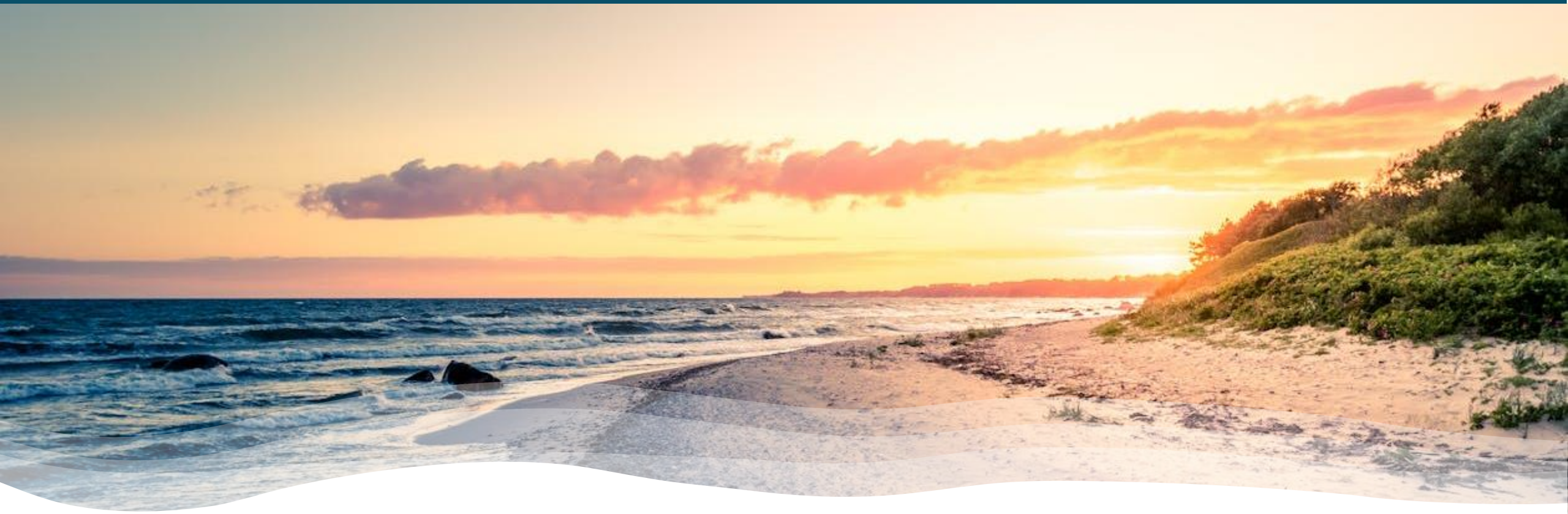
UWE Bristol | University of the West of England

SmartBioC

www.smartbioc.com

Bio-minded society for net-zero carbon construction

Date: 17th Jully 2024
Time: 9:30 am to 4pm



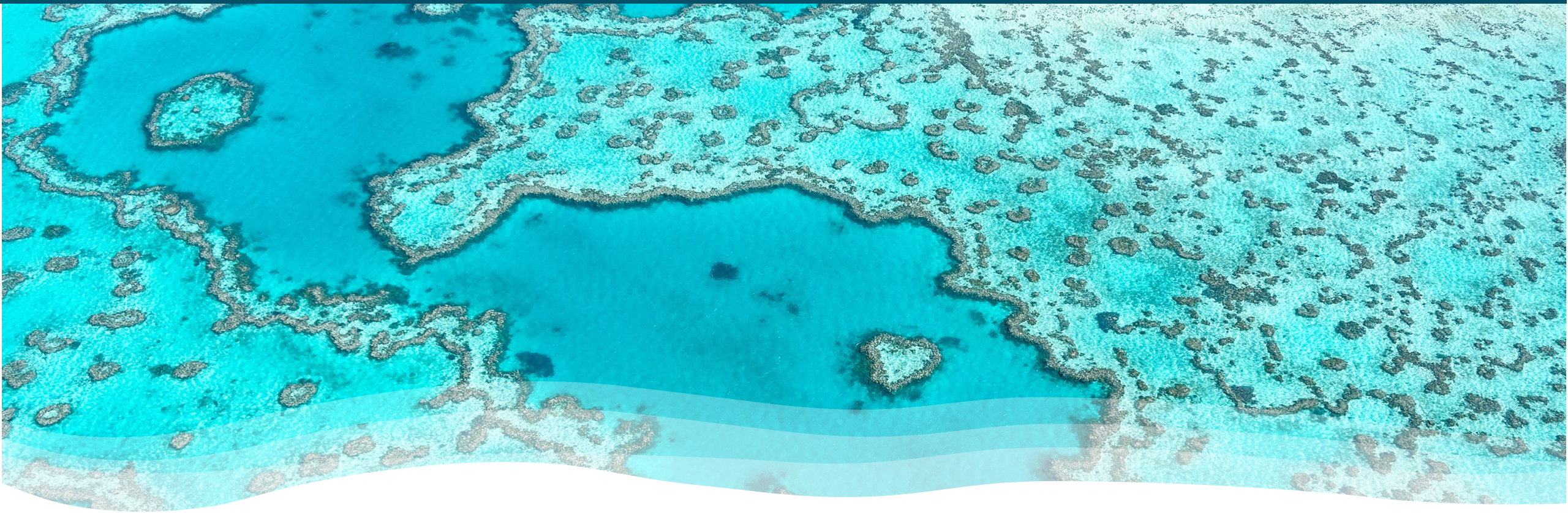
HOUSEKEEPING

Agenda

10:00 am	**Welcome & Housekeeping**
10:05 am	Introduction & Background
10:10 am	**Talk 1** - Harnessing the Wisdom of the Natural World by Dr Lidia Badarnah
10:25 am	**Activity 1** – SmartBioC's Five Capitals by Rebecca Lashley
11:00 am	**Talks 2 [7 mins]** - Three Speakers
11:30 am	**Activity 2 –** SmartBioC's Top Trumps by Clare Davidson
12:15 pm	Talk 3 - Mindshift & Data by Fernanda Speciale
12:30 pm	Lunch
1:30 pm	**Talks 4 [7 mins] & Pitches [3 mins]**
2:00 pm	Demos - Playing Serious Games (Salma & Hamza)
2:30 pm	Panel Discussion
3:30 pm	Closing remarks and wrap-up & networking
4:00 pm	Post-event Networking and Drinks

Objectives for the day

1. Listen, discuss and record the views and experiences from a diverse group;
2. Inspire and share knowledge;
3. Transfer research approach & findings for enabling widespread use of biobased solutions;
4. Establish and promote networks for future community participation and collaboration; and
5. Generate actions/pledges for a white paper outlining the enablers for building a sustainable future and achieving net-zero carbon goals.



INTRO & BACKGROUND

SMARTBIOC & BIOMINDED SOCIETY

How to speed-up the uptake of biobased building solutions to provide zero-carbon, healthy and socially and economically viable solutions for the built environment?

Smart Biobased Construction (SmartBioC) aims to speed up the uptake of circular biobased materials to provide zero-carbon, healthy and socially and economically viable solutions for the construction industry.

SmartBioC is redefining performance indicators used to assess sustainable building choices and it is implementing smart digital technologies to enable widespread use of biobased materials and building components.

The team

Fernanda Speciale
PhD Researcher

Ei Htay
BIM Manager

Salma Abdelrehim
Architecture Intern

Martin Bello Urbez
Product Design Intern

Hamza Usman
Gaming Consultant

Amalka Nawarathna
Co-Investigator

Dr Hector Archila
Principal Investigator

Rebecca Lashley
Co-Investigator

Lidia Badarnah
Co-Investigator

Clare Davidson
Co-Investigator

Morwenna Peters
Bristol Materials Network

Fionna Dowling
Bristol Materials Network

Biobased = more than wood!

bio-based insulation

eucalyptus wood

mycelium

root structure of fungi

cross-laminated timber (CLT)

agro-waste

rice husk ash, sugarcane bagasse ash, bamboo leaves ash, groundnut shell, sawdust, oil palm shell, cork waste ash, coconut shell

bamboo panels

hemp-based

sugarcrete

flax-based

miscanthus-based

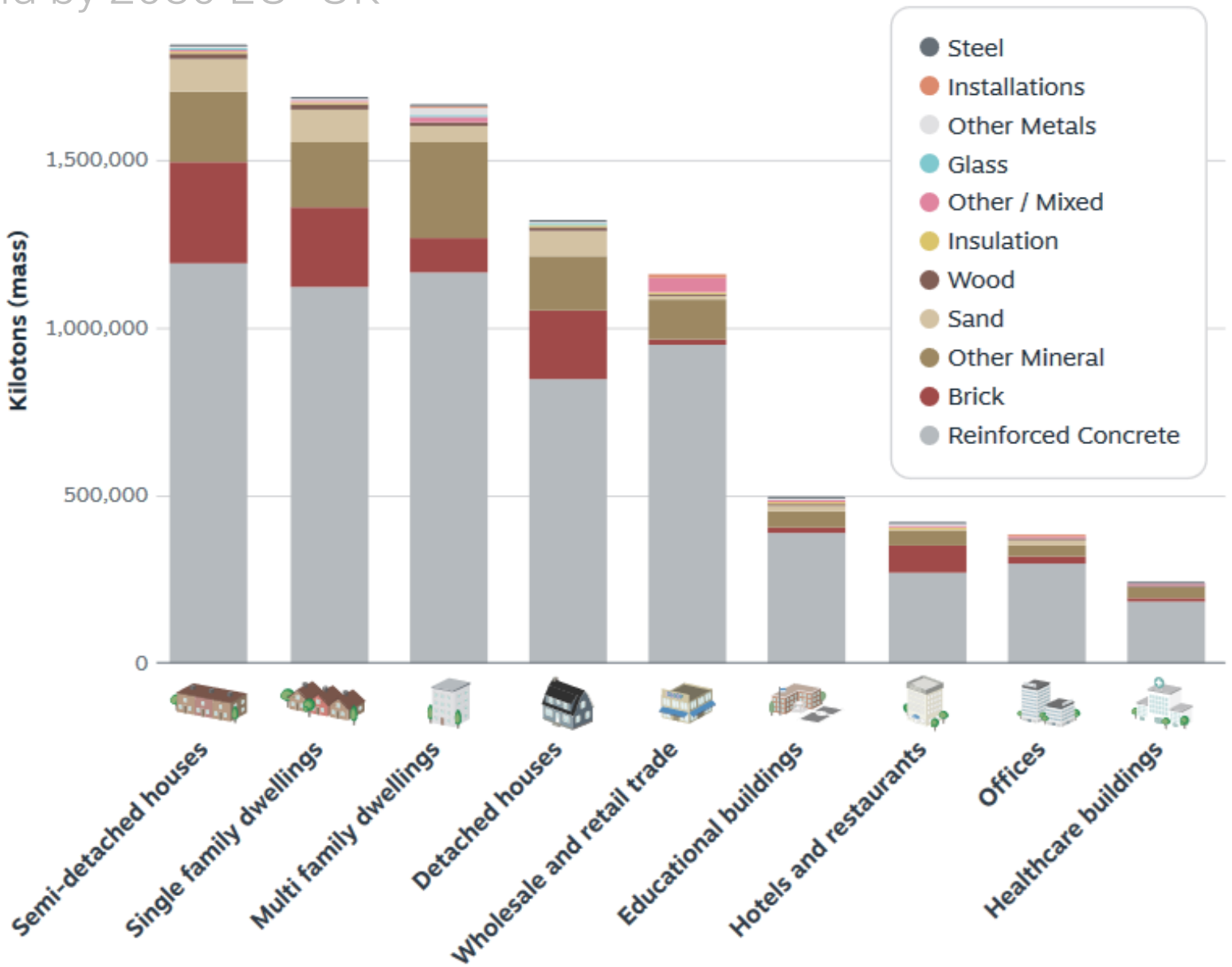
long-term bioplastics

e.g. pipes

biochar

Image taken from Presentation: Built environment Construction stored carbon by Sevim Aktas

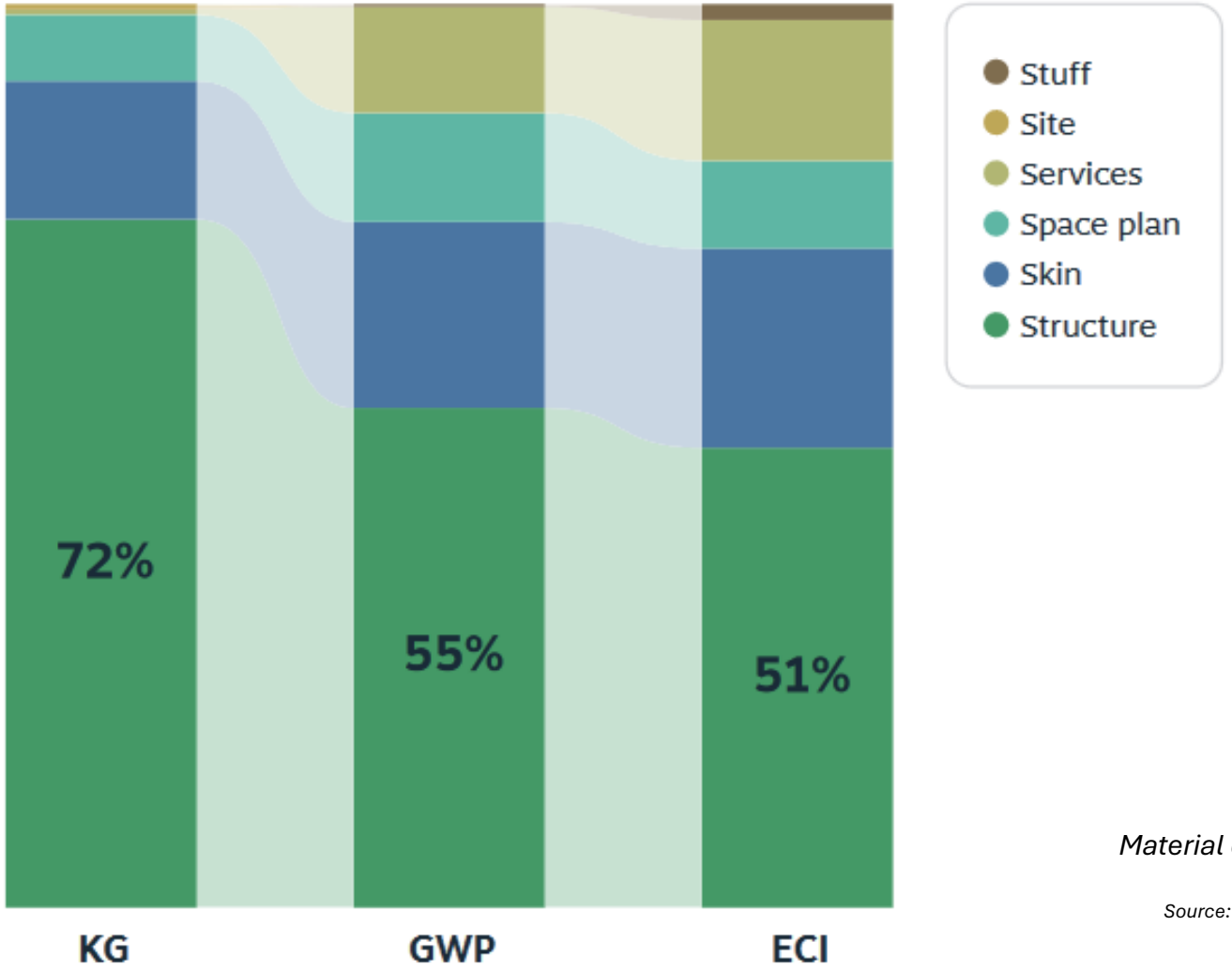
Construction material demand by 2030 EU+UK



Material demand (by mass) per building typology and building material based on typologies defined in Metabolics Urban Mining Model.

Source: Impact scan for timber construction in Europe, Metabolic consulting, 2023.

Construction material demand by 2030 EU+UK



Material demand by mass, GWP, and ECI, per S-layer based on Metabolic's Urban Mining Model.

Source: Impact scan for timber construction in Europe, Metabolic consulting, 2023.

High performance & Low-CO_2 are NOT enough…

1. Stakeholders' reluctance to change;
2. Limited **knowledge**, info & awareness;
3. Technological risk and obstacles;
4. Market and financial constraints;
5. Higher cost compared to traditional *

* Chan, A.P.C., Darko, A., Ameyaw, E.E. and Owusu-Manu, D.-G. (2017) *Barriers Affecting the Adoption of Green Building Technologies*. Journal of Management in Engineering. 33 (3), doi:10.1061/(ASCE)ME.1943-5479.0000507.

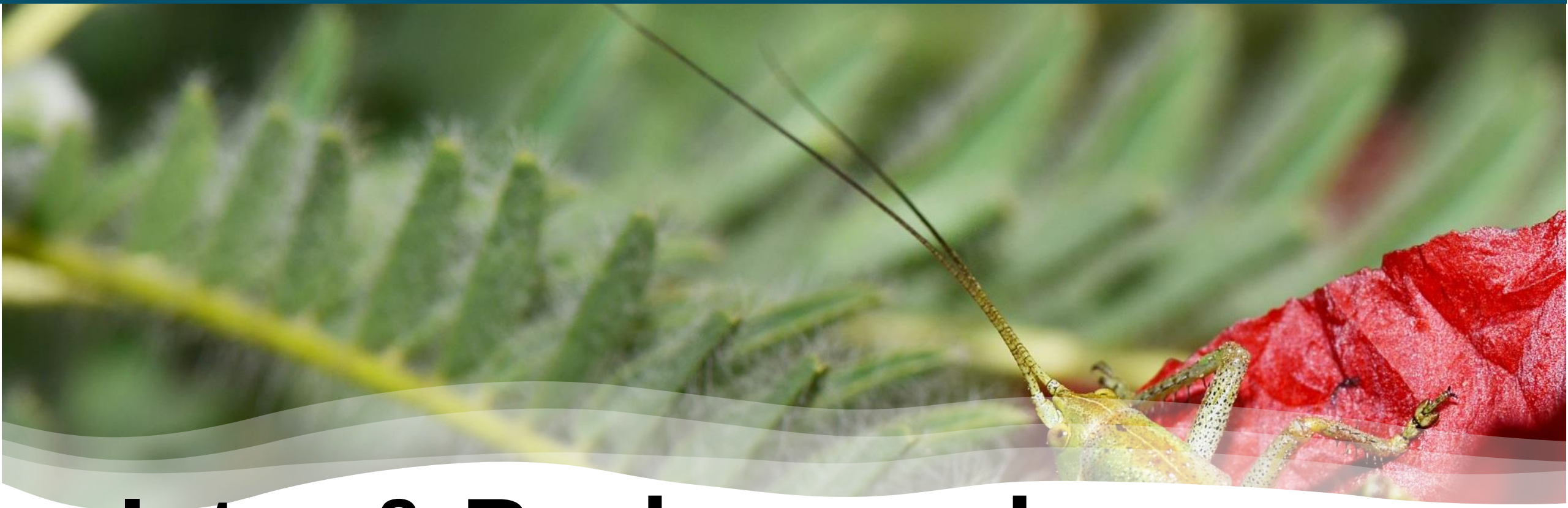
Nature as Mentor
Nature as Model
Nature as Measure

Janine Benyus

Nature-Inspired Design: Harnessing the Wisdom of the Natural World

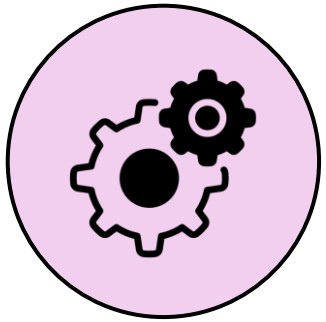
Dr Lidia Badarnah

PRESENTATION - AM1



Intro & Background
SmartBioC's Five Capitals

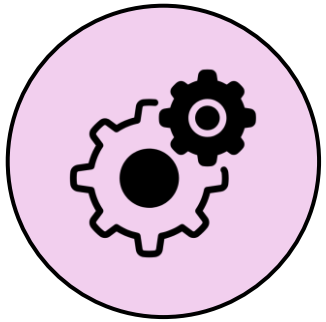
Dr Hector Archila



Manufactured

Financial

Mindshift in the value of materials and building choices from financial and manufactured to...

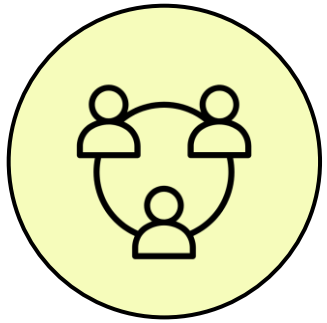


Manufactured

Financial

+

Natural



Social

Human

...to a balanced approach considering overarching values (capitals): natural, social, human.

Five capitals approach

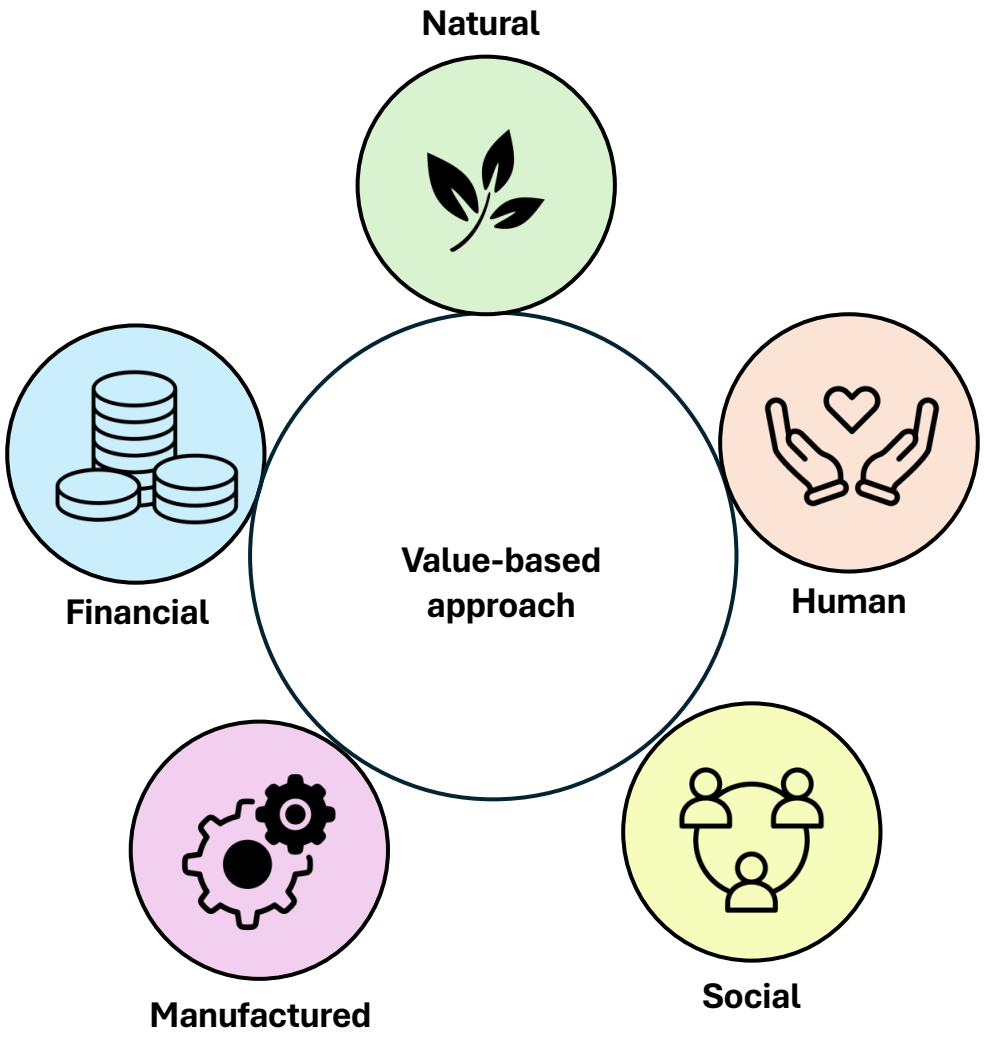
Natural: Refers to the environmental impacts of renewable and non-renewable resources

Human: Measures benefits and impacts to individuals including their physical and mental health and wellbeing

Social: Indicates the contribution to society, communities, small business and workers

Manufactured: Evaluates the technical performance of the solutions

Financial: Measures the financial & economic value f the building choices

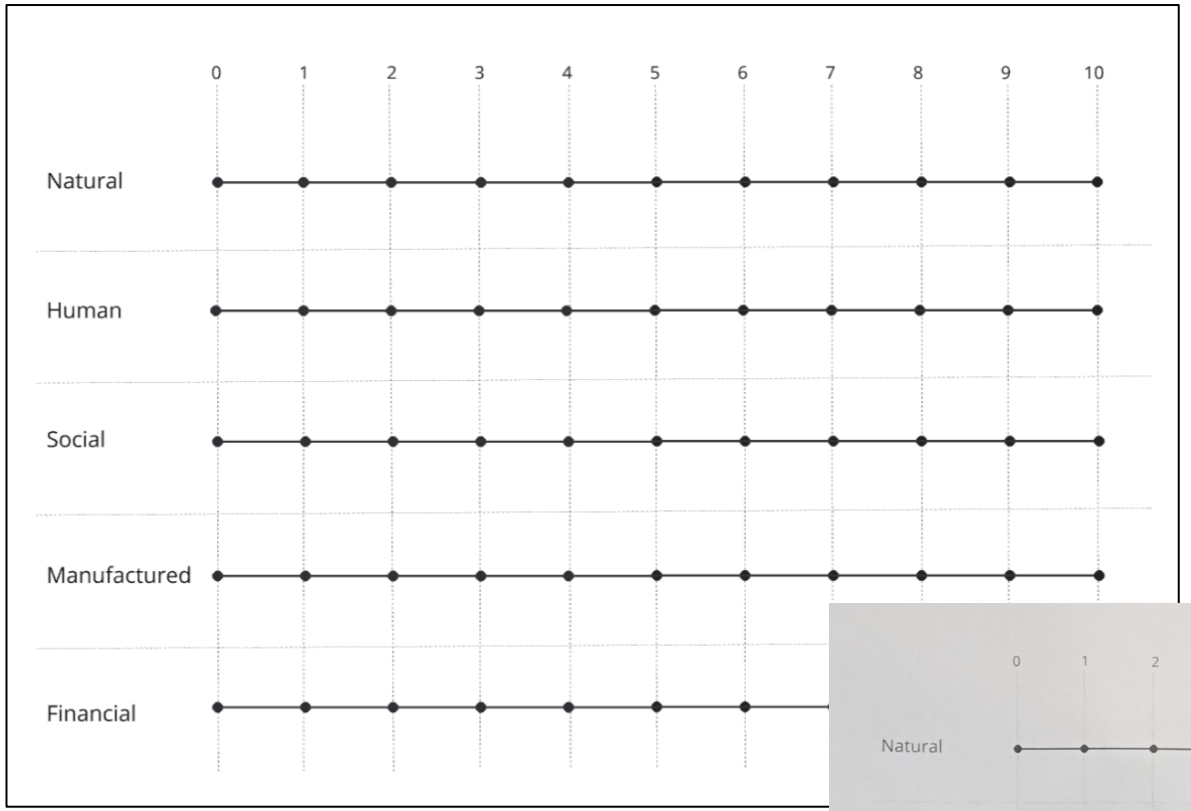


2018 - Jonathan Porritt

Activity 1
SmartBioC's Five Capitals

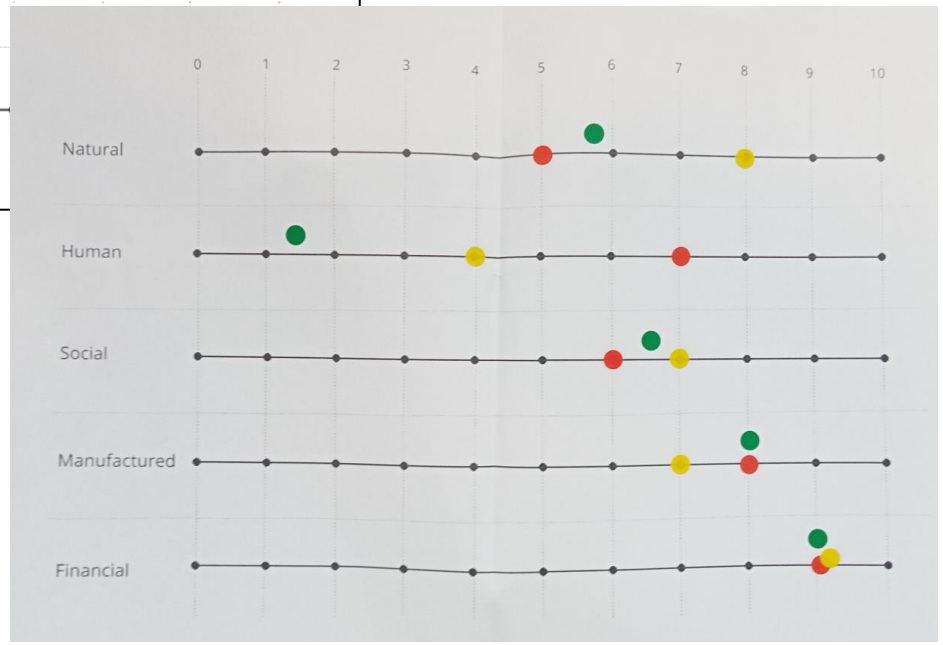
Rebecca Lashley

1. Scan QR code to open Q ualtrics link.
2. What is your role?
3. Move sliders on the screen to indicate how you prioritize each of the capitals when selecting construction materials.



4. Add coloured dots to the group's paper copy to record and share your individual judgements.

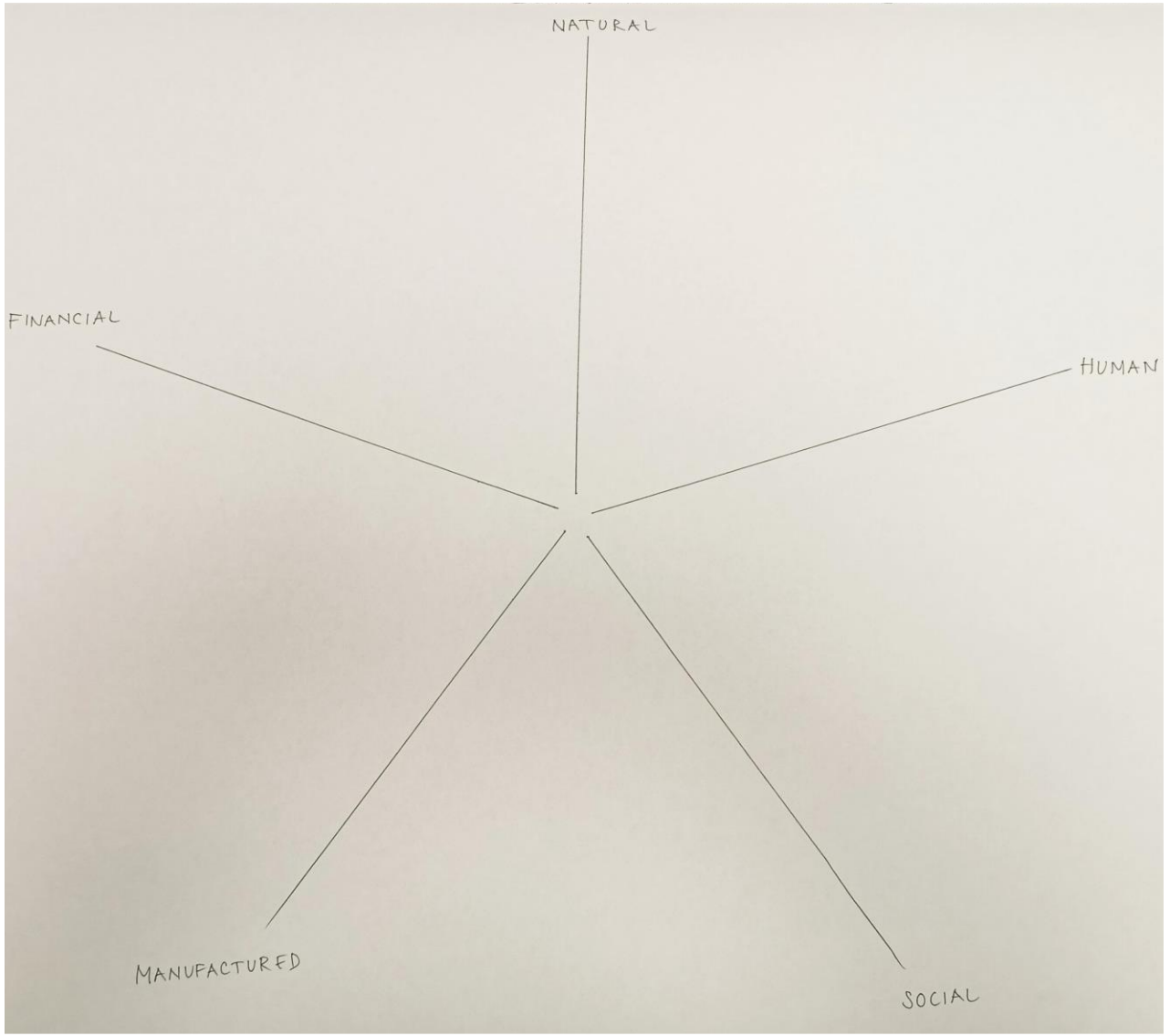
5. Discuss convergence/divergence of views.



6. Add comments to Post-it notes and stick to five-capital star.

7. Press yellow tab to enter first results and repeat exercise.

8. Do not move on to the next activity.



Participants engaged actively in the Activity led by Becky Lashley and provided their own interpretation of the five capitals applied to decision making in construction

Miro board

https://miro.com/app/board/uXjVKz2ileI=/

Talks

Guest Speakers

Diana Waldron, Peter Tomson & David Harris

PRESENTATION - AM2

Diana Waldron

Dr Diana Waldron presented the amazing work being led by Wood Knowledge Wales and commented on the Home-Grown project led by academics and industry in Wales and England

PRESENTATION – AM3

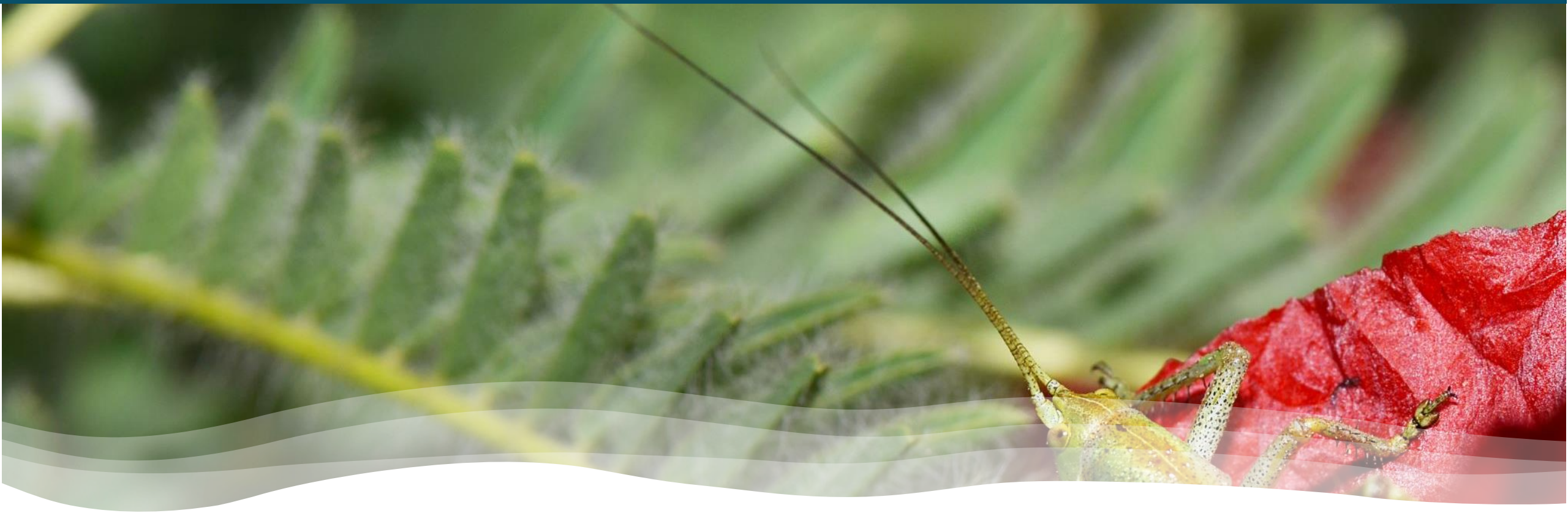
Peter Tomson

Peter Tomson from We Can Make told us all about their people and place-led approach to housing innovation, including their wonderful use of Ash die-back for windows.

PRESENTATION – AM4

David Harris

David gave us an amazing insight into the Eden Project in Dundee which plans to transform a former city centre Gasworks into a beacon of Regenerative Design and to reconnect the city with the natural world!



SmartBioC’s Build-ups

Dr Hector Archila

Hector introduced the work done by the research project SmartBioC on developing building assemblies using biobased materials from fast-growing plants and trees...

Traditional Build-up This build-up is a conventional brick and block construction system largely used for domestic construction in the UK.

Fast-Growing Biobased Build-up This build-up is mainly composed of short and fast-rotation biobased materials which take between 5-months (hemp) and 6 years (bamboo) to mature, and with the right processing, to be ready for use in long-lasting construction applications.

Timber-Bamboo Biobased Build-up This build-up entails a structural timber and bamboo cross-laminated panel with hemp insulation and plasterboard.

Passivhaus Build-up This build-up uses a timber-based structural system and insulation to meet Passivhaus standards.

SmartBioC's build-ups offer feasible and buildable systems which are alternative to traditional construction system. Information about their overall performance against the five capitals is provided in top-trump cards created to convey the message...

Activity 2

SmartBioC's Top Trumps by

Clare Davidson

SmartBio-C

Innovative Biobased Solutions

Aims to speed up the uptake of circular biobased materials to provide zero-carbon, healthy and socially and economically viable solutions for the construction industry. SmartBioC is redefining performance indicators used to assess sustainable building choices.

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DITIONAL FLOOR

nd block suspended floor system
ng concrete beams 'infilled' with
blocks with polyisocyanurate (PIR)
placed on top. Then a floor screed
top of a Damp Proof Membrane
vides a levelled floor for a wood
oring.

al 100
300
100

Manufactured 200
Financial 400

AST-GROWING FLOOR

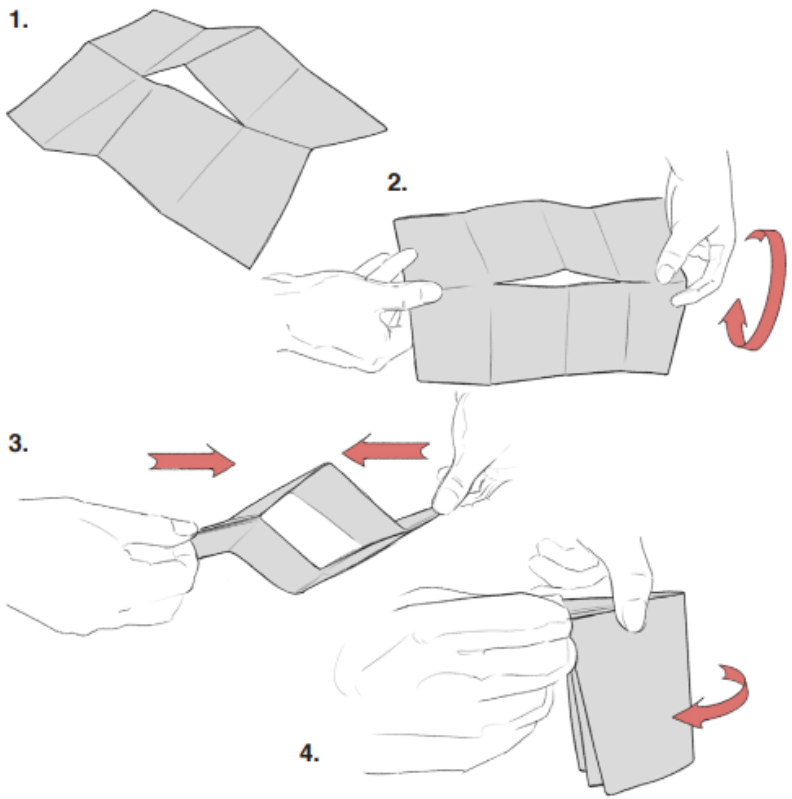
n engineered bamboo 'I-joist' box provides the
ructural support for this suspended floor. The
oist' boxes are infilled with hemp-flax insulation
a breathable membrane protects them from
ng water or humidity. A high-density
nated bamboo floor with a cork underlay is
ver rigid wood insulation boards.

Natural 367
ocial 350
uman 400

Manufactured 350
Financial 300

SmartBio-C
Innovative
Biobased
Solutions

How to fold the Top Trump zines;



SmartBio-C
Innovative
Biobased
Solutions

How to Play SmartBio- C Top Trumps;

1. Ensure each player around the table has an equal number of cards.

2. Each player is to shuffle and place their own cards face down, in a pile, in front of them.

3. Choose which player in your group is to start.

4. The first player (1) turns over their top card and looks at it, but doesn't show anyone else. They will be battling with the player on their left (2).

5. Player 1 chooses a category/capital that they believe will beat their component.

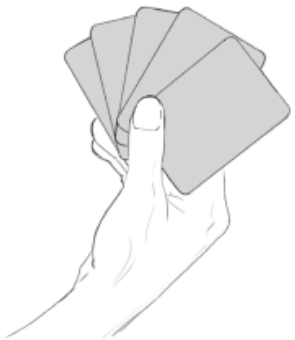
6. Player 2 picks up their top card and looks at it.

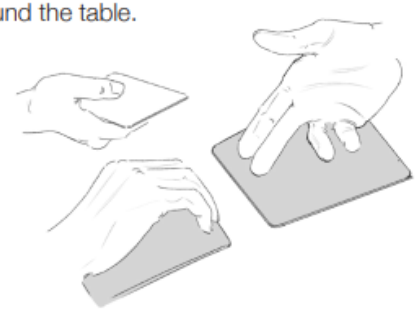
7. Player 1 announces their chosen category/capital, followed by the result on their card.

8. Player 2 announces their equivalent result for the same category/capital and the player with the best result wins the battle.

9. The winner takes the card from their opponent and places the two cards on the bottom of their pack.

10. Player 2 now battles with the player on their left, player 3, moving around the table.





SmartBioC's Top Trumps received an impressive response from the audience who enthusiastically engaged in the game and discussed the information provided in the cards!

SmartBioC's Top Trumps received an impressive response from the audience who enthusiastically engaged in the game and discussed the information provided in the cards!

AFTERNOON SESSION

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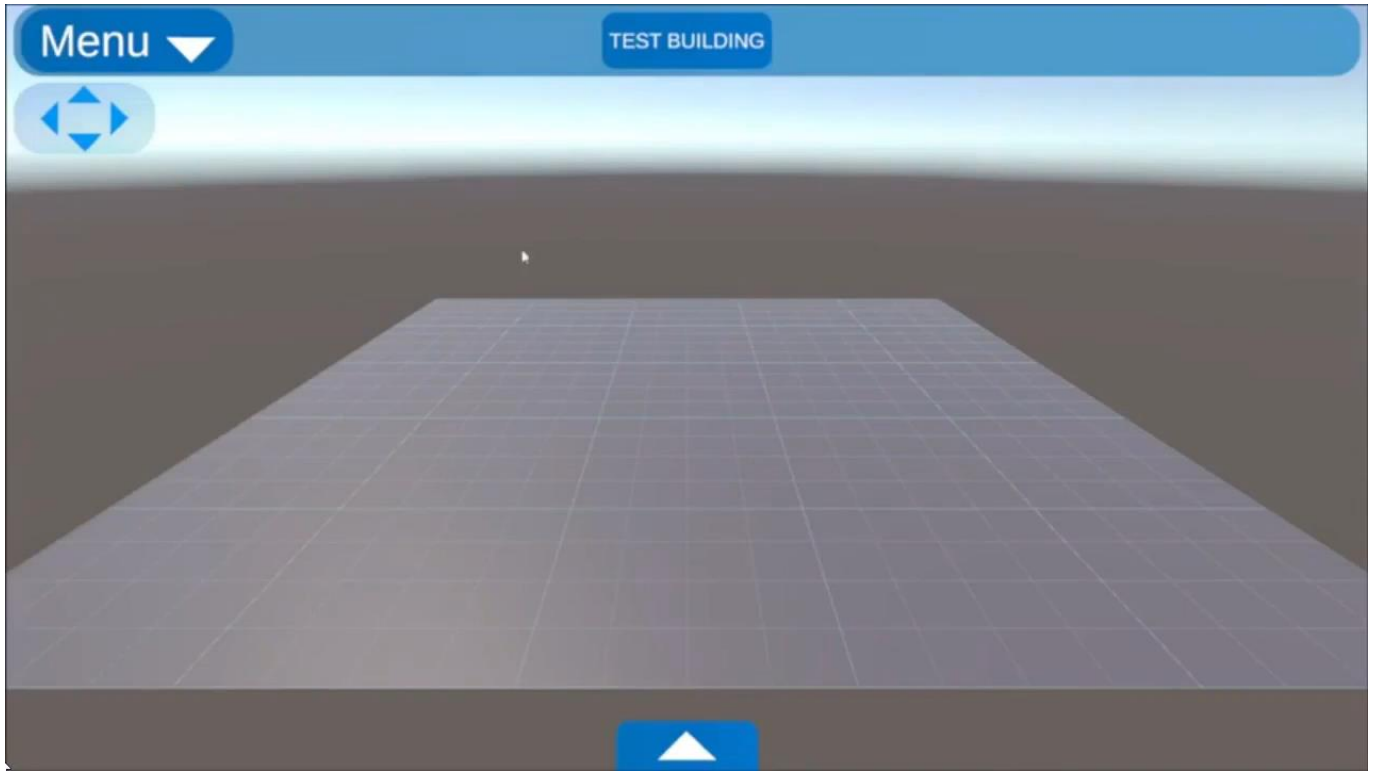


SmartBioC webGL demo - https://youtu.be/lvU7LGQBmCY

Bio-minded society for net-zero carbon construction

Date: 17th Jully 2024
Time: 9:30 am to 4pm

Talks

Guest Speakers

Dave Judd & Richard Broad

PRESENTATION – PM1

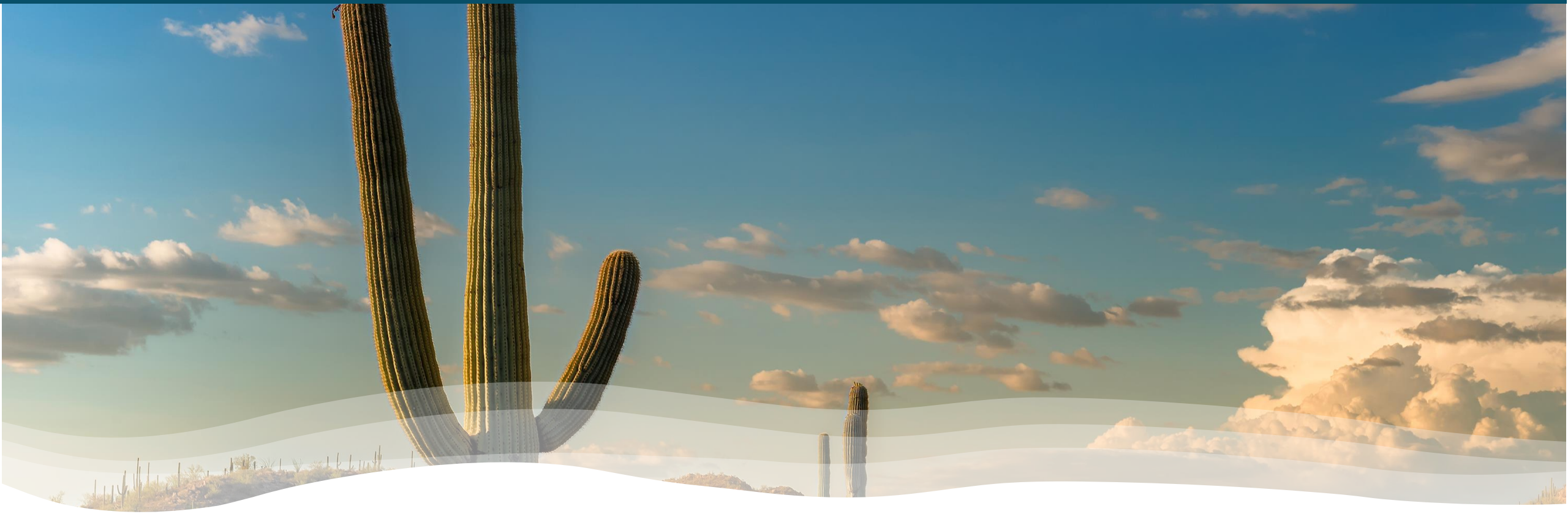
Dave Judd

Dave Judd from Ecological Building Systems, who have contributed to the research project with materials, provided examples of recent built projects using the biobased materials supplied by the company.

PRESENTATION – PM2

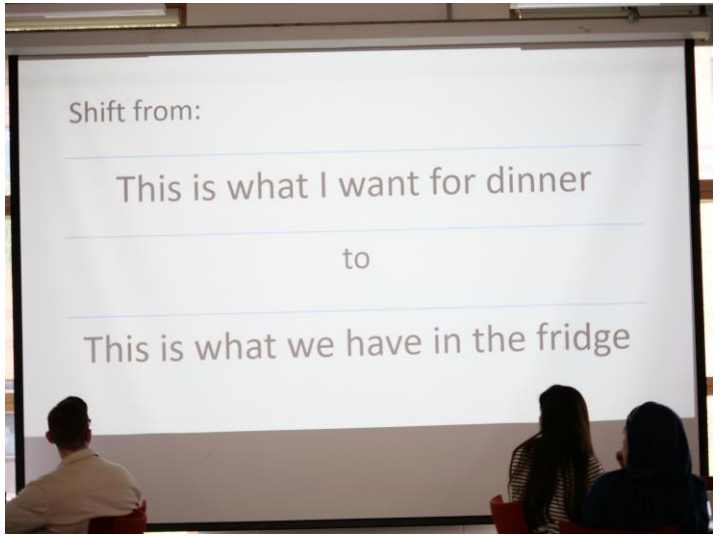
Richard Broad

Richard Broad from the Alliance for Sustainable Building Products (ASBP) provided an overview of the fantastic work undertaken by the ASBP on the promotion of sustainable building products.



Pitches

George, Jenny, Martin & Fiona + Morwenna



George Mikurcik - EcoCoCoon,
Jenny Ford - Materials In Mind,
Martin Chastney - Cheltenham council
and **Fiona Dowling & Morwenna Peters -**
Bristol Materials Network
They all joined to give us a short account of their work and experiences around biobased materials in the Southwest and beyond.

Talks

Playing Serious Games

Salma & Hamza

‘Smartifying’ Construction

for Circular & Zero-carbon Biobased Buildings

SmartBioC Project

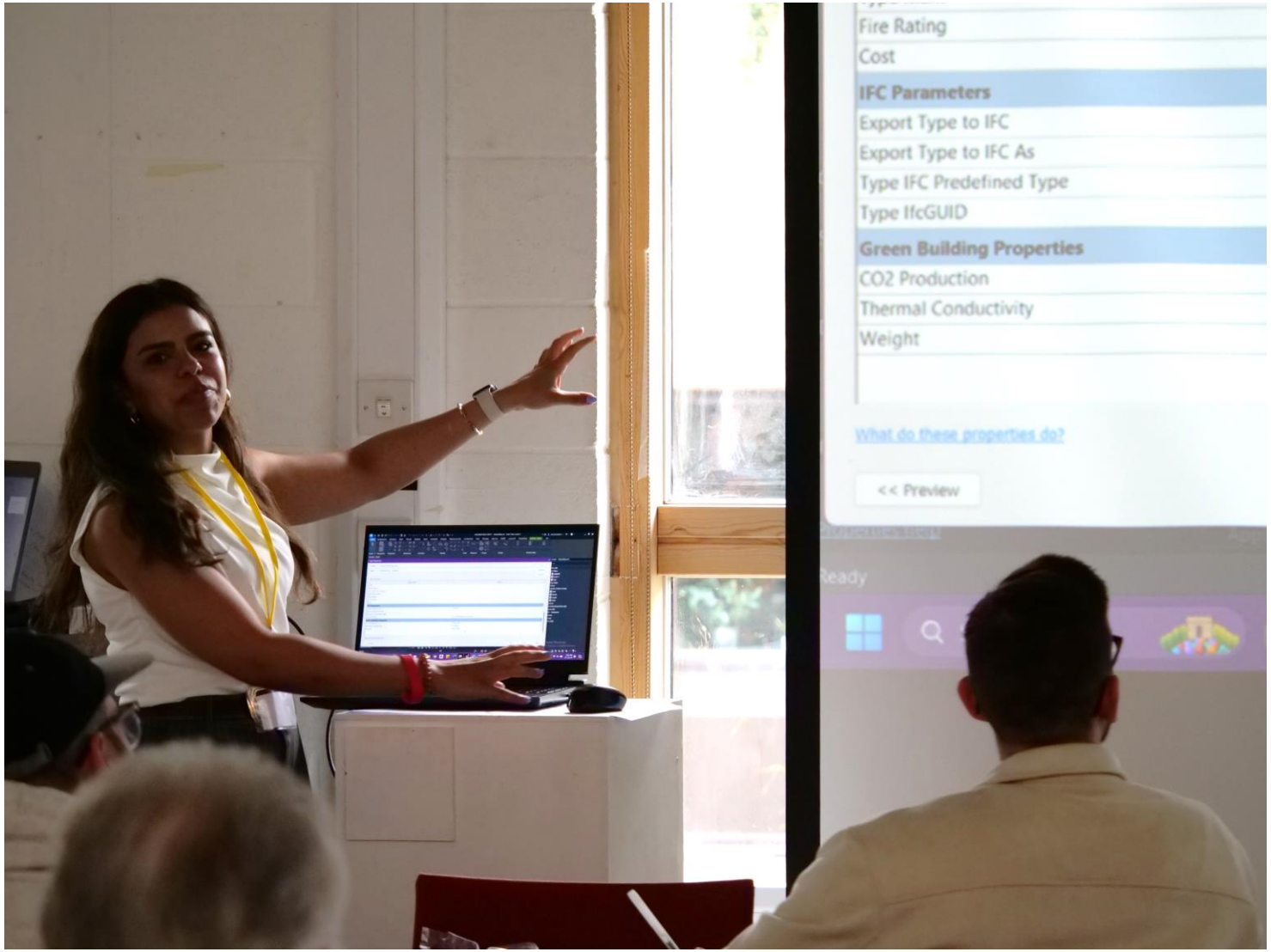
Co-A: Rebecca Lashley[1], Jessica Lamond[1], Abhinesh Prabhakaran[1], Ashleigh Msipo[2], Edwin Zea Escamilla[3]
1 University of the West of England, Bristol BS16 1QY, UK
2 Amphibia BASE Ltd., Chester CH3 5JQ, UK
3 ETH Zürich, 8093 Zürich, Switzerland

*"…using **smart digital technologies** as part of a **systemic transition towards a circular economy** and a **radical shift in the construction industry** from net carbon emitter to a **carbon sink**."*

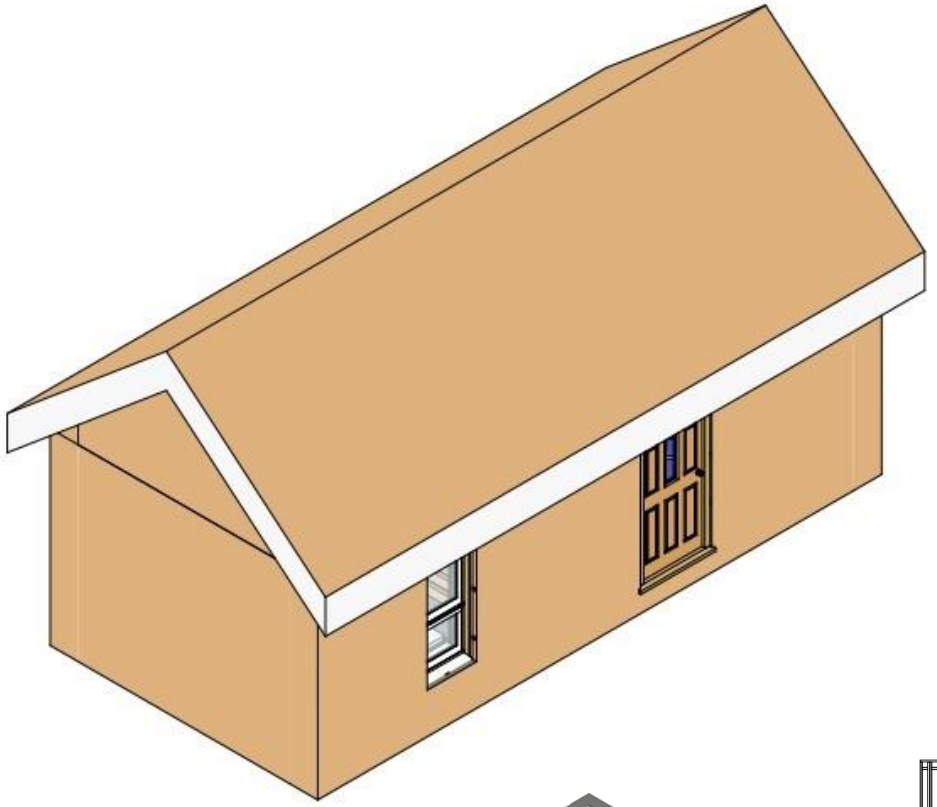
Mrs von der Leyen

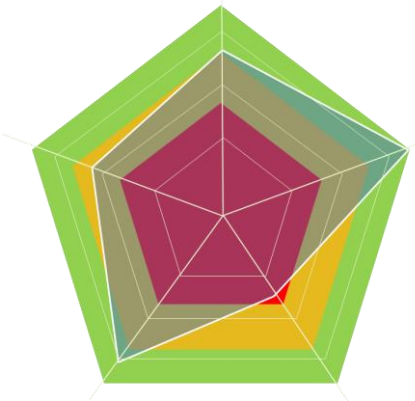
"State of the Union Address 2020"

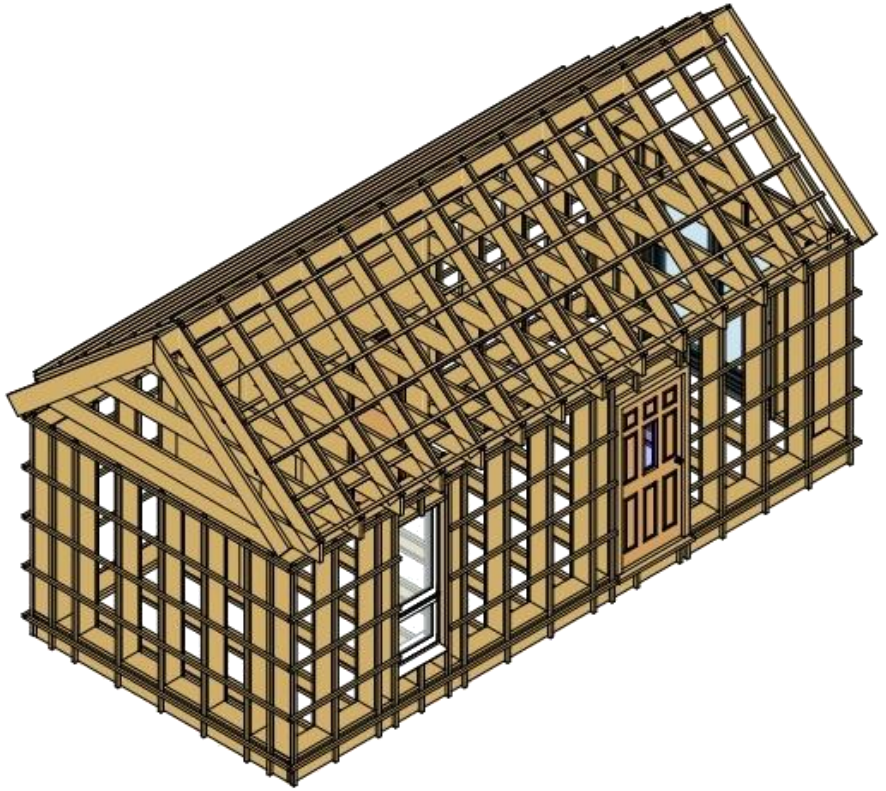
€750 billion EU economy | 2030 Nature-based solutions = up to $10.1 trn annual business value, create 395 million jobs (BIC, 2017)

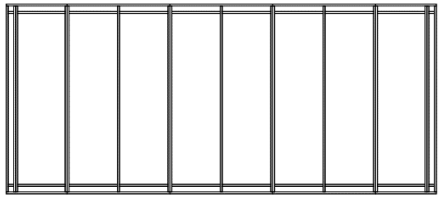


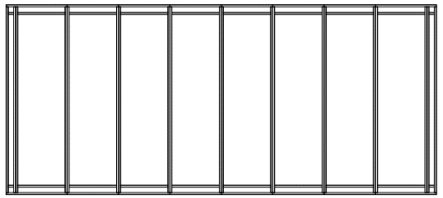
Salma, a research intern at SmartBioC showcased her work on producing Revit models of the different build-ups and adding embodied carbon footprint data to the object libraries, These can be used by designers to track their designs' impact on human, social, natural, manufactured and financial capitals!











How…?

…to communicate, inform and deliver systems?

Gamification

Serious games

Simplified 'Playful'

Intuitive Logic Reactive

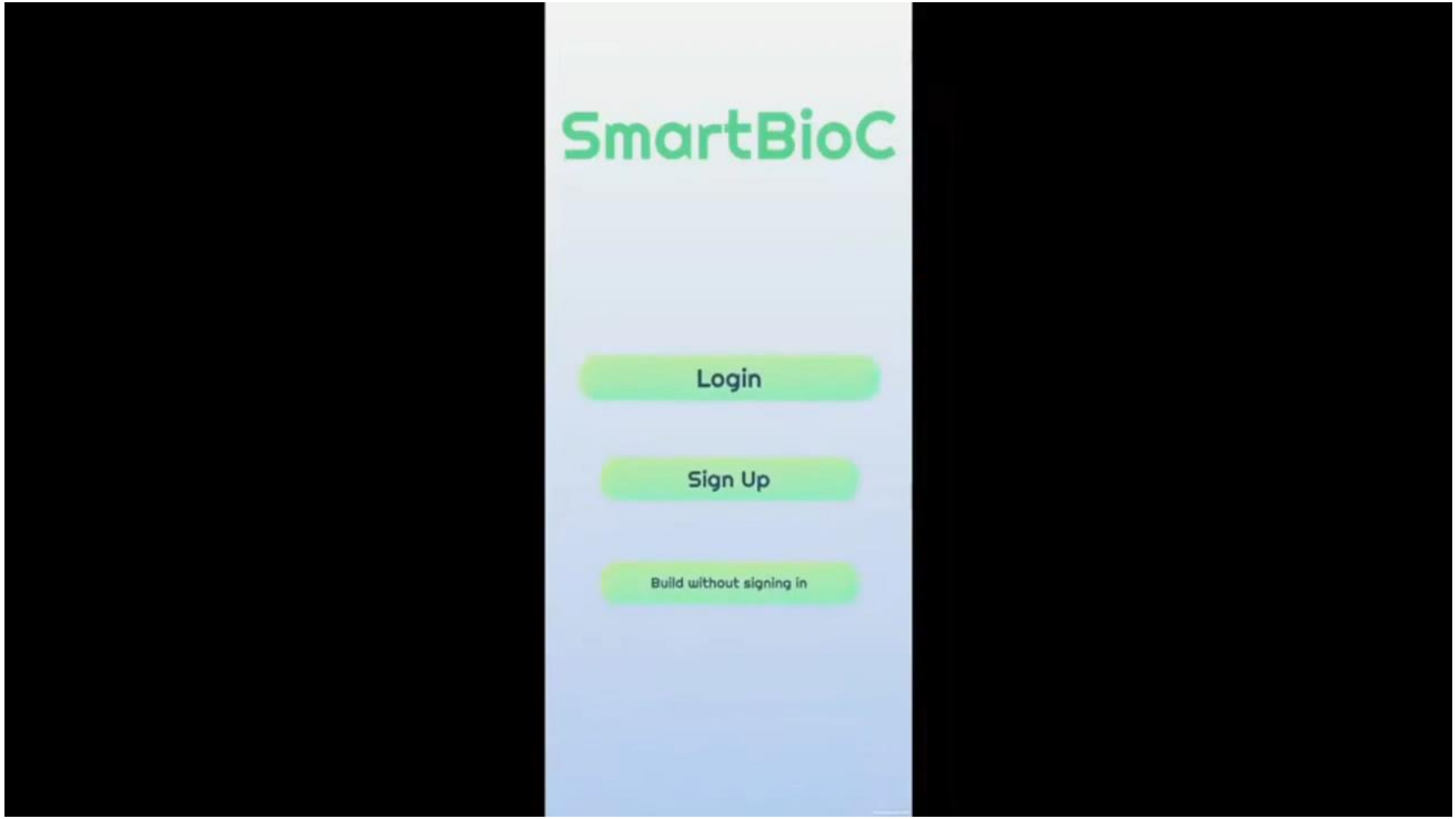
Interactive Visual

Positive Evocative

Instantly Shareable

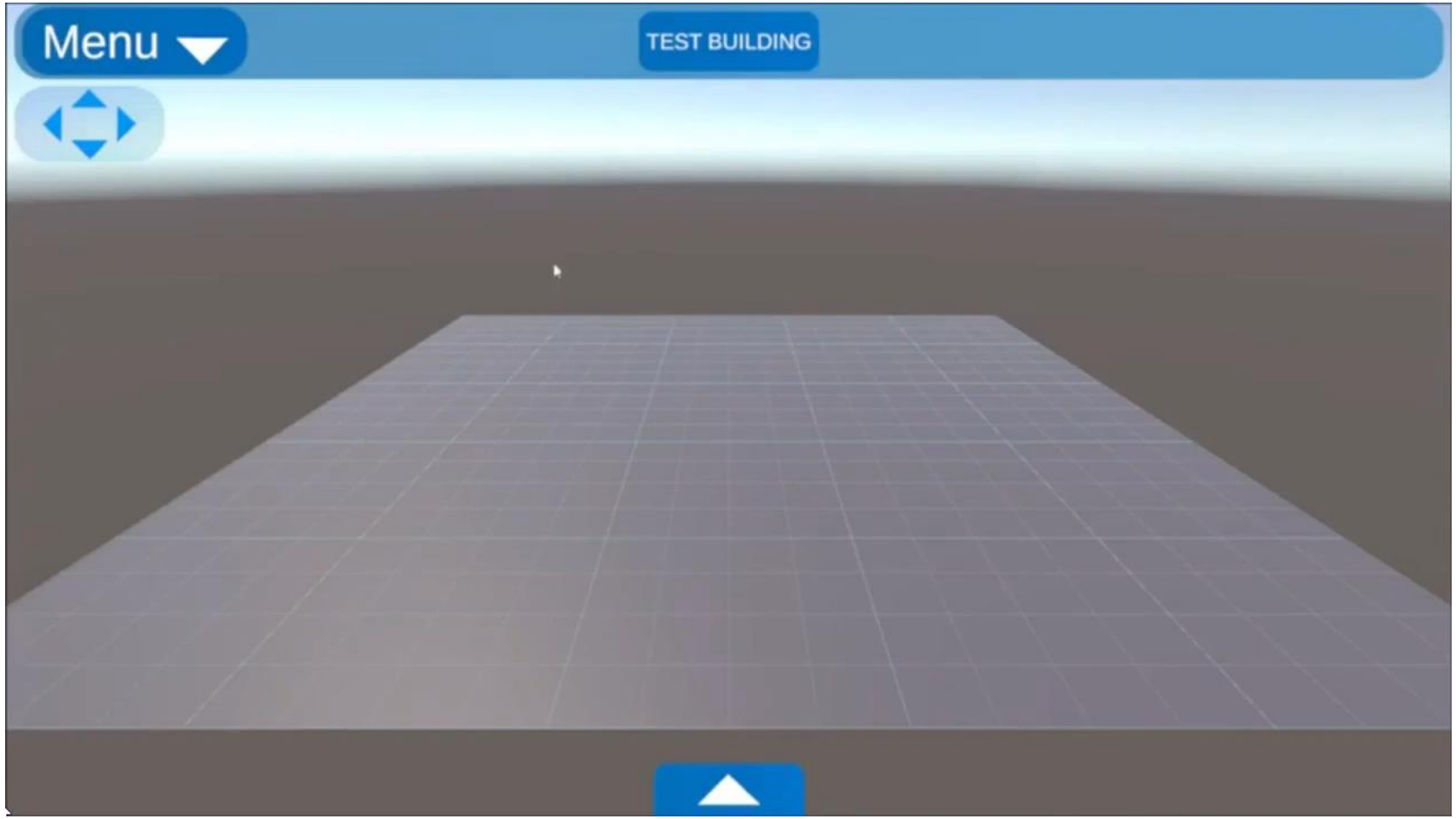
Hamza, a former research intern at SmartBioC told us about his work and approach to making it easier for end-users to select biobased materials using a ‘serious-games’ platform.

SmartBioC viewer App – augmented reality



SmartBioC APP demo - https://youtu.be/mmj1H4RX6oo

SmartBioC builder Web-GL



SmartBioC webGL demo - https://youtu.be/IvU7LGQBmCY

SmartBioC

Multicriteria assessment method

Fernanda Speciale

Fernanda Speciale, a PhD candidate at Polimi, Italy and research intern at UWE, Bristol presented her contribution to the multi-assessment criteria proposed by SmartBioC.

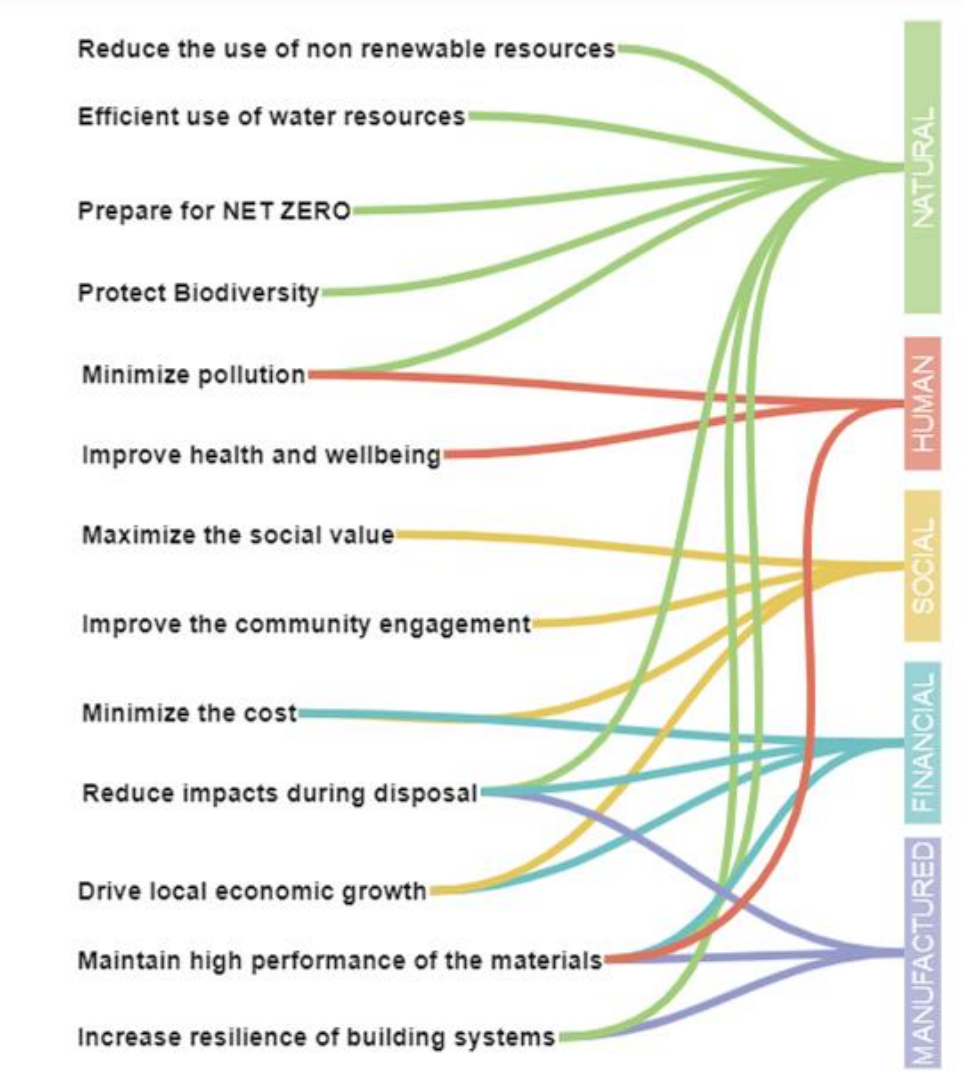
From capitals to indicators

from capitals to strategic objectives

Five capitals approach

↓

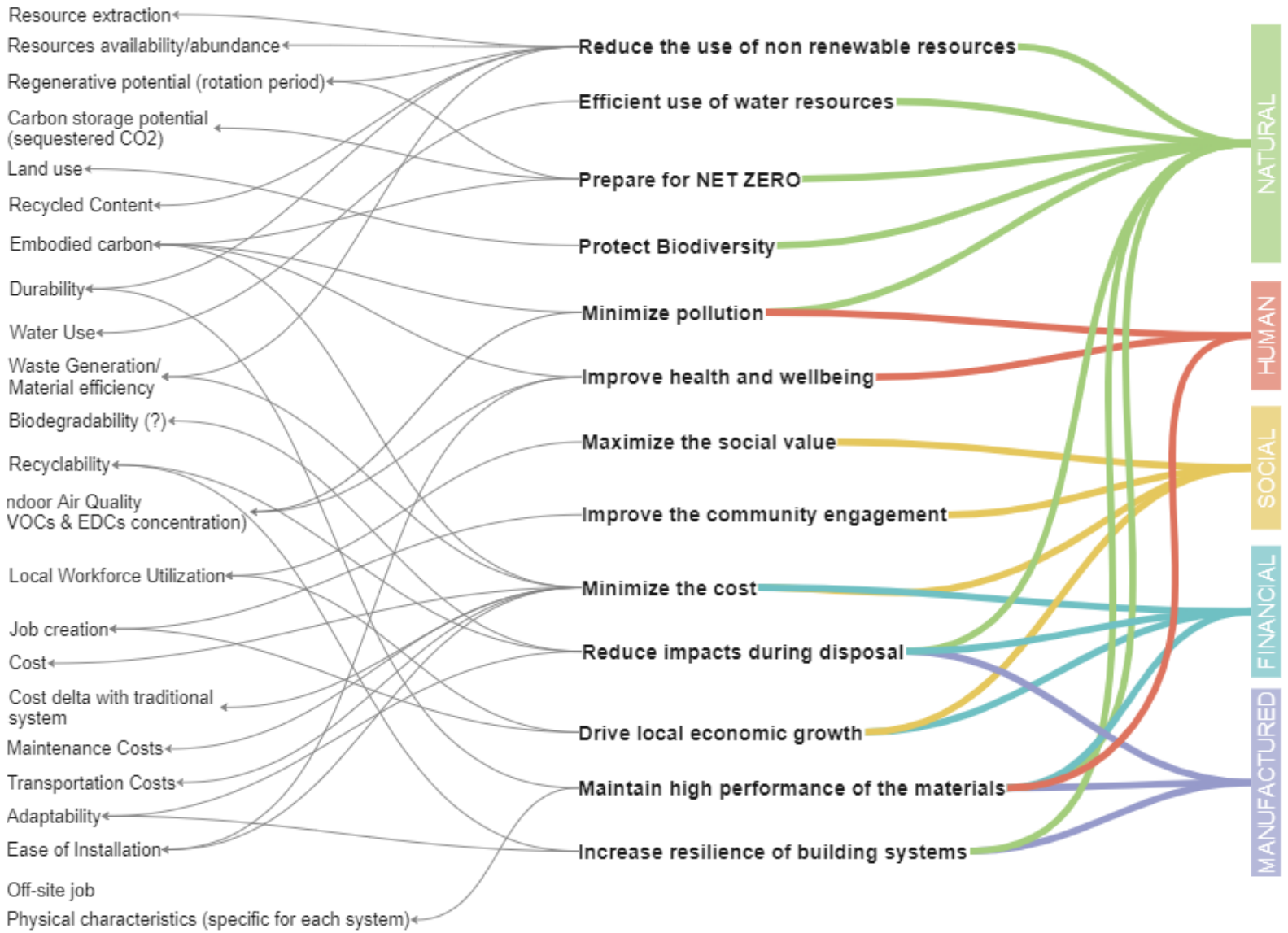
Strategic objectives definition



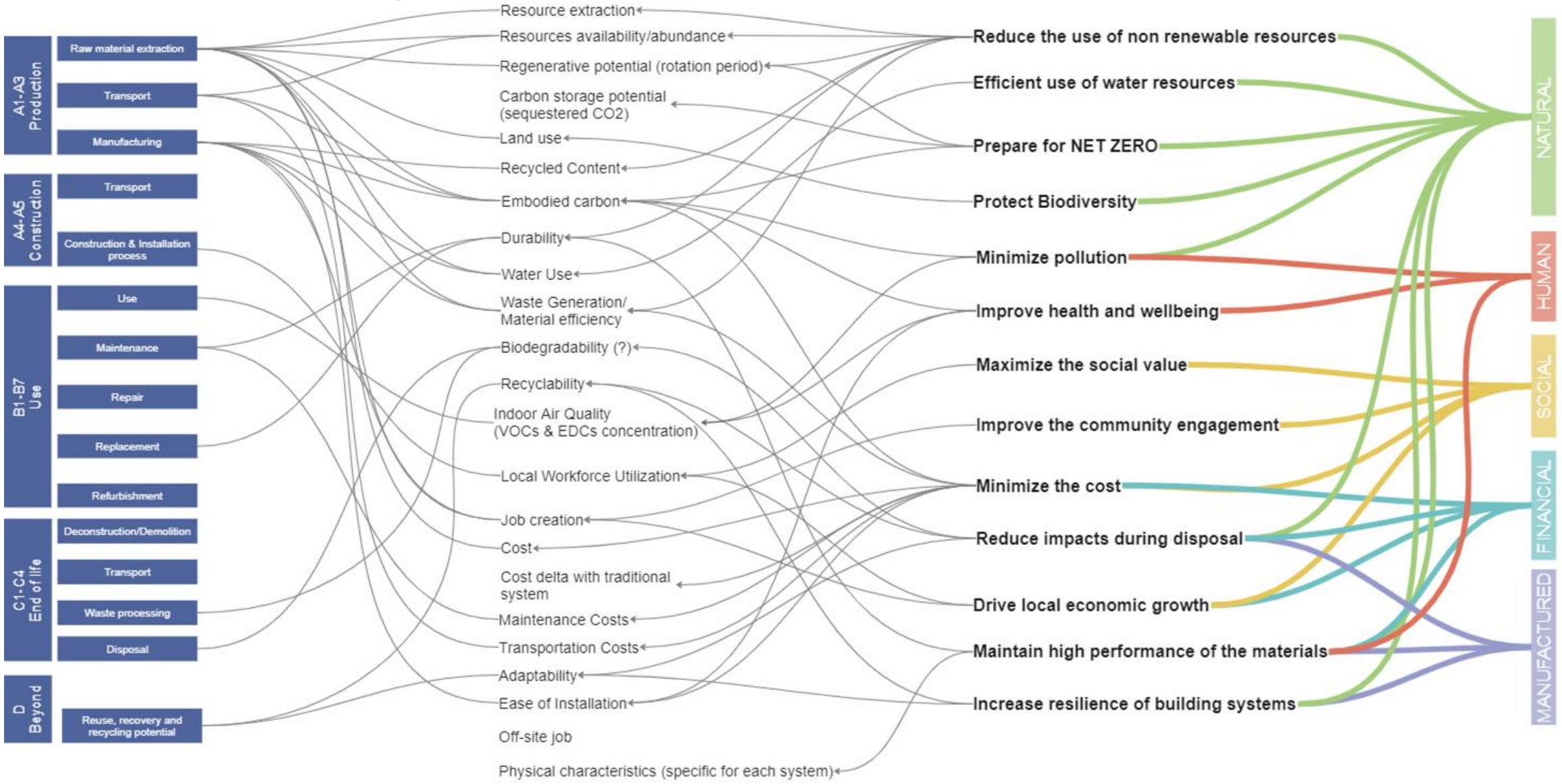
Strategic objectives definition

↓

Promising indicators definition



link with life cycle stages



the framework's purpose

Multi-criteria assessment

Not only one sum category considered

Not just quantitative indicators

An approach integrating quantitative and qualitative indicators

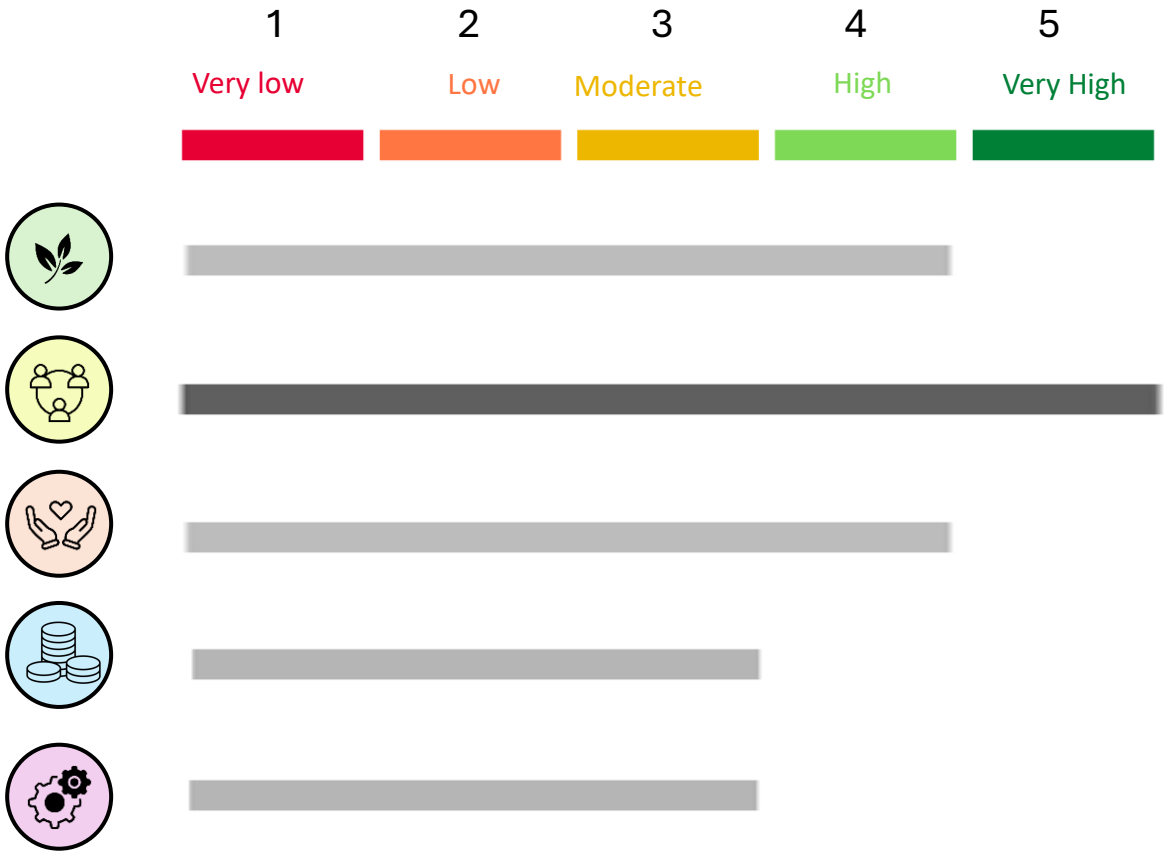
Early-design stages application

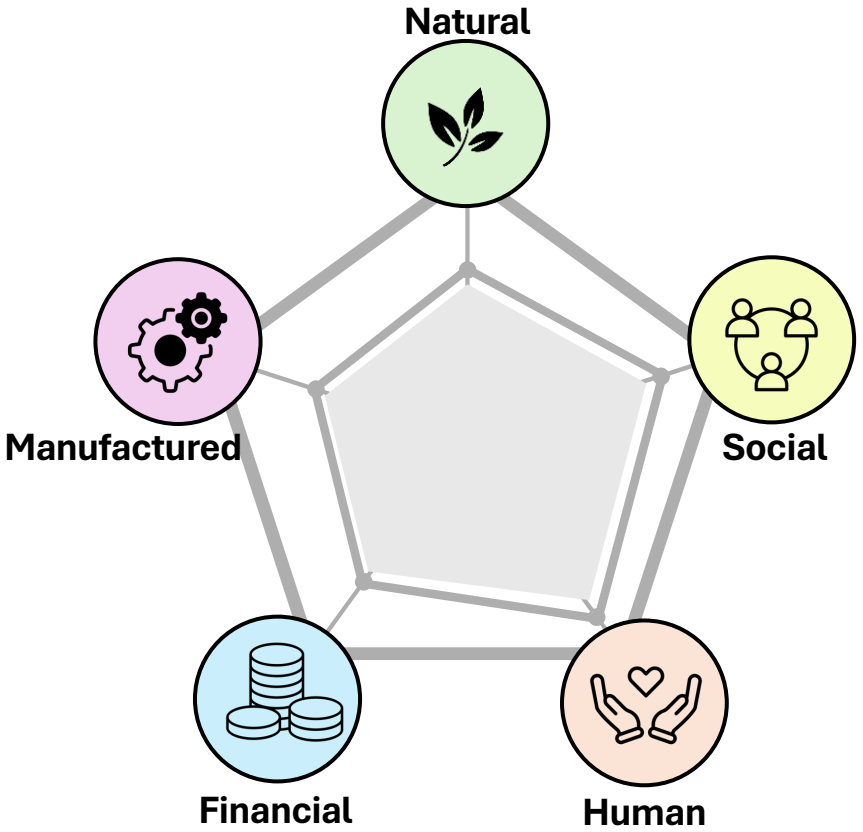
Indicators do not require accurate details on the project

How to make it easy?

Can we measure...?

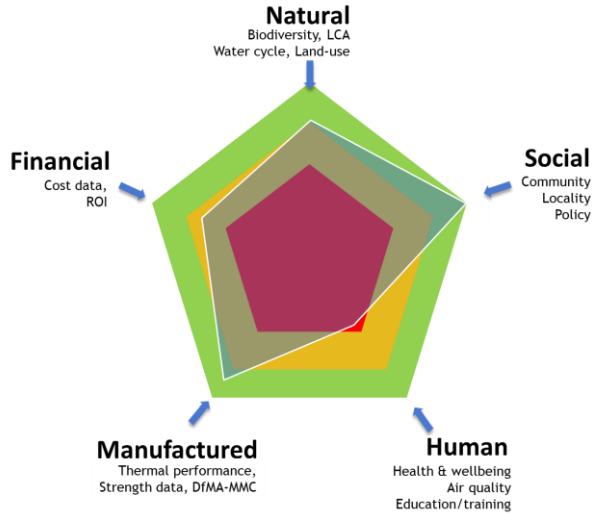
Five capitals scoring system

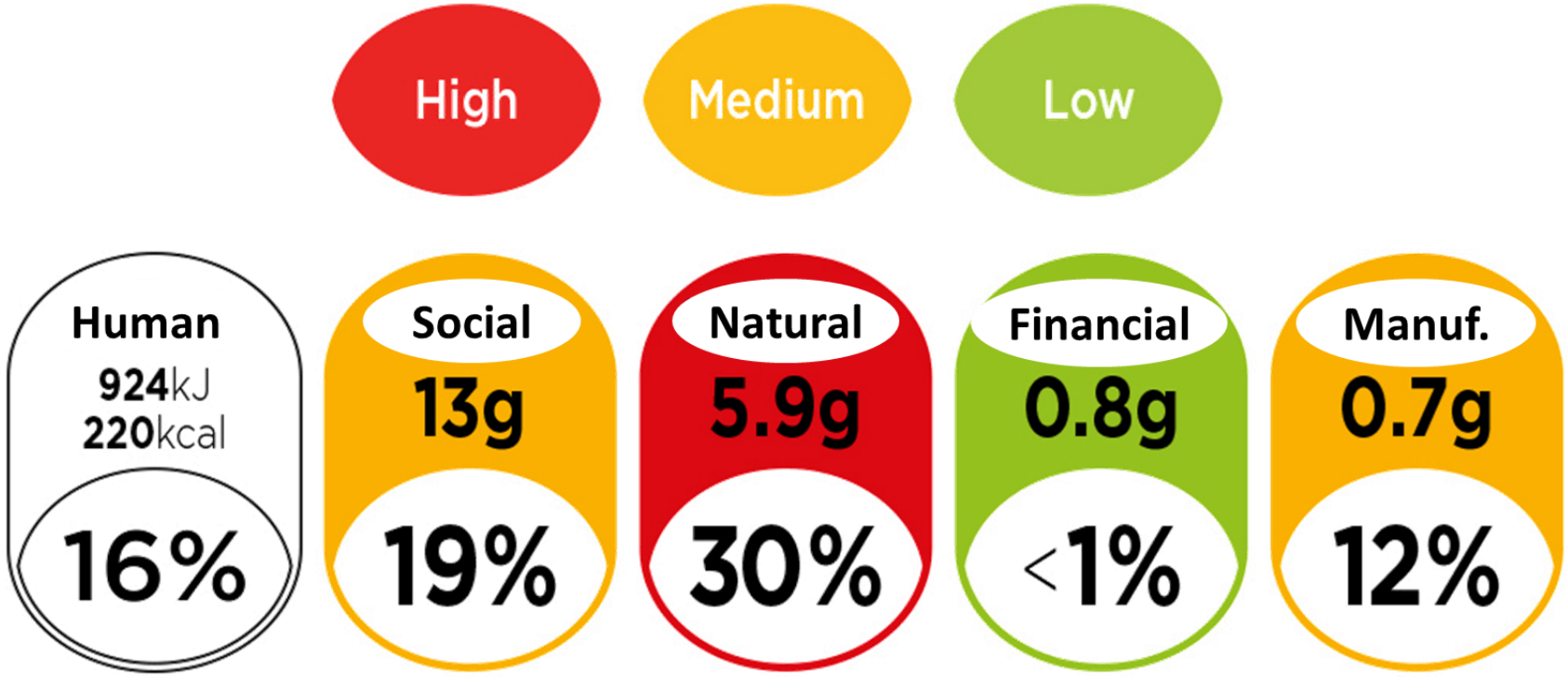




Would that be of use...?

Five capitals scoring system





of a building's reference intake

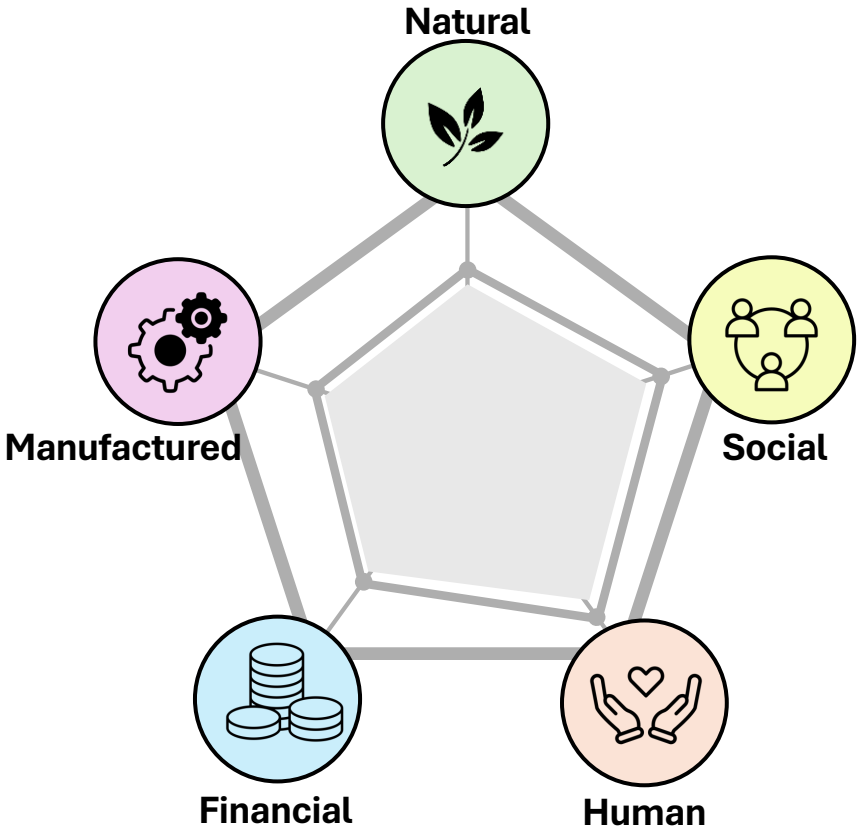
Typical values (as **built**) per **ton / m² / m³ of building**

SmartBioC

Research highlights

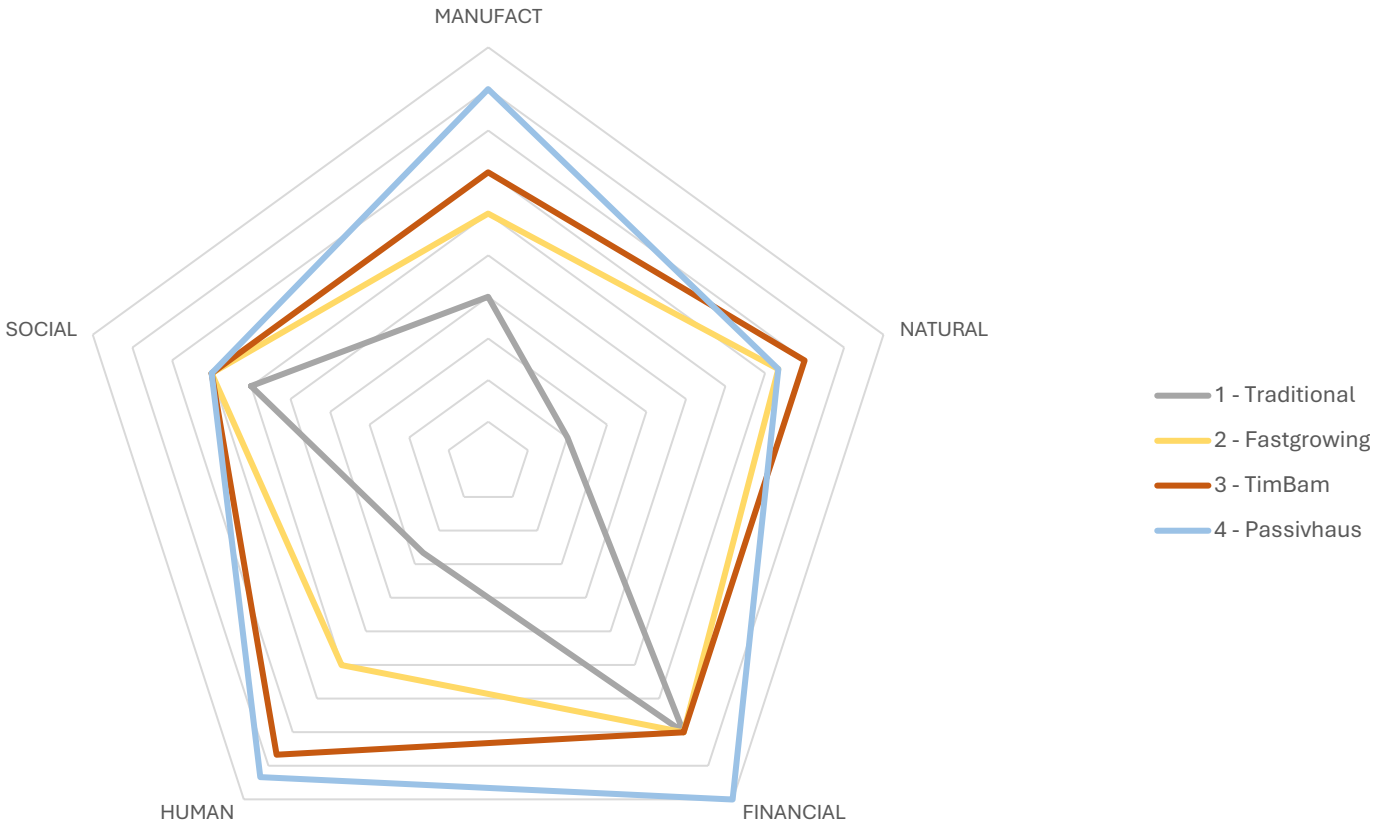
Fernanda Speciale

five capitals scoring system



results

The results generally show how the values of the alternative solutions are more widely distributed among the five capitals than the traditional solution considered



Scores for the four different wall types

MANUFACTURED

Performances

U -value

- All the options are under 0.19 W/(m^{2}K);
- Highest score awarded to those closest to Passivhaus requirements;

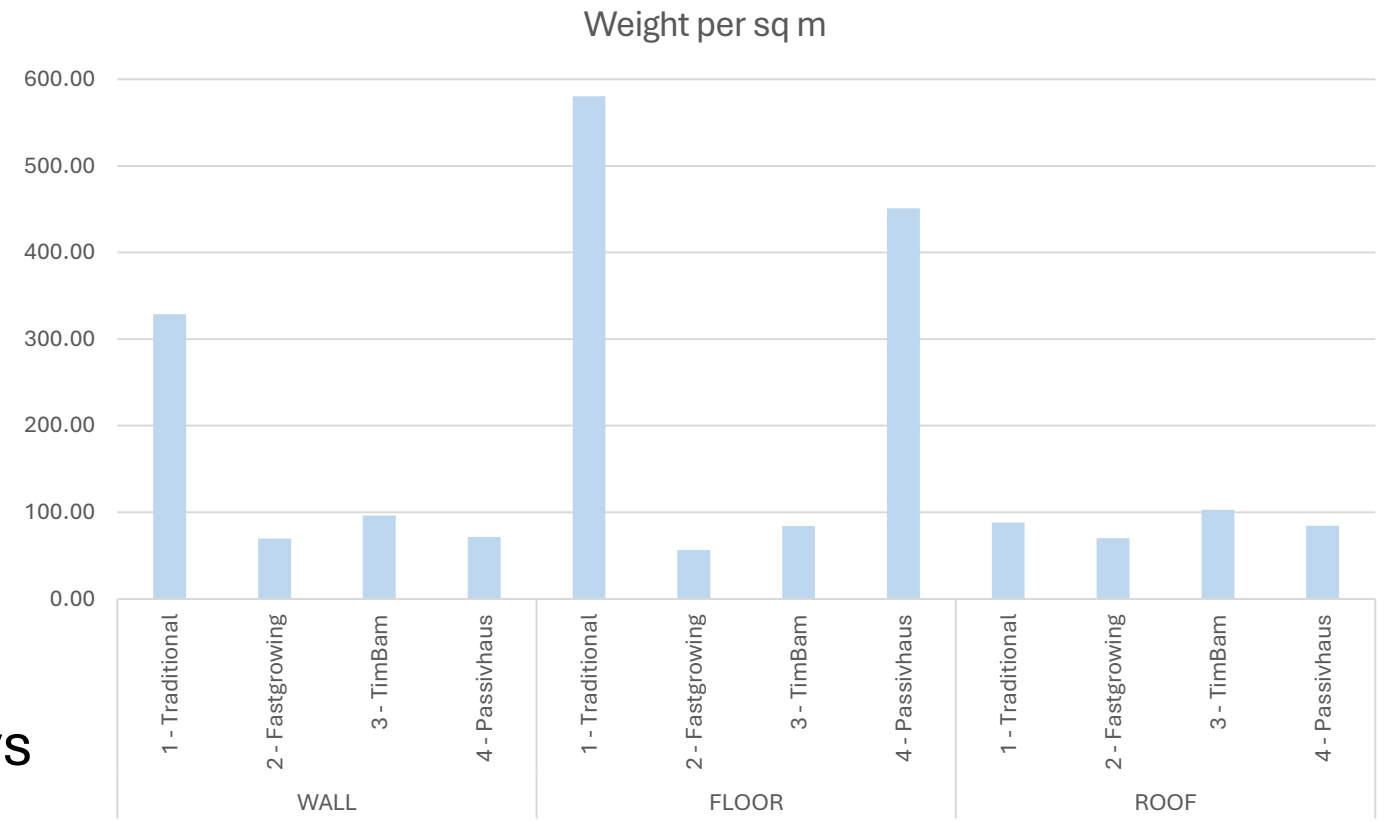
MANUFACTURED

Highlights

Lightweight Index

A lighter solution can result in reduced transport costs, reduced weight on foundations (and thus the possibility of reducing them), reduced site management costs..

- Traditional options are the heaviest, except for the roof;
- Fast growing solutions are always the lightest;

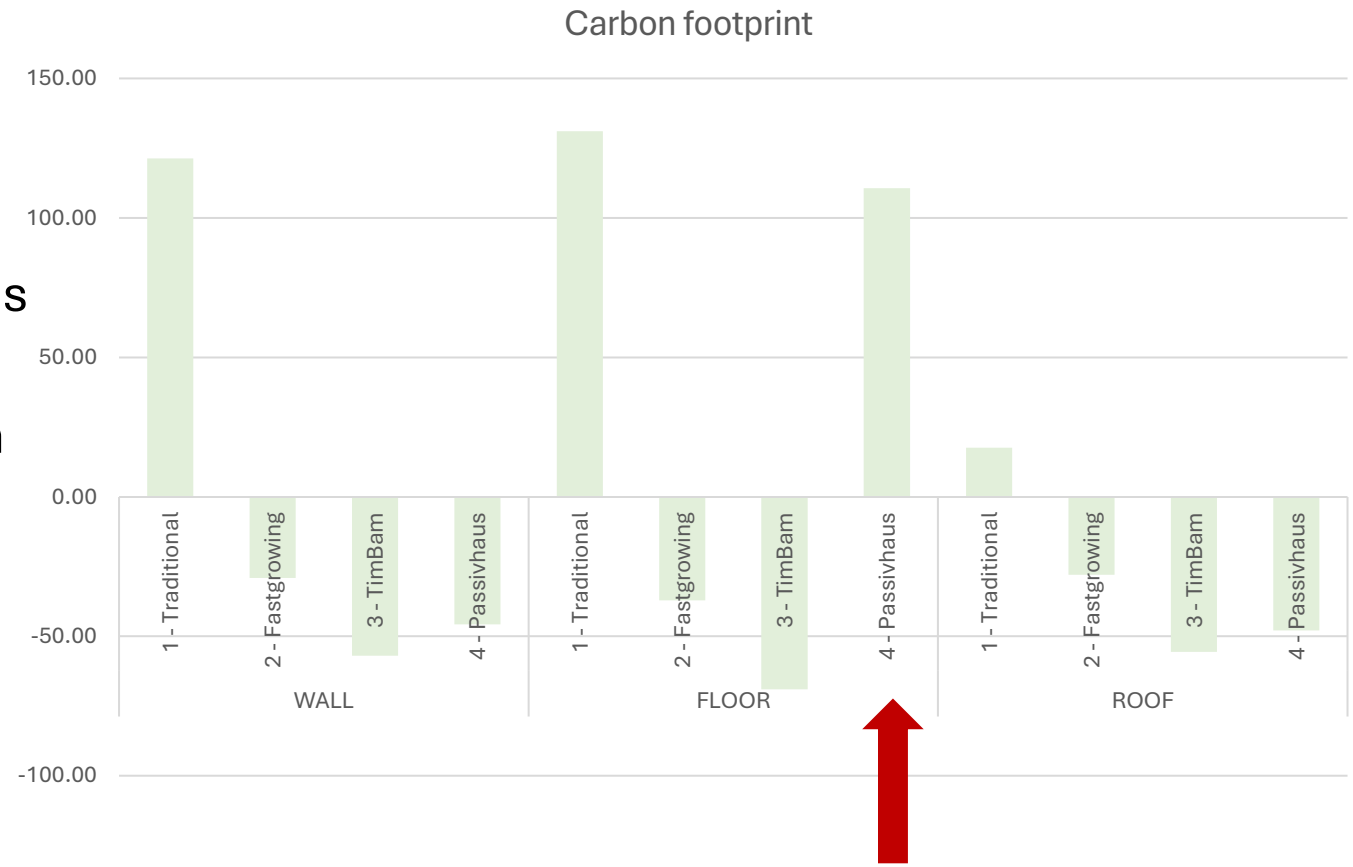


NATURAL

Highlights

Carbon footprint

- Traditional options are the ones with the highest values in all three systems;
- Passivhaus solutions have negative values when they employ bio-based materials;
- Passivhaus floor has high value of carbon footprint resulting mostly from concrete slab and PIR insulation

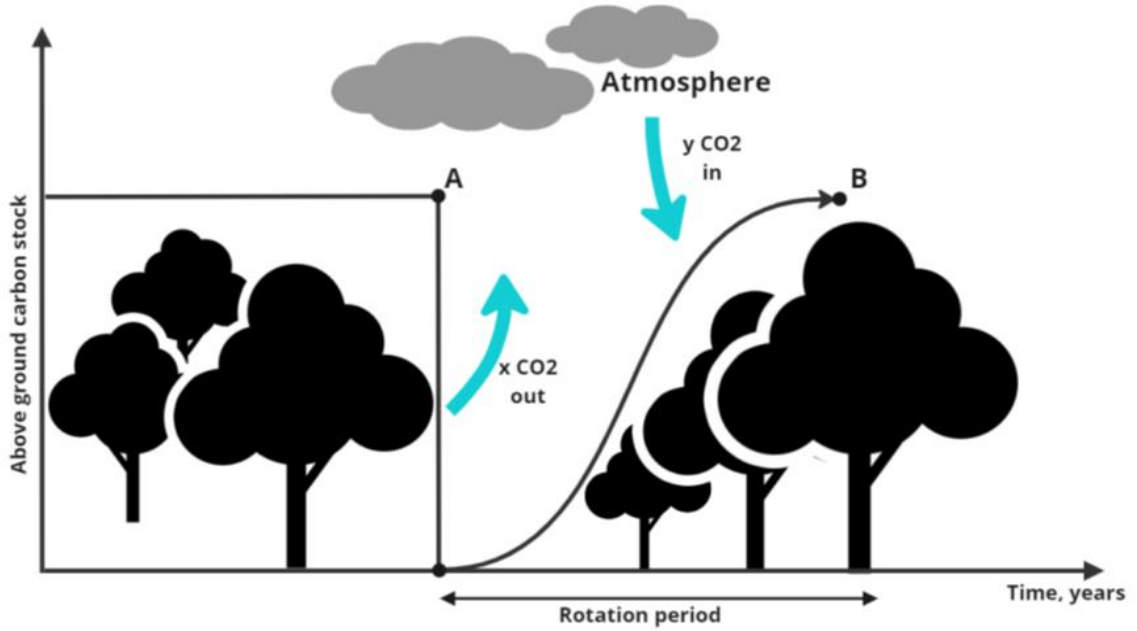


NATURAL

Responsible resources

Regenerative potential

- It measures the potential of the material to regenerate in the environment and be ready to be employed as construction material.
- For biobased materials, it is related to the rotation period of the origin biomass, highlighting the difference between fast and slow-growing species
- Synthetic and mineral materials are classified with the lowest score as considered having more than 50 years of regeneration potential



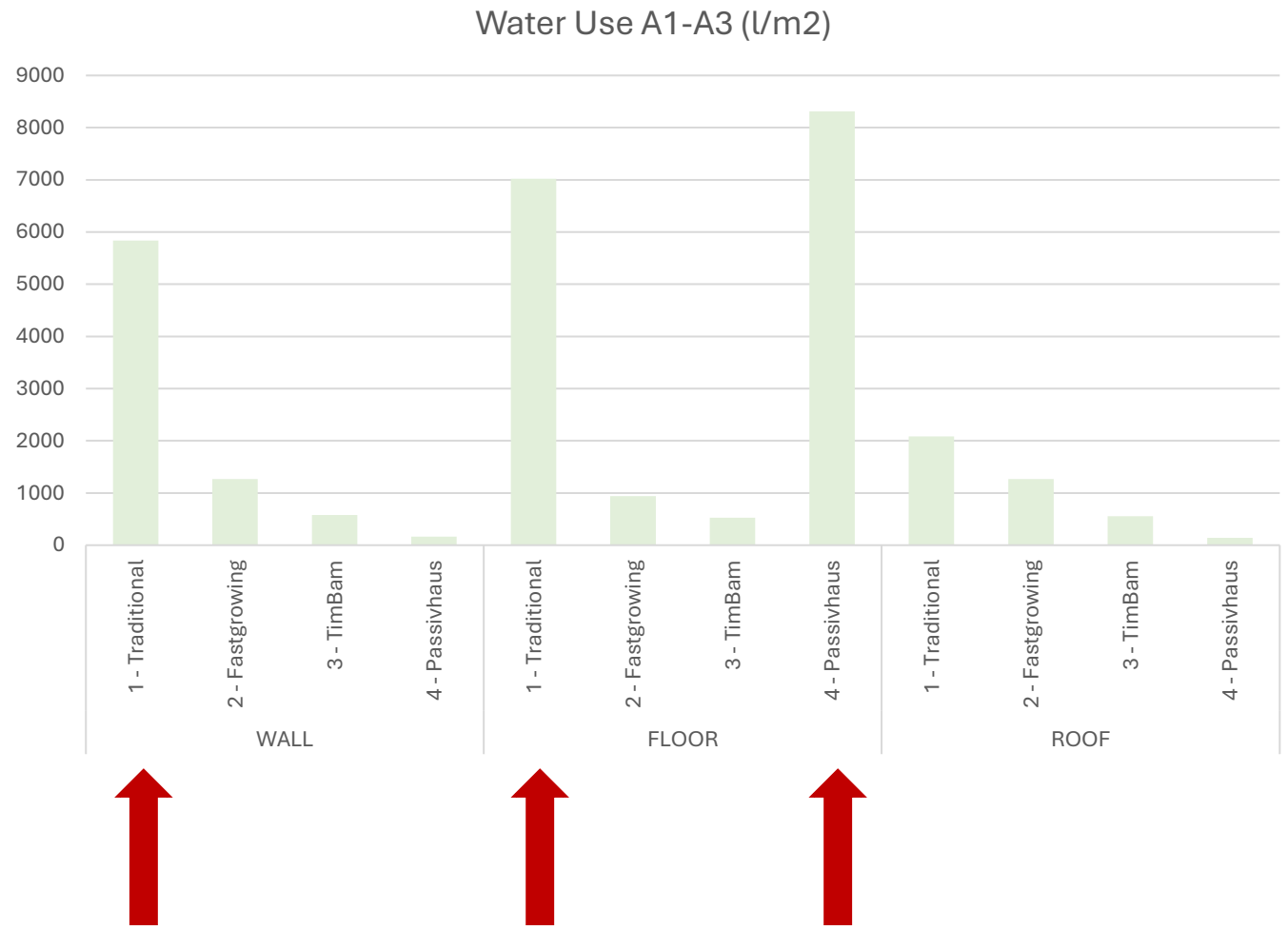
Simplified scheme of the neutral carbon flux system, personal elaboration (source: (Cherubini 2015). (a) Biomass stock at steady state; the aboveground carbon is harvested and temporarily stored in construction. Simultaneously, the same biomass is replanted and grow by sequestering the CO2; (b) the same quantity of carbon is regenerated again in the vegetation at the end of the rotation.

NATURAL

Highlights

Water use

- Measured as use of net fresh water during A1-A3 stages in terms of liters per sq m
- PIR insulation solutions request a higher quantity of water then the other insulation materials

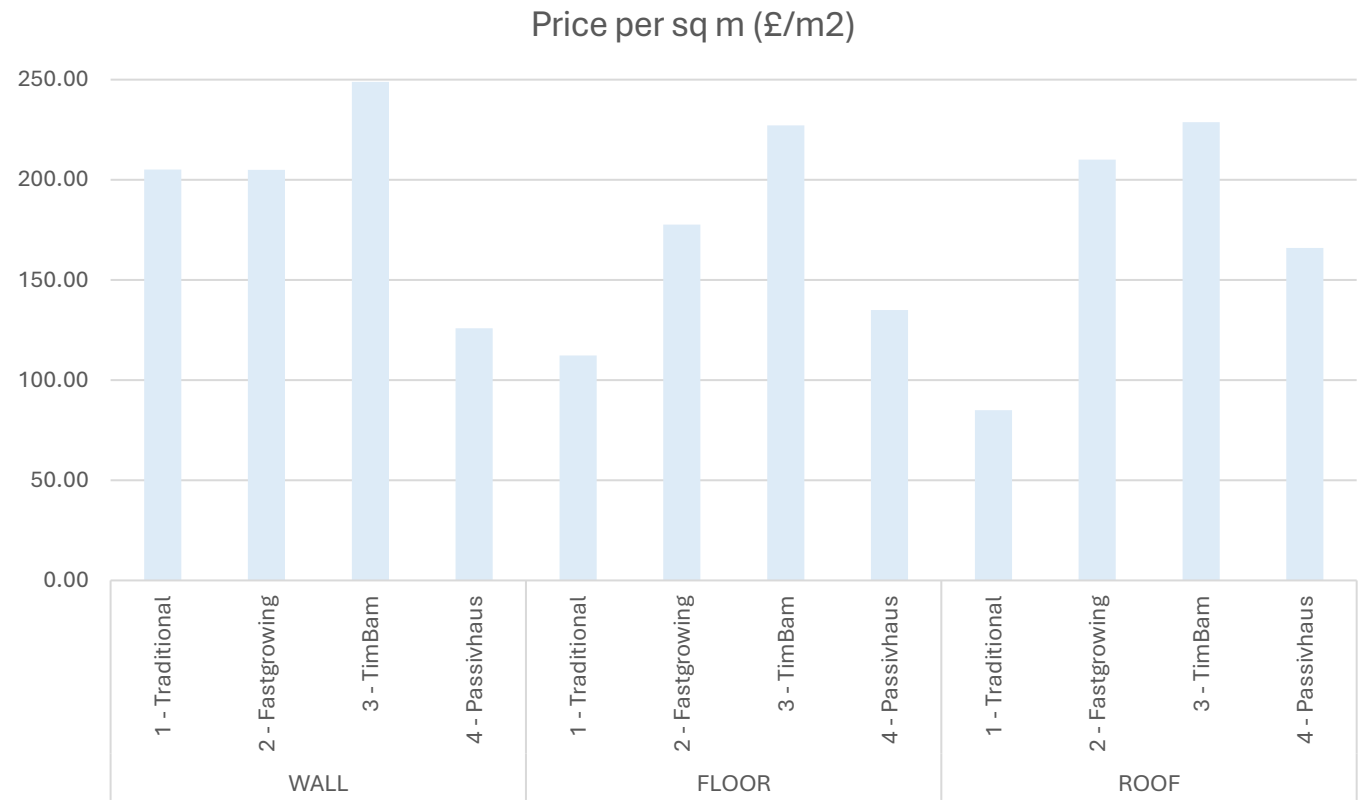


FINANCIAL

Highlights

Cost

- For the financial scores, we compare the price of the different solutions with that of the corresponding traditional solution;
- Regarding walls, the price of traditional, fast-growing and timbam is almost the same, while Passivhaus is cheaper



Social factors

SOCIAL

Categories taken in consideration:

- Health & Safety For Workers & Users
- Worker's Conditions
- Impacts On The Local Community
- Impacts On Regional Sustainability

Based on scientific researches, wip

Discussion & Networking

Everyone


SmartBio-C
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https://www.menti.com/alg3egqa47xg

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END OF THE DAY