

Developing a seamless digitally networked value chain for building with pine wood

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Almost 40% of global CO₂ emissions are caused by the construction and building sector. When energy and building materials production are factored in, it accounts for about 28% in Germany. The German

government's goal is to reduce greenhouse gas emissions in the construction and building sector by up to 67% by 2030.

The [project](#) "Digital value chain for pine-based timber construction in Berlin-Brandenburg" (DiKieHo) was launched to find ways to achieve this goal. The aim is to construct multi-story houses using pine. Pine makes up 70% of Brandenburg's forest area, and spruce, which is otherwise in such high demand, is becoming scarce. The region's stock of pine forest is the largest in Germany and is growing by about six cubic meters per hectare each year.

The aim of the project is to establish an end-to-end digitally networked value chain in urban multi-story timber construction using the Berlin-Brandenburg region as an example, and in doing so make the use of regionally available pine wood in the construction industry more efficient.

"This means that the individual processes and the associated information—from planning a [building](#), to felling the timber, transporting the timber to the sawmill, further processing it in factories where modular prefabricated timber components for the respective buildings are produced, through to the assembly of the prefabricated timber components on the construction site—are digitally networked with each other. We are fundamentally rethinking the timber construction industry from the forest to the building site," says project leader Professor Dr.-Ing. Holger Kohl, who teaches at the Chair of Sustainable Corporate Development at TU Berlin's Institute of Machine Tools and Factory Management.

The project builds on an earlier project, Bauhütte 4.0, which pursued the development of a regional cluster for innovative timber construction in Berlin with particular reference to the creation of the Schumacher Quartier on land previously occupied by Tegel Airport.

"Basic principles for digitizing the value chain already modeled in Bauhütte 4.0 are now being consistently applied and expanded to Brandenburg pine in the DiKieHo project. We want to transfer the value chain into a model that can be digitally accessed and used at any time by all stakeholders, i.e. planners, architects, the timber industry, the construction industry at all levels of the value chain system, in other words the architectural and development planning level, the production level and the actual construction phase, as well as at the level of all stakeholders along the value chain. This is what makes the project innovative. What we are talking about here is the digital transformation of the construction industry," says Valentin Eingartner, who coordinates the project at the Chair of Sustainable Corporate Development.

Until now, conventional construction projects have been characterized by long planning phases. They are also inefficient as well as energy, material and cost-intensive as the procedures for hiring construction companies to perform work on construction sites are very different and often still analogue.

The entire planning and construction process is now to be simplified for everyone involved through a model of a digital [value chain](#) for building with wood, taking into account innovative architectural concepts and the latest technologies from Industry 4.0. For example, the timber requirements for the planned building are to be determined digitally during the planning phase and compared with digitally retrievable information on regional pine stocks.

The planning phase will also include the digital planning of modular timber construction elements, which can be visualized in real time and coupled with the appropriate construction principles. At the same time, different construction principles are continuously compared in the background and evaluated in terms of their sustainability. And all this takes place even before the actual construction phase begins.

The fact that all the requirements are known by the end of the planning phase means that at the start of the implementation phase, orders can be placed immediately and the modular timber construction elements which were digitally designed during the planning phase can be commissioned for production. They then only need to be assembled on the [construction site](#).

"This means that, as with the information on pine stocks in the region, all necessary information for the construction of the building should also be available digitally throughout, i.e. at all points of the building life cycle and at any time," says Valentin Eingartner. This makes it possible to greatly reduce the construction phase.

The use of regional wood as a building material shortens transport routes. Buildings made of wood also act as CO₂ reservoirs, and, thanks to the modular construction method, building parts and even entire buildings can also be reused. All this contributes to a sustainable, circular [construction industry](#) within the Berlin-Brandenburg region.

"As a result, regional [timber construction](#) makes an important contribution to a paradigm shift away from a linear economy, i.e. a throwaway economy, towards a sustainable circular economy with responsible resource consumption. This was also the central theme of the 18th Global Conference on Sustainable Manufacturing, which took place at TU Berlin in fall 2022," Professor Kohl adds.

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