

Results: Nordic-Baltic Study-Trip to Skellefteå on Wood construction

BSRWood project

By Alberto Giacometti and Hilma Salonen, Nordregio



Picture 1. Participants from the Baltic Sea Region

In mid-November 2022, the BSRWood project gathered a mixed group of participants including architects, representatives from wood industries, academics, and practitioners from the Baltic countries and Sweden in Skellefteå for a 2-day study trip to learn about the city's experience as a pioneer in modern wood construction. The city offers an inspiring benchmark for other cities to learn about the role of local authorities in close coordination with local actors, from industry, science, and the community, to push forward a green transition, particularly in the construction sector.

The BSRWood project, financed by the Swedish Institute, aims at speeding up the development of wood construction in the Baltic Sea Region (BSR). As wood construction gains attention as an effective way of cutting emissions, opportunities emerge for generating economic development and new quality jobs across the BSR. This is specifically relevant here in the Nordic and Baltic countries which enjoy huge forest resources, a long legacy of wood industry and tradition of wood building, and already strongly integrated supply chains across Nordics-Baltics. To help this process, the BSRWood project organises activities to mobilise stakeholders, strengthen partnerships, and facilitate knowledge exchange.

Background

Wood construction has a long history in Sweden. However, after devastating fires in cities such as Umeå and Sundsvall in the 1800s, the Swedish government banned wooden buildings taller than two storeys. "Skellefteå did not need to burn because we demolished it ourselves" joked the head of the building permit department in Skellefteå. With modernism, wood became regarded as a low-quality second-class material that needed to be replaced with 'good quality' materials of steel and concrete, and thus many buildings were demolished in the city. Today, this has completely changed, Skellefteå is a leading municipality in modern wood construction with new buildings sprouting like mushrooms, from apartment blocks to schools, bridges, and the new crown jewel of Skellefteå: the SARA Kulturhus (Cultural Centre).

Day 1

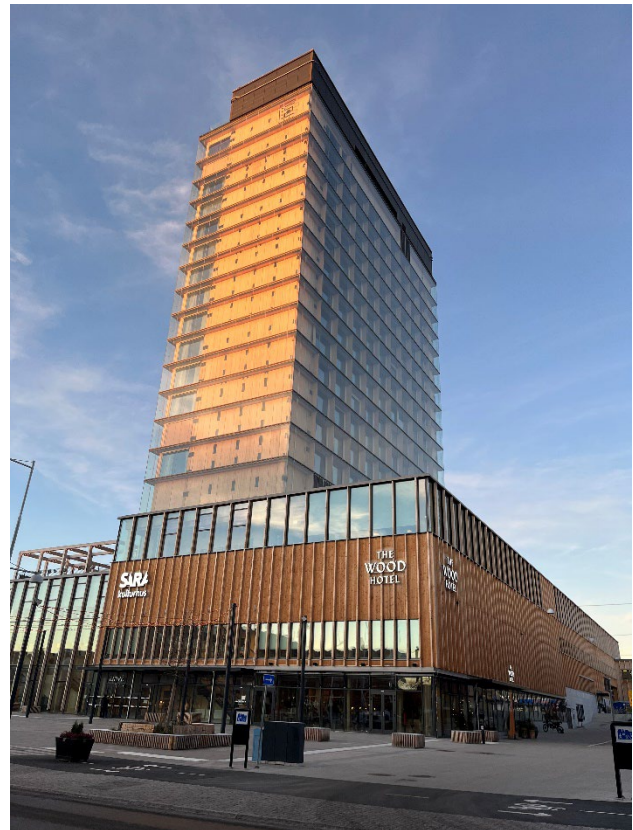
The event was formally opened with welcoming words by Felicia Lundmark, president of the construction and environment committee at Skellefteå municipality. Lundmark referred to the high ambitions of the city to push the sustainability frontier forward. Enar Nordvik, head of the building permit department, followed up with a historical overview of how Skellefteå regained its identity as a wood city after becoming a city of concrete and brick. As values and thinking about city planning and architecture are again under revolution, wood is now at the centre of innovation in modern and sustainable construction. Finally, Mikael Bergström from Västerbotten County Administrative Board, and Alberto Giacometti, researcher at Nordregio gave welcome words in representation of the BSRWood project.



Picture 2. Tour of SARA Cultural Centre with Robert Schmitz, White Arkitekter and Therese Kreisel, Head of urban planning, Skellefteå municipality

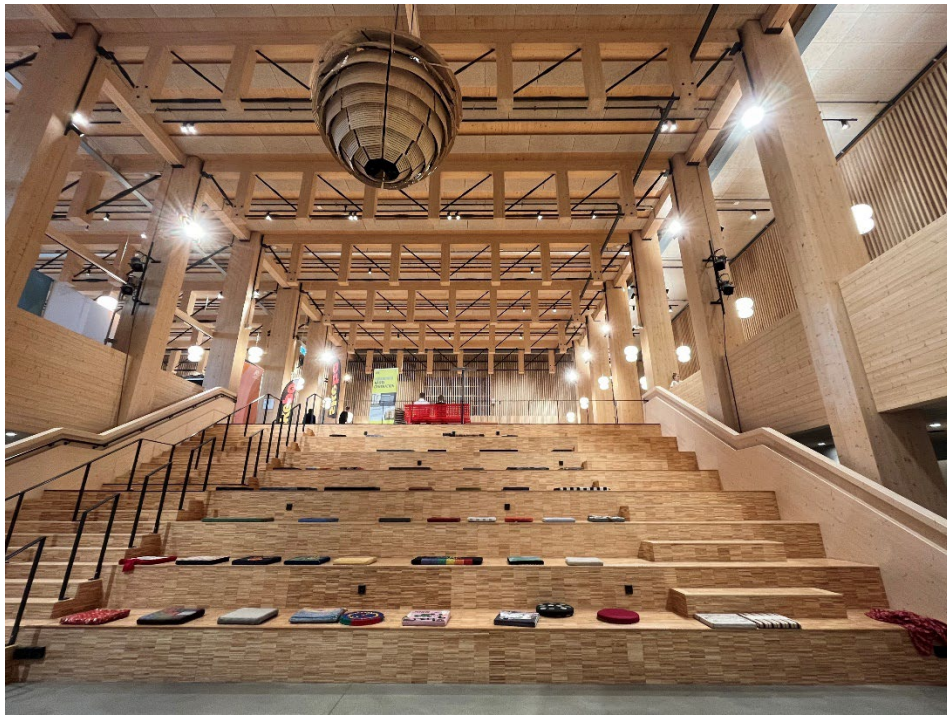
After welcoming words, the excursions began with a tour through SARA Cultural Centre, a large building complex SARA combining conference centre, event and community spaces, a library and a 80 meters and 20 storeys high skyscraper where the Wood Hotel operates. SARA was built using 9,000 cubic meters of timber harvested from ca. 120km radius, including glued laminated timber (glulam) frames and cross-laminated timber (CLT) boards, which store in the material about 6,000 tons of carbon dioxide for the lifetime of the building.

Picture 3. SARA Cultural Centre



We were able to gain a holistic overall picture of different aspects involved in the planning, designing, building, and operating the building with our tour guides representing various actors: Therese Kreisel, Head of urban planning at Skellefteå municipality who led the development of the programme for the culture centre; Robert Schmitz from White Architects who designed the building, and Patrik Sundberg, business unit manager of energy solutions at Skellefteåkraft. Touring the building together with these experts, we were able to see how closely linked the new cultural house is with the overall development and future of Skellefteå.

As a large and demanding investment, it represents the city's plan to significantly grow its population, attract new industry to the region, and continue developing its identity and knowledge of modern wood construction. Emphasising the scale of investment and innovation involved, experts from LTU and RISE explained that the construction process required engineers and mathematicians to work on improving algorithms to optimise the soundness of all structures. Eventually, concrete slabs were added to the upper floors to balance the light materials and prevent structures from bending. As one sign of its social ambitions, the building was designed not to have a backside but to remain an open and inviting space from any direction. Patrik Sundberg added to this perspective by pointing out that the building is planned to be as "friendly" as possible towards its neighbours in very concrete terms, for example by using artificial intelligence to align its (renewable) energy needs with nearby energy users so that all may ensure their share.



Picture 4. SARA wooden heart

The day continued with a “Träsafari” (wood safari), a guided tour to several sites around the town led by Jan Tarras-Wahlberg, environmental strategist at Skellefteå Municipality. We began from yet another ambitious project, the Zero Sun house run by Skellefteåkraft, which is a family house otherwise completely ordinary but with an energy system that combines solar cells, batteries, electrolysis, geothermal, hydrogen, and fuel to ensure that the house can operate detached from the power grid using its own energy supplies throughout long dark winters and short bright summers.



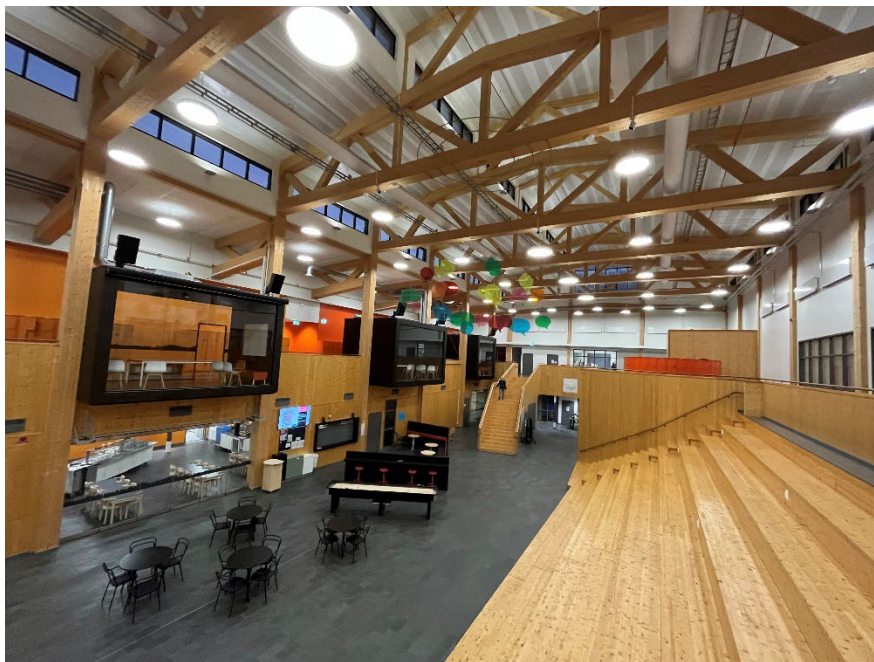
Picture 5. Bonnstan Church Village

The name refers to the efforts required to rely on the energy stored only five sunny months per year. We were then guided to admire a variety of sites showcasing Skellefteå's long legacy in wood construction, starting from Bonnstan, an old church village built solely for travellers heading for mass on Sundays and a rare example of a complete block of houses that survived the years of demolition. From there, one may peer towards the river to spot Lejonströmsbron, the oldest wooden bridge in Sweden, completed in 1737, which is still in use for car traffic. A few hundred years later, a new wood bridge, Älvsbackabron, was inaugurated in 2011 for pedestrian and bicycle traffic, in the eastern part of the city. The 130-meter span makes it the longest wooden cable-stayed bridge and the longest wooden bridge in the Nordic countries. By the riverside stood also the city's first wooden four-storey apartment buildings which only ten years ago were considered as exceptionally, even controversially high.



Picture 6. Älvsbackabron Bridge

As the city is reaching towards wider horizons in terms of population and architectural ambition, these houses have quickly transformed from a novelty to an everyday sight. Our final stop was the Morö Backe school which is built by using glulam and CLT provided by the local producer Martinsons (now Holmen). The health benefits of wood and visually pleasing material make it a popular choice in schools and kindergartens, also with the intention of creating positive environments for learning and development.



Picture 7. Möro Backe School

DAY 2

The second day took place at Campus Skellefteå, where different education and research institutes are co-located, including branches of Luleå Technical University (LTU), Umeå University, Research Institutes of Sweden (RISE) and other vocational schools. The morning activities were led by Bror Sundqvist, Program Director of WoodCenter North in LTU and Rickard Falkman Director Wood Building Technology at RISE. They introduced the work carried out in both institutes in relation to technological development but also their role in business and policy arenas. After the presentation we were also able to see the X-ray scanner lab, wood material labs and the T2 education arena for professional training.



Picture 8. Tour of wood material labs

In relation to LTU work, Sundqvist referred to the work done around raw material supply and quality from logistics and transport to economy, sustainability, utilisation and processing. With highly rigorous protocols, the material can be traced back, with high certainty, to its precise origin. Sundqvist also referred to the work done surrounding material optimisation. An interesting development is the X-ray LogScanner, which is now used to measure and visualise different log properties, "such as diameter under bark, species, log type, knot structure, rotational position of knots, density, heartwood content, annual ring width and predict strength and grade of sawn boards."¹

¹ <http://ltu.diva-portal.org/smash/record.jsf?pid=diva2%3A999396&dswid=-1589>

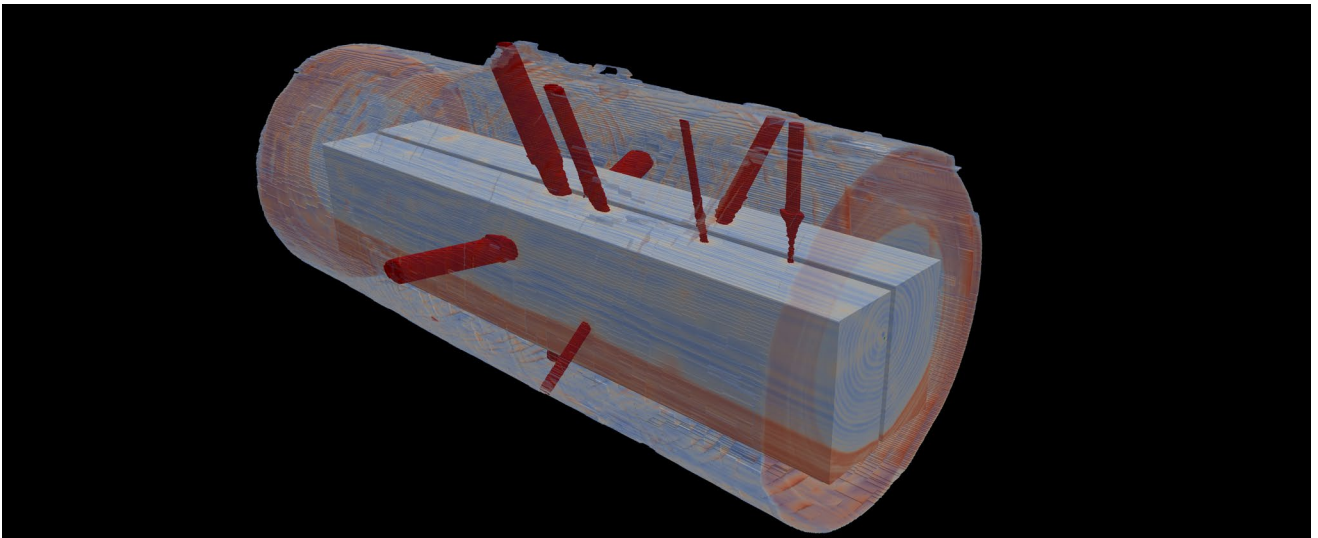
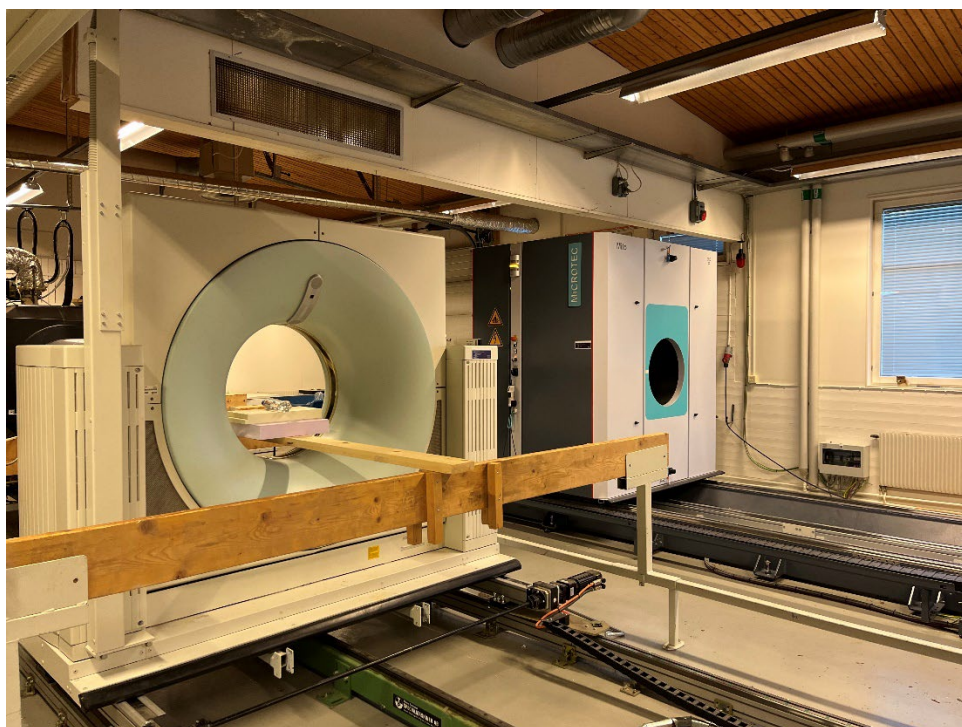


Image 1. The interior of the log revealed in 6 ms with X-ray technology. Source: LTU

Sundqvist also referred to the educational offer by LTU including Master programmes in science wood technology and wood construction, and professional education programmes in wood technology (distance learning). Participants were encouraged to look into LTU areas of research and literature to be found at the university repository on Environmental Product Declaration (EPD) of Swedish sawn lumber, climate impact from industrially produced multi-dwelling wooden houses, productivity of industrial construction, fire safety, sound insulation of timber frames, moisture, transport, and construction technologies. Finally, the health effects of wood in buildings is a largely unexplored area so far, which LTU will be focusing more, particularly with Skellefteå hospital.



Picture 9. X-ray LogScanner

Furthermore, Rickard Falkman pointed out the strong collaboration between key actors in the region, which is also formalised under the Wood Innovation Cluster coordinated by Skellefteå municipality. The cluster brings together research and education, representatives of the wood industry branch organisation and the local authority. Falkman then informed about the services offered by RISE, including transition management (targeted analyses, planning, policy), applied research and development (test and demonstrations, industrial processes, and upscaling, problem-solving), testing, certification and calibration, and lifelong learning. More specifically, RISE works with timber engineering buildings, bridges, assembly, disassembly and renovation, industrialisation of timber construction, structural dynamics, circular economy and technology. In relation to multi-storey wooden buildings: stability, acoustics and vibrations are key research areas.

Also, solutions regarding fire safety, accelerations due to wind load, impact sound, measurement and modelling, and vibrations are developed for buildings above 8 storeys. RISE also works with circular economy, looking into all parts of the supply chain to increase resource efficiency. In practice, this entails starting from the design of buildings to achieve demountable and reusable timber structures allowing future reuse and accounting their full life cycle to enable reuse, recycle, and end-of-life product management.



Picture 10. Rickard Falkman, RISE

Workshop on innovation systems



Picture 11. Workshop on Innovation Systems

The final item of the agenda was a workshop on innovation systems led by Alberto Giacometti and Hilma Salonen, researchers at Nordregio. The purpose was to identify 1) the enabling and hindering factors for the development of wood construction; and 2) the role of different actors: public institutions, market, academia among others and the role governance and networks. The World Café method was used to facilitate the discussion. Participants with mixed backgrounds were divided into four groups, each of them was placed in thematic 'stations' for discussion. Every 15 minutes, groups rotated thematic stations. The four themes included: 1) technical and technological issues, 2) Policy and public sector innovation, 3) Cultural and societal perspectives, and 4) systemic and structural issues.

1. Technical/technological

This thematic table was tasked to address issues related to technical challenges, solutions to them, and opportunities emerging from technological innovation and R&D. As was later discovered to be a common theme for all thematic groups, the need for deeper cooperation and alignment of resources emerged as an important issue here. Currently, there is a lot of parallel work being conducted regarding developing building systems and solutions for various key issues related to sound insulation, fire safety, structural engineering, etc. and efforts to identify common grounds and harmonise standards would be much needed. Standardisation of both products and building processes could be a way to make wood construction even more effective, as well as in general the further institutionalisation of wood construction via regulations, laws, certificates, policies, and related funding. The participants also emphasised the key role of cooperation, networks, and knowledge sharing (for example in the form of data banks). Without active communication, stakeholders might not be aware of the considerable amount of technical knowledge,

research and literature already accumulated in the Nordic Countries, such as the publications from LTU and RISE, as well as other resources and support already available. In addition, much of this work is published in Swedish, making it inaccessible for the Baltic participants.

Another issue is related to the competencies and the lack of experience of many professionals regarding the material properties and functions of wood. Much work still needs to be done in generating those skills. Funding and generating innovation remain fundamental questions, so groups also discussed the need for funding basic research and whether it should fall under the responsibility of public authorities or private companies. Also, more support for pilot projects and design initiatives is needed. While support from policy actors is most important, the problem is that policies tend to prefer a more traditional stance, meaning that they do not encourage cross-technological innovation.

One way to boost more forward-oriented thinking could be focusing on the circular economy aspect of technological innovation on wood, meaning to use of materials more effectively to reuse, recycle, and remanufacture to achieve better traceability of material flows. Utilising waste as a resource would add value to materials in the process, e.g., wood chips, dust, and ash. All side streams create more opportunities for value creation. Furthermore, thinking of flexible uses of buildings during their life cycles, such as the possibility to repurpose them according to changing needs and requirements, represents a great advantage for wood construction. This flexibility is possible because wooden modules within a building can be easily replaced if the design for disassembly has been integrated already during the design phase. In short, industrialised wood construction can be very cost-effective.

Prefabricated buildings may advance even further, for example with the help of artificial intelligence, robotics, and further automatization. Finally, it was noted that the wood construction industry should utilise its technological advantages more for branding and advertisement, e.g., by presenting the above-mentioned opportunities in a more strategic and dynamic manner, even showcasing wood construction as the 'carbon-absorption industry.'



Picture 12. Glulam beam at Holmen Factory

2. Public sector innovation & legislation

In this thematic 'station', participants discussed policy perspectives and the role of public sector innovation and regulation in driving wood construction forward. A main part of the discussions focused on the competences and experience of practitioners working for public authorities, which can limit wood construction prospects. For example, lack of experience may set higher thresholds for practitioners to accept proposals if they appear as risky to them, or if they are unable to assess the risks. In such cases "the safe choice is simply not to accept the proposal", or the eventual permit represents "an exceptional case". However, producers cannot rely on exceptional projects for their long-term business planning. More importantly, plans and zoning regulations are often designed considering conventional construction standards, which may directly exclude the possibility of building in wood for example when decreeing the maximum height allowed for buildings. Participants therefore pointed out the importance of practitioners and policymakers getting involved in technical discussions and learning the specific challenges requiring policy intervention. Yet, it was noted that municipalities vary in their conservative or open-minded stance regarding adopting new practices. In addition, political shifts in leadership tend to influence the willingness of local authorities to mobilise efforts.

Baltic participants noted that, as opposed to Sweden, there are no strategies or a clear vision in the Baltic countries to foster wood construction. In Lithuania, however, national authorities are the ones driving the conversation and are currently designing legislation to push for an increased use of wood in construction. Indeed, the participant from the Ministry of Environment in Lithuania explained that forthcoming legislation will introduce requirements for wood utilisation.

On a positive note, the increase in the number of good cases and practices could already be highlighted as a benchmarking step for policy-learning. Local authorities can contribute to policy learning opportunities by sharing good practices in more systematised ways, of which an example could be the 'wood safari' tour that participants took part in day 1. These tours are organised by the Skellefteå municipality on a regular basis for different types of stakeholders visiting from various countries. In addition to generating awareness, municipalities hold a key role in coordinating actions and making good ideas happen, such as the role that the Skellefteå municipality plays in coordinating the Wood Innovation Cluster, or in investing in schools, bridges and other public buildings made of wood. By taking the lead through 'green finance,' municipalities can help break the structural inertia, boosting cultural acceptance and societal awareness.

3. Cultural / societal

The workshop table looking into cultural and societal factors was asked to consider a wide array of possible issues, ranging from industrial traditions and established practices to values and perceptions (for example regarding the environment, costs, and location), myths and fears impacting decision making, and the role of social relations and possible drivers within the public mindset, such as the growing belief in wood, changing needs and priorities regarding housing or what is overall considered as good design or living environment. What several of these factors share is that while their influence within society and among actors in the field is strong, it is often more implicit than explicit, making it more difficult to address and reform.

In practice, participants identified several ways for how cultural beliefs may materialise as challenges for new actors. Lack of current understanding, of education in vocational schools and universities, and of everyday experience with wood results in inadequate understanding of what wood construction actually

entails in terms of costs of building, for example. Creating architecturally ambitious projects such as cultural centres may help improve the public opinion but, on the other hand, may also polarise views on wood buildings (if they appear more as vanity projects than as meeting a real housing need). Myths and historical legacies, even traumas related to poor housing, add to polarised views, adding connotations such as fragility, poverty, fire hazards and mould, out-datedness in wooden buildings. Since these factors are supported by the strong lobby of the concrete industry and lack of holistic visions for wood construction, they form a major barrier.

Opportunities to overcome these barriers rely on knowledge sharing, study tour and branding events, and storytelling with an emphasis on human wellbeing as ways to battle the persistent myths and fears. Linking wood construction more tightly into wider themes such as the ecosystem debate, with a link to efforts on developing smart homes and new technologies, could be an efficient way to formulate a more holistic view on wood building. This view could then be introduced into educational programmes as well. In addition, certain positive ideals linked to concrete building have not been questioned for decades and should be put under scrutiny: these include the long and 'dusty' construction process, as compared to the more smooth and quick wood construction process. In addition to construction, education and governance, actors working in the fields of innovation and health also have an important role to play in this process.



Picture 13. Tour Skellefteå

4. Structural / Systemic issues

The workshop section focusing on structural and systemic issues aimed at gathering views from several complex issues at hand. What is common to all of them is that they point towards strong structural inertia that results from over a century of unchallenged dominion of the building systems based on concrete and steel and where the established actors had very little competition in the market space. As a result, different

barriers on the way of wood construction reinforce each other while the enabling factors are largely separate and singular. The dominance of established construction systems remains so strong that building on wood appears as the risky solution, a leap to the unknown. At the systemic level, the effects of this are visible in a very tangible manner for example in the slowness and reluctance of institutions such as banks and insurance companies to offer more flexible options that would consider different building processes or review risks based on different parameters. Therefore, change is possible by creating competing new ecosystems. They may build e.g. on new business models with new players, compiling committed and well-informed teams, creating finance and insurance tools that enable more equal risk-sharing, or knowledge sharing and education efforts. Ideally, all these efforts contribute to widening the horizon of wood building activities, encouraging people working in the industry to consider wood already at the early stages of a building process. As a process, wood construction elementally differs from traditional construction (happening largely offsite instead of onsite). Although this condition adds to the possible problems that occurs if wood is not considered from the beginning, this new model of operation also represents one of the wood construction sector's main competitive edges, most importantly by making the construction process more efficient and possibly cheaper as well. In forming new business models, cooperation across sectors, regions, and eventually national borders is key.

Launching from these discussion points, participants at the workshop round tables focused especially on risks related to the current situation where actors driving wood construction must work alone without the ability to rely on strong institutional support. The responsibility for possible risks falls too often on the shoulders of a single person, making wood construction appear riskier than it would have to be, to the point that in certain Baltic contexts, it may even pose a challenge to get an insurance for a wood construction project at all. In addition, a single actor deciding to oppose a wood construction may successfully halt a whole project. As solutions for these deep structural problems, more knowledge sharing, and education on wood among everyone involved in the industry were raised most often, gradually building new ecosystems as flexible and cooperative as possible. Only via holistic approaches including all actors involved and using, it is possible to combat the current systemic barriers. Also here, it was noted that cooperation and an open mindset is crucial to avoid inadvertently creating new cartels in the spot of previous ones. Instead of holding onto specific roles and established institutional mandates, it is essential to put efforts on building trust by taking responsibility for the quality of wood construction efforts.

Post-hoc reflections from participants:

Following the event, participants were asked to share their key learnings and reflections about future opportunities or what they look forward for the future. We provide edited comments below:

Key learnings collected from participants:

- There is a huge potential and interest for sustainable wood building in the Baltics. There is much work to do to raise awareness of opportunities by, for example, sharing good examples.
- The biggest benefit for me was to meet in person and devote time to discuss common interests.
- We have common challenges related to legislation and popularising timber construction, to myths and human emotions, and to fire safety norms and sustainable forestry.
- Despite the common challenges across the region, Baltic actors are mostly working separately. There is much to learn from knowledge exchange as some are more advanced in mass timber, other

prefabrication, and others in legislation, etc. There is also a lack of joint understanding between the countries on how to approach to Life Cycle Assessments (LCA) and to achieve climate goals.

- Not all issues can be addressed at a state level, municipalities can be and are drivers of change. Counties are at different levels of adoption of timber architecture, but generally the needs and processes are the same.
- It is useful to learn from mistakes, not only success. It is fascinating how Skellefteå tells of their success story by navigating around negative experiences. Storytelling is also a powerful tool in place branding.
- It was interesting to learn about the role of training and competences, i.e. T2 education arena for professional training.
- Technological innovation should go hand in hand with the development of 'Soft Values', i.e. motivating people to make more conscious choices.
- Architecture and design are important in increasing the attractiveness of places. I believe this is why people are moving to Skellefteå!
- Most 'wooden' constructions are actually hybrid with other materials (for ex. cement). The goal should not be to eliminate other ways of construction, but to find ways to benefit from a combination of materials. This opens up new opportunities for design solutions and material development, such as upcycled or recycled materials, as well as collaboration between sectors and professionals.
- Prefabrication offers many benefits for design and circularity as it allows for designing from the start for repurposing buildings, and reutilising building elements that can be replaced in a versatile/simple way.

Opportunities for the future collected from participants:

- We need cooperation on various levels (state, business, associations, and technical experts) and study visits to other Nordic and Baltic countries.
- We would benefit from having technical workshops concentrated on calculation methods, connections, building physics, etc.
- There are many opportunities to write academic papers from the built experience in Skellefteå, not the least in the processes that led to the construction of Sara Cultural Centre.
- I look forward to collaborating on a real project, to build a real or digital building that involves all participants.
- We can build on this first trip and deepen the cooperation between Sweden and the Baltics. Västerbotten County Administrative Board would be interested in such a cooperation.
- Cooperation should not only involve companies and research institutes but also municipalities as we are dealing with common challenges.
- There is a need for an umbrella organisation that gather all information into one well managed database
- There are useful competencies in regional labour markets (architects, designers, prefab, timber industry), so we need to work closely with them identify practical solutions.
- We need a performance-based building code with a possibility to apply fire safety engineering methods to allow design of high-rise wooden buildings and create landmarks, such as Sara.
- Speculative Design could be applied to predict future opportunities, products, city development, challenges, etc.
- The industry should take careful steps, as public opinion can rapidly change in case of mistakes or bad practices. We should avoid another 'plastic phenomenon' and introduce wood construction respecting the environmental boundaries and pressures that forests can cope with.

- Construction is very costly today and social systems are rigid. The 'simplicity' offered by prefabricated modules, Lego-like, offers the opportunity to revolutionise construction and social structures. For instance, by mainstreaming affordable living by means of open-source designs and do-it-yourself construction, just like IKEA furniture.

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