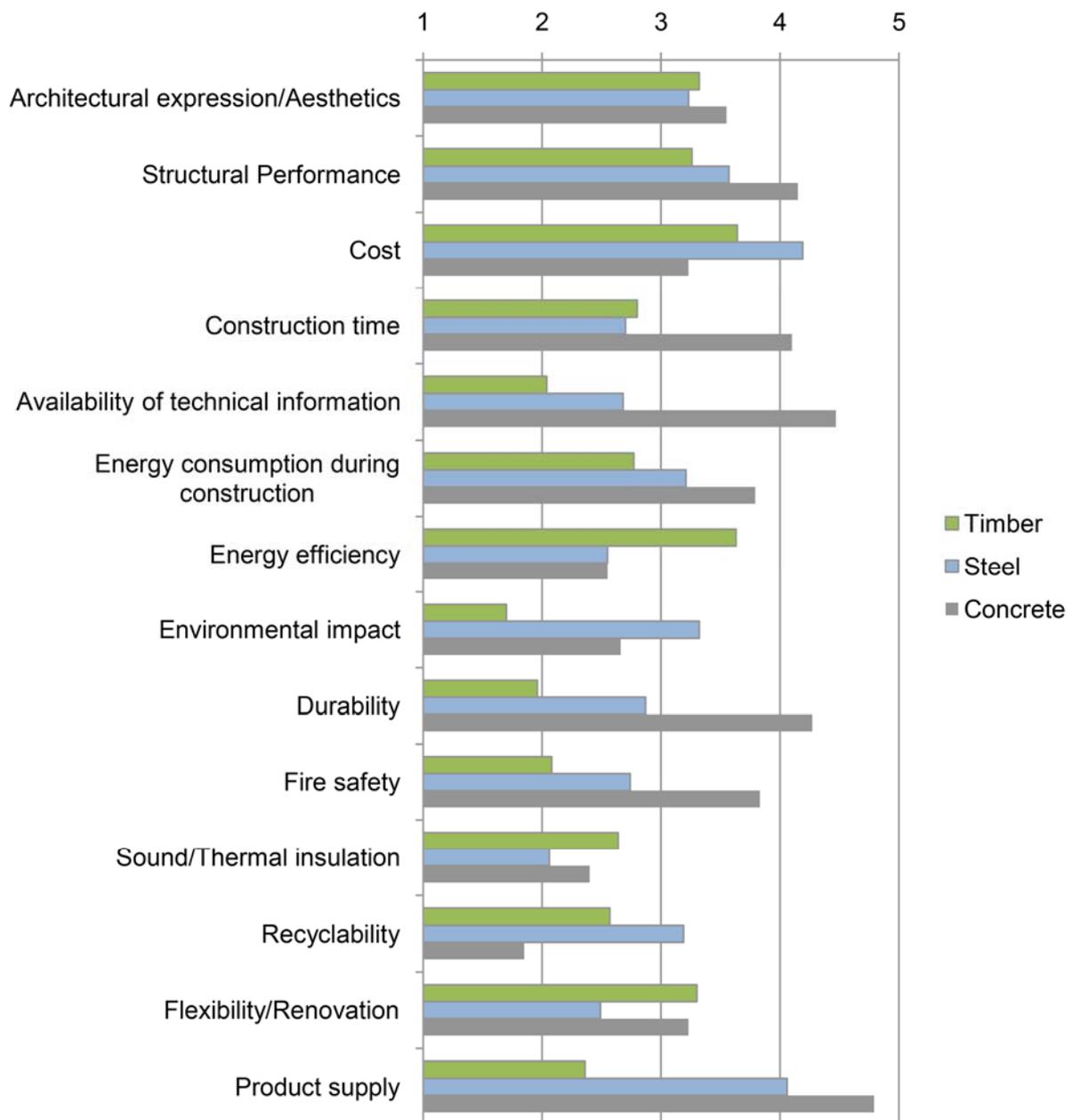


Figure 3. The level of perceived performance, in mean values, of different attributes of timber, concrete and steel as construction material (1-very low; 5-very high)

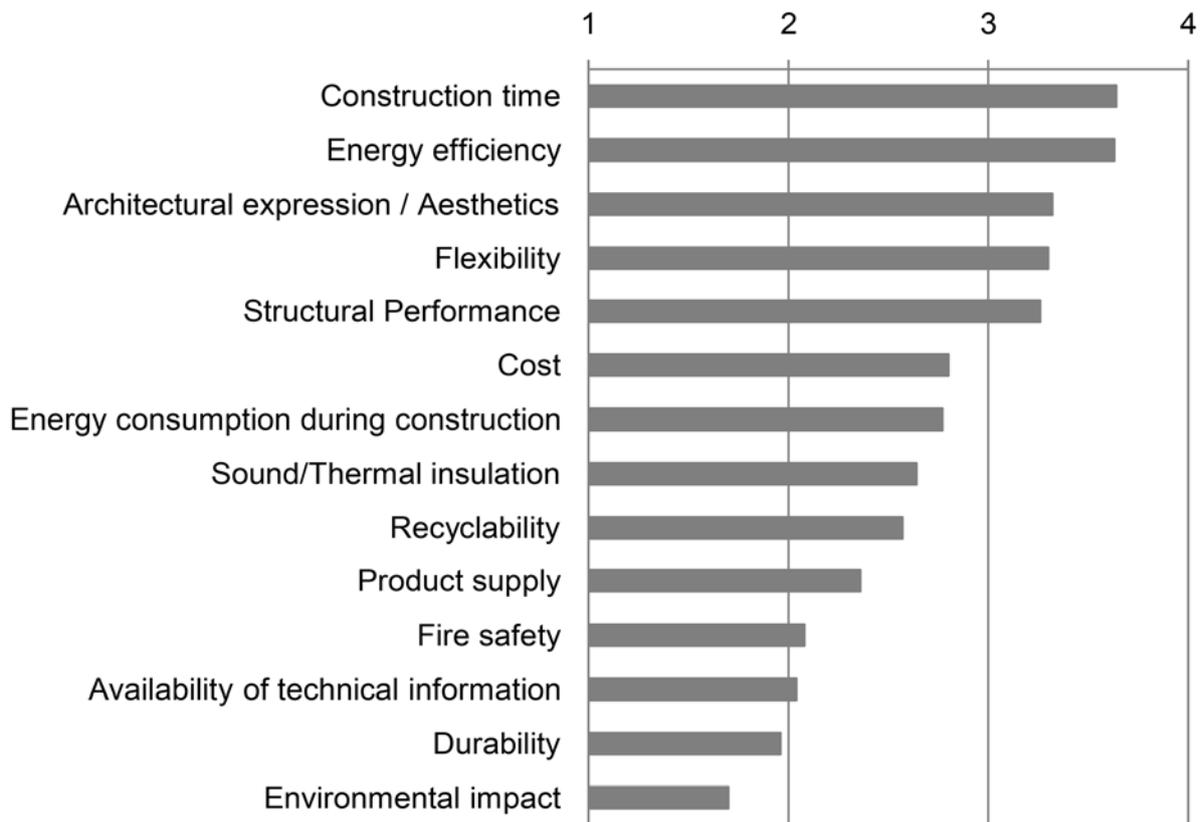


Figure 4. The level in mean values (ranked in decreased order) of perceived performance of different attributes of timber as construction material (1-very low; 5-very high)

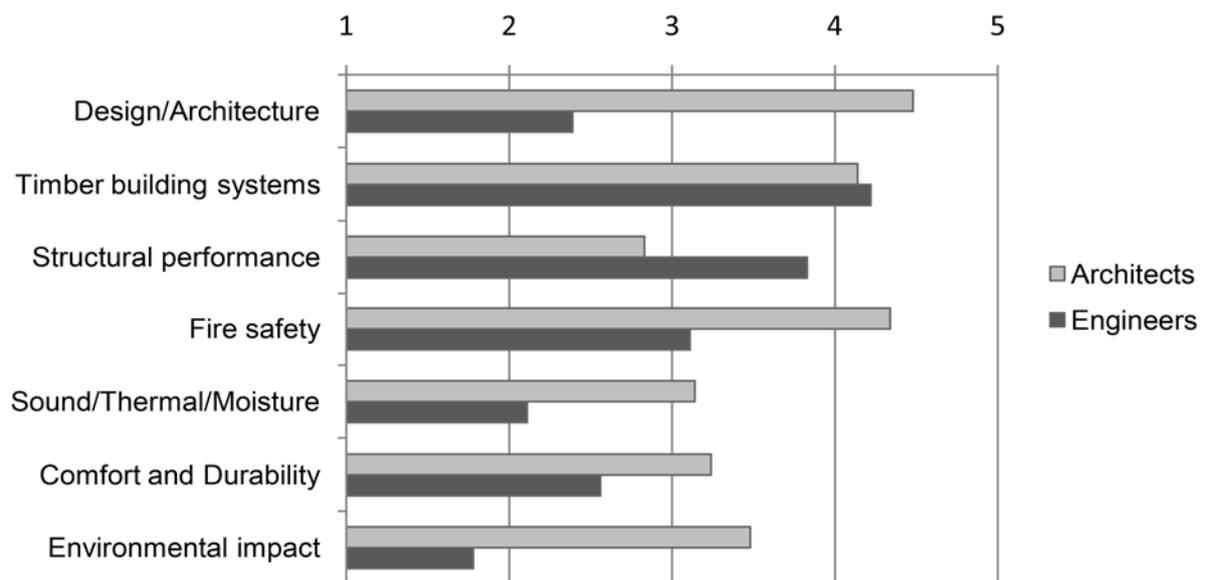


Figure 5. The level of professionals' interest on acquiring more information on timber application (1-no interest; 5-very high interest)

Concrete has been perceived as the most used and suitable material in relation to timber and steel, being rated very high with reference to durability, structural performance, fire safety and availability of technical

information and product supply. Additionally, aspects such as flexibility, aesthetics, and insulation are ranked almost equally amongst timber and concrete. Steel is perceived positive regarding construction time,

durability and recyclability. Respondents ranked very high timbers aesthetics, energy efficiency, cost, recyclability, flexibility and time of construction.

The study reflects a lack of experience, therefore a lack of information with regard to timber application in construction. Respondents declared high interest for information on timber design, building systems, fire safety, structural performance and durability, in order to overcome the identified barriers toward use of timber as structural material, such as: building code, product availability and lack of gained professional knowledge during academic education.

With regard to most positively perceived timber attributes, the study reflects similarity to the results derived in countries with much higher rank of timber application, like Sweden and Norway [11-13], however answers are predominantly based on professional knowledge and general perception and not necessarily on experience.

The rate of respondents has been dominated by architects, which is also reflected in results. Additional qualitative approach among extended building community (involving builders, contractors, construction material suppliers), timber industry and government institutions would provide a clearer and more objective overview on the role and perception of building community toward use of timber in construction. Such an approach would ensure a better understanding of the importance and challenges related to the use of timber as construction material, hence its potential for a national economical benefits.

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