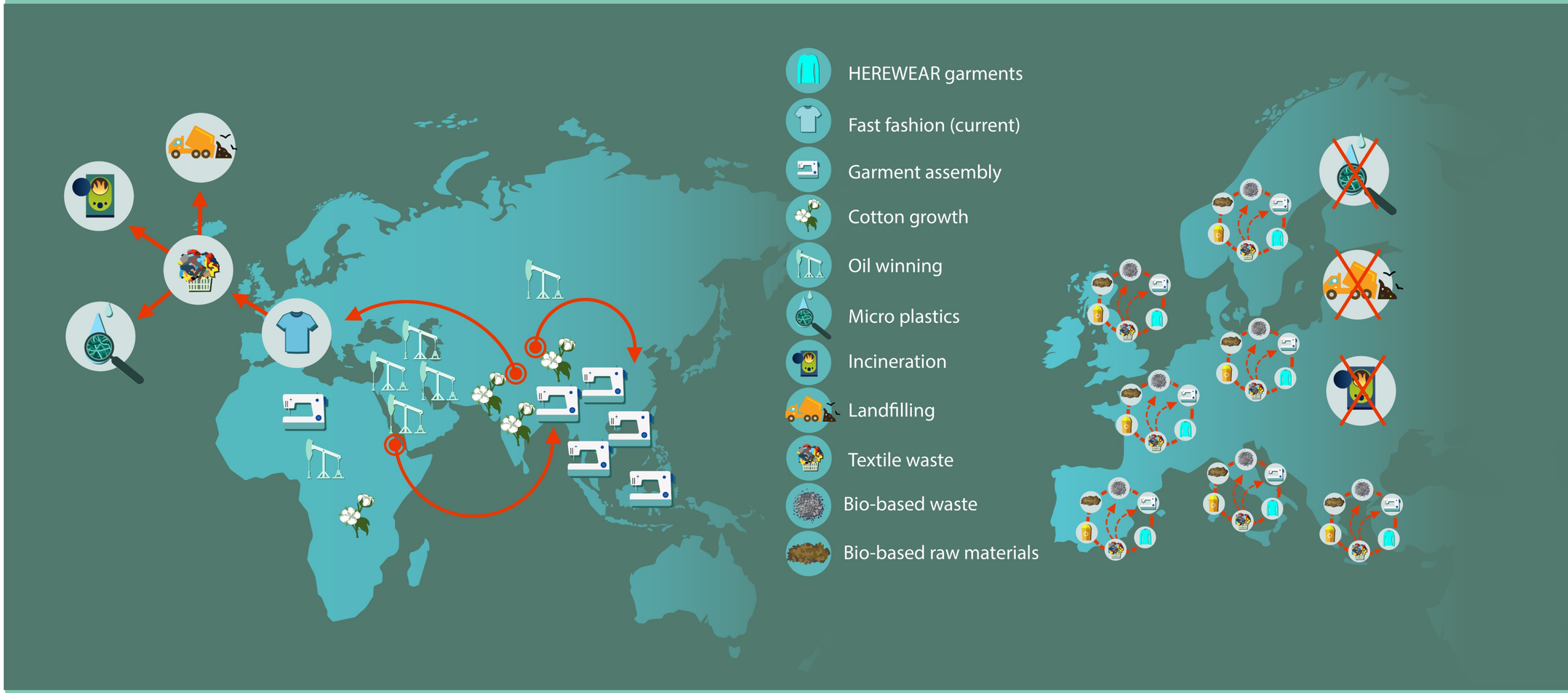
Co-designing knowledge flow for systemic innovation in textiles: Bio-based, Local, Circular

HEREWEAR

ual: centre for circular design

Dr Rosie Hornbuckle
Research Fellow: Complex Design Collaborations

HEREWEAR GOAL



ual: centre for circular design

HEREWEAR GOAL

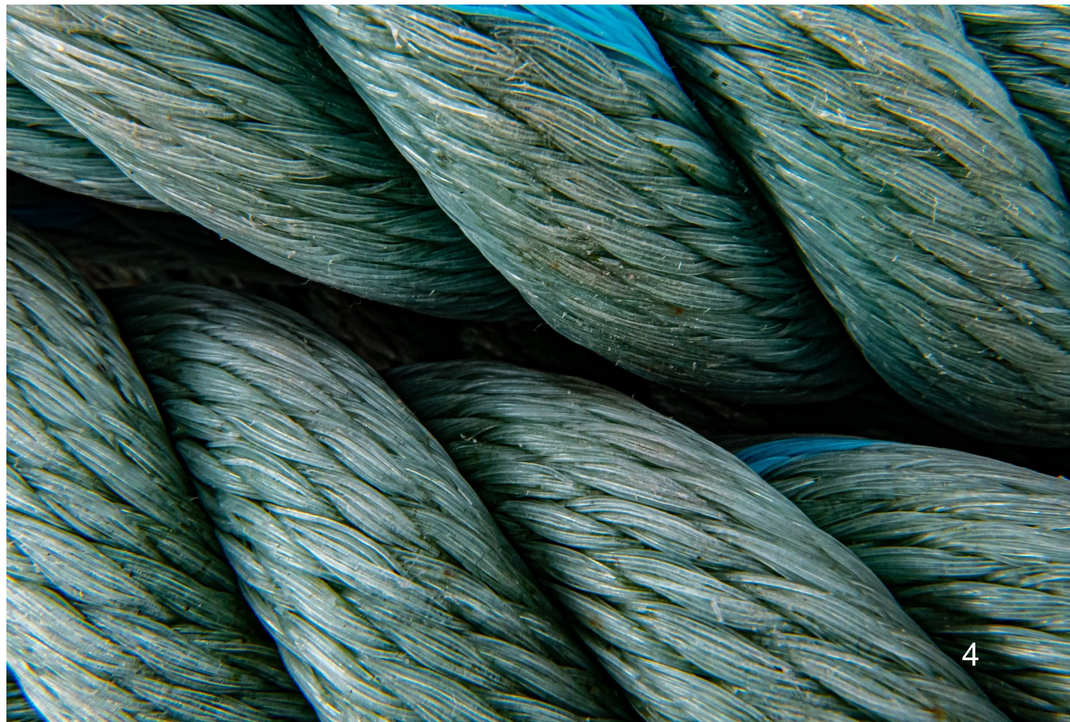
Design and manufacture clothing that is **truly sustainable** via:

- Assuring **circularity** of textiles
- Textiles made from locally-sourced **bio-based** materials/waste
- **Local** small-scale automated production and networked manufacturing

ual: centre for circular design

PROJECT DETAILS

Call	FNR-14-2020
Type of action	IA – Innovation action
Total budget	€ 6.96 mio
EC funding	€ 6.16 mio
Starting date	October 1 2020
Duration	48 months
Coordinator	Centexbel



ual: centre for circular design

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000632.

AIM AND OBJECTIVES

To create project outputs (guidelines and training materials) that address the questions, concerns and core values of the stakeholder community who we hope will adopt/adapt the HEREWEAR technologies and practices.

> Understand the partner assumptions of the value of the HEREWEAR technologies and practices

> Discover the questions, concerns and values of stakeholders in response to the HEREWEAR technologies and practices

> Provide a brief for the partners developing guidelines, to guide the generation of appropriate content

> Translate the guidelines into ‘training materials’ or other outputs, that address stakeholders’ concerns, questions and values

WHY IS STAKEHOLDER ENGAGEMENT SO IMPORTANT IN TECHNOLOGY PROJECTS?

Transition from the current paradigm to a more sustainable one, requires multiple actors to change their operations and relationships.

John Wood
https://metadesigners.org/WRITING-THE-PARADIGM?s=03

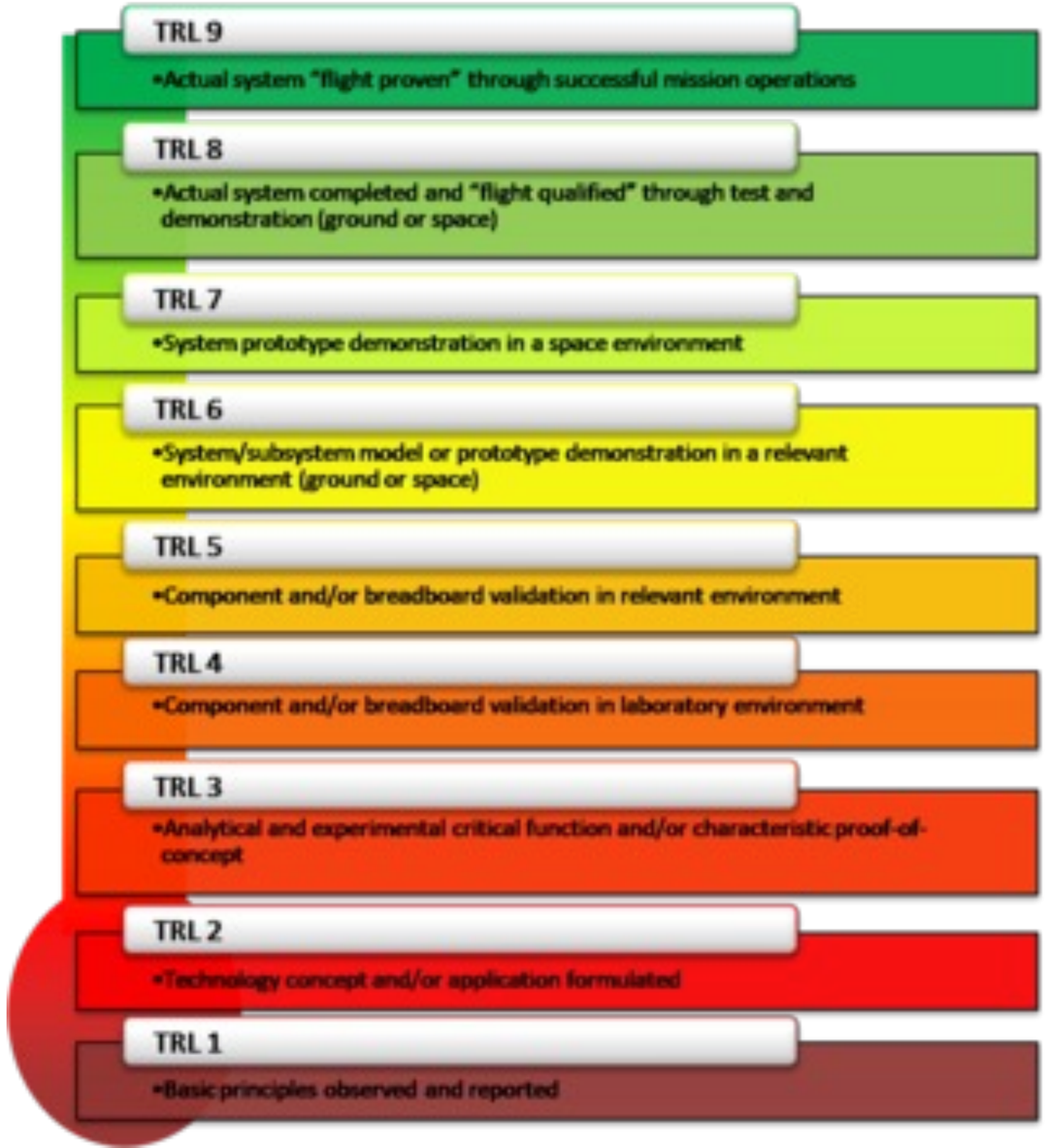
In order to change, stakeholders need to understand the co-created value that the new paradigm offers them and their wider networks...

... they will (understandably) have concerns and questions about these changes because change is unknown and risky.

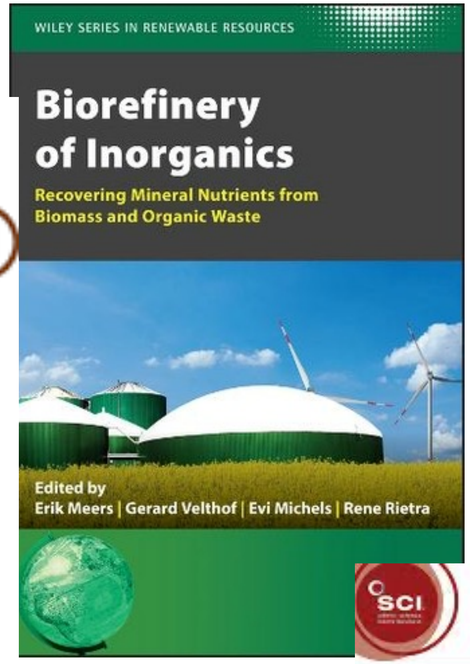
Vargo, S. L., & Lusch, R. F. (2004) Evolving to a new dominant logic for marketing. Journal of Marketing 68: 1–17.

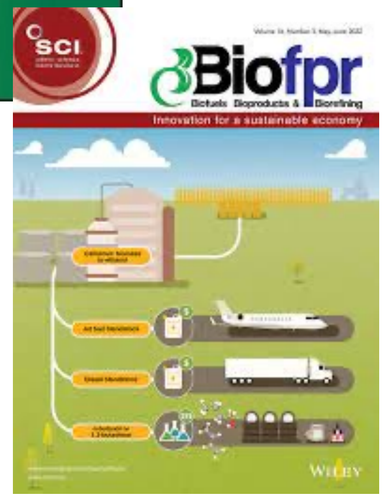
COMMUNICATION V. DIALOGICAL APPROACH TO STAKEHOLDER ENGAGEMENT

At what point, and how, do you start to talk to other other people about your technology?



COMMUNICATION V. DIALOGICAL APPROACH TO STAKEHOLDER ENGAGEMENT





COMMUNICATION V. DIALOGICAL APPROACH TO STAKEHOLDER ENGAGEMENT

“engagement can take many different forms, varying in the approach, the resource invested, the time taken and the involvement of different viewpoints. [...] rather than rely on assumptions about the potential value of the technology to stakeholders, the project could adopt an iterative methodological approach which aims to build dialogue between technology developers and stakeholders through a series of workshops and ultimately build scientific capacity. This would have a multiplier effect: building trust with stakeholders, better understanding the value and therefore being able to communicate more effectively with the public, developing an authentic narrative, and providing technology developers with insights about the value of their products to inform their future work.”

Prendiville, A., Hornbuckle, R., Fuller, S., Grimaldi, S., & Albaquerque, S. (under contract). Deep and meaningful: an iterative approach to developing an authentic narrative for public engagement.

SYSTEMIC MATERIALS INNOVATION

Project partners

Stakeholder community

Wider audiences

Hornbuckle, R. (2022) Translational Design Practices in Complex Collaborations: towards transferrable design methods for transformative innovation; Design Research Society conference, 25th -3rd July 2022 Bilbao

SYSTEMIC MATERIALS INNOVATION

RESEARCH PROCESS

OCT 2021

FEB 2022

MAR 2022

MAR-JULY 2023

OCT 2023

JUNE 2024

1. Consultation with WP Leaders & HW Industrial Partners

2. Stakeholder identification & recruitment

3. Development of co-design tools

4. External Stakeholder Engagement

5. Consolidation of co-created knowledge

6. Sharing Guideline ‘best practice’

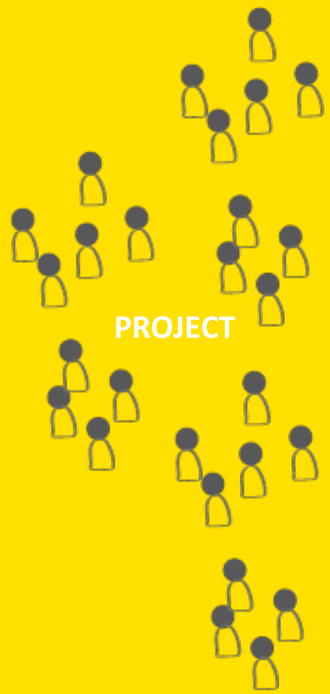
7. Feedback to partners

8. Developing the ‘brief’ and ‘template’ for HW guidelines

9. Guidelines review when writing guidelines deliverables

10. Sense-checking with community

11. Deliver impactful outputs

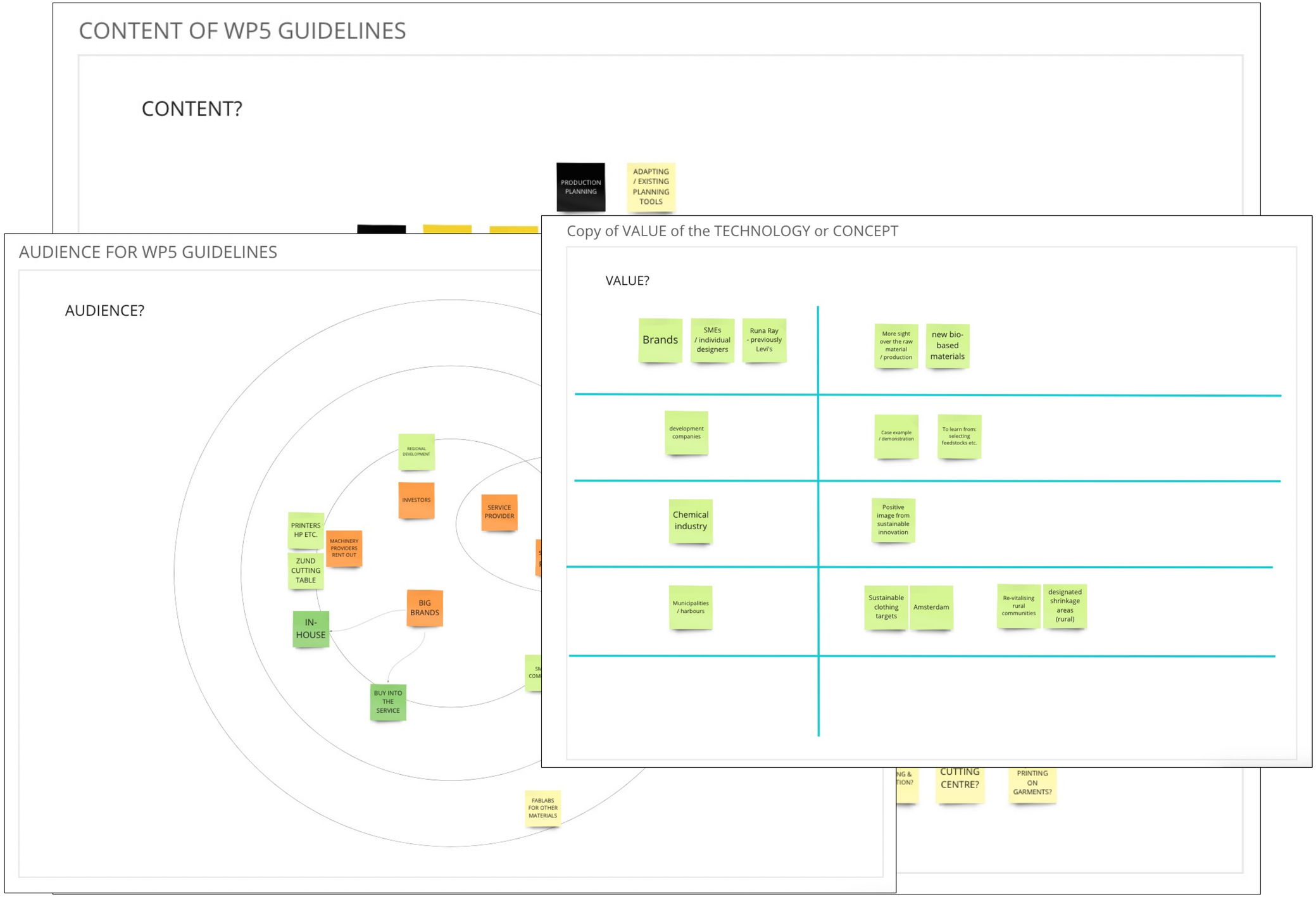


ual: centre for circular design

HEREWEAR

1. Consultation with WP Leaders & HW Industrial Partners

2. Stakeholder identification & recruitment

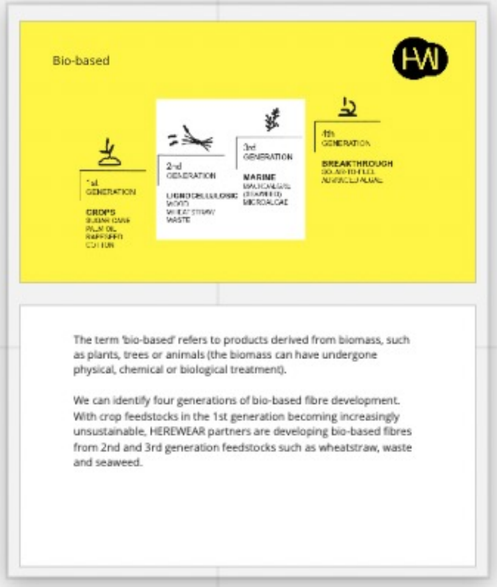


ual: centre for circular design

HEREWEAR

3. Development of co-design tools

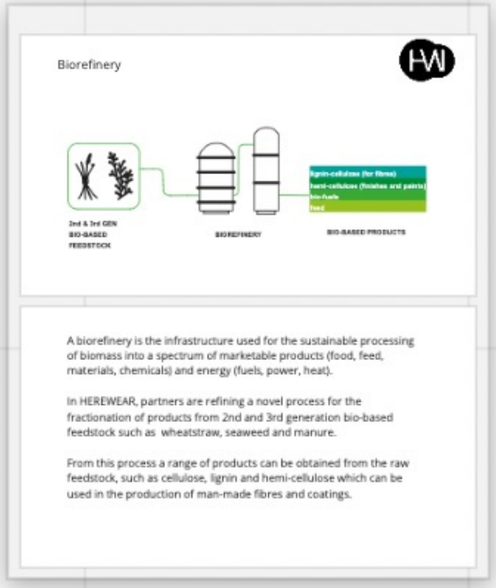
Frame 29



The term 'bio-based' refers to products derived from biomass, such as plants, trees or animals (the biomass can have undergone physical, chemical or biological treatment).

We can identify four generations of bio-based fibre development. With crop feedstocks in the 1st generation becoming increasingly unsustainable, HEREWEAR partners are developing bio-based fibres from 2nd and 3rd generation feedstocks such as wheatstraw, waste and seaweed.

Frame 27

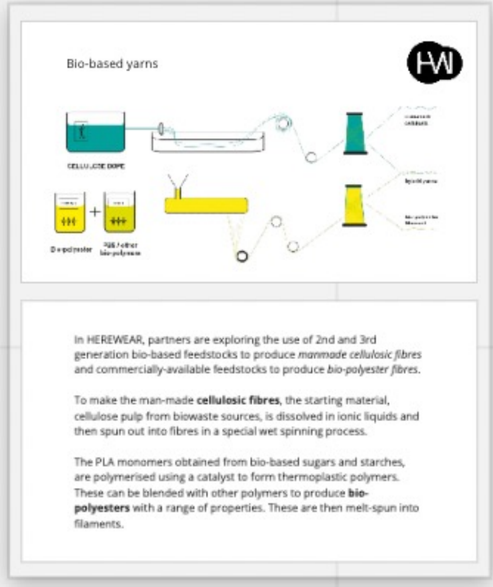


A biorefinery is the infrastructure used for the sustainable processing of biomass into a spectrum of marketable products (food, feed, materials, chemicals) and energy (fuels, power, heat).

In HEREWEAR, partners are refining a novel process for the fractionation of products from 2nd and 3rd generation bio-based feedstock such as wheatstraw, seaweed and manure.

From this process a range of products can be obtained from the raw feedstock, such as cellulose, lignin and hemi-cellulose which can be used in the production of man-made fibres and coatings.

Frame 28

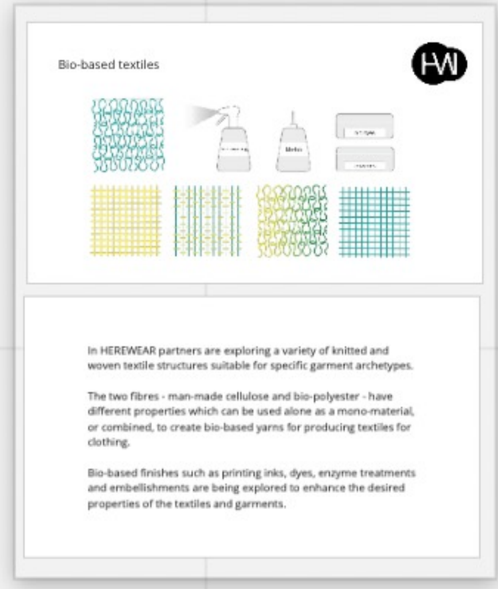


In HEREWEAR, partners are exploring the use of 2nd and 3rd generation bio-based feedstocks to produce *manmade cellulosic fibres* and commercially-available feedstocks to produce *bio-polyester fibres*.

To make the man-made **cellulosic fibres**, the starting material, cellulose pulp from biowaste sources, is dissolved in ionic liquids and then spun out into fibres in a special wet spinning process.

The PLA monomers obtained from bio-based sugars and starches, are polymerised using a catalyst to form thermoplastic polymers. These can be blended with other polymers to produce **bio-polyesters** with a range of properties. These are then melt-spun into filaments.

Frame 26



In HEREWEAR partners are exploring a variety of knitted and woven textile structures suitable for specific garment archetypes.

The two fibres - man-made cellulose and bio-polyester - have different properties which can be used alone as a mono-material, or combined, to create bio-based yarns for producing textiles for clothing.

Bio-based finishes such as printing inks, dyes, enzyme treatments and embellishments are being explored to enhance the desired properties of the textiles and garments.

Frame 25

HEREWEAR partners are exploring the characteristics of 'local' to understand how the regional context can influence the design and production of bio-based, circular textiles and garments.

Utilising locally abundant bio-based feedstocks and agricultural by-products could make economic sense, as well as enabling local communities to find additional value in their local production, based on demand and local policy.

Designing, thinking, producing, and acting locally could also support a variety of positive impacts in textiles and clothing economies. Producers, designers and end-users can more easily work together to co-create garments that are culturally relevant and sustainable, made with local materials and production technologies. Through data services users could be supported to act locally to repair or upgrade the garment, or choose places where their garment can be re-used or recycled. This would help to reduce waste and over-consumption.

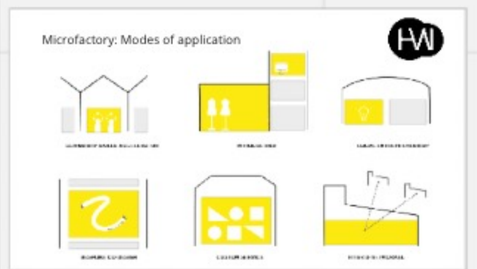
Frame 24

HEREWEAR partners are exploring the concept of the (digital textile) microfactory for local bio-based textiles and garment design and production.

There are lots of potential ways of configuring and realising a microfactory, but the key elements are local, small-medium scale, digitally integrated, and flexible production.

Digital services enable the smooth management of the production process and enable closer collaboration between producers, end-users and designers. The micro-factory concept allows more flexibility in purchasing, design and production, meaning lower volumes and bespoke services are possible. In turn, this could reduce time, logistical issues and costs.

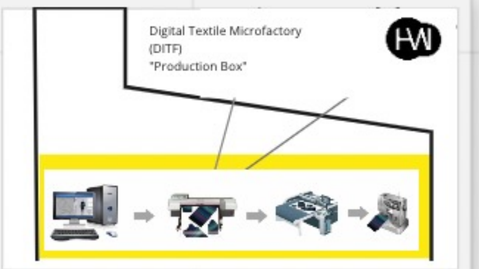
Frame 23



The 'microfactory' is a key feature of sustainable garment production as it allows for smaller orders, durability of style and sizing, and reduced pre-production waste, even zero waste. Important data is captured for full lifecycle intelligence, for example the end-user can find local lifecycle extension services and make conscious decisions about how they use garments and what to do when they are no longer wanted in their current form.

The microfactory can be conceived in different parts of the value chain depending on the business model of the adopter, it can include semi-automation, it can be entirely on one site or with some processes networked, though still digitally connected. The microfactory can also be adopted by brands as an in-house co-design service offer, for R&D, or within the community as an education, skills multiplier and social entrepreneurship enabler.

Frame 31



A digital textile microfactory is a manufacturing setup with textile and clothing production equipment, with a fully seamless integrated and automated information flow from design&configuration to process planning & preparation to production &finnishing, typically for small series and on-demand production of (personalise) textiles.

A microfactory typically covers several process stages, e.g. for digital textile printing and clothing, with technological advanced equipment.

It can be considered as "production box".

Microfactories can be scaled-up by replication rather than growing the size of a plant.

Frame 22

Frame 30

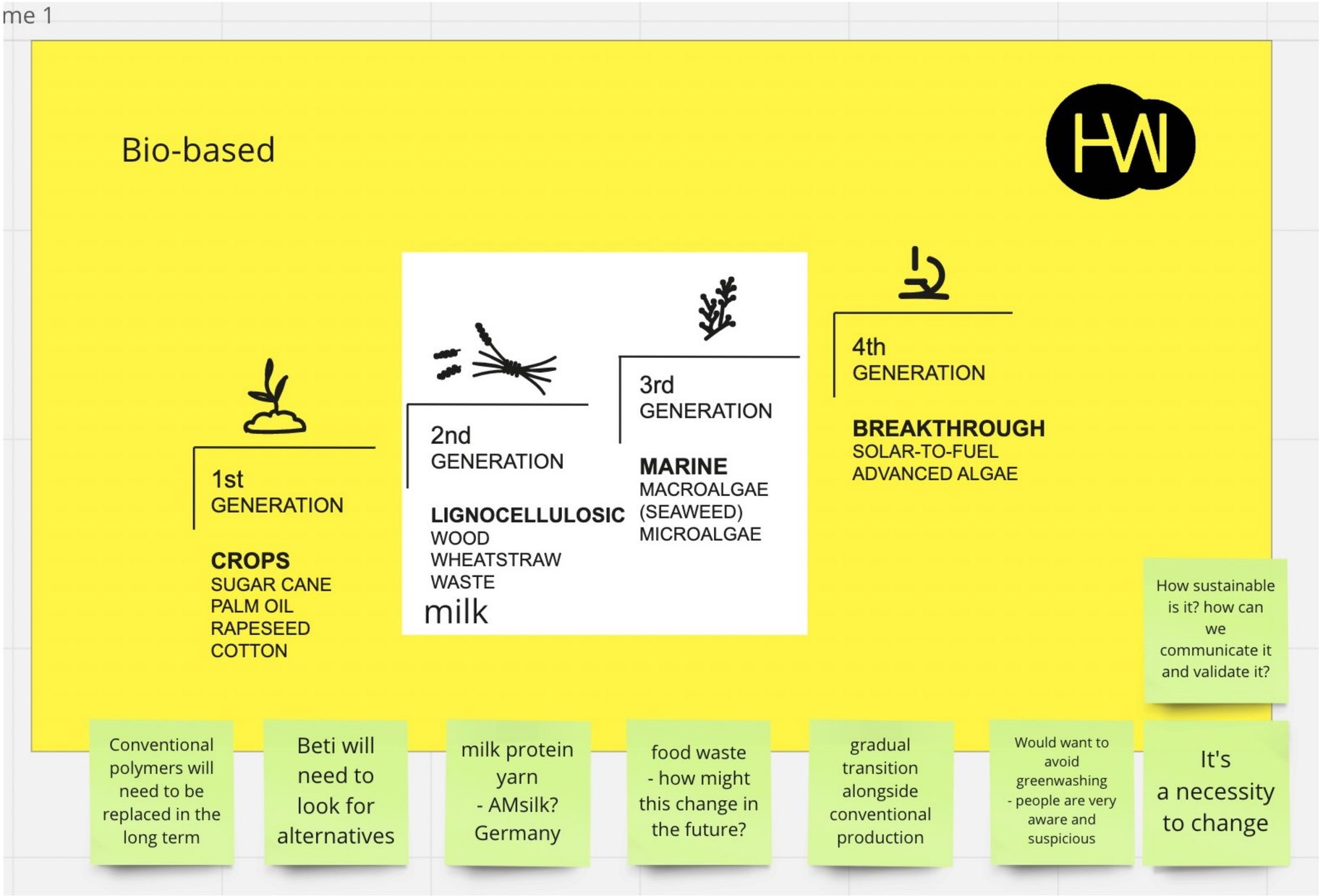
Frame 31

Frame 21

ual: centre for circular design

HEREWEAR

4. External Stakeholder Engagement



ual: centre for circular design

5.
Consolidation of co-created knowledge

6.
Sharing Guideline ‘best practice’

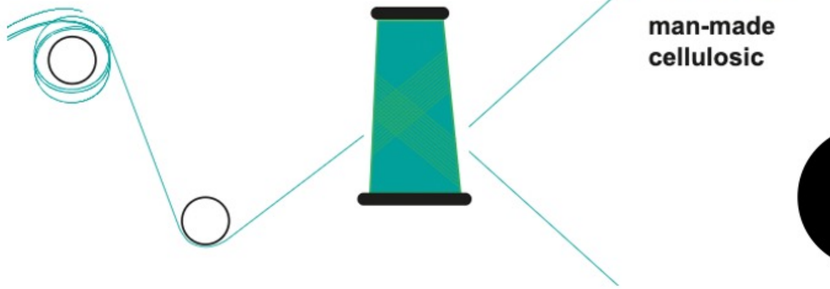
7.
Feedback to partners

[stakeholder]:
CELLULOSIC FIBRES SPINNING – HYGEINE PRODUCTS

“Many of the trends we see in our future are pointing towards bio-degradable and more EU supply”

“What about post-consumer waste as feedstock?”
“Dying, biodegradability and recycling complicated by blending CL & PLA”

“Could we have tailor-made feedstocks with longer chain lengths?”

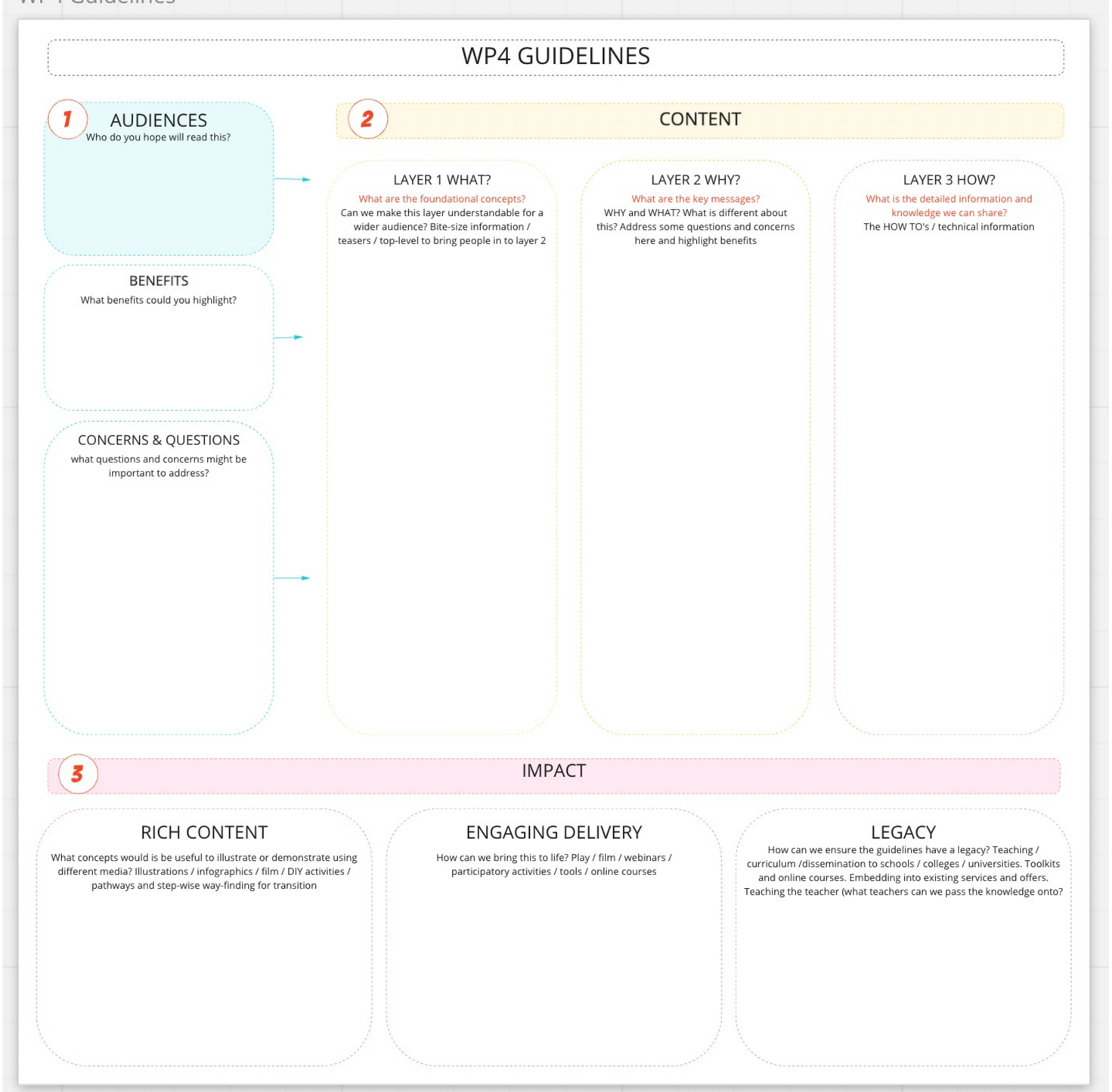


PLA could be used for non-wovens (low melt temp) tensile strength and rigidity

Is there a cost-saving for yarn spinning?
Is the quality consistent?
Is the sustainability proven?
Is it compatible to our process?
At what scale?
How many times can it be recycled?
Communicate and understand bio-cycles as well as recycling
What are the implications for working conditions and social impacts?

ual: centre for circular design

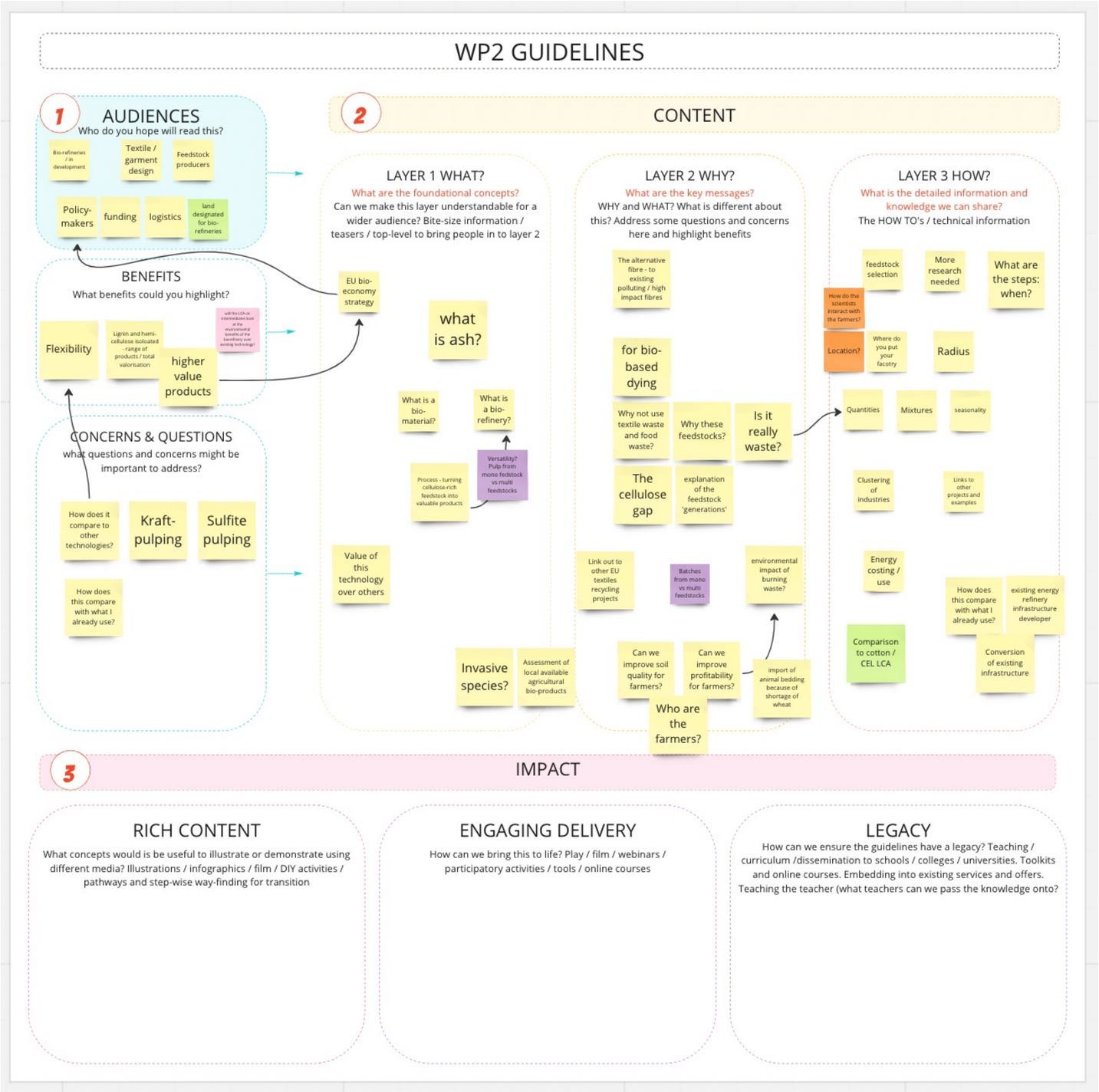
8. Developing the ‘brief’ and ‘template’ for HW guidelines



ual: centre for circular design

HEREWEAR

9. Guidelines review [at the point of writing guideline deliverables]



ual: centre for circular design

WHAT HAS BEEN THE IMPACT SO FAR?

- Integration of roadmaps into guidelines
- Social aspects of microfactory being explored
- Building an introductory framework to simplify the concepts and answer first questions: ‘is it really waste?’
- Development of clear language around ’bio-based’ ‘how do we communicate this with our networks?’
- Development of systemic concepts: location, reconfiguration of supply chains, new roles and ways of working.

CONCLUSIONS (SO FAR)

- Many of the stakeholder questions and concerns will be addressed through the framing of the guidelines rather than through changes to the technical content;
- By giving stakeholders a voice in the project, we have have helped shape discussions and researchers' ideas about what is possible and desirable in the translation of their technology to industrial practice;
- It has exposed researchers to alternative perspectives from system actors they may not have engaged with before;
- It has set up a dialogue between stakeholder value and the technology development.

r.hornbuckle@arts.ac.uk