CIRCULAR ECONOMY OF TIMBER BUILDINGS – WORKSHOP 1 (12TH JULY 2022)

SUMMARY

The first workshop of the GW4 research community in the Circular Economy of Timber Buildings provided the opportunity to bring together the academic, industrial and community sector and key stakeholders to initiate discussions on how the net zero targets can be met in the UK with the use of homegrown timber. The morning session of the workshop was dedicated to key talks provided by Andy Leitch (Confor), Tabitha Binding (Timber Development UK), Richard Hawkins (Sevenoaks Modular Ltd), Robert Jockwer (Chalmers University) and Dave Lomax (Waugh Thistleton Architects). The morning session covered aspects related to the homegrown supply chain, off-site manufacturing and design for adaptability reflecting the multidisciplinary approach in the topic of circular economy of timber buildings and setting the scene for the brainstorming afternoon session. In the afternoon session of the workshop four topics were discussed among the attendees as selected by the GW4 research community. The agenda of the workshop can be found here and a summary of key points of discussion is provided below.

THEME 1: HOW CAN UK GROWN TIMBER CONTRIBUTE TO NET ZERO?

(Introduced by Anna Harper)

The UK has committed to reaching net zero greenhouse gas emissions by 2050, and UK forests have a role to play by removing CO_2 from the atmosphere. The lifespan of standing trees or harvested woody products determine whether this is an effective climate mitigation strategy. Timber construction also helps with net zero when it replaces materials with higher embodied energy costs and when it results in higher energy efficiency. However, impacts of UK forests and timber on climate policies depend on planting the right trees in the right place, working with landowners and adequately incentivizing planting, and ensuring down-stream use of harvested products.

Invest more on UK grown timber and secondary processing products

- The established supply chain should be revised to focus more on local sawmills and contribute to net zero with minimum transportation emissions. The builder can go to the local timber supplier and buy oven dry timber. Resulting profits support the local mills and local community (e.g., local sawmills in Cornwall). Something equivalent of independent local businesses?
- There is a knowledge gap in the efficient use of C16. In most design software C24 is the default minimum option
- Is CLT made of C16 a potential UK structural option?
- Rebranding UK grown timber e.g., 'Wales wood'. Douglas fir is the strongest of our homegrown timber
- In the UK every sawmill sells to a building merchant and the builder liaises with the building merchant. Can we make the supply chain more localised? Is the warranty process more expensive?
- Shall we rely on material efficiency and innovative structural products given the low percentage of current and future woodland coverage in the UK even if we account for afforestation policies?
- Hierarchical use of home-grown wooden products according to the properties of those products. Appropriateness of timber and best use of it to raise its value

- Lack of processing capacity – a break in the industry – why is this a hurdle? Too massive investment to build a sawmill? We need to focus on processing capacity and supply.

Invest more on afforestation

- 30,000 ha P.A. Can we not increase this massively? To grow more trees? What are the key barriers there?
- Can the UK create forests that will sustain the UK construction industry now and in the future?
- Barriers with afforestation: Who owns the land and how to convince owners to start planting trees?
- Afforestation strategies: Is there a way to optimise and strategically organise planting of wood species with optimum/high mechanical properties and higher carbon sequestration rates. This might entail the risks of monoculture and lack of biodiversity but also land pressure with different uses (e.g., farmland)
- Planting is cheap. Managing forest, felling, and processing are the most expensive activities
- Financier – pension funds are looking to invest in carbon storage and trees and forestry as a carbon storage solution
- How can we incentivise planting? Carbon pricing. If legislation develops, then it would be easier for people to see the value of that industry

THEME 2: SECONDARY PROCESSING PRODUCT USING HOMEGROWNW TIMBER - INNOVATIVE MATERIALS

(Introduced by Eleni Toumpanaki)

The aim of this themed discussion was to understand the current timber supply chain and identify current limitations and future possibilities for new market opportunities in engineered wood products (e.g., CLT) and innovative sustainable materials accounting for the UK current and future forest cover. Can we rely more on local resources and optimise the use of timber and manufacturing methods?

Current uses of British–grown timber

- Current uses of homegrown wood in the UK
  - 60%: pallets, fencing (42%) and construction (e.g., sawn timber) (27%)
  - 40%: small round wood for panels, paper, posts and bioenergy
  - Sawdust from sawmills can be re-used in panels, papers, pellets and compost
- There are existing glulam manufacturers in the UK such as Buckland Timber, Inwood Developments Ltd
- CLT manufacturing hub in Scotland (Transforming Timber) – homegrown CLT and GLT
- There are some local producers of Accoya (chemically modified wood) and Tricoya (acetylated wood fibres to produce MDF). Existing research in Accoya at Bangor University

Barriers/ Limitations

- There are limitations with engineered wood products in the UK due to the woodland coverage (approximately 3 million hectares) and the forestry sector is undervalued. The lower market prices in the raw material disincentivised further investments in forestry with respect to commercial timber. There is a more direct return if land is used as farmland. For commercial timber we rely on a 50-year to 100-year return period

- Lack of investments and governmental policies in developing skilled workforce in the forestry and timber construction sector
- There is not enough processing capacity. There are a few sawmills. This is a scale and investment challenge
- A significant barrier identified with engineered wood products especially OSB and products made of wood fibres and higher volume of adhesive (approximately 20%) is the toxicity of glues. Alternatives considered are equivalent to Dowel Laminated Timber (DLT)
- The life extension of timber products (e.g., cladding) requires the use of treatments that are energy intensive and toxic
- Industry is always looking for stronger and stiffer material and this cannot be supported with homegrown timber. Tendency of designers to overspecify timber although the design can be achieved with C16 or C16+
- If we switch to construction uses from other uses of UK-grown wood, there will be a reduction in biomass over time
- There is a lack of transparency regarding reporting carbon sequestration values for the manufacturers. More detailed information is needed from forestry to make accurate reporting of embodied carbon values and create EPD labels
- Transportation: Many lorries are stuck on bridges and underpasses in Wales. Lorries from Europe too

Future Possibilities

- More investment in recyclable and biodegradable glues is needed
- Production of niche and high-end value products could be a better investment for homegrown timber (increased market prices)
- Investment on high value sustainable construction building materials with hemp, straw, miscanthus and bamboo
- Use of wood fibres in scrimber products
- Upcycling of wood waste materials (e.g., recycling of old wooden floors). Why not taking reclamation yard into a company! Aim for longevity and innovation on connections and assembly of timber components that can allow reuse. Can we implement an equivalent WEEE disposal protocol for buildings?
- Connections will play a key role in design for adaptability, assembly, and disassembly. Metallic vs non-metallic connections. What is the impact in LCA? An analysis for timber components should be considered for the 1^{st} , 2^{nd} and 3^{rd} life of the timber component (reuse)
- Repair and maintenance market is very valuable
- What is the optimum commercial use of homegrown wood? Considering the UK woodland coverage industrial sectors such as furniture products or lightweight floor systems or cladding (products that are better suited to UK forests) could be more emphasized. UK might be better at maintaining and improving current timber supply chains (e.g., cladding). Mass timber structural solutions (e.g., CLT) might not be the best solution for homegrown wood
- Emphasis in resilient supply chains. Not 100 % reliance in one sawmill
- Can we import raw timber and then make the final engineered wood product in the UK? Engineered wood products will be a combination of homegrown timber and imports. Estonian, Italian and Slovenian business model: They export raw material for the production of CLT elsewhere.

- Governmental incentives regarding creating protocols and delivering things through testing. Government to subsidize the cladding testing. So much timber is going to skip – why there is no agricultural policy to give a guaranteed price for disclaimed timber
- If we are better at specific products (e.g., components, wool fibre insulation or cladding), we need to invest in this market and all routes including validation and testing to be subsidised. Then there is a context for subsidised innovation.

THEME 3: AFFORDABLE AND LOW-ENERGY TIMBER HOUSING USING UK GROWN TIMBER

(Introduced by Steve Coombs)

The rapid increase in world population, urbanisation and global greenhouse gas emissions combined with a rise in income inequality and house market prices has led to the need for affordable sustainable housing. Current predictions suggest that 3 billion house units will be required by 2040 and most of it will be needed in low-income neighbourhoods in big cities and developing countries. This theme aimed at instigating discussion around the definition of affordable housing and how low-energy houses can affect upfront costs. Is standardisation a solution to affordable housing and what are the tectonic qualities in this case? Is a homegrown home a marketing opportunity?

- Definition of affordable housing: What is affordable? Is it 80% of market value? Affordable housing should be defined in terms of local incomes and not market
- Owning, renting or leasing. What is considered more affordable? What is considered affordable if we account for maintenance costs and who is responsible for maintenance the renter or the social housing developer?
- Modern Methods of Construction (MMC) that are usually adopted in mass timber buildings are not considered affordable. Imported MMC and modular timber house units from other European countries (e.g., Estonia) create no value to local communities and local economy. We need to focus on training the local community and tackle skills shortage
- Engage people, homeowners and local community in the design and construction/self-build. Develop skills through engagement. Create a kit of parts to be put together locally. Create a user-friendly catalogue and demystify the construction process. Investments on training people. Local government encouragement and support is necessary.
- Available design books on how to build your own timber house (e.g., 'Wie baue ich mir ein Eigenheim' by Fritz Weber)
- Use of standard typologies. Should the houses be a standard template and repeated? Can you enable the design of kits and parts to allow for flexibility and adaptivity for different designs and accommodate different clients' preferences (e.g., Wikihouse)?
- Similarity with automotive industry. Develop 6 or 7 standardised types of buildings. Develop many solutions for details and then pick and choose. Quite long period of innovations and now is time to review. Time for incremental changes and not innovation
- Challenges with standardisation is that we deliver a product and not a place to stay. Clients invest on a home, my safe place and not a product (sense of belonging)
- Botswana example: when you get to certain age, government provides you a piece of land to build your own house
- Who is the client? Social housing provider or developer.
- Perceived challenges with safety and liability in case of a failure. Barriers to using timber construction
- There is lack of transparency, how things work, how much they cost

THEME 4: INDUSTRY – ACADEMIA COLLABORATION: WHAT DOES AN EFFECTIVE COLLABORATION LOOK LIKE?

(Introduced by Peter Walker)

The aim of this themed discussion was to discuss elements of fair, equitable and effective collaboration between academia and non-academic partners (industry, public sector, community groups and charities etc), and how can we apply these to developing research on timber development.

What can universities do for industry?:

- Research and Learning & Teaching and Training
- Research and development (generally not leading directly to certification)
- Knowledge transfer
- Research: experimental testing; characterisation; modelling; data analysis; design. Problem solving
- Do both consultancy (not publishable) and research (publishable)

Academics are motivated by:

- publications
- number of PhD students
- grant proposals
- impact

- Industry is motivated by profit, wants to own IP and has higher rhythms of delivering tasks
- Universities can focus on addressing skills shortage in timber engineering and construction (teaching)
- In some Universities there are established relationships with Industry and extensive collaboration via MSc, UG and PhD projects (e.g., BuroHappold and the University of Bath). In some Universities there are centres subsidised by Industry (e.g., the Laing O'Rourke Centre for Construction Engineering and Technology at the University of Cambridge or BRE centre at the University of Bath). It is a 'win-win' situation since industry invests money in training students to solve particular pressing questions and then adds the graduates with the desired advanced skills in their workforce
- Companies would most likely invest money in research for hot topics and pressing research questions (e.g., moisture and fire in timber or new products to create a new breakthrough in the market)

Effective collaboration

- To increase impact and speed of deliverables, you need the right people in the right places. Speed of progress and solutions
- Knowledge sharing is better. Joint meetings between academics and industry professionals (e.g., ICE/RIBA meetings)
- The key for an effective collaboration is to have motivated employers and enthusiastic employees who invest time to collaborate with academia and work with students.
- There are more than two sectors (industry and academia). There is also the community sector willing to collaborate – user driven, co-cooperation! Inclusivity and funding schemes should be more inclusive

- Effective collaboration is true partnership between academia and industry/community/public sector

Barriers

- There is a lot of bureaucracy in academia. It might take 12-18 months for a successful grant to start and contracts to be signed, but industry often would like the research questions to be solved by then. Technology might have progressed considerably within this timeframe depending on the technological sector.
- Loss of profit from industrial staff dedicated to research project.
- Funding models where only 80% of costs covered.
- Academia does not understand economics of industry and industry does not understand the economics of academia. Industry is looking for deeper and broader longer-term relationships.
- The construction sector is more reluctant to innovation compared with the mechanical engineering sector (e.g., examples from car racing industry and Formula 1).

OTHER POINTS OF DISCUSSION

- Embodied Carbon
- Who owns the embodied carbon? Is the manufacturer or the client?

GOLDEN NUGGETS

'Teach how to use timber'

'More advertisement to have industries other than timber (or related timber) in workshop'

'Continue Collaboration'

'Multi-disciplinary approach'

'Multi-disciplinary collaboration'

'Prove timber is safe'

'Is this a technical problem-problem that needs research?'

'Put effort in education. Wood and Timber in Architecture, Engineering, Manufacturing, Construction'

'Keep up the good work ! Collaboration is key. Very keen to see next steps and how theory can be implemented in practice'

'Inclusivity'

'Collaboration'

'Share the knowledge'

'Real life issues/applications'

'Plant more trees'

'It is too late to let perfect be the enemy of good. What can we definitely do right now? Let's do it'

'Selling end goals across supply chain. It is about achieving the goal not how you get there'

‘A lot of work to be done’

‘Bring in people from forestry’

‘Action ideas’

‘Expand your definition of collaborators (beyond academia + industry). There is more richness + know how out there’

LIST OF ATTENDEES

Name		Company
Alexander	Grief	BuroHappold
Andy	Leitch	Confor
Andy	Shea	University of Bath
Anna	Harper	University of Exeter
Bertrand	Nortier	University of Exeter
Charley	Brentnall	Xylotek
Colin	Rose	UCL
Dan	Maskell	University of Bath
Dave	Lomax	Waugh Thistleton Architects
David	Langley	The Strategic Observatory
Eleni	Toumpanaki	University of Bristol
Gabriele	Tamagnone	NMITE
George	Fisher	Knowle West Media Centre
Joni	Jupesta	RITE
Luka	Vojnovic	University of Bristol
Melissa	Mean	Knowle West Media Centre
Nicole	Wong	University of Bath
Pegah	Behinaein	University of Bath
Peter	Corbett	WhitbyWood
Peter	Walker	University of Bath
Phil	Isaac	Simple Works
Rebeka	Anspach	University of Bath
Richard	Broad	ASBP
Richard	Harris	Time for Timber Ltd
Richard	Hawkins	Sevenoaks Modular Ltd
Robert	Jockwer	Chalmers University
Robert	Thomas	Hiraeth.
Steve	Coombs	Cardiff University
Steve	Denton	Powell Dobson Architects
Tabitha	Binding	Timber Development UK
Tom	Westwood	Bristol City Council
WENCHEN	DONG	UCL
Will	Hawkins	University of Bath