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The conference is organized by the InnoRenew CoE and the University of Primorska in the framework of the project Green, Digital & Inclusive University of Primorska (GDI UP).

The project Green, Digital & Inclusive University of Primorska (GDI UP) is co-fi nanced by the Republic of Slovenia, the Ministry of Higher Education, Science and Innovation and the European Union – NextGenerationEU. The project is implemented in accordance with the Recovery and Resilience Plan (RRP) under the development area Smart, Sustainable and Inclusive Growth, component Strengthening competencies, in particular digital competencies and those required by the new professions and the green transition (C3 K5), for the investment measure Investment F. Implementation of pilot projects, the results of which will serve as a basis for the preparation of a roadmap for the reform of higher education for a green and resilient transition to a Society 5.0:
project Pilot Projects for the Reform of Higher Education for a Green and Resilient Transition.

Keynote speaker

Alan Organschi

Alan Organschi is a principal and partner at Gray Organschi Architecture, an architectural practice in New Haven, Connecticut, USA, recognized internationally for its integration of design, construction, and environmental research.

In April 2021, Mr. Organschi was appointed Director of the Innovation Labs at the Bauhaus Earth, a global interdisciplinary initiative that seeks to transform the building sector from a major source of anthropogenic environmental and social impact into a regenerative and ecologically sensitive means to meet the housing and infrastructural needs of an urbanizing global population. Mr. Organschi continues as a Senior member of the faculty at the Yale School of Architecture where he has taught architectural design and building technology for two decades.

Mr. Organschi has written and lectured extensively on the carbon storage benefits of biogenic material substitution in urban building. He is a co-author of the recently published book Carbon: A Field Manual For Building Designers and the scientific paper "Buildings as a Global Carbon Sink" published in the journal Nature Sustainability in January 2020.

In 2012, Mr. Organschi and his partner Elizabeth Gray were honored for their work with an Arts and Letters Award in Architecture by the American Academy of Arts and Letters.t J4-1767.

Environmental impact of phenol from residual water in debarking processes and comparison with fossil -based phenol

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This contribution presents a study on the potential environmental impact of substituting petrochemicals with biochemicals from pulp and paper industrial by-products in the production of phenol (polyphenolic compounds) and tannins. The forest -based industry generates a large volume of water from the debarking and the bark pressing processes. Such water is polluted and needs to be cleaned and is considered a waste stream or low value by-product. But this polluted water has the potential to be a renewable source of polyphenolic compounds. Life Cycle Assessment (LCA) is used to evaluate the environmental feasibility of recovering polyphenolic compounds and tannins from debarking water and bark press water, compared to traditional fossil-based methods of phenol production. Three different routes are investigated for the recovery of these compounds, and their environmental performance is assessed. The study provides valuable insights into the potential of industrial by-products as a sustainable source of polyphenolic compounds and tannins, and the feasibility of their recovery using different techniques. The results of the LCA can guide decision-making for up-scaled processes and provide a better understanding of the environmental impact of the future biobased system of phenol production replacing fossil-based phenol.

Keywords: debarking water, bark press water, phenol, tannin, life cycle assessment (LCA)

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LPWAN sensors for timber structure monitoring – Challenges & Advantage

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Sensors for monitoring conditions in timber structures are still not a standard solution for timber structures but could be seen in more and more new commercial as well as residential projects (Riggio at al. 2023). Wired sensors provide solutions with unlimited service life and are suitable for newly constructed buildings with good access to the timber structure during the construction phase. The installation costs are often equal to the HW of the system and thus not negligible in the total budget of the monitoring project. Battery powered IoT wireless communication offers an alternative technology to the wired sensors. The limited service life of the battery and hard access to replace it open new challenges for LPWAN technology used in this market segment. New wireless products in various timber structure monitoring applications will be introduced within this contribution. Specific requirements of the timber monitoring system, low-energy communication protocol, achievable parameters of the sensors will be presented together with methods to overcome the main problems in various application scenarios. Innovative way of combining wired and wireless sensor components and using the advantages of both will be shown in an example of timber-frame prefabricated elements. The applicability, ease of installation, and data analysis will be presented on the first pilot installation of the wireless system for industrial building and residential building.

Keywords: IoT sensors, timber structure monitoring

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Lignin-based covalent adaptable networks (CANs): a potential substitute for thermosets made of fossil fuels

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Thermoset polymers offer high strength and durability; however, they display limited recyclability. In contrast, thermoplastics are more flexible and have greater recyclability, but they may lack strength and durability. Petroleum-based polymers are no longer acceptable given our current environmental crisis. Their main drawback is not only their non-renewable character, but most importantly the detrimental impacts that their extraction and processing have on the environment, including air and water pollution, habitat destruction, and climate change. Thus, covalent adaptable networks (CANs) emerged as an interesting approach to develop reprocessable thermosets (Kloxin et al., 2013). The combination of covalent and non-covalent bonds in CANs provides several advantages. Covalent bonds provide strength and stability to the network structure, while non-covalent bonds allow for dynamic, reversible changes in the network's properties. Using lignin and its building blocks to develop bio-based CANs is an attractive option due to the lignin's renewable and abundant character (Zhao et al., 2022). This work focuses on the use of vanillin and syringaldehyde (two lignin derivatives) to develop lignin-based CANs. The diversity of this work relies on the fact that imine (Lei et al., 2021) and acyl hydrazone bonds are built on vanillin structure and incorporated in the final structure of thermosets, allowing its recyclability at the end of its life.

Keywords: lignin, bio-based materials, vanillin, reversible bonds

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Fault detection and diagnostics

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Building automation can significantly contribute to a building's energy efficiency, comfort, and security, not only directly through automated procedures and schedules, but also through visualization and especially data analysis of data collected during building operation. When we talk about visualization, we usually have in mind nice touch screens to operate various devices in different spaces, but with the right application/automation behind visualization can alert us to unusual use of devices, consumption etc. Data analysis is even more interesting, and it comes on different levels.

Fault detection and diagnostics is a solution that fits into the data analysis. It not only follows the operation of devices, but also measures the impact of the device's action. If this impact is comparable with the baseline, then the system assumes that the device is working properly. If the impact is not what is expected, then a fault is reported. Fault is not necessarily an error and, in this case, can be just a deviation of expected outcome from the device, but the efficiency of the device is reduced. The consequence of reduced efficiency is higher energy usage, less environmental friendliness, and higher costs. The reasons for the fault can be different and statistics show that 45% of such faults in buildings can be resolved in less than a minute. As an example, we can give an obstruction (p.ex. plastic bag) in the ventilation system. Automatics of the system will increase the RPMs of the system to keep the desired air flow, but this will also increase power consumption. Another example is when the heating in a certain room is turned on. The expected outcome is that the room will heat 1 degree every 2 minutes. If the room temperature after 5 minutes is not raised 2.5 degrees fault is triggered.

Predictive maintenance is also part of this solution. If we take our example of ventilation. This time we notice higher power consumption to keep the same RPMs. Worn bearings could be the reason. We can plan for repairs before the device fails completely. In both cases we will have a higher cost of energy, repairs, and worse environmental impact.

Keywords: building automation, fault detection and diagnostics, predictive maintenance

Olive leaf biomass evaluation methods

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In this study, we aimed to assess the quantity of produced olive leaves during the pruning period using various methods, including the measurement of the diameter of the branches that were cut, measurement of the weight of the cut branches, acquisition of 3D scans by land-based laser scanning, and the acquisition of aerial and land-based photography.

To accomplish this goal, we conducted a field study in 3 orchards where we pruned at least 3 olive trees. We used the above-mentioned methods to collect data on the quantity of produced leaves, which were then analysed using statistical methods.

Our preliminary results suggest that the most accurate evaluation of the quantity of produced leaves can be done by the measurement of the diameter of the branches that were cut, followed by the measurement of the weight of the cut branches. However, we found that the acquisition of 3D scans by land-based laser scanning and the acquisition of aerial and land-based photography were less effective methods for this purpose.

Overall, our study provides valuable insights into the methods that can be used to assess the quantity of produced leaves during the pruning period. These findings can be useful for orchard managers, researchers who are interested in optimizing their pruning practices and improving the yield of their crops, and for industrial applications where olive leaves represent a valuable resource (Estornell et al., 2015; Vorster et al., 2020).

Keywords: olive leaves, biomass availability, biomass modelling, biomass upcycling, sustainable development

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Demonstrating innovative wood-based materials and products in green public procurement: the co-design of the BASAJAUN demo building following the New European Bauhaus values and principles

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Upscaling the use of wood products in new buildings and renovation can contribute to transform the built environment into a large-scale carbon sink and help to unlock the low-carbon, circular economy. This case study describes the co-design of a residential wood building in a new school complex in rural southern France. The purpose was to maximise the use of wood in the building design, in response to green public procurement (GPP) criteria set by the regional authority. The 4-years project was carried out by a large consortium of research centres, architects, engineers, manufacturers, construction companies and public bodies.

A series of innovative wood-based products and system solutions were designed, tested, and manufactured for integration in the building, including: i) a main industrial prefabricated glulam structural timber, ii) a façade system using biocomposite profiles, and iii) a structural insulation panel for roof components and interior partitions. Additional innovations included: iv) a pulp-based insulation foam, v) thermoplastic composite materials, and vi) coatings with less harmful biobased agents. A digital twin model of the value chain was developed and LCA addressed the environmental benefits. The NEB Compass assessment of the co-design highlights the role of the coordination team to steer all phases, including the formal approval procedures of innovative solutions for use in the public building. Thorough planning and follow-up with all parties was essential to ensure that all components fulfilled the required performance levels and could be correctly installed by the contractor. The transdisciplinary team made it possible to address all technical, budgetary, and managerial challenges of the complex design and construction process. The final demo building represents a successful showcase for the New European Bauhaus (NEB) movement on how wood innovation can bring together all relevant stakeholders to co-create beautiful, sustainable, and inclusive solutions for the big green transformation (European_Commission, 2023).

Keywords: engineered wood products, upscaling, co-creation, decarbonisation, rural development, NEB

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Designing Hospitality. New European Bauhaus and possibilities of dialogical hotel and restaurant design

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In one of his famous lectures entitled Hospitality Derrida (2000) engages in a creative dialogue with Kant's famous third article of A Perpetual Peace in which Kant makes an argument for universal hospitality in connection with the cosmopolitan right and Derrida embarks on a discussion of language which shows hospitality and hostility in close proximity as they share the same Latin root. Hospitality can be understood as an opportunity or indeed necessity to keep hostility at bay. A similar point was made by classical anthropological studies of cultures in which hospitality rituals were analyzed to show that the primary function was neutralizing potential hostility. Selwyn (2013) points out that modern hotels are focused on individual needs and desires, and commercial relationships, and that the hospitality industry has undercut the very roots of hospitality. Traditional hospitality includes obligation and cultural exchange, and like Mauss's gift it needs to be reciprocated while commercial 'hospitality' may offer space and food, and even politeness, but not necessarily respect, warmth, kindness, and consolidation of relationship that is fundamental to traditional hospitality.

The proposed contribution aims to look at the principles and potentials of New European Bauhaus applied to the design of contemporary hotels, restaurants, and cafes. After assessing the original Bauhaus achievements in hospitality design, and specifically teaware including the dialogical connection between European and Asian traditions (Forlano et. all 2019, Čapková 2017) it ventures to propose that The New European Bauhaus as envisioned by the EU calls for imagination, creativity, sustainability inclusivity, and cooperation that may contribute to giving the hospitality industry its necessary roots as it were.

Keywords: hospitality, Bauhaus, dialogism, hotel and restaurant design

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Colour changes in natural and treated wood

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Colour, texture, and gloss are among the most important aesthetic properties of wood. Wood discoloration can affect the natural visual appearance of many wood species and cause significant economic problems in the timber industry. Natural weathering and accelerated weathering test are two key methods for testing the durability of materials exposed to different weathering conditions. In most cases, outdoor testing of materials takes too long to ensure the necessary results before use. Accelerated weathering test provides information on the behaviour of products when exposed to long-term weathering in a single week.

We investigated the colour change in the ageing of untreated larch and spruce wood in a natural environment over a period of 18 months, and of spruce and larch wood protected with a transparent finish and a "Palisander" colour finish for outdoor use using the accelerated weathering test method. The gloss and colour measurements of the samples were carried out using an Ericksen Easy Co 566 in the CIE L*a*b* colour space. Unprotected wood shows a different colour after two months of exposure. After 18 months, the measured colour points of spruce move into the grey zone of the a*b* colour space, while in larch the yellow and red colours are still detectable. In the protected wood with finishes, the gloss and colour change depend on the combination of the type of finish and the type of wood. As the material ages, this combination affects the colour difference ΔE*, the displacement of the points in the a*b* colour space and the gloss.

Keywords: wood, weathering, color measuring, properties

Bioinspired living coating system for wood protection: Exploring fungal species on biofinish coated wood surfaces

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The service life of timber products exposed to natural weathering limits the broad use of wood as an external building element. Biofinish is a novel surface finishing solution based on the bioinspired concept designed for effective wood protection. This innovative surface finishing approach enhances the wood's hydrophobicity through oil treatment, resulting in improved dimensional stability. Living cells of Aureobasidium pullulans effectively shield wood from deterioration caused by infestation of other competitive fungi. The melanin pigment produced by the fungus provides an appealing dark surface and protects against UV radiation. Another noteworthy advantage of using living cells of A. pullulans as a coating system is its remarkable self-healing ability. This property does not exist in any traditional wood protection systems, which distinguishes Biofinish from conventional wood protection methods (Sailer et al., 2010).
This study aimed to identify fungal species on the surfaces of in-service wood coated with Biofinish. Additionally, it evaluated Biofinish's protective properties against wood-infesting fungi and assessed the survival and adaptation of A. pullulans within the coating during its in-service period. The study was performed on the façade of the InnoRenew CoE building in Izola, Slovenia, following a 9-month exposure period. The façade is comprised of European Larch wood (Larix decidua) treated with linseed oil and coated with Biofinish. Swab samples were collected from wood surfaces at 0.5 and 4 meters in all four cardinal directions of the building and cultured on nutrient media. Morphological characteristics and sequencing of PCR-amplified DNA from the ITS regions of rRNA gene clusters were used for fungal identification. The majority of species detected belonged to the Ascomycetes genera Aureobasidium and Cladosporium. The results indicated the survival of A. pullulans within the Biofinish coating after nine months of service.

Keywords: wood treatment, building material, fungal colonisation, self-repairing

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Fungal colonisation on biobased cladding materials assessed with conventional and high throughput methods

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Wood degradation by biological and environmental factors remains a challenge despite its longstanding use in construction. Fungi are associated with biotic degradation of wood and great efforts have been invested in their prevention. However, this perspective has been challenged by Sailer et al., 2010, who reported an innovative bioinspired approach where a yeast-like ascomycete, namely Aureobasidium pullulans, is intentionally applied on linseed oil impregnated wood for its protection.

To further such approaches, it is important to determine which fungi can thrive on different wood-based materials and what are the material properties supporting or inhibiting their growth. Implementation of novel techniques is necessary to facilitate such efforts and enable high throughput, exhaustive assays.

Here we show that the treatment of wood and the exposure site influence fungal colonisation and the occurrence of dominant species on the samples.

A set of 34 different cladding materials including natural wood, wood thermally, chemically, and surface treated, impregnated wood, biobased composites, and hybrid materials was exposed to natural weathering. Surface roughness and wettability measurements were performed to assess their physical properties. Periodical sampling of surfaces was performed, followed by culturing. Fungal identification was performed by a combination of morphological characteristics observed in pure cultures and analysis of PCR-amplified specific DNA regions. An increase in microbial burden as well as an increase in samples with a dominant species were observed over time. The most common dominant species was Aureobasidium melanogenum. Hyperspectral imaging was shown to be a suitable high throughput method to visualize fungal presence on surfaces and enable quantification of the infested area.

By integrating methodologies from microbiology and materials science a more comprehensive picture of fungal colonization on cladding materials was obtained. We see this work as a starting point for further studies unravelling the interaction between fungi and materials in greater depths.

Keywords: Aureobasidium, cladding materials, wood, hyperspectral imaging

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Time-lapse microscopic analysis of Aureobasidium spp. growth and insights into environmental adaptation

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The study of microorganisms, particularly fungi, at the microscopic level has gained increasing interest and importance in recent years. Fungal populations and structures, such as biofilms, have become subjects of investigation. Fungi initiate growth from spores, extending apical hyphae to form an interconnected, tree-like mycelial network. This corded network exhibits species-specific variations and undergoes continuous reconfiguration in response to environmental stimuli, involving new growth, branching, fusion, or regression. Innovative methodologies, including time-lapse microscopic observation, have provided comprehensive visualization and quantitative analysis of morphological features, characterisation of mycelial network dynamics, and their response to environmental changes. The integration of time-lapse microscopic observation with mathematical analysis offers valuable insights into simulating the growth of mycelia, which is crucial for our understanding and controlling of fungal biofilm development, that can be implemented in various applications.

In this study, we focused on visualizing the growth of Aureobasidium spp. and evaluating their morphological characteristics to generate statistical functions for simulating free mycelium growth. Cultures of A. pullulans and A. melanogenum were observed using the EVOS™ M7000 Imaging System, which captured 3D and 2D projection images at defined time intervals. The acquired images served as quantitative data for analysing various morphological and growth parameters of Aureobasidium spp., such as tip growth rate, hyphal density, branch angle, and branching location. Subsequently, we investigated the effects of nutrient, temperature, and humidity variations on fungal growth. Moreover, the relationship between A. pullulans and A. melanogenum was evaluated, as they are known to frequently colonize various building materials.

Keywords: Aureobasidium spp., growth, microscope, time-lapse observation

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Circular bio-based construction in Portugal

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Circular construction is defined by the application of the circular economy`s principles to the construction and building sector. In this case, circularity means the reuse or recycling of non-renewable resources and bio-based materials and products (e.g., wood, engineered wood, cork, straw, bamboo, coconut fibers, hempcrete, etc.) that can also be disposed (compost) and returned to the biological cycle.
Because they are forest or crop-based, these materials also have a relevant role related with the carbon sequestration, embodying CO2eq in buildings and infrastructures of the cities, for a large period of time and contribute to tackling climate change (Koster et al., 2020).
Circular construction in the built environment is achieved by designing out-waste and by the extension of the life cycle of materials, products and services at their highest value for as long as possible (ecodesign), as well as minimizing its environmental impact fostering the resilience and regeneration of the ecosystems, for which the bio-based materials positively contribute (Ellen MacArthur Foundation, 2019).
In Portugal, there is a huge opportunity for addressing the circular economy in the built environment, strongly associated with the adoption of building systems that are more sustainable and circular (Konstantinovas et al., 2019).
The aim of this study is to highlight the importance of renewable (bio-based) materials to achieve, and implement, circularity in construction and simultaneously show some examples of buildings in Portugal, where bio-based materials and Circular Construction principles are used in the foundations, structure, and envelope.
The results were obtained from a literature review and case studies in the context of a PhD thesis research.

Keywords: sustainable construction, circular economy, circular construction, bio-based materials, sustainable architecture

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Cross-Laminated Timber furniture as Earthquake Shelter: updates on the Lifeshell concept

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Lifeshell is a wooden furniture acting as safe shelter during earthquakes, thereby saving lives. The concept presented at IRIC2020 (Fellin et al., 2020) has been further developed into a 2.0 version. To improve this design, it is essential to understand the forces, actions, and direction of a building collapse during an earthquake. Reports on building typologies and vulnerability indicate that rubble stone, adobe, unreinforced brick or masonry, reinforced concrete frames with inadequate earthquake-resistance buildings, and poorly constructed timber structures are most prone to collapse. Earthquake image databases were also used to approximate the typical dimensions of collapse, and 14 case studies of seismic countries were analyzed in detail.
For each scenario, the mass ranges of floor and wall collapse over a desk were estimated, with vertical loads ranging from 300 to 2100 kg and lateral loads ranging from 75 to 3600 kg. These data were used to simulate a collapse over a desk, testing several software for both finite element analysis and static/dynamic simulation. Results show most of the software have significant challenges in defining wood as an orthotropic material and defining cross-laminated timber panels as a sum of multi-layered glued boards: nevertheless, one of the finite element-based software was successful.
Preliminary models of the Lifeshell desk indicated no further strengthening of the structure is needed. In fact, a lightened structure can safely carry the applied load resulting in more efficient and cost-effective solutions. Further validation of the design is planned using both finite element analysis and real-life tests to assess each desk variation's suitability for different building typologies and risk of collapse.
The Lifeshell 2.0 is a non-structural revision of the original design for aspects such as aesthetics, geometries, wheels, handles, safety, millings, and accessories. The Lifeshell 2.0 design is freely available under the Creative Commons 4.0 license.

Keywords: anti-seismic, furniture, cross-laminated timber, shelter, creative commons

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Fire behaviour of thermo-hydro-mechanical (THM) densified poplar

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Thermo-hydro-mechanical (THM) densification, which involves a combination of heat, moisture, and compressive force in the transverse direction of the wood, is a method of increasing the density and thereby improving the mechanical properties in the first place of fast-grown low-density wood species (Sandberg et al., 2021). However, as with all cellulose products aimed at the built environment, the fire performance of the densified wood products needs to be characterized. Therefore, cone calorimeter experiments, following the ISO 5660-1 standard (ISO, 2015), were carried out for a range of densified samples of Black poplar (Populus spp.) to investigate its fire behaviour. Densification was performed by THM treatment in open system press at 170°C-200°C. Time to ignition, critical heat flux, pyrolysis properties derived from thermogravimetric analysis, and the heat release rate (HRR) were determined during the testing campaign. The test on poplar had five groups (1) unmodified specimens, (2) THM-densified specimens (densified from 20 to 10 mm), (3) THM-densified specimens (densified from 15 to 10 mm) (4) phenol-formaldehyde resin-impregnated and THM-densified specimens (densified from 20 to 10 mm), (5) phenol-formaldehyde resin-impregnated and THM-densified specimens (densified from 15 to 10 mm). The preliminary results showed that the time to ignition was increased 5 times after resin impregnation (when exposed to 35 kW/m^2 heat flux), whereas the influence on time to ignition from densification alone is weak-dependent. The heat release rate (HRR) of poplar was slightly decreased by densification, but the peak HRR increased somewhat by densification. For the untreated poplar sample, the critical heat flux is around 16 kW/m2, while the densification increased the critical heat flux of poplar to 18 kW/m2. The poplar samples after resin impregnation and densification achieved the highest critical heat flux at around 22 kW/m2. All in all, resin impregnated and THM treated poplar are significantly less ignitable than untreated poplar.

Keywords: wood densification, time to ignition, heat release rate, black poplar, critical heat flux

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Evaluating the potential of citizen science in transition to a more sustainable society

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Transitioning to a more sustainable society is not only a matter of scientific discoveries but requires systematic cooperation between governments, science, research institutions, and the wider society. The recent pandemic shows that those relationships are complicated and multi-dimensional. Aside from the scientification of society and the reflexive socialization of science, we can observe strong opposition to science by some social groups with rising general distrust in science, which renders difficult the acceptance of scientific and technological sustainability innovations.

Some authors (Sauermann et al., 2020) see the concept of Citizen Science (CS) as having the potential to help address sustainability problems by increasing scientific production and bridging the gap between science and broader society. In this sense, we can also see CS as a good counterweight to conspiracy theories and the lack of trust in science (Adam and Gorišek, 2022). Others (Fraisl et al., 2020) mention that CS is already contributing to a more sustainable society by collecting data needed to monitor sustainable development indicators. However, all of this depends on how participants are involved in CS projects, what their impact is on the research process and how they communicate with scientists. This contribution addresses this dilemma, discusses the concept of CS in a wider socio-scientific context and warns of methodological ambiguities and insufficient consideration of similar concepts and models, which are especially characteristic of some branches of social sciences.

While CS has great potential, there are also risks in the sense of dilution of research and scientific activity. We emphasize the need to focus on greater interdisciplinarity and improving dialogue between disciplines, finding ways of resolving conflicts and different opinions and interpretations. This leads to greater utilization of knowledge, optimization of research findings, and consequently towards a more sustainable society.

Keywords: citizen science, sustainability, interdisciplinarity, sociology of science, science society relationships

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The role of Social Life Cycle Assessment in the housing market

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This study focuses on how Social Life Cycle Assessment (S-LCA) can be applied to improve the effect buildings, especially homes, have on society. Houses have a dramatic influence on the way people who inhabit them live. Aspects such as indoor temperature, Indoor Air Quality (IAQ), light exposure, or even space planning change not only the physical and mental health of the building users but even their behavior and the way they see the world. Over the last decade, Environmental Life Cycle Assessment (E-LCA) has been extensively used to analyze the effects of the different stages in the life of a building affecting the environment. Using LCA has helped identify the critical processes that need to be addressed to lower the environmental footprint of buildings. S-LCA can be used in the same way to optimize how buildings are built to positively impact the building users and society around them. In this work, a set of indicators for the use phase of buildings (B) is analyzed, and their suitability as markers for the social performance of buildings is rated. The results show that it is possible to quantify many aspects that characterize the buildings' effect on society. Quantifying the social performance of buildings can help architects and other industry professionals implement socially aware designs.

Keywords: Social Life Cycle Assessment, energy poverty, socially responsible design

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Natural appearances on wooden wall coverings in interiors - the opinion of potential users

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Today's trend of increasingly rapid construction of residential and public buildings and interior design has initiated innovations in the field of architectural, construction, and wood-technological building materials that have achieved certain advantages, but also shown a number of negative impacts on the environment, people's health, and their preferences. Historically speaking, wood has always been used as a traditional material in construction and furniture making, and interior decoration (Ritter et al, 2011). Nevertheless, today's attitudes about the influence of wood on the behavior and health of users are again being examined more intensively (Burnard and Kutnar, 2015).
The goal of the research is to examine users' opinions on how they perceive the natural phenomena of wood (discoloration, ray fleck, sapwood, knots) observed on wall coverings in the interior. In the technical sense, the mentioned phenomena are considered errors and represent wood residue in production, while in the design sense they can be used for a sustainable design and an ecologically biophilic product on the walls (Mamić and Domljan, 2023). This interdisciplinary research presents the preliminary results of new knowledge about the attitudes of users in the use of wood (with an emphasis on veneer waste) in interiors and confirms that wood in the interior affects human behavior and feelings.
Further research is focused on confirming the positive impact of wooden wall panels on the natural environment, symbiosis with natural, biophilic design, on the well-being of users in the interiors of residential and public buildings, as well as on the branding of a new environmentally friendly product made from wood residues in the company Spačva Ltd.

Keywords: interior design, wood wall panels, trends in wood waste applications, human health and behavior, environmental perception of wood

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Age friendly indoor built environment

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The paper offers an overview of the results of project ERASMUS+ DESIRE – DESIGN FOR ALL: METHODS TO CREATE AGE-FRIENDLY HOUSING, done by an interdisciplinary team of researchers. It deals particularly with useful recommendations for designing the built environment indoor and outdoor by preventing ageism.
It questions the meaning of an age-friendly environment from a social perspective as well.
It offers some solutions on how to design the built environment in a way to prevent health and social problems.
This paper questions the role of universal design/design for all and adaptive housing in combination with other approaches of human-centred and body-conscious design.
It offers recommendations for social inclusion solutions and support of socialising by maintaining security and privacy/intimacy, rethinking sitting culture and motivation for natural movement, complex active ageing. It explores also the main benefits and solutions for keeping pets and age-friendliness. It emphasises the conflict of maintenance vs authenticity and biophilic experience. It shows good practice examples of age-friendly environments and no-ageism design.

Keywords: age-friendliness, universal design, adaptive housing, social inclusion, sitting culture, pets

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Analysis of the influence of the properties of building materials in load-bearing sandwich structures on fire resistance

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Knowledge about the fire resistance of building materials is among the most important when choosing building materials for construction (Hafke et al., 2022). However, the influence of individual properties of building materials on the overall behaviour of the building structure in the event of a fire is not so well explored (Kontogeorgos et al., 2016). In this contribution, we deal with the analysis of the behaviour of individual building materials in a load-bearing sandwich structure during fire. In experimental studies, we examine the temperature development itself, not only on the surface of the test sample, but also behind the individual layers of building materials that make up the load-bearing sandwich structure. To determine the behaviour of the given materials during fire, we used the test method according to the EN 1365-1 standard. The composition of the load-bearing sandwich structure consists of the following building materials. And that is a universal plasterboard construction board, thermal insulation material made of expanded polyurethane with a surface treatment of mineral felt, a layer of mineral wool, and new types of fireproof boards complete the construction. The load-bearing capacity of the sandwich structure is ensured by wooden posts. By choosing a suitable combination of building materials in the load-bearing sandwich construction, we can ensure increased fire resistance. From the analysis of temperature data obtained using thermocouples behind the layers in the load-bearing sandwich construction, we found a temperature difference of up to 809 °C behind the exposed and unexposed material. In the contribution, we discuss the influence of building materials on the resulting fire resistance of the load-bearing building structure.

Keywords: building materials, structures, fire resistance, analysis of properties

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Car fire blankets as a tool for fire spread control in parking garages

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When prevention fails, proper repression plays an important role in preventing the spread of fire. Vehicle fires in parking garages represent one of the more demanding types of interventions from the point of view of firefighters. There is also a risk of the fire spreading to surrounding vehicles and objects in a relatively short time. Moreover, problems may occur in accessing the place of intervention due to a small space for the passage of firefighting apparatuses. These issues may increase the risk of fire spreading to the entire building. A great solution for vehicle fires in closed spaces like parking garages are car fire blankets. In addition to ordinary vehicle fires, certain types of car fire blankets can also be applied to vehicle fires with electric or hybrid propulsions. As part of the cooperation between the Fire and Rescue Service of the Slovak Republic and the University of Žilina, experiments were carried out a focus on effect of car fire blankets on the heat flow. From the results, it was found that after the application of car fire blankets, there is a significant reduction in the heat flow to the surroundings. Besides, the application of these effective tools to vehicle fires can be performed by 2 people. Considering these facts, the use of car fire blankets in parking garages fires has great potential and it is directly connected to the fire safety of the building's structures.

Keywords: vehicle fires, fire protection, car fire blankets, parking garages, garage fires

Chemical and enzymatic starch modification for various sustainable applications

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Starch is one of the most abundant biopolymers. Like cellulose, starch can be considered a condensation polymer because its hydrolysis yields glucose molecules. It is completely biodegradable, inexpensive, and renewable. Unmodified starch can takes up water very easily, swell rapidly, rupture, lose viscosity, produce cohesive pastes, and are is not stable to in acidic conditions, at high temperatures, or under mechanical action. We can change overcome these shortcomings by chemical, physical, and enzymatic modificationying of starch methods. In this study, the effect of chemical and enzymatic modification on the properties of wheat starch were investigated. The chemical modifications were accomplished by the addition of suitable reagents to aqueous starch slurries while controlling the pH and the temperature. For enzymatic modification, extracellular starch-degrading enzyme complexes from the fungi Morchella esculenta, Pleurotus ostreatus, Ganoderma lucidum, Trametes versicolor, and Fomes linzengae were used in the study. In both modification methods, iodine paper was used to determine the residual starch after modification. Iodine forms a blue to -black complex with starch. After modification, the modified starch was washed four times with clean water and dried in a fan oven at 45°C for 48 hours. It was then ground in an IKA grinder and stored in sealed containers. The zeta potential, pH value, and thermal properties of the modified starch for use in emulsion and suspension were determined. Results showindicate that a pH greater than 7.,5 and particles with positive zeta potentials with more positive than +30 mV or more negative zeta potentials more than −30 mV are important indicators of the stability of colloidal dispersion. The thermal degradation of starch bellow 300°C involves the dehydration of the OH from the glucose monomers followed by main chain secession to produce volatile compounds. The replacement of the starch OH components with oxides improves the thermal stability. Starch and its derivatives will be used in as biodegradable alternatives to conventional petroleum-based material.

Keywords: wheat starch, modification, enzyme, properties

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The impact of environmental awareness on customer needs and purchasing behaviour related to residential renovation and furnishing in Slovenia

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There is a growing awareness among consumers about sustainability issues and climate change (Hedstrom 2018). In this contribution we aim to examine the extent to which Slovenian consumers consider environmental aspects when making decisions about renovating or furnishing their apartments, including the purchase of new furniture. Firstly, we provide an overview of existing data on attitudes and behaviours related to the renovation or furnishing of living environments, both for Slovenia and other countries. One of the primary sources of information is a survey completed in 2013 among ten European countries on purchasing behaviour and consumer needs concerning furniture products (Renda et al. 2014). Second, we conduct our own study on the topic combining selected survey questions from previous surveys and our own original questions utilizing an online survey panel that is representative of the Slovenian population. In the analysis, we evaluate the effect of demographics and other factors such as environmental concern, on customer needs and purchasing behaviour. By comparing results with previous studies, we discuss main trends and evaluate similarities and differences compared to consumers in other countries.

Keywords: customer needs, online survey, purchasing behaviour, sustainability

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Traditional material culture in built environment and wellbeing

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The paper deals with the topic of the relationship between elements of traditional material culture and well-being in the contemporary built environment.

It explores the principles of material culture (buildings, crafts, clothes) that are related to complex comfort and well-being. Why are users attracted by traditional elements and how can we work with the feathers by developing new products related to regional development and social sustainability? This paper questions the phenomena of the attractiveness of elements originating in the traditional material culture which have a kind of regional identity. There are defined strategies for their transformation then into new forms needed in contemporary housing culture, lifestyle, and provided services, particularly in the recreation and touristic areas that are important for regional development.
First, it is the survival principle (safety, livelihood, sharing and support in the community) and the principle of availability and use of local natural materials. This is connected also with the availability of local know-how, which strongly influenced the traditional material culture anywhere.
Very important is the simplicity, functionality, effectiveness in local climate, proportion aligned to the natural setting or geomorphological character of the environment and the accuracy or proportion in the social setting or „lifestyle ".
Crucial is contact with known stereotypes and at the same time visible authenticity and application of decor/ornament often inspired by local nature (biophilic principle) that serves also as an identity element – identification with the local community.
There were used research methods: an online questionnaire and environmental simulation with170 respondents in 2021 (Kotradyová and Borysko, 2021) and face biometry through the online measurement system Samolab with 50 respondents in 2022

Keywords: traditional material culture, well-being, creative strategies, regional development

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Enhancing spatial resolution in durability assessment of wood at different scales: a data-driven approach for moisture content prediction

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The durability of wood in exposed environments is influenced by a range of biotic and abiotic factors. Among these factors, fungal decay poses a significant threat as it breaks down the wood structure. Wood moisture content is a critical factor that affects the development of fungal decay. Therefore, accurate modeling of wood moisture content is essential for the design of wooden structures and commodities. Existing mechanistic models based on finite element modeling provide accuracy but demand substantial computational resources, limiting their applicability.
In this work, we explore data-driven approaches to predict moisture content in durability applications requiring high spatial resolution. Specifically, we focus on two different scales: decay risk of building envelopes and the development of decay hazard maps. We used a time-lagged neural network trained on simulated data with inputs of relative humidity, temperature, and precipitation to predict moisture content. The model was used with the CERRA reanalysis dataset as input, enabling us to assess the decay hazard of wooden specimens under different European climates at a horizontal resolution of 5.5 km. Moreover, for a specific location, we used the same model with a simplified environmental analysis to predict decay risk at a resolution of approximately 10x10 mm over a building envelope.
This work aims to contribute to user-friendly and open-source tools which facilitate performance-based service life assessment of wood. In doing so, we aim to enhance the resilience and reliability of wood in diverse applications, optimizing its potential for sustainable and enduring construction solutions. Future work will focus on the development of similar models with data stemming from field measurements rather than simulation.

Keywords: wood, modeling, moisture, data-driven, durability

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