Education, innovation and research in wooden architecture and construction in the Alps

Nuova serie / *New series* **n. 12 - 2024**

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Copertina / Cover: detail of the façade of the Salgenreute chapel, Bernardo Bader Architekten, Krumbach, 2016 (Photo Cristian Dallere)

Errata corrige
Nel numero 11-2023, nella didascalia di p. 72 compare erroneamente come immagine d'apertura Église du Sacré-Coeur, Brig, Atelier coopératif d'Architecture et d'Urbanisme (ACAU), 1970 (Nadine Iten), la didascalia corretta è: Église St-Nicolas d'Hérémence, Hérémence, Walter Förderer, 1967 (Michel Martinez), ce ne scusiamo con gli autori e i lettori / In No. 11-2023 issue of ArchAlp, the captions on pages 72 erroneously report as the opening image Église du Sacré-Coeur, Brig, Atelier coopératif d'Architecture et d'Urbanisme (ACAU), 1970 (Nadine Iten), the correct caption is Église St-Nicolas d'Hérémence, Hérémence, Walter Förderer, 1967 (Michel Martinez). We sincerely apologise to the authors and our readers.

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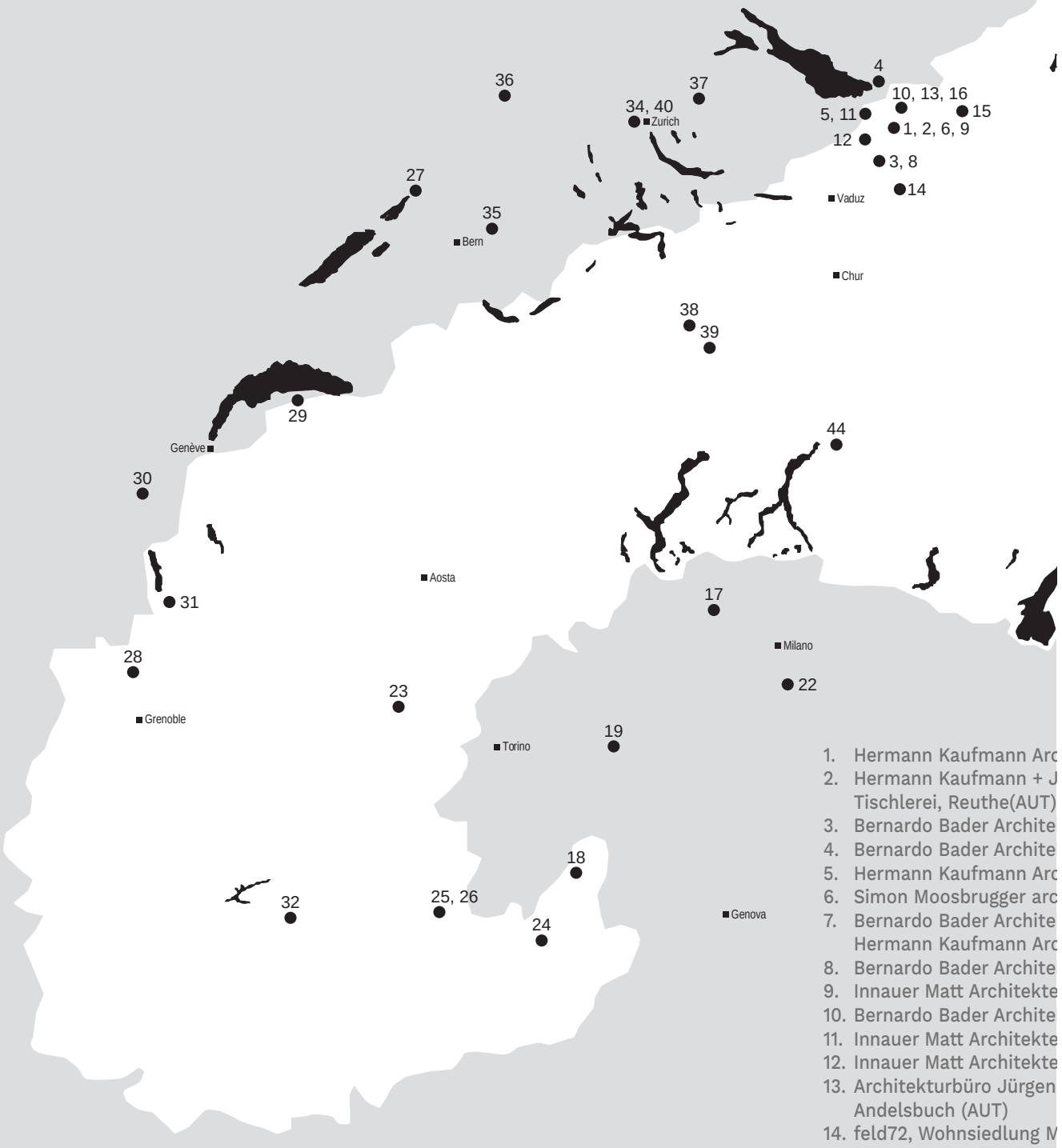

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Education, innovation and research in wooden architecture and construction in the Alps

Conversations edited by Roberto Dini

The essay explores the importance of teaching and research in the building cultures of specific territories, with a particular focus on the use of wood in construction. Through interviews with experts from research centres and universities, such as Andreja Kutnar from *InnoRenew CoE* in Slovenia, Frédéric Pichelin from the *Bern University of Applied Sciences* in Switzerland, and Florian Court from the *Haute École du Bois et de la Forêt* association in France, the essay highlights how such institutions are promoting innovation and sustainable development in the wooden construction sector. Kutnar emphasises the importance of interdisciplinary and holistic research to develop renewable materials and improve the quality of the built environment. Pichelin discusses how innovation can emerge from the integration of new technologies and biobased materials, while Court addresses the challenge of industrialising wood production processes while preserving unique local characteristics.
The essay also examines future challenges for wooden architecture in the Alps, such as climate change and the need for sustainable resources, highlighting projects like VETA/NOVA developed by the Bern University of Applied Sciences, which aims to develop guidelines for the restoration of historic wooden buildings. Finally, it discusses the possibility of translating global prerogatives into a local context, influencing the contemporary architectural identity of the Alps and its multidimensional impact on the territory.

Roberto Dini

Architect, PhD and associate professor of architectural and urban design at Politecnico di Torino, he studies recent transformations of the Alpine landscape and territory at the research centre Istituto di Architettura Montana (IAM). He has published several books and essays in national and international journals.

Keywords

Research, education, innovation, wooden architecture.

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A central aspect of a discussion about the building culture of a specific territory is undoubtedly the ongoing teaching and research in the sector. These are the main vectors through which innovation moves, both in terms of developing contextual solutions and establishing expertise in a specific area. From the many professional institutes, universities, and institutions working in this field, we spoke with several experts who have been working with wood in construction for a long time and play a significant role in their respective regions in the coordination of educational and research centres. They shared insights about the particularities of their institutes and their efforts to promote local building cultures in a contemporary context.

Andreja Kutnar is the director of the research institute *InnoRenew CoE* and a full professor in the field of wood science at the *University of Primorska* in Slovenia. *InnoRenew CoE* conducts interdisciplinary research on renewable materials and healthy built environments, specifically focusing on innovative approaches to wood and its use, with the aim of transferring scientific knowledge into industrial practice. She notes: «Currently, we are working on 35 international and national research projects from various fields. For example, we are developing engineered living materials that can interact, adapt, and respond to environmental change».

At the university level, *InnoRenew CoE* creates new knowledge with students in the master's program in Sustainable Built Environments and the PhD program in Renewable Materials for Healthy Built Environments. Additionally, Kutnar mentions, «We are developing a new professional higher education program in Sustainable Built Environments, aiming to fulfil the need for systematic investment in developing top-tier personnel necessary to stimulate breakthroughs in the woodworking industry».

The Alpine region, and the rest of Europe and beyond as well, must be equipped with professionals

1

In apertura
The internal space of the *InnoRenew CoE* research institute (photo Miran Kambič).

Fig. 1
External view of the *InnoRenew CoE* research institute (photo Miran Kambič).

who have the necessary knowledge and skills to effectively operate in industries that are crucial for the sustainable transformation of our society. Kutnar asserts, «The wood industry is undoubtedly an integral part of this transformation, and we at InnoRenew CoE are working hard to contribute our part to this necessary change».

Frédéric Pichelin is a professor and vice director of the *Bern University of Applied Sciences, School of Architecture, Wood, and Civil Engineering* in Bienne/Biel, Switzerland. The recently renovated institute conducts teaching and research activities in multiple fields: the *Institute for Building Materials and Biobased Products* focuses on environmentally friendly mate-

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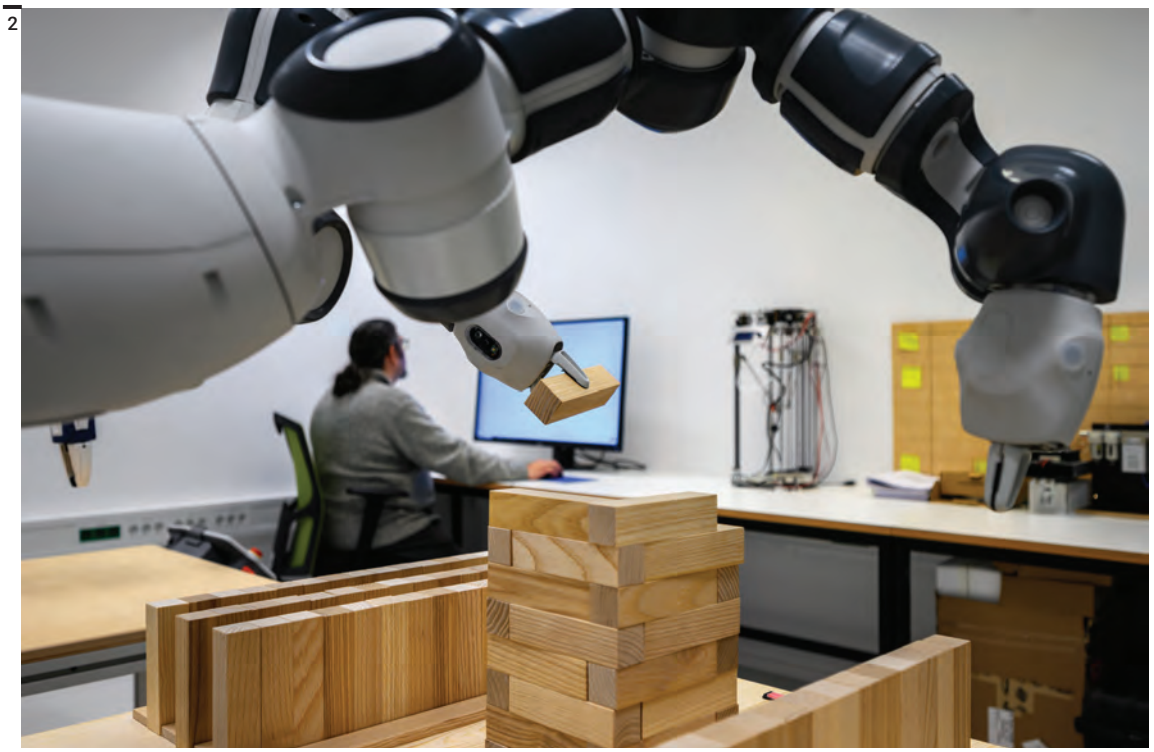

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Fig. 2
The high-performance Computing lab, *InnoRenew CoE* (photo Miran Kambič).

Fig. 3
The Physical Testing lab, *InnoRenew CoE* (photo Miran Kambič).

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rials made from reusable raw materials; the *Institute for Digital Construction and Wood Industry* explores the transformation currently revolutionising the timber and construction industries with new technologies that enable integrated planning, efficient construction site management, and automated manufacturing; lastly, the *Institute for Timber Construction* develops innovative solutions focusing on timber and composite structures, earthquake and fire safety, building physics, and envelopes. Pichelin states, «By adopting this multi-faceted approach, we contribute to the development of the wood and construction industries in Switzerland and abroad».

Florian Court, a forest engineer and public policy advisor, is the founder of the association *Haute École du Bois et de la Forêt*, which focuses on creating a European campus for wood and forestry professions in the Hautes-Alpes Department in France. Court explains, «This centre for skill development and innovation complements existing centres in Europe in terms of the specificity of the training provided and research focused on the 'Alpine-Mediterranean' resource». In his view, the creation of this European campus, recognised by the profession, will make higher education more accessible in a field with a promising future, diversify and revitalize the industrial economy, and develop the "Alpine-Mediterranean" forest-timber sector at the European level.

Speaking of wood in the construction industry, what direction should research and innovation take?

According to **Andreja Kutnar**, «Wood in the construction industry can and should play a pivotal role in transforming the construction industry into a more sustainable one. At this point, we are all aware of how much the construction industry pollutes, but this also gives us a great opportunity to address the issue by using renewable materials, including wood, more frequently and properly». She is strongly convinced that future research should adopt an interdisciplinary and holistic approach. Combining different disciplines can lead to significant scientific breakthroughs: «Key directions for wood research include developing more sustainable practices for sourcing wood and exploring alternative sources like engineered wood products. We should focus on developing innovative treatments and coatings, including those from engineered living materials, to enhance the strength and durability of wood products. Fire resistance of wood is another important aspect that researchers should prioritise. Additionally, research on human health and well-being, the impact of wood on indoor air quality, and acoustic properties are crucial topics for future research and innovation».

Frédéric Pichelin believes that innovation can emerge from the intersection of various perspectives, ranging from infrastructure and urban development to biosourced construction materials and digital construction, including architecture and wood construction. He states, «This plurality allows us to design built environments in a transdisciplinary and integrated manner, shaping it sustainably with the future in mind. We rely on renewable raw materials and circular approaches».

Florian Court highlights the challenge of changing the paradigm to integrate industrialised wood production processes while preserving the local characteristics of wood and forests. In this con-

Fig. 4
Berner Fachhochschule BFH, Architektur, Holz und Bau, Meili Peter Architekten AG, Biel, 1990-99 (photo Cristian Dallere).

Fig. 5
The Berner Fachhochschule joinery workshop (photo Cristian Dallere).

Fig. 6
The renovation of a historic building in Upper Valais as part of the VETA/NOVA project. Atelier Summermatter Ritz, Eischoll, 2019 (photo Pascal Schnydrig e Medea Karlen).

text, prefabricated construction becomes a strategic sector. Court explains, «The goal is not just to produce components in a workshop or factory, but to enable the off-site construction sector to increase productivity and improve profitability. This benefits all stakeholders involved, including small-scale businesses».

What are the future challenges for wooden architecture in the Alps? How do these future challenges differently affect specific territories?

According to **Andreja Kutnar,** wood in the construction industry can certainly compete with other materials, especially in the Alps where wood has a strong presence due to its traditional use, but future challenges in this area are closely tied to climate change. Kutnar asserts, «The wood industry in the Alps can contribute to regional development from the environmental point of view, since it can help mitigate climate change and protect the beautiful natural ecosystems in the Alps. Healthy forests and sustainably managed forests in the Alps can contribute to this sustainable development. The most critical issue, which is also connected to short supply chains, is the availability of resources. Especially spruce, which is the primary wood used in timber buildings today. Scientists, together with industry professionals, need to address this issue and develop innovative products, especially from hardwood that can be used in timber buildings».

Frédéric Pichelin highlights the results of the VETA/NOVA project, which involves researchers from *Bern University of Applied Sciences* in collaboration with regional and national business partners. They have developed guidelines in the village centres of Upper Valais to create model solutions that make converting old buildings easier and more attractive as a solution. Pichelin notes, «In the mountains, more and more buildings stand empty because historic wooden buildings do not meet modern standards for home comfort. However, the refurbishment of such buildings is costly and time-consuming. Guidelines and model solutions enable authorities, private builders, architects, and engineers to convert and renovate old buildings faster and with reduced costs. Historically valuable village centres can now be preserved and revitalised». Therefore, contemporary construction culture must be made available to individuals and organisations in order to renew and enhance the historical heritage of wooden architecture which holds significant cultural value in the Alps and contributes to its identity.

Florian Court explains his philosophy: «The central issue, however, lies in the possibility of industrialising local wood supply chains and preserving the cultural identities of individual territories. The variety of Alpine forests and the richness of the vernacular architectural heritage constitute important resources that should serve as a starting point

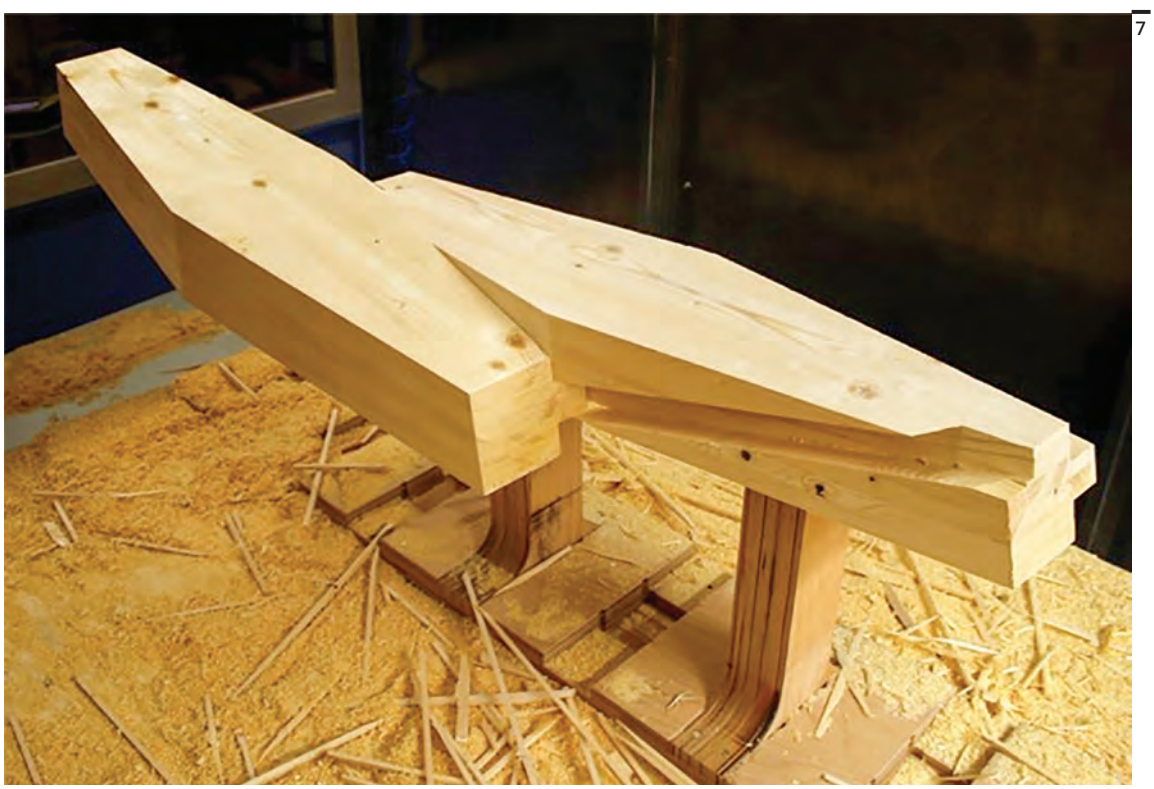

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Fig. 7
Hexagon massive timber trunks forming a continuous shell structure by means of lateral wood-wood connections (photo IBOIS).

from which to approach these issues in each area». He also points out that the statistical classification methodology for wood commonly used in Europe (based on the characterisation of homogeneous batches of wood) does not adapt well to the variability of wood found in the Alpine-Mediterranean zone. Consequently, mechanical classification of wood in the region is currently impossible. Court suggests, «It's necessary to develop a new method of empirical classification of wood based on the evaluation of the suitability for use of sawn products through testing. This includes studying vernacular architecture on a territorial scale, identifying work components based on the form of vernacular architecture, evaluating operating costs by type of building use, establish a 'vernacular wood products & resistance thresholds' benchmark, measuring the mechanical resistance of each sawn product, and assigning a resistance class through empirical testing». This method would adapt perfectly to the variability of wood in the region, thereby making their use in buildings feasible. This approach is also being explored by the Swiss *I-BOIS* institute at *École Polytechnique Fédérale de Lausanne*. Under the direction of **Yves Weinand**, the institute is studying the digital implementation of new parametric tools for developing models aimed at the integral use of local irregular timber in building and construction systems (see Archalp n. 9).

Unfortunately, the brevity of this space does not allow for an in-depth discussion of the individual teaching and research specificities of the schools, institutes, and research centres in the Alps. However, it is clear that current lines of work focus on the possibility of translating certain global prerogatives into a local context. These include the industrialisation of construction processes and products, the prefabrication of components, and the opportunities presented by digitalisation and numerical control to optimise transformative methods in the production chain. What is at stake is not only technical but also involves promoting the individual characteristics of the architectural identity of contemporary Alpine building culture on a different scale. This has a multidimensional impact on the territory, affecting the economy, culture, settlements, and landscape. ■

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