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THE SITUATION WITH USE OF WOOD CONSTRUCTIONS IN CONTEMPORARY LATVIAN ARCHITECTURE

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Abstract. Wood is a historic building material used throughout the Baltic States. Latvia's forests cover 52% of the country and there are more than 30 producers of timber constructions materials, but during the last two decades the use wood in Latvian architecture has declined when compared to other countries in Europe. In particular – Latvian architects avoid the use of timber in public and multi-unit apartment buildings. Wood is a sustainable and technically appropriate building material for many types of buildings including complex construction, but in Latvian architecture it is used more in facades as a finishing material. This study analyses buildings built during the last few decades, conducted a number of interviews and found that the percentage of wooden buildings in the total building volume in Latvia is less than 5% in both apartment buildings and public sector buildings. Restrictive legislation and negative stereotypes were mentioned as reasons as to why architects avoid the use of wood. For the survey results seven Latvian Museum of Contemporary Art competition projects were analysed as well.

Keywords: architecture, wood, timber, Latvia, construction, decision maker.

Introduction

Wood as a building material is returning to the architecture in a new qualities. Wood is called new concrete (Ronken 2016) and there is a forecast that timber will be the most used construction material of the 21st century. About the wood construction renaissance discuss in many countries because it is time to change the legislation and understanding about innovative timber materials. Architects and engineers compete to design and built the highest wooden buildings. In any case, already three last decades the experts discuss about wood and timber as an excellent building material. It is strong and light, making it easy to transport and erect. It can also be machined to very high tolerances, making it ideal for prefabrication. Wood is not just back, it's back in a new quality – glulam, LVL, CLT, I-beam. The new technologies and technical capacity is helping to change and glue wood in a variety of innovative ways.

Wood also helps to mitigate climate change because trees and other living biomasses absorb and stores carbon dioxide (CO_2), which is the most significant greenhouse gas. The harvested forest biomass (e.g. timber) can be used to replace materials and fuels, which involve higher CO_2 emissions (e.g. concrete, metal). The more the forest grows, and the more it is harvested and replaced by new trees, the more CO_2 is removed from the atmosphere and absorbed. Trees do absorb more CO_2 in the growing phase and the absorption slows down when trees mature. From the perspective of climate change and efficient use of resources, the harvested biomass should be used as material for as long as possible in order to replace more fossil energy intensive materials in structural components (e.g. bearing and enclosing structures), before they are used to generate energy (Werner *et al.* 2010; Poudel 2014; Upton *et al.* 2008).

There are many forests and a well-developed timber industry in Latvia, and adjoining Baltic States. Several companies produce timber products as well as panels and modules for the construction industry, but about 90% of production is exported to other EU countries (Andersons 2012). Latvian society does not seem to care about climate change, its CO_2, footprint or the Life Cycle index, but is positively disposed towards ecology and sustainability in many sectors – i.e. food, clothing, decoration materials and private house construction. Wood in architecture has been used for centuries, but nowadays wood is used less than other materials among government and municipal procurement projects and private business projects as well.

The information on the history of wooden architecture is available in various sources. The oldest wooden house remains were found at the Latvian Lubana Plain archaeological excavations and are attributable to the Mesolithic and Neolithic eras (from the 9th millennium to the second

millennium BC). They were a pile of wooden buildings with stone fireplaces. Later archaeological excavations show that in the ancient Latvian countryside and fortified settlement mounds – wooden log buildings dominated. In later centuries wooden buildings were built in countryside, villages and cities as well. In the cultural layer of Riga from 12th–13th century (Albert Square, Peldu, the Udens street corner and other places) traces were found of a wooden building complex including commercial buildings and in addition evidence of craftsmen's workshops. Between the 13th and 19th centuries, manor houses in areas surrounding Riga and many other places in Latvia, were constructed from wood. Even during the late 17th century and early 18th century buildings in Latvia were mostly wooden and only some stone buildings were built in cities (Emsinš 2014). In the 18th century prestigious building complexes were built entirely from the wood. A well preserved example is Kudums 1732th–1750th year built Ungurmuiza complex – basically log building and only some prestigious buildings are with wood cladding. Not only were residential and farm buildings constructed from wood, but also complex public constructions. Until the 18th century the majority of churches were constructed of wood. The Usma and Livberzes churches and Malnava St. Rozukrona Roman Catholic Church built in 1763 in Karsava are also well-preserved (Kundziņš 1974). At 1690th St. Peter's Church tower was completed in Riga and the newly constructed tower was remarkable for its 64.5 meter high spire structure and became the world's highest wooden building.

The wooden architecture of 19th century Riga is mentioned in the UNESCO world heritage description of the city as one criteria which makes it of Outstanding Universal Value. About a century ago, there were around 12 000 wooden buildings in the city and approximately 4000 have survived to this day. In Riga wooden buildings could never be put up in just any place. As far back as 1293 it was forbidden to build wooden houses in Old Riga due to the risk of fire (Albergs *et al.* 2001). After the fire of 1812 wooden houses in the suburban areas were reconstructed again from timber. The 1885 amendment to the city's building regulation prohibited the construction of wooden houses in the entire territory of the city center. At the end of the 19th century and the early 20th century were constructed mainly 1–3 story wooden apartment buildings. Stylistic of wooden houses architecture developed only slightly different from the construction of masonry edifices. From the mid-20th century from timber were built small utilitarian buildings, mostly in rural areas and small towns, but some apartment buildings and the other public buildings as well. In general, wooden buildings have been not well maintained during the second part of 20th century and now they are in bad technical condition and this creates the stereotypes about wood as an inappropriate construction material.

Wood was not used widely in the construction industry in Latvia during the second half of 20th century because of the arrival of new building materials and technologies, which were tested and used for modern architecture. In addition, over the centuries in many countries city blocks built out of the wood caught fire and it caused the creation of new construction standards and regulations with limitation of the use of wood. The timber changes to new innovative material and it is time to change the legislation, regulations and restrictions for the new wood materials with different fire resilience and fire reaction classifications.

A recent conference in Tallinn demonstrated solutions where the metal beams protection from fire (and possible deformation) is made as wood frame or capsule. Wood has its own "strengths and weaknesses", but the negative stereotypes of wooden buildings and architecture are much more discrediting to timber than it is. Wood burns but the burning rate is predictable and occurs at a rate of 0.7 mm per minute. Timber decays if it is incorrectly used or built-in, but wooden buildings can usually operate 50 or more years. Old wooden buildings all around the world are not only in museums but also in urban centers. If all the information collect where in recent decades wood and timber are used in Latvia, this improvements may be seen because of the new materials are coming into use every year. But looking at data from a one year period wooden constructions are about 1% of the total buildings erected. If compared to the Swedish city Växjö and its commitment to build-with wood in 50% of new municipality buildings in 2020 (Dale 2011), we have a lot to do to reach this result in Latvia.

This study was carried out among architects and other experts in Latvia in order to analyze their impact on the selection of building material. The research is a part of preparation of a doctoral thesis and it aims to identify the problems and barriers to the use of wood. During the research the data about the number of wooden buildings in Latvian were searched to prove that wooden buildings are very few. And finally Latvian Museum of Contemporary Art International Design competition case was analyzed to check data from interviews and focus group discussion and because before announcing competition several indirect activities were made to influence selection of building material.

Methods

First, the data about the wooden building amount were collected from the primary (Latvian Cadaster Information

system data base) and secondary (media etc.) sources. For the investigation of barriers, twenty five interviews (Table 1) were conducted, data from 73 questionnaires (Fig. 1) was analysed, and the Focus group were organised as well (Rinne, Fairweather 2012). There were structured interviews to understand the stakeholders' (engineers, architects, developers, representatives of municipality and timber industry) choice of wood as a building material. Structured, qualitative interviews (Lindlof, Taylor 2002) are best suited for comparing and contrasting participant responses in order to answer a research question. An interview schedule that lists the wording and sequencing of questions (Patton 1991) and increases the reliability and credibility (Lindlof, Taylor 2002) of the research data was developed.

Table 1. The number and timing of interviews conducted

Stakeholders	2014	2015	2016
Architects	5	4	3
Engineers	1	1	2
Municipality representatives	1	1	2
Timber industry representatives	1	1	1
Developers	0	0	2

A questionnaire survey method was used after the structured interview period, in February 2016 as the second step. A short questionnaire was developed using findings from the interviews (Table 2).

The questionnaire was created to check the main subject topic with a wider audience and to understand the barriers that the different public perceives. The questionnaire consisted of 7 questions regarding the main barrier to the use of wood as a building material. There were 73 answers received from 85 persons registered for the seminar. Most of participants were students and architects, but there were also representatives from timber production firms, lecturers and media representative. The focus group research was organized as a discussion among professionals where the stakeholders were invited and their opinions were collected (Laplume *et al.* 2008). The discussion was organized in the Riga City architect's office to validate the findings in the structured interviews and questionnaire. Finally, there was made the analyses (Yin 2009) of the seven proposals for The Latvian Museum of Contemporary Art International Design competition.

Results and discussion

Wood is a popular and modern building material used in many countries and during the last decade also in Latvia if you follow sustainability topics in media and discussions. In other words, it is theoretically popular but it was important to ascertain if it is also practically used in construction in Latvia, and as well how many wooden buildings exist in Latvia.

First of all, it must be clear what is meant when you define wood architecture or wooden construction. In Latvia there is no clear distinction if it is construction with wood inlay or finishing or it is building with the wooden structure. There are also no principles concerning how much wood or timber has to be used in order to call a wooden building. This is more or less like a private, emotional choice of the owner, architect or expert. This is important information to take into account also during the analysis of the wooden building data, because there could be mentioned different construction material instead of wood depending what the owner registered or what the expert decided.

There was no accessible and clear statistics about the amount or percentage of wooden buildings among each building category in Latvia. It is possible to analyze the data from the State Land service of the Republic of Latvia (Valsts zemes dienests 2015). For research needs information about public and apartment buildings was requested, but not about single or two family residential buildings. Data about each building material has been divided into 5 parts – basement, wall, covering, roof construction and roof finishing material. For the research needs all buildings with the wall material wood or timber construction were chosen independent of whether the wood was used as finishing or construction material.

Analysis of the data of public buildings from the Latvian Cadaster Information system data base indicates that there are less than 1% of buildings from wood of the total number of public buildings in Latvia. Data shows

Table 2. The topics mentioned in the structured interviews

	Legislation	Quality	Costs	Stereotypes	Experience
Architects	11	6	5	11	7
Engineers	4	2	3	4	2
Municipality representatives	4	1	3	3	2
Timber industry representatives	3	1	2	3	1
Developers	2	2	2	2	2

that of the new buildings during the last ten years there are about 1% new public buildings from wood. In the category of multi-family buildings there are about 4% of buildings from wood. But analysis of the last decade data shows there are more reconstruction projects of historical residential buildings from wood than new timber buildings. In general, the data from the State Land service confirmed that an average percentage of wooden buildings in Latvia is very small (1–4%) and it is important to find out what are the main barriers as to why customers, architects and engineers don't use or avoid the use of wood.

The main barriers for the use of wood

After analysing the statistical data and other information sources it became important to find out why wood is not usual or typical material choice and who is the main decision maker, when choosing building material. To get the information and answers during 2014–2016 one survey with a questionnaire (2016), some interviews (2014–2016) and a focus group (2016) with professionals from industry were conducted.

There is a possibility of increasing the use of wood as a building material if there is information about main barriers. In other countries several researches were also done concerning architects' and engineer's attitude to wood. The data in the previous research was analyzed using decision making and behavioral plan theories (Wang *et al.* 2014; Roos *et al.* 2010; Bysheim, Nyrud 2009; Mahapatra *et al.* 2012; Kozak, Cohen 1999). Use of wood in public buildings and multi-*storey* buildings is being investigated as well. It would be useful to find out and understand who decides and who can influence the choice of selecting the wood (Ajzen 1991, 2001). It is important to know about the decision makers (Edwards 1954) and influences in both private and municipal building projects.

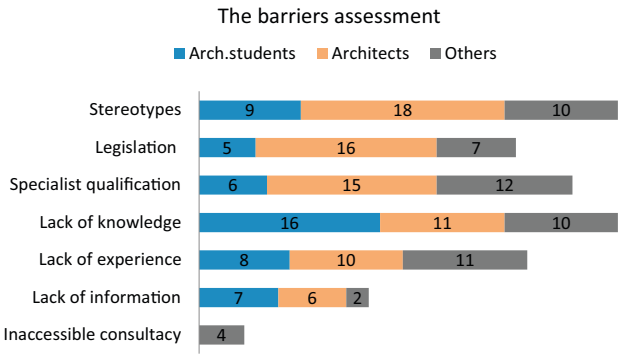

Fig. 1. The main barriers to use of wood as a building material

In the online questionnaire survey seven main barriers to wood use were given that mentioned stakeholders in structured interviews. The main barriers impeding the use of wood as a building material resulting from the interviews – Legislation, Lack of knowledge, Lack of experience, Inaccessible consultancy, Lack of information, Specialists qualification and Stereotypes. The result is similar to the data from other interviews – the legislation and stereotypes were the main barriers mentioned during interviews with architects, but they also commented on some additional reasons.

The only barrier to the use of wood in architecture that is documented is the Construction Standard for Building fire safety LBN 201–15, but it is more restrictive than a prohibitive document. The Construction Standard permits the use of wood or use of timber constructions at the buildings with the highest floor level of up to 8 meters or higher if this is justified by calculations. To overcome this barrier additional resources for architects and engineers (time and calculations) as well as money from developers are needed. This was the information from interviews. From investigating deeper situation about the legislation it is clear that some respondents were not involved in such a situations, but they have heard that the problems with the project alignment had their colleagues.

One of the causes why the amount of timber buildings is not growing is connected with a lack of good projects or demonstration projects from timber structures. The Timber production industry announced the idea that is needed a pilot project to get knowledge and experience for all parties involved – for producers, for architects and engineers and also for local authorities and other control bodies. Examples of successful wood construction projects were also mentioned in other research (Roos *et al.* 2010) and these could show how to minimize the perceived risk.

The selection of the wooden construction demonstration project

The focus group discussion with stakeholders was organized in the Riga City Architect's Office on February 2016 to discuss the situation of timber construction use for public and residential buildings in Riga and Latvia. One of the barriers mentioned in the survey was a lack of pilot projects or good wooden architecture examples in Latvia. A potential future object or project that could be constructed from wood for a focus group discussion to gather the stakeholder's opinion was needed. After the exploration and information gathering the Latvian Museum of Contemporary Art (LMoCA) was selected, because

already a process of architecture design competition for the Museum building was started. Also the representatives from the Latvian Museum of Contemporary Art Foundation were invited and were interested in participating in a focus group. During a focus group discussion there were no barriers announced as to why the Museum building could not be built from wood. LMoCA Foundation representatives agreed that a museum could be a timber structure but as the competition regulation was already completed, there was not a plan to include constraints for any material in the construction terms. So two ways were left to promote the use of timber. There was the Sustainability section in the competition terms inviting the use of sustainable buildings materials. The other way to influence the Museum design and material choice were the recommendations from the local architects and the information provided to teams before the work began.

After the focus group discussion the opinion of Riga's architect and this question was formulated "Is it possible to build the Latvian Museum of Contemporary Art in Riga as a timber building?" After the discussion the opinion text was published in professional and other media in Latvia (Princis 2016). This information was a good way to influence the society's and the professionals' attitude to having the new museum building as a timber construction. During the discussion information was collected about other potential timber projects as well.

The Latvian Museum of Contemporary Art International Design competition. Case study

The competition was held in 2015 and 2016. Because it was a competition, participating architects from several countries with different experience were expected to evaluate and check if there would be an impact from the same barriers for the use of wood in architecture. Seven participants were left after the competition's first-stage. All seven teams were a combination of Latvian and foreign architects. There were no limitations and restrictions on the use of any material, nor were there recommendations for any desired material. During the competition participants visited Riga and met with Latvian architects. There were some lectures and speeches about Latvian architecture and speeches from Riga's architects as well.

There wasn't a separate evaluation of the construction materials used but this was included in the sustainability section which was evaluated. These projects demonstrated and described different aspects of sustainability, but even after all the public activities only one offer was made for a timber construction project. *Adjaye Associates* was selected

Fig. 2. *Adjaye Associates* and *AB3D* proposal from Latvian Museum of Contemporary Art competition

ahead of six other studios: *Henning Larsen Architects, Caruso St John, wHY, Lahdelma & Mahlamäki* (Fig. 2), *Sauerbruch Hutton and Neutelings Riedijk*. London-based *Adjaye Associates* partnered with the Latvian team *AB3D* (Fig. 1) and their proposal is for "a building with an angular roofscape, referencing the traditional wooden houses of domestic Baltic architecture, where steeply pitched roofs are designed to support heavy snowfalls…The main staircase features a combination of a concrete base with a solid timber guardrail that matches the exterior wood cladding and leads to galleries, which are wrapped in a skin of red stained vertical fins to match the Latvian flag". The jury praised the design for its distinctive silhouette (Latvian museum of Contemporary… 2016). "Through the use of wood and form, the concept design subtly references Latvian architecture, proposing a very animated structure with a lively entrance that will enable the museum to create architectural presence in a new and emerging district," said V&A design director David Bickle, who chaired the jury.

To investigate if there was potential to use timber construction for the Museum building the experience of all architects offices – seven Latvian architect offices and seven international architect bureau were analysed. Only one Latvian architectural office works mainly with timber, but some small size timber experiments or buildings are associated with other offices as well. *Lahdelma & Mahlamäki* from Finland and Made Arhitekti (Fig. 3) are the only team with experience through many timber projects. The winning project is one with "with an angular roofscape, referencing the traditional wooden houses" and the "main staircase features a combination of a concrete base with a solid timber guardrail that matches the exterior wood cladding". The winners, *Adjaye Associates* partnered with the Latvian team *AB3D* have no timber construction experience, but *AB3D* has severals projects with exterior wood cladding.

Fig. 3. *Lahdelma & Mahlamäki*, Made Arhitekti proposal from Latvian Museum of Contemporary Art competition

Caruso St John Architects (Switzerland) worked in partnership with *Jaunromans un Abele*, but have no timber construction projects. Latvian architects *Jaunromans un Abele* have several small sized wood architecture ventures. They understand material and work with timber for residential and public architecture. *wHY Architect* from the USA have some wood experiments, for example, the Waterfall pavilion, finished last year. Their Latvian partners *OUTOFBOX Architecture & ALPS* are working with different materials but don't have timber construction projects. Similar is the situation with other three teams – *Sauerbruch Hutton* (Germany) with Latvian architect Ingurds Lazdins, *Neutelings Riedijk.Architects* (Netherland) and Brigita Bula and *Henning Larsen Architects* (Denmark) with MARK Arhitekti.

Conclusions

The future of wood as a building material in Latvia is in the development stage. The restrictive wood legislation in Latvia is in the process of changing. There is a working group for Fire safety regulation (Noteikumi par LBN201–15) established at the Ministry of Economics. The Latvian society's understanding about sustainability and wood is also slowly starting the process of change. The old stereotype about wood has to be replaced with new understanding and a positive stereotype about wood as a future building material.

This study identified barriers in Latvia which are both subjective (stereotypes, lack of information) as well objective (legislation, lack of experience). According the situation that the legislation is mentioned as one of main barriers but after investigating deeper not all respondents had a private experience with this barrier it is more subjective than objective barrier. It may be concluded that it is not the legislation but the knowledge about the legislation is a barrier. In other countries there are different instruments to support the specialists' e.g. free consultations for timber projects in Canada, supportive network Nordic Wood cities in Scandinavia. The research has also shown that, even by removing the restriction on the use of wood i.e. Construction Standard, major changes will not happen. It is most directly related to the lack of information on the use of wooden features and properties for stakeholders and society, and the lack of knowledge and experience of architects and engineers along with various other aspects.

Even though the architects are willing and able to work with wood and use it in their projects, they are not "use of wood" advocates and not always ready to persuade the customer, no matter whether or not it is a municipality or a private contracting. It is important to be aware that the stereotypes are hard to change, or more precisely they cannot be changed. It is necessary to create new stereotypes e.g. to live in a wooden house is prestigious. To reach success in the promoting wood as a building material it is necessary to cooperate. In order to increase the amount of wood construction in Latvian architecture.

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MEDINIŲ KONSTRUKCIJŲ PANAUDOJIMAS ŠIUOLAIKINĖJE LATVIJOS ARCHITEKTŪROJE

A. Viluma

Santrauka

Mediena yra tradicinė statybos medžiaga, naudojama visose Baltijos šalyse. 53 proc. Latvijos teritorijos dengia miškai, šalyje yra daugiau nei 30 medienos perdirbimo įmonių. Bet pastaraisiais dviem dešimtmečiais medienos panaudojimas Latvijos architektūroje sumažėjo, ypač lyginant su kitomis Europos šalimis. Latvijos architektai vengia naudoti medieną viešiesiems pastatams ir daugiabučiams namams. Mediena yra tvari ir techniškai tinkama statybos medžiaga skirtingiems pastatams, taip pat ir daugiafunkciams, tačiau Latvijos architektūroje ji dažniau naudojama fasadų apdailai. Šiame tyrime nagrinėjami per pastaruosius keletą dešimtmečių pastatyti statiniai, o atlikus daug apklausų nustatyta, kad mediniai pastatai tesudaro mažiau nei 5 proc. bendros viešųjų ir gyvenamųjų statinių statybų Latvijoje apimties. Ribojantys reglamentai ir neigiami stereotipai buvo paminėti kaip pagrindinės priežastys, dėl kurių architektai vengia naudoti medieną. Tyrimo rezultatai buvo gauti išanalizavus septynis Latvijos šiuolaikinio meno muziejaus rengto konkurso projektus.

Reikšminiai žodžiai: architektūra, medis, mediena, Latvija, statybos, sprendimo priėmėjai.