leanWOOD

FINAL REPORT

Title of the research project	**Innovative lean processes and cooperation models for planning, production and maintenance of urban timber buildings**
Coordinator of the project	Wolfgang Huß (06.2014 - 08.2016) Manfred Stieglmeier (09.2016 – 07.2017)

BASIC PROJECT DATA

Project period	01.06.2014 - 31.07.2017
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URL of the project	http://www.holz.ar.tum.de/leanwood/home/

FUNDING

Total budget in EUR	1.356.343,95 €
Public funding from WoodWisdom-Net Research Programme:	Total funding granted in EUR by source:
Finland	
Tekes – the Finnish Funding Agency for Innovation	
Academy of Finland (AKA)	210.000,00 EUR
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Academy of Finland (AKA)	210.000,00 EUR
France	
Ministry of Agriculture, Fisheries and Forestry Resources (MAAF)	78.856,00 EUR
French Environment and Energy Management Agency	45.378,03 EUR

(ADEME)	
Germany Agency for Renewable Resources (FNR)	338.532,92 EUR (322.132,92 EUR + 16.400,00 EUR additional funding, 01.03.2017)
Switzerland The Commission for Technology and Innovation (KTI; in the Federal Department of Economic Affairs FDEA)	321.434,00 EUR

Other public funding:

VTT, Finland	60.000,00 EUR

Other funding:

Cash contributions by industry partners, Switzerland Lignatur, Makiol Wiederkehr, Timbatec, Kämpfen à CHF 5.970 € / Uffer CHF 8.265 €)	32.143 EUR
Rakennusliike reponen, Finland	30.000 EUR
Finnish Wood Research (Puutuoteteollisuus ry), Finland	15.000 EUR
Kouvola Innovation Oy, Finland	15.000EUR

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DEGREES (if relevant)
Degrees earned or to be earned within this project.
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PROJECT SUMMARY REPORT

Modern timber architecture is associated with the industrialized production of construction elements that involve a high level of prefabrication. Specialist knowledge of timber construction and its production facilities is missing in early planning stages, especially in the case of multi-storey buildings, because timber manufacturers' and/or timber construction engineers' involvement in projects happens too late within the process. Significant expenses are incurred if a project stage is late and results in a 're-design phase'. This will often cause missed deadlines and eventual cost overrun. Best conditions are given if future building projects are planned right from the start by a team of architects, engineers and timber construction specialists working together.

Against this background, a consortium of 5 research partners from 4 different countries and their respective practice partners was established, to examine this problem and to develop proposals for solutions. On the basis of numerous interviews with representatives from practice and scientific research, the national framework conditions were analysed and compared. In summary, the background of the involved partners with regards to building culture and building procedures is very different. This is apparent in procurement processes and cooperation models (e.g. different public process procedures) as well as in building law (e.g. fire protection, sound protection, ecology).
In addition, best-practice examples in the participating countries were examined and assessed, using an evaluation tool especially developed for the project. It draws conclusions about the difficulties, but also the strengths of prefabricated timber construction according to the respective national framework conditions.
Detailed discussions within the consortium revealed a shared planning culture amongst the German-speaking nations which is characterized by the strict separation of planning and execution stages of construction services. This leads to completely different approaches for solutions among the research partners.
Therefore, the main goal for the German and Swiss partners was to develop recommendations for new cooperation and procurement models for prefabricated timber construction and to clarify the interfaces and responsibilities among the specialists involved in the planning process.
FCBA, France examines the implementation of *"lean"* aspects into the building prefabrication and the interface to the planning phase.
The Finnish partners VTT and Aalto deal with the topics of standardization in order to avoid the redundancy in repetitive planning in different construction projects. In the resource efficiency section, their study clarifies understanding about material use and efficiency in wooden buildings. They also examine the project delivery method chosen for a construction project, which sets preconditions for efficient implementation and verify the additional investment costs compared to construction costs of timber buildings.

Several close panels of experts led to breakthroughs in finding new strategies to develop model solutions for the optimized workflow of cooperative planning and implementation processes in timber construction. Based on the research and analysis of "best-practice" examples and work methods of other highly developed industrial sectors, for instance ship-building, leanWOOD suggest options for optimized processes and goal-setting.

Methods and models for an optimal transition from planning to production phases are achieved through the early collaboration between architects and timber-engineers, alongside the planning input of timber manufacturers. There is a great demand from practice for the project's final results in the form of a decision-making aid, especially from planners, clients and authorities: Like a toolbox for the diverse constellations of tasks and for all parties involved in the building process, it should be used to support the method of prefabrication in timber construction.

1.1 Introduction

1.1.1 Background

Modern timber architecture is associated with the industrialized production of construction elements that involve a high level of prefabrication. Each planning stage is complex, with off-site prefabrication of building elements, transport and assembly logistics becoming more prevalent in order to save time during on-site assembly. The traditional way of building, which mainly focuses on on-site production has shaped the framework of organization and legislation for centuries. This process presents a significant barrier for a wider usage of timber within building construction. Specialist knowledge of timber construction and its production facilities is missing in the early planning stages, especially in case of multi-storey buildings, because timber manufacturers' and/or timber construction engineers' involvement in projects happens too late within the process. Looking at the current German planning regulations, for example, the timber manufacturer first gets involved in the project when 66% of the architects work is already done. Significant expenses are incurred if a project stage is late and results in a 're-design phase'. This will often cause missed deadlines and eventual cost overrun.
The "*lean"* method represents the optimisation of processes and the efficient and effective coordination of all participants. This could be the significant collaboration needed to improve productivity in industrialized timber construction. Despite the fact that companies in the production sector have been applying the methods of lean management for a long time, these techniques and values have so far rarely been adopted by the building sector.

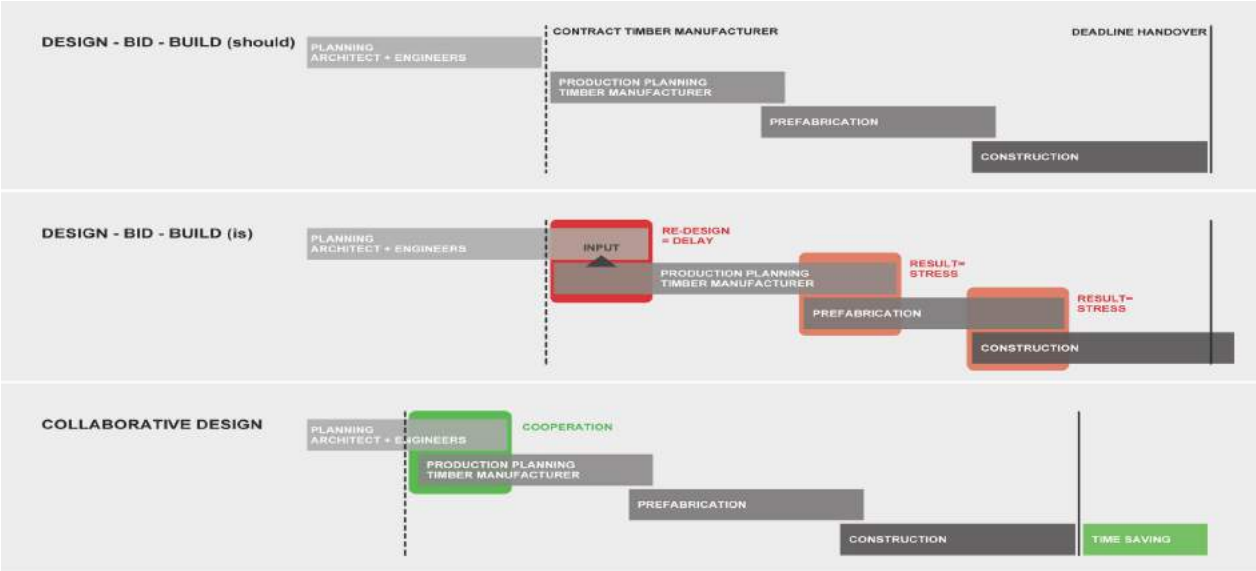

fig 1: Specialist knowledge of timber construction and its production facilities is missing in the early planning stages

1.1.2 Objectives

The main goal for the Swiss and German partners in the consortium was to develop recommendations for a suitable planning process for prefabricated timber construction such as

new cooperation and procurement models, and to clarify the interfaces and responsibilities among the specialists involved in the planning process.
In addition to the existing guidelines, leanWOOD also examines the classic scope of services of all planning participants. LeanWOOD has developed solutions such as how the competitiveness of prefabricated timber construction can be strengthened in public procurement law, or, how the scope of services can be adapted to the requirements of prefabrication within the conditions of the current national fee regulation. The example of the Swiss timber-engineer must be examined, whether this profession could be introduced as a missing link between the architect and the timber manufacturer at an early stage of planning. In this context leanWOOD has prepared a proposal for the course of study of timber-engineers.

LeanWOOD has developed model solutions for the optimized workflow of cooperative planning and implementation processes in timber construction. Based on the research and analysis of "best-practice" examples and work methods of other highly developed industrial sectors, for instance ship-building, leanWOOD suggests options for optimized processes and goal-setting.

FCBA examines the implementation of *"lean"* aspects into building prefabrication and the interface to the planning phase.
The Finnish partners VTT and Aalto have dealt with the topics of standardization in order to avoid redundancy in repetitive planning in different construction projects. In its resource efficiency section, their study clarifies understanding about material use and efficiency in wooden buildings. They also examine the project delivery method chosen for a construction project, which sets preconditions for efficient implementation as well as verifying the additional investment costs compared to construction costs of timber buildings.

1.2 Results and discussion

Based on the evaluation of best-practice examples and the analysis of national frame conditions, the consortium discovered a shared planning culture amongst German-speaking countries characterized by a strict separation of the planning and execution stages of construction services. This means that the architect works independently as a consultant to the client and is not commercially connected to the execution services. In public tendering this separation is prescribed by law. Moreover, the architect in these countries is obliged to develop the construction details but typically lacks the technical know-how of prefabrication and specific requirements, for instance in fire-protection.
Best conditions are possible if future building projects are planned right from the start by a team of architects, engineers and timber construction specialists working together. Therefore our project focus was set on the frame conditions which influence the planning process and the cooperation among the involved parties. The analysis of those conditions shows that it is not possible to develop one single model for an ideal cooperation or procurement method. A variety of models has been developed for use. The appropriate model, however, depends essentially on the type of client and the local regulations. One promising cooperation model is, for example, the "Bauteam" which provides for an early cooperation of all parties, including the timber manufacturer, in which creative and economic aspects are considered equally.
Above all, the main factor is the inclusion of timber construction expertise in the early planning

phases.
Legal barriers in procurement, fee and building regulations must be adapted to facilitate prefabricated timber construction. For this purpose, a description of tasks for timber construction requirements was developed in the architects' and engineers' fee structure. The necessary interfaces between the cooperating parties must be clearly defined: All those involved in the project have to know who has to do what and when, and who is responsible for the different parts of planning; a specification sheet was designed for this purpose.
In order to be able to integrate timber construction expertise independent from commercial interests in the early planning phases, a suitable timber engineering degree course based on the Swiss model seems an extremely effective solution. Timber engineers must have knowledge about prefabrication of components in the production facility as well as their assembly on site, in addition to a good understanding of architectural and technical needs such as HVAC, fire-protection and building physics. Should the architect have little experience in timber construction, the timber engineer would be an valuable consultant. He also would be able to advise communities and other clients by preparing competitions or tendering processes.

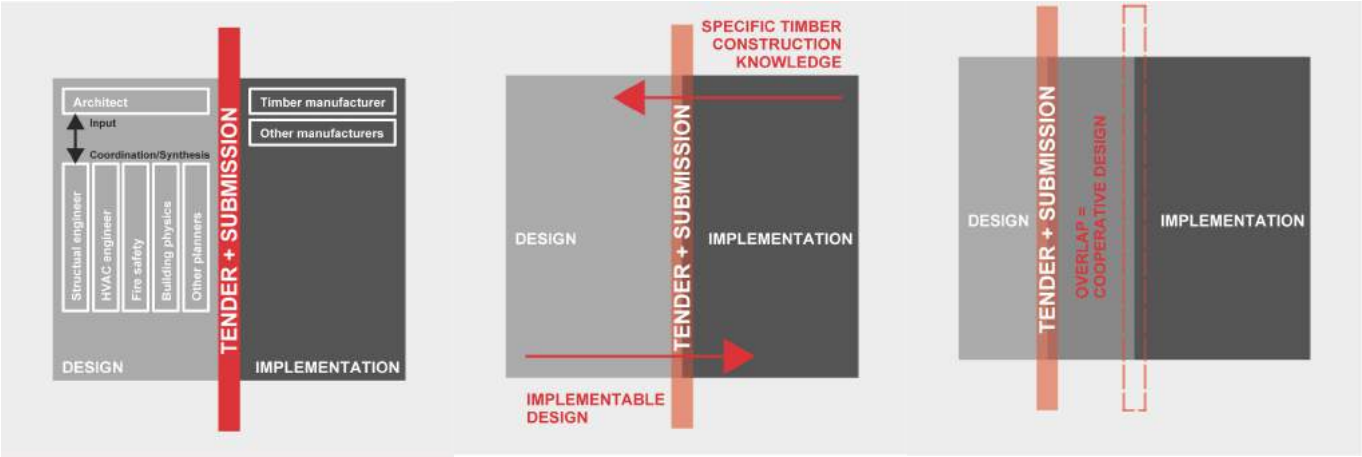

fig 2: planning culture amongst German-speaking countries characterized by a strict separation of the planning and execution stages

Besides examining the administrative aspect, the project's focus also lies on the process itself. The idea of lean processes is already widely used in construction in France and it can be adopted in different stages of building projects. It can be particularly easily applied to building with timber companies, as prefabrication is widely used. The transfer of technology methods from industry, where "lean" method was created, to building prefabrication is already being performed by major builders.
The analysis of experience and methods used opens a domain of investigation and evolution for the building with timber industry. All existing examples of "lean" applications have started with training from, as well as a partnership with, a "lean master". FCBA decided to invest in training capacity together with their French practice partner. In such training sessions, the "lean" subject can be covered accordingly to the French timber industry's demand. They have also created a guide to successfully implement "lean" aspects in construction and move from theory to practice. In the guide, the major stages of construction processes are tackled: the prefabrication

phase, implementation phase, as well as the planning phase, with the help of TUM and their practice partners.
Moreover, the work on lifecycle cost assessment (global cost analysis) was found to be an interesting tool to promote the lean construction philosophy as a money saving process.
From the inquiries conducted, FCBA identified French expectations of the “lean” process as a need for: (1) guidance, (2) training, (3) experts to help, (4) evaluated case-studies, (5) communication.
After the leanWOOD project ends FCBA will remain active in the “lean sphere” proposing training sessions and cooperation with partners in building methodology working groups, promoting “lean” aspects as a relevant way of development for the timber building industry.

The survey of the Finnish partners responses were organized on a map and grouped according to the schema of strengths, weaknesses, opportunities and threats (SWOT). The total number of comments in the map across the topics was 236. The distribution of comments was roughly even, with 23% strengths, 31% weaknesses, 25% opportunities and 21% threats. The results of the survey reveal that timber construction has its own unique strengths and emerging opportunities as politics drive construction in a more ecological direction. However, established processes and construction methods still play a major role, and resistance to change is recognized among the construction industry.
Standardisation in detailing is one approach to improve building practice. It is common practice that for example joints and structures, are first designed by the architect, redrawn by the structural engineer, redrafted by a sub-contractor and revised on site before completing the building. This type of redundancy is a waste of effort and resources in the building design process. For a practising architect, the detail collections offer an overview of timber solutions and a means of verifying the compatibility of designs with local building regulations. This finding supports the idea of limiting building-specific detailing in the design process. The similarity of structures is an opportunity for the construction industry in European-wide competition. Based on this study, timber buildings in Austria, Finland, France, Germany and Switzerland could in principle be designed and constructed with similar structural solutions.
The resource efficiency section of the study clarifies understanding about material use and efficiency in wooden buildings. It describes building design solutions, identifies the magnitude of raw material consumption, highlights the generation of material waste and reveals the building’s GHG impacts. All the wooden buildings that were studied also contained concrete structures; one has a concrete garage, while another has a concrete storage floor. Life-cyclebased material flow accounting shows that the lightweight nature of wooden structures embodies efficiency in resource use.
The project delivery method chosen for a construction project sets preconditions for its efficient implementation. This method also has an influence on a building information model (BIM) based design process. In Finland, the same BIM programs are used for the design and engineering of wooden multi-story buildings as are used for other multi-story housing solutions. The problem in the wooden multi-story building has been the lack of suitable smart planning components and related add-in programs. The greatest benefits of BIM-based design are obtained in an industrial building process which is based on regular components and details which are only configured per project.
Lean production of cost optimised wooden nZEB causes relatively low additional investment costs compared to construction which only fulfils the minimum requirements set by the

regulations. Savings in energy cost are almost 10 €/m² per annum and in the annual life cycle cost about 5 €/m² per annum as a current value for a calculation period of 30 years. Resale value and user value are also slightly higher compared to those of a traditional building. The importance of lean construction for total investment costs is relatively low, because the share of the labour cost is rather low.

1.3 Conclusions

The main outcome at the end of the project is, to have generated results which can be implemented like a toolbox. As the project progressed it became apparent that leanWOOD would not be able to deliver a single and ideal way to solve all problems. As the project completed we identified several measures that each suit different requirements and different clients and which can be used as a tool kit. The tools were developed within the leanWOOD consortium. The expectations in the leanWOOD results at symposia and congresses is very high. The results should be understood and used as a decision making aid for all parties involved in the building process to support and further develop methods of prefabricated timber construction.

1.4a Capabilities generated by the project

The main outcomes of the project are:
- Specification sheet as a free web application which defines the interfaces and the tasks of the parties involved (who does what when)
- Description of tasks for timber construction requirements in the fee structures for architects and engineers (national)
- Procurement model for timber construction requirements (national)
- Recommendation of cooperation models
- Master documents for a functional tendering process
- Identification of resources for timber engineering skills (education)
- Tool to evaluate the complexities of timber buildings
- Training initiatives with “lean” subjects in France
- The Finnish book with articles on standardization, resource efficiency, project delivery method and cost optimization

1.4b Utilization of results

The results will be available in the form of publications, except for the specification sheet, which will be available as a free web application.
In Germany and Switzerland, a publication with basic knowledge on the subject and treatment recommendations will be developed, which will provide arguments for legislators and decision-makers to initiate change in processes in the areas of procurement law, fee structures and

building regulations. The aim of which is to reduce obstacles in deciding for the use of prefabricated wooden structures.
The Finnish book shows the strengths and potential of timber construction by studying a SWOT analysis in an increasingly politically desired ecological environment. It discusses the advantages of standardisation, resource efficiency and new planning methods like BIM (Building Information Modelling) for a lean construction and planning process.
FCBA, France opted to invest in training capacity. With training sessions, the “lean” subject can be covered according to the French timber industry’s demands. Also, FCBA will create a guide to successfully implement lean in construction and move from theory to practice.

1.5 Publications and communication

a) Scientific publications

1. Articles in international scientific journals with peer review

W. Huß, S. Geier, F. Lattke, M. Stieglmeier pp. 130 – 137 (2017), Teil D – Prozess 1. Planung, In: Prof. H. Kaufmann, Prof. S. Krötsch, Prof. S. Winter Edition Detail (2017), ATLAS Mehrgeschossiger Holzbau, ISBN: 978-395553-353-3/ Involved project partners: TUM, lattkearchitekten, HSLU

2. Articles in international scientific compilation works and international scientific conference proceedings with peer review

Cronhjort Y., Bannier F., Geier S., Lattke F.: Conference oral presentation and proceedings publication/ Timber Building Details for a Leaner Design Process, In: Sustainable Built Environment Conference 2016 in Hamburg : Strategies, Stakeholders, Success factors, 7th - 11th March 2016 ; Conference Proceedings, Karlsruhe Institute of Technology KIT, ZEBAU – Centre for Energy, Construction, Architecture and the Environment, pp.1286-1295, 07 / Involved project partners AALTO, FCBA, HSLU, lattkearchitekten/ www.sbe16hamburg.org/wp-content/uploads/2016/03/SBE16Hamburg_BookOfExtendedAbstracts_web.pdf

Cronhjort Y., Hernández Maetschl S., Huß W., Lattke F., le Roux S.: Conference oral presentation and proceedings publication/ Inefficiency in Building Retrofit Processes - TES EnergyFacade Cases Evaluated, In: Hájek P., Tywoniak J., Lupíšek A. and Sojková K., CESB16 - Central Europe towards Sustainable Building 22.06.2016 ISBN 978-80-271-0248-8, pp. 94-101. Electronic publication/ Involved project partners AALTO, Gumpp & Maier, TUM, lattkearchitekten/ http://cesb.cz/download/

Le Roux S. K., Bannier F., Bossanne E., Stieglmeier M: Conference poster presentation and proceedings publication/ Investigating the interaction of building information modelling and lean construction in the timber industry, In: WCTE 2016 World Conference on Timber Engineering August 22-25 2016 Vienna Austria CD-ROM Proceedings, ISBN:978-3-903039-00-1/ Involved project partners AALTO, FCBA, TUM/ http://wcte2016.conf.tuwien.ac.at/home/

Lattke F., Hernandez-Maetschl S: Conference oral presentation and proceedings publication / leanWood – advancing performance of design teams in timber construction, In: WCTE 2016 World Conference on Timber Engineering August 22-25 2016 Vienna Austria CD-ROM Proceedings/ ISBN:978-3-903039-00-1. Involved project partners lattkearchitekten, Gumpp + Maier/ http://wcte2016.conf.tuwien.ac.at/home/

Geier S., Huß W.: Conference oral presentation and proceedings publication/ "New procurement and cooperation models for planning + execution of timber buildings – case studies and visions" In: WCTE 2016 World Conference on Timber Engineering August 22-25 2016 Vienna Austria CD-ROM Proceedings, ISBN:978-3-903039-00-1. Mini Symposia " Execution of Timber buildings" chaired by Tomi Toratti/ Involved project partners HSLU-CCTP, TUM/ http://wcte2016.conf.tuwien.ac.at/scientific-programme/mini-symposia/

Huß W.: Conference oral presentation and proceedings publication, "Planungskultur für den Holzbau–leanWOOD", in IHF 2016 Internationales Holzbau Forum December 07-09, 2016, Garmisch-Partenkirchen, Germany, Participant's Handbook, p.147-188, ISBN: 978-3-906226-14-9 / Involved project partners TUM, HSLU-CCTP, TUM, lattkearchitekten

Geier S.: Conference oral presentation and proceedings publication, "Vom Holzbau-Totalunternehmer zum Holz-Bauteam-alternative Vergabemodelle im Holzbau", in IHF 2016 Internationales Holzbau Forum December 07-09, 2016, Garmisch-Partenkirchen, Germany, Participant's Handbook, p.147-188, ISBN: 978-3-906226-14-9 / Involved project partners TUM, HSLU-CCTP, lattkearchitekten

Zöllig S.: Conference oral presentation and proceedings publication, "Der Holzbauingenieur-die Prozessoptimierende Schnittstelle", in IHF 2016 Internationales Holzbau Forum December 07-09, 2016, Garmisch-Partenkirchen, Germany, Participant's Handbook, p.147-188, ISBN: 978-3-906226-14-9 / Involved project partners TUM, HSLU-CCTP, lattkearchitekten, timbatec

Lattke F.: Conference oral presentation and proceedings publication, "Prozesse und Schnittstellen in einer Planungsstruktur" In IHF 2016 Internationales Holzbau Forum December 07-09, 2016, Garmisch-Partenkirchen, Germany, Participant's Handbook, p.147-188, ISBN: 978-3-906226-14-9 / Involved project partners TUM, HSLU-CCTP, lattkearchitekten

Schuster S.: Conference oral presentation and proceedings publication, "Planungskultur für den Holzbau-leanWOOD" in: IBF 2017 Internationales Branchenforum für Frauen des Holzbaus und Innenausbaus, June 29-30, 2017, Meran, Italy, Participant's Handbook p. 35-40 / Involved project partners TUM, HSLU-CCTP, lattkearchitekten

Stieglmeier M.: Conference oral presentation and proceedings publication, „Planungskultur für den Holzbau – leanWOOD in EBH 2017 Europäischer Kongress Bauen mit Holz im urbanen Raum, October 18-19, 2017, Köln, Participant´s Handbook p. xx / Involved project partners TUM, HSLU-CCTP, lattkearchitekten

3. Articles in national scientific journals with peer review

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4. Articles in national scientific compilation works and national scientific conference proceedings with peer review

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5. Scientific monographs

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6. Other scientific publications, such as articles in scientific non-refereed journals and publications in university and institute series

Huß W., Lattke F.: Eine neue Planungskultur für den Holzbau, in Bauen mit Holz 06/2015, p. 54-57/Involved project partners TUM, lattkearchitekten/ www.holz.ar.tum.de/leanwood/publications/

Huß W., Lattke F.: Integrale Holzbauplanung – Fenstereinbau im Werk, in Zuschnitt 58/2015 06/2015, p.15 / www.holz.ar.tum.de/leanwood/publications/

Huß W., Stieglmeier M.: Überdacht – Planung im Holzbau in Mikado, 09/2015, pp 40-43/ Involved project partners TUM/ www.holz.ar.tum.de/leanwood/publications

Geier S.: Publication of 2 articles in specialist journal "WIR Holzbauer" (Editor Holzbau Schweiz) „leanWOOD Planen und Kooperieren im Holzbau" and „lean WOOD nimmt Schweizer Holzbauten unter die Lupe" 01/2016/ Involved project partners HSLU-CCTP/ www.hslu.ch/de-ch/hochschule-luzern/forschung/projekte/detail/?pid=710

Huß W., Stieglmeier M., Geier S., Lattke F., Kaufmann H. LeanWood Kooperation Planung im Holzbau Mikado Special Supplement (20 pages) 07/2016 / Involved project partners TUM, HSLU-CCTP, lattkearchitekten/ www.holz.ar.tum.de/leanwood/publications/

Pawlitschko R. „Hölzerne Hürden?" Publication in magazine: db deutsche bauzeitung 12/2016 / Involved project partners TUM, lattkearchitekten,
/www.holz.ar.tum.de/leanwood/publications/

Schuster S., Stieglmeier M.: leanWOOD Publication in magazine Detail, Edition Detail 12/2017 Involved project partners TUM /www.holz.ar.tum.de/leanwood/publications/

b) Other dissemination

Webnews "leanWOOD meets Zürich", 20.01.2016 / Involved project partners HSLU-CCTP/ https://www.hslu.ch/de-ch/technik-architektur/aktuell/2016/01/

Webnews „leanWOOD im Fokus der Swissbau“ 22.01.2016 / Involved project partners HSLU-CCTP/https://www.hslu.ch/de-ch/technik-architektur/aktuell/2016/01/22/cctp-swissbau-leanwood/

Webnews Innovativer Holzbau auf neuen Wegen – Das WoodWisdomNet+ Projekt «leanWOOD» startet! 01.06.2016 / Involved project partners: HSLU-CCTP/ www.hslu.ch/cctp/aktuelles

Exhibition at fair stand TUM.wood at Bau 2015 - International Trade Fair for Architecture, Materials and Systems, 19./24.01.2015 / Involved project partners TUM/ www.holz.tum.de

Cronhjort Y., Airaksela M.: Television appearance/Trävåningshus når nya höjder FST/YLE, Involved project partners AALTO and Rakennusliike Reponen, 28.10.2015 www.svenska.yle.fi/artikel/2015/10/31/travaningshus-nar-nya-hojder

Website Hochschule Luzern/ Involved project partners: HSLU-CCTP / www.hslu.ch/de-ch/hochschule-luzern/forschung/projekte/detail/?pid=710

Publication in newspaper: Holzkurier 27, 06.07.2017 / Involved project partner TUM www.holz.ar.tum.de/leanwood/publications/

Lecturs / Presentations

Huß W.: Project presentation “leanWOOD” at Bau 2015, Exhibition at fair stand TUM.wood, 19./24.01.2015 / Involved project partners TUM/ www.holz.tum.de

Prof. Kaufmann H.: Project presentation at TUM.wood Symposium – Alles aus Holz? 05.02.2015 / Involved project partners TUM/ www.holz.tum.de

Lattke F.: Project Presentation at conference Netzwerk Holzbau Munich / „leanWOOD – Planungsprozesse im Holzbau“, Symposium Mehrgeschossiger Holzbau, Bauzentrum München 09.07.2015 / Involved project partners TUM, lattkearchitekten

Geier S.: Presentation on national conference for timber construction “Faszination Holzbau” St. Gallen «leanWOOD» Für eine holzbaugerechte Planungskultur!, 17.09.2015 / Involved project partners HSLU-CCTP/ http://www.faszination-holzbau.ch/impressionen/158/22654

Lattke F.: Presentation on conference at international fair trade / „leanWOOD - optimale Planung im Team!“, EXPO Real 2015, München, 08.10.2015 / Involved project partners lattkearchitekten

Cronhjort Y.: Conference presentation / Standard Timber Building Structures for Lean Architectural Design The 7th Annual Symposium of Architectural Research in Finland, 23.10.2015 / involved project partners AALTO

Geier S., Lattke F., Zöllig S., Echsle H. (architect lecnWOOD case study), Dr. Schoch O. (ETHZ – Digital Fabrication): Conference oral presentation / Focus event "leanWOOD" with 5 presentations by the leanWOOD team on national fair "Swissbau 2016" Basel, 13.01.2016 / Involved project partners HSLU-CCTP, lattkearchitekten, timbatec http://www.swissbau.ch/de-CH/news/blog/2016/01/13-leanwood.aspx

Geier S.: Presentation on "VGQ Technikertag" EMPA Akademie Dübendorf „lean WOOD Planen und Kooperieren für den Holzbau der Zukunft", 03.03.2016 / Involved project partners HSLU-CCTP/ http://www.vgq.ch/aktuelles/aktuelles/vgq-news0000.html

Cronhjort Y.: Public presentation / Sustainable building retrofits in Finland, EnergyWeek Vaasa, Energy & Buildings Seminar 2016, 18.03.2016. 163 registered participants / Involved project partners AALTO

Geier S.: Presentation on "Architos Tagung" Luzern „leanWOOD Planen und Kooperieren für den Holzbau der Zukunft", 22.04.2016 / Involved project partners HSLU-CCTP/ http://www.architos.ch

Lattke F.: Conference presentation "Innovation in timber construction", Institute of Chartered Foresters (ICF) National Conference at Newcastle UK, 28.04.2016 / Involved project partners lattkearchitekten

Lattke F.: Conference presentation "leanWOOD – advancing performance of design teams in timber construction" , Seminar bei Deutscher Holzfertigbau Verband e.V., Ostfildern, 25.10.2016 / Involved project partners lattkearchitekten

Stieglmeier M. Conference presentation at International fair trade BAU 2017, "Planungskultur für den Holzbau - leanWOOD" In: Branchenabend proHolz Bayern, 19.01.2017, Munich, Germany / Involved project partners TUM

Lattke F.: Conference presentation / „Gebäudemodernisierung vorgefertigt! Lösungen für Hülle und Erweiterungen", Beuth Holzbauforum 2017, Berlin, 23.03.2017 / Involved project partners lattkearchitekten

Lattke F.: Conference presentation /„leanWOOD – Prozesse und Schnittstellen in einer Planungsstruktur", Seminarreihe Holzbaukompakt, Immenstadt, 27.04.2017 / Involved project partners lattkearchitekten

1.6 National and international cooperation

Good experiences:

- Consortium and data collecting are very close to the building practice
- Importance given to demo projects ensures relevance of the topics
- Great demand from practice according to the final result

Challenges:

- The different national backgrounds of the participants (building laws, procurement culture, planning culture, integration of BIM…) requires different solutions and a lot of internal information exchange to get a good understanding between the partners and leads to completely different approaches for solutions among the research partners.
- Different parties in the planning process have different perspectives, objectives and goals – this must be considered while developing solutions