

Research Plan | aE Studio

Personal Information

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Studio

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Title: Urban-rural transformation from dichotomy to integration.

Exploring the potential of contemporary timber tectonics and holistic, regenerative design to revive European coutryside.

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Choice of the studio?

I chose Architectural Engineering Studio because of its practically-oriented, grounded yet often experimental design approach and an expertise within tutoring group in areas of circular design, manufacturing, material flows as well as focused research group supporting my fascination in contemporary timber structures. I appreciate the flexibility to pick a problem and context according to our personal fascination which helps us formulate our own methodologies and positions as future designers.

Key wrods

The 5 most relevant topics of the research – for the detailed definitons of which please refer to the Glossary of Key Terms at the end of this document



Problem Statement

TECTONIC THINKING

CULTURE

MATERIAL

TOOLS

Increasing rural-urban divide despite mutual dependency

The period since 1980s has been characterised by a rapid urbanisation and strong shift in the distribution of people and capital. While this transformation offered unprecedented opportunities for millions of people, creating in the process a broad middle class, this economic progress seems to be threatened by a number of long ignored and increasingly urgent consequences: the exploitation and distribution of limited natural resources, loss of biodiversity and a growing dichotomy between the countryside and the metropolitan centres despite mutual dependency. Rural areas with their natural and cultural heritage have a lot of potential to offer especially when it comes to creating models for new circular value chain and holistic education. Despite that, local communities lack confidence in the future. What they often miss is quality infrastructure and attractor points to create incentive for people to engage and invest diversifying agriculture-centric business models with services, education, culture and tourism. Those rural challanges and opportunities became main theme of Polish pavilion during latest Venice Architecture Biennale (Mazan, 2020).

Minimal use of renewable materials in construction despite resource depletion

Timber is inseparable form forestry which is particularly interesting in shaping rural-urban dynamics and how we guide this transition will have a profound influence on both urban and rural land development. The global resources depletion is amongst the biggest challenges faced by mankind today. It created urgency for increased use of renewable construction materials – with timber being most structurally applicable material in central Europe. Despite the availability of the resource and latest technology the use of timber in European construction remains marginal. It's a call for architects and engineers to develop innovative ways of working with this material and a critical evaluation of both opportunities and constrains that come with it.

Adapting design methodology to contemporary means of timber manufacturing

Modernity driven by technological developments inevitably affected our ways of designing and production of architecture shaping tools and materials we use. As contemporary designers we need to become fluent in using those tools and enviion a new conceptual circular mindset to use this power more responsibly while being aware of its side effects on society, culture, and climate. How can those tools be more closely integrated with circular design principles and what will be the guidelines of resulting tectonic language?



Urbanised areas, which are home to 60% of the population of Poland, cover only 7% of the country's territory.

Source: Trouble in Paradise - PROLOG + 1 (Mazan, 2020)



research focus

Source: IEA & UNEP (2018) Global Status Report. International Energy Agency & United Nations Environment Programme

Objective

The overall objective of the graduation project is **to develop a methodology for revitalisation of rural areas in central Europe** – envisioned as interconnected circular nodes for economical and ecological innovation – using regenerative design principles. This will be approached by focusing on a **detailed study of Budachów village in Lubusz Province in western Poland,** with an attempt to reimagine an underused plot of land and prove its potential through holistic design approach at an intersect of culture, technology and ecology. The aim of the project is to give subjectivity to the countryside as a fertile area for architectural research.

Within that overall objective a research focus will be put on innovative ways of working with timber – as a widely available regenerative resource in the area – within a contemporary design workflow. The research paper act as a foundation to deeply understand the potential of the material. First, through detailed investigation – a re-examination of past and current developments focusing on tools and manufacturing processes as drivers of change and how they translate into architectural design. Those techniques will be critically evaluated by their potential to meet the needs of transition towards circular economy. The resulting understanding of state-of-the-art tools will form a basis for conclusion — aiming to define principles of new "circular tectonics" in timber construction utilising contemporary design workflows and helping me to formulate my own position towards the topic. This will inform a phase of experimentation where ideas will be tested systematically by means of digital as well as physical prototyping inspired by site and context-specific investigation.

The design goal is to envision an inspiring use of timber as a primary construction material across different scales and building types of a multifunctional development. The detailed programme is yet to be determined following a more in-depth context analysis, but it will include an adaptation of an existing building and a new public facilities, housing activities at an intersect of art, education, care and ecology, complemented by guest-houses for visitors. The idea is for the programme to stem from and amplify local qualities and potential of the place and community development.



Theoretical Framework

The research aims to integrate the insight gain from the analysis of advancements in design workflows and manufacturing processes of timber structures. It will operate within a framework defined by **Christoph Schindler in his Periodisation Model**. He simplifies and distinguishes three main periods defining a history of timber fabrication development: "hand-tool technology", "machine-tool technology" and "information-tool technology" — and describes their relation between three categories — matter, energy and information in each period (Schindler, 2009).



Man gradually becomes the creator of the whole process while the machine is the creator of the product.

It will serve as a framework to plot my research findings focusing on potential for informing circular tectonic principles and use the findings of current period – "information-tool technology" as a state-of-the-art point of departure for further design research.

The understanding of contemporary tectonic thinking will be building upon recent research programmes at CINARK – Centre for Industrialised Architecture at KADK – and the **work of Anne Beim in the area of Ecology of Tectonics** (Beim et al., 2021).

The final step will be an attempt to integrate those two parallel research tracks with principles of circular economy and the aim to evaluate the potential of contemporary means of design and production and their influence on shaping a circular tectonic language of today's timber architecture.



Man gradually becomes the creator of the whole process while the machine is the creator of the product.

Through its interdisciplinary and multi-scalar nature, the research and especially later on the design integration is positioned within a **broader framework of systems thinking and integral theory** defined by Ken Wilber — aiming to "draw together a number of separate paradigms into an interrelated network of approaches which as a result are mutually enriching" (Wilber, 2001) by integrating the societal, ecological and technological considerations both locally and globally. The approach will build upon it's application in architectural design thinking described by Peter Buchanan in The Big Rethink — towards a complete architecture (Buchanan, 2012).

Budachów, Poland photographed by the author

Overall design question

How can we integrate circular design principles in contemporary design and manufacturing workflow by using innovative timber tectonic solutions to develop a methodology for rural revitalisation in forested areas of central Europe through precise architectural interventions within existing communities?

A vision for stronger and resilient countryside hosting circular nodes for economical and ecological innovation based on a focused study of Budachów village in Lubusz Province in western Poland.

focus of the research paper



Thematic Research Question

How advancements in manufacturing processes and design workflows could inform a new circular-tectonic language of contemporary timber architecture?

Research Hypothesis

By synthesizing technologically advanced design workflow and understanding of production methods of timber components with principles of circular economy and renewable material sourcing it will be possible to develop guidelines for circular-tectonic language of contemporary timber architecture which could respond and adapt to local conditions.

Sub-questions:

What are the array of tools and their possibilities currently at the forefront of design and manufacturing workflows?

What theories and inventions are defining the direction of current development in timber architecture?

Can the tectonic work be approached in ways where resources are used more thoughtfully – taking the principles of circular economy into account?

We build in accordance with specific contemporary conditions, defined by production methods, construction and materials as well as ethics, meaning, culture and values. Tectonic thinking is not only about portraying a constructional logic. Tectonics is to create material realities that reveal narrative meaning. Tectonics is to construct with cultural references. – Charlotte Bundgaard



Research Methodologies

episteme + techne

Aristotle classified knowledge in three different types and apart from **Episteme (Scientific Knowledge)** he distinguishes **Techne (Skill – Applied Knowledge)** and **Phronesis (Wisdom).** Techne is defined as the set of principles, rational methods, involved in the production of an object. It resembles episteme in implying knowledge of principles but differs in that its aim is making or doing, not abstract understanding.

While attempting to define what a contemporary timber tectonics is, **working mainly with epistemes of material culture**, ecology and technology, I would like to engage with physical qualities of my subject of study by making, oscillating between physical and digital prototyping (Techne) complementing and enriching the research findings and hopefully revealing new insights.

Various research methodologies are selected to match specific phases and areas of the investigation which are broken down into three main phases and described in the diagram below. Together they aim to create a broad and multi-dimensional understanding around a focused design and research problem.

RESEARCH METHODS

Explore and systhematise current information building an correlational research: analysis of understanding of "tectonic alphabet" of timber structures. patterns, surveys, case studies What were the key moments, technological advancements, I. INVESTIGATION tools and how they influenced the architectural possibilities ESEARCH case studies research: study existing of working with timber. Focusing on period between 1900's projects, re-drawing, re-modelling untill now and defining state-of-the-art. experimental research: study the impact of a treatment through testing Build a series of scaled prototypes utilising digital tools R for design, fabrication and analysis inspired by contextual II. EXPERIMENTATION simulation and modelling research: analysis. Test end evaluate both process and the outcome building digital and physical models, for their potential in circular economy. DESIGN prototyping site investigation: in-depth analysis of Apply the findings on a real-scale project requiring a conscious selection of best suited structural solutions to context across region-site-building scale III. INTEGRATION meet the needs of a mixed-use neighbourhood including domestic and public scale buildings build in accorance with design research: site and funcitoncircular design principles. speccific concept development

MASTER THESIS

Research Structure | Part I: Investigation (episteme)



methodologies, theories and products (systems). It is ment to help build a detailed understanding of the evolution and formulate a state-of-the-art manifesto for contemporary timber tectonics - point of departure for prototyping and experimentation.

investigating state-of-the-art tools and methodologies through physical and digital prototyping aiming to define contemporary circular tectonic principles.

Research Structure | Part II: Experimentation (techne) <-

Oscilating between digital and physical prototyping this part of the research will explore and critically evaluate contemporary digital tools, workflows and manufacturing techniques, their implication on tectonics of timber construction and potential for integrating with cricualr design principles. It will enable me to reflect both on the process as well as actuall material properties and inform future design proposals.



Research Structure

RESEARCH

DESIGN

Research question: How advancements in manufacturing processes and design workflows could inform a new circular-tectonic language of contemporary timber architecture?

Design question: How can we integrate circular design principles in contemporary design and manufacturing workflow to develop innovative timber tectonic solutions and create a model for rural revitalisation in forested areas of central Europe through precise architectural interventions within existing communities?



Argument on Relevance

The main value of the graduation project in the larger social and scientific framework will come from an attempt to develop a methodology for revitalisation of rural areas in central Europe – one of the development goals and key policies highlighted by European Commission — with the aim do so through holistic architectural intervention. The ruralurban cohesion is of existential importance for the future of both communities and broader ecosystem. The countryside as a place often unconstrained by systems in place and therefore presents a potential for redefining the future models of social and economical value creation. Although very site-specific, the project will aim to develop a replicable methodology and guidelines for similar interventions across Europe.

The focused research objective will critically evaluate the evolving role of timber in contemporary construction industry looking at it through the lens of changing design tools and manufacturing processes and attempt to define rules for emerging tectonic language for new circular economy — a significant and urgent challenge set out by New European Bauhaus initiative. The project will result in building know-how and vision for wider implementation of renewable materials in construction – quest which can only be successful if integrated with contemporary workflows and manufacturing techniques and taking into consideration wider implications of increased timber use on global ecosystem.



Planning: Research Timeline

The detailed timeline below represents research planning and activities up until P2 – when the final research paper will be submitted.

		MSc 3																			
WEEK	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	
			September			October				November						December			January		
DATES	30/08/21 - 05/09/21	06/09/21 - 12/09/21	13/09/21 - 19/09/21	20/09/21 - 26/09/21	27/09/21 - 3/10/21	4/10/21 - 10/10/21	11/10/21 - 17/10/21	18/10/21 - 24/10/21	25/10/21 - 31/10/21	01/11/21 - 07/11/21	08/11/21 - 14/11/21	15/11/21 - 21/11/21	22/11/21 - 28/11/21	29/11/21 - 05/12/21	06/12/21 - 12/12/21	13/12/21 - 19/12/21	20/12/21 - 26/12/21	27/12/21 - 02/01/22	03/01/22 - 09/01/22	10/01/22 - 16/01/22	
DEADLINES & MILESTONES						Draft Research Plan	Research Plan Feedback		P1 Final Research Plan										P2 Final Research Paper		
RESEARCH					D	EVELOPING R	ELOPING RESEARCH PLAN														
								PHAS	EI: INVESTIG	TION CONCLUSIONS								SYNTHESIS			
											PH				RIMENTATI	ON			PHSE I + PHASE II		
DESIGN /									1										DDELIN		
CONTEXT					FRODLEIM											ONTEXT	1				
	COLLECTING INFORMATION & DATA BROADER CONTEXT AVALTSIS LOCAL CONTEXT														CONCEI	DESIGN					
TOOLS /						TI				IBER PARAMETRIC STRUCTURES COURSE											
COURSES				EDX MOOC: CIRCULAR ECONOMY FOR BUILT ENVIRON					MENT	DESIGN FOR MA				JFACTURIN	G & FABRIC	ATION					

Glossary of Key Terms

Understood as strengthening the connection between rural and urban economies to spur entrepreneurship, job creation and ensure long-term resilience utilising the unique values those locations have to offer. Rural revitalisation analyses system-wide transformations making rural areas more productive, diversified, climate-resilient and attractive places to live and invest.

Understood precisely as defined by Ellen McArthur Foundation: "Circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles: design out waste and pollution; keep products and materials in use; regenerate natural systems."

Scope of the definition of Tectonics in architectural theory varies highly but in this work the emphasis is put on portraying a constructional logic and as concisely defined by Charlotte Bundgaard *"building in accordance with specific contemporary conditions, defined by production methods, construction and materials as well as ethics, meaning culture and values."* (Beim et al., 2012)

Refers to an array of engineered timber construction systems and products creating structural systems utilising most contemporary design and manufacturing tools and processes. Often characterised by composite, prefabricated and modular nature shifting majority of the construction away from construction site.

Understood as an integrated approach towards design and manufacturing utilising digital processes across all areas of production from design, analysis, optimalisation to workflow, production, and assembly where all those processes mutually inform one another.

Rural Revitalisation Circular Economy Architectural Tectonics Contemporary Timber Construction Diaital Desian & Manufacturing Processes

Bibliography:

Books:

Beorkrem, C. (2013). *Material strategies in digital fabrication.* Hoboken: Taylor and Francis.

Brock, A. (2017). *Change here now: permaculture solutions for personal and community transformation.* Berkeley, California: North Atlantic Books.

Büren, C. (1985). *Funktion & Form – Gestaltungsvielfalt Im Ingenieur– Holzbau.* Basel: Birkhäuser.

Crawley, N. (2021). *Cross Laminated Timber – a design-stage primer.* London: RIBA Publishing.

Dangel, U. (2016). *Turining Point in Timber Construction: A New Economy.* Basel: Birkhauser.

Hickel, J. (2021). *Less is more: how degrowth will save the World.* London: Penguin.

Kaufmann, H., Winter, S., & Krötsch, S. (2018). *Manual of Multistorey Timber Construction*. Munich: DETAIL Business Information.

Lacy, P. (2020). *The circular economy handbook: realizing the circular advantage.* London: Palgrave Macmillan.

Lugt, P. v. d. (2020). *Tomorrow's Timber.* Netherlands: MaterialDistrict.

McDonough, W., & Braungart, M. (2009). *Cradle to cradle: remaking the way we make things.* London: Vintage.

Ross, P., Downes, G., & Lawrence, A. (2009). *Timber in Contemporary Architecture – a designer's guide.* London: TRADA Technology Ltd.

Stungo, N. (2001). *The new wood architecture.* London: Laurence King Publishing.

Tedeshi, A. (2014). AAD_Algorithms-Aided Design. Italy: Le Penseur.

Wilber, K. (2001). *A Theory of Everything.* New York: Shambhala Publications.

Edited Books:

Beim, A., Jensen, J. Z., & Arnfred, L. (Eds.). (2019). *Circular construction* – *materials, architecture, tectonics.* Denmark: KADK Royal Danish Academy of Fine Arts.

Bianconi, F., & Filippucci, M. (Eds.). (2018). *Digital Wood Design: Innovative Techniques of Representation in Architectural Design.* Switzerland: Springer.

Brell-Cokcan, S., & Braumann, J. (Eds.). (2013). *Robotic Fabrication in Architecture, Art, and Design.* New York: Springer.

Burry, J., Sabin, J., Sheil, B., & Skavara, M. (Eds.). (2020). *Fabricate.* London: UCL Press.

Deplazes, A. (Ed.) (2013). *Constructing Architecture – Materials Processes Structures.* Basel: Birkhäuser.

Hascher, R. (Ed.) (2015). *Emergent timber technologies: materials, structures, engineering projects.* Basel: Birkhäuser

Hudert, M., & Pfeiffer, S. (Eds.). (2019). *Rethinking Wood – Future Dimensions of Timber Assembly.* Basel, Switzerland: Birkhäuser.

Ibañez, D., Hutton, J., & Moe, K. (Eds.). (2019). *Wood Urbanism: From the Molecular to the Territorial.* New York: Actar Publishers.

Kolb, J. (Ed.) (2008). *Systems in Timber Engineering.* Basel, Switzerland: Birkhäuser.

Koolhaas, R., Armstrong, R., & Therrien, T. C. (Eds.). (2020). *Countryside, A Report.* Koln: Taschen GmbH.

Lovell, S. (Ed.) (2020). *The Songyang Story: Architectural Acupuncture as Driver for Rural Revitalisation in China.* Zurich: Park Books.

Mazan, W. (Ed.) (2020). Trouble in Paradise. Warsaw: Zachęta.

Menges, A., Schwinn, T., & Krieg, O. D. (Eds.). (2017). *Advancing Wood Architecture: a Computational Approach.* New York: Routledge.

Rinke, M. (Ed.) (2019). *The bones of architecture: structure and design practices.* Zürich: Triest Verlag für Architektur.

Weinand, Y. (Ed.) (2017). Advanced Timber Structures: Architectural Designs and Digital Dimensioning. Basel: Birkhäuser.

Williams, J. M., Chu, V., Lam, W. F., & Law, W. (Eds.). (2021). *Revitalising rural communities.* Singapore: Springer.

Articles:

Beim, A. (2013). *Tectonic Thinking in Contemporary Industrialized Architecture.*

Beim, A. (2021). Tectonic ecologies in Architecture.

Beim, A., Bech-Danielsen, C., Christiansen, K., Budgaard, C., Jensen, T. B., Madsen, U. S., & Pedersen, O. E. (2012). *Tectonic Thinking in Architecture.*

Buchanan, P. (2012). *The Big Rethink: Towards a Complete Architecture.* The Architectural Review. Retrieved from https://www.architectural-review.com/archive/campaigns/the-big-rethink

Charleson, F. (2019). Lamella: *Evolving the timber frame in the age of information.* (MArch). Bartlett School of Architecture UCL.

Deplazes, A. (2000). *Timber: Indifferent, Synthetic.* DETAIL Magazine. Epp, L. (2018). *Computational Design with Timber. Wood Design & Building.*

Schindler, C. (2009). *Ein architektonisches Periodisierungsmodell anhand fertigungestechnischer Kriterien, dargestellt am Beispiel des Holzbaus.*

Staub-French, S., Poirier, E., & Calderon, F. (2018). *Building Information Modelling (BIM) and Design for Manufacturing and Assembly (DfMA) for Mass Timber Construction.*