APPLIED DDMI

A WHITE PAPER ON HOW DESIGN-DRIVEN MATERIAL INNOVATION METHODOLOGY WAS APPLIED IN THE TRASH–2-CASH PROJECT

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TRASH
CASH

Foreword

Trash-2-Cash was a European collaborative research project funded by the European framework program Horizon 2020. The project was granted to 18 partners from 10 European countries and investigated new sustainable chemical regeneration and recycling technologies for textile waste, applying a design-driven material innovation methodology. The project ran from 1 June 2015 to 30 November 2018.

OUR CHALLENGE
Textile waste and its disposal is a growing problem in the European Union. Design has been identified as being able to contribute to helping overcome this problem, by working closely with new technologies that can process waste and make new materials. The idea of bringing design, science and industry partners together to explore how high-quality regenerated materials could be co-created from waste was the focus of this project; a timely, yet complex, challenge. Using three emerging technologies, Trash-2-Cash would bring the textile supply chain in to the same room, time after time, to work out how this jigsaw puzzle of creative change could fit together.
The project answered a call for proposals that from the European Commission in December 2013, on the topic of materials solutions for use in the creative industry sector.

BRINGING OUR PARTNERS TOGETHER
Research Institutes of Sweden (RISE) and Technical Research Centre of Finland (VTT) had previously made contact about a possible project proposal based on research with sustainable cellulose regeneration techniques using wood cellulose at the both Scandinavian research institutes. Successful results on cellulose dissolution and regeneration could potentially be applied on cotton and cardboard - as these are also cellulose-based - in order to recycle the waste cellulose fibres. This could be a sustainable

way to recycle discarded waste cotton; currently down-cycled into lower-performing products or incinerated for energy recovery. Also, since the cotton production issues include non-sustainable water and pesticide use this would constitute large resource savings and less use of toxic chemicals. VTT had earlier been collaborating with its neighbor Aalto University and their Department of Chemical Technology on cellulose regeneration and could see that their process - the Ioncell technology - also could be very interesting to use for cotton recycling purposes.

VTT took part in a brokerage event in Brussels during December 2013 where a range of interesting partners were present. As a result of the event, a number of partners that could contribute and benefit the project were invited in: Material ConneXion Italia (MCI) was identified as the partner that could be responsible for the methodology development, having just participated in another European project on design-driven material innovation (Light.Touch.Matters). Söktas, Tekstina, and Reima joined the project as end-producers and Maier, Celanese SOFTER and CIDETEC also came on board to explore polyester recycling and plastic parts manufacturing. Thanks to MCI, GradoZero Innovation and VanBerlo, (also partners in Light.Touch.Matters), joined the proposal.

In 2014, RISE already had three years' experience in leading an interdisciplinary research program about sustainable fashion, Mistra Future Fashion (funded by the Swedish national funding agency Mistra). The program is working towards a systemic change in fashion, including design, recycling technologies, supply chains and consumer behavior. Through the program, RISE had been working with University of the Arts London since 2011; they were leading the textile design research in the program and were subsequently assigned to lead the communications work for the proposed project. Copenhagen Business School was also part of the program and a role was identified in the project proposal on behavioral research. SOEX and Swerea IVF were invited in as interesting partners on textile waste collection, sorting and polyester recycling.

Having created a strong cluster of interests and using the networks of the partners, Aalto University School of Arts, Design and Architecture was invited to join the project to contribute to the design research work. Finally, TEKO was invited to the project as a representative for associations in the textile industry.

OUR RESULTS
Together we created the Trash-2-Cash project, co-creating the processes of moving from a proposal in to the three project cycles and to the creation of final outcomes in the form of mastercases. It was a hugely rewarding project for all involved. To create new solutions for the fashion, textile and interior automotive industries, reducing waste and creating economic value at the same time is an enormous challenge. It's one that can only be met by bringing everyone together, and supporting them as they learn to work well, focusing on finding ways around shared barriers. You will learn all about this unique collaboration and the development of the Design-Driven Materials Innovation (DDMI) methodology in this White Paper. We invite you to use it to support your own collaborations; we hope you will use it to tackle waste and new material challenges, in your own creative ways.

Dr. Emma Östmark
Director, Sustainable Textile Fibres
Project Co-Ordinator, RISE

Stockholm, November 2018

GLOSSARY & ACRONYMS

DELIVERABLE [D]
In the funding programmes, it means a distinct output of the project, meaningful in terms of the project's overall objectives, and constituted by a report, a document, a prototype, etc.

DESIGN-DRIVEN MATERIAL INNOVATION [DDMI]
A process aimed to introduce design inputs within the research and technological development (R&D) of emerging material technologies (EMTs) at early stage. DDMI involves a creative and iterative process, which uses design thinking and design facilitation to collaboratively open future possibilities, to construct a shared goal and to select best ideas for implementation.

EMERGING MATERIAL TECHNOLOGIES [EMTS]
Innovative materials and related processing technologies that have not reached a full level of development either do not have a well-defined technological maturity or have not found an application that fully exploits their potential.

MASTER CASE [MC]
Master Case is a design concept selected to be the one ready for the new product development, prototyping and in-depth analysis for industrial scalability and validation. MCs represent also the interdisciplinary results of T2C process, they combine all knowledge from different streams and are composed by design briefs including all kinds of specifications (R&D, manufacturing, circular process, etc.), different kinds of prototypes (from fibres level to yarn, textile structures and products), product design specifications, storytelling and communication strategies, business models, LCA flowcharts, and industrial process flowcharts.

MATERIAL REQUIREMENTS
Material requirements are not material properties or technical specifications but challenging design requirements to characterise the emerging material. They match in the theoretical range of technological feasibility but may not be achievable in the near future.

MILESTONE
In the funding programmes, it means control points in the project that help to chart progress. Milestones may correspond to the completion of a key deliverable, allowing the next phase of the work to begin. They may also be needed at intermediary points so that, if problems have arisen, corrective measures can be taken. A milestone may be a critical decision point in the project where, for example, the consortium must decide which of several technologies to adopt for further development.

SCENARIO
Scenario is intended as a strategic vision or context of design intervention, a statement from which designers are able to create design briefs (from which come the concepts, that are project proposals). A scenario is a theme that will drive future applications/design of the emerging material. It sets the context. The main aim of scenario is to give the opportunity to material researchers and designers to question the primary design idea and material requirements in terms of technological directions.

WORK PACKAGE [WP]
In the funding programmes, it is a major sub-division of a proposed project. A WP consists of several tasks.

WORK PACKAGE LEADER [WPL]
In the funding programmes, a WPL is the responsible of a WP.

WORKSHOP [WS]
In Trash-2-Cash this was a 2-day periodical meeting involving all participant-representatives from each partner. Workshops represent a key asset to set up and developing the interdisciplinary dialogue among the different competencies involved into the project. Each workshop is experimental and exploratory, and is set up as a "platform of discussion" referring to design culture and tools, having the aim to: support the decision-making process using both logical and intuitive approaches; developing effective knowledge transfer activities with fruitful hands-on sessions aimed at specific inputs-outputs; to achieve common decisions and address technical and/or R&D issues that are difficult to resolve using online communication.

CONTENTS

1   TRASH-2-CASH PROJECT AND THE DDMI

1.1 Premise

This report describes how the Trash-2-Cash (T2C) project has been formulated and developed using a design-driven process to achieve material innovation in a specific context and taking into account specific processing technologies, disciplines and competencies. Mainly it is focused on how the interdisciplinary and knowledge sharing approach has been mediated by design, involving the implementation of an experimental and exploratory applied methodology. The main aim of the applied methodology has been to integrate design inputs, fed by life cycle, consumer behaviour and manufacturing expertise, into materials R&D in order to contribute towards closing a specific innovation cycle.

A group of facilitators and design researchers (named "Methodology Team") supported the development of the interdisciplinary process, and the contents of this report represent the perspective of the facilitators. The whole process has been observed, monitored and studied in order to elicit some final recommendations for future Design-Driven Material Innovation (DDMI) initiatives. A sum up of these recommendations is presented in this paper, the full research analysis and results are included in a confidential report titled "D3.7 – Knowledge for the Applied Methodology".

The first part of this paper introduces the T2C project and the DDMI methodology, both in relation with the project and as a general concept. A final process scheme completes this part, representing a generalisation and conceptualisation of what occurred during the whole DDMI process. Twelve interdisciplinary workshops have been a key asset to set up and develop the interdisciplinary dialogue and knowledge-sharing among the different competencies involved in T2C project; they have been crucial for the development and implementation of the applied DDMI methodology. The relevance of the workshops is such that most of this white paper is dedicated to the description of what happened during these meetings, how they have been designed, and what tools have been used. The conclusive third part of the report presents the final recommendations: the

DDMI Recommendations Map comprising 32 core recommendations derived from the research as a whole, relating to four themes: Project, Knowledge & Information, People & Roles, and Tools. These are mapped to the general T2C process scheme. The circularity and Life Cycle Thinking represent the other body of knowledge related to the DDMI process in T2C, included in the third part the main findings[1].

The report contains several footnotes that refer to other project reports and deliverables, most of them are confidential, i.e. accessible only to the members of the project consortium and of the European Commission Services. Any way the design research conducted on methodology has been published broadly in academic contexts considering different perspectives and approaches. The list of publications can be found in Annex 4 for further study [2].

The authors tried to generalise and conceptualise the information contained in this white paper in order to provide useful information, inputs, and insights to organisations and professionals interested in replicating the methodology in other fields, industries, technology fields, beyond those explored in theT2C project. It is also hoped that other researchers can adapt this knowledge to the circumstances and context of the projects they are planning or working on.

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(1) More information can be found in report D.3.7 – confidential and report D.3.5 – confidential
(2) Several design scientific papers has been published and will be published on the subject, updated information can be found on Trash-2-Cash website: https://www.trash2cashproject.eu/

1.2 Trash-2-Cash project

Trash-2-Cash is a European Union funded project under the Horizon 2020 research programme.
The project proposal was submitted for the call "NMP-18-2014 Materials solutions for use in the creative industry sector"(3). The call addressed the development of innovative material solutions for use in the creative industry sectors based on post-consumer waste or process by-products to produce new materials. A sustainable and socially responsible approach to reduce energy consumption and environmental impact were to be clearly demonstrated, as well as proof of concept in terms of product and/or process were to be delivered within the project, convincingly demonstrating scalability towards industrial needs.
The full title of the T2C project is "Designed high-value products from zero-value waste textiles and fibres via design-driven technologies" and its active funded period has been June 2015 to November 2018.

TRASH-2-CASH PROJECT STATISTICS:

TOTAL PROJECT BUDGET: **8,928,994.75 €**
EU CONTRIBUTION: **7,933,461.00 €**
DURATION: **42 MONTHS**
START DATE: **1 JUNE 2015**
END DATE: **NOVEMBER 2018**
17 PARTNERS FROM **10** COUNTRIES
9 WORK PACKAGES
3 MILESTONES
+90 DELIVERABLES

THE OBJECTIVES

The project aimed to face growing problems with textile waste developing new materials and methods for a more sustainable textile industry. The main objective was to create added value materials (textiles, plastics and reinforced plastics) from pre-consumer and post-consumer textile waste feedstock, and from these materials to develop innovative new products in the clothing and automotive industry. These materials would not be only "waste-based" but also have characteristics which translate into desirable products with sustainable business models, which mean they remain in use for longer as well as being designed for future recycling processes.
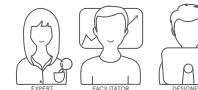The general goals of the project were to:
- integrate design, business and technology into a coherent discipline to establish new creative industries;
- develop new material and product opportunities via creative design from waste or process by-product
- reduce the utilization of virgin materials;
- improve material efficiency, decrease landfill volumes and decrease the energy consumption;
- use design for recycling with the vision of closing the material loop;
- create new business opportunities by adding the return loop of the discarded goods to be recycled into attractive products;
- promote development of the creative sector by providing technological solutions for exploitation of waste streams;
- demonstrate viable technical routes for value-chains in the creative industry.

THE CONSORTIUM

The interdisciplinary collaboration in T2C project has involved 17 partners from 10 countries. This consortium formed a cross-disciplinary team of designers, design researchers, material scientists, and manufacturers and in combination with the specialist on behavioural research and cost and environmental analysis they constitute the full consortium. The 17 partners has been chosen to represent a large section of textile supply chain. However, the expertise of the consortium is far more complex than the above simple categories would suggest. Each partner's main role in Trash-2-Cash is outlined in following table.

COUNTRY	PARTNERS	ROLE
Sweden	RISE The Swedish Research Institute (Coordinator)	Development of new cellulosic materials, LCA, project management, Sorting technology, future recycling studies
	TEKO Swedish Textile & Clothing Industries' Association	Industry Engagement
	SWEREA IVF-RISE The Swedish Research Institute	Polyester fibre regeneration, spinning, nonwovens
Finland	VTT Technical Research Centre of Finland	Raw material pre-treatments, feasibility study of research hypothesis
	REIMA Children's outdoor clothing company	Design and prototyping [end-user insights]
	AALTO UNIVERSITY Chemical Engineering and Design departments	Cellulosic fibre regeneration, fibre spinning. Design research, knitting, material liaison, workshop facilitation
Italy	GRADO ZERO INNOVATION Advanced materials research and prototyping company	Advanced materials research, material liaison, product design, prototyping scalability, validation
	MATERIAL CONNEXION ITALIA Consultancy company	Lead facilitator, project flow and integration of disciplines, design thinking, material liaison
	SO.F.TER-CELANESE Thermoplastic materials manufacturer	Plastics upgrading [chain extension]
Spain	CIDETEC Applied research organization	Reinforced plastic research, validation, prototyping
	MAIER Aesthetical plastic automotive parts supplier	End-user automotive insights, product design, prototyping, validation
Netherlands	VANBERLO Design agency	Design, workshop facilitation, design thinking
United Kingdom	UNIVERSITY OF THE ARTS LONDON Centre for Circular Design	Communication and exploitation, design research, prototyping, lifecycle thinking, workshop facilitation
Denmark	COPENHAGEN BUSINESS SCHOOL	Sustainable consumer behaviour research
Turkey	SÖKTAS Fabric design and manufacturing company	Cotton and cellulosic weaving, printing and finishing, validation
Slovenia	TEKSTINA Fabric design and manufacturing company	Cotton and cellulosic weaving, printing and finishing, validation
Germany	SOEX GROUP Collecting, recycling, trading company of used clothes	Waste textile collection, supply and sorting trials

THE TECHNOLOGIES

The T2C project focused on two different categories of materials present in textile waste, that is polyester and cotton, working with three different state-of-the-art textile recycling technologies: a newly developed eco-efficient cotton fibre regeneration process (Cellulosic Regeneration), a new polyester regeneration technology (PET De-Re-polymerisation) and a polyester recycling technique (Chain Extension Upgrading).
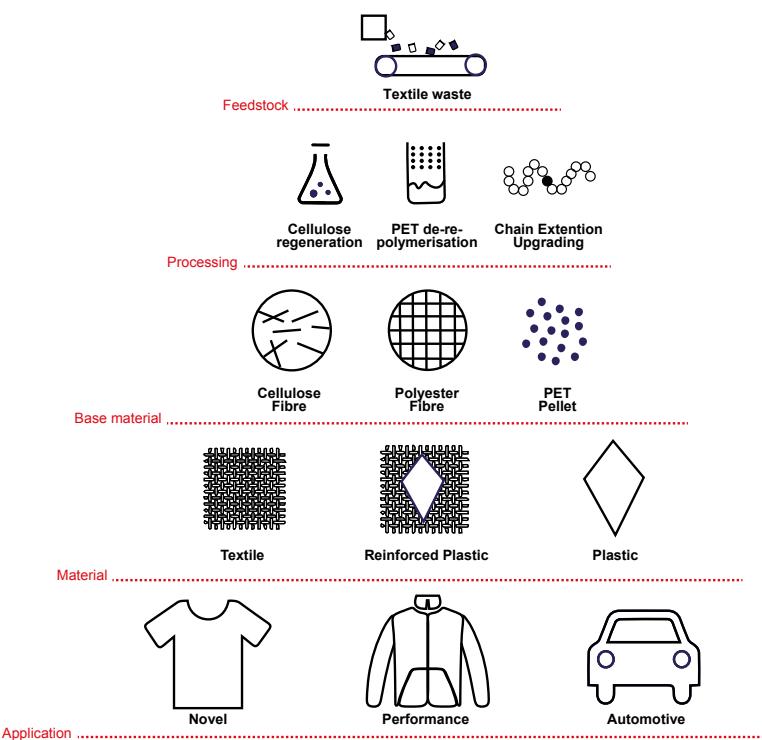

Fig. 1 T2C Materials Pathways Map

Cellulose regeneration
This processing technology is named Ioncell-F and is a new technology for producing man-made cellulosic textile fibres from wood. The process is developed by the research of Prof. Herbert Sixta's group, and uses a novel solvent, ionic liquid, invented at University of Helsinki by Prof. Ilkka Kilpeläinen's group. It is an environmentally friendly alternative to water-intensive cotton production. In addition, the process has the potential to revolutionise recycling of textile waste, turning cotton-rich textile waste into upcycled high-quality, high-end fibre. After a specific pre-treatment and refinement process, a low-impact ionic liquid dissolves the cotton fibres, removing other materials such as polyester, which can then also be recycled separately and used again to make new fibres. It is a sustainable closed-system, which means that almost all chemicals are recovered. The ionic liquid used in the Ioncell-F process is an environmentally friendly and inherently safe alternative to the solvents used in current man-made cellulosic fibre production processes.

Polyester De-Re-Polymerisation
Swerea IVF (now RISE) focused on the development of a catalyst that activates depolymerisation of polyester at a low temperature: an environmental friendly nano-catalyst for alcoholysis of polyester is used, it can be also directly disposed into natural environment. This process can be used on pure polyester as well as cotton polyester blends. The obtained monomers are easily purified from dyes and finishes, and are subsequently suitable for use as raw materials for virgin polyester production. Basically this low-temperature technology means that the valuable polyester molecules can be taken away from all the other unwanted substances and built back up – 're-polymerised' – into new, virgin-like polyester fibres. Compared to polyester synthesized directly from crude oil, polyester made from this regeneration process consumes less energy and releases less CO_2.

Polymer Chain Extension Upgrading
Developed by Softer-Celanese the melt-mixing process used a chain extension agent to convert the mixed textile waste (mainly polyester fleece) into recycled PET plastic pellets that can then be used in injection moulding to make new plastic parts. The specific chain extending agent and additives are able to enhance viscosity, processability, and mechanical properties of the new recycled material. Impact resistant properties and aesthetical qualities (colour tuning, laser marking, etc.) have been improved to achieve high standard, in order to use the plastic for interior of decorative parts into automotive industry. The new higher quality materials can be used in many other different applications. A set of experiments have been performed to process the recycled PET pellets into yarn and non-wovens, this experimentation was not successful at the stage of the project closure.

The novel materials have been constructed starting at the molecular level in order to generate new and environmental friendly solutions: regenerated textile cellulosic fibres, regenerated textile polyester fibres, recycled PET plastic pellets. The three base materials developed three different typology of manufactured materials: textile [woven, non-woven, knitted], reinforced plastics, and plastics. Then these materials have been addressed to three main application sectors: performance garment, novel garments, automotive interior. Prototypes have been produced in a realistic test production environment. Furthermore it is necessary also to consider the several treatments and finishing for each material stream. The pathways relate to the material processing goals of T2C reflect the complexity of the project itself, as well as the expertise and market sectors within the consortium. The great challenge of the project has been to create a common ground for all the different processing technologies, competencies, innovation levels through an interdisciplinary process driven by design.

CIRCULARITY

From a methodological perspective, T2C project had two main characteristics. The first is the integration of disciplines so that creative design and manufacturing demands become an integral part of the material R&D for a DDMI project. Circularity is the other central defining feature of the project. The goal of developing 'circular' materials shapes many aspects of the T2C DDMI methodology, including the size of the consortium, the expertise of the stakeholders involved, the interdisciplinary challenge, the tools and methods developed and used, and the types of design proposals that emerge from the inputs of multiple expert areas. The emerging field of "design for the circular economy" provides the multi-stakeholder and interdisciplinary approach required for the recycling of textiles through challenging disciplinary boundaries. In T2C project the circularity approach positioned material science, industry stakeholders, consumer behaviour, Life Cycle Costs (LCC) and Life Cycle Analysis (LCA) into the heart of an iterative design process, with the aim to steer the DDMI methodology with a Life Cycle Thinking (LCT) perspective. A specific paragraph is dedicated to this topic in the third section of this white paper. The T2C circular concept diagram in figure 2 shows the parts of the material lifecycle included in the T2C project work, and the expertise of the partners is spread throughout these areas. Facilitation and leadership are not directly outlined in the diagram but were also crucial roles in this project.
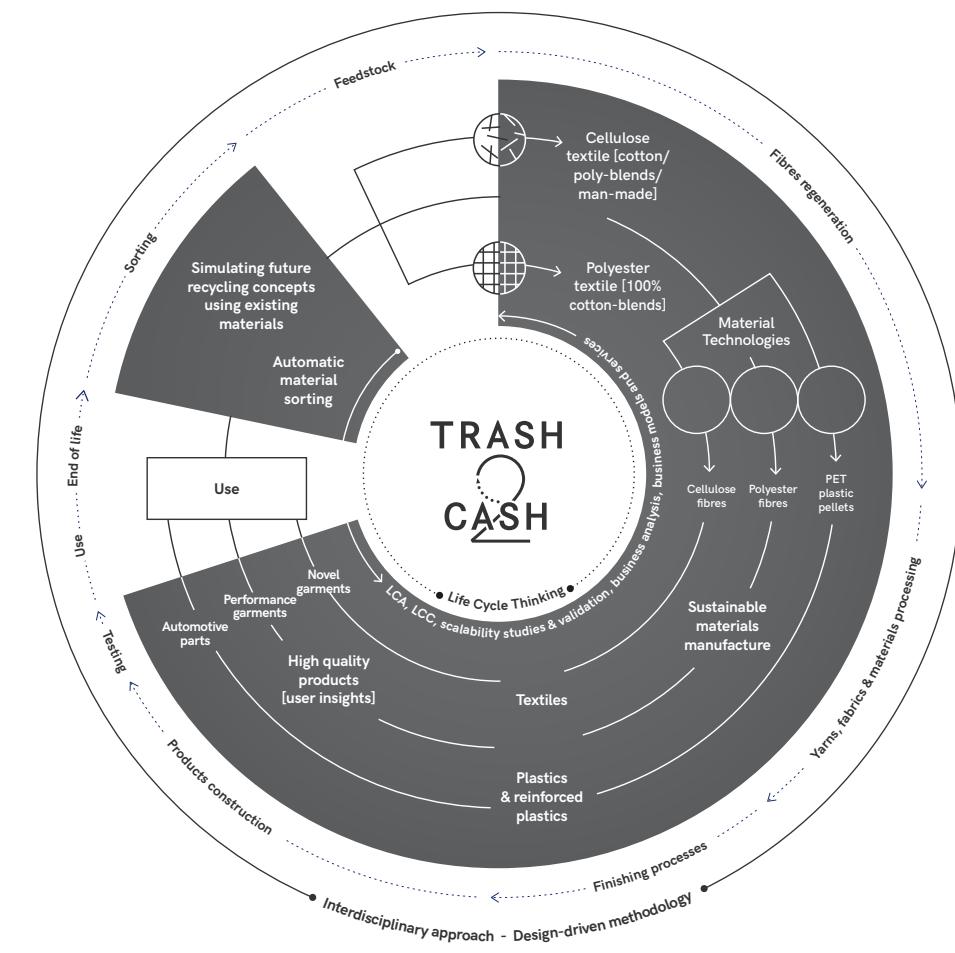

Fig. 2 Schematic overview of the T2C circular concept

1.3 DDMI background

As previously declared, T2C project had the ambitious aim of devising and implementing an experimental methodology for a DDMI project, and then reflecting on that process in order to present a new methodology.

DDMI is a process, which differs from well-known New-Product Development (NPD) process. NPD process starts from known materials and therefore a new product and its functions can be designed based on known material attributes. In DDMI the aim is to develop futures materials and therefore in DDMI process everything has to be designed differently. Accordingly uncertainty of the process and suitable methods to support this innovation process needs to be constructed in each project uniquely. The process needs to include flexibility while the project is evolving and a lot of reflection to collect feedback and learnings throughout the process. The DDMI project needs to be planned to be open, flexible and not too fixed so that the best ideas can evolve and all possible solutions will be mapped.

DDMI is grounded to design-thinking which supports creativity in problem solving and collaborative approach through iterative process. Therefore the process asks creativity and new kind of activity from all partners, whether they are designers or not. The DDMI process challenges all participants and their traditional professional way of working. While aiming for designing properties for unknown material and futures innovations from these novel materials for different application sectors challenges all; designers, material scientists, manufacturers, marketers and researchers. We can highlight that the design-driven material innovation process is an experimental journey, through which the innovation is constructed together and where everyone's contribution is valuable. The importance of participants' engagement into the process is vital for the successful outcome and even for new shared knowledge to emerge. Further open knowledge exchange between different areas creates the ground for futures innovation. In design-thinking approach the process is kept open as long as possible to map all possible solutions before narrowing it down to find solutions for the next development stage.

DDMI process uses designer's skillset for facilitation, and especially facilitating collaborative problem solving, designers can "look into the future" through scenario building and through creating several options for the development work, but they can also create tools and methods to lead the collaborative process. The skill to combine different knowledge flows seems to be one success factor while using design to construct innovations. Moreover a collaborative approach and co-design methods can boost innovation scouting even in very complex problem settings.

Design is becoming increasingly multidisciplinary, and many new concepts in design are now being crowd-sourced and used by people who are not trained designers. This means that the role of the design leader will no longer be to develop unique creative solutions, but one that revolves around facilitating ideas. To lead and facilitate the DDMI process the ability to adapt the understanding towards the situation in hand, in problem solving, is important. Even if the leader is experienced, every project is a new one and needs new problem framing and new process planning.

DDMI can define to mean creative and iterative process, which uses design thinking and design facilitation to collaboratively open futures possibilities, to construct a shared goal and to select best ideas for implementation.

1.4 Design-driven methodology in Trash-2-Cash

GENERAL PERSPECTIVE

In T2C project the design-driven process has been an innovation management process where creativity and co-design methods and iterative process have been used to push the innovation aspect further in a collaborative manner. The innovation process has been a network type of interdisciplinary innovation process, where all knowledge flows has been integrated. Furthermore it can be defined to be discontinuous innovation while the group working in this project is new for each other, people come from different organizations and there do not exists for example product line or manufacturing process which could be seen as a continuous development step for T2C innovation. In here the risks to successful outcome are higher than in continuous innovation process. Moreover the most important phase in the T2C innovation process has been the fuzzy-front-end stage, which has formed the strategic aspects of the innovations in T2C and in circular economy CE context. The following table describes the process in T2C and its design actions according to each stage, their impact, advances as well as limitations in the process.

DESIGN-DRIVEN PROCESS FOR INNOVATION IN T2C (NIINIMÄKI, 2018) [4]

Phase	Design actions	Impacts	Advances	Limitations
FUZZY FRONT END **Co-playing and co-dreaming**	Imagining Inspiring Facilitating Visualizing Collaborating Playing with substituting materials Evaluating first round material prototypes Prototyping	Experimental and creative knowledge building **Building the community** Pushing boundaries **Constructing co-design innovation space**	Opening future opportunities Creating knowledge network (tacit, haptic, industry, intellectual, academic) Learning to collaborate	Frustration Confusion Misunderstanding Conflicts Lack of disciplinary knowledge Lack of shared goal
BRIDGING THE GAP **Co-visioning**	Concept designing Storytelling Integrating knowledge flows Evaluating concepts Second-round prototyping	**Engaged partners (strong ownership)** Shared vision Shared goal Excluding options Constructing solution space	Shared understanding Framing and reframing to find the right focus Constructing clear directions for the development work	Wrong focus? Complex and slow decision-making
PRODUCT DEVELOPMENT **Co-producing**	Constructing prototypes based on design concepts Disseminating	Innovation opportunities identified Clear process **Deep collaboration**	Communicating to external audiences through prototypes and stories Looking for market opportunities	Risk for limited view on innovation

THE PREVIOUS DDMI EXPERIENCE

The T2C methodology was adapted from a previous project named Light.Touch. Matters project(5) (LTM) in which were involved three T2C partners. LTM aimed to develop a new generation of smart materials that combine touch sensitivity with luminosity, based on latest developments in polymeric piezo materials and flexible OLEDs. LTM used a design-driven research methodology based on a comprehensive body of industrial product design knowledge that has been built up both by the academic partners of the consortium, and through the well-defined tools and methods used by the design agencies involved in the project. The core of this new methodology was an iterative development process in which materials R&D was done in parallel with the conceptualization and design of products that made use of the unique material properties. Three iterations have been made in product concept ideation and development, where each cycle was an essential opportunity to learn: for designers, to learn what is really possible, and for materials researchers, to learn what is really needed, allowing step-by-step updating and redefinition of target properties and reprioritization of tasks. This allows for the convergence of the two main streams in the project: design activity and materials R&D. Beyond other outcomes, the LTM project produced a public report relate to DDMI experienced, titled "The white book. Lessons from a four-year journey into design-driven materials innovation"(6).
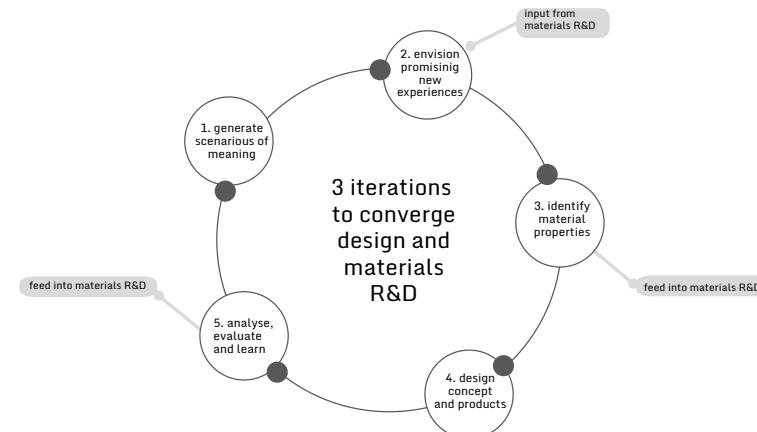

Fig. 3 The 5 steps in each LTM project cycle

THE T2C APPLIED METHODOLOGY

Also in T2C initiative, it was necessary to look at design and other perspectives in an early stage of technology R&D. It was necessary to steer the whole process using design methods, in order to achieve material outcomes ready for specific applications, markets, business models integrating environmental and economic impact analysis. As LTM, T2C project was framed by three crucial development phases (cycles) in order to involve in an iterative process the three main streams that characterized the project:
- Design Stream (designers and design researchers)
- Science and Technology Stream (materials technology researchers and developers)
- Manufacturing and other expertise Stream (manufacturers, evaluators and end-user researchers)

The methodology was organized into three iterative cycles that aimed to enable knowledge transfer between the different competencies through a continuous input-output process. All the different areas of competencies shared/learned/applied/developed what was possible and what was needed, allowing a step-by-step updating and definition of task and objectives per each processing technologies.

A primary overview of the proposed methodology is given in the general in figure 4. Design stream appears in the centre of the innovation process by applying a material developed within the material R&D stream integrating the inputs from the manufacturing and other expertise stream.

The three cycles in T2C had specific aims:
- A. Envisioning Cycle: envisioning material and design scenarios
- B. Evolving Cycle: evolving material and design specifications
- C. Refining Cycle: refining material and design outcomes

Each cycle is deeply described in the part 3 of this report, as short overview it is interesting to highlight that, from a design-driven perspective, the first cycle represented the initial collaborative design work to create scenarios for the new materials, in the next cycle the materials were developed in response to feasible design requests, and in the final cycle the materials were refined in response to design product concepts. At the end of each cycle the aim was to produce new prototypes as material and design outputs [milestones].
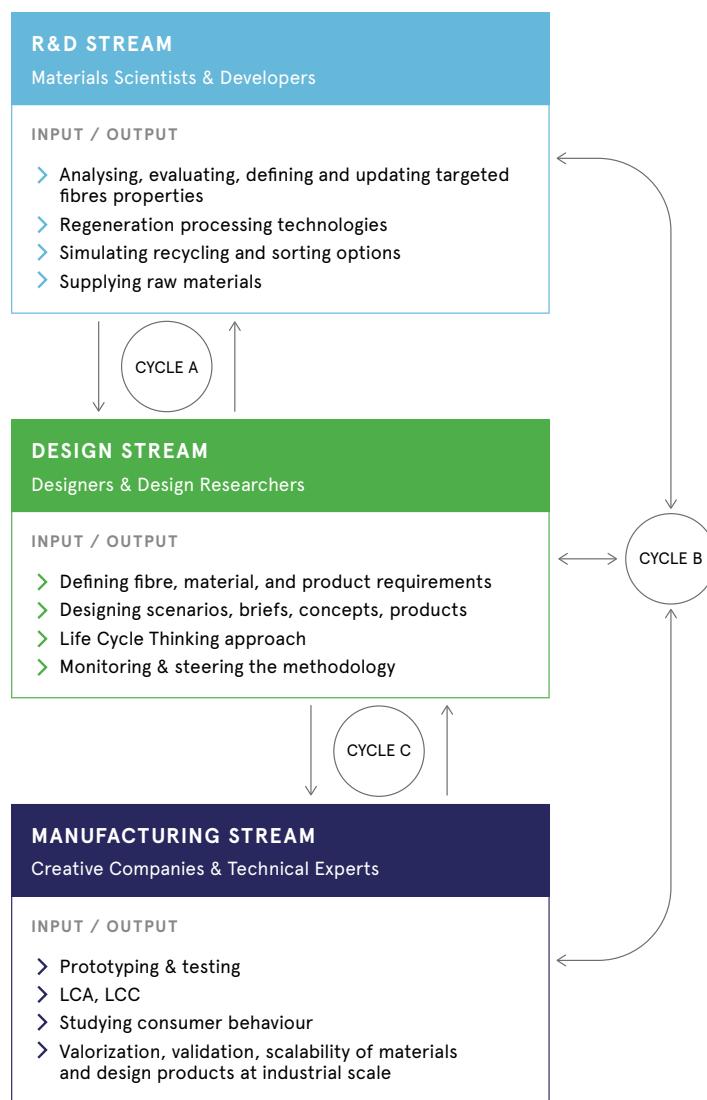
R&D STREAM
Materials Scientists & Developers

INPUT / OUTPUT
> Analysing, evaluating, defining and updating targeted fibres properties
> Regeneration processing technologies
> Simulating recycling and sorting options
> Supplying raw materials

CYCLE A

DESIGN STREAM
Designers & Design Researchers

INPUT / OUTPUT
> Defining fibre, material, and product requirements
> Designing scenarios, briefs, concepts, products
> Life Cycle Thinking approach
> Monitoring & steering the methodology

CYCLE C

MANUFACTURING STREAM
Creative Companies & Technical Experts

INPUT / OUTPUT
> Prototyping & testing
> LCA, LCC
> Studying consumer behaviour
> Valorization, validation, scalability of materials and design products at industrial scale

CYCLE B

Fig. 4 Four overview of the three T2C streams

ANALYSE POTENTIALS — 1

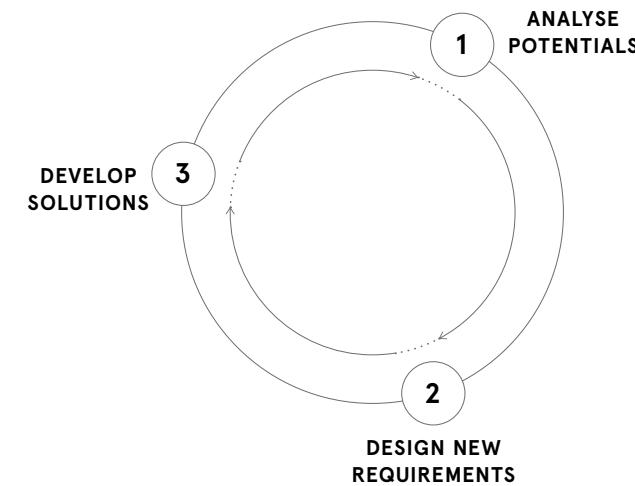DESIGN NEW REQUIREMENTS — 2

DEVELOP SOLUTIONS — 3

Fig. 5 The three iterative steps in each cycle

In turn, each cycle had three steps in order to achieve different objectives in the project process in the different streams: the first step started with the analysis of the potentialities moving in the definition of new requirements, and ending with the development of solutions related to the specific progress of the project. The end/begging of each step corresponded most of the time with a step in the cycle. Later in this report a description of cycles is provided, pointing out the meanings and objectives of each step for each specific cycle.

The T2C work plan was divided into work packages (WPs), as usual for the EU funded project. 7 WPs were related to project implementation, and 2 transversal WPs related to management and dissemination.

Here a short description to highlight the connectivity of the WP to the methodology:

- **WP1** set up and managed the interdisciplinary dialogue among the three main streams integrating in the first part of the project all the stimuli from and to the streams. With it started Cycle A;
- **WP2** was the material scientists WP focusing in the implementation of the processing technologies and related base materials. WP2 communicated

closely on materials and information with WP5, and on specifications and ideas from WP3 and WP6;

- **WP3** was the central WP in the process; it included all the design tasks related to circularity and manufacturing resulting in design scenarios, concepts, master cases. It had also the role to capture, record, and analyse the whole process and with WP1 to reflect on the DDMI methodology, to feed the project process and inform decision-making;
- **WP4** simulated recycling options based on its quality properties and dealt with the need of improving the automatic sorting of recycling textiles, informing design and manufacturing streams;
- **WP5** prototyped and tested material samples for improving the manufacturing of base material prototypes. It has been a crucial WP in the second and third cycle, providing and receiving stimuli directly by WP3 and informing directly WP6 and WP7;
- **WP6** defined and evaluated the business potentials and environmental (LCA, LCC) impacts of design concepts and Master Cases during their development phases, it also included the study of consumer barriers and behaviours;
- **WP7** studied the scalability and validation of the processes used to make the prototypes from lab- and pilot scale to industrial scale.

In addition to these work packages, 2 work packages related to dissemination and exploitation (WP8) and project management (WP9) completed the work plan. The methodology plan was to take place during twelve collaborative workshops, where partners could generate new knowledge together which would inform the direction of the project work; partners could see one another's work, present material prototypes, and request input from other experts.

The implementation in T2C started (Cycle A) with the execution of WP1 and WP2 in parallel and prior to the others, in the process WP3 developed an initial knowledge sharing and exploratory phase. At the end of this cycle the first milestone is provided and the next iterative cycle started, and so ahead. The cycle A is executed involving mainly the tasks of WP1, 2, 3 (prioritising R&D stream); the cycle B involves mainly WP3, 5, 4, 6 (prioritising Design stream); the cycle C involves mainly WP 3, 4, 6, 7 (prioritising Manufacturing and other experts stream). The importance of milestones was crucial (7), as the process aimed to allow the consortium to respond to the new prototypes in order to drive its development from the perspectives of design, user and market factors, rather than the

traditional technological drivers.

The framework meant that each competency must receive inputs from others before then conducting their own research. The ability of each competency to transfer knowledge at the given time was therefore crucial in allowing the other competencies to continue their own work; competencies were dependent on one another for the work to progress. Exchange processes continuously occurred in the project and were accented by the workshops involving the whole consortium about every third month. In figure 7 the scheme provides a general representation of the workflow, considering the overall strategy (WSs, WPs, milestones, cycles, steps), to graphically highlighting the connection between the planned methodology with the work plan.
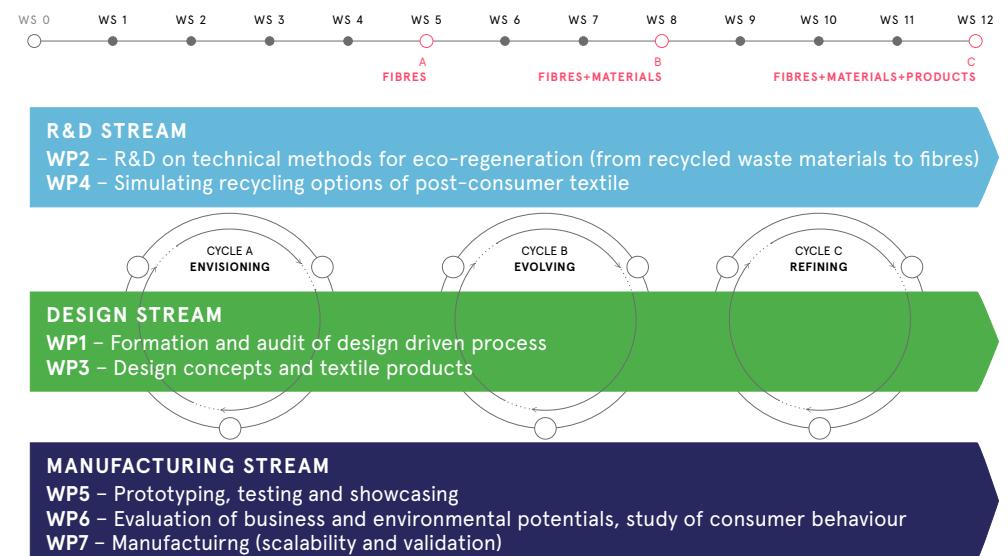

Fig. 6 Overview of 7 implementation work packages and the three cycles with three steps in T2C project

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(7) In general the importance of material prototypes and material samples has been crucial in the overall project process. A specific research investigated the tools and methods used to support interdisciplinary communication in T2C focusing on material samples: D.3.7 chapter 4-T2C through the lens of materials and design communication.
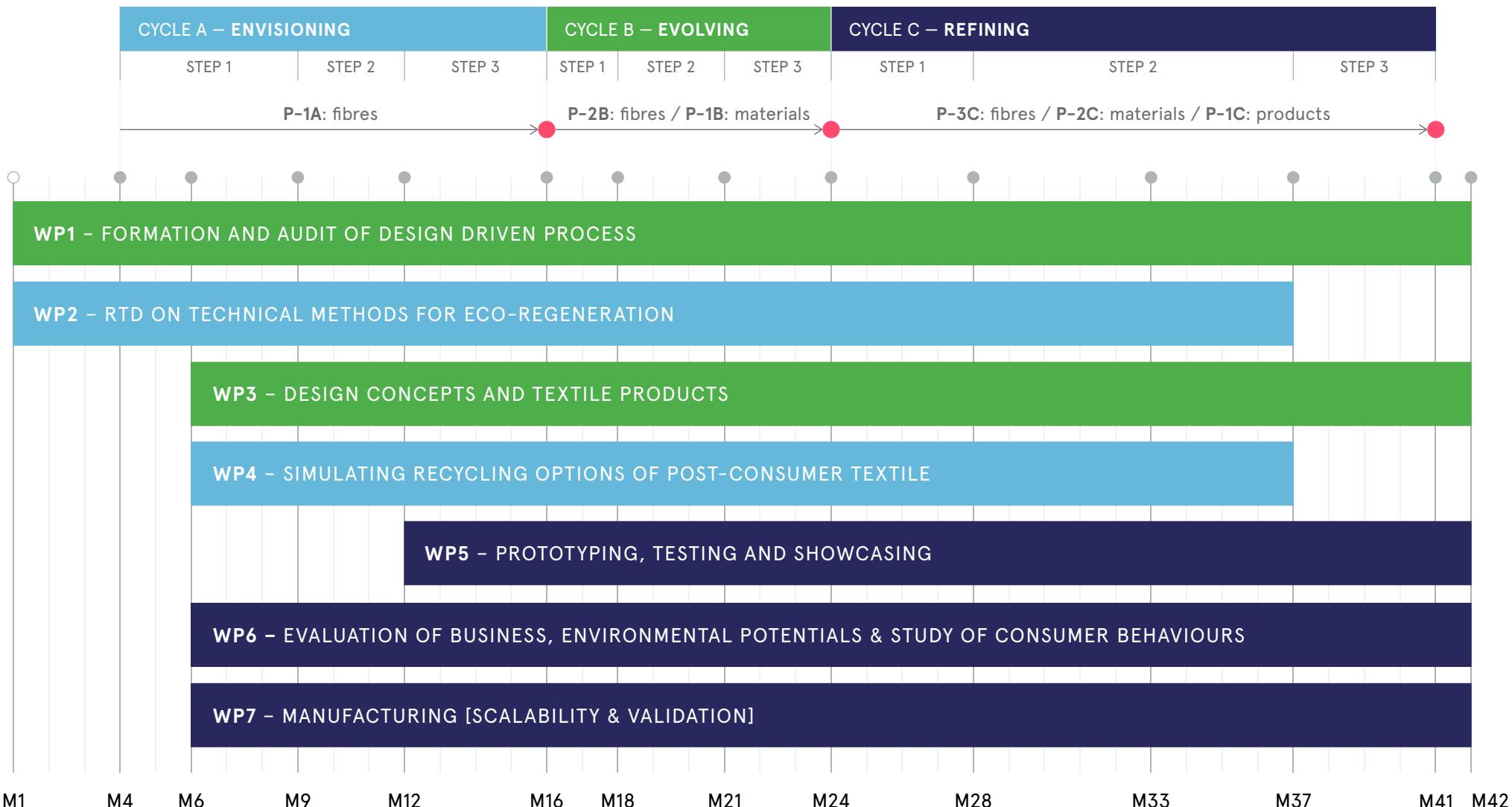
TRASH-2-CASH WORKFLOW — 42 months

CYCLE A — **ENVISIONING**			CYCLE B — **EVOLVING**			CYCLE C — **REFINING**		
STEP 1	STEP 2	STEP 3	STEP 1	STEP 2	STEP 3	STEP 1	STEP 2	STEP 3

P-1A: fibres   →   **P-2B**: fibres / **P-1B**: materials   →   **P-3C**: fibres / **P-2C**: materials / **P-1C**: products

WP1 – FORMATION AND AUDIT OF DESIGN DRIVEN PROCESS

WP2 – RTD ON TECHNICAL METHODS FOR ECO-REGENERATION

WP3 – DESIGN CONCEPTS AND TEXTILE PRODUCTS

WP4 – SIMULATING RECYCLING OPTIONS OF POST-CONSUMER TEXTILE

WP5 – PROTOTYPING, TESTING AND SHOWCASING

WP6 – EVALUATION OF BUSINESS, ENVIRONMENTAL POTENTIALS & STUDY OF CONSUMER BEHAVIOURS

WP7 – MANUFACTURING [SCALABILITY & VALIDATION]

M1   M4   M6   M9   M12   M16   M18   M21   M24   M28   M33   M37   M41   M42

Fig. 7 Schematic overview of the workflow basing on 12 WSs in relation with months, cycles, steps, work packages, timeline

THE FINAL T2C PROCESS

T2C, in short, proposed a design-driven process merging R&D approach, and manufacturing practice and other expertise with the comprehensive body of design methodology, to bring these three streams into a systematic, coherent, and integrated process. The planned methodology of the project aimed to facilitate knowledge exchange and disciplinary integration between the different competencies in the project so that the materials technologies could be 'driven' from a design, end-user and market perspective and also towards material circularity (LCT). The methodology approach therefore was intended to be responsive to design research findings, with a degree of flexibility in how the collaboration took place, particularly through the planning and facilitation of the twelve interdisciplinary project workshops, for this reason a session of this report is dedicated to the description of what happened during these meetings, how they have been designed, and what tools has been used.

So, even if planned with sharp outlines, the T2C process and the applied DDMI method have been exploratory and adaptive. It has been continuously monitored and audit by a Methodology Team (more info in the introductory part of workshops). A systematic and theoretical analysis of the DDMI method applied in T2C project (the applied methodology) has been carried on in order to produce new knowledge on the topic and several recommendations (8). The combined and continuous integration between the applied process and the methodology research has been crucial for the success of the project itself.

A final scheme (figure 8) has been produced at the end of the project in order to sum up and show the overall process and interdisciplinary exchanges. It represents a generalization and conceptualisation of what occurred during the project process. It doesn't represent what exactly happened (it would have be too complex (9)), just considering the three processing technologies and their specific misaligned R&D stages (due to specific issues, incurred problems, etc.). It has been necessary to elicit from the applied methodology a general timeframe to represent a coherent flow of the process. In each stream the series of steps have been pointed out, they aimed to align the various disciplines so that inputs and outputs were received at appropriate times for the project work to progress in a 'design-driven' manner.
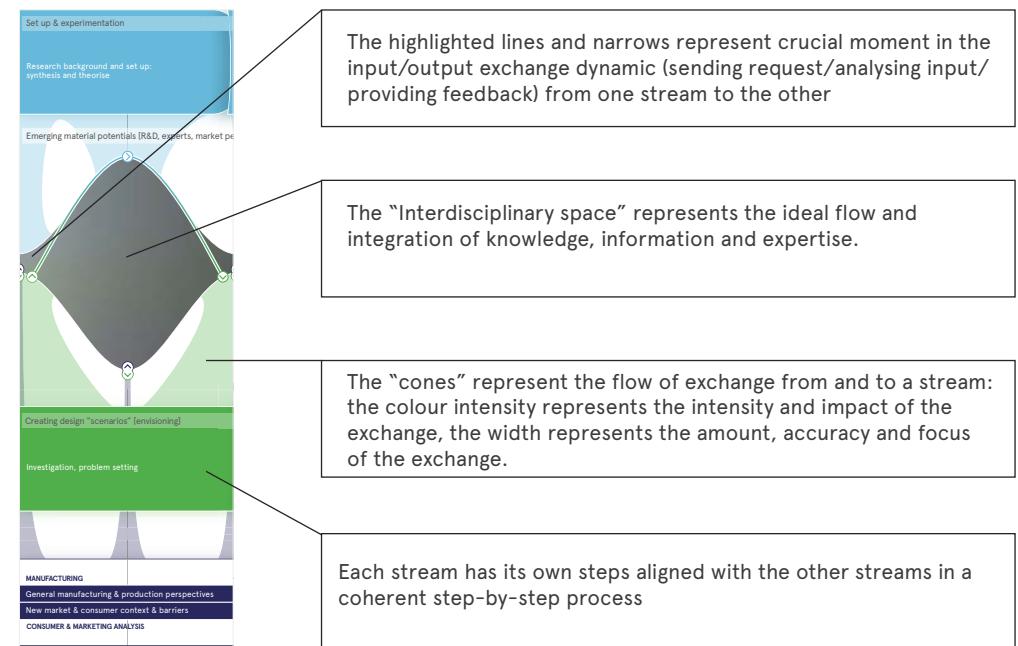
The scheme is mainly a theoretical refinement of the overall process, the steps that took place, the interdisciplinary exchange, the flow of information. The initial planned process has been revised and reframed merging and mediating the rationalisation of what happened and what was planned.

A generalisation of the framework has been attempted in order to provide a process not strictly connected to the T2C specificities so that it can be applied more broadly, (technological field, typology of materials, specific industry, etc.), so the authors tried to not include these specific references (e.g. fibres are named "base materials", textile are named as "manufactured material", etc.) Some explanations of graphical elements are provided to facilitate the reading of the scheme (see below).

The interdisciplinary space has been represented with a converge/diverge development step by step, referring to the typical design thinking divergence and convergence cycles: to diverge in many directions to better understand and define (new) potentials, limitations, possibilities; to focus and converge around the vision, having explored a number of possibilities, dismissing the paths that are not feasible, stray too far, or are too ambitious.

The highlighted lines and narrows represent crucial moment in the input/output exchange dynamic (sending request/analysing input/ providing feedback) from one stream to the other

The "Interdisciplinary space" represents the ideal flow and integration of knowledge, information and expertise.

The "cones" represent the flow of exchange from and to a stream: the colour intensity represents the intensity and impact of the exchange, the width represents the amount, accuracy and focus of the exchange.

Each stream has its own steps aligned with the other streams in a coherent step-by-step process

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(8) A summary of the final recommendations is presented in the third part of this white paper, the main results of the methodology research (new knowledge, recommendations, specific analysis and results) have been reported in D.3.7 confidential.
(9) Any way the real T2C Gantts are provided after the end of each cycle description in part 2 of this report.
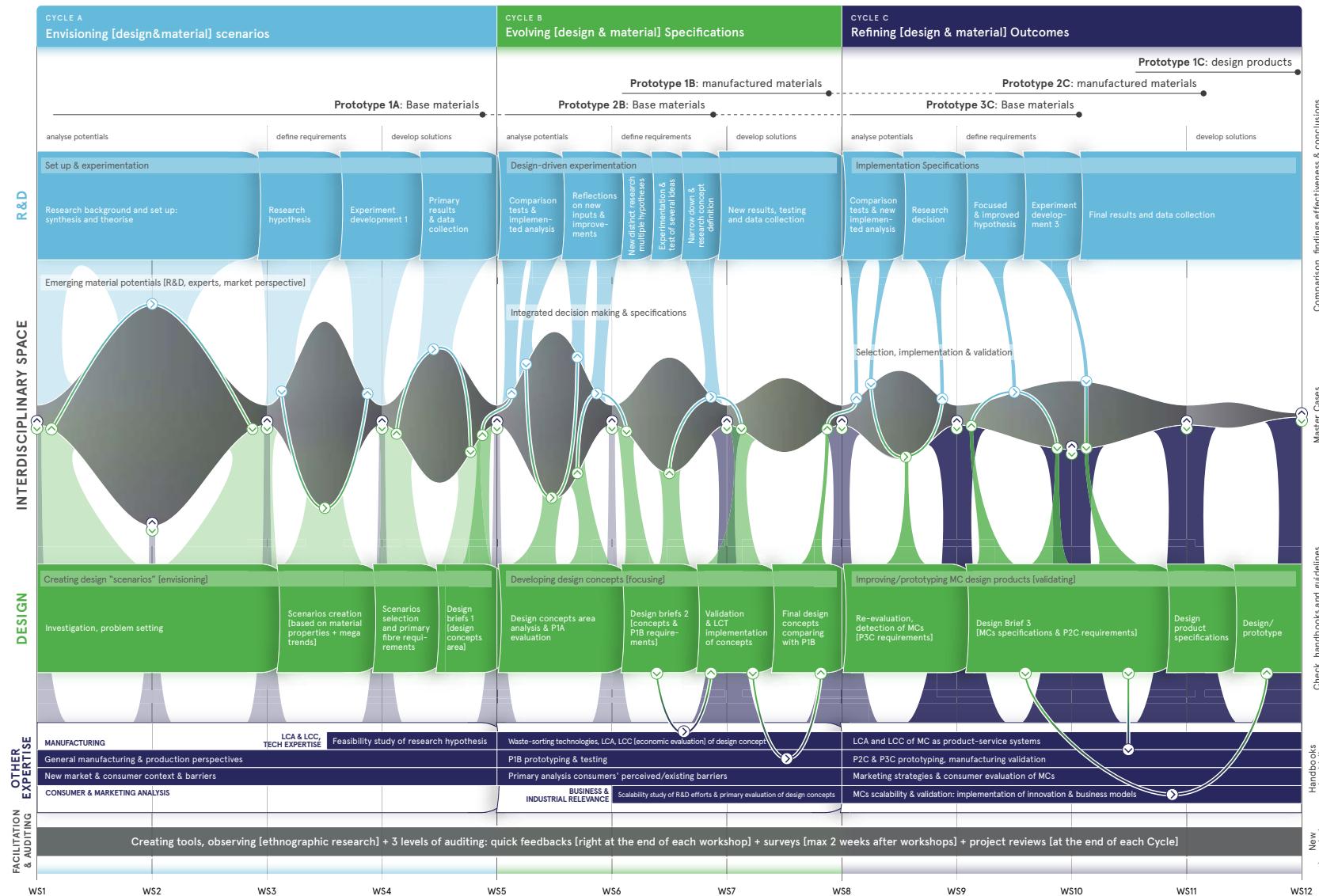
Fig. 8 Refined T2C interdisciplinary process scheme (zoom in to read the content)

1.5 Auditing and monitoring the process

The overall T2C process and the applied methodology have been the subject of several auditing and monitoring activities, from different perspectives and at different levels. The monitoring has been done for research purpose and also to feed and actively influence and affect the project development. On the one hand, the monitoring tools have been able to provide to the Methodology Team useful inputs, feedbacks and suggestions, to fine-tune and set up necessary workshop activities and to support the interdisciplinary exchange within the whole working group. On the other hand, they have provided important information to the design research studying and analysing the applied DDMI methodology in the project. Basically, a macro-level ethnographical research looked at the design-driven nature of the project as a whole, whereas a micro-level practice- and action- research looked at the specific tools and methods developed to support the interdisciplinary work. Several types of data was collected during the project to elicit specific information; workshop observations as well as specific interviews of project participants, and special reflection moments on DDMI have been carried out.

Beyond the research methodology purpose, three main tools have been adopted to monitor the project process at the practice and action level, to audit the effectiveness of used tools, to detect possible needs from participants, to prevent possible issues, to elicit new ways of action. These three tools considered three different time frames during the process:
- the tips & tops roundtables, right after the closure of each WS;
- post-workshop surveys, a few days after each WS;
- project review exercises, after the end of each cycle.

With the tips & tops roundtables, the project facilitator and the project coordinator asked the participants about the greatest moment experienced during the WS and any suggestion for the next one. These requests had the aim to

highlight immediate and spontaneous feedback at a practical and micro level. On the other hand the post-workshop surveys were complete questionnaires that partners were asked to fill in. They had more time to reflect on workshops and mainly to the input/output dynamic, as well as considering the usefulness of the WS outcomes. Two examples of post-workshop survey questionnaires (not filled) can be found in Annex 2. The project review had the main aim to receive feedback from participants considering a wider project process part, at a more macro level, a description of project review exercise is provided in the next paragraph.

Interviews, tips & tops sessions, surveys and review exercises were all mapping project participants' experiences of the process. To complement this point of view, the workshops were also observed by design researchers to form an overall picture of each workshop and project progress. These researchers followed the workshops, made notes and took photos, videos and audio recordings. As members of the Methodology Team, they were able to reflect the observations against the background of project methodology, and the purpose of tools created for each workshop. These observations were then discussed in the Methodology Team online meeting (together with the feedback survey results) after each workshop, to form an understanding of what worked well and what needed to be improved for the next workshop.
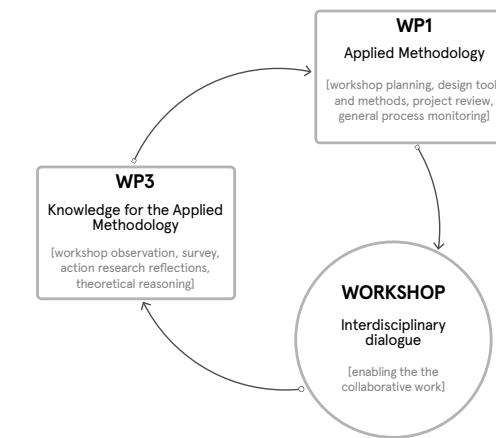

WP1
Applied Methodology
[workshop planning, design tools and methods, project review, general process monitoring]

WP3
Knowledge for the Applied Methodology
[workshop observation, survey, action research reflections, theoretical reasoning]

WORKSHOP
Interdisciplinary dialogue
[enabling the the collaborative work]

Fig. 9 Overview of 7 implementation work packages and the three cycles with three steps in T2C project

1.5.1 PROJECT REVIEW EXERCISE

Three Cycle Review Exercises have been executed at the end of each cycle, i.e. after each milestone. The project review has been used also at the end of LTM project. The exercises requires participants to sit down and reflect on the project path, the achievements, the challenges, what worked, what didn't, and what could have worked better considering three different perspectives: as individual, as organisation, and as a group of competence (stream). The analysis and the results of each project review exercise are described in the workshops section, at the end of each cycle. Here follows the general description of the tools, their aims, and theirs execution.
The project review consists of 3 main exercises: Project Chronology, Collaboration Matrix and Collaboration Islands.

PROJECT CHRONOLOGY EXERCISE

The first exercise is individually and executed by each participant. It has the main aim to provide the personal perspective of each single participant about the workshops execution considering any kind of aspect (organization, location, general consideration, etc.). The exercise takes at least 40 minutes to be executed. A simple tool is used: a table on which the WSs of each cycle are listed in a row in a chronological order and described with short key words (main aim, dates, location, etc.). The table is also divide horizontally in two main area: challenging and great moments. In order to support the memories of participants, a presentation with key moment photos and keywords of each WS can be shown. To start, each participant had to draw her-/himself on a post-it, placing it on the chronology table where she/he attended the first WS. Then, each participant had to write down on post-it notes great and/or challenging moments experienced during the project WSs, related to each single thematic WS, mentioning any aspect related to the WS experience, such as organisation of the WS, venue, contents, activities, interaction with other participants.
The great moments are written on a post-it of a specific colour, meanwhile the comments about challenging moments are indicated on post-it notes of another colour. After the exercise, all the comments can be collected and linked to
 aspects categorized as:

a) WS contents and methods;
b) sharing knowledge and collaboration between participants;
c) project progress and results;
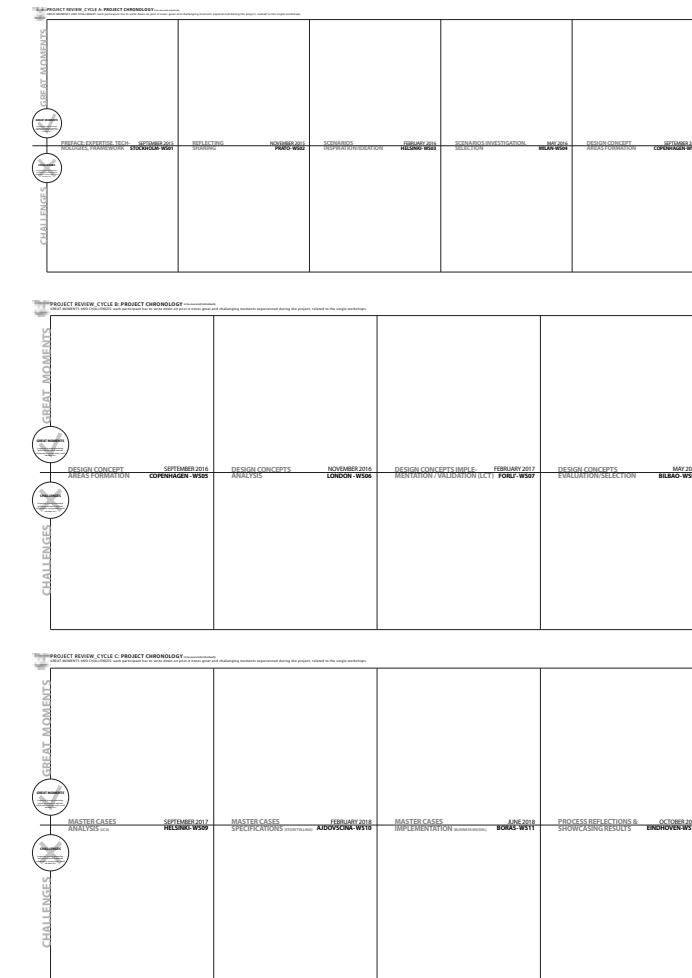d) ambience and social activities.

Fig. 10 Template of the Project Chronology tool used for Cycle A, B and C (zoom in to read the content)

COLLABORATION MATRIX EXERCISE

The Collaboration Matrix has the main aim to provide the perspective of each institution involved in the project, thus the participants must coordinate with their colleagues the kind of feedback they want to give. The exercise takes at least 40 minutes to be executed.

The Collaboration Matrix consists in a table divided into columns and rows corresponding to the number of the involved institutions, listing the institutions' name from top to bottom for the rows and from left to right for the columns in the same order. The cell corresponding to the same institution in row and column is cleared since in this exercise only comments about collaboration with external institutions are sought. Prior to task execution, it must be agreed on if comments are added by identifying own organisation in the rows and adding comments in the cells proceeding through the columns or vice versa.

Using the above described tool, the representatives of each institution have the possibility to indicate on the matrix other institutions they collaborated with, detailing if the collaborative exchange was light, medium or intense ("collaborate how and with who"). The representatives also have the possibility to indicate with which institution they would have liked/would like to collaborate more ("desired collaboration").

Furthermore, representatives also are asked to comment on what they collaborated/would like to collaborate on, as well as indicate potential improvement for future collaboration ("collaborate on what").

COLLABORATION ISLANDS EXERCISE

This exercise is executed gathering participants in three groups of competencies, considering participants' expertise: R&D/Material Scientists, Designers/Manufacturers, Facilitators/Design Researchers. The primary aim of the exercise is to steer groups to reflect on the nature of collaboration within the group and with the other groups of competences, mainly to provide possible solutions or push the current situation further to improve the collaboration or to keep it improving. For each group two "messengers" (group representatives) are designated. The exercise takes at least 80 minutes for its execution and is divided in three different activities:

- self-analysis (30 minutes): the three groups reflect upon their path, as a group, indicating what they should stop doing (STOP), start doing (PLAY) or keep on doing (FAST FORWARD);
- outside reflections (30 minutes): the three groups discuss internally potential improvements about what they collaborated/would like to collaborate with the other two groups;
- sharing feedback (20 minutes): the two designated messengers of each group are sent to share the improvement suggestions with the other groups.

Three dedicated posters are prepared for each group (R&D/Material Scientists, Designers/Manufacturers and Facilitators/Design Researchers). The single poster is divided in three rows, offering space for comments related to the three type of actions that the expert group should consider, that is a row for comments suggesting what to start doing (PLAY), what to keep on doing (FAST FORWARD) and what activities to stop doing (STOP). Moreover, the poster is divided also vertically in two columns: one dedicated to self-analysis where the expert group first analyses and comments internally about their activities providing suggestions. The second column leaves space for the suggestions to be collected from the other expert groups, gathered and conveyed by the designated group representatives (messengers).

Fig. 11 Template of the Collaboration Matrix tool used for Cycle A, B and C

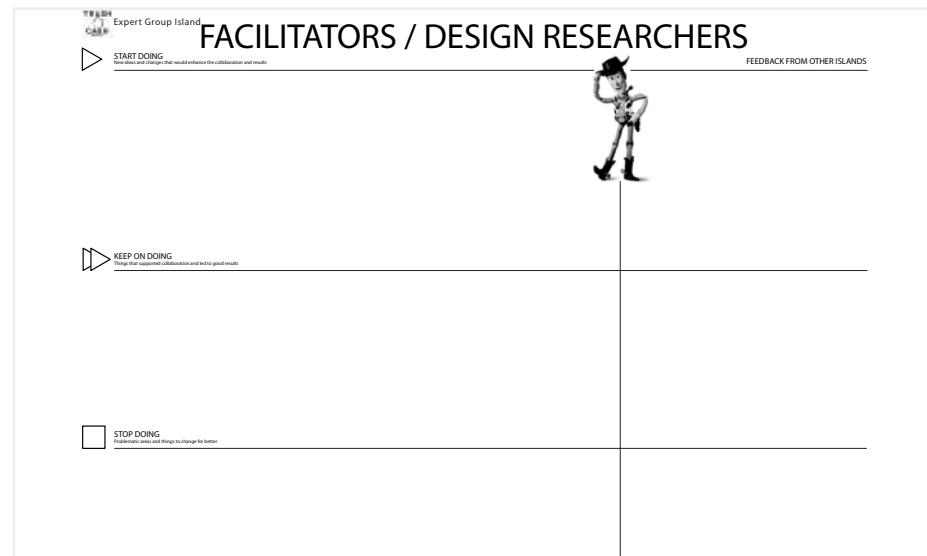FACILITATORS / DESIGN RESEARCHERS

Expert Group Island

START DOING
New ideas and changes that would enhance the collaboration and results

FEEDBACK FROM OTHER ISLANDS

KEEP ON DOING
Things that supported collaboration and led to good results

STOP DOING
Problematic areas and things to change for better

R&D / MATERIAL SCIENTISTS

Expert Group Island

START DOING
New ideas and changes that would enhance the collaboration and results

FEEDBACK FROM OTHER ISLANDS

KEEP ON DOING
Things that supported collaboration and led to good results

STOP DOING
Problematic areas and things to change for better

DESIGNERS / MANUFACTURERS

Expert Group Island

START DOING
New ideas and changes that would enhance the collaboration and results

FEEDBACK FROM OTHER ISLANDS

KEEP ON DOING
Things that supported collaboration and led to good results

STOP DOING
Problematic areas and things to change for better

Fig. 12 Template of the three Collaboration Islands tools (for facilitators/design researchers group – first one – R&D/material scientist group – second one – designers/manufacturers group – third one) used for Cycle A, B and C (zoom in to read the content)

2   THE DDMI THROUGH 12
     INTERDISCIPLINARY WORKSHOPS

2.1 The workshops

The workshops (WS) have been a key asset to set up and develop the interdisciplinary dialogue and knowledge sharing among the different competencies involved in the T2C project; they have been crucial for the development of the applied DDMI methodology.
The WSs were periodical meetings that involved all participants with an active role, full-time for 2 days with the main aims:

- to implement and refine the inter-dialogue among the 3 streams;
- to support decision-making process using both logical and intuitive approaches;
- to develop knowledge sharing with fruitful hands-on sessions aiming at specific inputs-outputs;
- achieve common decisions and address technical and/or R&D issues that usually are difficult to resolve using online communication.

WSs were aligned with significant points in the project where knowledge exchange was particularly important or when key results would have been ready, such as prototypes. Considering the methodology applied in T2C, each WS represented a start phase of a new step and the end of the previous one, cycle by cycle (this concept is clearly described further in each cycle introduction).
WSs, as well as the whole DDMI process, were monitored by the Methodology Team. In this case, the role of the team was to review the outcomes of the previous WS and propose ways of achieving the next step of the project within the following WS; to enable knowledge exchange and ideation. WSs have been experimental and designed case-by-case with specific aims, based on the specific inputs-outputs phase of the project, considering specific actions, and considering the requests and feedbacks of participants.
The content of the WSs, how the collaboration would be enabled (through what type of activities, using what type of tools) was left open to an exploratory process, equally collaborative in nature, inviting input from the various partners involved in the Methodology Team.
The Methodology Team typically met two to three times between WSs via

Skype conference calls, and consisted of representatives from:

- design research (2 groups from 2 universities: 4 people with research themes on human factors, design tools & methods for circular economy;4 people with research themes on multi-professional collaboration, methodology for DDMI, design for circular economy);
- manufacturing (1 person, advisory);
- material R&D (1 person that was also the project coordinator);
- design industry (1 person, advisory);
- one facilitator also part of the project coordination.

The relevance of the WSs in the DDMI process is such that a significant section of this white paper is dedicated to the description of what happened during these meetings, how they have been designed, and what tools have been used.
The descriptions have a regular template:

- WS cover page: short description of the aims of the WS;
- WS preparation: short description of the "homework" requested to participants;
- WS organisation: description of the developed sessions (sometimes divided into communal and parallel part) and of the related used tools;
- WS feedback: the main interesting feedbacks received by participants for each WS from the post-WS survey[1].

Furthermore, the analysis and the results of the Project Review Exercise (see paragraph 1.5.) are presented at the end of each cycle.
All T2C WSs have been designed considering four main sessions (main topics), and each session presented a variable number of slots (specific activities). Two examples of WS agendas can be found in Annex 3 of this report. The agendas can provide useful information on how WSs were organized and planned. Differently from these agendas, the WS description on the following pages is a generalisation (e.g. no references to specific participants will be found) in order to make them easy transferable and replicable in other processes, projects, or contexts.
The agendas, as well as the used tools, have undergone a gradual evolution during the project workflow; this evolution was planned and related to the exploratory nature of the T2C interdisciplinary process.
A short and focused overview of the general design process related to WSs is provided in figure 13. It aims to summarise the main design steps and output

considering the order of the twelve WSs. The design process was planned referring to the main project milestones (mainly prototypes), the timetable of the different versions (three) and meanings of design briefs, and the WSs timetable. Above and beyond this, the specific steps and outcomes were left open to be defined and specified during the evolution of the process itself and of the interdisciplinary workflow, also because, the design process, as the methodology approach, was intended to be responsive to design research findings. Reading the scheme, as well as the WS descriptions, it should not be forgotten that the main goal and output of the design (-driven) process were the material innovation objectives (at different levels): base materials (EMTs), used for, but also affected by, the creation of manufactured materials and products.
A clarification is needed referring to the different design briefs:

- the design briefs 1 aimed to provide material requirements to R&D to produce the second generation base materials;
- the design briefs 2 aimed to specify the kind of manufactured materials, including the refined outputs and feedback from the 1st generation of base materials;
- the design brief 3, thanks to the iterative process, specified the final design requirements for design products, considering the needed base materials (3rd generation) and manufactured materials (2nd generation).

The complex and vast ideas generated within the developed interdisciplinary design process show how the design process steered the directions of the material innovation. 16 Material/Design Scenario Moodboards have been elaborated during the interim period WS01/WS02 and presented at WS03, which led to 10 primary Scenarios and related Design-Driven Material Requirements that were presented at WS04. The primary scenarios were further reduced to 5 Scenarios , developed into 13 primary Design Concept Areas and related 18 potential design directions. Starting from these proposals, presented at WS05, the interdisciplinary working groups elaborated 10 Design Concept Areas, developed into 28 Design Concepts (design briefs 1). Summarising posters were presented at WS06 and reduced to 26 Design Concepts (design brief 2). At WS07, 23 Interdisciplinary Design Specification Sheets were presented and reduced to 14. These were then organised into 8 Material Clusters and 16 Design Concepts through a Cluster Tree. At WS08, 23 design concepts were presented (Design Specification Sheets), evaluated and selected through an iterative evaluation exercises, and finally developed into the 6 Master Case Design Briefs (Design Briefs 3).

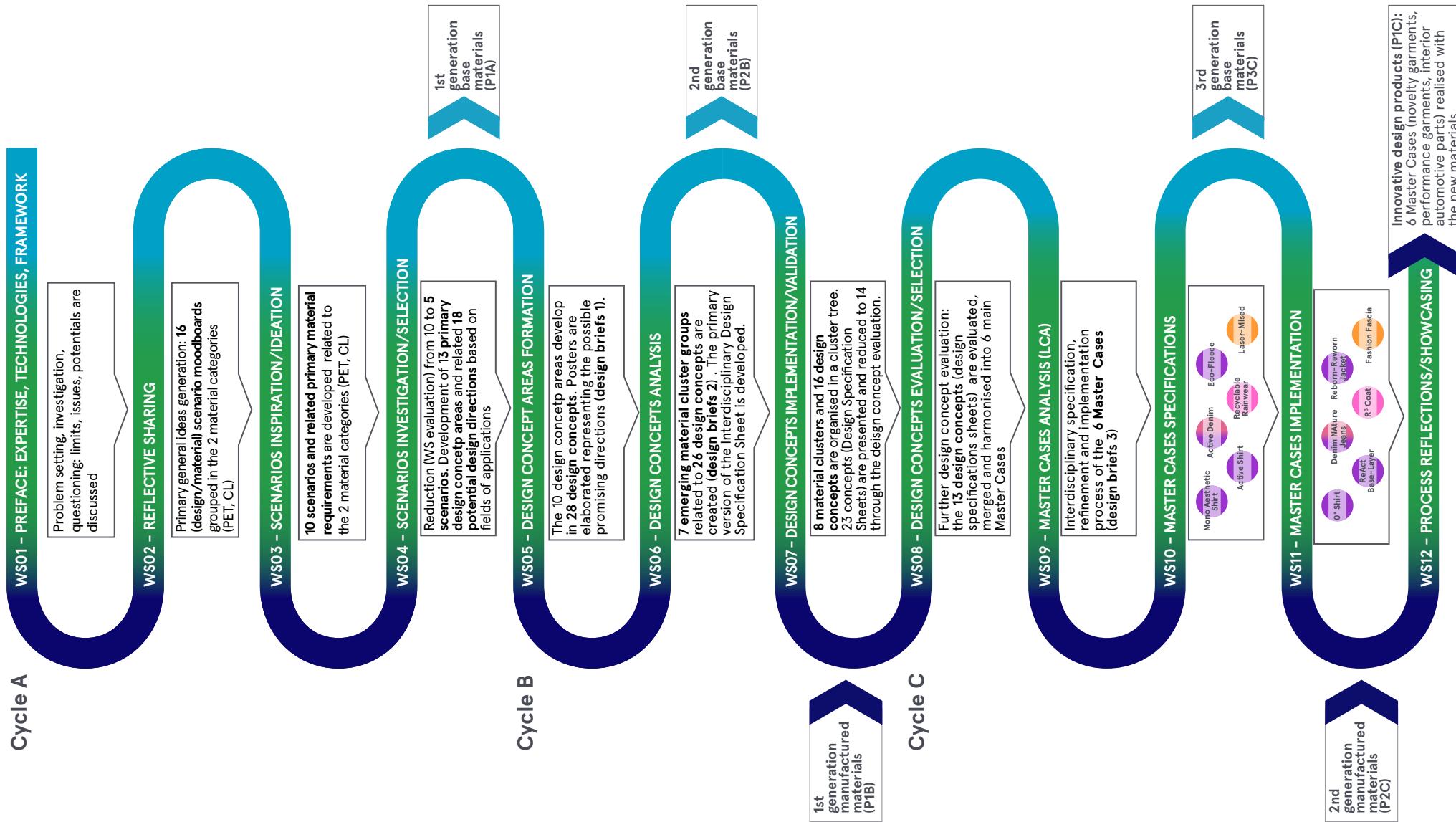(1) 2 examples of post-workshop survey questionnaires can be found in Annex 2

TRASH CASH

Cycle A

WS01 – PREFACE: EXPERTISE, TECHNOLOGIES, FRAMEWORK

Problem setting, investigation, questioning: limits, issues, potentials are discussed

WS02 – REFLECTIVE SHARING

Primary general ideas generation: **16 (design/material) scenario moodboards** grouped in the 2 material categories (PET, CL)

WS03 – SCENARIOS INSPIRATION/IDEATION

10 scenarios and related primary material requirements are developed related to the 2 material categories (PET, CL)

WS04 – SCENARIOS INVESTIGATION/SELECTION

Reduction (WS evaluation) from 10 to **5 scenarios**. Development of **13 primary design concetp areas** and related **18 potential design directions** based on fields of applications

1st generation base materials (P1A)

Cycle B

WS05 – DESIGN CONCEPT AREAS FORMATION

The 10 design concetp areas develop in **28 design concepts**. Posters are elaborated representing the possible promising directions (**design briefs 1**).

WS06 – DESIGN CONCEPTS ANALYSIS

7 emerging material cluster groups related to **26 design concepts** are created (**design briefs 2**). The primary version of the Interdisciplinary Design Specification Sheet is developed.

2nd generation base materials (P2B)

WS07 – DESIGN CONCEPTS IMPLEMENTATION/VALIDATION

8 material clusters and **16 design concepts** are organised in a cluster tree. 23 concepts (Design Specification Sheets) are presented and reduced to 14 through the design concept evaluation.

1st generation manufactured materials (P1B)

Cycle C

WS08 – DESIGN CONCEPTS EVALUATION/SELECTION

Further design concept evaluation: the **13 design concepts** (design specifications sheets) are evaluated, merged and harmonised into 6 main Master Cases

WS09 – MASTER CASES ANALYSIS (LCA)

Interdisciplinary specification, refinement and implementation process of the **6 Master Cases** (**design briefs 3**)

WS10 – MASTER CASES SPECIFICATIONS

Mono-Aesthetic Shirt
Active Denim
Active Shirt
Eco-Fleece
Recyclable Rainwear
Laser-Mised

WS11 – MASTER CASES IMPLEMENTATION

0° Shirt
Denim NAture Jeans
ReAct Base-Layer
Reborn-Reworn Jacket
R² Coat
Fashion Fascia

3rd generation base materials (P3C)

2nd generation manufactured materials (P2C)

WS12 – PROCESS REFLECTIONS/SHOWCASING

Innovative design products (P1C): 6 Master Cases (novelty garments, performance garments, interior automotive parts) realised with the new materials

Fig. 13 Short and focused overview of the general design process related to WS (zoom in to read the content)

TRASH
2
CASH

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WS2: ANALYSIS
Thinking about existing ES materials

Knitted

n Union's
under

WORKSHOP ICONS

WS01
Expertise,
technologies,
framework
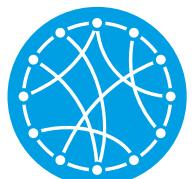
WS02
Reflective Sharing
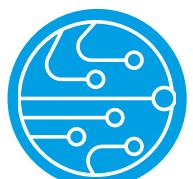
WS03
Scenarios
Inspiration/
Ideation

WS04
Scenarios
Investigation/
Selection

WS05
Design Concept
Areas Formation

WS06
Design Concepts
Analysis

WS07
Design Concepts
Implementation/
Validation (LCT)

WS08
Design Concepts
Evaluation/Selection

WS09
Master Cases
Analysis (LCA)

WS10
Master Cases
Specifications
(storytelling)

WS11
Master Cases
Implementation
(business model)

WS12
Showcasing
results

2.2 Cycle A – Envisioning (design&material) scenarios

The Cycle A is the envisioning cycle in which the initial collaborative design work creates scenarios for the new materials. In this first iterative phase the primary effort is to check and/or to update the logical framework of the project process with all the teamwork, the involved expertise and competencies, the material and processing technologies subject of innovation and implementation. In this cycle design inputs to R&D are general and hypothetical aimed to stimulate research hypothesis and experimentations. EMTs are in an exploratory phase (also at proof of concept level) with a certain degree of unknown. The cycle starts focusing on the research background of the R&D stream in order to highlight the EMTs potentials analysing them from different perspectives (technological, market, environmental, etc.). The in-depth investigation takes the participants, and mainly the design stream, to open the EMTs potentials in many directions (divergence) to explore, questioning and to better understand and define limitations and possibilities. Values, user barriers and perceptions, market trends, advanced applications are explored. This long problem setting and "reflecting sharing" process has the result of creating scenarios, namely context of design intervention, or strategic vision. These scenarios are analysed, scored and the most promising (and feasible) are selected. From the selected scenarios, the designers are able to generate the general design briefs (first version): base material requirements (for the next iterative experimentation of the R&D in Cycle B) and design concept area. The scenarios are based on inputs from all competencies but are mainly steered by socio-cultural (and design) mega trends and potential base material properties (R&D). Beyond the investigation and questioning activity, some of the other experts (manufacturing and other experts stream) carry out feasibility study of R&D hypothesis. This crucial activity starts quite early in Cycle A and is carried out in the other two cycles (always ahead cycle by cycle).

The interdisciplinary exchange between design and R&D has a primary role in this phase, rather than with manufacturing and other expertise stream, as shown in the process scheme. Generalizing, the exchange and collaboration with the R&D is broad (represented with faded colour and large flows), the information flow is extensive but does not affect really research hypothesis and the R&D experimentations; on the other hand the collaboration with the manufacturing is supportive but not yet on a consistent and effective basis (represented with faded colour and thin flows) with the exception of feasibility study of research hypothesis carried out by specific experts. R&D is broad (represented with faded colour and large flows), the information flow is extensive but does not affect really research
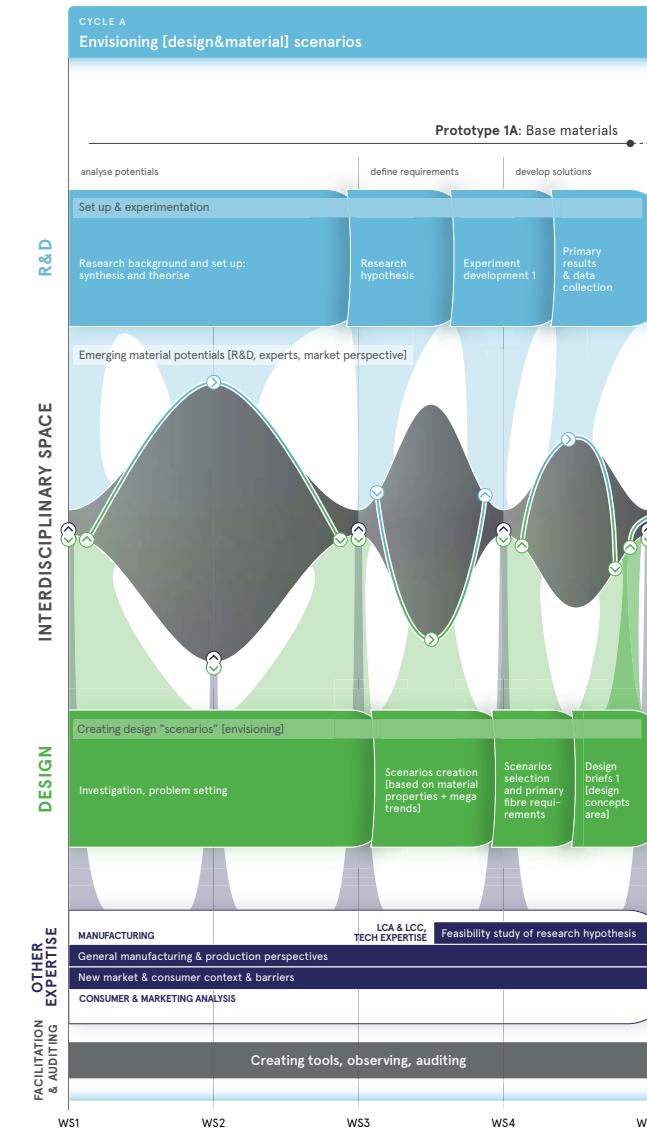
Fig. 14 Cycle A process scheme (zoom in to read the content)

hypothes is and the R&D experimentations; on the other hand the collaboration with the manufacturing is supportive but not yet on consistent and effective basis (represented with faded colour and thin flows) with the exception of feasibility study of research hypothesis carry out by some specific experts.

Cycle A develops in four WSs (plus the closing WS of the cycle). An additional WS has been considered useful in the first step (analyse potentials) of the cycle, in order to increase the time dedicated to the interdisciplinary investigation. Also Cycle C required an additional WS, but in the second step (define requirements) in order to provide partners enough time to define the right and feasible MCs specifications. The milestone of Cycle A is the production of the first generation of base material prototypes (P1A), which are the subject of analysis to start the next cycle.
As the scheme highlights, in Cycle A the focus is on the R&D and the investigation of the EMTs, for this reason the light blue colour (the R&D stream colour) has been chosen to characterize this cycle.
The scheme of figure 15 clarifies the relation among WSs and steps and the main aim of the different streams in each step.

WS1 1 ANALYSE POTENTIALS

Design: Investigation and problem setting
R&D: Set up of research and background
Other expertise: Investigation and questioning

WS2

WS3 2 DEFINE NEW REQUIREMENTS

Design: Create scenarios [based on material properties and mega trends]
R&D: Set up Research hypothesis, experiment development 1
Other expertise: Feasibility study of research hypothesis, primary inputs on end-user perceived barriers

WS4 3 DEVELOP SOLUTIONS

Design: Scenarios selection, and primary material requirements, design briefs V1 [design concept area]
R&D: Primary material results, testing and data collection
Other expertise: General manufacturing issues

WS5 P-1A 1st Generation Base Material Prototypes

Fig. 15 Steps and WSs overview of Cycle A

THIRD SKIN

WS01 - Preface: expertise, technologies, framework
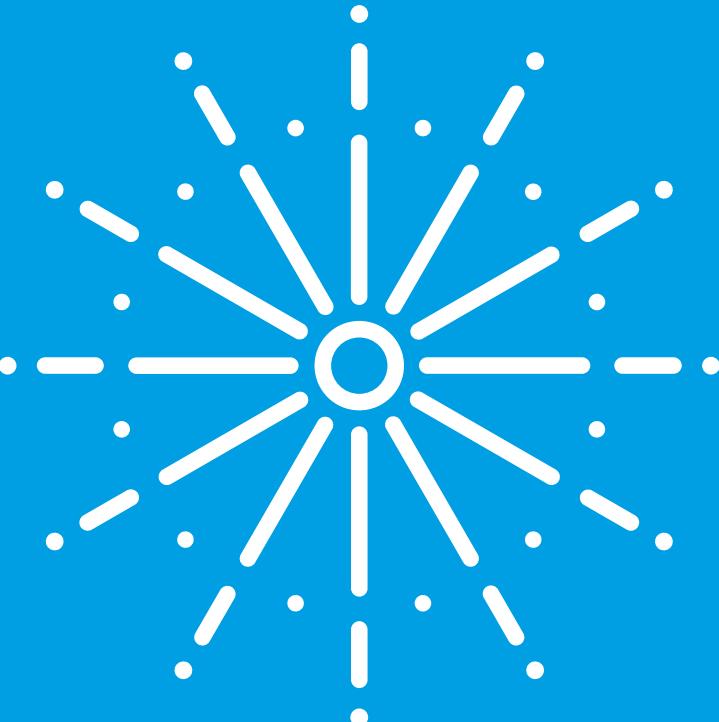
The descriptions of WS01 (first) and WS12 (last) follow a template that is different from that of the other workshops. This is because the project's opening and closing have a set-up of their own and are, by the way, workshops of relative importance in terms of process.
In fact, WS01 is the kick-off meeting of the project and it is aimed mainly at starting the knowledge sharing process.

The WS01 is the kick off meeting of the project aimed mainly to begin the knowledge sharing process. It opens Cycle A and provides the operative and practical information about the main project objectives, roles, and the whole path. A common introduction of all teamwork members is required. In order to check and update the logical framework of the project, each WPL is called to present shortly the actions of which they are responsible, clarifying their institution competencies and expertise. Besides working as a recap of the project and its objectives, the WS is mainly aimed to:

- present primary information about EMTs and processing technologies used in the project;
- provide primary information about EMTs subject of implementation from other non-technological perspectives;
- start a discussion about "specification of expectations" and "field of feasible design actions".

WS PREPARATION

The project coordinator and the main facilitator ask participants to read the original project proposal in every single part. Each WPL prepares a presentation about WP of which he is responsible, in order to introduce tasks and actions, and highlights possible issues or inconsistencies in the planned process. Specific presentations are required to key experts and designers.

WS ORGANISATION

WS01 is organised in two main sessions: the first one is related to the recap of the project's logical framework, and the other one to primary knowledge exchange among participants. A short description of the second session is provided.

SESSION A
OVERVIEW ABOUT INNOVATION IN THE FIELD OF EMTs

Communal part

Several experts and designers present information about innovation in the field of investigation in a very focused and quick way.
Three main topics are introduced:
- design evidences about design for recycling and "designing for cyclability" (design research methods, approaches, case studies, products as systems);
- market and socio-cultural trends from a consumer perspective (Why do we buy clothes? what to do with our unwanted clothes? and what about recycled products? are there potential barriers towards recycled products? is there a potential market for recycled textiles?);
- innovative materials and applications, advanced commercially available solutions.

The main aim is to provide primary stimuli without considering the current limitations, constrains or technological readiness level of EMTs subject of implementation.

USED TOOLS

Slide presentations
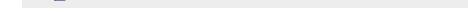
Fig. 17 Some slides of presentations during session A

SESSION B
OVERVIEW ABOUT TECH PROCESSES, CHALLENGES, AND POTENTIALS

Communal part

The responsible material scientists describe the EMTs through simple slide shows, informing about the technology readiness level of the technology, the technological context, the potentialities, and the proof of concept they want to pursue. As an integration to the speech, a sort of technological tour is organized. Participants are split into four small groups, and each of them visits a "technological island" where base materials, used as samples of processing technologies, are displayed, and the processing technologies are described

in each step through photos and videos. For the technologies at pre-proof of concept stage, commercially available materials are used to explain the possible achievements.

USED TOOLS

Slide presentations and tech-islands
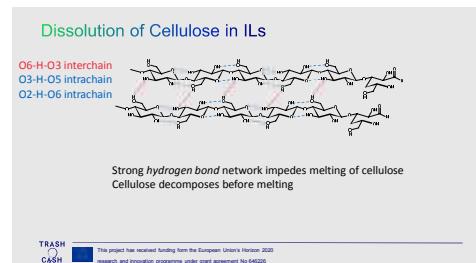
Fig. 18 Some slides of presentations during session B

closure: roundtable asking participants the WS's top moments and specific tips to improve the next meeting.

TRASH
CASH

WS01 FEEDBACK SUMMARY

HIGHLIGHTS

Networking, understanding each others' fields.
Good presentations to get to know people, presentation and good mini exhibition.

Appreciate the interactions during day 2. Information through presentation followed by personal discussions during break gave insight.

CHALLENGES

Concerned about the working path. Will designer have enough material to work on? Suggestion to start working on a similar material that is commercially available.

Understand design processes and manufacturing possibilities.

Need demands for demonstrator for next meeting. Need to start the production at the beginning of next year in order to be able to deliver P1A in time.

Concerned about quantity, will we be able to produce enough material?

SUGGESTIONS

More interactions needed to find out together what directions we should go.

We need to define the applications and the demonstrators. Then we can go back and start to define the different steps.

Wish for more discussions about applications, from an end user point of view.
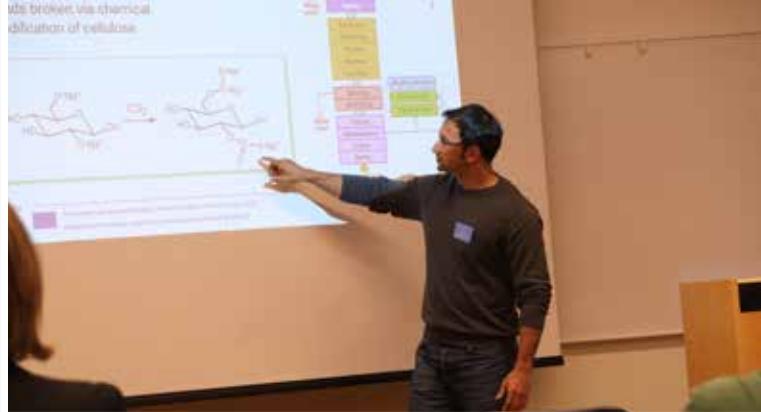
WS02 - Reflective Sharing
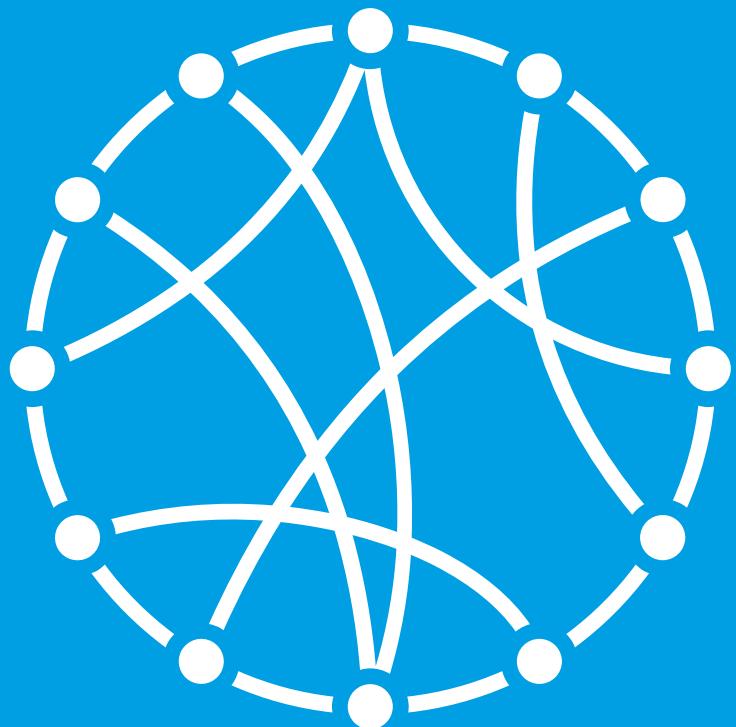
WS02 continues to push further the primary knowledge exchange activity, so that the design stream can proceed with the problem setting, the investigation and the questioning on EMTs together with manufacturers and other experts. The WS gives once again the opportunity to designers, manufacturers and other experts to go through the technological processes face to face with material scientists and to discuss about the range of possible interventions in the definition of the new EMTs characteristics (i.e. possible base material's properties). Among others tools, existing and commercially available material samples and prototypes coming from previous R&D experimentations (both named "Prototypes-0") are used to support the discussion. The WS is characterized by a particular kind of sharing of insights to commonly reflect on potentials and challenges, pushing participatns to think out loud on the spot going beyond any kind of constrains, issues, limits , etc. The WS aims to:

- share insights among different participants and expertises and start co-creating visions by capturing ideas as they emerge from the discussion;
- give the whole working group a chance to discuss possible fields of design investigation, as well as to understand the range of interventions directly with the material scientists to affect the base material characteristics;
- map the specific design expertise within the whole working group.

The WS02 does not focus on product design ideas (more specifically to T2C: not on textile design, textile manufacturing, and not on possible product design ideas, etc.) but on base materials per se, in order to figure out qualities and requirements that could characterize the next base material prototypes. These primary qualities and requirements are elicited taking into account consumer behaviours, existing materials and innovations, limits and potentials of the EMTs, and carrying out brainstorming activity and interdisciplinary discussions. The outcomes of WS02 are the inputs for the next project period. These inputs will feed the three streams, will guide reasoning, and will provide first indications to build up the design scenarios in the next project steps.

WS PREPARATION

2 main groups are created to execute parallel sessions during the WS considering the 2 main categories of base materials (Polyester and Cellulosic in T2C project) in order to involve participants simultaneously in the execution of same activities on different topics. Participants indicate their group based on their knowledge and interest and these indications are used to build up the session activities. To be part of one group category does not mean that the participant will work only on the chosen topic for the whole project, it just means that he/she thinks to provide important inputs mainly in that group in this specific WS.
Furthermore facilitators request participants to create a bulleted list for each of the three main groups of expertise (designers, R&D people, manufacturers and experts) in each group categories (see the homework table figure 19.
Each participant creates the related bulleted lists following these indications:

- be concise quoting just the main elements for each bulleted list: 4 or 5 points max for each list related to each material category
- do not use keywords with long explanations for each point of the bulleted list; the chance to explain each point will be given during the WS activities;
- if possible, consider 3 different typologies of materials for each bulleted list, i.e. specifically for T2C project: knitted, woven and non-woven/composites

The replies are used to make "discussion postcards" to be used during the WS (see Used Tool description).
urthermore, each participant is requested to select and bring material samples to the WS (i.e. specifically for T2C: fabrics - cellulosic fibre-based and polyester-based materials) he/she finds interesting for any reason (added value finishing, great touch, hand feeling, technical aspects, interesting performance, etc.). In order to avoid being overwhelmed by samples and manage a reasonable number of them, it is requested not to bring the whole sample set of a material but to choose exactly a single interesting sample to support the discussion or the proposer's point of view. Finally, facilitators ask R&D people to prepare explanations (no ppt) of their EMTs focusing on the processing technologies and highlighting where it is possible to have some intervention and 'change', and how these latter could affect the EMT's possible final qualities and characteristics. Use

of real material samples is encouraged for this.
The facilitators, with the support of material scientists, outline a simplified overview of the processing technologies to be used as a tool to support the discussion.


Fig. 19 WS02 homework table: each participant replied to the question of his group (Cellulosic or Polyester) and expertise (manufacturers and other experts, designers, material scientists) (zoom in to read the content)

WS ORGANISATION

WS02 is organized in two main sessions and opens with a recap of the WS agenda, WS objectives, project phase and current step.

SESSION A
SHOW UP, INSIGHTS & ANALYSIS
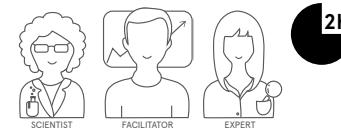
1st part: Show up & tech-insights

Parallel part
Participants are split in 2 main groups considering the two EMTs (Cellulosic and Polyester) subject of investigation and implementation into the project. Participants start discussing directly with material scientists about limits, constrains, potentials. EMTs are investigated from the technological perspective mainly going through:

- material samples brought by participants and prepared in a sort of material showcase
- processing technology flowcharts where interventions (and effects) that may occur are indicated with blank boxes (to be filled in during discussion)

Material scientists have the chance to explain from their perspective where it is possible in their processing technologies to have some 'changes' and how these affect the base materials. Participants provide inputs and feedbacks to the discussion and ideas are discussed in order to understand the possible range of interventions and specifications of expectations.
The samples are used in a "show & tell activity" during the discussion supporting the dialogue among the different participants in the working groups.

✂ USED TOOLS

Prototypes 0: material samples
Two tables are set up to collect two groups of existing and commercially available material samples and prototypes coming from previous R&D experimentations are used to support the discussion.

Fig. 20 Photos of some material samples (Prototype 0) used as communication tool to support the dialogue among participants.

Processing technology flowcharts
The flowcharts facilitate the explanation of EMTs and support the explanation and discussion about changes and effects (feasible interventions) and possible requirements (achievable results). The charts are filled in with the outcomes of the discussion. These information will be elaborated in the next period and used in the next WS.
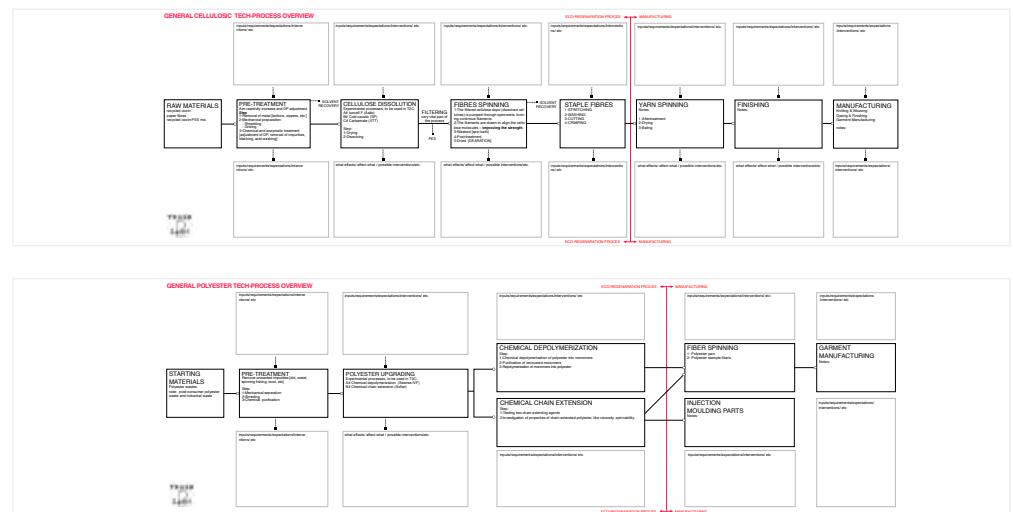

Fig. 21 Processing technology flowcharts related to the two EMTs (zoom in to read the content)

1h

EXPERT

2h

FACILITATOR DESIGNER

2nd part: Consumer & market insights

Communal part
Two slide presentations are proposed to participants in order to provide new inputs after the discussion with material scientists. The first presentation is related to consumer and market perspectives and reflects on finding "determinants" for recycled products from a consumer's perspective related to the EMTs. The presentation also aims to start the set up of the study on consumers and recycled products that will be carried out in the next period. The second presentation provides new insights about material innovation in order to underpin the next brainstorming activities with material case studies and physical samples.

USED TOOLS

Slide presentations about consumer perspectives on recycled textile, products ("finding determinants") and about textile innovation (brief overview of commercially available novelties related to EMTs).
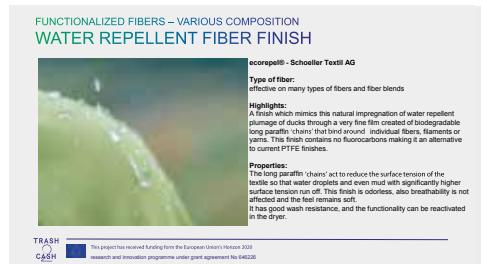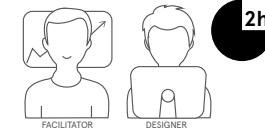

Fig. 22 Some slides of presentations about consumers perspective and recycled products

3rd part: Analysis & discussion

Parallel part
In this part of the session, participants work again split into the two working groups and start discussing about the possible fields of investigation and material requirements from design and manufacturing perspectives. To catalyse and support the analysis the "discussion postcards" are used as inputs. Facilitators support the discussion in the two working groups and fill out the "Analysis Spread Sheets". This part is mainly a preparation to the real brainstorming activity planned in the next session.

USED TOOLS

Discussion Postcards
The discussion postcards contain the indications provided by participants as replies to their homework (homework table (figure 19). More than 120 postcards have been elaborated: about 60 postcards to foster the discussion
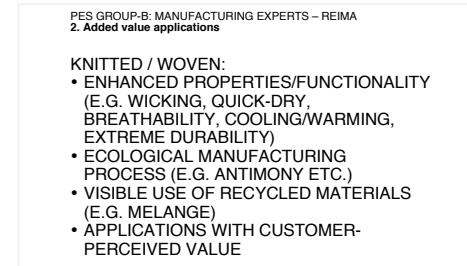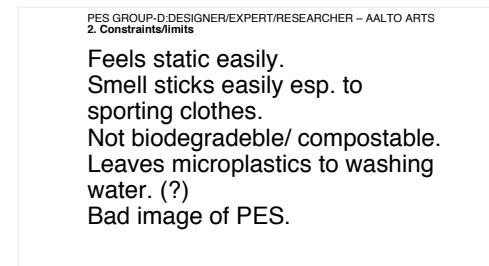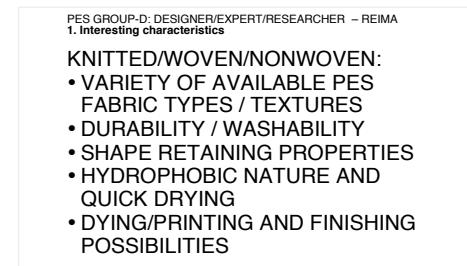

Fig. 23 Some examples of "discussion postcards" related to one of the material category (Polyester) and used by the related working group

CF GROUP-E: MATERIAL RESEARCHER– SP
1. Interesting characteristics

- MORE SMOOTH, SLIPPERY AND GLOSSY FIBRES THAN COTTON FIBRES
- BLOW-WEIGHT FEEL OF THE TEXTILES
- INTENSIVE COLOUR - EASY TO COLOUR

CF GROUP-E: MATERIAL RESEARCHER – AALTO CHEM
2. Constraints/limits

Fibrillation:
- Leads to pilling of textiles
- Can be decreased by chemical treatment, e.g. by cross-linking (however, the treatment is difficult to control)
- Cannot be completely avoided (a property of the dry jet-wet spinning process)

CF GROUP-E: MATERIAL RESEARCHER – AALTO CHEM
3. Value applications

Luxury fibers: high-quality fibers for textiles and technical materials

Different raw materials can be used (even highly contaminated materials, e.g. materials with a high lignin content)

CF GROUP-C: DESIGNER/EXPERT/RESEARCHER – MCI
3. Value applications

- GREAT ON NEXT-TO-SKIN APPLICATION (UNDERWEAR, BASE LAYER, JEANS)

- TRANSPARENCY (CELLULOSE FIBER IN RESIN INFUSED COMPOSITES)
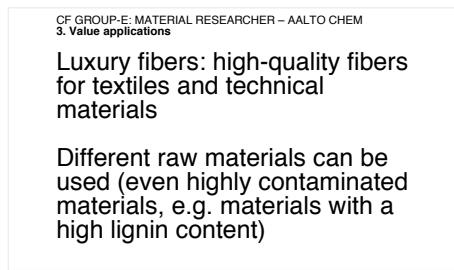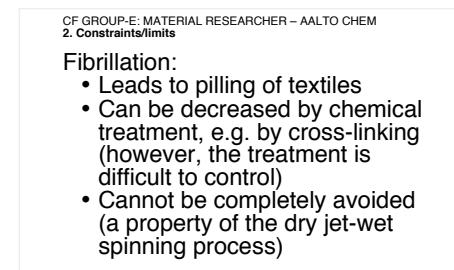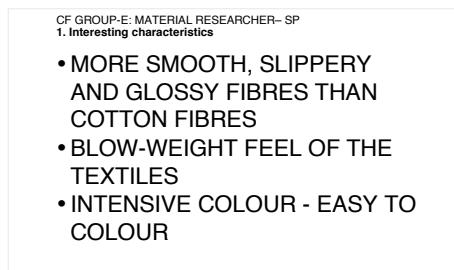
Fig. 24 Some examples of "discussion postcards" related to one of the material category (Polyester) and used by the related working group

in one material category group (Polyester working group) and about 60 for the other material category group (Cellulosic working group). Both postcard categories are divided into "interesting characteristics postcards", "constrains & limits postcards", and «added value applications postcards». With this grouping, facilitators have the chance to better steer the discussion.

Analysis Spread Sheets

The spread sheets are a useful tool to collect all the discussion's outcomes.
The board is divided in different boxes considering the different potentials (applications and characteristics) that EMTs can take during their future development and implementation. Specifically for T2C project, the base materials (Cellulosic and Polyester fibres) can produce different kind of manufactured materials (yarns, filaments, knitted, woven and non–woven textiles). All these possibilities are summed up in the boards that used by the facilitators in the two working groups.

Fig. 25 Analysis Spread Sheets provided to the two working groups (zoom in to read the content)

SESSION B
GENERATING IDEAS & FIXING DECISIONS

2h
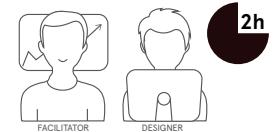
1st part: Wrap up & design pitches

Communal part
The session starts with a summary of the previous session's outcomes. The facilitators use the analysis charts filled in by the two working groups to share the discussed topics with all participants.
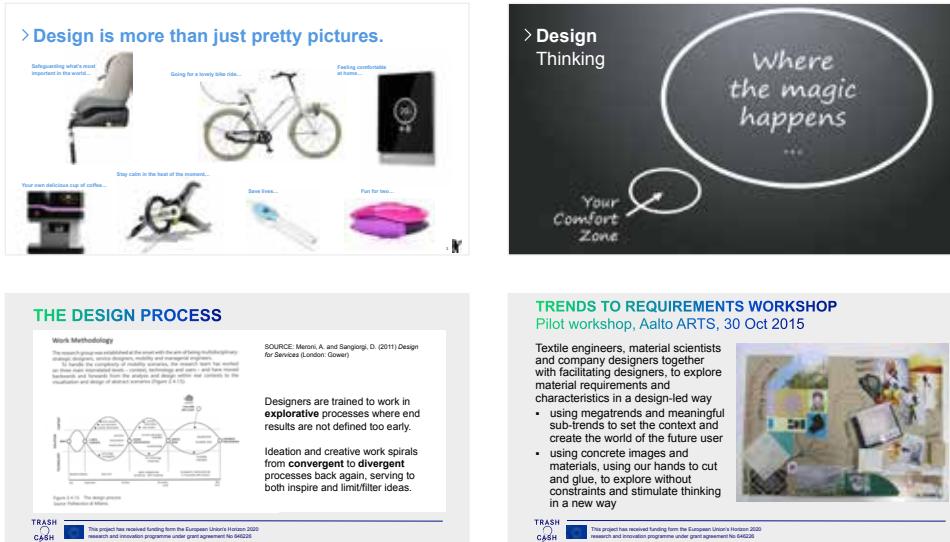In order to provide some knowledge about design thinking and design process to participants that are not familiar with that (i.e. material scientists, technical experts, etc.) some slide presentations take place, specifically:
- A brief overview of design processes
- Design methodology used in other projects
- Pitches of Design thinking

These brief presentations prepare also participants to face the brainstorming part.
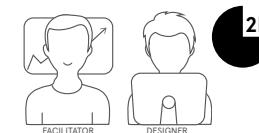
USED TOOLS

Slide presentations

Fig. 26 Some slides of presentations about design thinking and design methodology

2ⁿᵈ part: Brainstorming & ideas

Parallel part
The participants are involved in an envisioning work, i.e. an investigation of interesting context of use, envisioning of scenarios, envisioning possible materials requirements, etc. This primary brainstorming follows the discussion with material scientists so participants are invited to discuss idea in the field of feasibility but without specific limits. The main aim is to explore the visions and understand the barriers, discussing how it could be possible to creatively overcome them. Brainstorming Spread Sheets are used in each of the two working groups, intended as matrix of possibilities. Discussion postcards are used again by

facilitators that have to fill in the spread sheets with the discussed ideas. In order to facilitate the categorization of the ideas coming up during the discussion, specific stickers (elaborated by designers) are used to label the different brainstorming outcomes.

USED TOOLS

Brainstorming Spread Sheets
The boards are used to collect and categorize the outcomes of the creative discussion. Also this board is divided in different boxes considering the different potentials applications and characteristics of EMTs. The boards are filled in by facilitators during the execution of the activities.
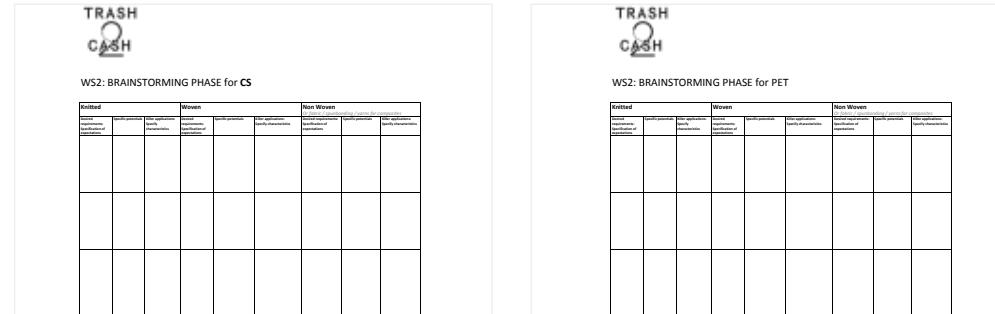
Fig. 27 Baristorming Spread Sheets provided to the two working groups (zoom in to read the content)

T2C stickers

The stickers are used to label the ideas and insert notes and comments during and after the brainstorming.

Fig. 29 T2C stickers used during the brainstorming

3th part: Wrap up

Communal part
The facilitators in the two working groups wrap up the outcomes using the filled wall boards. A sharing discussion takes place also to compare the different results. The aim is also to check and to set the outcomes to be elaborated after the WS.

USED TOOLS

The Brainstorming Spread Sheet filled in and edited by the facilitators.

WS closure: roundtable asking to participants the top moments of the WS and specific tips to improve the next meeting.

Fig. 28 Some photos of the Brainstorming Spread Sheets filled in during the task execution

TRASH
CASH

WS02 FEEDBACK SUMMARY

HIGHLIGHTS

"

Gained unexpected knowledge. Felt the cohesion within the group grow each hour.

Interesting place (Prato and the Textile museum). Inspiring to work with people with different backgrounds.

Nice to see that everyone has been involved in the process. I really liked that this was an active WS and we split into smaller teams.

Common understanding from technical and design points of view through the knowledge sharing activities.

CHALLENGES

Too tight time schedule during the WS. Once we understood the task, we had to move to the next task.

There could have been more knowledge exchanges between the two working groups.

SUGGESTIONS

More time for recovery and shorter sessions

Maybe a little more time for each task, and maybe smaller groups, so there would be more time for each person to express thoughts.

Would appreciate to work closer to realistic applications. Create more constant working groups.

"
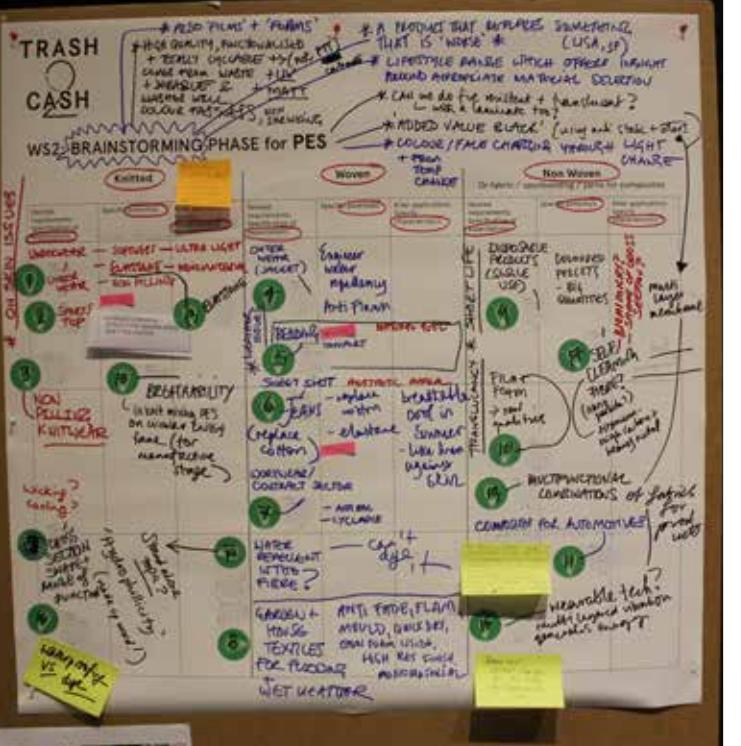
WS03 - Scenarios Inspiration/Ideation
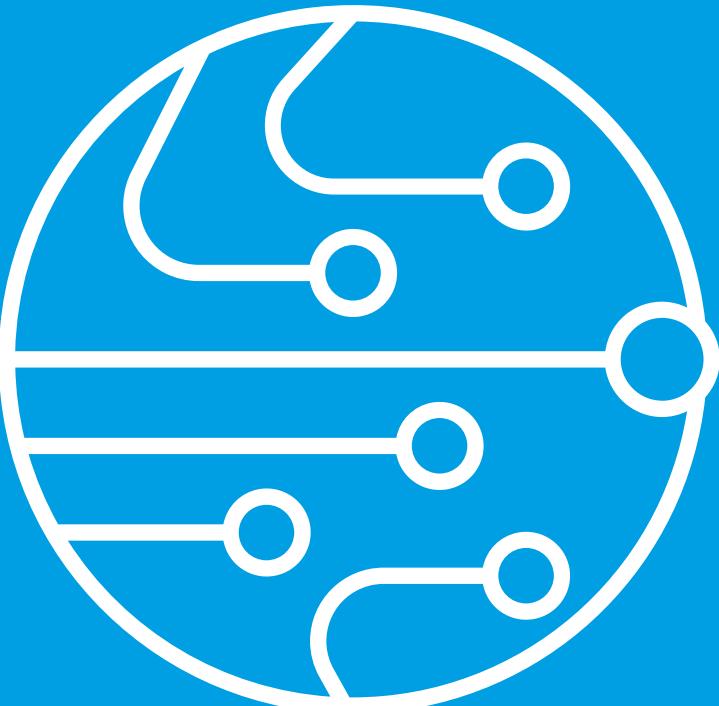
The main purpose of WS03 is to develop scenarios for the EMTs. The definition of scenario is discussed and outlined by Methodology Team and provided to all participants prior to the WS. Scenarios will be the main guide for the development of the primary design briefs (i.e. material requirements referenced to base materials) which will evolve in design concepts. Scenarios shall be construed as contexts, they do not describe the details of a specific concept yet, but they give direction, they define what you aim to and they give a clue of the boundaries that will face participants in the next steps.

WS sessions are designed to gather perspectives from all competencies to develop and refine primary draft scenarios elaborated by responsible partners in charge and based on the outcomes of WS02 sessions.

WS02 was a chance for participants to explore the potential of the base materials and start creating some 'visions' about what the new base materials could be (characteristics and applications). Design researchers and the wider design team worked together from WS02 to develop these visions and to discuss how they relate to building scenarios for these base materials. The separation in two working groups referring to base materials categories (specifically for T2C, cellulose and polyester) has continued in these WS. The WS02 outcomes have been elaborated in form of "moodboards", brainstorming sessions foster their analysis using megatrends as key elements. The themes resulting from these sessions help give scenarios a reality-check and define their direction. The major scopes of the interdisciplinary sessions in WS03 are:

- to create a frame for the development of scenarios as well as evaluation points;
- to gather new information for additional development and finalization of scenarios after the WS, in order to arrive to WS04 to evaluated and narrow down them.

WS PREPARATION

Besides some tool and material preparation, the focus of this WS preparation is related to material samples. Facilitators ask participants to bring new material samples basing on the discussions and outcomes of the two working groups in WS02 and the work carried out after that WS. The purpose of the request is to create a collection of samples, i.e. the "T2C Samples Suitcase".
Before the WS, the Methodology Team decided to create this samples suitcase to be used in all future WSs as interdisciplinary communication tool(2) collecting the different samples used during the different stages of the project implementation. The Methodology Team aims to continuously updated and filled the sample suitcase. The material samples collected in the suitcase will be grouped into four categories:

- Pre-project Material Samples (named Prototypes 0): Samples produced by partners prior to the project start
- Commercial Material Samples (named Prototypes 0): Samples of materials that are available on the market (the amount of these samples is reduced as soon as the project proceeds and material requirements become specific; these samples will be fully replaced by project demonstrator material samples and project design-driven material samples);
- Project Demonstrator Material Samples: Samples prepared to demonstrate the material's potential within the project timeframe.
- Project Design-Driven Material Samples: Samples produced within the project (either by a consortium partner or an external manufacturer, contracted to produce samples for the project as part of a project task)

Indications are provided to participants to select commercial material samples for WS02, i.e. they have to bring samples that represent the following general key concept from their own perspective considering the two main base material categories (specifically for T2C: Polyester and Cellulose):

- high quality
- performance
- technology

The commercial material samples have to represent the above key concepts. The concepts are open to participants' interpretations.
Further indications are also given:

- samples should fall in the range of what it is achievable or participants think it is possible to achieve within the project and with the EMTs, mainly considering the primary inputs/outputs of the interdisciplinary discussions in WS02;
- the most meaningful and appropriate samples must be left to the suitcase responsible;
- samples must be accompanied with their commercial names and/or data sheets and/or as many information as possible;
- it is possible to select one or more samples for each idea/possible scenario discussed by participants during WS02;
- each sample has to be labelled with information (related idea/possible scenario, material information, etc.).

Samples are used in WS02 to fill the gap between "wording material attributes" and "show material attributes" starting from existing materials, or just to express what participants have in mind with a specific attribute.

WS ORGANISATION

WS03 is organised in three main sessions and opens with a recap of WS agenda, WS objectives, current project phase and step, and feedback from previous WSs. Sessions are designed to gather perspectives from all participants to feed, refine and validate the primary scenarios.

3h
DESIGNER
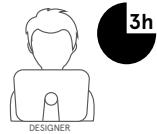
SESSION A
EXPLORING PRIMARY SCENARIOS

Communal part
A brief explanation of the meaning of scenario and of the design process (from base materials vision to draft scenarios) is provided to all partners, followed by a presentation of "primary scenarios" in the form of moodboards (two design

partners were in charge of the translation of WS02 outcomes into moodboards): 9 moodboards for one base material category, and 7 moodboards for the other one. Moodboards can help the working groups to visually define scenarios with the help of potential applications. Scenarios can then be evaluated with respect to evaluation points that will be created after the WS and elaboration of outcomes. Moodboards are meant to inspire participants and decide what is in the scope of the scenario. Defining the scope helps working groups to define EMTs base materials characteristics needed for each scenarios.

Parallel part

During parallel session participants are split into two main groups considering the base material categories (specifically for T2C polyester and cellulose). These sessions aim to explore primary scenarios through megatrends. Megatrends are meant as projections of global, important and macro-economical, technical, and socio-cultural shifts in the development of society and personal lives. Thereby these megatrends are not specifically related to project topics (base materials, EMTs, technological field, etc.). Megatrends are presented and explained to both working groups using wall boards. The interactive and brainstorming activity involves all participants and competencies with the help of design facilitators. Going through the megatrends and using post-its, participants explore the primary scenarios by challenging them, defining the relevance and giving them direction, taking into account this exercise can lead to new scenarios.

USED TOOLS

Slide presentation
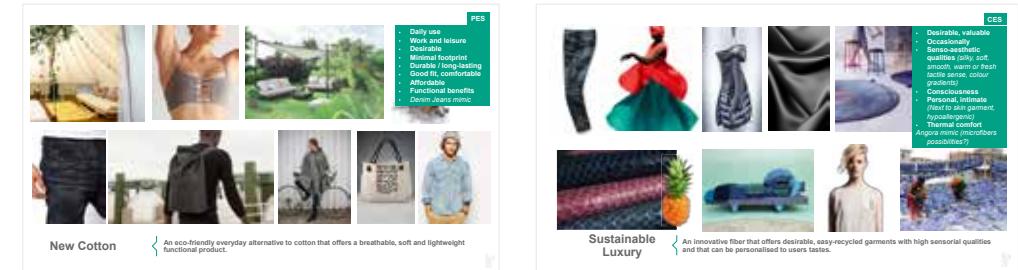
Fig. 30 Some example of moodboards presented and printed for session A in WS03

Megatrends Wall Boards

It is not possible to refer to the used megatrends for confidential reasons (furthermore, megatrends are not related to nor specific for the project, as previously mentioned); some photos of the session are proposed.

Fig. 31 Partners during megatrend exploration during session A

SESSION B
MARKET & TECHNOLOGICAL INPUTS

Communal part

The expert partner in charge to study market potentials, context of use and consumer perspective, presents primary results in order to provide stimuli to the participants. The presentation provides several points for discussion and inputs for the follow-up, as well as feedbacks to the expert partner for further study.
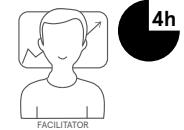
To receive feedbacks from all participants in a quick and efficient way, a voting (clicking) system have been used (each participants received a button ? to be clicked to express specific answers; all the replies are recorder and shown in real time).

Parallel part
Participants are split again in two groups to go through some samples brought by material scientists grouped considering the base material categories. Scientists present table-top samples to show the technological challenges considering mainly expressive qualities and aesthetic characteristics in relation to technical properties: what is possible (not just feasible) and achievable?

Communal part
An intense panel discussion takes place led by material scientists. Simplified characteristics of base materials modification are presented to better clarify the EMTs potentials. In order to facilitate the discussion, questions are written down by participants on "T2C postcards" and collected by facilitators who ask the questions directly to the material scientists. The use of postcards allows each participant to ask questions with less insecurity and concern.

Fig. 32 Scientists present table-top samples and discuss with the working group during the panel discussion.

SESSION C
REVISING SCENARIOS AND ASSIGNING MATERIAL ATTRIBUTES

4h

Parallel part
The participants are split in further small groups to analyse and study the outcomes of Session A in order to revise the primary scenarios. This parallel session is executed in two steps, taking into account two key questions in each step, i.e. "which scenario is more interesting?" (1st step) and "what is missing from these scenarios?" (2nd step). These group activities aim also to assist material scientists in understanding what information is needed for the technical challenges definition. Facilitators lead these discussions using revision spread sheet to revise each scenario.

During a task break participants are involved in an easy but insightful exercise: to collectively assign a superhero to each draft scenario (images of many comics superheroes are provided), in order to characterize the primary scenarios with further values through a soft exercise.
After that, participants go through each primary scenario in order to collectively assign them key material attributes through a tactile session with the support of the facilitators. The interactive session is supported by material samples

(homework) that participants brought to the workshop, and with key attributes post-its and lists.
The session closes with a wrap up moment led by facilitators in order to share the session outcomes with the whole group, as well as to propose a primary evaluation of the resulting draft scenarios.

USED TOOLS

Revision spread sheet

Each small group (assigned to one of the two base material categories) has to fill in the revision table for each primary-scenario. The table aims to revise and support the discussion considering:
- idea's appeal(does it follow the current socio-cultural trends or mega-trends? is it an updated vision? does it provide insightful inputs to the design stream? etc.);
- business potentials (is it interesting from a business perspective? does it result in interesting market opportunities? does it generate an interesting value proposition? etc.);
- manufacturing potentials (is it interesting in a manufacturing perspective? can you envision advantages? etc.).

Fig. 33 Revision spread sheet to revise each primary scenario considering also the outcomes from previous sessions (zoom in to read the content)

Key material attributes post-its and lists

The tool provides two lists referred to the two main base material categories. The working groups related to the categories have to assign at least 4 key material attributes to each primary scenario, considering also possible limitations. The list groups the attributes in senso-aesthetic attributes and performance ones, divide further in attributes (pros/plus) and limitations (cons/minus). The lists are provided also in form of post-its (each post-it includes one attribute, divided by colours).

Fig. 34 Key challenge attribute lists useful to support the discussion and to characterize the primary scenarios with material attributes (zoom in to read the content)

Pre-project Material Samples and Commercial Material Samples (Prototypes 0)
Material samples play an important role during the tactile exercise to facilitate and support the discussions between the different competencies and to express through a physical sample the main material attributes related to each scenario.

Fig. 35 Material samples are used to assign material attributes to scenarios through a tactile session

As a result of all sessions, scenario boards are created. These outcomes will be important materials to work after the WS and to start the next step
WS closure: roundtable asking participants the WS's top moments and specific tips to improve the next meeting.

TRASH
CASH

WS03 FEEDBACK SUMMARY

HIGHLIGHTS

" *Good that we started to focus, it is looking logical and coming close to project objectives*

Facing different possibilities via different perspectives, very efficient, we combined different voices, we understand each other better, sharing common language increasingly

Really like the tangible stuff, going to the posters, and what the material scientists pointed out during the Q&A session we could better understand the issues

During megatrends session we were able to broaden out and bring in other issues such as social issues, it brought home the relevance of what the fibre meant beyond materiality

CHALLENGES

Material samples worked in ad hoc way but we could have used them more, a specific session where the materials help us to talk in a more free way

SUGGESTIONS

Next time more time for technical issues

Reserve time to check how things are going, this is important for the technical side, what's happening in different WPs "

WS04 - Scenarios Investigation/Selection

The main purpose of WS04 is to evaluate the 10 scenarios in order to select the most promising ones in an interdisciplinary manner. The selected ones will be used to elaborate the 1st generation of design briefs (design concept area) right after the WS.

At this stage of the process it is also important that material scientists take stock of the technology stream situation (new constraints, technology challenges, new potentials, etc.) in order to arrive to the next WS with the first generation of base material prototypes (P1A).

In this WS material scientists have the chance to talk about the R&D progresses and the expected primary outcomes through focused and specific discussion sessions.

WS04 arrives after important deliverables in form of reports (market potentialities, technological challenges, primary scenarios of EMTs, design driven material requirements) elaborated also with the outcomes of WS03.

WS04 has also the goal to discuss about the overall project flow and work packages progresses. From this WS onwards, participants are no more grouped considering the two main base material categories (specifically for T2C, polyester and cellulosic fibres) but they will be mainly teamed in peer group (considering their competencies and/or their stream: design, manufacturing, R&D) and later on the design concept development in which they are involved.
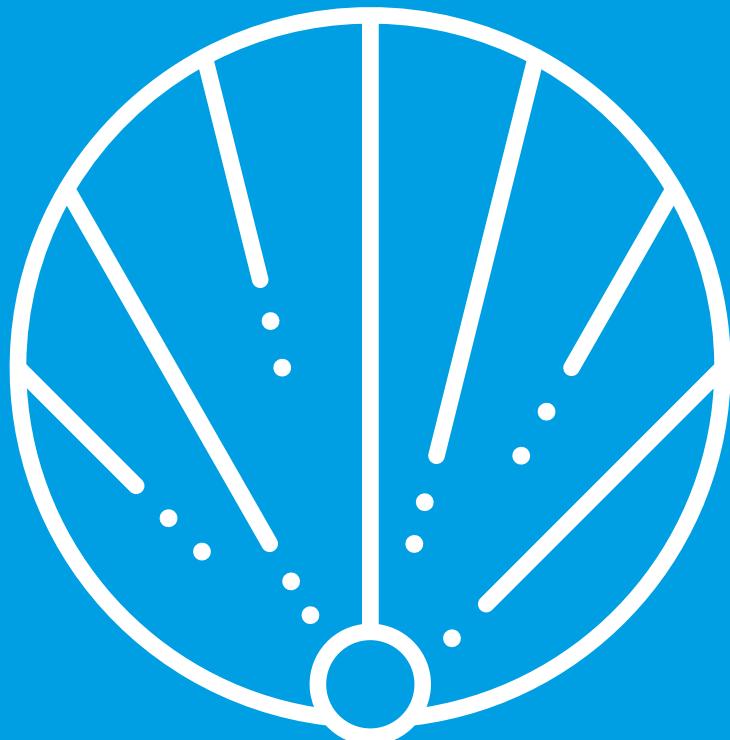
WS PREPARATION

In order to arrive prepared to WS04, participants have been asked to study the four main reports elaborated by specific partners (made available online):
- Final report on market potentialities
- Report on primary technological challenges of the 2 tech-eco-methods
- Report on primary scenarios for 2 eco-fibres
- Report on design-driven material requirements of the 2 eco-fibres deliverable

After the reading, each participant has to answer simple questions using an online form that asks to list 3 interesting points in each report, and to note any points needing further development or definition. The request is made to collect feedbacks and also to be sure participants actually read the reports. In the meantime, facilitators have developed the scenario's sum up boards as well as the needed tools to evaluate and select scenarios.

WS ORGANISATION

WS04 is organised in four main sessions. The first session aims to update the whole working group about the progress in the project`s different streams and WPs . The second and third sessions are focused on investigating, evaluating and selecting the most promising scenarios. The last session sets up a common discussion about R&D issues.

WS04 opening: recap of WS agenda, WS objectives, project phase and current step, and feedback from previous WS.
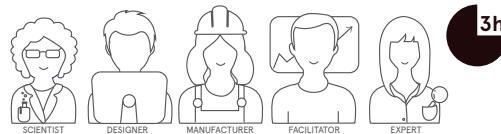
SESSION A
WORK PACKAGES PRESENTATIONS

3h

SCIENTIST DESIGNER MANUFACTURER FACILITATOR EXPERT

Communal part

Each WPL provides a WP sum up prepared using feedbacks from WP partners and a slide presentation template:
- At what stage the WP is

- First results
- Issues (+how to resolve)
- Next steps
- Deliverables

After that, material scientists lead a panel discussion to provide participants specific clarifications and updates about EMTs and R&D stream.

USED TOOLS

Slide presentations
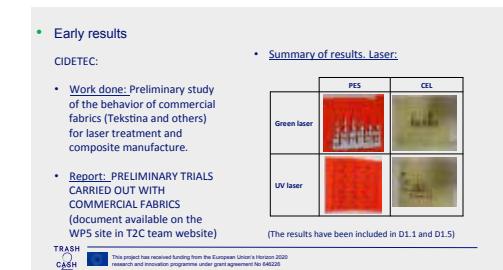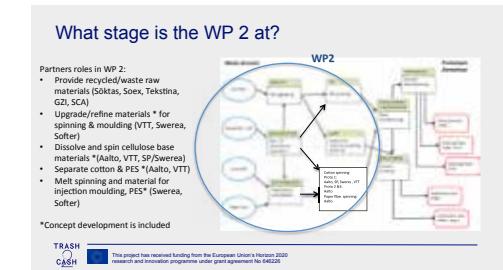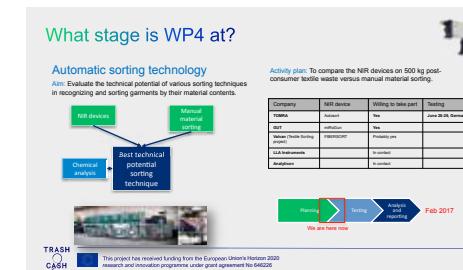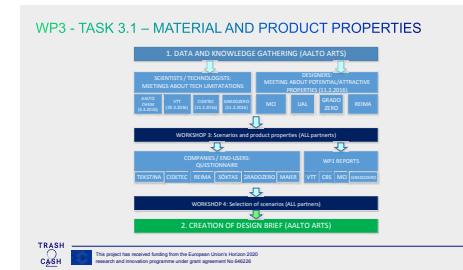
Fig. 36 Examples of slides related to different WPs

TRASH
CASH

SESSION B
SCENARIOS ASSESSMENT

FACILITATOR   DESIGNER   3h
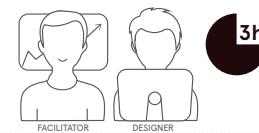
Communal part
Each of the 10 scenarios is summed up in a big (mobile) board. A quick presentation of each scenario takes place to recap to participants the main characteristics of each specific scenario. Scenarios refer to both base material categories (specifically for T2C, polyester and cellulosic fibres). Furthermore a quick explanation of the assessment tool (evaluation diagram) is provided.

Parallel part
The participants split into two main groups, i.e. R&D team (19 people) and Design team (14 people), and each of this working groups is further subdivided into two smaller groups.
These four working groups go through each board exploring each scenario from technological and/or design and/or business perspectives in the light of their competencies. The aim is to identify the feasibility of each scenario and to drop out or combine some of them. The 10 scenarios are evaluated and ranked(3) using the evaluation diagram.
One person from each small group reports back to the main facilitator of the larger group. During the task execution the two main facilitators merge the evaluation tools in order to create a single evaluation board for each of the two big teams. These evaluation boards are used in the next session.

USED TOOLS

Scenario boards
Each scenario board presents the name of the scenario, the superhero image, the keywords used by responsible partners to describe the scenario, the recap table of the primary design-driven material requirements, and the assigned material samples.

THIRD SKIN   NEW COTTON   MADE WITH MEANING

Fig. 37 Examples of scenario board files (zoom in to read the content)

Evaluation diagram
It is a simple tool developed for high level evaluation considering technological and business challenges together with the estimated speed and time of technological development. Participants discuss the merits of each scenario from their perspectives and position each scenario in the diagram.

TOOL FOR SCENARIO HIGH LEVEL EVALUATION

2029

TIME

2019

LOW   CHALLENGE RATE   HIGH
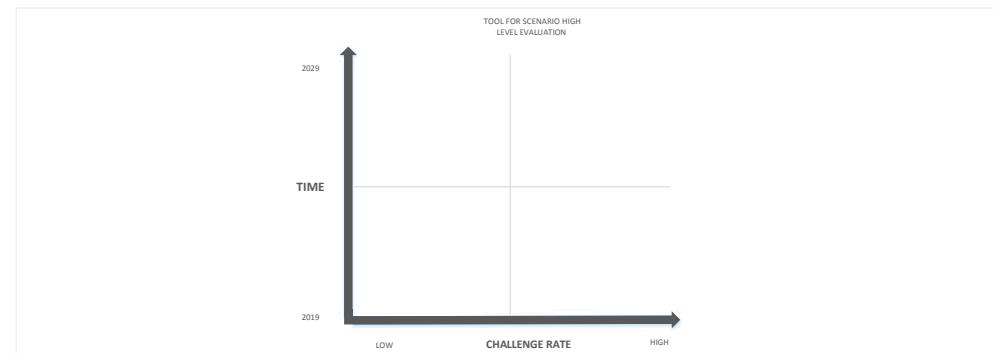
Fig. 38 Evaluation diagram tool

At the end of the evaluation process only 5 scenarios will continue to the next design stage serving as final base for the 1st generation of design brief elaboration.

(3) More information about scenarios and evaluation process can be found in report D 1.5-confidential, related design-driven material requirements of the base materials, and report D.3.1-confidential, related to the design briefs of 1st generation.

SESSION C
SCENARIO REFINEMENT FOR DESIGN BRIEF
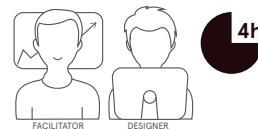
Communal part

Wrap up from previous session by the facilitators from R&D and design team using the evaluation diagram results. The aim of this session is to identify the most potential but challenging scenarios dropping out the most impossible ones. Refinement and further evaluation and discussion are carried out and new points and "second thoughts" are expressed. The panel discussion is in 4 slots:

• Highlighting barriers slot
• From barriers to opportunities slot
• Selecting opportunities slot (in parallel, see below)
• Sum up and scenario refinement slot

The main facilitators go again through the assessment charts in order to include the outcomes of the different discussion and refine the scenario evaluation.

Parallel part

The third slot of the Scenario Refinement session is carried out in small groups. Participants are split again into the 4 groups of session B to identify Barriers and Opportunities of each selected scenario. The aim of the exercise is to foster the interdisciplinary collaboration and approach (to teach how to work together) and to come up with issues that the consortium cannot deal with. A table of "Barriers and Opportunities" is filled in with different points. The listed points are used as basis of discussion in the sum up slot and in the next session.

⚒ USED TOOLS

Filled evaluation diagrams, scenario boards, and material samples

The Session B tools are used again; in this case the evaluation diagrams, filled by the four small groups, are discussed and revised commonly.
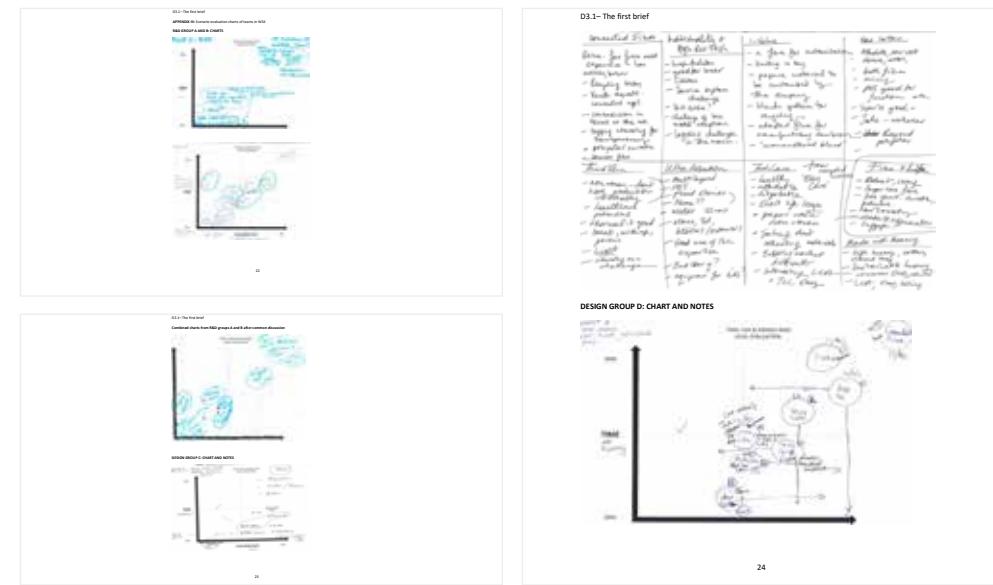
Fig. 39 Examples of filled evaluation diagrams

SESSION D
STREAM WORKFLOW OVERVIEW: CHALLENGES
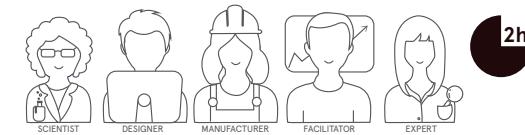
Communal part

The session aims to get a clear understanding of the key challenges, especially in the R&D stream, and how to solve them. One at a time, material scientists point out the key challenges related to the R&D also considering the forthcoming delivery of the first generation of base materials prototypes (P1A). The key challenges are commonly discussed (what are the challenges and how are we going to resolve them?). The processing technology flowcharts are used. Each R&D challenge is debated keeping in mind the selected scenarios and considering their inherent possible challenges. The design stream meets the R&D stream

into an interdisciplinary panel discussion integrated by manufacturers and other experts.

⚒ USED TOOLS

Updated processing technology flowcharts and material samples
Material samples and the technological process overview boards (filled in with inputs coming from previous WSs) are used to support the discussion.
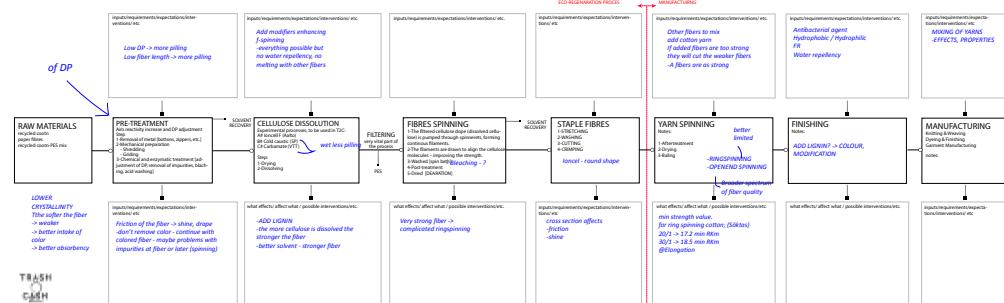
Fig. 40 Updated version of the processing technology flowcharts related to the one of the EMTs (zoom in to read the content)

During the several breaks in the WS, participants are asked to use the provided sticker portraits (small stickers with participants' faces printed on) to co-create a map of expertise. Each participant has to position his sticker face on the right area of the map considering which role and competences they better fit in.
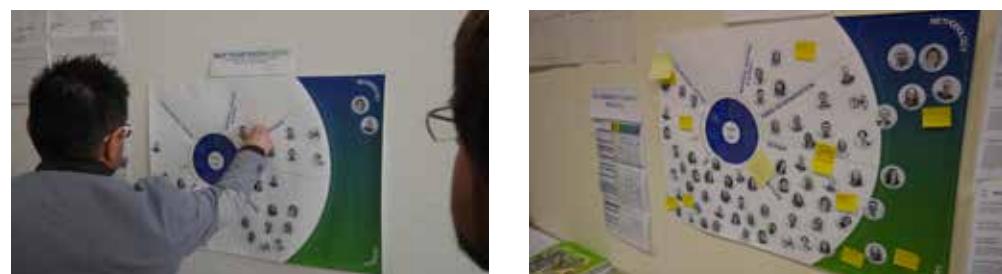
The map and the exercise have been elaborated by design researchers, and they aim at enabling people to understand each other's expertise. Observations from WS03 suggested that peoples' roles and abilities within the workshop setting were still unclear, creating stressful situations. For the same reason a capability survey has been conducted prior to the WS. The capability survey results are presented: a simple tabular presentation of the capability data using colour coding to make the information easier to comprehend. A hard copy is given to each workshop participant and the digital version made available on the internal project website.

Workshop closure: usual roundtable asking to participants the top moments of the workshop and specific tips to improve some aspects to the next meeting.

WS04 FEEDBACK SUMMARY

HIGHLIGHTS

Good balance of teamwork and presentations, between science, design and manufacturer's points of view

WP presentations were useful: good to know where we are going

Important that we narrowed down the scenarios, reduction makes easier to look into concepts design

CHALLENGES

WP presentations were useful even if tasks were not clear

Too many presentations, difficult to digest

It was not always clear in group sessions what the task was

SUGGESTIONS

Expected more discussions on the results achieved so far. Technical sessions. Expected to be able to exchange problems with the others.

Separate discussions on technical and design aspects.

Try to solve the problems before the WS and come to them with the solutions.

Start with commons session, focus on specific issues and then split into different groups.

WS05 – Design Concept Areas Formation

WS05 closes the Cycle A (Envisioning – design & material – scenarios) with the delivery of the first project milestone, i.e. the first generation base material prototypes (P1A). WS05 also opens Cycle B (Evolving – design & material – specifications) at the same time.

The five refined scenarios from WS04 have been elaborated and then made available to the whole working group as scenario sheets prior to WS05 to be used during the WS.

WS05 has therefore mainly three aims: to inform the whole team about the first milestone; to match the refined and elaborated scenarios with specific designers and manufacturers teams; to set up and discuss about the forthcoming prototyping and testing activities.

With WS05 the project team starts a primary strong convergence in the interdisciplinary process. Outcomes of design and R&D streams are compared in order to fine-tune them and to start the integrated decision making and specifications in the new cycle, considering also the increasingly importance of the manufacturing stream.

As to WS05 objectives, a high involvement of participants with design competencies is required.

WS PREPARATION

During the interim period between WS04 and WS05, the facilitators, jointly with designers, update and refine the selected five scenarios. Furthermore they develop potential design directions (primary Design Concept Area) from each scenario: 13 areas are detected which may develop in 18 possible design concepts. A summary description of each scenario (scenario sheets), as well as of the primary design concept area, is elaborated and shared with the whole team prior to WS05. The scenario sheets still refer to both base material categories (specifically for T2C, polyester and cellulose).
Material scientists have to prepare and categorise their base material prototypes (P1A) to be shown and described to participants using also commercially manufactured materials that can express their possible look & feel characteristics. Furthermore a short presentation of WP status is required to WPLs.

	Stretch Comfort	Laser / print ready textiles	Standard Colour	Fibres for Future Manufacture	Paper touch PES Denim	Stretch PES + PTT blend	Stretch CL + PTT blend	Automotive All-in-1	Soft and Strong	Extreme workwear	Meaningful colour	Decorative CL composites	Ioncel PES
Novel Garments		■	■	■	■	■	■				■		
Performance garments	■	■	■	■					■	■			
Plastics / Reinforced plastics				■				■	■			■	■

Fig. 41 T2C table represents the primary 13 design concept areas and the 18 possible design concepts (zoom in to read the content)

WS ORGANISATION

WS05 is organised in four main sessions. The methodology team decided from now on all WSs would have this schedule (i.e. four sessions, each characterised by a main topic and consisting in different slots under the same topic); furthermore in each WS a quick update presentation of each WP status will be kept, using always the same slide presentation structure: at what stage the WP is; first results; main issues; next steps; deliverables. These presentations will be split and provided in four different rounds to avoid too long presentation slots.
WS05 opening: recap of WS agenda, WS objectives, project phase and current step, and feedback from previous WS.

3h
SCIENTIST

SESSION A
R&D ISLANDS

Communal part
Material scientists give a quick presentation of each base material prototypes achieved so far: technical aspect, main issues, challenges, barriers, etc.

Parallel part
Three tables are created one for each material category (specifically for T2C, plastics and reinforced plastics, polyester fibres and textiles, cellulosic fibres and textiles). These "material islands" display: first generation of base materials produced in the first cycle, commercial materials able to represent the possible look&feel qualities achievable by base materials, and/or, in some cases, product examples that demonstrate the material qualities previously specified (these materials are selected by material scientists, and integrated by others selected by designers from the samples suitcase). All material samples are labelled and categorised. Participants are split into three interdisciplinary small groups (area groups containing experts from mixed disciplines, i.e. designers, manufacturers, LCA, etc.) to go alternatively through the "islands" (maximum 40 minutes in each island) in order to discuss with material scientists about R&D achievements. Each participant takes notes about issues, barriers, potentials, evidences, etc.
All participants' notes are collected on a board at the end of the activity.

⚒ USED TOOLS

Material samples (P1A and commercial samples)

Fig. 42 Part of the reinforced plastic material island in session A

SESSION B
DESIGN ISLANDS

3h

FACILITATOR

Communal part
A set of quick presentations take place, in particular:
• first generation of design brief (design-driven material requirements) as indications for R&D and prototyping;
• sum up of scenario sheets, clarification on design concepts areas, and scope of design islands session;
• presentation of the results of the focus groups' research on consumer behaviours.

Parallel part
Three tables (islands) are created based on the project's main application areas (specifically for T2C, novel textiles/garments, performance textiles/garments, automotive incorporating reinforced plastics and plastics). Each island has a

specific facilitator. Participants are split in three interdisciplinary small groups, i.e. area groups containing experts from mixed disciplines. Each group rotates around the tables spending an equal amount of time at each design island, interacting with material samples and suggesting design concept areas before moving to the next. All notes are reported onto the design directions worksheets, and collected on a board at the end of the activity. The aim of this session is to develop through collaboration the broader scenarios into more specific and developed design concept areas and in each area define the possible design directions. The focus is on designers interacting with material and product samples alongside with scientists, manufacturers and experts; this leads to understanding material attributes in order to be able to better define them as design concept areas are developed, and vice versa.

⚒ USED TOOLS

Scenario sheets
Each one of the five design scenarios is summed up in a scenario sheet. A set of 5 design sheets is provided to each design island.

Fig. 43 Two examples of Scenario Sheets prepared by facilitators and design researchers to support the development and assignment of concept design areas (zoom in to read the content)

Design directions worksheets

Worksheets with main information about proposed design directions (18) related to primary design concept areas (13). The cards are provided to every designer and manufacturer. Some cards are empty so participants have the chance to write down other possible design concept areas.
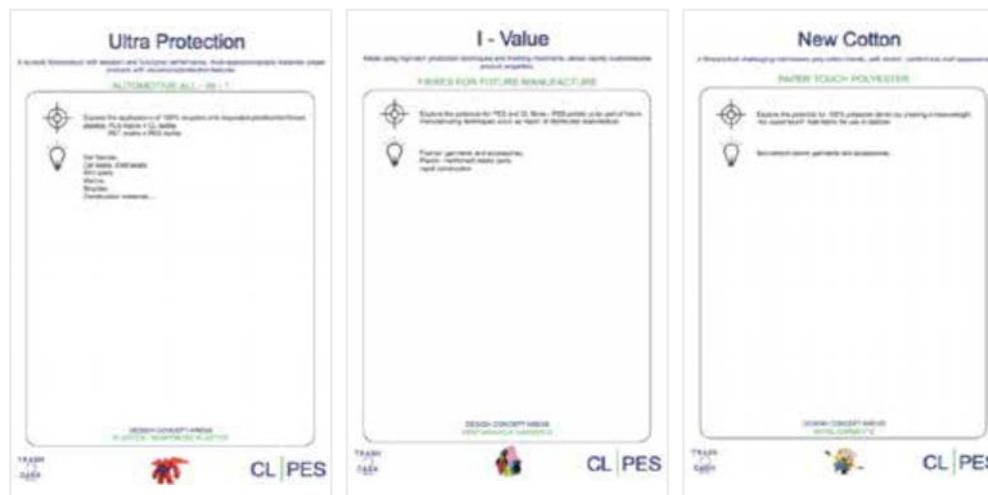
Fig. 44 Examples of design directions worksheets used in session B

SESSION C
MATCHING AND TAKING CHARGE

Communal part
The aim of this session is to assign the development of possible design directions to a specific responsible among design participants and form design working groups (manufacturers and designers). The new design concept areas originated in the previous session are presented and discussed during this common, post-activity feedback session. Designers are then asked to identify the design concept

area they wish to continue working on during the interim time following WS05 and prior to WS06.
In the previous WS sessions participants to have formed an idea in their heads about which areas/directions they would like to work on, or new design assignments that they would like to create;
instead Session C is an opportunity to formalise and push design working groups, enabling them to take important decisions, to facilitate the work between workshops and to move towards a common goal.
Detailed breakdown of the session in slots:
- Sharing phase: facilitators assign design directions to designers and manufacturers in an open discussion format;
- Matching phase: facilitators from design islands present the updated design concept areas and directions considering their application sector (specifically for T2C, novel garments, performance garments, automotive – plastics and reinforced plastics) which may have been developed further during the previous sessions or new ones have been created. Facilitators ask the whole team a few key questions: has each of you decided on which assignment you would like to work on? who has more than one? who has more than two? this determines if facilitators need to allow participants to visit other groups halfway through the session. Primary matching and convergence among participants are created;
- Taking charge phase: each designer/manufacturer discusses about its taking charge (selected design directions) in order to have ideas exchange about their exploitation with other partners/experts. Facilitators then ask which participant would like to work on which design assignments, placing stickers on the boards where all the notes from previous sessions are collected. After having formed working groups around a table for each assignment, each working group then discusses roles and how they might work together between WS05-WS06.
Some guidelines/topics are used to guide discussions around each table, for example: What is the realistic goal of the design assignment within the project? What might be each partner's role? What knowledge/expertise/equipment does the assignment need to succeed? Is there any knowledge/expertise/equipment missing from the current possible working group? (i.e. do you need to ask another partner to help in some way?) What are the potential challenges? How might you initiate the assignment?

• How often/when will you meet? Does anyone want to visit another assignment? Participants have the chance to visit other working groups with other assignments in which they would like to be involved. Each working group reports back to the facilitator – particularly concerning challenges – to see if anyone in the room can help.

At the end of the session, design working groups are created and assigned to update design directions/design concept areas (the initial 13 design concept areas have become 10 at the end of the WS, but the 18 design directions increased to more than 25 possible directions).

Fig. 45 Examples of possible results of taking charge exercise shown to participants during Session C presentation

⚒ USED TOOLS

Scenario sheets

The filled design direction worksheets and all the notes reported by each small group are used to support the discussion and create the matching and tacking charge.

Face stickers

Face stickers are used to visually indicate the design working group and the matching between them and the design concept areas.

Novel
Garments
Design Island

Performance
Garments
Design Island

Plastics /
Reinforced
Plastics
Design Island

Fig. 46 Examples of stickers assigned to facilitators and their field of application during design islands exercise
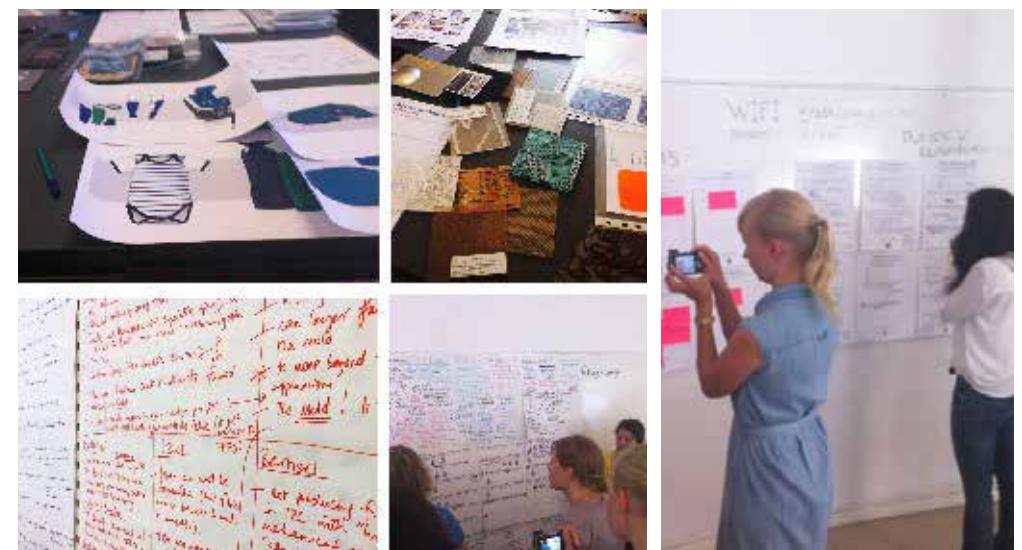
Fig. 47 Material samples and participants in action during the matching and taking charge session

SESSION D
PROJECT WORKFLOW REVIEW

2h
FACILITATOR
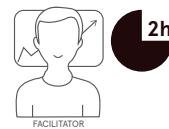
Communal part
A panel discussion takes place in this session, aimed to talk about project workflow issues. It represents an important moment for all participants at this project stage. A big poster Gantt Chart is used as basis for discussion. Participants have the chance to visualise the whole process in Cycle B (deadlines, interdependencies among streams, WPs and tasks, etc.) and several issues and inconsistencies arise during the discussion. The chart and the facilitators help participants to be involved in a common decision making and reasoning on possible solutions: needed postponement and delay, alignment in the process flow and among outcomes, etc. The chart has been previously used only as a management tool, and it is shared with participants for the first time. It has proven to be an important tool to make participants aware of the project workflow, clarifying possible inconsistencies among WPs and related tasks.

The basic Gantt chart takes into account just the three more relevant WPs at the current project stage. This basic chart will develop in a very complex and articulated workflow scheme. The Gantt will be used in several WSs from now on, and it will be kept constantly updated and made available to the whole team.

USED TOOLS

Gantt Chart – Cycle B
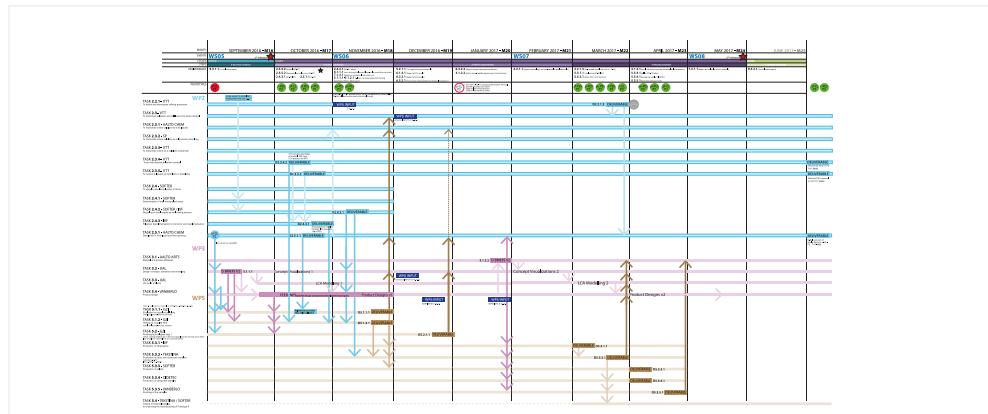
Fig. 48 Gantt Chart of Cycle A used during Session D in WS05 (zoom in to read the content)

WS05 FEEDBACK SUMMARY

HIGHLIGHTS

Most useful sessions: Gantt session (solving project issues) and the taking charge

Most useful tools: Gantt chart and material samples

Continually trying to improve strategy for making sessions more understandable to participants, such as formalising the facilitation roles

SUGGESTIONS

Investing more time on explaining the tools & more simple tools

Each task has to end with clear conclusions

Sharing more materials with partners before the workshop

More technical presentation and parallel sessions for that

CHALLENGES

Too many differences in facilitation styles

There wasn't enough time to explore scenario posters and design island worksheets to get the best out from them
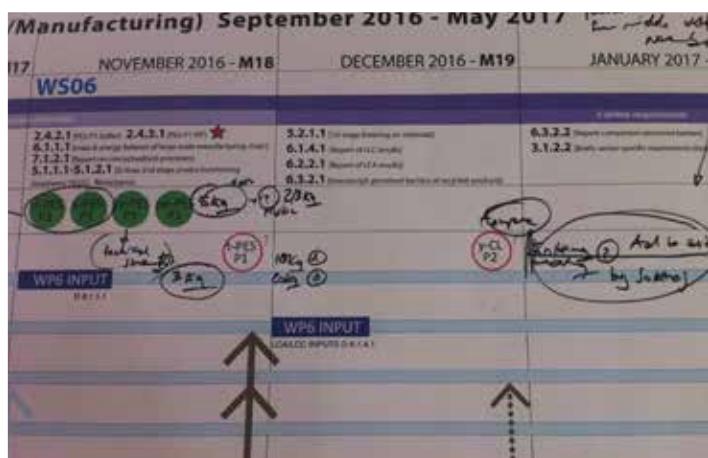
Fig. 49 WS participants indicating great and challenging moments related to the WS's of Project Chronology Exercise Cycle A

Project Review Cycle A

This first project review was held during WS 06 in London, which was actually the first WS after concluding the project Cycle A. The feedbacks collected for each WS of project Cycle A are summarized as following.

PROJECT CHRONOLOGY EXERCISE RESULTS

The first WS review exercise has been held to gather comments about great moments and challenges perceived during the WSs in this first project cycle.

ANALYSIS OVERVIEW

WS01 Feedback Summary
Major number of comments made about this first effective WS involving all project partners, are related to an overwhelming experience of meeting a lot of new people and receiving a lot of information. Crucial questions: how people meet and get to know each other? How to share information and knowledge? A total of 23 feedbacks have been gathered, where no negative feedback about 'ambience and social activities' and no great moments about project progress and results have been indicated. Most positive comments as well as major number of perceived challenging moments were about topics related to 'WS contents & methods'.
INSIGHTS: comments can be summarized as for the great moments in "meeting each other", and for the challenging moments in "knowledge sharing format".

WS02 Feedback Summary
Undiscussed highlight of the third project meeting was the venue: the WS location was perceived as really inspiring and had a positive influence on the participants. Meanwhile, participants rated WS methods and used tools as confusing, since instructions have been perceived as not clear. The total amount of gathered feedbacks is 38, majority of great moments agree on about 'ambience & social activities' as a highlight, whereas challenges have been perceived about 'WS contents & methods'.
INSIGHTS: comments can be summarized as for the great moments in "WS venue", and for the challenging moments in "instructions and tools".

WS03 Feedback Summary
Communication emerged as the main issue in this WS; instruction of WS activities were perceived as unclear and confusion mainly due to participants having different approaches to challenges. Meanwhile, knowledge sharing moments have been perceived as very enriching. The gathered feedbacks, total of 29, attribute the most

positive comments as well as major number of perceived challenging moments about topics related to 'WS contents & methods'.
Highlights: comments can be summarized as for the great moments in "interaction and Q&A session", and for the challenging moments in "communication and approach differences".

WS04 Feedback Summary
Again, at this WS the venue has received a lot of positive comments, offering the participants a relaxing and inspiring ambience. Participants were active and spontaneous group discussion contributed to an enriching knowledge exchange. On the other hand, participants commented negatively that no final conclusions and decisions have been made. As in WS02, also in this WS, where 33 feedbacks were gathered, the majority of great moments agree on about 'ambience & social activities' as a highlight, whereas challenges have been perceived about 'WS contents & methods'.
INSIGHTS: comments can be summarized as for the great moments in "group discussions and WP updates", and for the challenging moments in "conclusions and final decisions".

WS05 Feedback Summary
Positive perceived aspects have been indicated for the last WS of cycle A mainly about the venue for its relaxing ambience and the tools (Gantt-chart) used to clarify the project development. In general, positivity and enthusiasm are reported, mainly thanks to having discussed and overcome issues by turning difficulties into solutions and taking decisions. Negative comments cover all four aspects, highlighting the issue of not having a clear method and procedure for taking final decisions. The gathered 33 feedbacks about this WS indicate great moments almost equally for aspects related to 'WS contents and methods', 'project progress and results' and 'ambience and social activities'. Challenging moments are almost equally perceived for all four categories, besides the above mentioned three including also 'sharing knowledge and collaboration'.
INSIGHTS: comments can be summarized as for the great moments in "clarification and enthusiasm", and for the challenging moments in "decision making method".

TRASH
CASH

GREAT MOMENTS

CHALLENGES

WS00
getting started

uncertainty

INSIGHTS

WS01
meeting each other

knowledge sharing format

INSIGHTS

WS02
workshop venue

instructions & tools

INSIGHTS

WS03
interaction Q&A session

communication & difference in approach

INSIGHTS

WS04
group discussions & WP updates

conclusions & final decisions

INSIGHTS

WS05
clarification & enthusiasm

decision making method

INSIGHTS

Column headers (repeated for each workshop): workshop contents & methods | sharing knowledge & collaboration | project progress & results | ambience & social activities | total feedback

Fig. 50 Project Chronology Exercise –Cycle A table edited with participants feedbacks (zoom in to read the content)

CONCLUSION FROM PROJECT CHRONOLOGY EXERCISE

The collected feedbacks can be divided into three main topics, which identify important aspects to be considered when setting up an interdisciplinary project WS. For each thematic area, some crucial parameters are highlighted, which:

WS SET-UP
Ambience – a nice context fosters positive climate and enhances participation.
Surrounding conditions of the WS, such as the working venue, catering, changing context, etc. have an indirect, however real influence on participant's mood and thus ability to engage in an active and positive manner.
Great moments: "Inspiring location. Walk towards dinner", WS02
Challenges: "Too formal and official venue", WS00
Social Activities – creating a personal connection between participants takes down barriers.
Providing for short extra activities from the very beginning permit the participants to get to now each other also on a personal level; trust is crucial to start to collaborate. These social moments are useful at project start, and should be repeated regularly in order to bring on board also new entries.
Great moments: "Speed date dinner and very familiar ambient", WS01
Challenges: "Hard to get to know people and roles", WS03

COLLABORATION
Knowledge sharing – sharing individual knowledge to enable a common starting point.
By exchanging knowledge between participants in an initial phase, a common ground of understanding is created which facilitates communication in the first place, followed by a fruitful collaboration.
Great moments: "The scientist Q&A session", WS03
Challenges: "Lack of discussion about technical, practical issues per activities within the consortium. More coordination needed", WS02
Communication – finding a common language for an efficient collaboration.
Great moments: "First time proper discussion and dialogue between manufacturers, researchers, designers", WS04
Challenges: "Communication between different expert groups", WS05 -

"Difficulties to understand design language", WS02
Approach – aligning approach to enable clear and simple task executions.
The involvement of experts from different sectors, brings together professionals having different backgrounds which may apply a different or even a contrasting approach to problem solving and task execution. Aligning methods and agreeing on a common way on how to communicate and execute tasks previously fosters a successful involvement of all participants.
Great moments: "Description of processes by the scientists with tutorial and samples of fibres", WS01
Challenges: "Different facilitation styles caused confusion", WS03

PROJECT RESULTS
Structure – differentiation of activities helps to keep participant's attention and involvement level high.
Alternating social moments, interactive presentations, collaborative group sessions and individually executed tasks favours a responsive engagement of all participants.
Great moments: "Games during WS to meet each other", WS01 – "Interactive sessions to create scenarios between designers, scientists and manufacturers", WS03
Challenges: "2 days of PPT's non-stop", WS01 - "Group work got repetitive", WS03
Tools – schemes and charts help to understand project aims and processes.
Providing simple but effective project management tools such as Gantt-charts, project timelines, collaboration maps, etc. help to understand how the project is supposed to perform; should be provided to all involved actors.
Great moments: "Solving problems by the Gantt-Chart", WS05
Challenges: "Trying to understand how the WP's connect together", WS04
Decision Making Methods – agreeing in advance on how and when decisions must be taken.
Defining methodology and timing of taking decisions prevents time consuming discussions, which might call into question already achieved results. At the end of every WS foresee a moment to summarize the results obtained, decisions to be taken and define needed further actions.
Great moments: "We finally made some decisions", WS05
Challenges: "Democratic voting about difficult technical things", WS05

COLLABORATION MATRIX EXERCISE RESULTS

ANALYSIS OVERVIEW

How Facilitators / Design Researchers
Since the begging of the project, facilitators and design researchers indicated a quite intense collaboration between partners belonging to this same expert group, with a minor auspice to intensify collaboration and knowledge (data) exchange. Not a lot but some intense exchange has happened with participants of the R&D/Material Scientists expert group and a more active collaboration is definitely requested, in particular about data evaluation and feedback. Likewise, a need for more collaboration is expressed by R&D/Material Scientists and in general feedback from this expert group indicate a similar perception of collaboration. Only few participants from the Facilitators/Design Research group mentioned an exchange with Designers/Manufacturers but are very interested in some more direct (1to1) involvement. Whereas according to Designers/ Manufacturers collaboration has been perceived as quite constant with only few expressions for wish for more collaboration.

How R&D / Material Scientists
According to R&D and material scientists there has been a good collaboration within participants belonging to this same category, in particular on providing raw materials and working on samples. By almost all participants some light collaboration is indicated with Designers/Manufacturers, but the whish for more collaboration and exchange – especially about material requirements – is strongly highlighted. This way of rating collaboration is reflected also according to Designers/ Manufacturers, which indicates a similar perception of collaboration by both expert groups. Collaboration between participants belonging to R&D/Material Scientists and to Facilitators/ Design Researchers has been rated similar: only few partners of these two expert groups indicated light or intense collaboration, most of them whish to have more exchange, especially about market and consumer data.

How Designers / Manufacturers
During this first project cycle there has been some collaboration between participants belonging to this expert group, but as much future collaboration is desired. All Designers/Manufacturers indicated some collaboration with the materials experts, wishing to have more knowledge-sharing about technical issues related to materials and processes. A similar perception of collaboration is indicated also according to R&D/Material Scientists. Collaboration with Facilitators/Design Researchers has been perceived as not very intense but executed by almost all partners belonging to the Designer/Manufacturers expert group. More exchange is not especially desired. This perception dose not reflect collaboration perceived by the facilitators, which indicated less collaboration and the wish to intensify.

TRASH CASH

FACILITATORS / DESIGN RESEARCHERS   R&D / MATERIAL SCIENTISTS   DESIGNERS / MANUFACTURERS

KEY TO SYMBOLS:

LIGHT COLLABORATION

MEDIUM COLLABORATION

INTENSE COLLABORATION

DESIRED COLLABORATION
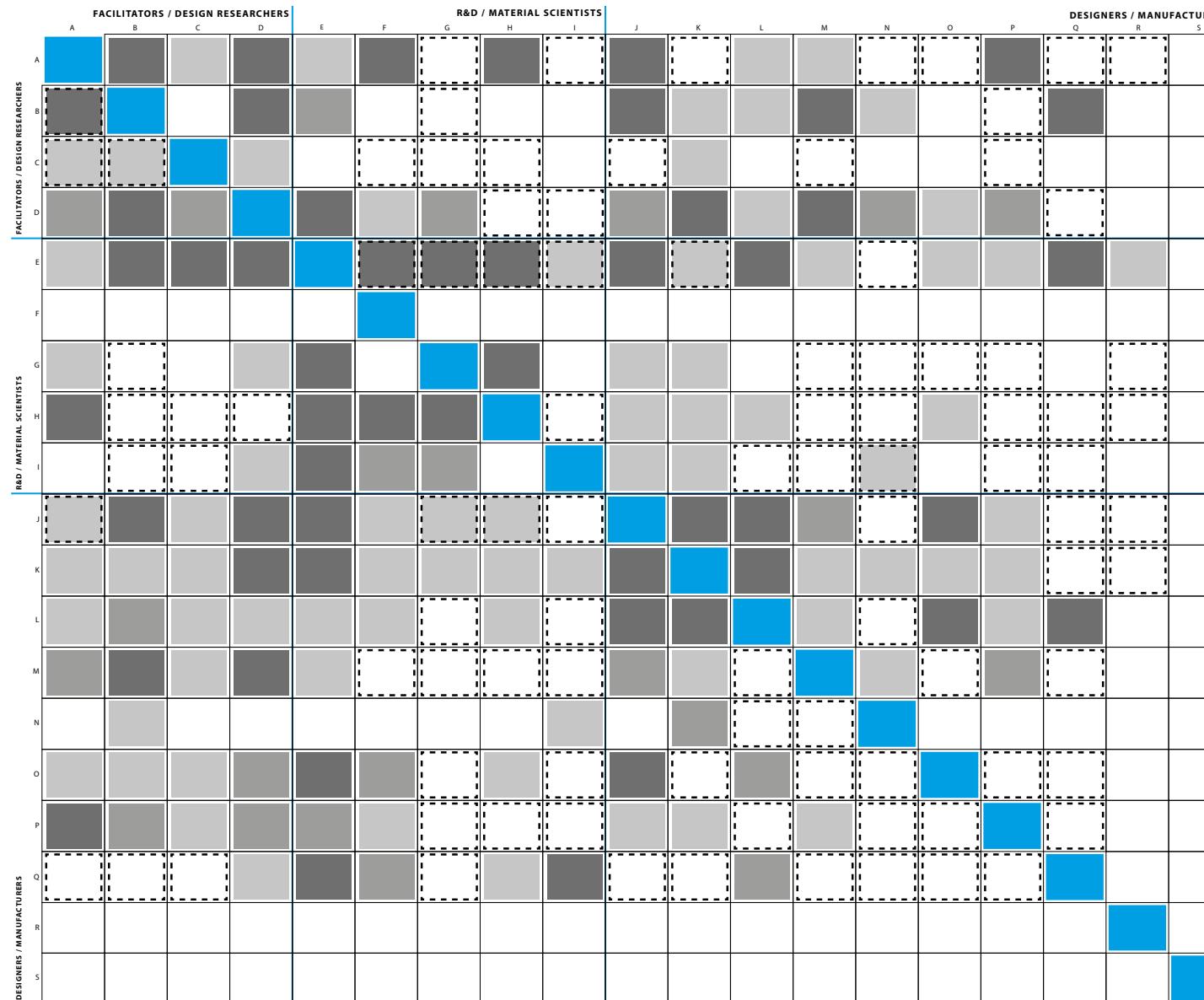
Fig. 51 Collaboration Matrix–Cycle A with area of competences highlighted (zoom in to read the content)

CONCLUSION FROM COLLABORATION MATRIX EXERCISE

Overall, this first evaluation exercise highlights that a more intense collaboration has happened mostly between partners of the same expert group (Intra-connections), where Facilitators/Design Researchers and R&D/Material Scientists indicated a sufficient collaboration with no specific expression for more collaboration. Meanwhile Designers/Manufacturers expressed the need for more exchange between partners belonging to this same expert group.

Collaboration between the three expert groups (Inter-connections) has been perceived almost equally between partners belonging to Facilitators/Design Researchers and R&D/Material Scientists. Whereas exchange between Facilitators/Design Researchers and Designers/Manufacturers is perceived as more active by the latter one. A desire to have a more intense exchange between R&D/Material Scientists and Designers/Manufacturers, is clearly expressed by partners belonging to both groups.

COLLABORATION ISLANDS EXERCISE RESULTS

How R&D / Material Scientists suggest enhancing collaboration
Self-analysis
During this evaluation exercise participants belonging to the expert group of R&D / Material Scientists were quite self-critical providing several feedbacks about their own behaviour, indicating in a pro-active way what to stop doing, what to start doing and what to improve doing. Main issues were identified about communications and how information is managed (tracking, sharing). As Strengths are identified the monthly exchange and an active collaboration on material development.

Shared Feedback
In the second part of the exercise, R&D/Material Scientists shared only a few suggestions with the other expert groups highlighting some issues related to a targeted (towards right people and content) and focused communication.

Received Feedback
On the other hand, the feedback received from the representatives of the other expert groups, indicated as hindering for a good collaboration engagement and way of communication and knowledge-sharing of R&D/Material Scientists. As a strength were highlighted their open-mindedness and the performed research-activity.

How Designers / Manufacturers suggest enhancing collaboration
Self-analysis
The participants belonging to the Designers/Manufacturers were very productive in this collaboration evaluation, providing major number of suggestions during the first part of the exercise, the self-analysis. Issues of own behaviours highlighted the need for more and efficient sharing of information, and a call for less analysing and more concrete action. As strength are identified good communication and collaboration between participants of this expert groups.

Shared Feedback
Designers/Manufacturers provided quite a lot of feedback to the other expert groups mentioning a focused and clear communication as a need to improve collaboration, highlighting as positive aspects to be cultivated the creativity and open-mindedness of the other expert groups.

Received Feedback
The suggestions received from the other expert groups indicated as an issue the need

to involve only key-persons in communications and meetings, whereas asking and giving feedback is a very appreciated strength of Designers/Manufacturers to be kept up.

How Facilitators / Design Researchers suggest enhancing collaboration
Self-analysis
Participant belonging to the Facilitators/Design Researchers expert group condensed their internal evaluation on some few indications highlighting the need to overcome argumentations on basic questions (research ethics) in order to keep discussions focused. The regular exchange is indicated as a strength.

Shared Feedback
The feedback provided to the other expert groups mentioned aspects of inclusion as an issue, asking for more involvement between the three expert groups. On the other hand, a good spirit of collaboration is generally perceived as a strength between participants.

Received Feedback
Facilitators/Design Researchers gathered some requests to simplify comprehension of tools, methods and structures of the WSs, and to being more coordinated thus clearer during sessions. Whereas the diversified sessions were highlighted as a positive aspect to be continued.

TRASH 2 CASH

R&D
MATERIAL SCIENTISTS

☐ STOP
Problematic areas and things to change for better

· stop to present issues only during WS: improve communication!
· do not spread communication to partners not involved.

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results

· progress meeting about WP2 once a month
· having direct connection with the partner that provides the post-consumer material
· use the T2C teamsite more for document sharing
· WP2 leader should care much about activities and issues of the other partners in WP2, also in the PES-stream
· WP2 leader should prepare agenda of progress meeting (P.M.) involving partners, write minutes after P.M.
· develop a testing methodology
· technical web-seminar about finishing treatments

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results

· progress meeting about WP5 once a month
· keep testing materials
· more knowledge sharing activities: possibilities with finishing/weaving-knitting/printing etc.
· keep sending materials to Swerea
· keep testing materials of Swerea
· boundaries and rules of communication improving

DESIGNERS
MANUFACTURERS

☐ STOP
Problematic areas and things to change for better

· stop thinking about business as a limitation before knowing all facts
· less presentations: more focused cooperation

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results

· divide the design concept developement task into subtasks
· more focus on business: try to envision user perspective
· more collaborative discussions at the WS design + R&D
· designer should give more information what they want
· more information sharing
· teamside messaging
· talk!
· exchange more technical info between us
· clarify needs and requirements
· taking notes under post-it about your role

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results

· combine and define the design concepts
· keep the same pace/rhytm
· keep on developing collaboration with material scientists
· writing clear mails

FACILITATORS
DESIGN RESEARCHERS

☐ STOP
Problematic areas and things to change for better

· discuss about basic research ethics - between researchers (should be clear)

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results

· strategic /higher level problem analysis and solving needs more time: one day WS?
· permission for using data for various purposes?
· more focused discussions

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results

· regular Skype meetings: works well to discuss details

SELF-ANALYSIS EXPERT GROUP ISLANDS

FEEDBACK FROM OTHER ISLANDS

· Skype meetings with key-players only (focused and brief)

☐ · stop going home early: stay until the end

▷ · explain complex concepts in simple words: try to explain more for designers
· more communication with WP2 (R&D)

▷▷ · keep on doing good research activity
· keep being open minded about design/coll. + fibre developement
· keep being open-minded in WS

▷ · provide designers with more materials
· think as a designer (we are all users)
· be more careful about deadlines

▷▷ · keep on doing good research activity
· feedback on concepts (be involved in concept generation)

☐ · more sessions focused on specific topics (e.g. design concepts) from all points of view

▷ · work to be coordinated, be clear with methodology/aims
· keep it simple; why you do, how you continue

▷▷ · good job and inventing good sessions

▷ · find ways to contact everyone and expose your opinion
· CBS wants to be more inlcuded in the design developement phase…

☐ · collaboration with design concepts
· asking questions
· give feedback
· show your own opinion

☐ · describe the meaning of the tools used, to much complex!

▷ · Skype meeting for preparing activities and share knowledge

When possible use similar approach [visuals, structure of the session/tools]: easier to get into the session

"Good research = good documentation"

Every time new stuff

Inform before meeting about tools [especially complex tools + tired people = not getting good results]

To be clear for certain session/task [what happened, why did it happen, how are we planning to continue?]

Idea of tools: make it more clear, what you want to gain with it
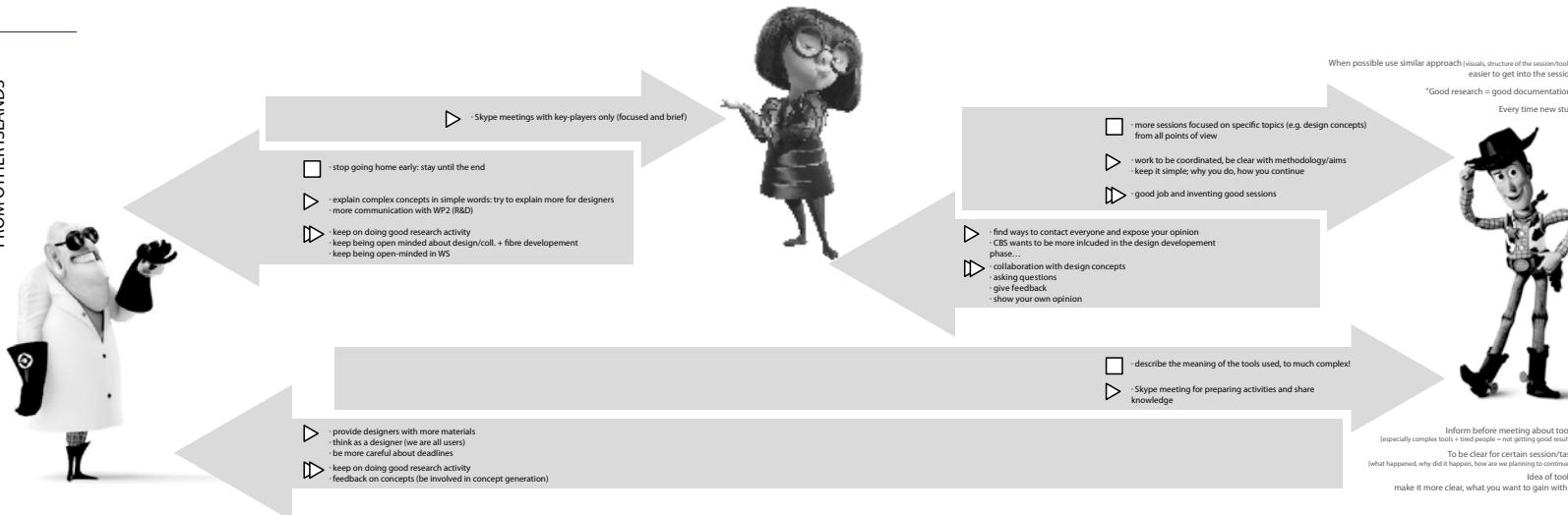
Fig. 52 Partner Islands Cycle A – Answers (zoom in to read the content)

TRASH
CASH

CONCLUSION FROM COLLABORATION ISLANDS EXERCISE RESULTS

As a result of this self-evaluation exercise, a total of 60 comments have been gathered. Most of them providing suggestions on how to foster collaboration (PLAY) and a lot of encouraging feedback to continue already established practices (FAST FORWARD). Only few requests to stop some bad habits were collected (STOP), some of them indicating an attitude that harms the spirit of collaboration, in particular:

"Stop to present issues only during WS"
"Stop going home early: stay until the end [of WS]!"

Analysing the amount of feedback made, shared and received by each expert group, arises that the R&D/Material Scientists was the most self-critic expert group making several consideration about own behaviour and giving few feedbacks to the other expert groups. Designers/Manufacturers were the most consistent commentators providing 16 suggestions to adjust own behaviour and 10 feedbacks to the other expert groups. Meanwhile Facilitators/Design Researchers were most critic towards other expert groups sharing 11 suggestions, making 5 comments about own activity.
Summarizing the content of the comments, the following suggestions were gathered from the directly involved participants, indicating how collaboration between expert groups could be enhanced:

"Explain complex concepts in simple words: try to explain more for other expert groups"
"Regular Skype meetings: works well to discuss details"
"Use the T2C team site more for document sharing"
"Find ways to contact everyone and expose your opinion"
"More knowledge sharing activities e.g. technical web-seminar"
"Prepare agenda of progress meeting involving partners, write minutes after progress meeting"

2.3 Cycle B – Evolving (design&material) Specifications

The Cycle B is the evolving cycle where the materials are developed in response to design scenarios and requests: design and material specifications evolve in parallel and affect each other. It is the most complex and articulated cycle. The exchange between disciplines and competencies is more consistent. Design inputs, fed by other expertise, become interventions in R&D decisions. These interventions are limited, focused and in the range of possibilities. After the first R&D outputs and related analysis of their potentials, the degree of interventions are clarified and design inputs are taken into account to be integrated into the analysis of new research hypothesis. The R&D stream reflects on the new inputs and improvements, and set up new multiple distinct research hypothesis. The experimentation and

test of several ideas is carried out and a subsequent narrowing down phase takes place, in order to test several ideas. This R&D process leads to new base materials results (2nd milestone of the project). On the other hands, the scenarios become concept design in this cycle, to be implemented in MCs in the next one. A second implemented version of design briefs is defined (design concepts and new material requirements), improved through a validation process and a Life Cycle Thinking approach (LCT). Final design concepts are analysed, evaluated, scored and selected and finally compared with the new generation of materials: first generation of manufactured material prototypes (P-1B) obtained from the second generation of base material prototypes (P-2B). A large amount of different prototypes are produced during the whole cycle. In this cycle roles, aims and design-driven process became much clearer, perhaps because the nature of the interdisciplinary exchange becomes more focused and also because the methodology team better understand the facilitation capabilities of individuals and the communication needs of the consortium, both within the WSs and in between.

All streams have an intense interdisciplinary exchange in this cycle, as highlighted in the process scheme. The collaboration is more focused among streams (represented with more saturated colour) than the previous cycle, the information flow is more specific and the amount of information balance (represented with medium-thin flows). The crucial moments are frequent and the exchange dynamics (sending request, analysing input, providing feedback) are articulated and overlapped. The importance of the manufacturers and other
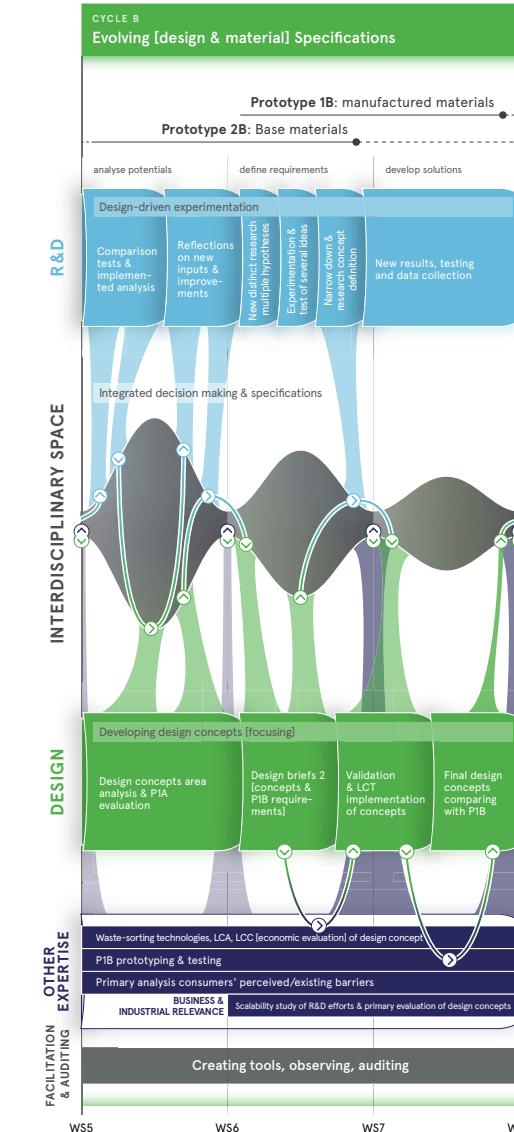

Fig. 53 Cycle B process scheme (zoom in to read the content)

experts' perspectives increases step by step.
Cycle B develops in three WSs (plus the closure WS of the cycle). No additional
WS is necessary in this cycle, each WS open or close a cycle step. This cycle starts
with the closure WS of the previous cycle (WS05): the ending WS of a cycle is
indeed the beginning of the next one in term of activities and focus.

The second generation of base materials (P-2B) are developed earlier in cycle
C than Cycle A. In this way, manufacturers can produce from them the first
generation of manufactured materials in the right time frame (if not specific
issues occur). It is crucial that all the activities and related outcomes are well
planned from a time perspective in this process phase.

Even if all the process is design-driven, the role of design is particularly central in
this cycle; for this reason in our graphical representation the cycle has the green
colour (design stream). Non l'ho capita.
The scheme of figure 54 clarifies the relation among WSs and steps of the cycle,
and the main goal of the different streams in each step.

WS5 **1** **ANALYSE POTENTIALS**

Design: Analyse design concepts area & evaluation
of fibre requirements
R&D: Testing, comparison, & implemented analysis [P-1A];
Reflecting on improvements considering new inputs
Other expertise: Providing inputs and questioning

WS6 **2** **DEFINE NEW REQUIREMENTS**

Design: Design briefs 2 [design concepts and manufactured
material requirements]
R&D: New distinct research hypothesis [more than one];
experimentation and test of several ideas; narrow down
and research concept definition
Other expertise: Primary LCA inputs; scalability study of R&D
efforts and primary inputs to design concepts

WS7 **3** **DEVELOP SOLUTIONS**

Design: Validation & LCT implementation of concepts;
final design concepts comparing with material prototypes
R&D: New results, testing and data collection
Other expertise: Material prototyping s and testing,
primary LCA, LCC, sorting study, scalability study of
R&D efforts

WS8 **P-2B** **2nd Generation Base Material Prototypes**
P-1B **1st Generation Manufactured Material Prototypes**

Fig. 54 Steps and WSs overview of Cycle B

WS06 – Design Concepts Analysis

Following WS05, designers developed primary design concepts, while manufacturers and experts carried out their testing on P1A and material scientists reflected on new inputs (including requirements received from the other streams) and improvements for the elaboration of updated research hypothesis. In this complex stage of the project, WS05 has the main objective to converge all the work done during the interim period (WS05-WS06) from the different streams (design, R&D and manufacturing, and other experts).
The main WS objectives are:

- To present and evaluate 28 Design Concepts;
- To present and discuss new R&D results (comparison texts, implemented analysis and new research inputs);
- To present and discuss primary (few) manufactured materials (and issues related to the other ones);
- To introduce primary Life Cycle Thinking (LCT) and LCA inputs to the whole team.

The WS objectives will be achieved through panel discussions, a mix of informative and brainstorming activities mainly directed at providing primary indications to design stream about LCT and LCA, using all competencies involved in the process. The WS has to provide specific outcomes so that all streams can proceed in the next process stage with common decisions and interdisciplinary inputs in order to: set up new multiple research hypothesis for the next round of experiments (R&D stream); develop the 2nd generation of design briefs and requirements for the 2nd generation of base materials – P2B – and the 1st generation of manufactured materials – P1B – (design stream), provide manufacturers and experts information to proceed with their analysis and understand the needed input in the other streams.

WS PREPARATION

During the interim period between WS05 and WS06, a digital template is developed for each design concepts area (10) and related design directions (25), elaborated and selected in WS05. The Digital Sharing Tool is a method to manage design development and collaboration between designers through digital remote communication: it supports the development, recording and communication of design ideas of design concept areas and design directions for material attributes. Three special facilitators – Material Liaison Officers(4)– are appointed to be intermediaries between designers and manufacturers, and to support design development based on the three material application areas of the project (specifically for T2C, novel textile/garment, performance textile/garment, automotive). Their role is to capture the designers' ideas development with regards to materials' attributes and to support the information flow across work packages and disciplines.

The digital sharing tool is made of four sections: a first section containing directions for use, and three sections to be completed by designers with indications about the initial design idea/inspiration, the material's attributes, and considerations about its life cycle.

The tool prompts designers to firstly consider then describe specific material attributes of their design concepts; and then it introduces life cycle thinking, to allow designers to link life cycle implications with specified material attributes. Life cycle thinking(5) is introduced at this stage for two key reasons: firstly,; to provide the opportunity to establish the level of life cycle understanding that existed within the designers and their existing process; and secondly, to ensure life cycle thinking is linked to the origins of the design process and concept developments within the T2C project.
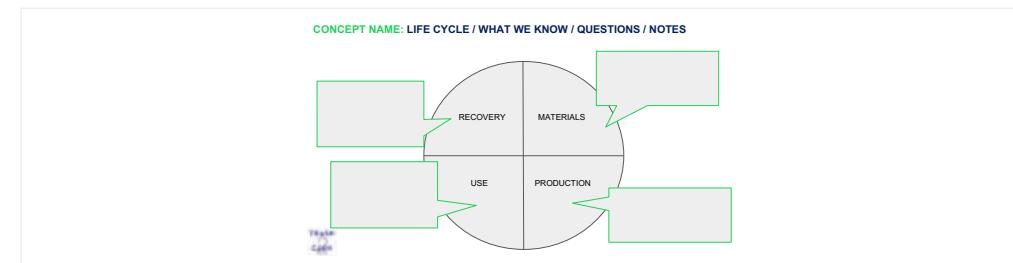

Fig. 56 The digital sharing tool document used on a digital sharing platform to allow design partners to collaboratively work into and develop design ideas both together and independently
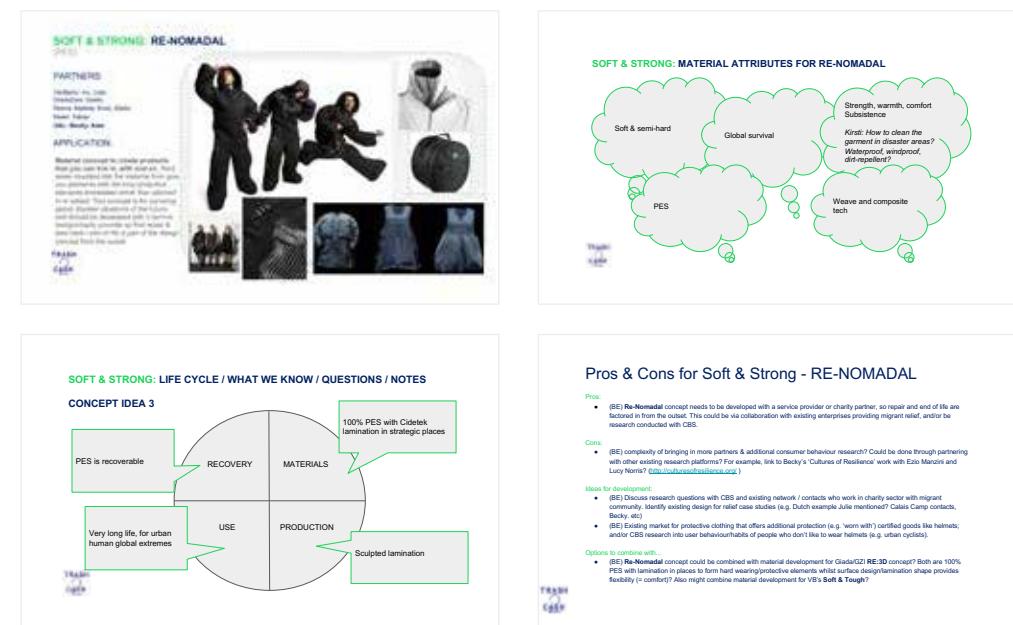

Fig. 57 Example of a completed digital sharing document

After the development of design concept through the digital sharing tool, designers are required to prepare design concept posters (A0 format) for each of their proposals: 28 design concept posters are presented during WS06. The whole team is required to familiarise with the new information and tools

(4) The detailed liaison process development in relation to the DDMI process is presented in deliverable D3.7–confidential
(5)The full reporting for the development of life cycle thinking tools and methods within the T2C project is reported in report D3.5–confidential (this text is an extract from this report).

shared prior to the WS, as well as study the reports produced during the interim period WS05-WS06.

WS ORGANISATION

WS06 is organised in four main sessions. The first session aims to present and evaluate the elaborated design concepts, the second one is addressed to discuss about primary manufactured materials' prototypes (using commercially available materials at this stage of the process), the third one is a merging session in which design concepts and EMTs potentials are investigated through a life cycle thinking approach. The last session is related to the project review exercise.
WS06 opening: recap of WS agenda, WS objectives, project phase and current step, and feedback from previous WS. WPLs present WP status and updates before each session, considering also the relation between the WP and the session topic.
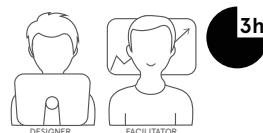
SESSION A
DESIGN CONCEPTS TALK

3h

DESIGNER   FACILITATOR

Communal part
The aim of this session is to communicate to the whole team the developed design concepts in order to evaluate them as an interdisciplinary group against the T2C objectives. In total, 28 design concepts are evaluated during this session covering different applications (specifically for T2C, textiles, novel garments, performance garments, automotive interior parts).
The design concept pitches and evaluations are carried out in an interactive common way. Detailed breakdown of the session in slots:
- Intro: introduction of the session and pros & cons activity.
- Idea pitches: concept design teams get 2 minutes per concept to pitch using A0 poster. Everyone takes notes of pros, cons & improvements per concept on post-it, which can be added at the end of the pitches.

Fig. 58 Interdisciplinary discussions and evaluations of design concept's posters during session A

- Pros & Cons evaluation: round up of post-its plus what can be learnt from them: what needs to be improved? Any possible combination?
- Break: during the break facilitators make a pre-evaluation. During the presentations many of the design concepts were recognised as having overlapping material themes; this was probably due to designers having developed their individual concepts from the same design concept area. Facilitators therefore group design concepts by material theme and collate them into 18 material themes. This is to provide a clear focus on the material research proposed within each theme for evaluation during the next slot. 2 design concept posters are removed in accordance with all team.
- Ladder evaluation: evaluation of the concepts on specific evaluation categories (investment, feasibility, publicity, etc.). Participants are split into themed groups considering the different evaluation categories. Facilitators walk around to help where needed. The ladder tool is used. The purpose of this slot is for the whole team to work in themed groups based on specific categories related to the T2C objectives to evaluate and score the design concept material groups from their themed perspective. Each themed group spend an allocated amount of time discussing each design concept posters within each material group before applying their score (assigned coloured post-it) to the relating material ladder scale. Among groups interdisciplinary discussions take place to arrive to a common evaluation decision. Themed groups scores (one per group, per design concept material group) are added to the ladder scales positioned within the group of Design Concept posters relating to material themes.

- Groups vote their favourite and second favourite design concept. On the evaluation post-it ,some comments and notes are also added by each themed group.
- Conclusion and product claim: summary of both rankings, and common discussion on which design concept can continue, as well as plenary selection of concept teams: who will continue to develop which concepts?
- Round up: wrap up session for any remark.

USED TOOLS

Design Concept Posters
Designers elaborated the design concept posters (all in the same template) including all the information contained into the digital sharing document.

Fig. 59 Examples of design concept posters used during session A (zoom in to read the content)

Ladder evaluation
The score scale range from 0 to 10 with 0 being the weaker and 10 the stronger end of the scale in relation to group themed perspectives. As themed group, participants are provided with coloured post-it, one colour for each group and evaluation criteria. Each group evaluates each design concept material group provided of an evaluation ladder. Evaluation criteria:
- Life Cycle Assessment (scoring on environmental impact, circularity / recyclability potential),
- Societal Impact (scoring on consumer perception),
- Viability (scoring on business potential, mainstream potential, non-niche),

- Client (scoring on T2C partners client network),
- Technical feasibility (scoring on technology readiness level questioning near or far time frames)
- Innovative & New' (scoring on uniqueness and authenticity)
- Cool (scoring on the Fun, Inspiring, Publication and PR value of the concepts).
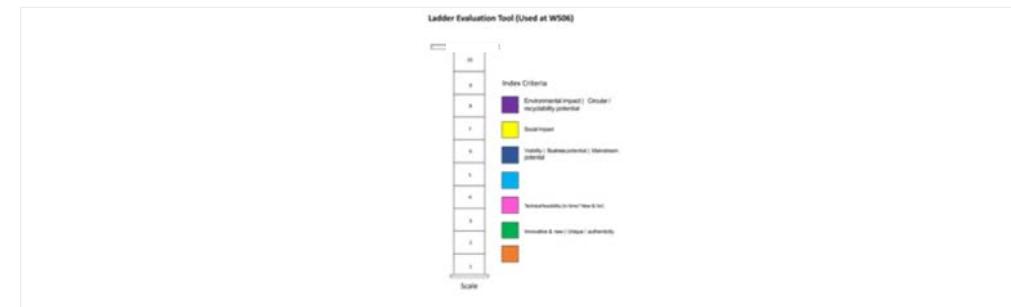

Fig. 60 Ladder evaluation, criteria and colour code for the themed groups (zoom in to read the content)

SESSION B
PROTOTYPES TALK

Communal part
Presentation of new information about R&D activities and results: technical aspect, main issues, challenges, barriers, etc. Each material scientist spends a specific amount of time to present the results for each EMTs (specifically for T2C, cellulose regeneration, PET de-re-polymerisation, chain extension upgrading). Experts present also their primary test results (on base material prototypes –P1A) and valorisation study.

Parallel part
This second part of the session is mainly addressed to present the first result of manufactured materials based on the primary design requirements elaborated in the interim period between WS05 and WS06 during the development of the design concepts. These primary manufactured materials have been produced

TRASH
CASH

using commercial available materials in order to preserve the small amount of base material prototypes of the project (P1A).

Two tables are set up considering manufactured material prototypes created in time for the workshop (specifically for T2C, table 1-reinforced plastic/plastic prototypes, table 2-textiles (PES, CL) prototypes with finishing experiments).

Detailed breakdown of the session in steps:

- 1st step: participants are split into 2 groups to go alternatively through the tables and investigate the labelled sample, listen the description by material experts and material scientists, and taking notes;
- 2nd step: an informal break to write down questions on postcard (postcard Q&A) for experts and material scientists;
- 3rd step: the facilitators collect and read out the questions for the panel to stimulate discussion about prototypes in terms of limitations/issues/potentials considering design concepts.

USED TOOLS

Material Samples and Postcards

Fig. 61 Interdisciplinary discussions and questions about material samples considering design concepts during Session B
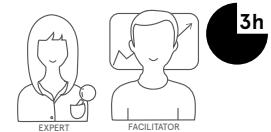
SESSION C
MEETING LIFE CYCLE THINKING

3h

EXPERT   FACILITATOR

Communal part
The session is opened with two brief presentations about topics related to life cycle thinking and the project field: primary reflections on LCC, LCA, from raw-waste material, to collection, up to production of base material staples (the topics are related to several reports and deliverables produced by experts within the project); study about perceived barriers of recycled products by consumers.

Parallel part
The participants are split into three expert area groups, i.e. designers, scientists and manufacturers. Expert groups rotate in turn around the three tables on which Design Concept Life Cycle maps are arranged. The disciplinary groups are hosted by a facilitator at each life cycle table, and together they discuss the barriers to creating material circularity for the specific Design Concept example. Only three examples are taken into account in this WS (one for each of the three material application areas of the project), with the aim to test the tool and the activity, and reintroduce them improved in the next WS. Following this initial activity, facilitators use both data directly obtained from the workshop session, and post-workshop data, captured and collected on feedback postcards.
These data are used to develop the next stage of LCT for use in WS07.

The aim is to develop a circular understanding for the T2C materials within all members of the consortium by setting a baseline amongst the group for the material life cycles within which Design Concepts would need to be developed. This enables all stakeholders across each work package within the consortium to be identified and linked to their specific expert area. In T-2-C, material scientists, production experts, industry designers, LCA experts, business model experts and user perspectives from social science where all represented.

USED TOOLS

Design Concept Life Cycle Maps
The life cycle template maps life cycle stages for the two base material categories

(specifically for T2C, polyester and cellulose fibre streams) considering the T2C circular concept diagram (see paragraph 1.1, page 14). A design concept example has been used from those being developed by design teams as the focus for the development of the three separate life cycles maps (one for each of the three material application areas of the project). These are (presente) then used to provide the focal point for group discussion and the collective development of a circular product journey. The aim of the tool is to introduce the principles of LCT through these life cycle visualizations and highlight some of the interdisciplinary challenges faced in developing circular materials.
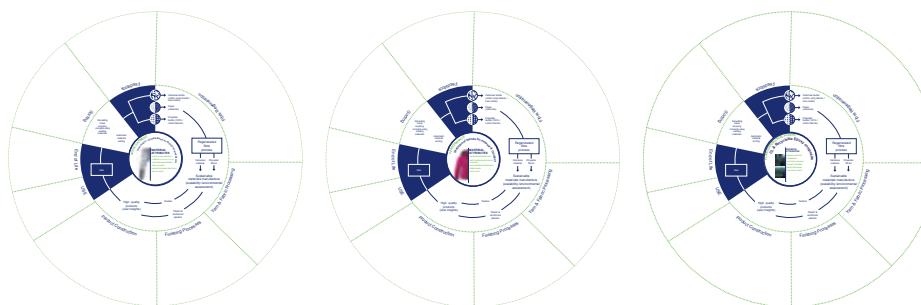

Fig. 62 The three examples of developed Life Cycles for Concept examples (zoom in to read the content)
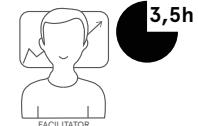
Feedback postcards

Insights….

Suggestions…

Fig. 64 Examples of participants' immediate session feedback postcards with key comments

Fig. 63 Meeting Life Cycle Thinking session in action during Ws06

3,5h

FACILITATOR

SESSION D
AUDITING AND REFLECTING ON THE PROCESS

1st part- Innovation expectations

Communal part
A specific slot is arranged to reflect on potential innovation areas within the project.
Based on some design research assumptions, identifying potential innovation areas provides an important base for decision-making in the steps of the design process targeting (focusing/addressing) to innovative product concepts. The exercise wants to provide a common understanding about (the kind of) innovation the team is aiming at in the project, with the assumption that this understanding is useful to set the baseline for the further design and technology developments. The potential areas have been initially set up by design researchers through a questionnaire survey (right after WS05) proposing two open questions:
  • What does the term innovation mean in your own field or context?
  • What kind of innovation can we achieve it in the project?
Design researchers propose the resulting areas in WS06 in form of a map – i.e. the Potential Innovation Areas Map – asking participants to reflect on it and to

select the most feasible and reachable potential innovation areas considering the project objectives.

Participants are split in four groups of expertise (i.e. science and technology, manufacturer, design and other experts) with a colour assigned. After the explanation of the map and a quick discussion within each group, each participant indicates two of the most potential innovation areas using its the provided coloured stickers. Participants have to indicate the typologies of the selected innovation areas: incremental or radical, and ideal or marketable.

In this way all the participants are able to express, at this stage of the process, their expectations of the most potential innovation areas to be realised within the project.

The results of this exercise will be presented and discussed during WS07.

USED TOOLS

Potential innovation areas map
The map consists of eight sectors, where each sector (wedge) represents one innovation area:
- Fibre material
- Textile/composite material
- End-user product
- Fibre Manufacturing process
- Textile/Composite Manufacturing process
- DDMI Process
- Service
- Business Model

Each area (wedge) is divided into four different type of innovations: incremental or radical; ideal or marketable.

2nd part - Project Review Exercise – Cycle A
The project review exercise and tools are fully described in paragraph 1.5.1 and the results of the review of Cycle A are proposed in paragraph 2.2.6.
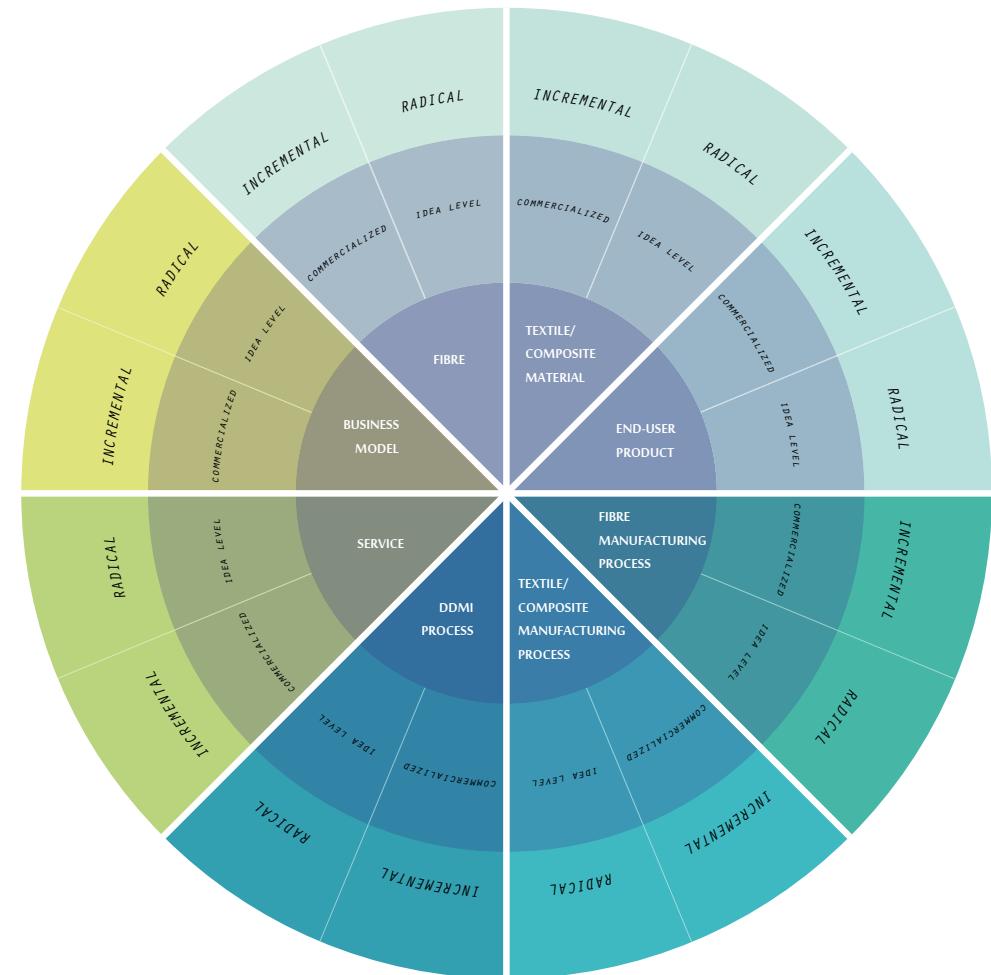

Fig. 65 Potential innovation areas map used in session D

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WS06 FEEDBACK SUMMARY

HIGHLIGHTS

[most participants] Really useful: the Prototype tables session, the life cycle brainstorming, and the evaluation process of design concepts

CHALLENGES

Too rushed sessions and tight schedule

Good balance between teamwork and presentations; maybe too many presentations

Too generic overviews (LCT or reporting) or too detailed presentations (theory/ tech)

Listening when others "argue"

SUGGESTIONS

Be more consistent with tools and ways of organizing the sessions would make participation easier

Try to develop the WS in three days (afternoon + full day + morning)

Tell everyone not to leave earlier

Theoretical input sessions are important, but need to be adjusted to be understandable also for non-experts in the field

WS07 - Design Concepts Implementation/Validation (LCT)

With WS07 the convergence process increases among the three streams (the cycle B is next to the closure), and the role of material manufacturers (specifically for T2C, textiles, reinforced plastics and plastics manufacturers) and the other experts (specially for T2C, LCA, business model and scalability experts) become fully operational. The R&D stream delivers the second generation of base material prototypes based on design requirements (design brief 2). New R&D information need to be shared and discussed so R&D stream can carry out the testing phase in order to start to work on the new research decision.

The new base materials will be used to realize the first generation of manufactured materials based on the new design concepts. The implementation and validation of design concept is carried out in parallel with the experimentation and trials of manufactured material prototypes.

For all these reasons in WS07 the interdisciplinary process is mainly focused on Life Cycle Thinking and circular co-design, mapping the design concepts as a lifecycle journey and refining them during several rounds of facilitated discussions.

Tangible provocation tools and information gathering tools are used to capture insights and enable the exchange of interdisciplinary knowledge.

A new interdisciplinary design specification tool is developed (Design Specification Sheet) to achieve this goal in WS07.

The main operative objectives of WS07 are:

- design concepts implementation through the LCT for new design and material specifications;
- Presentation and discussion on new trial of manufactured materials (specifically for T2C, both for polyester and cellulose textiles – knitted, woven and non-woven, plastics and reinforced plastics;
- Update and common discussion about R&D Streams [WP2];
- Focused inputs from specific experts, in particular: feedstock and sorting study results, new inputs about end-user perceived barriers, primary LCA comments, primary inputs from experts on design concept scalability.

WS PREPARATION

During the interim period between WS06 and WS07, specific design concept maps are developed and continuously improved by design researchers and facilitators, in order to pass from a generic understanding to a tailored life cycle material journey for each design concept and to affect the interdisciplinary process. The circular life cycle template map used in WS06 is developed into a flow chart format that is then incorporated within a new template which will characterize the interdisciplinary description of design concepts from now on: the Interdisciplinary Design Specification Sheet(6).

As a starting point, the need for a standardised method to integrate design into material development and to communicate the design concepts across design, R&D, and manufacturing both during and between WSs is developed. It is a digitally accessible, editable (to allow constant updating) document for each developing design concept. It helps the interdisciplinary collaboration between designers, material scientists and manufacturers through digital remote communication, and the "circular" co-development of design concepts. For this reason the tool will evolve in the third and last generation of design briefs. Facilitators and design researchers ask the whole team and mainly designers, to use the tool and consider it as a reference point for the co-development of design concepts. Therefore, the new stage of design and material specifications already starts prior to the WS.

Furthermore the results from the ladder evaluation session in WS06 are used to develop focused Material Cluster groups: design concept ideas are merged and ultimately organised by overlapping design requests for material attributes, resulting in a more focused and reduced number of requests (just 7 emerging material clusters related to the 26 design concepts) avoiding the arbitrary elimination of any design concept by facilitators and design researchers.

Fig. 66 Design Specification Sheet for completion by designers as they develop design concepts after WS06 (zoom in to read the content)

WS ORGANISATION

WS07 is organised in four main sessions. The first session aims to present the updates in the development of prototypes and in the R&D stream, while the second and third ones are addressed to analyse material clusters through the LCT and to execute another interdisciplinary round of evaluation and selection of the most promising design concepts. The last session provides new inputs to all teams to further develop design concepts and requires new information from design and R&D stream to set up the further steps of experts' studies. WS07 opening: recap of WS agenda, WS objectives, project phase and current step, and feedback from previous WS. WPLs present WP status and updates before each session, considering also the relation between the WP and the session topic.

(6) An extensive description of the genesis and development of the tool can be found in report D.3.4 – confidential

SESSION A
PROTOTYPES and R&D

SCIENTIST   MANUFACTURER   3h

Communal and parallel part
As in the previous WS, this session is executed to provide information and updates about R&D and manufacturing prototypes (second generation base materials –P2B and first generation manufactured materials -P1B). After a common updating, two tables are organized (specifically for T2C, textiles table, and plastics & reinforced plastics table) to show and explain in parallel the different samples to participants, split in two general groups. A subsequent common slot gives the opportunity for a discussion and decision-making about the process and the project issues in the two streams (R&D and manufacturing): alignments, timing issues, postponements of specific tasks, etc.

✂ USED TOOLS

Material samples
Second generation base materials of–P2B and first generation manufactured materials -P1B are used.
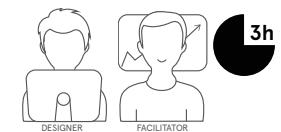

Fig. 67 Material samples used during the session A

Fig. 68 Material samples used during the session A

SESSION B
MATERIAL CLUSTERS & DESIGN CONCEPTS ANALYSES THROUGH LCT

DESIGNER   FACILITATOR   3h

Parallel session
The purpose of the session is to allow designers to present, discuss and gain feedback on the developed Design Specification Sheets from various discipline experts within the consortium. From a methodology perspective, the aim of the session is to incorporate LCT into an interdisciplinary exchange between designers and other life cycle experts. During the session, participants are divided into competences (expert groups) to reflect on each concept related to the six specified parts of the Life Cycle (sorting, material processing technologies, manufacturing, consumer behaviours, LCA, business model) and across the different levels of the material pathway (feedstock, base material, manufactured material, application/product). Creating these life cycle groups by areas of expertise ensures design concepts are reflected upon from all perspectives within the project competencies.
Designers are split into six material cluster tables; this means all design concepts relating to each material cluster are presented on the relating table by the designer(s) who developed them.

Expert groups spent an allocated period of time with each designer who used the design specification sheets to communicate material attributes of the individual design concepts to visiting expert groups. At the same time, experts have the chance to evaluate design concepts and to collaborate providing inputs for the elaboration of material attributes related to each concept. 6 rotations take place during the whole session.

Experts provide designers with information/feedback recorded directly onto the design specification sheets. Feedbacks are colour coded to each expert area linking to the project life cycle area it relates to, in order to ensure designers can follow up with specific experts after the workshop, and that post-workshop analyses can be used to inform the next stages of LCT development.

USED TOOLS

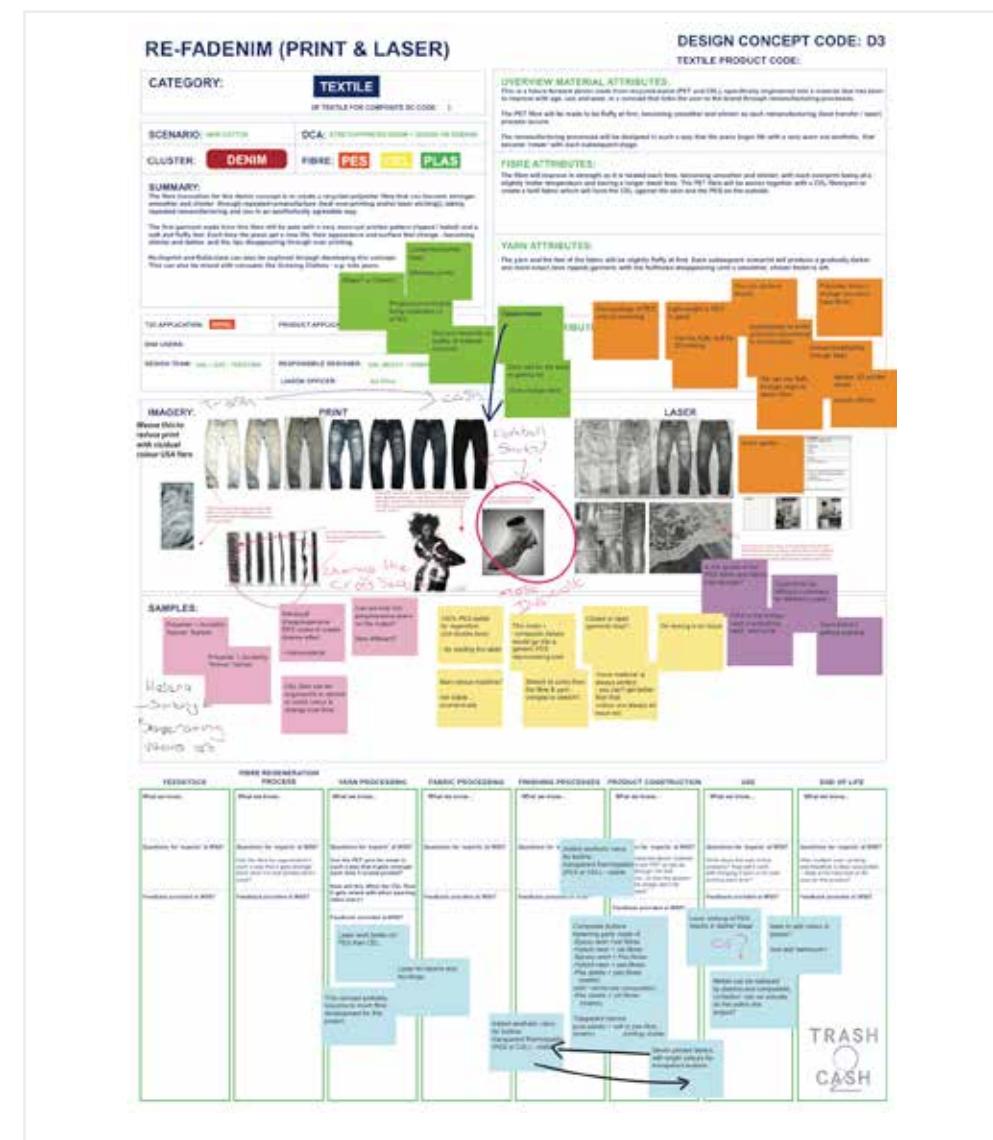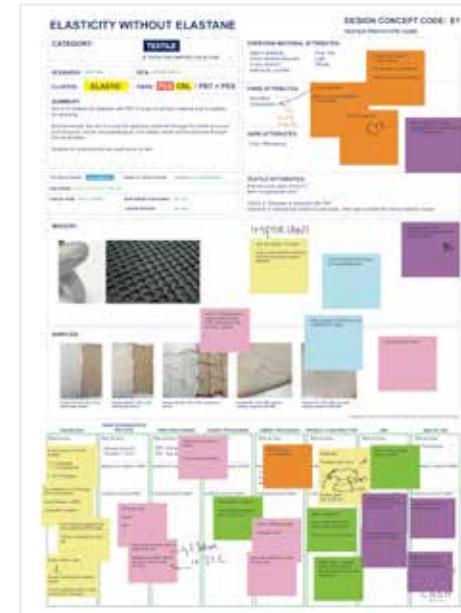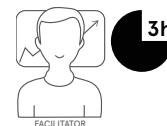**Design Specification Sheet**

Fig. 69 Few examples of Design Specification Sheet filled in by designers with the expert groups colour coded notes representing feedback gained during the WS (zoom in to read the content)

SESSION C
PARALLEL STREAM MEETINGS

3h
FACILITATOR

Parallel and communal part
This session provides the opportunity for design and technical experts to discuss separately and evaluate in parallel the design concepts in relation to their material clusters, using the feedback received during the earlier session, and considering also the material prototypes. Participants are therefore split into two large groups: designers, facilitators, and companies; technical experts and R&D people. Both groups reflect separately on the most promising concepts and related material attributes, considering their own specific perspectives. To support the discussion, a sort of evaluation tool (bulls-eye evaluation tool) is provided. Using cards that represent each design concept (and have colour code for material cluster), each group places one material cluster and concepts in a specific area of the map giving them a specific score, after the discussion and a common decision-making. At the end of the session, the conclusions achieved by the two groups are shared and the team discovers that the results of the two bulls-eye evaluation are surprisingly equal. The whole team collectively discusses again before merging overlapping design concepts and re-clusters them and to take the final decision, resulting in 8 material clusters and 16 design concepts, an additional reduction considering the number of concept prior to the WS.

⚒ USED TOOLS

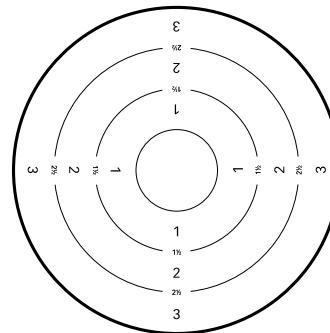**Bulls-eye evaluation tool**

Fig. 70 The bulls-eye used by the two groups during session C, to evaluate and re-group design concepts and material cluster

Fig. 71 Participants in action re-clustering and explaining the results on the bulls-eye tool

SESSION D
FROM PROCESSES TO SUCCESFUL PRODUCTS: CONSUMERS, LCA, SCALABILITY, INNOVATION

2h
EXPERT

Communal part
The last session draws the attention of designers and other participants to the perspective of specific experts, in order to receive further feedbacks for the development of design concepts and to provide inputs to experts' studies and analyses at the same time.
Detailed breakdown of the session in slots:

• **Scalability & validation**
  Brief presentation and discussion about the plan for industrial scalability of design concepts and their industrial validations, related issues, process, issues, input/output
• **LCA updates**
  Presentation about LCA to provide few clarifications about issues highlighted by experts during the design concept developments (interim period WS06-WS07)
• **Consumer perceived barriers**
  New inputs about consumer barriers and possible communication strategy to overcome them

• **From individual to shared expectations: T2C innovation**
During WS06 all participants expressed their expectations of the most potential innovation areas to be realised within the project. The design researchers elaborated the results and analysed them. During this slot they show and explain their interpretations to the whole team in order to commonl discuss about innovation within the project process.

✂ USED TOOLS

Potential innovation areas map (results)(7)
It is used to present the results of the potential innovation areas map used in WS06. The map consists of eight sectors, whereas each sector (wedge) represents one innovation area (fibre material, textile/composite material, end-user product, fibre manufacturing process, DDMI Process, etc.). Each area (wedge) is divided into four different types of innovation: incremental or radical; ideal or marketable. The numbers represent the different votes expressed by each group of competence during WS06.
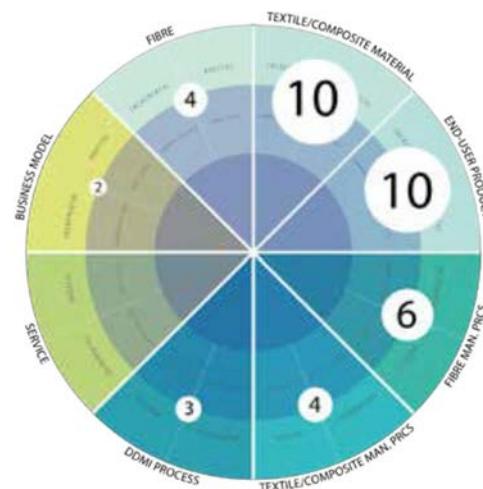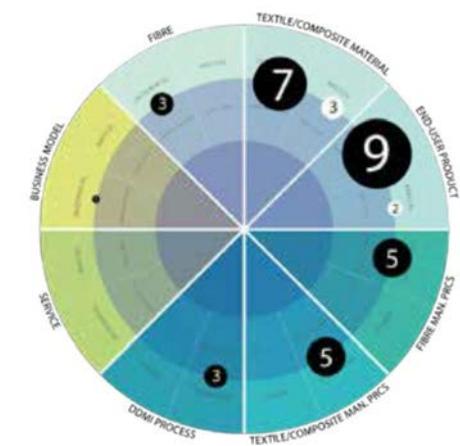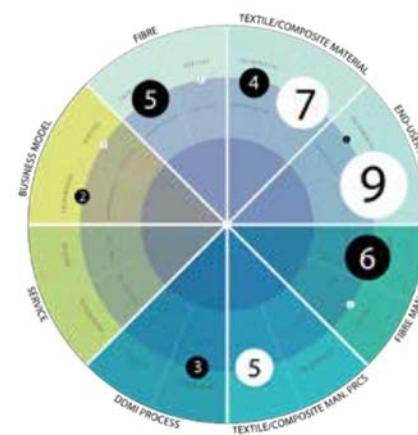

Fig. 73 The results are split in the different innovation typologies: on the left incremental (black) vs radical innovation (white); on the right, ideal level (black) vs marketable (white) level

Fig. 72 The results of the most potential innovation areas for the project

A visit at the industrial production plant of one of the partners is also organized, with the aim to down to practice some of the theoretical assumptions on base material production.
Workshop closure: usual roundtable asking to participants the top moments of the workshop and specific tips to improve some aspects to the next meeting.

(7) A complete description of the "innovation journey" in T2C project can be found in report D.3.6–confidential

WS07 FEEDBACK SUMMARY

HIGHLIGHTS

Session B was excellent and prototypes were really good

Big success in working in small groups of members with a similar professional occupation

Great to notice that designers and experts shared the same vision on how to combine the concepts (session C)

CHALLENGES

We reduced the amount of concepts, but there are still too many

Some presentations seemed too long

Loose discussions could be shortened; people lose (o lost) their attention

SUGGESTIONS

Possibilities for specific meetings (e.g. during Gantt-type discussions)

It would be good if every presentation had mandatory "next steps" portion, as it would better clarify the upcoming working process

Introduce outside activities (even if just a short walk)

Organise pre-WS meeting (the day before) if (o when?) there are specific issues in certain streams
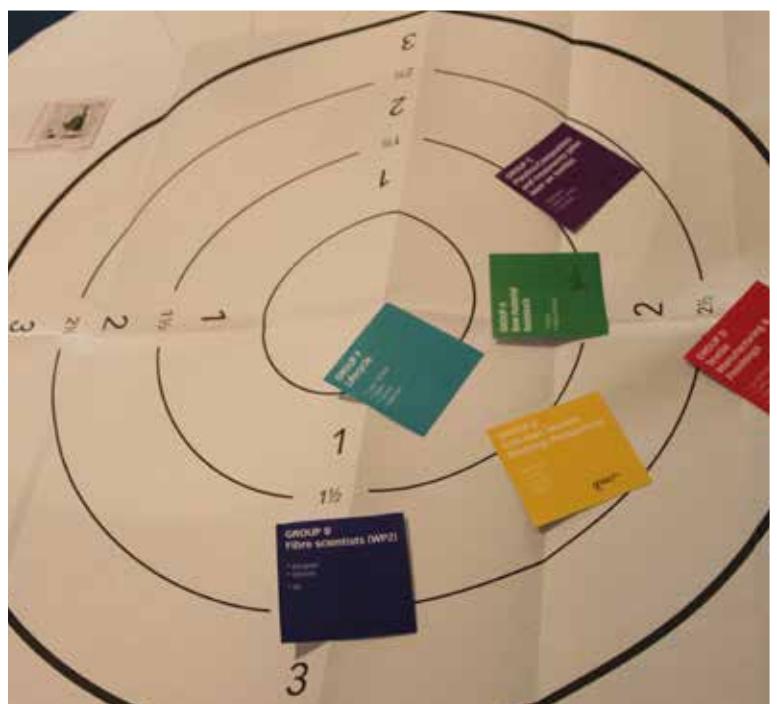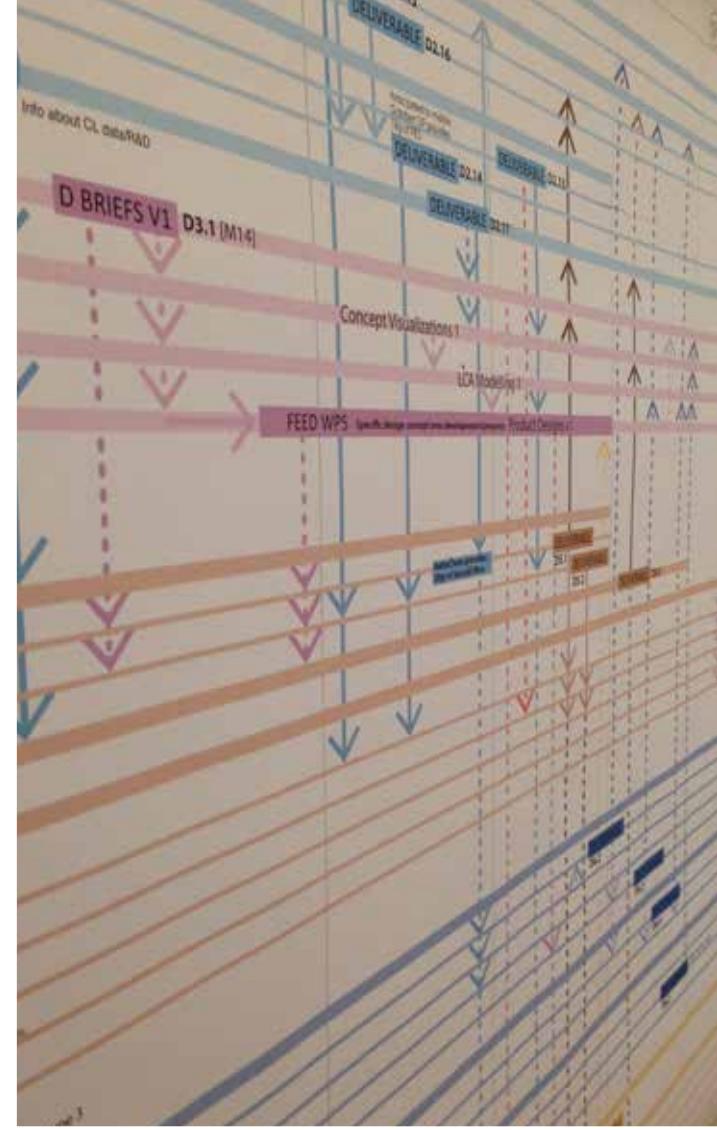
WS08 - Design Concepts Evaluation/Selection

WS08 is one of the most complex and critical WS of the whole interdisciplinary process. It closes Cycle B (evolving specifications) and opens Cycle C (refining outcomes).
All streams are fully operative at this stage and the new cycles need both the definition of the final research hypothesis from the R&D, and the final selection of design concepts, in order to proceed with the improvement of the Master Cases from the design stream in collaboration with the manufacturers.

In this WS the new milestones are presented (the final first generation of manufactured material prototypes obtained by the second generation of base materials).
R&D collects all the necessary data to present the final results of the second iteration to all team, and designers, manufacturers and experts evaluate design concepts and select the most promising ones from which MCs are elaborated in the interim period WS08-WS09.
The main activities of WS08 are:

- Presentation and discussion about P1B with finishing/treatment;
- Design concepts selection for product design phase;
- Analysis and discussion about possible design products (product prototypes) from specific manufacturers' and other experts' perspectives;
- Interdisciplinary approach to support design in a circular assessment (LCT+LCA);
- Primary inspirational inputs for the storytelling of design concepts (first step of the "Brainstorming Storytelling" process that starts in WS08, and will be fully executed from WS9 to WS111): a first introduction into brand stories (how to present the design concept, how to make it into a brand).
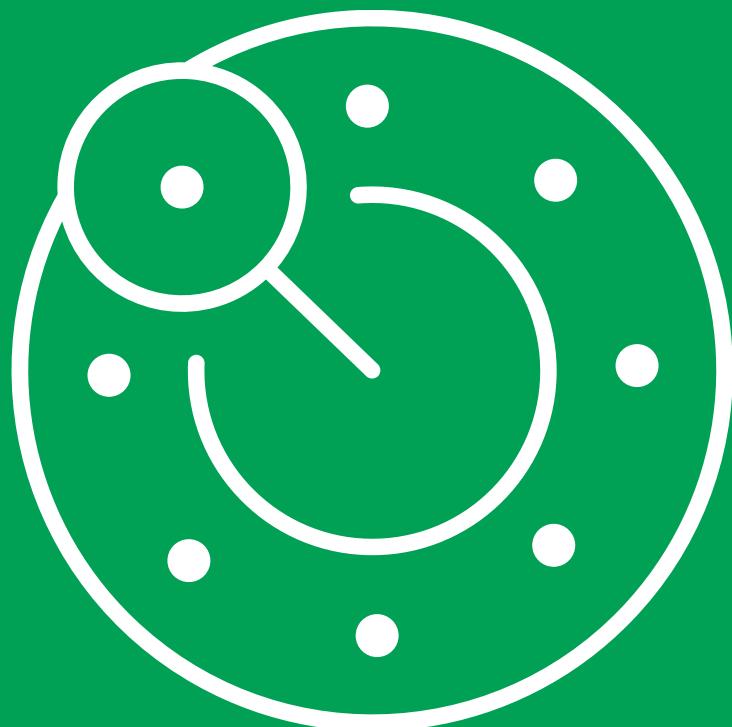
WS PREPARATION

The feedbacks collected in WS07 have been elaborated and included into the digital version of the design specification sheets by design researchers. The composed sheets are then circulated and shared with all team via digital platform. Designers work in their material cluster working groups to update the design specification sheets using the WS07 feedback and remote discussion with manufacturers and experts. Designers are encouraged by facilitators and design researchers to discuss about possible testing and scalability methods with manufacturers and produce as final a design specification sheet as possible for the 16 remaining design concepts for use during WS08.

Fig. 74 Examples of Coded feedback from WS07 included in the design specification sheets (zoom in to read the content)

Furthermore, a method to organise the whole team into design and manufacturing working groups around the material cluster themes (decided during WS07) is produced, named the Cluster Tree.
The aim of this tool is to clearly identify then link designers and manufacturers involved with each Design Concept, in order to ensure that during the interim period WS07-WS08 a development work on design concepts can continue through clear communication across all actors involved from different work

packages.
The cluster tree works also as a map for the whole theme, and mainly for the facilitators and project coordinators.
When evaluating the WS07 session using the feedback provided to designers by expert groups, some key issues are identified by design researchers and facilitators.
They concluded that designers need a new LCT tool to combine and communicate the interdisciplinary life cycle knowledge of the whole team as an all-encompassing overview. This tool has to support designers in evaluating design concepts, taking into account not just "product spheres" but also business models, service dimensions, disposal etc. In the interim period WS07- WS08 this new circular evaluation tool is developed, i.e. the circular evaluation cards. The tool is based on the coded colour areas of T2C life cycle developed for WS07 and aims to capture the knowledge of each expert group to be communicated to designers. To develop the tool's first iteration, repetitive expert area feedbacks from WS07 and technical information provided through deliverables are used to develop the "expert area cards". The cards are collated into a PowerPoint template for each life cycle group. The relating set of expert cards is then shared for review with key figures from each group, for example the work package leader or technical experts. This enables key experts to input and feedback further suggestions (recycling barriers).

USED TOOLS

Cluster Three
In the Cluster Tree, each design concept is organised into a colour-coded cluster stream with the working group (material scientists, designers, manufacturers) and roles clearly identified at the different stages of each material development process (specifically for T2C, e.g. fibre production, yarn production, textile production, finishing, treatment, etc.). Each material cluster has a cluster leader and a lead designer. The
cluster leader's role is to facilitate and 'take control' over communication between designers and manufacturers (this role is the evolution of the earlier liaison officer). The lead designer's role is to coordinate, monitor, collect, and

update design specification sheets with developing gained information.
design specification sheets with developing gained information.

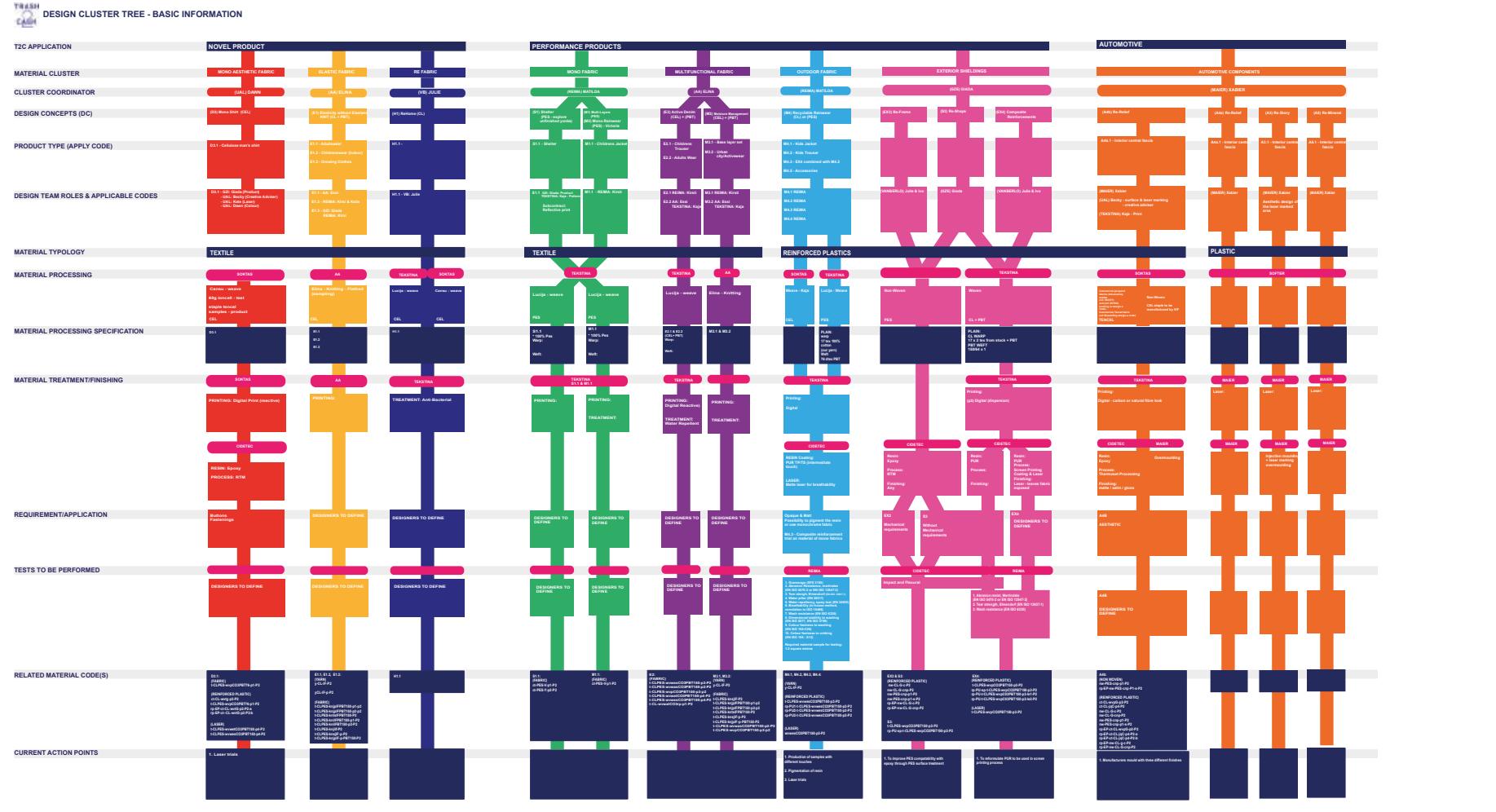Figure 11: Design Concept Material Cluster Tree

Fig. 75 Design Concept Material Cluster Tree

Circular Evaluation Cards

The cards are incorporated into a worksheet for designers to use as means to evaluate their design concepts in preparation for WS08.

Fig. 76 Circular Evaluation cards developed for WS08

Design Specification Sheet (updated version)

16 design specification sheets are elaborated for WS08, including all inputs, information and decisions developed during WS07 and the interim period WS07–WS08. The sheets content become more complex and interdisciplinary while the convergence process and the concepts development proceed.

Fig. 77 Two examples of the updated version of the design specification sheets (zoom in to read the content)

TRASH CASH

Sheet 1

DESIGN CONCEPT: RE-SHAPE

DESIGN CONCEPT CODE:

TEXTILE PROTOTYPE CODE: **S3**

CATEGORY: EXTERIOR SHIELDING — **TEXTILE**

DC CODE: rp-PU-sp-1-CLPES-avrpCO3PBT150-p3-P2
Triangles rp-EP-nw-CL-cnp-P2 and rp-EP-nw-CL-c-P2

DCA: | **CLUSTER COORDINATOR: GZI**

CLUSTER: EXTERIOR SHIELDING | **FIBRE: PE / REINFORCED PLASTIC**

SUMMARY:
The idea is to develop light and foldable 3D fabric that can generate playful and sculptural shapes. Deal with origami patterns, the product is made by recyclable and reusable technology as RTM or screen printing
Possible applications:
Fashionable urban bags, clothing with intergrated decorative elements, adaptable wear for travel backpacks, furnishing.
The aim is to stimulate designers in express their creativity in trasform this material into novel functional products.

T2C APPLICATION: | **PRODUCT APPLICATION: URBAN BAG / BACKPACK**

DESIGN TEAM: GZI - VANBERLO | **MANUFACTURE TEAM:** CIDETEC

OVERVIEW MATERIAL ATTRIBUTES:
WATERPROOF
LIGHTWEIGHT
DURABLE
PACKABLE/EXPANDABLE
FLEXIBLE AND FOLDABLE - SOFT/HARD
CLEANABLE
REUSABLE AND RECYCLABLE

FIBRE ATTRIBUTES:
RECYCLABLE
NOT LOOSE STRENGHT

YARN ATTRIBUTES:
STRENGHT
RETAIN COLOUR

TEXTILE ATTRIBUTES:
WATERPOOF
TEAR RESISTANT - ABRASION RESISTANT

IMAGERY / TEC.DRAWING:
RE-SHAPE 1 | RE-SHAPE 2 | RE-FRAME

SAMPLES / PROTOTYPES: Two possible recyclable and reusable material solutions:
RE-SHAPE 1. 100% PES fabric + RTM Epoxy reinforcement + 100% PES fabric
RE-SHAPE 2. 100% PES fabric with 3D screen printing CIDETEC PU

SCALABILITY (WP7):
The products should be easy scalable. RTM technology feasibility is proven, while an investment for scalability will be necessary.

3D Screen printing technique already exist in the market. It is only a matter of capability.

Textile used comes from regenerated fibers. Big potential to have a closed loop.

TESTING (WP5):
• Grammage (SFS 3192)
• Water pillar (EN 20811)
• Water repellency, spray test (EN 24920)
• Abrasion resistance, Martindale (EN ISO 5470-2 or EN ISO 12947-2) • Tear strength, Elmendorf (EN ISO 13937-1)
• Wash resistance (EN ISO 6330)
• Dimensional stability to washing (EN ISO 5077, EN ISO 3759)
• Color fastness to washing (EN ISO 105-C06)
• Color fastness to rubbing (EN ISO 105-X12)

POTENTIAL MARKETS:

FEEDSTOCK	FIBRE REGENERATION PROCESS	YARN PROCESSING	FABRIC PROCESSING	FABRIC FINISHING	PRODUCT CONSTRUCTION	USE	END OF LIFE
What we know... - 100%Polyester fabric is easily recognised. - Today the epoxy resin is not sorted - Multilayer not easy to sort, but can be mechanically separated	**What we know...** PES fiber can be regenerated	**What we know...**	**What we know...** Standard weaving process	**What we know...**	**What we know...** Laser cut, ultrasonic welding, reduce use or zippers, buttons that could be done in R-PES	**What we know...** Not need to be machine washed as garment. Same material could have many different applications from fashion to technical gear and furnishing.	**What we know...**
Questions for 'experts' Can we have a closed loop for the resin or should be mixed with new resin?	**Questions for 'experts'** What about minimum and maximum yarn count fro R-PES?	**Questions for 'experts'**	**Questions for 'experts'** Is it possible to have different texture on the resin? Soft touch, rubbery and more flexible	**Questions for 'experts'**	**Questions for 'experts'**	**Questions for 'experts'**	**Questions for 'experts'** Easy to separate components Fabric recover

Sheet 2

TRASH CASH

DESIGN CONCEPT: SHELTER

DESIGN CONCEPT CODE: S1

TEXTILE PROTOTYPE CODE:

CATEGORY: — **TEXTILE**
YONKA FABRIC

DCA: | **CLUSTER COORDINATOR: REIMA**

CLUSTER: MONO FABRIC | **FIBRE: POLYESTER**

SUMMARY:
The idea is to create a multipurpose monomaterial bivy bag/sleeping bag cover, rain garment, portable windbreak, and emergency shelter, all in one – and all in a super light package.
Made of 100% R-PES it gives protection to the elements for hiking, trail running and other outdoor activities. It should have oversize fit to be able to cover backpack and have one size.
It can have three configurations: short jacket, long jacket, sleeping bag. All the components should be recyclable.
Possible application: Refuge wear for homeless or survivals from global disaster situations. In this case the project should include a service design/charity provider so that repair & take back / end of life is part of the design concept from the outset.
For harsh environment application it may necessary to add a thermal insulation layer. This could be done with nonwoven pad so at the end of life you have 100%PES to be easily disassembling and recycle.

T2C APPLICATION: | **PRODUCT APPLICATION:**

DESIGN TEAM: GZE | **MANUFACTURE TEAM:** TEKSTINA

OVERVIEW MATERIAL ATTRIBUTES:
100% R-PES
WATER RESISTANT
LIGHTWEIGHT to be packable
BREATHABLE
DURABLE (Abrasion, Tear, Wash cycles)

FIBRE ATTRIBUTES:
hydrophobic
lightweight and fine
strong

YARN ATTRIBUTES:
100% R-PES
Durable and fine enough to be lightweigh and resistant

TEXTILE ATTRIBUTES:
Plain weave, 110gsm without membrane, solid color dyed
Waterproof breathable PES laminate/coating (total weight with coating approx.140gsm)
Durable water repellency eco finish (Fluorocarbon free)
Anti-wrinkle, Matt surface

IMAGERY / TEC.DRAWING:
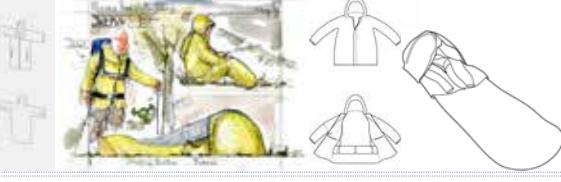
MATERIAL PROTOTYPES:
This should be easily scalable.
This kind of material processing is already commercially available, just the raw materials are selected differently compared to the existing ones to make this recyclable unlike the ones in the market.

Price is the biggest potential problem.

In case of application for refugees service design will be necessary.

SCALABILITY (TO INFORM WP7):
This should be easily scalable.
This kind of material processing is already commercially available, just the raw materials are selected differently compared to the existing ones to make this recyclable unlike the ones in the market.

Price is the biggest potential problem.

In case of application for refugees service design will be necessary.

TESTING (RECOMMENDED BY WP5):
• Grammage (SFS 3192)
• Water pillar (EN 20811)
• Water repellency, spray test (EN 24920)
• Breathability
• Abrasion resistance, Martindale (EN ISO 5470-2 or EN ISO 12947-2) • Tear strength, Elmendorf (EN ISO 13937-1)
• Wash resistance (EN ISO 6330)
• Dimensional stability to washing (EN ISO 5077, EN ISO 3759)
• Color fastness to washing (EN ISO 105-C06)
• Color fastness to rubbing (EN ISO 105-X12)

FEEDSTOCK	FIBRE REGENERATION PROCESS	YARN PROCESSING	FABRIC PROCESSING	FABRIC FINISHING	PRODUCT CONSTRUCTION	USE	END OF LIFE
What we know... In NIR process monofabric (like-like with membrane) would be recognised as 100% PES. Same goes to bonded multilayers (soft-shell). Multi layer garment (winter jacket) is more difficult recognize in NIR, only surface is scanned	**What we know...** If PES textile and PES mem- brane are same form of PES (PBT or PET), the regeneration process is possible. If not the same, it will be down gradable. Water repellency treatment can be washed off.	**What we know...**	**What we know...** Regular weaving process	**What we know...** > Dying/printing > lamination/coating process > DWR finishing treatment	**What we know...** Buttons and zippers could be also made of PES (commercially availa- ble, not possible to produce within T2C) Seams must be sealed with (PEST) tape to make the garment water- proof.	**What we know...** Durable long life products. Same material could be used in other outdoor garments and equipment	**What we know...** PES membrane makes the textile material recyclable unlike com- monly used material with PU membrane. Zippers, buttons - is already possible to remove in textile sorting today.
Questions for 'experts'	**Questions for 'experts'** Controlled ways to clean the DWR finish from garment?	**Questions for 'experts'**	**Questions for 'experts'**	**Questions for 'experts'** Does the print effects on the cycle? How much?	**Questions for 'experts'**	**Questions for 'experts'**	**Questions for 'experts'** Can the buttons/zippers be removed automatically or it should be a manual work?

Fig. 78 Two examples of the updated version of the design specification sheets (zoom in to read the content)

WS ORGANISATION

WS08 is organised in four main sessions. The first session aims to present the second milestones (final T2C first generation of manufactured materials made from base material prototypes of second generation). The second session is aimed to further develop and analyse design concepts considering the LCT approach. The goal of the third session is to evaluate the design concepts in order to select the most promising and feasible one. The final session provides insights to all team about product storytelling and possible brand stories. Updates about WPs' status, issues and next steps are provided by WPLs prior to each session in accordance with the topic of the activities. During each session special breaks are carried out to "charge up attention" of participants and reduce stress: "unlocking your enthusiasm break".

Fig. 79 Some prototype producers explain material attributes referring to design concepts (design specification sheets)

SESSION A
PROTOTYPES 2 MILESTONES TABLES

3h

Parallel part
Manufacturers and material producers are split in three main tables to present the final material prototypes (second generation base materials – P2B – and related first generation manufactured materials – P1B) grouped by material clusters (specifically for T2C, finished cellulosic textile, finished polyester textile, reinforced plastics/plastics). In turn, the rest of the participants are split in three groups with mixed competences. Each material group explains the achieved prototype results to each working group taking into account design concepts (design specification sheets) as main reference. This means that material producers have to explain the material attributes achieved comparing them with the design material requests related to each of the 16 design concepts (each design concept stems form/is assigned to one or to a set of prototypes). Each group with mixed competences spends a specific amount of time at each table, and three rounds take place during the whole session. All notes, comments and reflections, are written down by every participant to be used during the next sessions.

SESSION B
CIRCULAR ANALYSIS: LCT MEETS LCA

3h

Parallel session
The updated design specification sheets are used with the specifically developed circular evaluation cards to encourage designers to "critically reflect" on their design concepts with the support of expert groups (material scientist, technical manufacturers, business experts, scalability experts, consumer behaviour experts, sorting experts, etc.) based on the key Life Cycle Thinking criteria for T2C.
Six tables are organised, one for each material cluster led by the responsible designer, each table (material cluster) containing different design concepts (16 in total). A design team pack is provided to participants: A1 Life cycle evaluation chart for each concept, with notes elaborated by the design team prior to the WS (placed on the table so that everyone can see it and contribute to it); A1 design specification sheets prepared by cluster teams for each concept (placed on the table for reference); pack of "consideration cards"; expert tips (blank) cards (placed on the table so that designers can pick "key cards", make notes on cards during the session and expert groups can provide new tips cards); and

colour-coded post its and pens. The cluster table format of WS07 is followed and design specification sheets are presented to expert groups who then work with designers to fill in the circular evaluation tool.

Each group of experts spends an allocated period of time on each table discussing with designers about its own area of competence and providing feedback. Six rotations of the six groups of experts among six tables take place. All different aspects of the T2C value chain is evaluated and analysed (sorting, business, manufacturing, finishing, processing technologies, disposal, etc.). The aim of the session is to link the remaining design concepts and prototypes for analyses with an interdisciplinary approach. Data collected from this session are used to support decision-making for the selection of Master Cases in the next session.
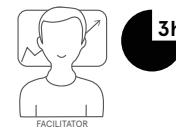
Fig. 80 WS08 'Circular Analyses LCA meets LCT' session in action

Fig. 81 Two examples of circular evaluation tool resulting from circular analyses session (printed card version, integrated with notes on new tips cards and post-it) (zoom in to read the content)

SESSION C
DESIGN CONCEPT FOR P3: NEXT STEP

3h
FACILITATOR

Parallel part
The session aims to evaluate and select the most promising design concepts to progress as project Master Cases (fully studied through different perspectives and fully prototyped in order to form a complete proof-of-concept story of the case). The whole team has to elect at least one design concept for industry application (specifically for T2C, novel garments, performance garments, interior automotive parts).

The rationale for the selection of the master cases is based on participants' scores with emphasis on LCA and sorting, ability to prototype and scale up, and consumer acceptance. The needs and interests of end-user companies are also considered.
 The best concepts from each sector include:
• The most innovative concepts with high business potential, ability to form a nice product family, and having strong sustainable/circular rationale behind;
• New base material attributes (R&D innovation)
• Potential to design attractive product collections with interesting prototypes.

Four evaluator groups are created considering the category topic for selection (referring to the key topic of each project WP):
• Technological and technical perspectives: feasibility and innovativeness of base material attributes, ability to prototype, technology readiness level;
• Circular perspective: sortability and LCA;
• Consumer acceptance perspective;
• Design and marketing perspectives: high product design potential, strong product stories and identity.

Each group discusses internally to decide where to place the sticker onto the evaluation tool. While scoring, partners are also encouraged to give reasoning in a written feedback format. This allows valuable data to be collected representing the reasoning for the final choices of Master Cases. All concepts are evaluated spending an allocated period of time each.

USED TOOLS

Evaluation tool for scoring selection
The evaluation tool presents eight segments, one for each project WP. Each segment is divided in four options among which each group has to decide where to place the design concept considering its specific perspective:

• Option 1, "go!" – selected if the concept/product type should continue;
• Option 2, 'only if' – selected if there are small uncertainties that would be crucial for the concept's continuation but can be addressed;
• Option 3, 'reserve for portfolio' – selected if the concept has uncertainties, but the idea is suitable for the project portfolio;
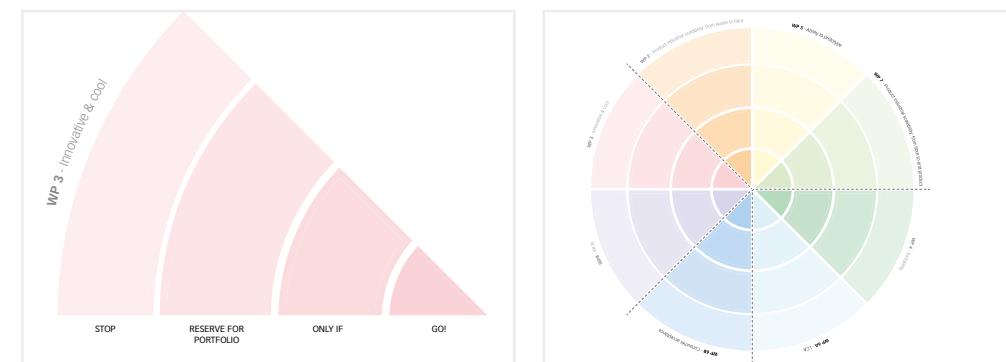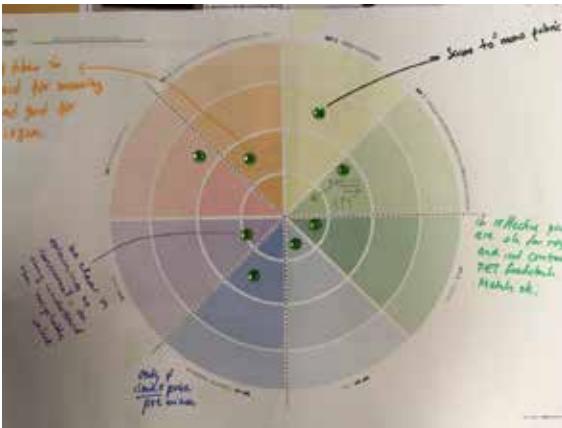• Option 4, 'stop' – selected if the concept development should not progress further.

Fig. 82 (left) Evaluation tool for scoring and selection used in session C; (right) Particular of one segment of the evaluation tool divided in the four options for the placement of the design concept (zoom in to read the content)

M1. Mono Rainwear / Children's jacket

D3. Mono Aesthetic Fabric / Men's shirt
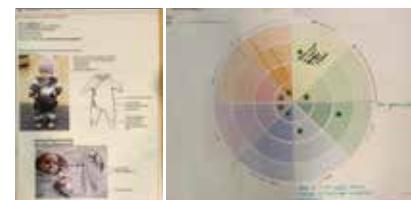

E1. Elasticity without Elastane / Fleece jumpsuit

Fig. 83 Examples of completed evaluation tool during session C

SESSION D
THE STORYTELLING AND THE VISUAL

3h

EXPERT

Communal and parallel part
This session provides general insights to participants in order to encourage them to start taking into account also a non-material perspective during designconcept

developments. All the inputs and insights are developed in form of short presentation and brainstorming slots, considering different perspectives. These primary exercises are also a test phase, and will be further developed and used in the next WSs.
Detailed breakdown of the session in slots (a general presentation with an overview and specific aims takes place before the execution of each slot):

- **Brand Stories**
  It intends to dig deep into the importance of storytelling, provide primary knowledge to participants, and support future decision-making. The storytelling is proposed as an activity that helps bring the story of brand, product and organization to life. After the presentation of the topic, a short brainstorming activity takes place: participants are split into five mixed groups; each group selects one of the design concepts and has to develop a quick story behind the concept considering the What (main value proposition), Why (purpose, cause, belief, etc.), How (how to produce, develop, sell, transport, etc.). After each group has built up its story, they present and share the results.
- **User Stories**
  Also in this case participants are split into four mixed groups, and each of them has to select a new design concept. Each group is asked to reflect on possible barriers perceived by consumers and on how this can be overcome through storytelling. After each group has built up its story, they present and share the results.
- **Research Stories**
  After a quick introduction to the task, each participant has to individually reflect on how the research path and the whole process effort can be communicated in a proper way, and write down notes about it on a A4 profile sheet. Few minutes of sum up follow.

To close the session, a general discussion takes place in order to recap and clarify the aim of the brainstorming activities, considering the next step of the interdisciplinary process.

Workshop closure: usual roundtable asking participants the top moments of the workshop and specific tips to improve some aspects in the next meeting.

WS08 FEEDBACK SUMMARY

HIGHLIGHTS

All sessions were fruitful and all tools were very good

All presentations were necessary with the same level of interest

We learnt the importance of storytelling, and end-user perspectives

Nice to see the progress in physical samples

CHALLENGES

Most sessions have been done quite in a hurry; if there is anything that can be done for this, it would be the best way to improve the meetings

Make sure that all sessions are more tuned within each other. Session C was slightly repeating stuff from Session B, which was a pity

SUGGESTIONS

More information and discussion regarding what actually happens in the labs between the meetings

I would like to see processing technology labs to better understand all base material processes to better define the products

Make R&D people more active in the preparation of the workshop

Facilitators should keep all teams more focused

Start the workshop by shortly presenting/pitching each concept and summarizing what are the concepts we are finally working on – and on which level

Project Review Cycle B

This second project review was held during WS 09 in Helsinki, which was actually the first WS after concluding the project Cycle B.

PROJECT CHRONOLOGY EXERCISE RESULTS

A second WS review exercise has been held after conclusion of Cycle B to gather comments about great moments and challenges perceived during the WSs in this second project cycle. The feedbacks collected for each WS of project Cycle B are summarized as following:

ANALYSIS OVERVIEW

WS05 Feedback Summary
WS05 has been included in this second project chronology exercise being at the same time closing moment of Cycle A and starting point for Cycle B. In general, this second re-evaluating of the WS held in Copenhagen gathered several more feedback, 31 about positive perceived aspects and 22 related to challenging moments, which confirm the usefulness of project management tools such as the GANTT-chart. Nevertheless, much more comments were gathered indicating that activities have been perceived as confusing and not clearly structured and explained, especially related to decision making methods.
INSIGHTS: comments can be summarized as for the great moments in "focused discussions and spontaneous exchange", and for the challenging moments in "Improvement of decision making".

WS06 Feedback Summary
The WS held in London gathered a lot of positive comments about the venue: conference room, coffee breaks and social activities have been perceived as very pleasant and welcoming. Besides ambience, also WS contents and methods, which led to good knowledge sharing moments, have been highly rated within the total of 36 positive feedbacks. In particular presenting and evaluation activities through pitch sessions were appreciated by all experts. As well as the break-out sessions offering not project related creative activities. The majority of the 17 comments indicating challenging moments, addressed mainly time as the main issue mentioning a constant feeling of hurry in the sessions and rushed discussions at round tables.
INSIGHTS: comments can be summarized as for the great moments in "Diversified and creative extra activities", and for the challenging moments in "Optimization of time scheduling".

WS07 Feedback Summary
In contrast to the previous WS, the one organized in Forlì gathered most of the 23 negative comments about WS locations. As already previously identified, ambience and logistic aspects influence indirectly but significantly attitude of the WS participants. Meanwhile majority of the comments about great moments (total amount 22) indicated the group activities, held between experts of own field as well as in interdisciplinary groups, as very enriching and effective.
INSIGHTS: comments can be summarized as for the great moments in "Group work and interdisciplinary sharing", and for the challenging moments in "Accommodating WS Venue".

WS08 Feedback Summary
Last WS of Cycle B was held in Bilbao, which gathered most comments so far: 48 related to great moments and 23 related to challenging moments. WS structure has been perceived as very positive, appreciating the several tools used and variety of activities. Moreover, participants seem to have developed the ability to share knowledge and critics in a constructive manner highlighting the overall perceived free interaction and exchange of insights. On the other hand, too much variety of tools and constant engagement in activities, even during coffee-breaks, may result as overwhelming, exhausting or redundant.
INSIGHTS: comments can be summarized as for the great moments in "Common and shared evaluation tools", and for the challenging moments in "Avoiding redundant activities".

TRASH CASH

GREAT MOMENTS

CHALLENGES

WS05
more focused discussions & spontaneous exchanges

improve decision making
[include into WSs schedule]
INSIGHTS

WS06
diversified activities & creative energizer extra-exercises

optimize time scheduling
[balance time/goals/activites]
INSIGHTS

WS07
group work & interdisciplinary sharing

attention to workshop venue
INSIGHTS

WS08
common & shared evaluation activity/tool
[all tools well prepared]

avoiding redundant activities & too packed schedule
INSIGHTS

workshop contents & methods | sharing knowledge & collaboration | project progress & results | ambience & social activities | total feedback

WS05 total feedback (great moments): 31
WS06 total feedback (great moments): 36
WS07 total feedback (great moments): 22
WS08 total feedback (great moments): 48

WS05 total feedback (challenges): 22
WS06 total feedback (challenges): 17
WS07 total feedback (challenges): 23
WS08 total feedback (challenges): 23

Fig. 84 Project Chronology Exercise –Cycle B table edited with participants feedbacks (zoom in to read the content)

CONCLUSION FROM PROJECT CHRONOLOGY EXERCISE

As already identified through the Project Chronology Exercise held after Cycle A, several parameters related to three main aspects need to be considered to foster successful interdisciplinary project WS. The findings arisen during this evaluation of the second project cycle, confirm the previously described recommendations. Following, some further inputs from Cycle B:

WS SET-UP
Venue - welcoming WS facilities and smooth logistics to inspire enthusiastic participants
The less participants have to worry about logistics of own WS participation, the more they are available for an active involvement in WS activities.
Great moments: "Very good organizing of practical things (venue, lunch, hotel, etc.)", WS08
Challenges: "The room and hotel: always inside, dark and nowhere to go outside/nearby.", WS07
Social Activities – considering cultural diversity and individual necessities
Especially in an international context, consider cultural differences regarding social interaction and habits and provide alternatives or inform/agree previously on arrangements.
Great moments: "Non-sweet vegan ‹energy' (nuts) snacks in the afternoon", WS05
Challenges: "Dinner too late", WS08
WS Agenda – business focused schedule and balanced activities to encourage participation
Suggest a WS schedule to accommodate the largest number of project partners and consider necessities in reaching the location; travelling on week end for business purpose is a no-go. Being able to set up a balanced WS agenda where to include all the task needed to be executed and keep participants involved is the real challenge: provide for diversified activities without confusing and exhausting. Break activities not related to WS tasks are perceived as refreshing and pleasant distraction.
Great moments: "Drawing during break", WS06

Challenges: "Starting on Monday meant travelling on Sunday, making the weekend too short", WS06 - "3 days away from company is too long", WS07

COLLABORATION
Knowledge sharing – Pitch sessions to update and create common knowledge base
Short presentations by all working groups illustrating activity and progress provide a common base for discussion and exchange, need to be kept short and marginal.
Great moments: "Merging of all information from R&D and Designers", WS07
Challenges: "So many concept pitches. Impossible to familiarize with all." – "Passive-listening", WS06

PROJECT RESULTS
Tools – Und diversified tools to foster creativity and engagement
New tools keep participants engaged and open-minded in order to change approach and reconsider consolidated mindsets. Nevertheless, the tools need to be simple, clear and easily executable for non-experts, avoiding excess or repetition.
Great moments: "Good storytelling exercise: nice to do something else in between - I love variation", WS08
Challenges: "Too many different activities: the focusing exercise helped, but we had too many things to do.", WS08 – "Storytelling: interesting to know about, but difficult, challenging to get into it for not expert people.", WS08
Decision Making Methods – Evaluation through clustering
Categorizing and grouping project results helps to summarize thus evaluate outputs. Parameters and criteria need to be clearly defined and transparent.
Great moments: "The clustering of concepts", WS07
Challenges: "The reasoning of scoring in evaluation was not clear", WS07
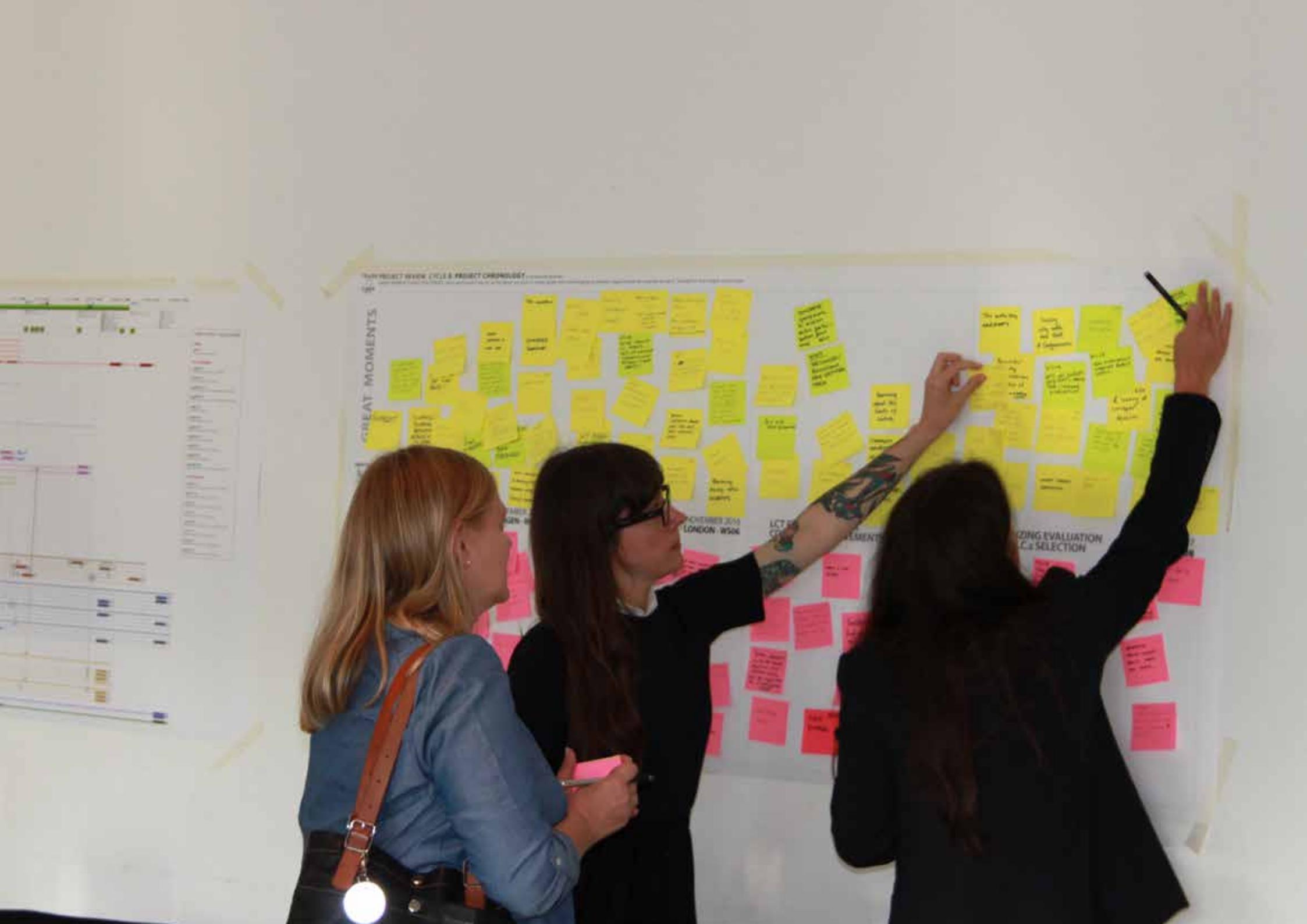
COLLABORATION MATRIX EXERCISE RESULTS

ANALYSIS OVERVIEW

How Facilitators / Design Researchers perceived collaboration
During the second project cycle, collaboration is perceived as much more intense between all partners belonging to the Facilitators / Design Researchers expert group, at the point that no request for more exchange is indicated. Also, an exchange with R&D / Material scientists has happened but still in a not very intense manner thus some request for more collaboration is expressed from the Facilitators / Design Researchers side, whereas R&D / Material scientists perceived collaboration as quite intense. The exchange with Designers / Manufacturers increased as well and is perceived almost equally by both expert groups.

How R&D / Material Scientists perceived collaboration
R&D / Material Scientists confirmed that some intense collaboration is happening within Institutions contributing with experts in these fields and indicating in general that exchange has increased to a high level. Moreover, also collaboration with Facilitators / Design Researchers is indicated as quite intense, which is not perceived equally by the later ones. Instead, the desire for more exchange with Designers / Manufacturers expressed after Cycle A has been satisfied and all partners belonging to this expert group indicated almost equally intensity of collaboration.

How Designers / Manufacturers perceived collaboration
Also Designers / Manufacturers indicated more collaboration between institutions of this expert groups, but in general less comments have been gathered during this second evaluation exercise. An already established exchange with Facilitators / Design Researchers increased during Cycle B. As well as collaboration with R&D / Material Scientists has been consolidated, although perceived slightly less intense than indicated by the later group.
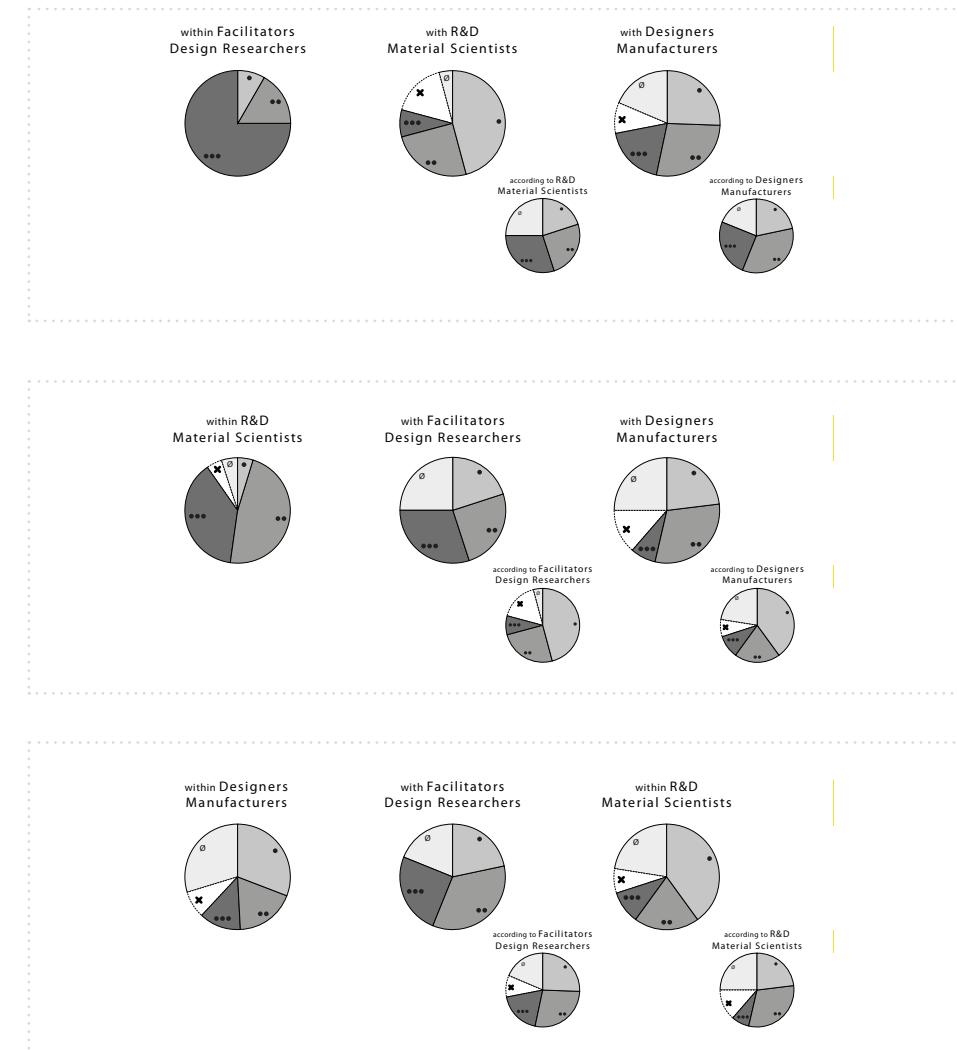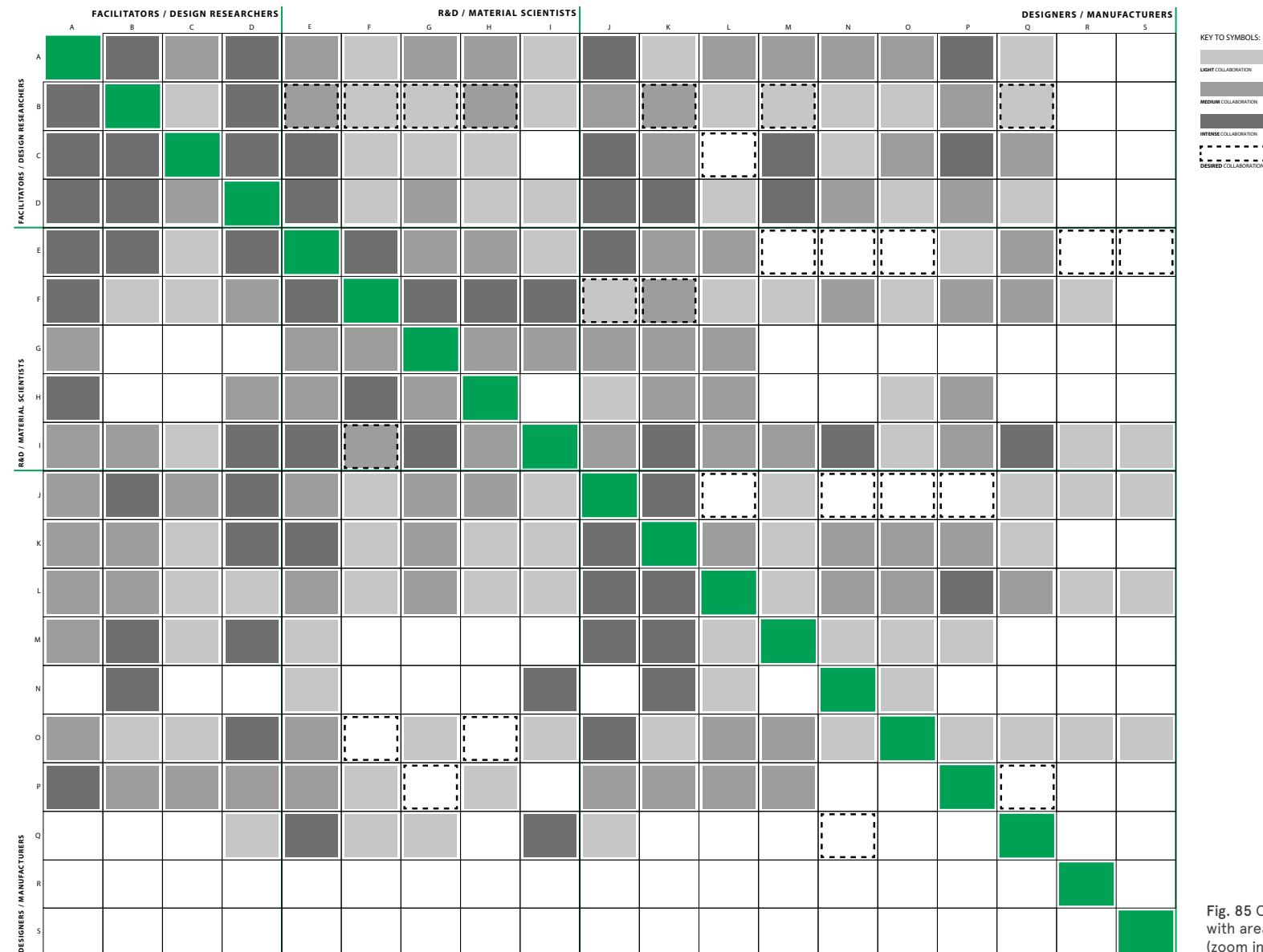
Fig. 85 Collaboration Matrix–Cycle A with area of competences highlighted (zoom in to read the content)

KEY TO SYMBOLS:

LIGHT COLLABORATION

MEDIUM COLLABORATION

INTENSE COLLABORATION

DESIRED COLLABORATION

CONCLUSION FROM COLLABORATION MATRIX EXERCISE

Besides having gathered some more feedbacks, the collaboration matrix completed after Cycle B indicates very clearly that collaboration started to happen in this second project cycle: whereas after project Cycle A several institutions expressed the wish to collaborate with other organisations within the project (indicated in the collaboration matrix by dotted lines), after Cycle B the request for more collaboration decreased drastically. Meanwhile amount of collaboration perceived as light (occasional exchange), as well as partners indicating intense collaboration, remained essentially at the same level, medium collaboration increased significantly in Cycle B, proportional to data for desired collaboration.

COLLABORATION ISLANDS EXERCISE RESULTS

How R&D / Material Scientists suggest enhancing collaboration
Self-analysis
Compared to the first Collaboration Islands Exercise executed after Cycle A (see 2.3.3) the expert group of R&D / Material Scientists has been some less self-critical about their own behaviour (11), providing most feedbacks about what to start doing (6) and some indication about what to keep on doing (4). Main issues identified are concerning planning of activities (time management, foresing peaks in workload, future activities) and sharing information (tools, availability). Again, the monthly exchanges are highlighted as a good practice to maintain.

Shared Feedback
R&D/Material Scientists shared some indications (9) with the other expert groups with the main request to limit WP communications only directly involved persons.

Received Feedback
The feedbacks received (14) from the other two expert groups asked for more active involvement and exchange (knowledge, information, opinion).

How Designers / Manufacturers suggest enhancing collaboration
Self-analysis
The Designers/Manufacturers are constant in suggesting feedback (17) within their expert group, with comments mainly asking for being more involved (reading reports, exchange of information and opinions) and respecting timelines.

Shared Feedback
Designers/Manufacturers gathered the occasion of this second review to share their suggestions (21) with the other expert groups. Main issues arisen during collaboration in Cycle B address active collaboration by providing feedbacks and explanations. Also, a need for keeping small working 'communities' linked to the different project tasks.

Received Feedback
Designers/Manufacturers received few feedbacks (11) from the other expert groups, mainly asking for engagement in overall project goals and to formulate clear and simple requests.

How Facilitators / Design Researchers suggest enhancing collaboration
Self-analysis
In contrast to the first exercise held after Cycle A, this review let to a prolific auto-criticism: main topic addressed in the comments (21) is the need for keeping focused on single project tasks and roles, and the project deliverables.

Shared Feedback
Facilitators/Design Researchers encourage (14) the other expert groups to be engaged with overall project goals and requests within single tasks.

Received Feedback
Facilitators/Design Researchers received several feedbacks (19) about collaboration within the consortium. Most of them about modalities and tools related to project management and task leading.

TRASH 2 CASH

R&D
MATERIAL SCIENTISTS

SELF-ANALYSIS
EXPERT GROUP ISLANDS

☐ STOP
Problematic areas and things to change for better
- stop requesting things at a short notice

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results
- start sharing results within the project
- start using the projectplace to share information
- start foreseeing peaks in labworkload and reporting
- start disseminating
- start planning for the future after the end of T2C
- start to call Ali [WP3 leader] instead of e-mailing

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results
- keep on using the projectplace to share information
- keep on doing monthly progress meetings
- keep on doing focused skype meetings
- keep on working interdisciplinary

DESIGNERS
MANUFACTURERS

☐ STOP
Problematic areas and things to change for better
- stop considering that a concept is your own baby: kill your darlings!
- stop waiting for others to challenge you
- stop keep on walking in circles with developing 30+ concepts

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results
- start reading the reports
- start communicating (+acting) on which concepts are feasible
- tips, tops & actions
- clear action timing guidelines
- communicating more between WS
- clear skype meetings: who do you need, conceise, small groups, agenda
- start focusing on things we can finally do
- all partners need to know what we are doing
- start keeping the timing of the GANTT chart
- start discussing specifications (is not possible yet)
- start focussing: narrow down master case so we can really focus and invest

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results
- keep all partners involved (relevant concepts: Master Cases)
- keep meeting minutes
- keep exchanging any doubts over email

FACILITATORS
DESIGN RESEARCHERS

☐ STOP
Problematic areas and things to change for better
- stop the work in other WP's where the needs differ too greatly
- stop material development
- limit hybrid roles [same person with many roles and as key person of all ot them, e.g. Elina-AA, ed.]
- stop having to own the concepts
- stop task 1; stop task 2

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results
- start to collate, analyse! share data!
- start personal research areas
- start report content
- start role review
- start frank, open, clear exchange on publishing
- start plastic stream material developement
- start to work on all deliverables
- start landscape contributions: we are making / going to make
- start sharing who is publishing / going to publish what research

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results
- keep doing regular skype calls weekly
- keep being responsive and listening as a team!
- keep cross-checking tools / session reference names
- keep scientists integrated to meth team / methods
- keep driving briefs to prototypes, designers input
- keep doing new weekly team meetings for task 4
- keep WP1/2 less deliverable on limitations: remember what has been/is being produces/published

FEEDBACK
FROM OTHER ISLANDS

- ▷ give us more feedback and comments on concepts, everything!
  - don't just say no, explain what limits and think together for solution
  - tips, tops & actions
  - master case communities => dedicated people
- ▷ you are working hard, keep up the good work
  - keep the nice comments like 'we know you are very busy, could you help us?'
  - reminder: we have other urgent business to focus on
    (projects have strict deadlines, production goes on = our income)

- ☐ requesting things at a short notice
  - in mail, stop copying in too many people
- ▷ explain the whole picture
- ▷▷ keep on communicating with facilitators, researchers

- ▷ how can we work out master cases?
  - engaging more with overall project goals
  - clear request and schedule if you need input
  - tools / templates to fill in the data
- ▷ sharing and developing with us
  - being available in the WSs
  - prototyping the concepts

- ☐ 'lost in translation' - who is re-writing stuff? Keeping the history
  - the business of the project is a small side of our real business
  - keep the promised schedule. We need to plan our schedules respect the timing
  - changing design concepts format all the time [e.g using a progressively adaptive format]
  - understand our view / give homework earlier
- ▷ setting up meetings related to master cases specific to be efficient
  - to do list after WSs
  - focus on things we can finally do
  - the time for the real work is too short in the WSs
  - have a clear action timing guidelines
  - tips, tops & actions
- ▷ inclusive WSs, very good!
  - are you developing a new tool? [keet developing new tools, ed.]
  - [keep asking yourself, ed.]how to gather feedbacks? How the information will circulate?

- ▷ start doing homework, engage more
  - task/project specific goals and reaching them, engagement in the project goals
  - methodology, input from science
  - you don't all have hours in WP3 but how do we do task 1, 2, 3 without your input? do you mind us asking help?
  - WP3 communication, design concepts: spec. sheet contributions, how to give clearer information
  - remember: we are not scientists, sometimes we need 'reality check', we always need explanation to explore innovation!
- ▷ keep sharing and developing with us, sample development and linking to design concepts

- ☐ in mail, requesting things at a short notice
  - in mail, stop copying in too many people
- ▷ people are waiting that facilitators say what to do, how to activate?
  - design process and the role of WS should have been opened earlier: target of the project/WS
- ▷▷ repeat the target, aim of session/WS

Fig. 86 Partner Islands Cycle B – Answers (zoom in to read the content)

CONCLUSION FROM COLLABORATION ISLANDS EXERCISE RESULTS

As a result of this second self-evaluation exercise, a total of 93 comments have been gathered. Most of them providing suggestions on how to foster collaboration (PLAY: 49) and a lot of encouraging feedback to continue already established practices (FAST FORWARD: 26). Only few requests to stop some bad habits were collected (STOP: 18), some of them indicating an attitude that harms the spirit of collaboration, in particular:

"reminder: we have other urgent business to focus on" / "the business of the project is a small side of our real business"
"Stop requesting things at a short notice"

Analysing the amount of feedback made, shared and received by each expert group, arises that this time the Facilitators/Design Researchers was the most self-critic expert group making 21 consideration about own behaviour and giving 14 feedbacks to the other expert groups. Designers/Manufacturers were the most critical commentators providing 21 feedbacks to the other expert groups and 17 suggestions to adjust own behaviour. Meanwhile R&D/Material Scientists started to comment more on their collaboration with the other expert groups by sharing 9 suggestions, making 11 comments about own activity.
Summarizing the content of the comments, the following suggestions were gathered from the directly involved participants of Cycle B, indicating how collaboration between expert groups could be enhanced:

"Don't just say no; explain what limits and think together for solution"
"Keep the promised schedule; we need to plan our schedules and respect the timing."
"Have clear action timing guidelines."
"Start doing homework, engage more!" / "Understand our view; give homework earlier."

2.4 Cycle C – Refining (design&material) outcomes

The Cycle C is the refinement cycle in which the materials are improved in response to design product concepts. It is the last iterative phase, where all efforts converge to define aligned specifications for the three streams (R&D, design, manufacturing and other expertise) at all levels of material (both base and manufactured materials) and product development. In this cycle design inputs are specific and feasible within the achievable range of EMTs developments. Interventions in R&D decisions are convergent, really focused and viable. They affect the final research hypothesis in line with the manufacturing and other expertise perspectives (LCA, consumer behaviour, scalability, etc.).

The R&D stream defines the necessary implementation specifications for the last experiment development to obtain the specified outcomes. On the other hand, design stream pushes further the improvement of MCs in their design, business, technical, manufacturing, and prototyping aspects, proceeding from the MCs Specifications Sheets (Design Brief 3) to the final design products specifications. The other experts provide inputs from their different knowledge domains in order to improve the MCs, to study their scalability and validation, and to set up the operative prototyping phases. So in this cycle the interdisciplinary collaboration focuses in fine-tuning, selection, implementation and validation of MCs.

There is a change in the collaboration between design and the other two streams, as clearly highlighted in the process scheme. The interaction and exchange with the R&D is really focused and intense (represented with saturated colour), than previous cycles, with reduced information flow but very specific (represented with thin flows).
The collaboration is detailed and mainly focused on the first part of the cycle.
On the other hand, also the collaboration with the other expertise is consistent and intense compared to other cycle, but the amount of information is bigger compared with the R&D stream (represented with saturated colour and large flows).
Cycle C develops in five WSs (plus the closing WS of the cycle). An additional WS is necessary like in Cycle A, but while in Cycle A it is added in the first step (analyse potentials), in order to increase the investigation phase and the general knowledge sharing, in Cycle C the additional WS is necessary in the second step (define requirements), in order to provide partners enough time to
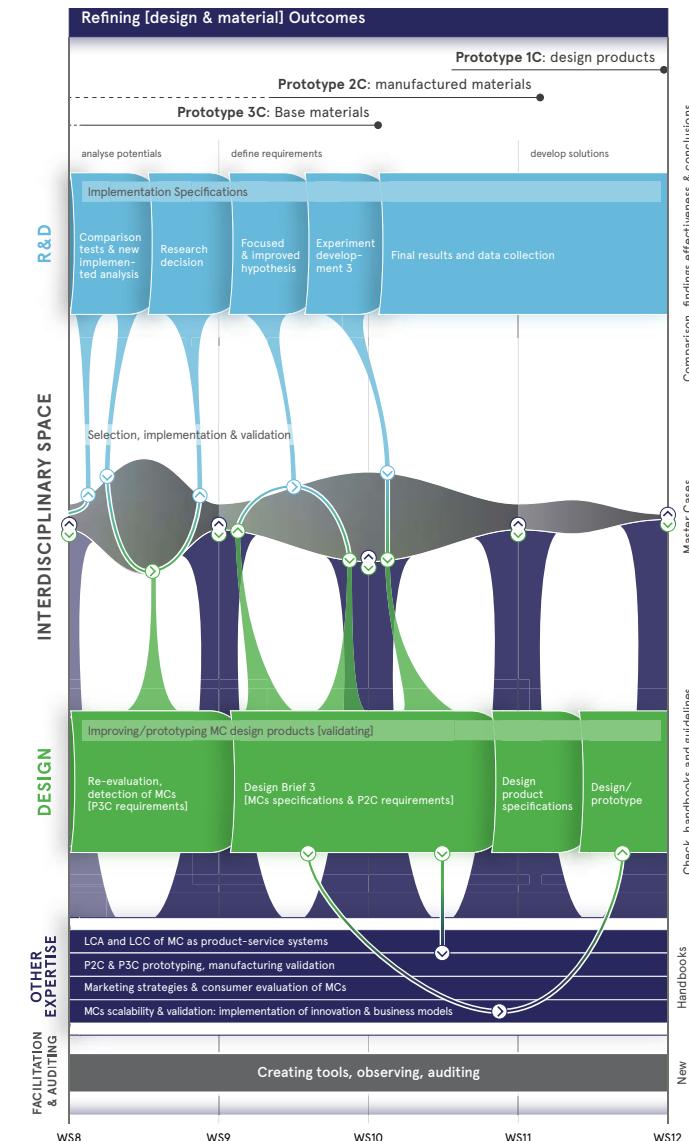

Fig. 87 Cycle C process scheme (zoom in to read the content)

define the right and feasible MCs specifications. Also this cycle starts with the closure WS of the previous cycle (WS08): the ending WS of a cycle is indeed the beginning of the next one in term of activities and focus.
In Cycle C, the third iterative production of the base material prototypes (P3C: third generation of prototypes) is realized sooner than in the other cycles. This allows manufacturers to realize the second iterative production of manufactured materials (P2C: second generation of prototypes), and, in turn, the P2C allows the prototyping of design products (P1C: first generation of final product prototypes). Every step takes into account the design specifications. It is crucial also in this cycle that all the activities and related outcomes are well planned from a time perspective in this process phase.
The scheme of figure 88 clarifies the relation between WSs and steps, as well as the main goal? of the different streams in each step. As it clearly appears from the scheme, in Cycle C the focus is on prototyping and on the full specification of MCs: for this reason the dark blue colour has been chosen to characterize this part: design and manufacturing (& other expertise) streams had a very intense exchange to realize the final prototypes.

The scheme in the next page (figure 89) provides an overview of the different real prototyping and design steps needed to develop each of the six MCs. It provides to the reader an idea of the complexity of this cycle and why a deeper exchange and a continuous dialogue among the different key partners are necessary. In the scheme, each MC is split in two streams (the design and the prototyping), and for each step the reader can figure out the amount of exchanges and specifications necessary to push further the development of design products, from the base materials to the product prototypes. The scheme has been a useful tool to monitor the whole process and it has been regularly updated (more than 20 versions have been realized).

WS8 — 1 — ANALYSE POTENTIALS

Design: Re-evaluation of concepts, and selection of MCs
R&D: Testing, analysis and comparison [P-2B] and new requests; Research decision
Other expertise: LCA, LCC inputs, primary analysis of business models

WS9 — 2 — DEFINE NEW REQUIREMENTS

Design: Design briefs 3 [MC specifications and final prototyping requirements]
R&D: Focused and improved hypothesis, experimentation
WS10 development 3
Other expertise: Manufactured materials prototyping, testing, definition of MCs business models, LCA, scalability, communication strategies

WS11 — 3 — DEVELOP SOLUTIONS

Design: Definition of design product specifications for manufacturing/prototyping
R&D: Final analysis and data collection
Manufacturing: Products prototyping and final business models, final scalability and validation studies, and communcation strategies

P–3C 3rd Generation Base Material Prototypes
P–2C 2nd Generation Manufactured Material Prototypes
P–1C 1st Generation Design Product Prototypes

WS12 FINAL SHOWCASING AND REFLECTIONS

Fig. 88 Steps and WSs overview of Cycle C

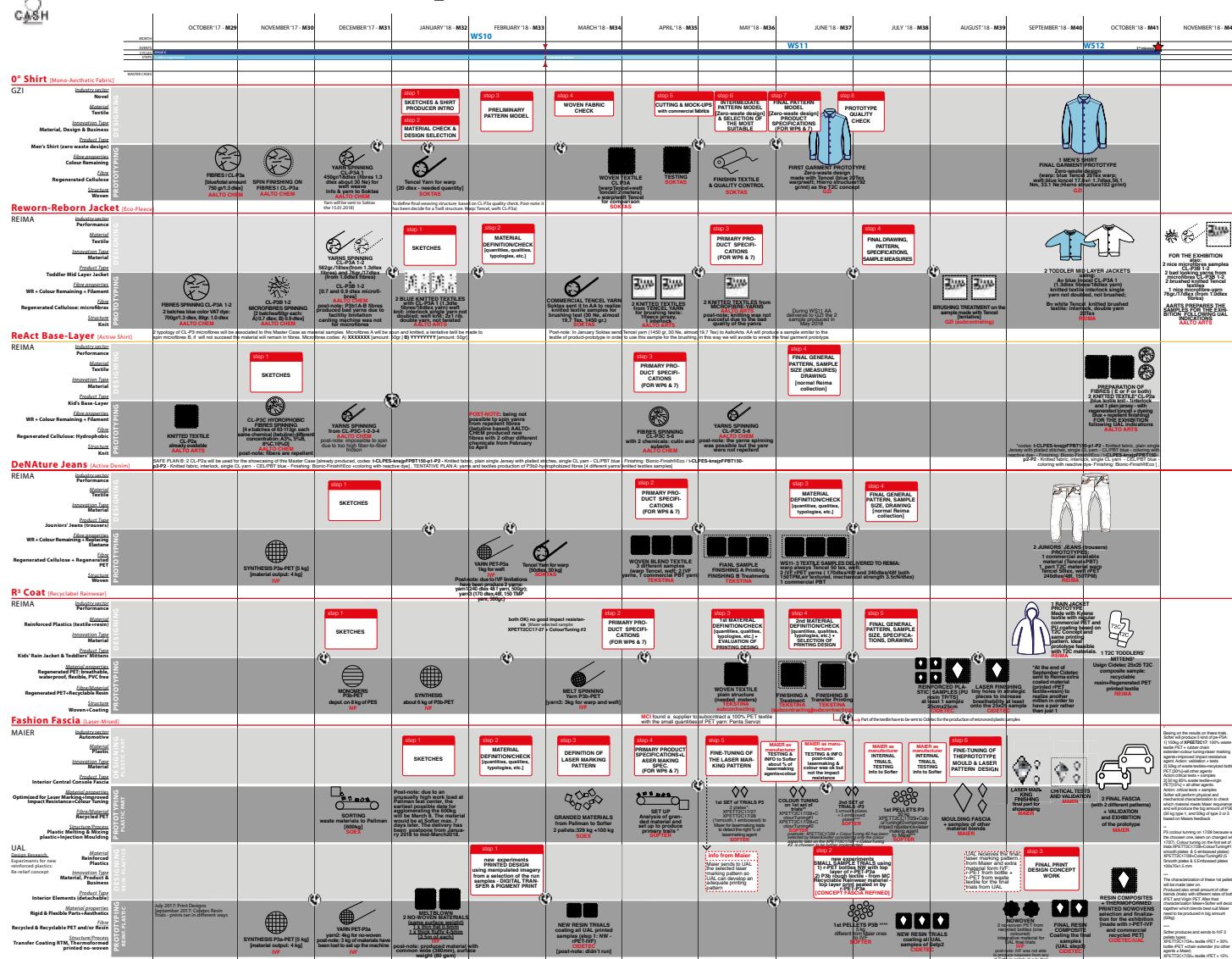DESIGN-PROTO SCHEME OF MASTER CASES_TIMELINE ACTIVITIES: OCTOBER 2017 - NOVEMBER 2018

Fig. 89 Proto–Design Chart developed during Cycle C to plan and monitor the prototyping and design steps of each MC from base material prototypes (fibres and pellets), to manufactured materials (textiles and plastic) and from these to design product prototypes (garments and plastic parts) (zoom in to read the content)

t-CLF

PES-wvwasCO3PBT150-p2-P2 ②

t-CL-wvwatCO3rp-p1- P2

150-P3-P2 ①

WS09 - Master Cases Analysis (LCA)

WS09 closes the "analyse potentials" step, and opens the "define requirements" step of the last iterative cycle: the specifications of the six MCs must generate the requirements for the manufactured materials of second generation. WS09 will not close the "define requirements" (second step of cycle C) that will be extended also to WS10, this is due to the importance of this phase's objectives, the need to have enough time to develop the MCs properly, to give the opportunity to material scientists of the different processing technologies to produce the third generation base materials in time for the following manufacturing steps. The manufacturing and the design streams will therefore finalize requirements for the R&D stream to produce the third generation base materials which will be available in the period WS09-WS10, while the specifications for the second generation manufactured materials, and the related design products, will be defined in the period WS10-WS11. In this and in the next WSs, manufacturers and experts are strongly involved in the development of the third version of design briefs, i.e. the final version of MC specification sheets. Also in WS09 and WS10 these sheets are still the main interdisciplinary document/tool to merge material requirements and design concepts that will be implemented into design products (product prototyping phase). In this WS the MC specification sheets will be presented in their updated version. From a micro- and practice- perspective, the WS09 has the following objectives:

- convey all the issues, reasoning, reflections on MC design briefs from environmental (LCA inputs), manufacturing (testing campaign, finishing trials, etc.) and industrial points of view;
- go back to R&D and re-consider technological limitations/potentials in the light of the new information coming from two cycles of proofs/trials/validations/outcomes;
- provide clear and final directions through MC specification sheets to R&D stream (processing technologies);
- harmonize the different technical levels (base materials, manufactured materials, finishing and treatments, products) with a common and aligned understanding among the different streams and tasks.

WS PREPARATION

Right after WS08, designers quickly update design specification sheets using feedback gained mainly during session B (Circular Analyses LCA meets LCT) and session C (Design Concept for P3: next step), to ensure every material development or creative change of direction is included for the final evaluation. An evaluation pack containing instructions, evaluation tool and updated design concepts sheets is created and distributed to all organizations by facilitators. Participants involved in WS08 set up an evaluation session in their own organisation, involving their internal team to re-assess design concepts by repeating the execution of session C of WS08, and using the evaluation pack. The final scores from each organisation about each design concept are collated and analysed by the facilitators and design researchers. The results from all evaluations are used to select the MCs: six design concepts achieve unanimity to progress as MCs. The design concepts with an unresolved score are discussed and evaluated during WS08. Prior to the WS, designers update the design specification sheets improving the selected MCs and integrating the feedback received from the evaluation.

In order to face the second part of Session A ("Brainstorm Storytelling"), facilitators and industrial design practitioners ask participants to read "Ten Types of Innovation"(8) , a specific publication about innovation. Technical participants (manufacturers, material researchers, responsible of finishing and testing, LCA experts, etc.) are also asked to study and to analyse the specification sheets (digital version shared through a web platform) of the six selected master cases. Material scientists are asked to send a list (in bullet points) of the main issues related to their own processing technologies, considering the base material requirements contained into the MC specification sheets. Each point should have a line of description (a very simple description: no data are required, nor proof of fact or technical, in-depth explanations) as well as possible solutions (in bullet points), if any, able to overcome the issue. Prior to the WS, the list is shared with all participants to allow them to reflect on the issues before the WS and to arrive well prepared for the common discussion.
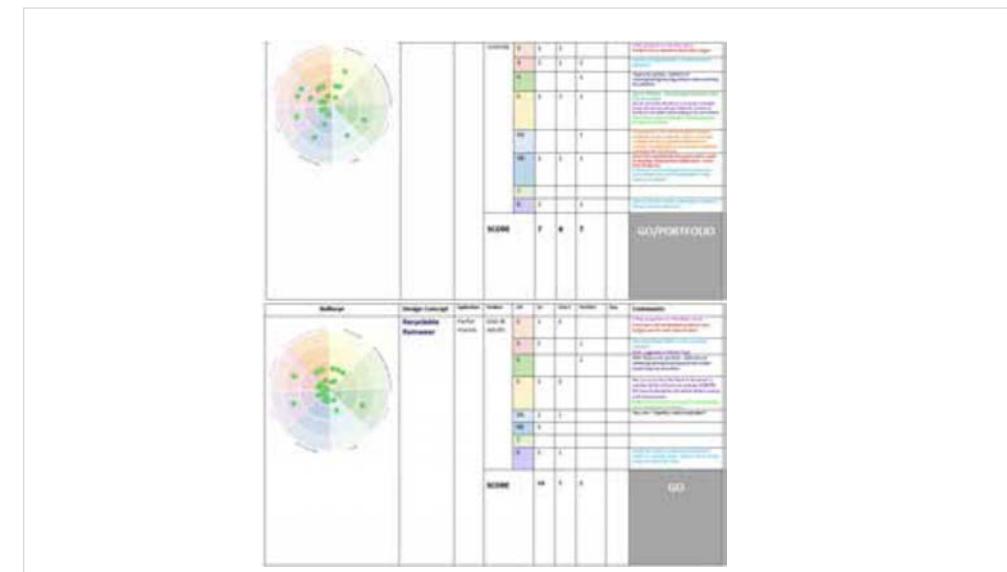

Fig. 91 Example of two result of the evaluation activity on two specific design concept elaborated by facilitators and design researcher (zoom in to read the content)

WS ORGANISATION

WS09 is organised in four main sessions. The first session aims to present the selected MCs and the updated versions of their specification sheets, as well as work on their improvement. The second session is aimed at executing the project review of cycle B. The goal of the third session is to discuss about manufacturing issues, and primary finishing and testing campaign on the manufactured material of the previous cycle. In the final session, material scientists present the new focused research hypothesis to all teams in order to discuss possible issues to achieve the design-driven material requirements. Updates about WPs' status, issues and next steps are provided by WPLs prior to each session in accordance with the topic of the activities. During each session, special breaks are taken to "charge up attention" of participants and reduce stress, named "unlocking your mind set" (informal activity with design research purpose).

(8) Keeley L., Walters H., Pikkel R., Quinn B. (2013) "Ten Types of Innovation: The Discipline of Building Breakthroughs", ISBN 978-1-118-50424-6

SESSION A
DESIGN-BRIEFS STEER INNOVATIONS

1,5h

DESIGNER   FACILITATOR
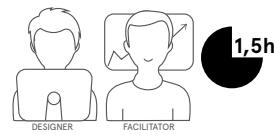
1st part – MCs PRESENTATION

Communal part
The facilitators explain to all participants the results of the evaluation activity carried out during the interim period WS08-WS09 by all partners, and the analysis activity provided by design researchers and facilitators. The resulting three typologies of design concepts are also presented: "master cases", "only if", "portfolio" (see Session C description in WS08). A common discussion and a decision-making process take place to evaluate the "only if".

After that, each lead designer explains each single MC and expresses all material requirements to material scientists (base materials) and manufacturers (manufactured materials). The presentation is carried out using the updated version of the MC Specification Sheets (which will become the third generation of design brief, i.e. product design briefs) and using project material samples. This session allows participants to proceed with the interdisciplinary material specification refinement process: to ensure R&D experts understand exactly what designers want to be produced and that designers understand exactly what R&D could produce, direct discussions between the two expert groups are facilitated. During these discussions both competencies determine and record together the required material specifications.

USED TOOLS

MC Specification Sheets
The MC specification sheets are the updated and improved version of the previous design specification sheets. They represents the interdisciplinary design briefs able to integrate design, R&D and manufacturing requirements, as well as results of the finishing and testing campaign and information related to circularity and other aspect of value chain. During the discussion in session A, the information in the design brief are updated and improved aligning all streams.

Fig. 92 Example of MC specification sheets used to communicate in an interdisciplinary manner the design concept quite close to become design product briefs (zoom in to read the content)

TRASH CASH

Active Denim

Master Case – Material Innovation

Design Code: E2

Summary:

The design concept aims to use recycled Cellulose and Polyester fibres in a blend to produce elastic denim textiles suitable for active life style. Elastane is currently widely used to provide stretch in denim garments, however it is a problematic fibre in terms of poor LCA. Replacing elastane with PES (PET within T2C) should improve LCA and allow the textile to be more recyclable. Product components used will be designed for ease of removal to allow for separation during the sorting for recycling process.

Water repellent finishing and durable denim structure enables these jeans to be worn in any weather and last long, while elasticity coming from PES makes the jeans comfortable ensuring freedom of movement for active life style. The denim look will be achieved through digital printing (and colour recycling bringing nice blue base color).

Innovation:

The concept has material level innovation - fibre (CL/PET elasticity) and textile (printed denim, water repellent denim).

Fibre Requirements:

Elasticity & Material Resilience/Recovery
- Elastic form of PES to provide good elasticity with good material recovery so the garment is durable

Residual Colour
- Colour from recycled cellulose textiles to be retained in fibre regeneration process to provide the blue colour of the garment produced > only if hygienic enough

Material Requirements:

Soft and comfortable
- Soft cotton denim look and feel

Elastic
- Comfort and freedom of movement

Extended Durability in Use Phase
- Durable textile structure, colour fastness / extensive use and laundering

Water Repellent
- Finishing treatment

Easy Care
- Reduce laundering & extend use

Moisture Management
- Breathable (moisture wicking) structure, garment may be worn over long periods of time & physical activities

Recyclability
- Blend % and structure to be optimized for sorting & recycling, no use of elastane

Design Concept

Product Drawing

Testing

Material Specifications (Textile)

Feedstock | Fibres | Yarn | Textile | Finishing | Performance Product | Collection | Sorting

Soex

PET waste without color, in theory all PET waste without color should be used for depolymerisation process. IVF tested different waste (e.g. bottle wastes, textile waste), as for textile waste, it should uncolored pre-consumer textile (PET, poly-blend or cotton-blend) waste .

Blue VAT dyed cotton. Not every dye can be recycled the same way. The blue VAT dye has been considered within T2C. In general terms, VAT dyes textiles (of the some colour) are more likely to be regenerated than reactive dyes. It is easier (but not necessary) to consider VAT dyed pre-consumer cotton textile waste as feedstock.

Aalto Chem

CL – loncell 1.3dtex -fibre In general terms, VAT dyes (of the some colour) can be regenerated but not endless re-generation/re-spinning is possible. It is possible to suppose that re-generated fibres (retaining color - coming from VAT dyed pre-consumer cotton textile waste) are recyclable 2 times in a loncell-F processing. After that, respective textiles can still serve as feedstock (after the recycling cycles the cellulose molecules are very short) but new cotton waste (with long cellulose molecules) needs to be added.

IVF

rPET Regenerated polyester should be same as virgin polyester. It should be recyclable. Depo-repo method is a circular way of recycling of polyester. But, there are some materials losing: there is around 20% of polyester is lost during the depolymerisation process. In reality, the polyester can be recycled only 4 to 5 times.

Aalto Chem

loncell-F yarn 10-15 dtex ring spun yarn (commercial Tencel used for T2C showcase samples) Titer; 50 Tex

+

IVF

Repolymerised texturized PET yarn modified to imitate stretch properties of PBT.

Yarn specs according to the textile Tekstina tested;

Density; Threads/cm warp CL 12 (D), weft PET 20D Threads 94 (CL) x 62 (PET)

(Lighter yarn preferable but may not be possible in the scope of the project)

Tekstina

Woven fabric to simulate denim; 3/1 right twill with CL warp and PET weft; around 280 g/m²;

Note! Fabric designed to be stretchy and recognised as a blend during and end of life sorting stages (>10% PET visible on surface).

Tekstina

Water repellent finish (fluorocarbon free) to increase durability & functionality, lengthening the lifetime & ecology of the use phase.

Digital printing (all over or digital transfer) to improve texture and look with eco-finishing techniques.

Reima

Children's denim trouser with performance elements to allow for play & movement in various weather (wet/dry) conditions. Designed with easily separable product components for easy recycling.

Use; Everyday use. Long life garment.

Soex

End of life Waste/Collection Regular textile waste collection

Soex

NIR recognizes as CL/PET blend.

Fabric designed to be stretchy and recognised as a blend during end of life sorting stages

Design Team

Reima: Kirsti

Manufacturing Team

IVF: Zengwei, Lisa
Aalto Chem: Michael, Simone
Tekstina: Lucija
Reima: Natalia

Evaluation Result

Evaluation Score Summary

Go	13
Only if	13
Portfolio	0
Stop	0

Fig. 93 Example of MC specification sheets used to communicate in an interdisciplinary manner the design concept quite close to become design product briefs (zoom in to read the content)

2nd part – BRAINSTORMING FOR STORYTELLING: BRAND DNA

Communal and parallel part

This is the first of three brainstorming phases to work on storytelling of MCs contributing to the development of their marketing strategies (together with the consumer barriers studies).

The whole process is named "Brainstorming for Storytelling" and is divided in three main phases executed during three WSs: 1st phase in WS09 about Brand DNA, 2nd phase in WS10 about Product Stories, 3rd phase in WS11 about Finalising Product Stories (9). Industrial design practitioners elaborate the results of each brainstorming phase after each WS, to feed the next WS and produce the needed outputs.

Fig. 94 Participants in action during the Ten Type of Innovation- Brand DNA exercise
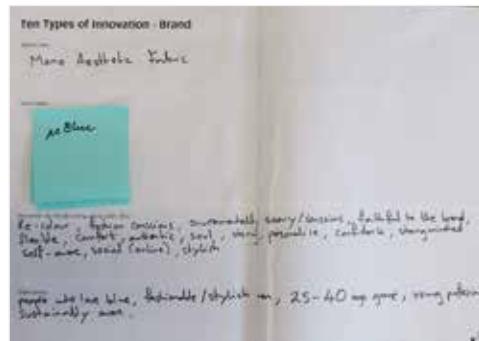
Fig. 95 Example of one results obtained by the 10 type of innovation exercise-brand DNA

These brainstorming phases aim to provide participants a qualitative overview of MCs' innovativeness, steering them to reflect on storytelling in order to improve MCs in their non-technological and non-material aspects (beyond the material innovation domain). Specifically in WS09 the focus is on reflecting and creatively reasoning on the brand DNA of the six MCs in order to improve their identities, work on their strategic aspects, build up brand values from their design briefs. This is done using the Ten Types of Innovation approach defined by the design agency Doblin(10). A quick and clear explanation of this approach and of the different types of innovation is provided to participants, showing an example for each type to which the participants can relate to.

Participants are split in six mixed-groups (each group is lead by the lead designer of the MC). Each group is invited to develop creative ideas about different aspects of the brand that could be built around the MC. Their challenge is to come up with as many innovations as possible spread over the ten types of innovation. On top of that, partners are asked to come up with a branding (brand name, target group and keywords). Even though the branding is not final at this stage of the project, it helps to come up with ideas. As a result, beyond the borders of product innovation, the session leads to a good first base to build a holistic story on. The results are perfect inputs to be elaborated and to be used for the brainstorming session in WS10.
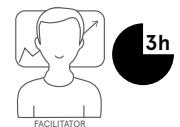
SESSION B
PROJECT REVIEW EXERCISE – CYCLE B

3h FACILITATOR

Parallel session

The project review exercise and tools are fully described in paragraph 1.5.1 and the results of the review of Cycle B are proposed in paragraph 2.3.4.

SESSION C
MANUFACTURING & ENVIRONMENTAL INPUTS

2,5h EXPERT

Communal session

In this session specific experts discuss commonly with all teams to share issues,

problems and solutions considering their competencies and taking into account the MC specification sheets. Breakdown of the session in specific slots:

- Discussion about finishing and testing campaign: results so far, next tests, issues, limitations and potentials about manufactured materials (specifically for T2C, yarns, textiles, composites) related to the MCs. The slot is led by manufacturers with the support of all experts involved at different levels in the testing and finishing tasks;
- Inputs about scalability/production processes: qualitative inputs and overview of primary SWOT analysis of MCs from a production perspective;
- Inputs about LCA: qualitative inputs, possible issues/suggestions for MCs' further development.

SESSION D
R&Ds/PROCESSING TALK
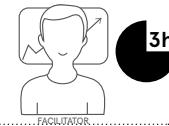
Communal part

&A format, also using Postcards.

This session makes use of the lists (in bullet points) elaborated by material scientists and shared with the participants prior to the WS. Each list contains the main issues related to each processing technology considering the new information gathered by material scientists after the comparison test and research hypothesis decision on base materials, and the material requirements from the MC specification sheets. Each point has a line of description of the issues (a very simple description: no data have been required to material scientists, nor proof of fact or technical and in-depth explanations) as well as possible solutions (in bullet points), if any, able to overcome the issue. The list is used as a guide for the common discussion considering: boundaries due to facilities and logistic limitations, processing issues, technology readiness level (TRL) of processing technologies/base materials, marketability of base materials, feasible achievements within the project timeframe, etc. A facilitator in each processing technology slot has the aim to keep "understandable" the technical language of material scientists, and to collect and read the questions on postcards the participants prepared during and prior to the WS.

At the end of the session, a tour to the laboratory related to one of the three processing technologies implemented during the project is organised. The visit is the occasion to sum up the steps of this specific processing technology, starting from the feedstock (material samples are used) to the latest generation of base material samples produced. All steps are explained in practice inside the lab.

USED TOOLS

Material samples, MC specification sheets, slide presentations
During Session C and Session D are used the same tools used in Session A (except for the 10 type of innovation exercise). Considering the process convergence and current knowledge sharing, it is possible and useful that all participants related to the different streams and competences use the same tools with different purpose and analysing them from different perspective.

Fig. 96 Tools and discussion during WS09- Session C and D

Workshop closure: usual roundtable asking to participants the top moments of the workshop and specific tips to improve some aspects to the next meeting.

Fig. 97 Manufactured material samples used to described the achieved results and to discuss about MC requirements

TRASH
CASH

WS9 FEEDBACK SUMMARY

HIGHLIGHTS

Visiting the laboratory was very useful to clearly understand the processing technology and the effort beyond its implementation and the production of base materials

Good walkthrough of the MCs, which led to very important discussions, and the brainstorming about the Ten Types of Innovation was fun and inspiring

Practical discussions to find the solution for prototyping step

CHALLENGES

The time was badly managed in Session D, so that the presentations in the middle of the day were too short

Sessions C and D could have been framed better, to clarify the overall purpose of each activity and how it fits to the whole

SUGGESTIONS

Time keeping could be considerably improved

Organize more small working groups for specific purposes and outcomes Visiting facilities in each meeting helps knowledge sharing

SAMPLE FOR DESIGN CONCEPT:

TRASH 2 CASH

Fibre

Structure

Finish
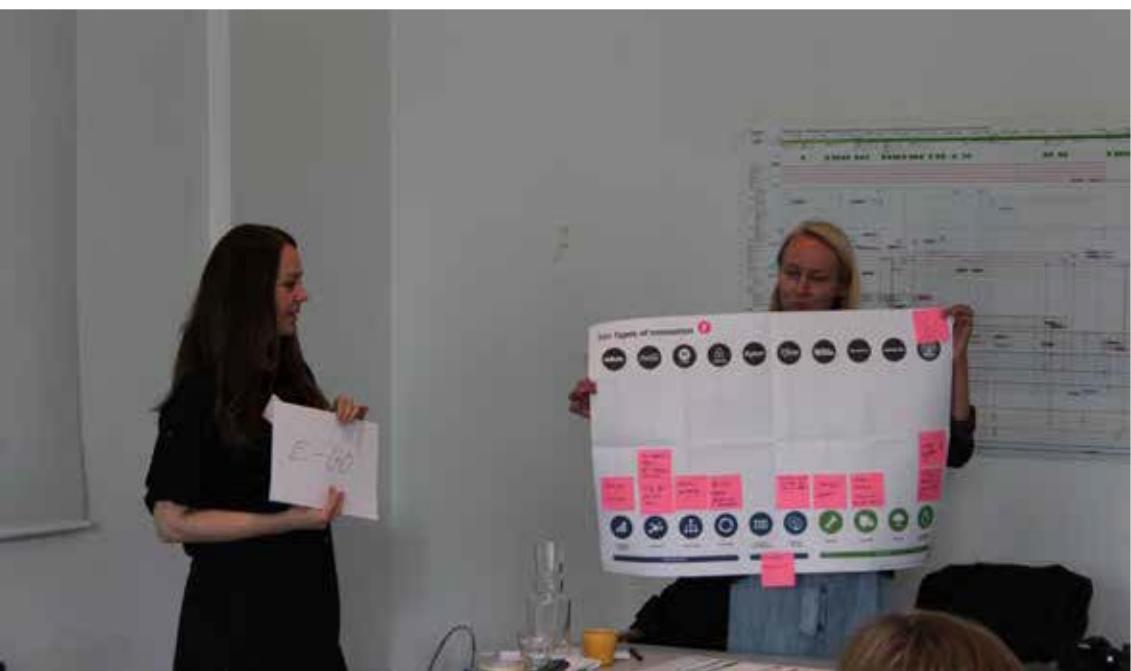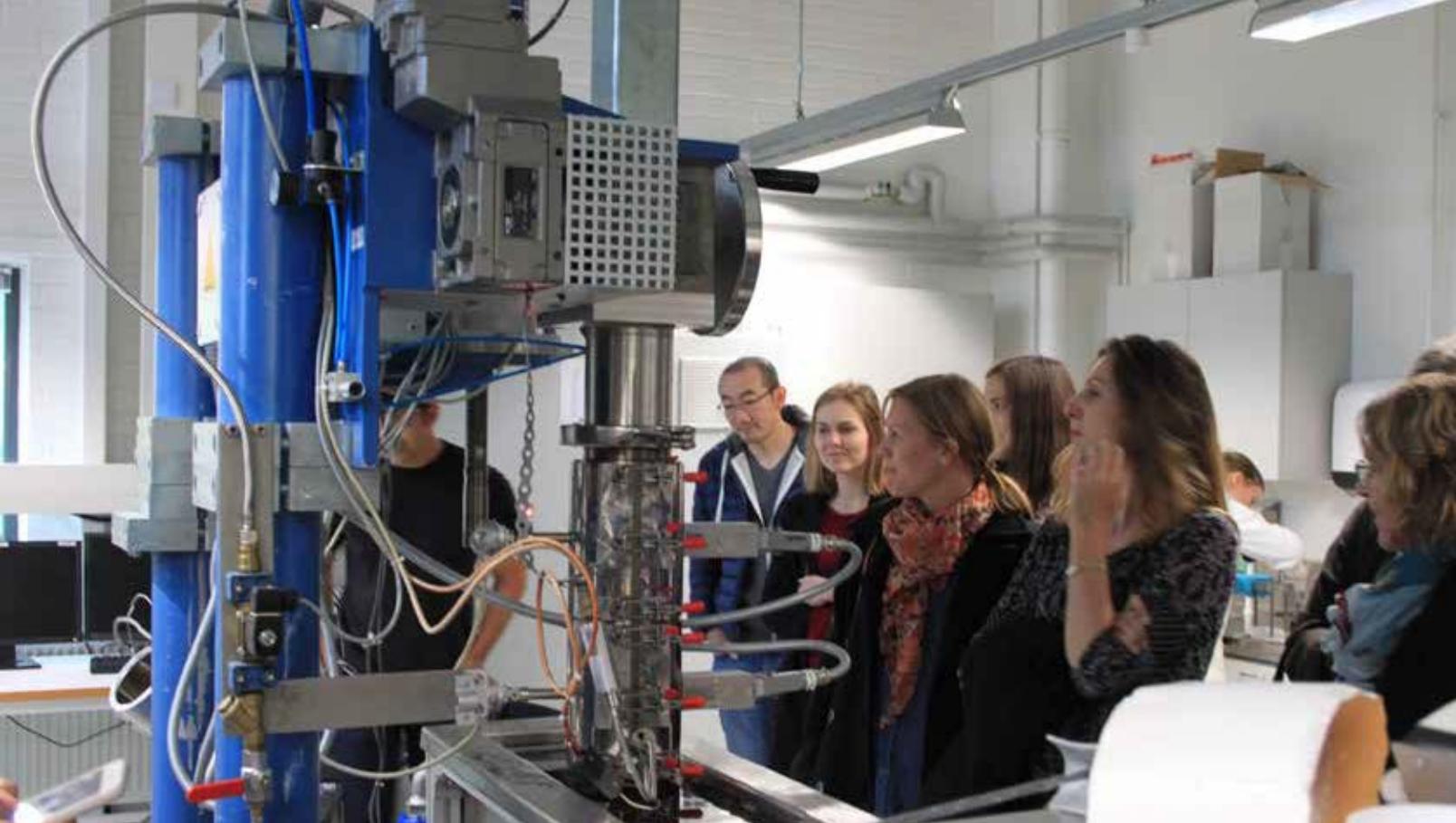
WS10 – Master Cases Specifications (storytelling)

From the DDMI process perspective, WS10 is an intermediary WS in the "define requirements" step. It does not close/open a step, but it pushes further the definition of design requirements addressed to manufacturers for the prototyping of MCs.

It aims at questioning the MCs in every aspect including storytelling, business, LCA and scalability perspectives. The meeting brings together all participants and their competencies in order to:

- audit the status of the 6 MCs and commonly discuss design developments and prototyping requirement issues;
- push forward the innovation level of MCs from the industrial and business viewpoint, as well as from the environmental perspective;
- provide new inputs to the experts and evaluators in charge of MCs scalability, LCA and LCC;
- map stakeholders (possible beneficiaries of the project outcomes) considering the project key results and assets to push further the next steps for dissemination and exploitation;
- reflect on the project process to generate primary inputs, thoughts, impression on the applied methodology and to elicit primary methodological considerations on DDMI.

TRASH CASH

WS PREPARATION

To prepare all participants to this WS, facilitators asked them to familiarise with all tools prepared for each session, mainly the tools related to Session C "Master Cases feed LCA and Business analysis" that were quite technical and complex for a non-expert, and to read and study the documents delivered during the interim period between WS09 and WS10.

A short and self-explanatory presentation of the business model canvas(11) (Business Model Canvas: Theory in a Nutshell) has been shared before the WS in order to skill participants, provide them an aligned basic knowledge and support the brainstorming activities about the business model in the related session.

Furthermore, technical and expert partners involved in MCs prototyping (manufacturers, material researchers, responsible of testing, finishing and LCA, etc.) had to arrive to the WS well informed about the primary MC design requirements developed during the period WS09 and WS10, to highlight possible issues and related potential solutions.
Designers had to update the design status of the MCs and the prototyping requests (also with sketches, drawings, etc.) they had also to be ready to present the MCs to the whole teamwork.

WS ORGANISATION

WS10 is organised in 4 main sessions set up to generated specific inputs and outputs (information, decisions, contributions, etc.). Differently form previous workshops, the activities and points for discussion in this workshop are to resume in WS11, that will be a sort of updated repetition of WS10.
This extra-repetition (corresponding to extra time) is mainly due to the necessity to clearly set up the design requirements for the prototyping phase, and mainly to give the opportunity to the experts in charge of the LCA, scalability and validation of the MCs to raise the needed information, and at the same time, to provide to the designers and all participants the needed information to develop properly the

MCs in every aspect.
WS10 opening: recap of WS agenda, WS objectives, project phase and current step, and feedback from previous WS.

SESSION A
MASTER CASES RECAP AND STATUS – 1st part

3h 1st DAY
DESIGNER   EXPERT

Communal part
Each designer recaps the design status of each related MC with the support of the (design and prototyping) task leaders and using the updated "MC specification sheets" elaborated and used in previous WSs and the Material Specification Documents. After each presentation a discussion takes place in order to commonly highlight and questioning possible issues. This primary discussion aims to take note of the possible issues by the task leaders and steer them later on or after the WS if it is not possible to solve them at this primary stage. 30 minutes are allocated for each MC. After each presentation and discussion the design practitioners present the results of the "Brainstorming for Storytelling–Brand DNA" related to each specific MC. The exercise has been carried out in WS09 and the results have been further elaborated by the industrial design practitioners to be presented and used in WS10.

SESSION B
MASTER CASES IMPLEMENTATION: PRODUCT STORIES - 2st part

2h 1nd DAY
DESIGNER

Parallel part
The second part of the session reiterates "Brainstorming for Storytelling" exercise already carried out in WS09 with a focus on product stories. This is the second of three brainstorming phases related to the topic to work on storytelling contributing to the development of MCs marketing strategies together with the consumer barriers studies: 1st phase in WS09 about Brand DNA, 2nd phase in WS10 about Product Stories, 3rd phase in WS11 about Finalise Product Stories(12). The exercise aims to implement the storytelling and branding of MCs and to push forward the results collected and elaborated during the exercise in the previous round (WS09). The outcomes of this session are useful also to provide inputs in

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(11) It is a visual representation of current or new business models, generally used by strategic managers providing a holistic view of the business. The Business Model Canvas gives people a common language through which they can evaluate traditional processes and bring innovation into their business models. It is a visual chart with elements describing a firm's or product's value proposition, infrastructure, customers, and finances.
(12)   The final results of Product Stories, the full description of the used tools, and the whole "Brainstorming for Storytelling" phases can be found in D.3.6-confidential

session C and to build up the MCs innovative and business potentials taking some primary decisions that will be finalized in the next cycle›s step and WS11. Participants are divided in pre-arranged small groups (one for each MC) based on partners competences/preferences. The session has 3 main parts: an intro with a brief explanation of the exercise, a brainstorming and a final quick presentation of each group findings. The session is set up and led by industrial design practitioners.

USED TOOLS

Design product drawings (13)

Designers explain their product design briefs to the whole teamwork also by means of design drawings and specifications, such as technical drawings, patterns, 3D models, etc.
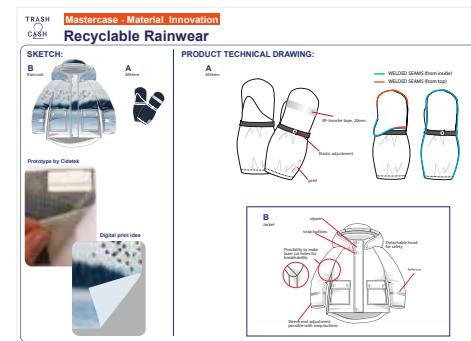
Fig. 99 Examples of design product drawings

Updated MCs Specification Sheets(14) (aka Design Briefs V3)

The updated version of the tools (improved in the follow-up activities from WS07) is useful to summarise the design briefs linking creative design ideas with specific, detailed and more technical information (testing results, analysis, finishing specification, etc.) for the desired product attributes required for each MC. The tool is used in this WS to discuss with and inform all participants involved in the implementation phase to develop design concepts in design products and related prototypes.

In the tool the pre-validated material requirements at material level are combined and linked with technical information at product level, including the results of material tests at different levels (molecular, material, structure, surface, etc.).

Fig. 98 An example of the updated version of the Master Cases Specification Sheet used in common session C with all info related to design concepts in terms of design requirements, test results and general idea about business model beyond the product proposal (zoom in to read the content)

(13) The final version of the technical drawing and a complete description of design products can be found in report D.3.6-confidential
(14) See report D.3.4-confidential for a complete description of the design process that led to the elaboration of Master Case Specification Sheets (from design scenarios WS04 to WS10). The complete set of MC Design Brief-final Specification Sheets can be found in report D.3.6-confidential.

MCs Material Specification Documents (15)

The tool is designed to capture product design requirements, prototyping specifications, and material specifications focusing on the three description levels: design requirements (short descriptions of the final requirement by designers from lab materials to the final design products), prototyping requirements (short descriptions of prototyping specifications – P-1C, P-2C, P-3C - by material scientists and mainly by manufacturers considering what is achievable within the consortium possibilities and limitations), prototyping results (short descriptions of what has been achieved in terms of prototypes, at this stage of the project – WS10 – this part is still partially incomplete). The documents have been drafted between WS09 and WS10 with the aim of finalizing them during WS10, in order to properly set up phase (mainly related to manufacturers) and facilitate decision-making.

Fig. 100 2 examples of pre-filled Material Specification Documents with the 3 level of descriptions (zoom in to read the content)

(15) In this report are presented only 2 documents completed to the considered project stage. See report D.3.4-confidential for a complete description of the design process that led to the elaboration of Material Specification Documents and the design process (from design scenarios WS04 to WS10). The complete set of documents can be found in report D.3.6-confidential.

TRASH
CASH

3,3h

EXPERT

Set of tools for product story brainstorming
An empty template is used to support the brainstorming among participants.
This is the second set of tools used to support the second creative phase of
«Brainstoming for Storytelling», to build up the right "product stories" for each
MC with marketing purpose. The set of tools are empty templates in which the
small working groups have to write down an ideal story related to their MC,
considering the ideal target, context of use and benefit for the users. Also the
results of the WS09 exercise (1st phase – Brand DNA – of the creative work on
storytelling) are used to stimulate the working groups.

> **A story begins…**
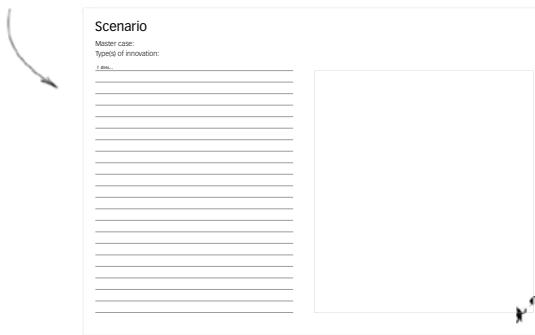   Choose < 3 innovations and write/draw a scenario

Fig. 101 Example of tools (empty template) used during the brainstorming for storytelling (product stories) exercise

SESSION B
TOWARDS DDMI METHODOLOGY: WHAT ARE YOUR KEY INGREDIENTS? (16)

This activity is not described because it does not provide information strictly
related to the applied DDMI process or method to the reader.

SESSION C
MCs FEED LCA AND BUSINESS ANALYSIS

Communal part
The LCA on a specific MC is presented by the expert through the MC flowchart,
highlighting what has been done, what are the limitations and results, what are
the implications for the further development of the specific MC, and what are the
missing information or gap in the definition of the MC ("LCA is about the learning,
not the numbers"). This presentation provides important information for the
following part of the session, as well as it gives the opportunity to the LCA expert
to receive feedbacks from participants to finalise the analysis of the specific MC.
It also provides an example of what LCA can tell to designers and other experts
and clarifies the kind of data that are needed as inputs: use of electricity and
heat, use of chemicals, emissions to air, water and soil, geographical location,
etc.

Parallel part
Participants are split in 2 groups: group of technical experts/material scientists
and group of designers/researchers/facilitators.
2 tables are created, one led by a scalability expert and one led by LCA expert.
In the first round of the exercise each group spends 1 hour and 20 minutes on a
specific table to go through the MC (about 15 minutes for each MC) and provide
inputs, information, and contributions to the respective experts. After this slot,
and a break, the groups change tables. In this way all the 2 experts can receive
the feedback of the 2 groups and all participants can provide their inputs, in the
same time frame.
On the LCA table participants go through each MC discussing about what can be
done, and what is relevant to do, in the final LCA iteration based on the current
levels of development of the MCs and expected data availability. On the scalability
and business analysis table the participants analyse the MCs in terms of business
cases using a revised empty canvas template with the scope to come out with
all the basic information to draft a business model and plan in line with the
development of design products.

(16) A description of this activity and its results can be found into D.3.7 – confidential

USED TOOLS

Draft version of LCA flowcharts (17)

Draft version of LCA flowcharts are used by LCA experts to go through each MC and discuss about the missing information, data and design decisions (about business models, product services, etc.) to finalise the LCA. The documents show for each MC each step needed to produce the final product: from raw material – collection of waste textile – until the distribution, retail and use, to take into account the next life cycle.
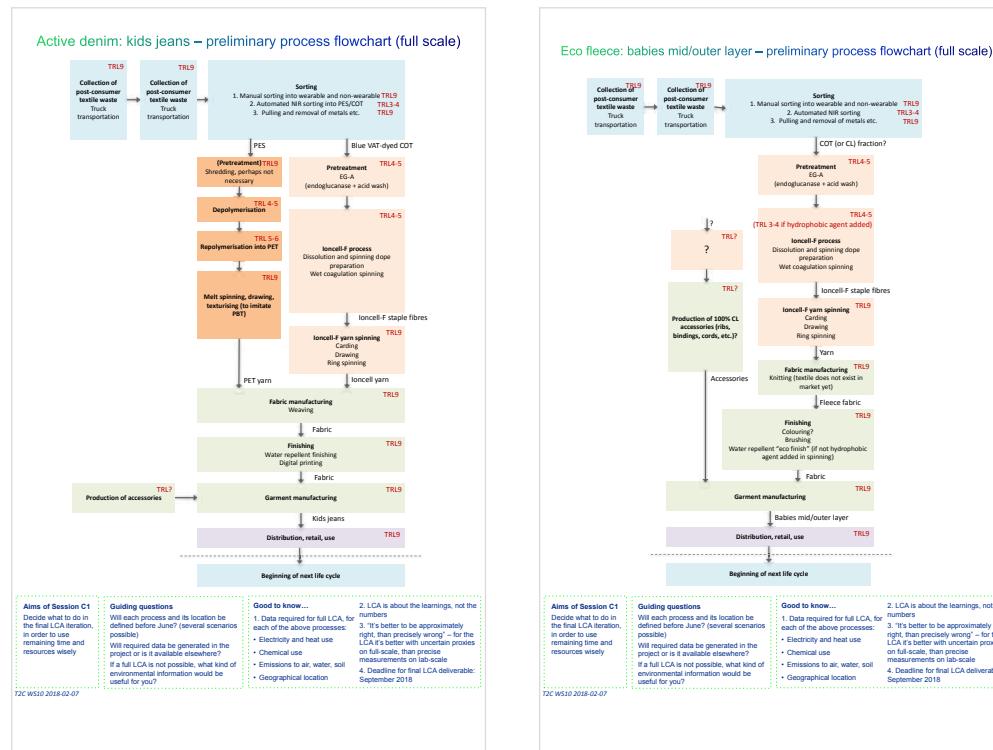
Fig. 102 2 examples of pre-filled LCA flowcharts used during the parallel part in Session C at the LCA Table (zoom in to read the content)

Business Model Canvas

In this case the tool is an empty template of a reviewed business model canvas to reasoning about the business model beyond each MC. The participants led by an expert go through each MC with the aim to fill all the boxes, or at least to push further the development of the MC business. The information obtained will be used also for the scaling up study of the MC.
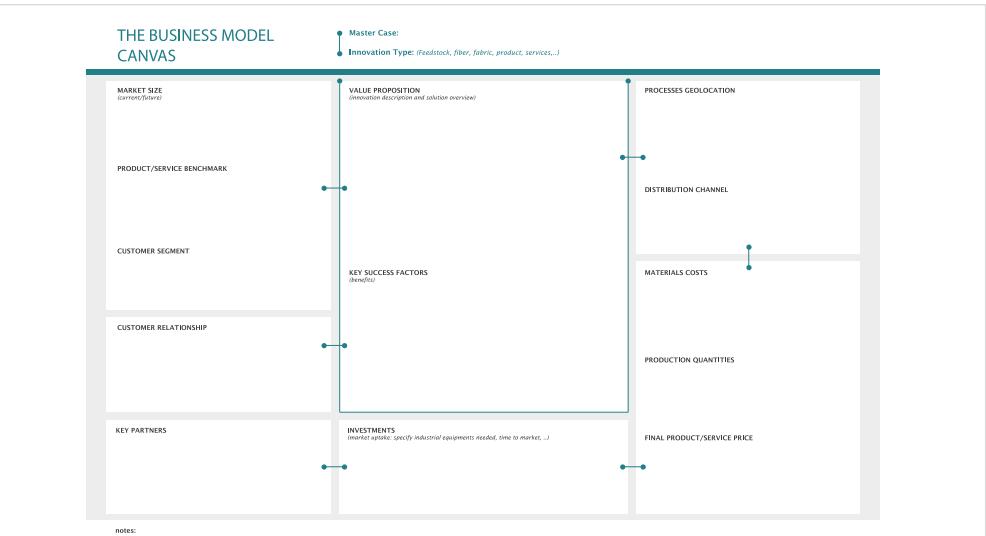
Fig. 103 Empty template of the Business Model Canvas used during the parallel part in Session C at the Business Analysis Table (zoom in to read the content)

SESSION D
EXPLOITING & DISSEMINATING T2C KEY RESULTS & ASSETS

This activity is not described because it does not provide information strictly related to the applied DDMI process or method to the reader.

Workshop closure: usual roundtable asking to participants the top moments of the workshop and specific tips to improve some aspects to the next meeting.

WS10 FEEDBACK SUMMARY

HIGHLIGHTS

"

Visiting the laboratory was very useful to understand the process.

Good walkthrough of the master cases, which led to very important discussions.

The brainstorming for storytelling exercise was fun and inspiring.

Real discussion and solutions for prototyping steps came out.

I really enjoyed the LCA presentations.

The presentation of the whole project and what it achieved so far was very clear.

CHALLENGES

The 2nd day the time was badly managed, so the presentations were too short in the middle of the day.

The sessions could have been framed better, to clarify the overall purpose of each activity and how it fits to the whole.

SUGGESTIONS

Time keeping could be considerably improved.

Prepare participants to be involved at all stages, in all sessions.

To give more for working in small groups. Visiting lab and/or production facilities.

"
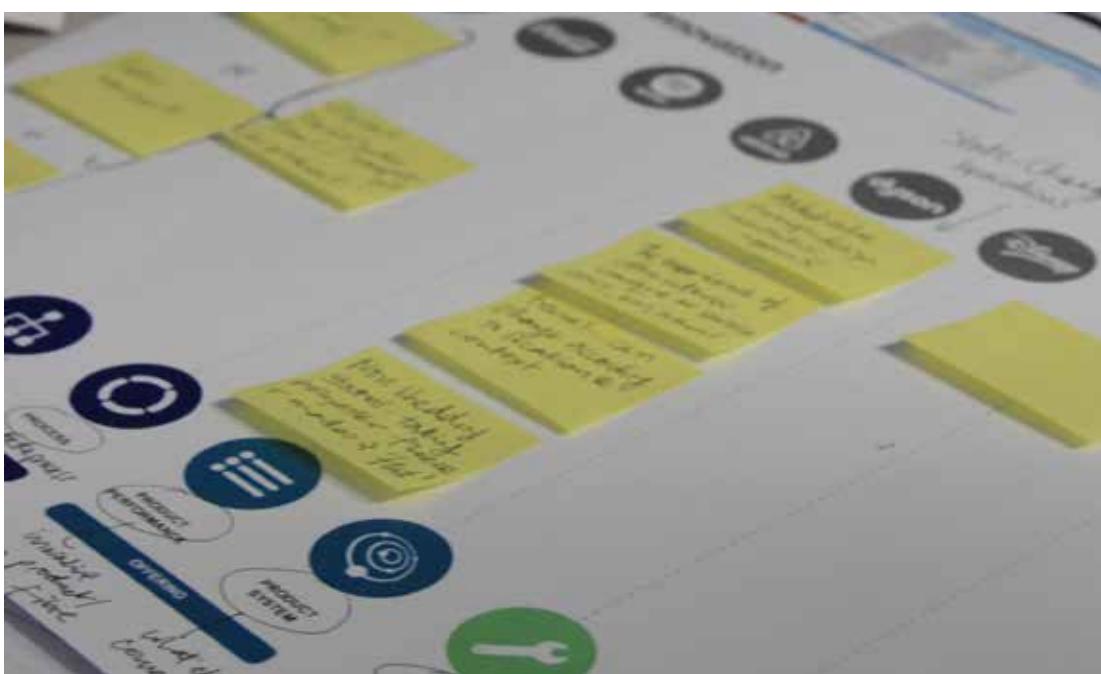
WS11 - Master Cases Implementation (business model) (1)

This WS marks the end of the second step of cycle C (define requirements) to push further the Master Cases in their final product prototyping phase (develop solutions). WS11 is ideally a continuation of WS10 with the primary aim to implement the 6 Master Cases focusing on their storytelling and business ideas in order to start the finalization of their industrial processes/logistics and business models/services. To achieve this main objective the WS activities have been planned in order:

- to audit the status of the 6 Master Cases and their design and prototyping developments, also organizing an internal-exhibition of the T2C-Cycle C outcomes so far;
- to provide to designers and manufacturers other inputs from LCA considering also the Life Cycle Thinking approach (circular concept);
- to provide inputs about consumer barriers and primary reflections onto the communication strategy;
- to reflect again on the project process and applied methodology to elicit new mutual considerations on the DDMI methodology.
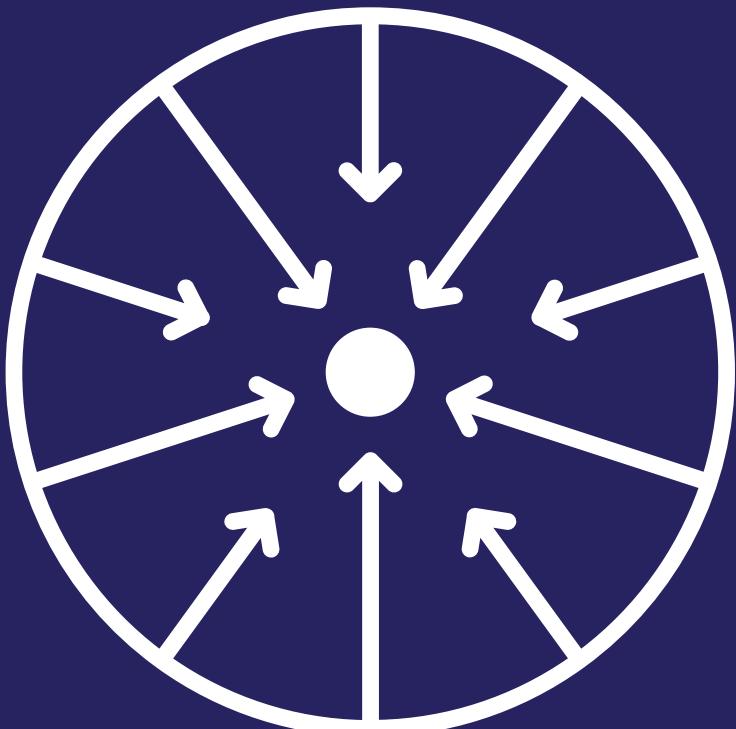
WS PREPARATION

To prepare participants to the WS, facilitators asked them to collect and bring all the prototypes related to Cycle C (all the other sample materials are archived into the T2C Samples Suitcase) as well as all the updated documents, in order to build up the internal exhibition and to check the status of design and prototyping progresses of MCs. In particular:

- designers – to update and bring the design products, patterns, printing patterns, illustrator drawings or sketches, storytelling posters, and/or any material produced and useful to communicate the Master Cases;
- prototype makers and manufacturers – to update and bring all samples, materials, prototypes (yarn, textile, garments, reinforced plastic parts, etc.) with no matter the definition of the prototypes;
- other experts: to update and bring all the other documents, also used in previous WSs or activities, useful to describe the Master Cases (e.g. draft version of business models canvas posters, draft version of the industrial process flowcharts, LCA flowcharts)

To arrive well prepared to the WS all partners study and take a look at the tools (see tool descriptions) prepared for the activities. Sometimes these tools are an updated (although still a draft) version of documents used in WS10: e.g. updated LCA flowcharts, Business Models Canvas, Product Stories posters.
A primary Benchmarking research (other materials, products, business models, technologies considered to be the best in the industry and comparable with the Master Cases) is made available prior to the WS to provide participants new insights to improve business models of Master Cases.
As in WS10, a short explanation of the business model canvas has been shared for knowledge sharing purpose and give all participants the opportunities to provide their contributions working on the business models during the WS.

WS ORGANISATION

WS11 is organised in 4 main sessions with specific aims in which specific tools are used to support the final brainstorming activities and decision-making processes. As already highlighted in the previous WS, the WS11 is mainly a sort of repetition of WS10, trying to use the same tools and activities in a more focused manner. Also in this WS, participants work in small groups for some specific activities based on their competencies, and in bigger interdisciplinary groups for other activities. To organize this WS facilitators take into account several suggestions from the internal surveys, trying to set up easier brainstorming activities.
WS11 opening: recap of WS agenda, WS objectives, project phase and current step, and feedback from previous WSs.

SESSION A
MCS UPDATING:
FINALISE PRODUCT STORIES

Communal part
The session opens with a common shared quick re-cap and review of the status of MCs and possible issues related to their prototyping and design. To facilitate this action the internal exhibition (see next pages) is used as basis for discussion. After that, participants receive information about new findings on consumer barriers research[18] through a short presentation, in order to provide new inputs for the communication strategies of MCs. The presentation is preparatory to the next brainstorming activity.

Parallel part
Participants are grouped in small interdisciplinary groups (pre-arranged), the facilitators are mainly design practitioners and consumer behaviour experts. The main aim of the session is to brainstorm about the product stories of the 6 Master Cases in order to work into their marketing dimension and also provide insights and inputs useful for the next Session C.

(18) The final and complete analysis about consumer barriers findings can be found in report D.6.10- confidential. The final findings about MC and related communication strategies considering consumer barriers can be found in report D.6.11-confidential.

The work on build up the product stories already started in WS10, in WS11 the aim is to finalize the stories. This is the 3rd phase of the "Brainstorming for Storytelling" exercise: 1st phase in WS09 about Brand DNA, 2nd phase in WS10 about Product Stories, 3rd phase in WS11 about Finalise Product Stories.(19)

� USED TOOLS

Informal-draft internal exhibition
A sort of internal exhibition is set up using all available materials useful to communicate each MCs status: MC A3 posters, draft poster of product stories, product drawings and/or patterns, A3s of draft business models, textile and product prototypes of Cycle C so far, as well as prototypes of Cycle A and Cycle B, material samples, etc. The set up is located into the WS space so it is useful for session A and B and during the whole WS.

Set of documents "Brainstorming for Storytelling – Finalise product stories"
The tools are posters, set up by the industrial design practitioners, to support an intense and tight brainstorming activity in order to write down final ideas on MC products, specifically:
• name (in two words: 1 word as product meaning and 1 word as fun element);
• one-liner (briefly highlighting the target group and containing something that triggers curiosity);
• emotional keywords related to product identity;
• functional keywords (the most important specification of the product: what is so unique about the product? What facts prove this? What enriches it? What important specs are missing in the current text?)
• manipu-helper/stimuli (similarity – utilizing the desire for social connectivity; scarcity-availability/scarcity of natural resources; morals-belonging to a specific group; wastefulness-avoiding/generating waste, etc.)
• innovation reality check & enrichment (define the customer journey throughout the main product innovation, describing the steps that the user experiences in using it and defining its specific benefits).

The updated draft versions of Product Stories posters (see also WS10 tools) are also used to support the discussion and to push further the outcomes from WS10.

Fig. 104 Some photos of the internal exhibition

Fig. 105 Examples of updated draft versions of product stories posters/brand DNA related to 3 different master cases (1st right))
Fig. 106 Posters to works on products stories writing down ideas (2nd right) (zoom in to read the content)

(19) The final results of the exercise, the full description of the used tools, and the whole "Brainstorming for Storytelling" phases can be found in D.3.6-confidential

SESSION B
EXPLOITING & DISSEMINATING: LAST STEPS

This activity is not described because it does not provide information strictly related to the applied DDMI process or method to the reader.

SESSION C
MCs UPGRADING: FINALISING BUSINESS MODELS & INDUSTRIAL PROCESSES(20)

FACILITATOR EXPERT

3h
2nd DAY
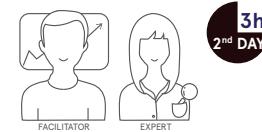
Communal part
A presentation of the updated LCA flowcharts introduces the session, in order to provide other inputs to participants and at the same time to point out and clarify the missing information to the LCA expert team. The presentation is related to 4 (of the 6) Master Cases for which an in-depth analysis is conducted (scalability, validation, LCC and LCA).

Parallel part
The core session is organized in parallel activities, and participants are divided in 2 groups of competencies ("Business Models/Services Group" and "Industrial processes/logistics Group"); each group is then divided into 2 sub-groups. The Business models/services groups are composed by designers, manufacturers, and suitable experts and use the pre-filled business model canvas with partial and draft information (coming from WS10 and "processed" by experts before the WS11). Each group works alternatively on 2 of the MCs, in particular on the creative level of their business models and services, also using the insights generated in Session A. Furthermore the T2C LCT map is used to support the discussion. After the first brainstorming round, the 2 groups exchange the 2 MCs working on the other 2 canvas.
At the same time, participants of the Industrial processes/logistics group (R&D and technical people, manufacturing processes experts) work jointly in order to share all the knowledge and expertise and to define the industrial processes and logistics related to the 4 Master Cases.

The group use the pre-filled industrial process flowcharts (already used in WS10) as basis for discussion.

USED TOOLS

Business model canvas
These tools are used by Business Models/Services Groups. The tools have been developed by experts responsible of scalability study and validation of the 4 selected Master Cases. The tools have been used totally empty already in WS10. In this WS they have been pre-filled with the info collected in WS10 and "processed" by experts. The tools developed for each Master Cases are useful to collect the missing or partial information related to business models and service beyond each Master Cases.
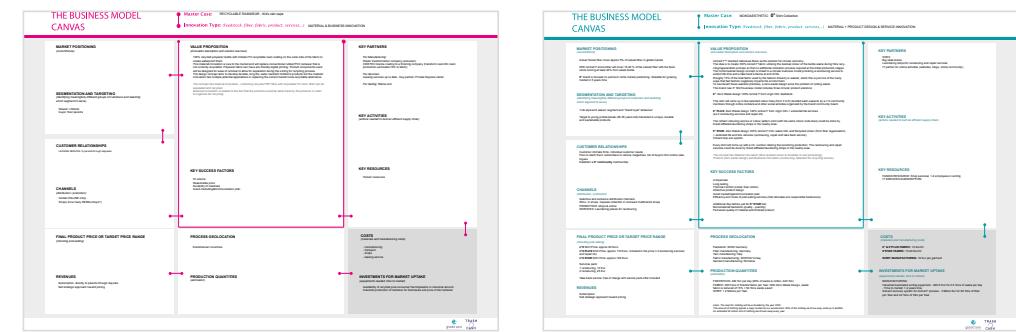
Fig. 107 2 examples of pre-filled Canvas used in Session C related to Master Cases Recyclable Rainwear – Kids' Cape, and Monoaesthetic Shirt – Mens' shirt Zero Wase Design (zoom in to read the content)

T2C LCT Map
This specific tool is developed by design researchers and LCA experts. It is useful to support the discussion about business models
The tool should not be filled in as its aim is to steer the development of business

models and services taking in account impacts of all decision in a 360° perspective (Life Cycle Thinking).
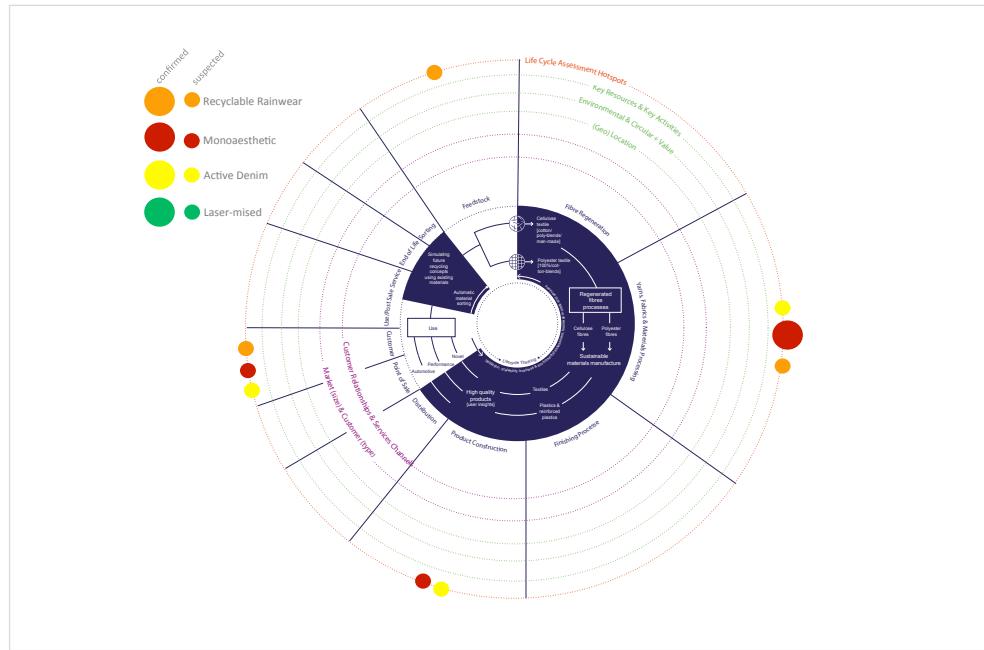
Fig. 108 2C LCT map used in Session C related to the 4 Master Cases (zoom in to read the content)

Industrial Process Flowcharts and LCA Flowcharts

The tools are used by the Industrial Processes/Logistics Group and also by other participants during the other activities. The tools are useful to take always into account LCA issues and impacts and the required industrial process for each of the 4 Master Cases during each discussion.

The tools have been developed by LCA experts and experts responsible of scalability study and validation of the 4 selected Master Cases.
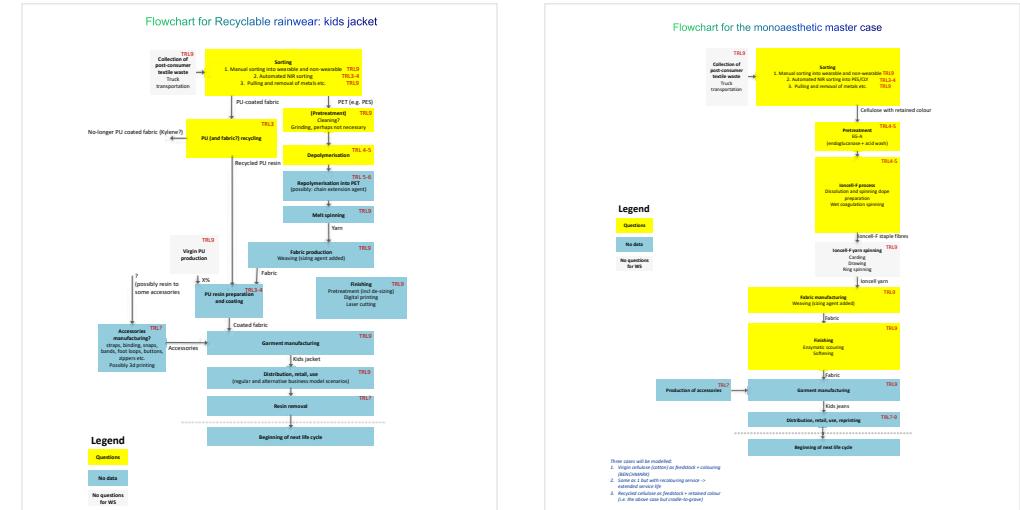
Fig. 109 2 examples of pre-filled LCA flowcharts used in Session C related to Master Cases Recyclable Rainwear – Kids' Cape, and Monoaesthetic Shirt – Mens' shirt Zero Wase Design (zoom in to read the content)
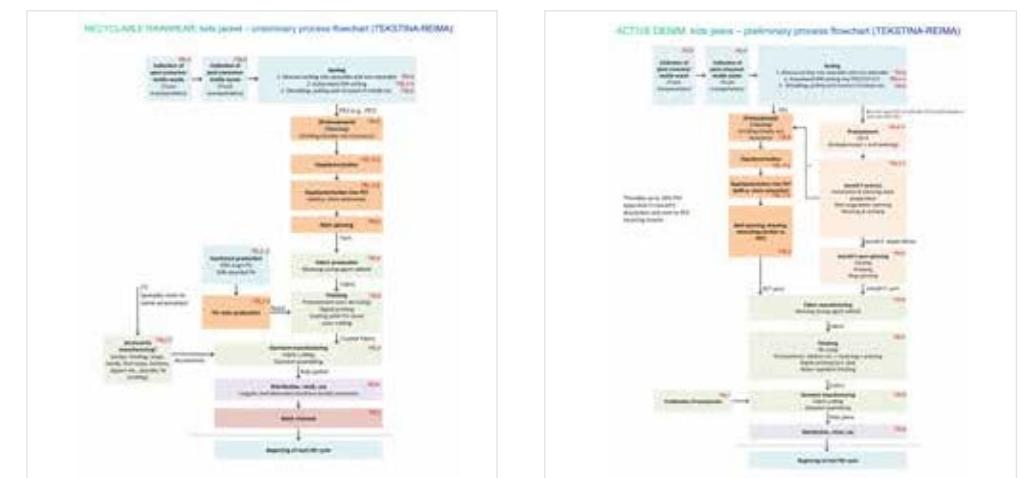
Fig. 110 2 examples of pre-filled Industrial Process flowcharts used in Session C related to Master Cases Recyclable Rainwear – Kids' Cape, and Monoaesthetic Shirt – Mens' shirt Zero Wase Design (zoom in to read the content)

**TRASH
CASH**

**3h
2nd DAY**

FACILITATOR

SESSION D
REFLECTING ON DDMI METHODOLOGY(21)

This activity is not described because it does not provide information strictly related to the applied DDMI process or method to the reader.

As in the last T2C WSs, an easy and informal activity is carried on additionally to each (coffee) break between each session. In this case during the extra activities participants have to discuss and provide insights and inputs about the final project outcomes exhibition, going through the internal draft exhibition.
This informal activity is mainly useful to increase the awareness of participants about what has been done so far and to elicit their expectations about the final exhibition of the project results.

WS closure: usual roundtable asking to participants the top moments of the WS and specific tips to improve some aspects to the next meeting.

(21) A description of this activity and its results can be found into D.3.7 – confidential

WS11 FEEDBACK SUMMARY

HIGHLIGHTS

"

The review and updating of the master cases and the associated Business model canvas,have been inspiring sessions.

Session C has been the most important for me in getting information from other partners needed for further development.

Customer behaviour analysis provided an understanding of how people perceive sustainable products. It is very useful for the development of exploitation strategy.

All parts (LCA, business model and industrial processes) were listed during useful sessions.

LCA flowcharts – useful – very clear: processing steps, missing data...

CHALLENGES

We still have so much missing information on LCA! LCA could not input for concept design & development.

Business model canvas tool could have been better.

The updated LCA flowcharts was not a clear session to me, as I cannot say the clear outcome of it.

As for product stories group work was not so understandable.

"
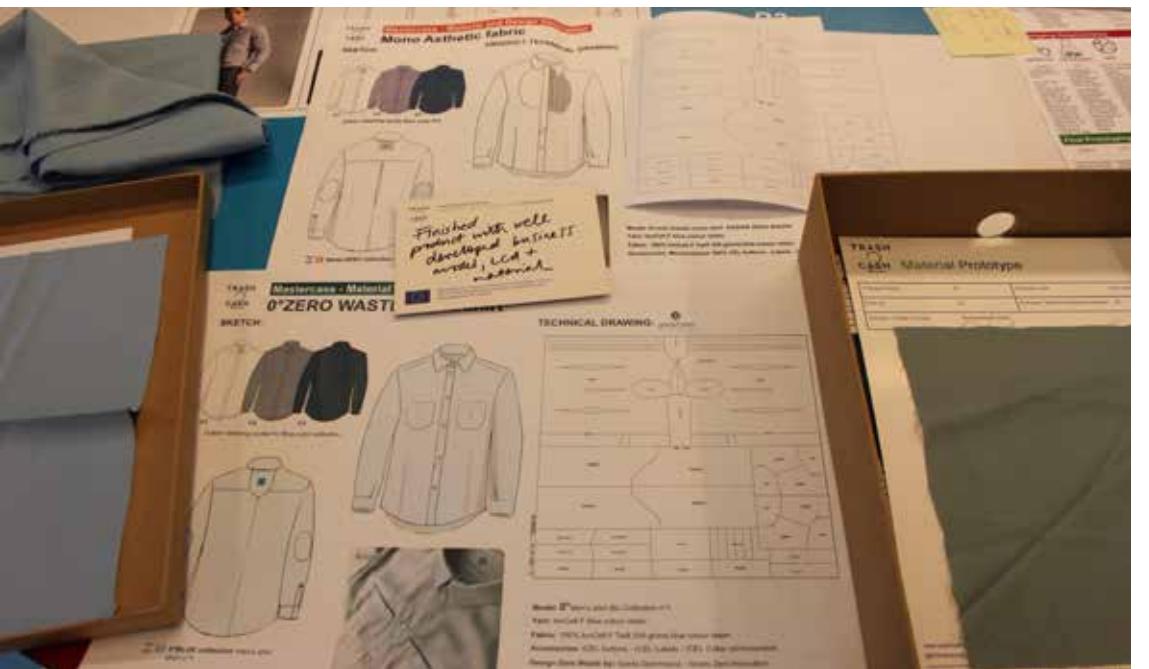
WS12 – Showcasing results

The last WS concludes the project process, showcasing its main final results, specifically the six MCs. Beyond the exhibition, the WS is organized in a half-day meeting with the aim to:

- execute the third and final Project Review Exercise to reflect on Cycle C;
- discuss about several deliverables and the achieved results focusing on the innovation topic;
- prepare participants to the conference organized the day after.

Beyond the Project Review Exercise results, this WS description is dedicated to the final exhibition, the work shown and the description of the final MCs. Apart from dissemination purpose, the exhibition has also the important role to give participants a clear perception of the achieved results, in form of high quality and brand new product prototypes (i.e. recycled and recyclable apparel and interior automotive parts). The three implemented processing technologies are described in a clear and accessible manner for a broad audience, and the base materials are shown in their simple and natural form. A 35 square metre exhibition is set up during the Dutch Design Week 2018 in Eindhoven. This biggest design event in Northern Europe showcases work and ideas of more than 2600 designers to more than 335,000 domestic and foreign visitors. A perfect event to present the final result of this long journey named T2C.

FINAL EXHIBITION DURING DUTCH
DESIGN WEEK 2018
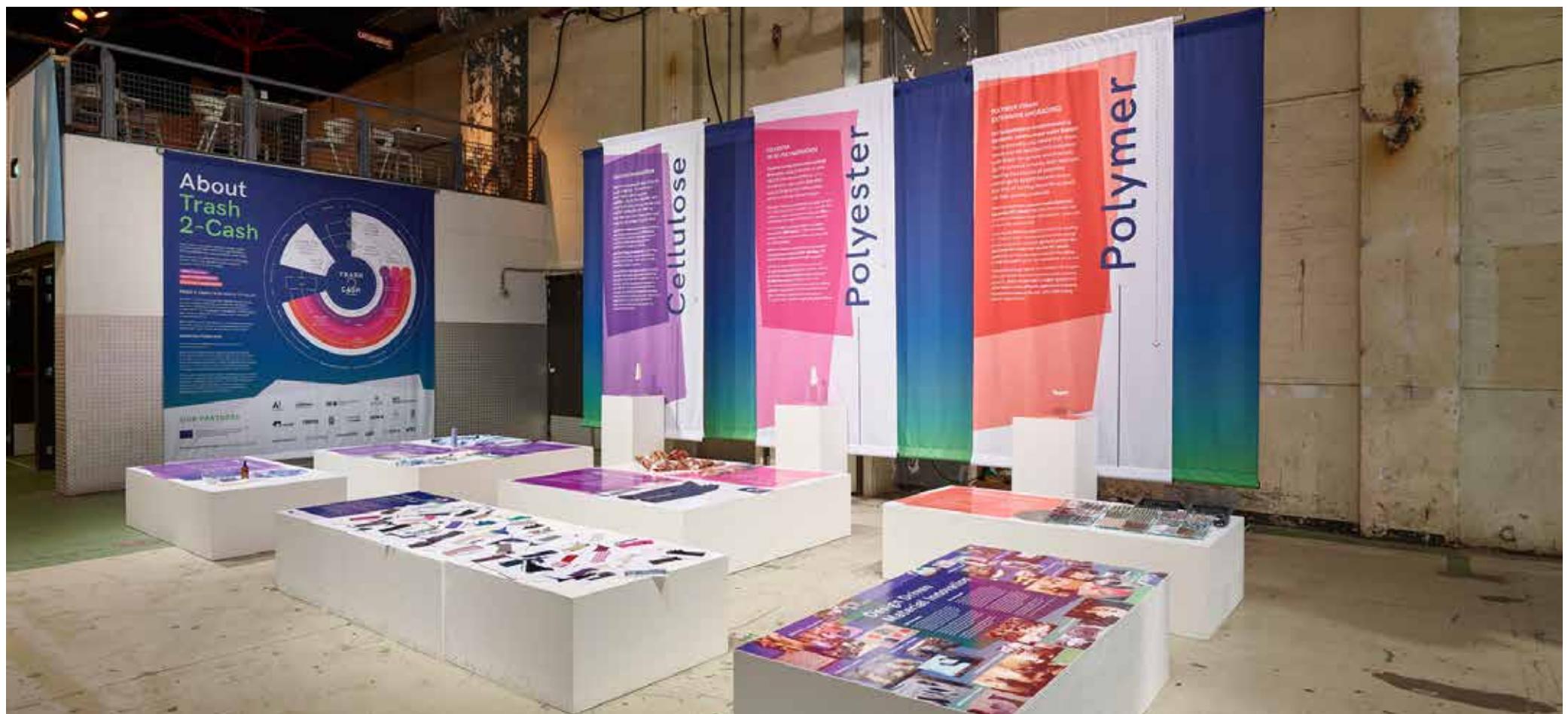
0° SHIRT

THE CHALLENGE
Cotton is a popular choice for menswear, but increased demand has resulted in huge environmental impacts in its production. The Trash-2-Cash designers wanted a fabric with a soft luxurious feel that, like cotton, is also cool to touch. Ideally this new material would not only save cotton production by using waste materials instead, but also use fewer processes in its production and create less waste during garment manufacture.
Designers wanted it to be valued by its owner and kept for longer,
and when it finally is no longer useful it can be recycled. In other words a shirt as close to 0° impact on the planet as possible. Not much to ask!

THE INNOVATION
Trash-2-Cash scientists used a low-impact method to regenerate waste cotton into new Ioncell-F fibres. Instead of bleaching away the colour (which would have added an environmental impact) the colour was left in, meaning that the blue textiles that went into the process produced pale blue fibres. These were woven by Trash-2-Cash manufacturers into a luxurious soft fabric with a beautiful drape.
The Trash-2-Cash designers used zero-waste pattern-cutting techniques to ensure there were no ocuts left after the tailored shirt had been constructed. Additionally, an innovative colouring service then allows the owner to re-colour their shirt over its lifetime, prolonging its life until it is finally recycled.

Our goal was to design a shirt that had as close to a 0° impact on the environment as possible. The result is a shirt made from Ioncell-F fibres, a material produced from waste cotton textiles. Its pale blue colour comes from the blue cotton feedstock, meaning no bleaching was needed, further reducing the material's impact.

DENATURE JEANS

THE CHALLENGE
To produce a high-performance fabric, manufacturers often blend comfortable cotton with hardwearing polyester. Poly-cotton is the most common material composition in clothing, used in jeans, shirts,t-shirts and uniforms. To make jeans stretchy elastane is added which, Trash-2-Cash researchers confirmed, cannot be detected by textile sorting technologies and pollutes the fibre regeneration process.
For the DeNAture Jeans, Trash-2-Cash designers wanted a fabric that was not only made from waste textiles but also fully recyclable at the end of its useful life. Yet they didn't want to compromise on comfort or performance. That meant that researchers not only needed to find a way of regenerating the textile waste into new fibres but also find something stretchy to replace elastane.

THE INNOVATION
Trash-2-Cash fibre scientists have found a new, sustainable method for separating polyester and cotton so that they can be used again in new yarns for new clothes. Some of that polyester can also be made into a stretchy alternative to elastane, meaning that the DeNAture Jeans are made from waste materials but are also recyclable when they are no longer useful. To prolong their useful life these jeans would be sold with a patch repair kit and free end-of-life collection to ensure that the material is recovered and recycled.

Polyester-Cotton blends are the most common materials used in clothing. Elastane, added for the manufacture of stretchy jeans, seriously disrupts textile waste sorting and recycling. DeNAture Jeans are made from yarn that is both recycled and recyclable.
Trash-2-Cash researchers have replaced the troublesome elastane with stretchy, recycled polyester, and used an innovative elastic weave structure, ensuring that the comfort and performance of the garment is maintained.

FASHION FASCIA

THE CHALLENGE
Currently, cars are mostly manufactured with virgin materials, including composites (combinations of materials) that can't be recycled. Recycled materials are mostly unattractive and remain hidden. New regulations coming into force will require car anufacturers to use more and more recycled and recyclable materials; this will mean using them in the visible areas of the car where aesthetic standards are higher.
The Trash-2-Cash automotive designers turned their attention to the car interior, where recycled materials could be an eye-catching feature. They focused on the central console and door inserts – the decorative areas by the gearshift and door handles. The designers wanted the new materials to add an individual touch and be luxurious, as well as being made from recycled materials and fully recyclable at the end of their useful life.

THE INNOVATION
Trash-2-Cash scientists and designers explored a variety of material innovations using T2C recycled polymers and fibres, laser etching, an innovative recyclable epoxy resin and textile print design. In one example recycled PET pellets from old fleece dressing gowns have been injection moulded to produce a central console panel for a car interior. Customisable laser etching adds to the surface decoration, removing the need for additional treatments. In several other experiments a creative print design approach was used to finish dierent non-woven recycled polyester textiles and then encapsulate them in the new recyclable resin. This set of experimental samples extends this approach even further, reworking recycled polyester wadding with industry-ready finishes, to add value through design. These innovations have produced a number of distinctly dierent but beautiful decorative fascia pieces, showing new material directions for cars of the future.

By law, cars of the future will be increasingly required to use recycled and recyclable materials in their production.
The Trash-2-Cash recycling technologies allow the proposal of new modes for manufacturing visually appealing, high-quality automotive interior plastics using recycled plastic pellets, recycled textiles and recyclable resin.

R³ COAT

THE CHALLENGE
Raincoats are currently made from PVC plastic or synthetic rubber-coated fabrics that cannot be recycled. To address this, the Trash-2-Cash designers wanted a high-performance textile for children's rainwear which could take a bold print design. It needed to be recycled and recyclable, rainproof and also breathable.

THE INNOVATION
Using the 'de-polymerisation – re-polymerisation' technology, the Trash-2-Cash scientists have been able to produce recycled polyester fibres from blended polyester-cotton and pure polyester waste textiles.
From these fibres, a high-performing and printable textile was manufactured. To make it waterproof, the Trash-2-Cash scientists adapted a self-healing material usually used to make sealants for the aerospace industry. The result is a flexible, resin-coated fabric that's waterproof and recyclable – a surprising innovation! Breathability was achieved by laser-cutting tiny air holes into the fabric.

The R3 coat is made from recycled materials, is recyclable and breathable.
To make sure the materials get back to where they need to be for recycling at end of life, an innovative business model has been developed based on renting, not owning these raincoats.

TRASH CASH

REACT BASE-LAYER

THE CHALLENGE

Performance layers are a fairly recent addition to our wardrobes, they cleverly wick away moisture to keep skin dry. Currently, this type of garment tends to be made from virgin polyester using fossil crude oil as a raw material. Cellulosic fibres however, are incredibly soft on the skin and have a natural cooling eect, but they also hold onto moisture rather than wick it away. So the challenge was to make a cool, moisture-wicking, Ioncell-F fabric from waste cotton, which was also soft, quick-drying and recyclable.

THE INNOVATION

To do this, Trash-2-Cash fibre scientists needed to make the fabric 'hydrophobic', which literally means 'water-fearing'. This could have been achieved using current finishing processes that apply additional chemical treatments to the fabric. However, to develop a low-impact garment, the scientists instead used a breakthrough technology that put the moisture management properties directly into the fibres at a molecular level to produce hydrophobic fibres.

Performance layers are soft
and functional, wicking moisture away from the wearer's skin. But unfortunately the materials currently used for mid-layer garments have large environmental impacts.
This alternative mid-layer material made from recycled cotton has hydrophobic properties added to the fibre, ensuring sustainability does not compromise performance.
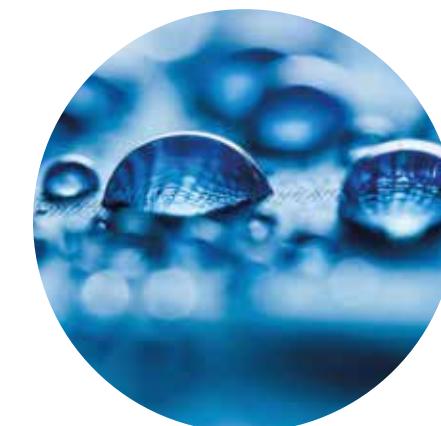
REBORN - REWORN JACKET

THE CHALLENGE
Polyester fleece was a breakthrough new material when first produced in the 1980s as an alternative to wool. Since then, it has become a popular and inexpensive choice for children's clothing due to its warm, quick-drying, easy-care properties. It is now known that during washing polyester fleece causes damage to the environment by shedding microscopic plastic particles into the waterways, polluting the oceans and the entire food chain, and causing untold damage to the health of many living creatures, including us.
In Trash-2-Cash, the designers asked if fibres fine enough to replicate the soft warmth of polyester fleece could be developed by the fibre scientists. The fabric needed to be made from textile waste and be
recyclable at the end of its useful life. Most importantly any fibres that broke away from the fabric during washing would need to biodegrade when released into the natural environment.

THE INNOVATION
Trash-2-Cash fibre scientists were able to modify the Ioncell-F technology to regenerate cotton waste into new, super-fine fibres that replicate the softness of polyester fleece but without the plastic pollution. The manufacturers knitted and brushed the biodegradable fabric to produce a super-soft natural fleece-like fabric perfect for a baby. The non-bleached, colour-retaining technology also used in the 0° shirt was used again here, making this a super-low-impact alternative to polyester fleece.
The Reborn - Reworn fabric is naturally soft and warm next to delicate skin without polluting us and our oceans with micro-plastics,
a life-saving jacket for the future of our children.

Polyester fleece was revolutionary in the 80's but is now known to be hugely harmful to the environment due to the shedding of microplastic particles. This natural fleece is made of soft and warm micro-fibres, produced from recycled cotton textiles, that will not accumulate in the environment.

Project Review Cycle C

This third project review was held during WS12 in Eindhoven, which was also the last WS of the whole project.
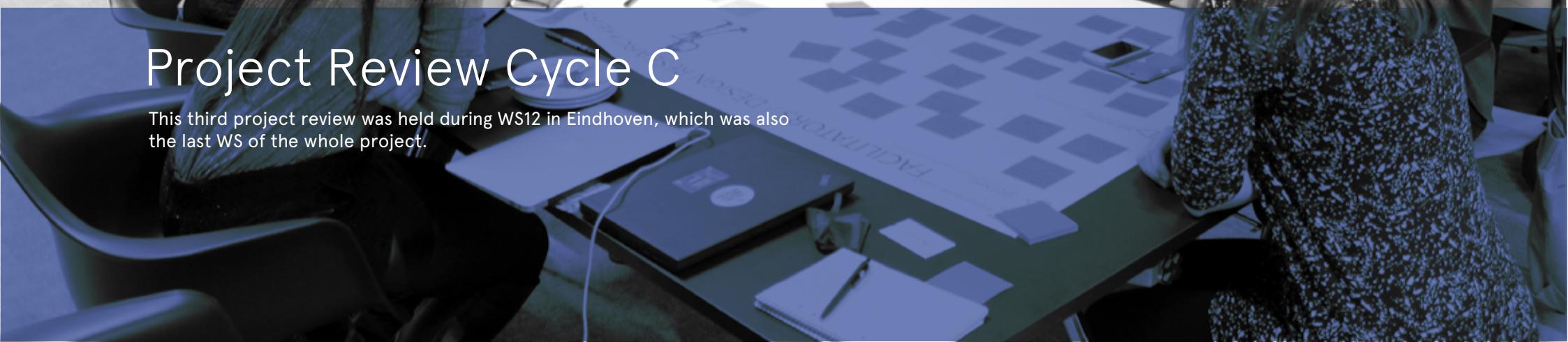
PROJECT CHRONOLOGY EXERCISE RESULTS

A WS review exercise has been held also after conclusion of Cycle C to gather comments about great moments and challenges perceived during the WSs in this third project cycle. The feedbacks collected for each WS of project Cycle C are summarized as followin:

ANALYSIS OVERVIEW

WS09 Feedback Summary
Evaluation of WS09 provided 43 feedback from the participants, 31 about positive perceived aspects and 12 related to challenging moments. Especially the visits to hosting organisation's facilities (laboratories, student exhibition) are perceived very positively, being linked to the WS content and offering a pleasant break to 'class-room' WS activities. As quite challenging is mentioned duration of the WS, stressing that in particular the second day is perceived as too long. On the other hand, no negative comments have been made about WS facilities.
INSIGHTS: comments can be summarized as for the great moments in "visits to local project partner facilities", and for the challenging moments in "avoid intense schedule

WS010 Feedback Summary
The second WS of cycle C gathered a total of 38 comments, 28 about positive aspects and 10 indicating challenging moments. The majority of great moments are linked to WS contents and methods, appreciating the used WS tools and highlighting again the positive impact of project partner facilities visits. As challenging is indicated one specific tool (business canvas) which was difficult to understand thus didn't provide the expected engagement and outcome.
INSIGHTS: comments can be summarized as for the great moments in "Knowledge sharing tools & feedback providing exercises", and for the challenging moments in "Target tools and exercises to the different involved profiles".

WS011 Feedback Summary
WS11 evaluation collected same numbers of WS09 attributing 31 comments to great moments and 12 to challenging aspects. In general, setting up a draft version of the final exhibition has been perceived as a very useful tool to grasp project contents and results, promoting a sense of collaboration and involvement. Comprehension and complexity of used tools, as well as summing up contents and drawing conclusions after WS are indicated as challenges not yet solved.
INSIGHTS: comments can be summarized as for the great moments in "making results tangible & sharing final decisions", and for the challenging moments in "WS outcomes: gather insights & collect, summarize, share".

WS012 Feedback Summary
WS12, which is officially the last WS of the project, has been structured in a half day project meeting, a public symposium and a project results final exhibition. The collected 23 feedbacks are thus mainly positive comments about organisation and set-up of the public final events. Negative comments indicate rushed organisation and lack of timely shared information, which led to a sense of exclusion.
INSIGHTS: comments can be summarized as for the great moments in "valorising project outcomes through well organised final event", and for the challenging moments in "timing of information sharing & involvement of partners".

TRASH
CASH

GREAT MOMENTS

WS09

visits to local
project partner facilities

avoid intense schedule — INSIGHTS

workshop contents & methods	sharing knowledge & collaboration	project progress & results	ambience & social activities	total feedback
				31

WS10

knowledge sharing tools &
feedback providing exercises

target tools and exercises to
the different involved profiles — INSIGHTS

workshop contents & methods	sharing knowledge & collaboration	project progress & results	ambience & social activities	total feedback
				28

WS11

making results tangible &
sharing final decisions

workshop outcomes:
gather insights & collect, summarize, share — INSIGHTS

workshop contents & methods	sharing knowledge & collaboration	project progress & results	ambience & social activities	total feedback
				31

WS12

valorising project outcomes through
well organised final event

timing of information sharing
& involvement of partners — INSIGHTS

workshop contents & methods	sharing knowledge & collaboration	project progress & results	ambience & social activities	total feedback
				16

CHALLENGES

workshop contents & methods	sharing knowledge & collaboration	project progress & results	ambience & social activities	total feedback
(WS09)				12
(WS10)				10
(WS11)				12
(WS12)				7

Fig. 111 Project Chronology Exercise –Cycle C table edited with participants feedbacks (zoom in to read the content)

CONCLUSION FROM PROJECT CHRONOLOGY EXERCISE

As already identified through the Project Chronology Exercise held after Cycle A and Cycle B, several parameters related to three main aspects need to be considered to foster successful interdisciplinary project WS. The findings arisen during this evaluation of the third project cycle, confirm the previously described recommendations. Following, some further inputs from Cycle C:

WS SET-UP
Edutainment (entertainment design to be educational) – combining WS content with social activities
Intense scheduling and complex activities are tiering; organising knowledge sharing moments packed as social event is a suggestion to keep participants engaged and providing useful information.
Great moments: "Seeing facilities: machinery, processes, meeting people.", WS10
Challenges: "Second WS day felt very long.", WS09

COLLABORATION
Knowledge sharing – hypothetical exhibition as knowledge sharing tool
Drafting a hypothetical exhibition or 'science fair' scenario offers the opportunity to present content in a more tangible manner unlocking hidden competencies and knowledge.
Great moments: "Draft exhibition was very effective to share understanding of work.", WS11
Challenges: "Not much time to comment/be involved in exhibition set up design.", WS12
Communication – supplying facilitated communication channels
WSs offer the great opportunity to have direct confrontation with and immediate feedback from participants. However, confrontations need to be facilitated in order to solve (technical and/or personal) issues at the moment.
Great moments: "Presenting Master Cases and getting immediate feedback from tech-streams.", WS09
Challenges: "Project review was difficult, the 'reporting back' felt confrontational at times.", WS09

PROJECT RESULTS
Tools – collecting project results in tangible outcomes
Creating a format to collect and summarize project results enables to 'pack up' the project journey.
Great moments: "Finally seeing the Master Cases materialize in the exhibition in DDW.", WS12
Challenges: "Business models were not developed; the 'products' not ready to go to the market.", WS11
Structure – concluding activities with a celebrating final event
Celebrating project outcomes through a public final event offers the possibility to end the project consortium activity in a neat and positive manner, valorising efforts and engagement.
Great moments: "We did an amazing showcase! Great job team! We are going public: symposium!", WS12
Challenges: "It's a pity Master Cases cannot be commercialized.", WS12

COLLABORATION MATRIX EXERCISE RESULTS

ANALYSIS OVERVIEW

How Facilitators / Design Researchers perceived collaboration
During the third project cycle, some less intense collaboration happened between partners belonging to the Facilitators / Design Researchers expert group, which is a logical consequence considering the project's evolution. The exchange with R&D / Material scientists is perceived similar to the previous project cycle indicating some collaboration happened between almost all institutions and perceived almost equally from both sides of these two expert groups. The exchange with Designers / Manufacturers is indicated as essentially at the same intensity as during cycle B but is perceived slightly more intense from the latter group of experts. At this point Facilitators / Design Researchers do not express the desire for more collaboration.

How R&D / Material Scientists perceived collaboration
R&D / Material Scientists indicated still a good collaboration exchange between experts of this group, although slightly less intense compared to cycle B. Same tendency is perceived concerning exchange with Designers / Manufacturers. Collaboration with Facilitators / Design Researchers is indicated as quite constant. Some request for more collaboration indicates the lack of needed exchange mainly with manufacturers.

How Designers / Manufacturers perceived collaboration
In Cycle C Designers / Manufacturers intensified collaboration internally, indicating some few missed exchange opportunities. Collaboration with Facilitators / Design Researchers is indicated as substantially at the same intensity as in cycle B with a couple of desired exchanges. Whereas, exchange with R&D / Material Scientists is definitely perceived as more intense during this last refinement cycle.
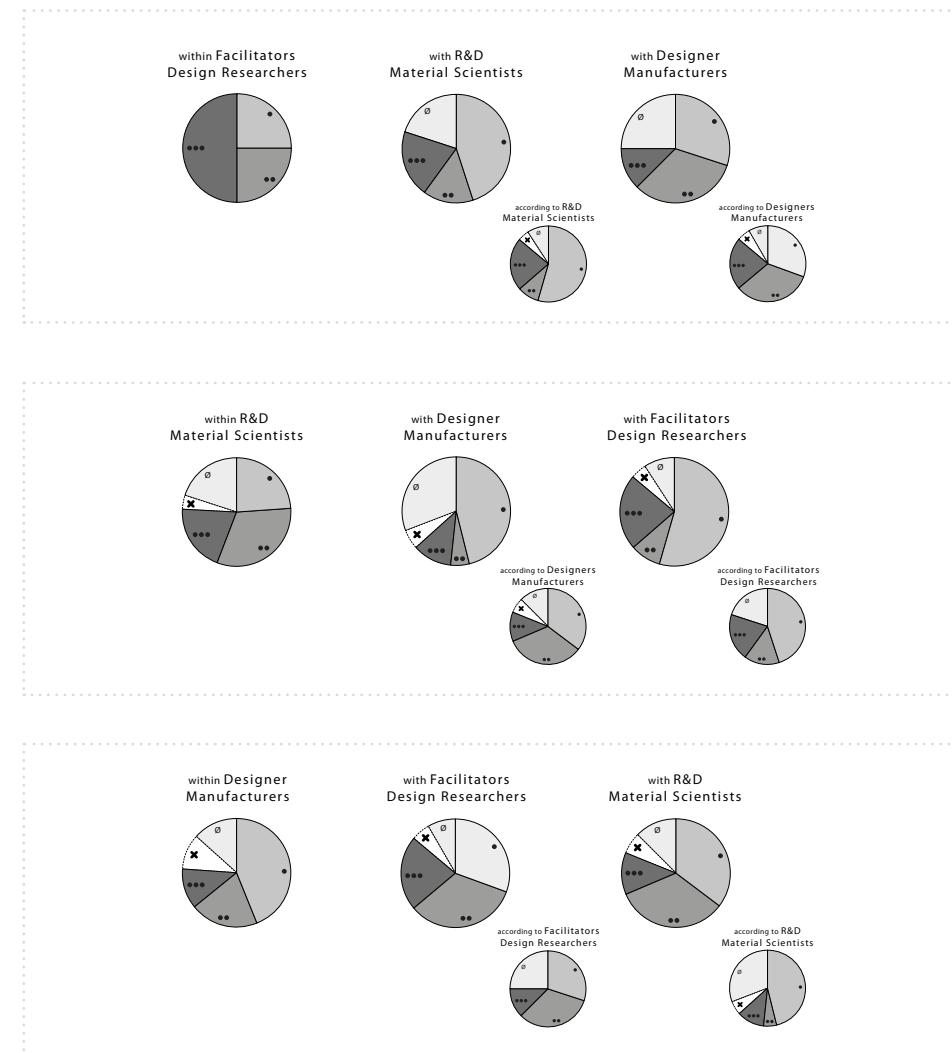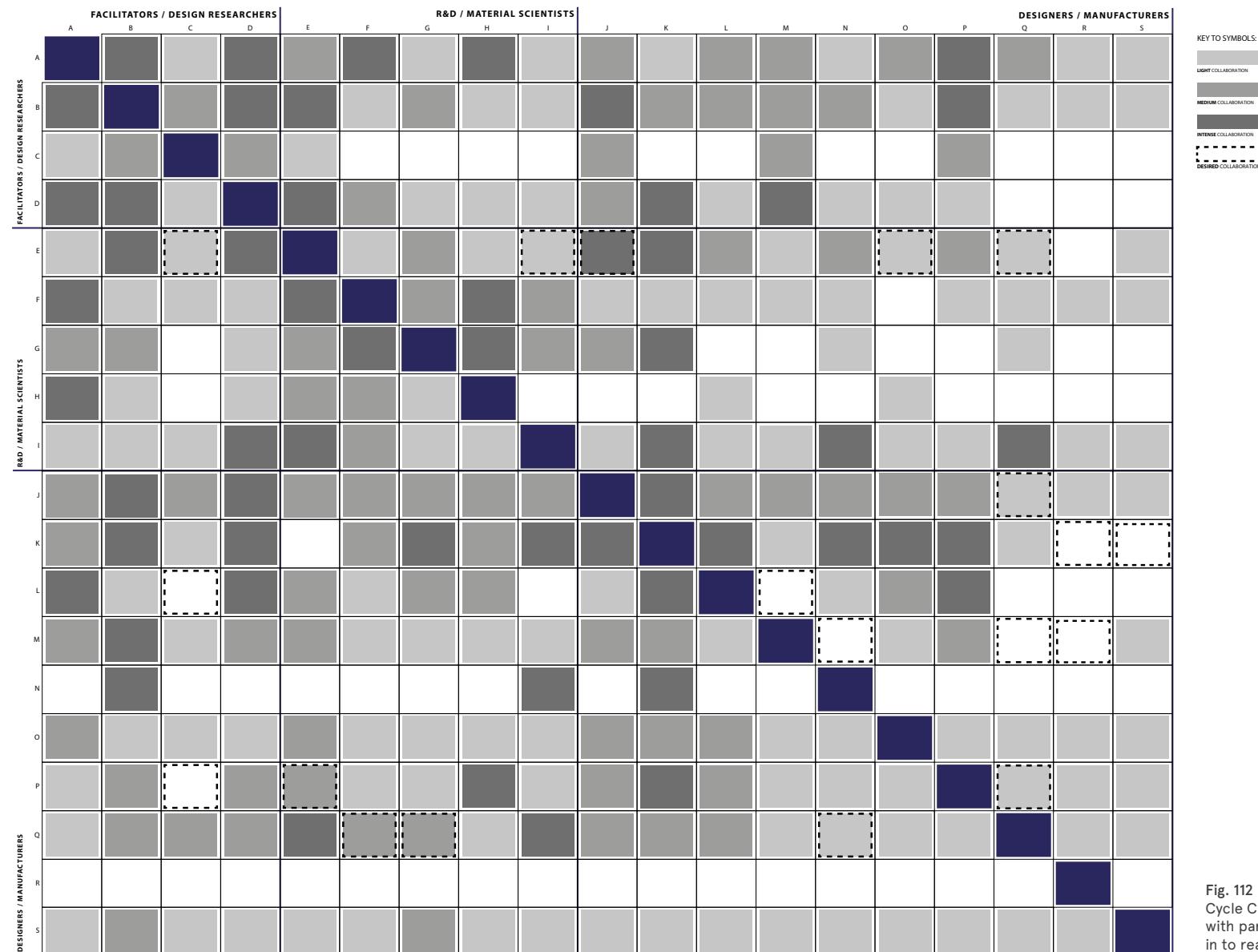
Fig. 112 'Collaboration Matrix–
Cycle C' Answers; table edited
with participants feedbacks (zoom
in to read the content)

CONCLUSION FROM COLLABORATION MATRIX EXERCISE

This last project review about collaboration between the several involved institutions in the project, gathered finally a high number of comments, probably due to the fact that the request for collecting feedback has been sent out prior to the final WS and answers have been collected via email (digital file) in order to safe precious time for other activities during the final WS12. Analysing the collaboration matrix after cycle C, a general decrease of intensity of collaboration is perceived, within the three different expert groups and especially between all institutions and Facilitators / Design Researchers. Meanwhile, collaboration between R&D / Material Scientists and Designers / Manufacturers, as well as within the latter, intensified due to technical reasons of project evolving. Thus, the gathered feedback about collaboration reflect the initially implemented structure of the project process, where three different phases focus to develop the final project outcomes with an iterative approach.

COLLABORATION ISLANDS EXERCISE RESULTS

How R&D / Material Scientists suggest enhancing collaboration
Self-analysis
The third Collaboration Islands Exercise reports the tendency of R&D / Material Scientists in giving only few comments (10) about own expert group behaviour, providing most feedbacks about what to start doing (7) and some indication about what to keep on doing (2). At this point, shortly before project end, attitude seems not to have changed a lot during cycle C as the main issues mentioned, again, are concerning time management (timely addressing of delays) and sharing information (updating of results, focused communication), also internally. Further, the monthly exchanges are confirmed as a good practice that has been maintained during this last project cycle.

Shared Feedback
R&D/Material Scientists' indications shared (9) with the other expert groups stressed the request already identified during the previous project reviews for clear, concise and targeted communication.

Received Feedback
The feedbacks received (19) by R&D/Material Scientists from the other two expert groups underline the need for an unhindered collaboration (direct and active confrontation), with the request for fulfilling of agreed deliverable

How Designers / Manufacturers suggest enhancing collaboration
Self-analysis
The Designers/Manufacturers revealed to be constant in suggesting feedback (17) within their expert group throughout the whole project. The cycle C project review highlighted some bad habits (4) such as postponing activities and decisions, valued some good practices (5) such as the implemented collaborative and iterative process and suggested some actions (8) to adopt, mainly addressing project and information management.

Shared Feedback
Reflecting on collaboration during cycle C, Designers/Manufacturers had some suggestions (11), almost equally split between the two other expert groups. Main feedback to R&D/ Material Scientists addressed material quantity and quality supplied for prototyping, whereas comments to Facilitators/Design Researchers focused on time management (respecting timeline) and communications (clear and targeted).

Received Feedback
Designers/Manufacturers received few feedbacks (12) from the other expert groups, mainly asking for information sharing within the institutions to assure continuity despite internal reorganisation and to implement planning tools (timely requests on inputs)

How Facilitators / Design Researchers suggest enhancing collaboration
Self-analysis
The Facilitators/Design Researchers contributed incrementally to the self-evaluation providing in this last review exercise several comments (25), highlighting the need for information sharing at an early stage to share (theoretical) insights for implementation and exploitation within the project.

Shared Feedback
Suggestions made by Facilitators/Design Researchers to the other expert groups (21) ask for more open and active exchange through direct communication and activities.

Received Feedback
Majority of feedbacks (12) received by Facilitators/Design Researchers are addressing the used tools asking for simple and easy to do exercises and for a prompt or facilitated gathering of feedback (remembering WS: pictures help).

TRASH CASH

R&D
MATERIAL SCIENTISTS

☐ STOP
Problematic areas and things to change for better

· stop unclear numbering of deliverables when we have missing information.

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results

· start informing about new important information uploaded onto projectplace
· start communicating tasks more clearly and in a concise way
· start having a more clear vision: management of data collection and who contributed
· start focusing more on scaling-up earlier in the process
· start earlier problem solving when we have delays
· start improving internal communication (more meetings)
· start earlier explanation on LCA (for entire consortium)

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results

· keep on having R&D status update meetings (with short minutes)
· keep on having the possibility to stretch out the project a bit at the end due to "empty time"

DESIGNERS
MANUFACTURERS

☐ STOP
Problematic areas and things to change for better

· stop postponing decisions
· stop working in the usual way
· stop providing too small amount of material (not possible to make good samples)
· stop delaying: delays at the beginning of the project influenced the rest of the project process

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results

· start pushing forward to achieve the results based on designers' requirements
· start defining roles in order to manage easily the whole project
· start keeping up a clear and concise project log to be sure that people replacing others are well updated
· start daring to make decisions faster
· start having a more focused and faster timeline
· start connecting thoughtfully the right expertises to the right roles
· start identifying end product manufacturers
· start engaging with spinning company to achieve a good quality result

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results

· keep the iterative process
· keep the good collaboration
· keep making decisions
· keep clarifying what is needed
· keep connecting fast and smoothly with new people

FACILITATORS
DESIGN RESEARCHERS

☐ STOP
Problematic areas and things to change for better

· stop sending too many emails
· stop making decisions and not telling anyone
· stop skyping in big groups (some people are too shy, questions go unasked)
· stop using emails instead of projectplace

▷ PLAY
Start using new ideas and changes that would enhance the collaboration and results

· start sharing earlier theoretical framework groundworks
· start bonding stronger the responsibility/ownership of MC's (change of personel)
· start crystalising and celebrating results at key points
· start sharing reflections influencing the 'whole' project
· start communication of reasoning and decision-making to all concerned
· start balancing better efforts (tasks) within consortium
· start using agreed on project management/knowledge extraction tool
· start doing external presentation about interim results
· start defining 'WP tasks' for specific research tasks
· start collecting final info incrementally

▷▷ FAST FORWARD
Keep on doing things that supported collaboration and led to good results

· keep on problem solving/resolving problems
· keep on learning, talking, taking (constructive) critique
· keep on being nice
· keep on doing weekly meetings
· keep on having energy and ideas
· keep on the routines for sharing
· keep on having full-time leadership (academic)
· keep on using tools for collaboration (shared documents and common formats)
· keep on sharing knowledge
· keep on using simple tools repeatedly (for familiarity)
· keep on reflecting on the projetc to inform the future work

SELF-ANALYSIS EXPERT GROUP ISLANDS

FEEDBACK FROM OTHER ISLANDS

▷ · try to complying with requirements
· bigger samples, please
· respect amount and quality of material agreed on
· all R&D processing technologies should be kept active and adaptive until the end
· say clearly what is possible and what is not, from the beginning

▷▷ · impressive tour in lab, very helpful for designers/manufacturers
· exploring many options for CEL (colour retaining, microfibres, …)

▷ · start communication early enough: data collection, scales (experimental)
· focus the communication to the right people
· communicate clearly, also internally within organisation

☐ · addressing partners in email communication: clear purposes for the tasks needed

▷ · too much time developing the tools; maybe in less time although not perfect
· respect cycles deadlines/timing; A should have been short, B longer and C even longer
· consumers perspective is missing

▷▷ · very good facilitators: you made it happen!
· DDMI took too much time to be implemented; explain better the aim of the work

▷ · how continue if people are changing; how to hand in internally (knowledge)
· inside company: sharing more, team activity (more than individually)
· need to know availability
· improving communication
· need a planning tool, a constructive to-do-list in advance

▷▷ · keep doing good prototyping
· keep delivering
· passion (positive)
· engaging design sheets

☐ · just communications by email
· internalising frustrations

▷ · communicating more in consortium and within WP's
· scheduling moments for closer collaboration (F2F focused and small group)
· challenges us: open up and ask questions at the beginning
· find a way to define and communicate limitations
· scheduling when you need inputs (starting spinning etc.)

▷▷ · delivering
· open to the process (enthusiastic, engaged)
· input to Design specifications and LCT
· presenting in a clear way
· being available (after task delivered, for design research)

☐ · too ambitious objectives for the tools of the workshops, participants not understanding the task
· difficulties due to people engage exchanged

▷ · one person responsible for communication in each team (emails out of control)
· interview scientists right away on the tools after the WS, more valuable feedback
· hard to memorise WS (sessions A+B, WS numbers), pictures helped

▷▷ · good communication

Fig. 113 Partner Islands Cycle B – Answers; table edited with participants feedbacks (zoom in to read the content)

CONCLUSION FROM COLLABORATION ISLANDS EXERCISE RESULTS

This third self-evaluation exercise gathered a total of 95 comments, most of them providing suggestions on how to foster collaboration (PLAY: 49) and a lot of encouraging feedback to continue already established practices (FAST FORWARD: 32). Only few requests to stop some bad habits were collected (STOP: 14), most of them underlining the necessity to pay attention to communication ("Stop sending too many emails" - "Just communicating by email" - "Addressing too many people in emails"), asking for being more pragmatic ("Too much time developing the tools; maybe in less time although not perfect") and trying to be more communicative ("Stop internalising frustrations").

Analysing the amount of feedback made, shared and received by each expert group, arises that in this last Collaboration Islands Exercise, again, the Facilitators/Design Researchers was the most prolific expert group making 25 considerations about own behaviour and giving 21 feedbacks to the other expert groups. R&D/Material Scientists were the most constant commentators throughout the three project cycles providing 9 feedbacks to the other expert groups and 10 suggestions to adjust own behaviour. Meanwhile Designers/Manufacturers analysed in this last review mainly own activity with 17 self-critiques and evaluated collaboration with the other expert groups by sharing 11 suggestions.

As already identified in the two previous project review exercises, some variations of issues related to timing and scheduling continue to arise («Scheduling when R&D needs inputs: starting spinning, etc.» - «Respect cycles deadlines/timing: Cycle A should have been short, Cycle B longer and Cycle C even longer»), which indicate the need to foresee and consider during the timetabling phase of the project the different timeframe and gaps in time among the different streams (R&D, design, manufacturers, etc.) and the related outcomes.

Moreover, some difficulties in understanding the design tools («Too ambitious objectives for the tools of the WSs, participants not understanding the task.»)

were mentioned also in review of Cycle C. It is recommendable to evaluate thoughtfully the amount of information participants have to manage; every new tool represents extra information that need time and effort to be understood and applied.

Summarizing the content of the comments arison after this last project cycle, the following concrete suggestions were gathered from the directly involved participants of Cycle C:

"Keep up a clear and concise project log to be sure that people replacing others are well updated."

"Hold external presentation about interim results."

"Use simple tools repeatedly, to familiarise."

"Schedule moments for closer (small group) exchange."

Concluding, after three Collaboration Islands Exercises executed, an unbiased, targeted and concise communication throughout the consortium and within the single organisations arises as the principle aspect to be managed thoughtfully in order to guarantee pleasant and prolific interdisciplinary collaboration. To Set up and manage clear and balanced rules for an efficient communication flow by aligning methods and agreeing on a common way on how to communicate facilitates collaboration and task executions.

TRASH PROJECT REVIEW_CYCLE C: PROJECT CHRONOLOGY

GREAT MOMENTS

CHALLENGES

MASTER CASES
ANALYSIS (LCA)
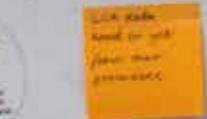
SEPTEMBER
HELSINKI-WS09

MASTER CASES
SPECIFICATIONS (STORYTELLING)

FEBRUARY 2018
AJDOVSCINA-WS10

MASTER CASES
IMPLEMENTATION

JUNE 2018
BORAS-WS11

PROCESS REFLECTIONS &
SHOWCASING RESULTS
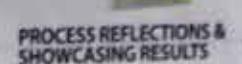
OCTOBER 2018
EINDHOVEN-WS12

3 KNOWLEDGE AND RECOMMENDATIONS FOR DDMI

In addition to the material innovation objectives in T2C, a principal aim was to study the methodological approach used to achieve such an ambitious interdisciplinary collaboration. Design Researchers from three institutions worked to capture and record phenomena relating to the applied project methodology.

The specific framing and focus of this work reflected the research expertise, interests, skill-sets and knowledge base of the individual researchers, ranging from practice-based and action research approaches and ethnographic observation in the tradition of social sciences.
Whereas one design research institution looked at macro level phenomena relating to the project as a whole, the other one focused more on the 'micro' level of the project, the specific activities, tools and methods used to enable particular outcomes to be realised collaboratively.

A third organization sought to understand the project partners' perspective by using the Cycle Review Exercise described in paragraph 1.5.1 (the analysis and results of the Project review are provided at the end of each cycle description section).
Finally, during WS10 the participants' reflections on the process they had experienced were also captured and analysed to complete the methodology research.
Here, the knowledge sharing aspect of the methodology is first discussed, before expanding on the LCT approach which was fundamental to enabling the consortium to fulfil the project objectives. In the final section the main outcome of this research is presented: 32 Core Recommendations for DDMI.

3.1 KNOWLEDGE SHARING IN INTERDISCIPLINARY COLLABORATION

DDMI brings together professionals from fields that don't usually work with each other. This sets some challenges for collaboration, since people participating the project have only little common specialized knowledge and shared professional vocabulary. They may also come from different companies and organisations, and consequently lack shared organisational practises that would help in information and knowledge sharing. On the other hand, successful integration of knowledge from distant fields offers high potential for innovation. This integration requires knowledge management, monitoring, workshop facilitation and tools focusing on knowledge exchange. As described earlier in this report, knowledge integration was supported in T2C mainly through 12 interactive workshops. Arranging such workshops would be useful also in future DDMI processes, together with a person having an assigned role to bring different fields together.

DDMI process can provide at least four different contexts for knowledge exchange: current reality, envisioned future, design concepts and selected Master Cases. These contexts require different types of support for knowledge sharing, and different knowledge management strategies (see figure 114).

In the beginning of the process, it is important to assist setting common ground by arranging interactive activities in the workshops, and having expert presentations and tools specifically aiming for sharing basic knowledge about the project topic.

Once the project moves to envisioning phase, the focus in the workshops is on ideation and the knowledge experimentation starts; what could or should be researched. At the same time, different fields still need to continue sharing their specialized knowledge. So it is important to provide simple tools to collect, not only ideas, but also questions and conclusions that take place in the workshops. Furthermore the process of knowledge co-constructing with others is important element in DDMI.

Therefore not only knowledge sharing but also collectively constructing new understanding on the situation on hand is important part of this process, which is supported by shared activities in workshops. When the process proceeds to the level of having design concepts, things get easier.

Design concepts can provide an integration point for the collection and integration of knowledge from various fields. Towards the end of the project, the focus shifts to exploiting existing knowledge of different professionals in validating, strengthening and communicating Master Cases (those design concepts that have been collaborative selected to be the main outcomes of the interdisciplinary process). Also internal monitoring within the project becomes important to keep small teams, working around specific topics or Master Cases, coordinated and aligned with rest of the project.

Even though the workshops were a useful venue for sharing knowledge between different professional fields, they did not provide a platform for building expertise within any specialized field. Experts participating DDMI processes should be encouraged to have knowledge sharing platforms of their own, in addition to the project–level workshops.

Another challenge of organizing knowledge sharing through a series of workshops, is related to practical arranging of groups in the workshops.

Project participants continuously reported that it was easier to work and ideate in small groups. But when working in several small groups, there is a risk of creating knowledge gaps or even misunderstandings between the groups. This could be minimized by working in large groups in the very beginning of the project (when knowledge sharing is most intense), and later assisting knowledge sharing between small groups with the help of tools and workshop facilitation.

Gathering feedback from project participants was also valuable for knowledge management. It enabled reacting to project participants' expressed needs for specific areas of knowledge. On the other hand, it was difficult for project participants to recognize, what knowledge was needed, and when. For that reason it is also important not to rely entirely on partner feedback, when planning the knowledge exchange activities, but already in the project building phase plan knowledge sharing activities and laboratory visits hosted by material scientists for the beginning of the project.

	CYCLE A		*CYCLE B*	*CYCLE C*
CONTEXT OF KNOWLEDGE SHARING	Current reality	Envisioned future	Design concepts	Selected Master Cases
EXPERT PRESENTATIONS ABOUT	Technology state-of-the-art Markets & user perception Existing innovative fibres	Megatrends	Project results: Prototypes, consumer studies, preliminary scalability analysis	Communication: Storytelling from brand and end user perspectives
INTERACTIVITE ACTIVITIES FOCUSED ON	Understanding technological processes	Brainstorming Envisioning future materials Building scenarios	Collecting expert input to revise design concepts, and matching them to technological results	Validating master cases with the work done within the project: LCA, business models, upscaling
TOOLS HELPING KNOWLEDGE EXCHANGE	Analysing properties of existing (and similar) materials on the market	Collecting questions and answering them in a workshop Mapping who knows what	Using a template to integrate knowledge around each design concept	Collecting information with business model canvas and process charts. Gantt charts for monitoring.
KNOWLEDGE MANAGEMENT STRATEGIES	*SETTING COMMON GROUND*	*KNOWLEDGE EXPERIMENTATION*	*KNOWLEDGE INTEGRATION* *INTERNAL MONITORING*	*EXPLOITATION*

Fig. 114 Key phases of knowledge exchange in T2C, and how it was supported in each phase.

3.2 LIFE CYCLE THINKING: A PERSPECTIVE FOR A CIRCULAR DDMI

The emerging field of 'design for the circular economy' requires a multi-stakeholder and disciplinary approach to enable the recycling of textiles through challenging disciplinary boundaries. The 'connected' nature of this challenge can only be achieved through effective collaboration between traditionally unconnected fields yet there are very limited tools which can be called upon to facilitate this collaboration. Existing lifecycle tools are predominantly either for 'audit' (scientifically based but post-production) or 'ideation' (design driven but lacking in scientific basis). The research presented in this section positioned material science, industry stakeholders, consumer behaviour and Life Cycle Assessment (LCA) into the heart of an iterative design process.

Fig. 116 Trash-2-Cash, Developing tools, methods & models to enable the complex collaborations essential for designing circular material scenarios.

LIFE CYCLE THINKING STAGES
The following four themes were identified as essential steps in the process which could be adapted and refined for future use by similar interdisciplinary research projects or industry schemes in order to embed circularity into the heart of any material and product development process. These are our recommendations.

Stage 1: Circular Baseline: identify the expertise
Within this stage the concept of life cycle thinking was introduced & expertise of stakeholders identified. A shared understanding of relevance to individual expert roles began to develop,
At the beginning of the design process, once a design brief and application is understood, life cycle thinking should be introduced to all involved stakeholders representing as many parts of the product cycle as possible. In T2C we included material scientists, production experts, industry designers, LCA & business model experts and user perspectives from social science.
The purpose of this stage is to ensure a shared understanding of the expertise relevant to individual roles. All partners are asked to 'map themselves' into a lifecycle segment map in order to show the area of their expertise. This enables the group to understand where there is expertise and where additional inputs or support might be needed. It also highlights areas of overlap which encourages useful debate from different perspectives. At this stage disciplinary 'differences in language' can also be identified and addressed.
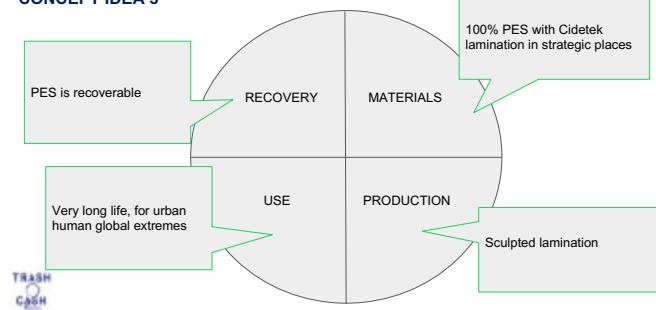
Fig. 115 Example of Life cycle template for Soft & Strong Scenario Design Concept idea 3 & developed Design Concept Poster for WS06

Stage 2: Circular Mindsets: define a shared understanding
The second stage of the process focused on visualising and collectively developing a circular map to enable a shared understanding of the material life cycles. Defined specific product concept maps could then be developed, building from a generic understanding to a tailored life cycle material journey for each design concepts to directly inform the design process,
The second stage involves setting a baseline amongst the group for circular understanding. The visualisation and collective development of a circular product journey can enable a shared understanding and circular mindset.
A useful exercise here is to present example design scenarios as physical life cycle maps to provide a focal point for group discussion. This allows the demonstration and exploration of the group's expertise as part of a prospective design process, 'in the round'. The main points of discussion can be captured and reviewed following the activity in order to develop the next round of design tools tailored to the application area. By defining example product-concept cycle maps the group can build from a generic understanding to a more product specific understanding and inform the design process.

Fig. 117 WS06 Meeting Life Cycle Thinking session in action.

Stage 3: Circular Co-Design: combine knowledge through iterative process
During this third stage stakeholder knowledge was combined through iterative knowledge exchange in the form of circular evaluation to inform the final design concepts.

This is the most complex of the activities and should run through several iterations designed to share knowledge and to inform the design process. By mapping the emerging concept as a lifecycle journey and refining it during several rounds of facilitated discussion, the expertise of the stakeholders can be embedded within the design process. Tangible provocation tools and information gathering tools should be used to capture insights and enable the exchange of disciplinary knowledge.

The circularity of the cycle should be constantly reviewed and adapted throughout this stage and insights collated and cross-checked across the expert groups. It is useful to engage design facilitators for these activities both during and between workshops to ensure their smooth running.

Stage 4: Circular Evaluation: refine concepts through LCA/LCT interplay
The final stage of the process communicates final product concepts as a fully-formed, detailed, life cycle maps in order to finalise the LCA impacts and refine the design if necessary. The LCA/LCT interplay can support improvements of environmental impacts around the cycle. This final collaborative resolution of the designs is essential to ensure maximum positive impact is reached.

Fig. 120 WS08 'Circular Analyses LCA meets LCT' session in action.

These four stages of activity can be adapted for multiple product and application areas and for different scales and complexity of collaboration.

Fig. 119 Expert area colour-code related to T2C material life cycle

Incorporating Life Cycle Thinking

Designers

Circular Baseline

Introduce life cycle thinking, ensure a shared understanding of relevance to individual roles.

Identify expertise of stakeholders & partners, ensuring all areas of the life cycle are represented. Are there any missing links?

Designers + Key Stakeholders

Circular Minsets

Visualise and collectively develop a circular map to ensure a share circular mindset.

Define specific product–concept cycle maps to build from a generic understanding to a tailored life cycle material journey and inform the design process.

Designers + All Stakeholders

Circular Co–Design

Combine & build knowledge through an iterative stakeholder knowledge exchange to inform the design process.

Combine knowledge, embed expert stakeholders within the design process using tangible information tools to enable the exchange of disciplinary knowledge.

Designers

Circular Design

Communicate the life cycle story by developing an LCT map for shared resolution and to inform the final circular design stage.

Refine design concepts informed by expert review use LCA / LCT interplay to support improvement of environmental impacts around the life cycle to support circular design process & develop closed–loop cycles.

Fig. 121 Recommendations for a four-step process towards collaborative and interdisciplinary circular design.

3.3 RECOMMENDATIONS FOR DDMI

The project as a whole was an immense learning journey which has required all participants to work beyond the limits of their usual practice. Together the T2C partners have learnt how to design and produce materials with many different voices, representing multiple knowledge areas and interests, from different parts of the material life cycle. This has meant creating a completely unique, co-developed approach, incorporating many skills, methods and tools from design research theory and practice, design industry, and materials consultancy. Importantly, the methodology was flexible, adaptive and responsive; each small step, as well as each large milestone, included a period of listening to the partners, reflecting and then designing and acting upon the new knowledge. This symbiotic relationship between the methodology research and the applied process was absolutely crucial to the success of the project. Incorporating this reflective-adaptive approach into large interdisciplinary projects of this type, we argue, is essential for an effective collaboration.

32 CORE RECOMMENDATIONS MAP

The 32 Core Recommendations represent the headlines of this research; these are mapped to the basic three cycle process used in T2C with an additional 'planning' phase at the beginning. The map extends from the 'macro/leadership' to the 'micro/participants' level of the project. The researchers then undertook a process of collaborative evaluation, nominating the recommendations from their own research which they considered to be the most important, combining and grouping the recommendations into four themes:

1.   Project,
2.   Information & knowledge,
3.   People & roles,
4.   Tools

In the main map the numbered dots show where in the DDMI process the related recommendation should be implemented. A dashed line links too related recommendations and the small dots denote that a recommendation has multiple steps.

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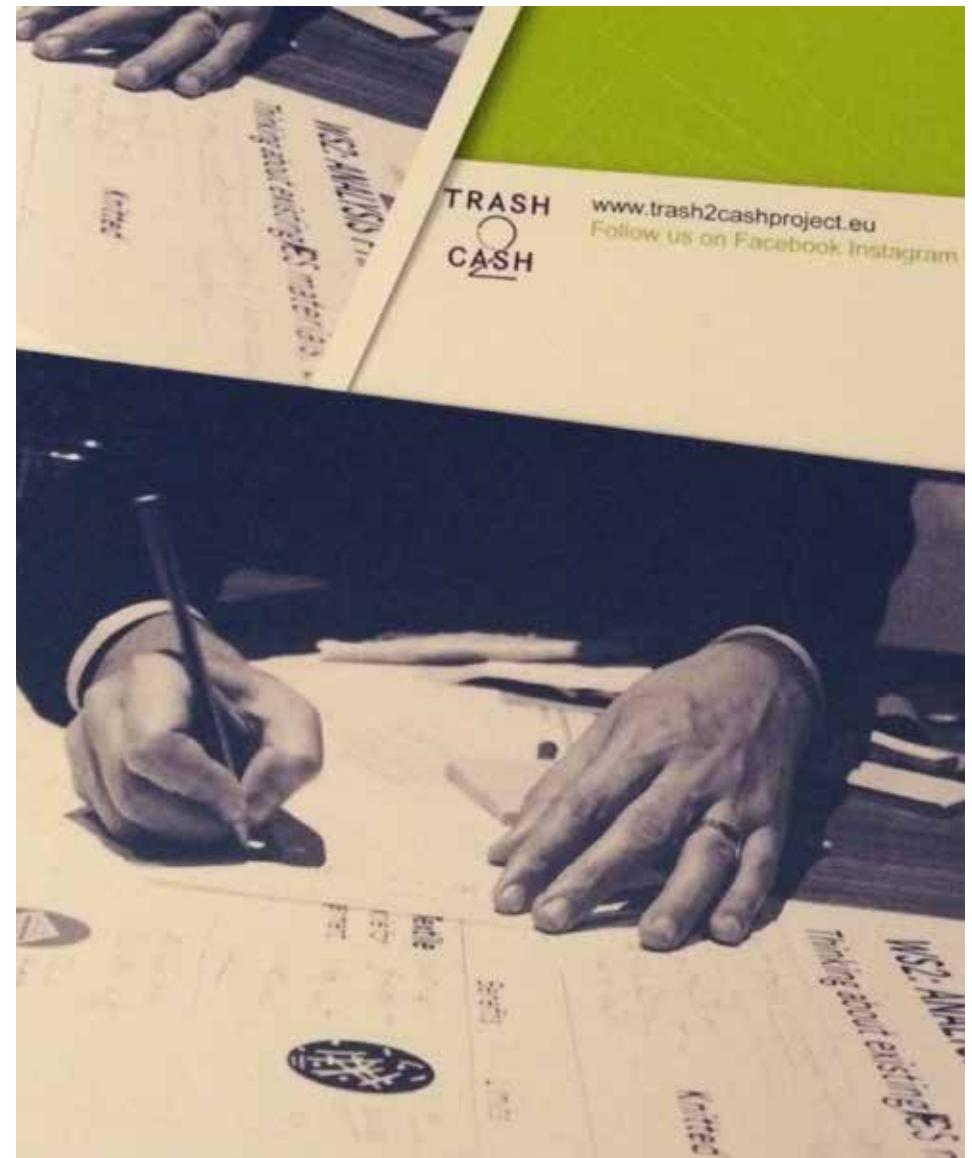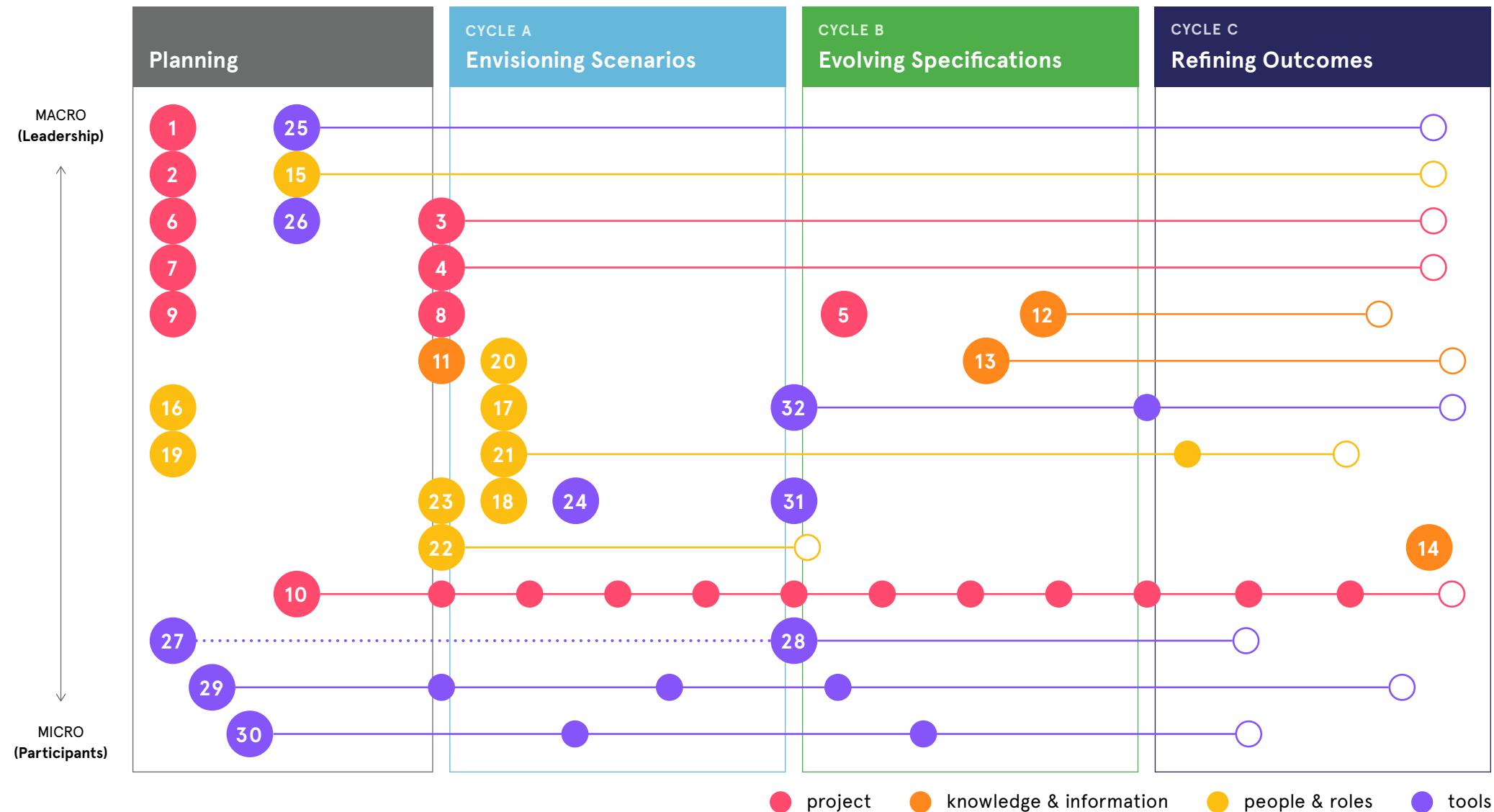
No.	Recommendation
PROJECT	
1	Create flexibility in the process
2	Plan how and when to make critical decisions
3	Manage the innovation process - through the process point of view (secure progress) - through people's point of view (emotional & motivation)
4	Iterate and reflect frequently
5	Create a shared goal
6	Start with the right material for DDMI
7	Aim for closer collaboration between design and materials R&D
8	Develop interdisciplinary mindsets and routines
9	Interdisciplinary scheduling: foresee the differences in timeframes of different disciplines: keep it active and flexible
10	Organize interdisciplinary meetings as pivotal steps of the process, balancing the information load of participants and avoiding a 'heavy' schedule
KNOWLEDGE & INFORMATION	
11	Facilitate setting common ground by: Interactive WS sessions, Expert presentations, Knowledge sharing tools, Laboratory visits
12	Monitor knowledge exchange internally
13	Integrate knowledge from various disciplines into shared outcomes (Master Cases)
14	Disseminate your learning outcomes externally & tell the story
PEOPLE & ROLES	
15	DDMI is best managed by someone not deeply involved in any particular discipline area: they have the same knowledge gap as all participants, giving an impartial overview representing all equally
16	Task and resource facilitation roles: Project flow, Knowledge Integration, WS, Communication
17	Focus on the people involved as individuals - their voices and stories. Include social moments, fun and interaction
18	Spend time learning each other's languages 'getting to know you'
19	Map needed knowledge and recruit accordingly

No.	Recommendation
20	During core discussions try to ensure all competencies are present: gaps can lead to lack of momentum, trust and limit problem-setting/solving
21	Identify a Lead Designer sooner and deepen the collaboration in specific teams: Clarify the focus and expected outcomes
22	Use all your skills and creativity to enhance collaboration and co-innovation
23	Be responsive towards the process
TOOLS	
24	Use simple tools that build familiarity when used repeatedly
25	Build up a visual model of a preliminary action plan, including interdisciplinary exchanges (such as a Gantt chart) and share with partners. Update and adapt as the project progresses.
26	Set up rules for intra-communication flow; understanding that a quick request from design may be a long time for R&D and visa versa IV
27	Co-create an interdisciplinary information system, such as the Design Specification Tool.
28	Allow the information system to evolve to link in different disciplines and crystalise important moments, including limitations and decisions.
29	Build a strategy for materials samples, incorporating four different types: Pre-project, Commercial, Project Demonstrator & Design-Driven Materials Samples.
30	Build a Life Cycle Thinking tool gradually, from the baseline, linking in experts as design detail increases.
31	Knowledge exchange will overlap with the ideation process. Create tools to capture knowledge exchange & learning, not only ideas
32	Constructive criticism can help to improve the collaborative and independent work: this can be managed through common evaluation tools in specific WS sessions.

TRASH
CASH

SEVEN THEMED RECOMMENDATIONS MAPS

Behind the 32 Core Recommendations there lies a wealth of new knowledge about specific aspects of the project that give readers the opportunity to learn more about a specific topic.
These represent the seven research studies undertaken by different Design Research teams in T2C which together can be seen as a multiple-lens, viewing the project from different perspectives:

1. The DDMI Process lens
2. The Knowledge Sharing lens
3. The Materials and Design Communication lens
4. The Life Cycle Thinking lens
5. The Social Connectivity lens
6. The Partner Integration lens
7. The Partner Reflection lens

Take a look at any one of these individual maps to delve deeper into the research and then explore the papers published by the T2C methodology researchers, which are detailed at the end of this section.

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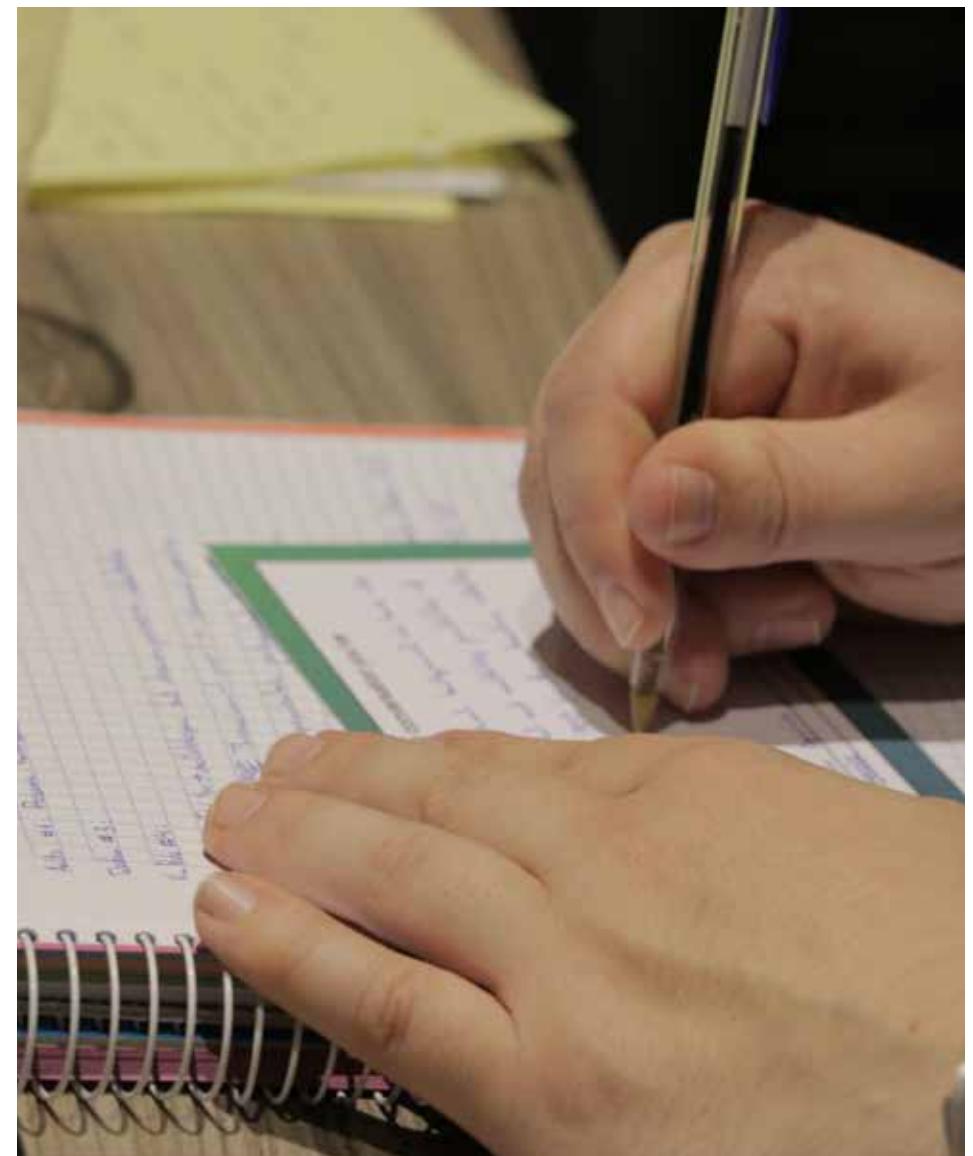
DDMI RECOMMENDATIONS: DDMI PROCESS
Kirsi Niinimäki (Aalto Arts)

Planning

CYCLE A
Envisioning Scenarios

CYCLE B
Evolving Specifications

CYCLE C
Refining Outcomes

MACRO
(Leadership)

MICRO
(Participants)

Create flexibility into the process

Plan how and when to make critical decisions

Map needed knowledge areas and recruit accordingly

Manage the innovation process
–through the process point of view, secure progress and right outcomes –through people's point of view (emotional & motivation)

Iterate and reflect frequently

Use and create generative tools

Create a shared goal

Be responsive towards the process

Use all your skills and creativity to enhance collaboration and co-innovation

Be prepared for fuzzy process at the beginning when different options are searched

Deepen the collaboration in specific teams. Clarify the focus and expected outcomes

Disseminate your learnings and outcomes externally & tell the story

● project   ● knowledge & information   ● people & roles   ● tools

TRASH 2 CASH

DDMI RECOMMENDATIONS: MATERIALS & DESIGN COMMUNICATION
Rosie Hornbuckle & Dwn Ellams (University of the Arts London)

Planning	CYCLE A — Envisioning Scenarios	CYCLE B — Evolving Specifications	CYCLE C — Refining Outcomes

MACRO (Leadership)

Design-Materials R&D Labs
(close proximity collaboration / materials-led designers)

Prepare for appropriate proximities of design-materials R&D collaboration

Facilitated Design-Materials R&D information exchange
(long distance collaboration / function-led designers)

Task and resource facilitators to coordinate the interdisciplinary communication, including a co-created information system.

1: Stepping up
Identify people with material communication skills within the workshops who could support interdisciplinary dialogue

2: Setting up
Facilitate the long-distance dialogue between design, tech and other experts, until direct dialogue is established

3: Stepping back
Monitor the direct dialogue, identifying misunderstandings and provide support when needed

Co-create an interdisciplinary information system to capture and record samples, connecting them with design concepts and other information relating to each discipline, including the evolving design discussions and decisions

Pre-project Samples
Complete information provides the starting point

Project Demonstrator Samples
Produced by partners to show capabilities, with complete information to support interdisciplinary discussions

Build a strategy for Materials samples
Different kinds of samples can be used for different phases of the project to support the interdisciplinary work.

Commercial Samples
With as complete information as possible to aid ideation and inspiration in Cycle A, and later to substitute project materials if unavailable for material or product prototyping

Project Design-Driven Samples
Materials produced by the consortium in response to the interdisciplinary design work

Archive
The complete information is a valuable resource available to partners (or open-source) for future work and exploitation

MICRO (Participants)

● project ● knowledge & information ● people & roles ● tools

TRASH
CASH

DDMI RECOMMENDATIONS: KNOWLEDGE SHARING
Marjaana Tanttu (Aalto Arts)

MACRO (Leadership)

| | CYCLE A — Envisioning Scenarios | CYCLE B — Evolving Specifications | CYCLE C — Refining Outcomes |

Assign one project partner as main responsible for knowledge exchange

Build the plan for collaboration around interactive workshops

Gather feedback along the way and respond to needs of specific knowledge expressed by project participants

Make all partners interact in the workshops

In large teams to avoid knowledge gaps

In small teams to enable active participation

In various types of groups, also expert teams

Analyse and learn what materials already exist

Envision futures, ideate and explore

Integrate knowledge from various disciplines in the creation of shared outcomes

Exploit knowledge from various fields to develop and validate shared outcomes

Within the whole project

Facilitate knowledge sharing by: Interactive workshop sessions; Expert presentations; Laboratory visits

Capture knowledge exchange while ideating

Monitor knowledge exchange internally

In specific groups

Create and use knowledge sharing tools

Create and use knowledge integration tools

MICRO (Participants)

● project   ● knowledge & information   ● people & roles   ● tools

DDMI RECOMMENDATIONS: LIFE CYCLE THINKING
Kate Goldsworthy & Dawn Ellams (University of the Arts London)

MACRO
(Leadership)

MICRO
(Participants)

Planning	CYCLE A **Envisioning Scenarios**	CYCLE B **Evolving Specifications**	CYCLE C **Refining Outcomes**
Circular Baseline	**Circular Mindsets**	**Circular Co-Design**	**Circular Review**
Introduce life cycle thinking and ensure a shared understanding of relevance to individual roles	Define specific product-concept cycle maps to build from a generic understanding to a tailored life cycle material journey and inform the design process	Embed expert stakeholder within the design process using tangible information tools to enable the exchange of disciplinary knowledge to support circular design process	Refine design concepts informed by expert review and use LCA/LCT interplay to support improvement of environmental impacts around cycle
Identify expertise of stakeholders and partner members ensuring all areas of the life cycle are represented. Are there any missing links?	Bring together then build up the LC Knowledge Areas and incorporate within the design process	Discipline experts collaborate with designers to develop a closed-loop product life cycle (collaborative DfR)	Build knowledge through an iterative stakeholder knowledge exchange to inform the design process.
Generic LC mapping for knowledge exchange and definition	Map product concepts as LC journeys and refine through an iterative and discursive process	Code discipline experts to specific life cycle stakeholders to develop collaborative iterative process	Communicate the life cycle story by developing an LCT map for shared resolution

● project   ● knowledge & information   ● people & roles   ● tools

TRASH
CASH

DDMI RECOMMENDATIONS: SOCIAL CONNECTIONS
Rebecca Earley & Rosie Hornbuckle (University of the Arts London)

Planning

CYCLE A
Envisioning Scenarios

CYCLE B
Evolving Specifications

CYCLE C
Refining Outcomes

MACRO
(Leadership)

Focus on the project participants as individuals, using faces, voices, stories, fun and interaction through design practice, to help build connections and shared understanding from the outset. Prioritise and resource this.

Podcasts of particpant interviews

Participant stories

Tactile interaction

Design practice

Easily accessible

Embed social moments and preparation for working together throughout the project

Postcards as a multifunctional communication tool

Participant portraits

Participant 'face mapping'

Connecting through meditation

"It feels like coming home"

Design tools and methods can be used to foster social connections within the group and create a project family

Spend time at the beginning: learning how to work collaboratively in workshops talking one-to-one about expertise, material knowledge and ways of working to develop a language and a way of communicating understanding the basics of other disciplines

MICRO
(Participants)

● project   ● knowledge & information   ● people & roles   ● tools

TRASH
CASH

DDMI RECOMMENDATIONS: PARTNER INTEGRATION
Christian Tubito (Material ConneXion Italia)

	Planning	CYCLE A Envisioning Scenarios	CYCLE B Evolving Specifications	CYCLE C Refining Outcomes

MACRO (Leadership)

The DDMI design process needs to be flexible, active and adaptive

Interdisciplinary scheduling: foresee the differences in timeframes of different disciplines: keep it active and flexible

Build up a visual model of a preliminary action plan, including interdisciplinary exchanges (such as a Gantt chart) and share with partners. Update and adapt as the project progresses.

Schedule sufficient time for knowledge-sharing and information processing

DDMI is best managed by someone not deeply involved in any particular discipline area:

Define a new decision-making process

The collaboration between partners of the same discipline group are as important as the cross-disciplinary collaboration.

The start is a crucial point: bring designers into labs

Integrate vertical and horizontal discussions
Material developments must be well communicated throughout

Set up rules for intra-communication flow

Constructive criticism can help to improve the collaborative and independent work

Organise interdisciplinary meetings as pivotal steps of the process

During core discussions try to ensure all competencies are present

The choice of meeting venue is important: ambience can enhance the mood and attitude which enhances participation and knowledge-sharing

Use updated versions of the same tools rather than new tools for each workshop which involve all partners actively

MICRO (Participants)

● project   ● knowledge & information   ● people & roles   ● tools

TRASH CASH

DDMI RECOMMENDATIONS: PARTNER REFLECTIONS
Rosie Hornbuckle (University of the Arts London)

MACRO (Leadership)

Planning

CYCLE A
Envisioning Scenarios

CYCLE B
Evolving Specifications

CYCLE C
Refining Outcomes

Start with the right material for DDMI. A TRL which allows for pilot-scale sampling (which design needs).

Aim for closer collaboration: for example by having design residencies in science labs or manufacturing facilities, or science residencies in design studios.

Manage expectations: of the DDMI process and how it affects individual work; understand other peoples' expectations of your work and how it will affect their tasks.

Resource effective facilitation and leadership that support this...

Map roles and capabilities of partner organisations and individuals: ensuring they are active when present

Demystify the DDMI workshop: What is it's purpose and how is it different to other workshops participants may have attended

Use appropriate tools: incorporating visual communication; simple tools that are intuitive or become familiar through repeated use.

Social time and having fun: include moments when participants can connect on a social and personal level

Develop interdisciplinary mindsets and routines: such as entering the interdisciplinary space as a novice; being open and communicating openly. Reinforce this on re-entering the interdisciplinary workshop.

MICRO (Participants)

● project   ● knowledge & information   ● people & roles   ● tools

SUMMARY OF THE CORE RECOMMENDATIONS

Taking the project as a whole it is clear the three cycles held different intensities of focus.

Cycle A involved an intensive period of knowledge exchange which the research suggests could have been improved with more attention to 'setting common ground', establishing a 'shared goal' and 'learning one another's language'; learning to communicate.

A variety of methods can be used, including the more familiar – such as PowerPoint presentations, paying close attention to translating complex concepts for novices. Moreover, providing opportunities for sharing through experience, such as table-top hands-on sessions, and lab, studio or manufacturing visits can enrich the atmosphere of common understanding and togetherness.

The research suggests that a focus on people as individuals is essential; each have their own voices, stories and particular skillsets, within the project work and the interdisciplinary integration. Indeed, resourcing facilitation is a key finding of this project in nuanced roles: for the project flow, for the workshop sessions, for knowledge integration and also for enabling communication. This has implications for the planning phase, understanding the expertise and skills that are needed and then recruiting people (not only organisations) accordingly.

Once the project is underway the focus shifts to understanding the pool of expertise available and adapting tasks accordingly. In particular, there should be a 'leader' figure who is not directly involved in one discipline or another, who can represent equally the interests of all of the partners.

Tools and methods in this phase should focus on capturing knowledge exchange, setting common ground and establishing a shared goal, and making this accessible to all partners. This is also the time to start putting into place interdisciplinary guidelines, concerning the workshops, communication and routines, and participants need to be reminded of these frequently.

The beginnings of an interdisciplinary information system can be co-created, simple at first but with the capacity to expand and evolve to document key conversations, project limitations and decisions, incorporating the design scenarios and the materials samples as boundary objects.

A visual model of the project can be a useful tool for the lead facilitator to keep the interdisciplinary exchanges on track with the project tasks and to communicate with all participants.
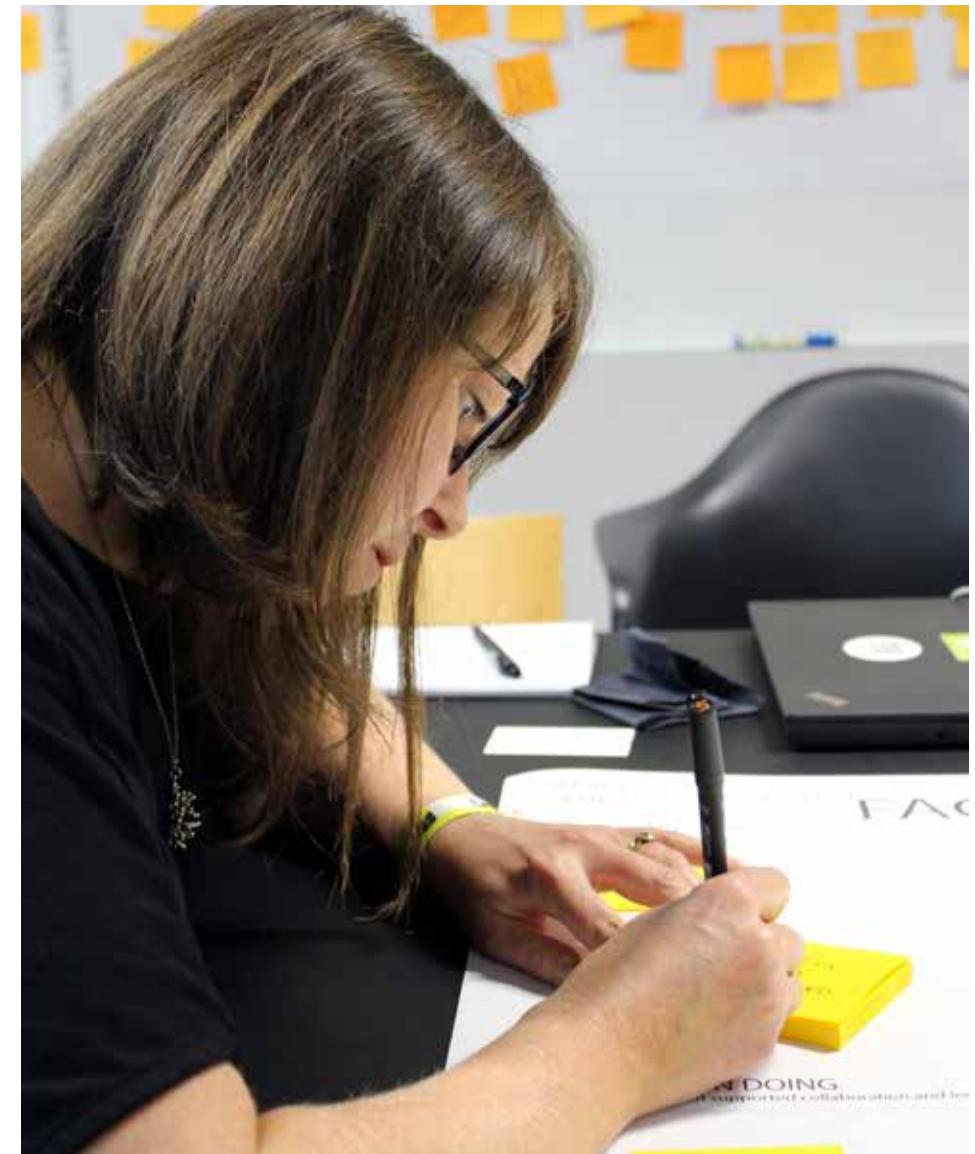
Cycle B was an intense period for interdisciplinary exchange outside of the workshops, facilitating, establishing and monitoring communication.
In this phase the direct dialogue between disciplines had to be facilitated at first, and once established it was monitored and supported by dedicated communication facilitators.
Simultaneously, the dialogue should be supported by the evolving interdisciplinary information system, acting as a reference point for all disciplines, so that all partners can progress their individual work within the interdisciplinary frame.
Smaller design groups with named Lead Designers need to be established more quickly (ideally before Cycle B begins) to allow designers to drive the interdisciplinary design process.
Moments for crucial decision-making can be unpredictable and so a protocol should be considered in the planning phase; identifying which types of decisions should be assigned to expert groups and which to the consortium as a whole, and how to manage this as an interdisciplinary but effective process.
The basics of Life Cycle Thinking will ideally have been introduced in Cycle A (earlier than occurred in T2C), and these can be expanded in Cycle B, increasing the number of stakeholders involved (as experts in a specific part of the lifecycle) as knowledge and complexity increase in the design concepts.
Meanwhile the social aspect of the project also needs to continue; creating opportunities to share on an individual, human level, creating moments for fun and interaction to increase the consortium's capacity not only to collaborate, but also to face challenging times with good humour and a willingness to collaborate.

Cycle C was a time for capitalizing on the hard work of the previous cycles to build an effective interdisciplinary team.
By this point the tools had evolved into familiar and well-established resources, which enabled workshop sessions to be efficient and stress-free.
The interdisciplinary information system contained detailed co-developed design and material information, and ideally this should be in an organized, easy-to-understand format.
Visual, written and numeric language can be used so that partners form different disciplines can easily access the information needed to conduct their individual work with confidence, communicating effectively with other partners in between workshops with a reliable reference point.
This accrued interdisciplinary knowledge allows for the finalizing and refining of

design 'master cases' that incorporate all disciplinary perspectives: in T2C the MCs embodied the materials R&D, design (informed by end-users/manufacturers/retailers), life cycle thinking (informed by LCA) and business models (informed by consumer behaviour).

These final conclusions relate to the particular challenges of T2C but, it is hoped, other researchers can adapt this knowledge to the circumstances and context of the projects they are planning or working on. Further reading on this subject can be found in the list of publications in Annex 4.

4 ACKNOWLEDGEMENTS

Annexes 1 – T2C Survey questionnaires

TRASH 2 CASH

Knowledge and idea sharing at Workshop 2

1. What is your role in this project?

_____

_____

_____

2. In which group were you during the workshop? *

○ Cellulose

○ Polyester

○ Both/I changed group at some point

○ Neither

3. Sharing knowledge

Please answer if you agree or disagree with the following claims concerning the workshop.

	I totally disagree	I disagree to some extent	I don't know	I agree to some extent	I totally agree
I gained new knowledge about fibre properties.	☐	☐	☐	☐	☐
I learned how these fibre properties can be influenced.	☐	☐	☐	☐	☐
I understood how these fibre properties effect textiles made out of them.	☐	☐	☐	☐	☐
I learned how these fibre properties effect composites made out of them.	☐	☐	☐	☐	☐

I gained new knowledge about designer's way of working.	☐	☐	☐	☐	☐
I learned how material properties effect sustainability.	☐	☐	☐	☐	☐
I am now more aware of customer's expectations.	☐	☐	☐	☐	☐
I learned more about designer's expectations.	☐	☐	☐	☐	☐

4. Did you learn something else, that was not mentioned in the previous list?

_____

_____

_____

5. Ways of sharing knowledge

Please answer if you agree or disagree with the following claims concerning the workshop.

	I totally disagree	I disagree to some extent	I don't know	I agree to some extent	I totally agree
Showing material samples and discussing about them helped in knowledge sharing.	☐	☐	☐	☐	☐
Discussing in a group was efficient for learning.	☐	☐	☐	☐	☐
Asking direct questions was a good way to get the information I needed.	☐	☐	☐	☐	☐
I learned a lot during the summary sessions, when the results of different groups were presented.	☐	☐	☐	☐	☐
I learned by following the presentations given in the workshop.	☐	☐	☐	☐	☐
I gained information by having informal face-to-face discussions during the breaks and lunch/dinner.	☐	☐	☐	☐	☐

TRASH
CASH

Brainstorming session was also an important learning moment.

☐   ☐   ☐   ☐   ☐

6. Were there any other activities that in your opinion were particularly efficient for learning and/or knowledge exchange?

----

7. Sharing ideas.
Please answer if you agree or disagree with the following claims concerning the workshop.

	I totally disagree	I disagree to some extent	I don't know	I agree to some extent	I totally agree
Showing material samples and discussing about them helped in generating ideas.	☐	☐	☐	☐	☐
Discussing in a group was an efficient way to create ideas.	☐	☐	☐	☐	☐
Questions asked in group sessions gave me new ideas.	☐	☐	☐	☐	☐
Summary sessions, where the results of different groups were presented, were also moments of creating ideas.	☐	☐	☐	☐	☐
I got ideas while following the presentations given in the workshop.	☐	☐	☐	☐	☐
I got new ideas when having face-to-face discussions during the breaks and lunch/dinner.	☐	☐	☐	☐	☐
Brainstorming session was the main platform in the birth of new ideas.	☐	☐	☐	☐	☐

8. Were there any other other activities in the workshop that helped in creating and /or sharing ideas?

----

9. Feedback about the knowledge and idea exchange
Please answer if you agree or disagree with the following claims concerning the workshop.

	I totally disagree	I disagree to some extent	I don't know	I agree to some extent	I totally agree
I was able to share my knowledge to other people	☐	☐	☐	☐	☐
I was able to actively participate in discussion	☐	☐	☐	☐	☐
I feel I could freely express my ideas	☐	☐	☐	☐	☐
I actively participated in groupwork	☐	☐	☐	☐	☐
I gained a lot of new knowledge during the workshop	☐	☐	☐	☐	☐
I got new ideas during the workshop	☐	☐	☐	☐	☐
I know now better what will be done in this project	☐	☐	☐	☐	☐

10. Would you like to share some other comments or suggestions related to knowledge or idea exchange?

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Copenhagen Workshop #05 feedback

(1/5) Background information

1. Is your partner organization a *

○ company?

○ university?

○ research institute?

2. What is your personal professional background mainly about? *

○ Design

○ Business and marketing

○ Science and technology

○ Other

_____

3. Were you participating #WS05 in Copenhagen? * (*if not, person directed to page 4/5*)

○ yes

○ no

4. Was there a good balance between presentations and teamwork? *

○ Yes

○ No, too many presentations

○ No, too much teamwork

5. I was able to express

	Totally disagree	Disagree to some extent	Don't know	Agree to some extent	Totally agree
my personal/professional views during the workshop.	☐	☐	☐	☐	☐
my organization's interests.	☐	☐	☐	☐	☐

6. What did we learn at WS05?

_____

_____

_____

7. Was there enought time for networking or specific meetings? How could we improve in future?

_____

_____

_____

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8. What was the most useful session/task from your perspective, why? *

----

9. What was the least useful session for you, why?

----

10. The tools listed below were used in the workshop. Which of these tools did you find useful and why? If you did not find them useful, please explain why not.
Scenario posters
Materials samples on R&D Islands
Materials samples on Design Islands
Design Concept Area Worksheets on Design islands
Gantt chart (used by Christian in the work flow discussion)
Face stickers

----

11. How could we improve the workshops?

----

12. During Cycle A (July 2015 to August 2016) how often did you have discussions with other partners in the project? (either face to face, video/phone call or email) *

	Mainly in the workshops	Once per month or less	A few times per month	Every week	Several times per week
I had discussions with the design stream	○	○	○	○	○
I had discussions with the manufacturing stream	○	○	○	○	○
I had discussions with the science stream	○	○	○	○	○
I had discussions with people in my own WP(s)	○	○	○	○	○
I had discussions with people outside my own WP(s)	○	○	○	○	○
I had discussions with methodology team	○	○	○	○	○

13. During Cycle A has the collaboration been successful *in between* the workshops? What worked well? What didn't?

----

14. Tell us a little bit about how Trash2Cash is discussed within your own organisation in between workshops.

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15. Any other comments about cycle A? How was it?

——

——

——

16. What does the term "innovation" mean in your own field? Do you think we can achieve it in Trash-2-Cash? *

——

——

(5/5) Next workshop 06 in London
21st - 22nd November

17. Is there something you would like to discuss in the next workshop? Why?

——

——

18. Do you have any travel/location/timing issues related to WS #06?

——

——

Annexes 2 - WS agendas

WORKSHOP 08 – 2ND MILESTONE
16TH – 17TH MAY 2017 –BILBAO – SPAIN

Host partners

Cidetec & Maier

Meeting Venue

–

Contact person for any need

–

WS08 SCHEDULE
Start: May 16th gathering at 09.00; End: May 17th at 18.00
Extra-optional meeting slot Monday afternoon the 15th of May 2017 l 15.00/18.00.
You can find the meeting slot to the following Google doc link:
https://docs.google.com/spreadsheets/d/1Xpyvj7GNlFXeojYStvM92Z0uXYRlz9s9fyPbt8gO3Vg/edit?
usp=sharing

Tuesday 16th of May 2017 l 09.00/18.00

09.00 – 09.30 Registration and gathering [Cidetec staff]
Welcome and facilities

09.30 – 10.00 Agenda presentation, project re-cap, WS07 feedback
[led by Christian-MCI and Marjaana-AA]
Agenda presentation: introduction of workshop and any 'new' participants, overview of workshop activities, feedback from previous WS07 based on survey.

09.30 – 10.00 WP presentations/1st round: WP 3, 5
WP3: Quick and brief presentation about **next steps** and status: 10 minute [AA]
WP5: Quick and brief presentation about **next steps** and status: 10 minute [CIDETEC]

10.00 – 13.00 SESSION A – PROTOTYPES2 MILESTONES TABLES
Parallel session
Manufacturers/material producers present prototypes 2 taking into account design concepts as main reference. The 3 groups have max 45 minutes on each table:
Table A – De/re-polimerised PES, r-PES, r-CO, no-woven - led by Zengwei-IVF
Table B – Finishing textiles - led by Tekstina and Soktas
Table C – Reinforced plastics/plastics - led by Cidetec and Maier
[Maier talks about plastics, manufacturing process and treatments]
Here a link where you can find the outline document of P2s descriptions:
https://service.projectplace.com/pp/pp.cgi/r1361044218
10.00 – 10.05 Tables set up
10.05 – 10.50 1st round table [GroupA/TableA, GroupB/TableB, GroupC/TableC]
10.50 – 11.20 Coffee break
11.20 – 11.40 Unlocking your enthusiasm, led by Marlon-Vanberlo
11.40 – 12.15 2nd round table [GroupA/TableB, GroupB/TableC, GroupC/TableA]
12.15 – 13.00 3rd round table [GroupA/TableC, GroupB/TableA, GroupC/TableB]

13.00 – 14.00 Lunch break

14.00 – 14.40 WP presentations/2nd round: WP 2
WP2: Quick and brief presentation about **next steps** and status
VTT about pretreatment – 10 minutes
Aalto Chem about CL R&D –10 minutes
IVF about PES R&D – 10 minutes
Softer about melt mixing stream – 10 minutes

14.40 – 18.05 SESSION B – CIRCULAR ANALYSIS: LCT MEETS LCA
Parallel session led by UAL and RISE
Design Concepts & prototypes will be analysed through an Interdisciplinary approach, design and technology combine to evaluate & provide feedback to designers & manufacturers taking into account not just 'product spheres' but also business models, service dimensions, disposal etc.
You can find a complete presentation of the session to the following project place link:
https://service.projectplace.com/pp/pp.cgi/r1507037417
14:40 – 14:45 – Introduction WS Overview – how to use the tool
14:45 – 15:15 – Cluster table 1
15:15 – 15:40 – Cluster table 2
15:40 – 16:05 – Cluster table 3
16:05 – 16:30 – Coffee Break
16:30 – 16:50 – "Unlocking your enthusiasm" exercise, led by Marlon-Vanberlo
16:50 – 17:15 – Cluster table 4
17:15 – 17:40 – Cluster table 5
17:40 – 18:05 – Cluster table 6

18.05   Closure 1st day
[18:05 – 19:00 – Gustav, Lisa/RISE 'review' concepts from the session and rank for LCA in preparation for session C]

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Wednesday 17th of May 2017 | 9.00/13.00 – 14.00/18.00

09.00 – 09.30 Coffee and gathering

09.30 – 10.00 WP presentation /3rd round: WP 4, 6, 7
WP6: Quick and brief presentation about next step and status: 10 minute [CBS]
WP7: Quick and brief presentation about next step and status: 10 minute [GZI]
WP4: Quick and brief presentation about final outcomes: 10 minute [RISE]

10.00 – 13.00 SESSION C – DESIGN CONCEPTS FOR P3: NEXT STEP
Parallel session led by AALTO ARTS
Deciding at least one product type per each sector (Novel garment, Performance garment
and automotive) for further studies in each WPs. The emphasis is on LCA and sorting,
industrial scalability, ability to prototype and consumer acceptance of the product type.
You can find a presentation of the session to the following project place link:
https://service.projectplace.com/pp/pp.cgi/r1354327945

10.00 – 10.05 Aim and output of the session
10.05 – 10.15 Instructions, what to do in the session
10.15 – 11.25 Group work; evaluation of product types from each WP- perspective
11.25 – 11.40 Coffee break
11.40 – 12.00 "**Unlocking your enthusiasm**" exercise   **, led by Marlon-Vanberlo**
12.00 – 12.20 Showing results of the discussion
12.20 – 13.00 Decision making phase

13.00 – 14.00 Lunch break

14.00 – 14.20 WP presentations/4th round: WP 8, 9
WP9: Quick and brief presentation about next steps – 2 milestone report: 10 minute [RISE]
WP8: Quick and brief presentation about next steps and status: 10 minute [UAL]

14.20 – 17.30 SESSION D – THE STORYTELLING AND THE VISUAL
Common session led by UAL, CBS and VANBERLO
Inspiring and insightful reflections/discussions on design concepts from the
dissemination/exploitation/networking perspectives in order to elaborate idea/proposals to
increase their storytelling potentials and the visual appealing for the next design step.
You can find a presentation of the session to the following project place link:
https://service.projectplace.com/pp/pp.cgi/r1352313966

14.20 – 14.30 General Intro: overview and specific aims
<u>Part 1: Brand Stories by VANBERLO</u>
14.30 – 14.40 Intro with examples
14.40 – 15.10 Brainstorming divided in 5 groups
15.10 – 15.30 Outcomes presentation, 4 minutes for each group
<u>Part 2: User Stories by CBS</u>
15.30 – 15.40 Intro with examples
15.40 – 16.20 Brainstorming divided in 4 groups
16.20 – 16.40 Coffee break
16.40 – 17.00 "**Unlocking your enthusiasm**" exercise   **, led by Marlon-Vanberlo**
17.00 – 17.10 Outcomes presentation, 5 minutes for each group
<u>Part 3: Research Stories by UAL</u>
17.10 – 17.15 Intro to the task
17.15 – 17.35 Solitary reflection onto A4 profile sheet
17.3 5 – 17.4 0 '"Pin up"

17.40 – 18.00 Sum up of the 2 days workshop and tips&tops roundtable [RISE, MCI]

18.00   Workshop Closure

WORKSHOP 11
11TH – 12TH JUNE 2018 – GOTHENBURG [BORÅS], SWEDEN

Host partners

RISE - Research Institutes of Sweden

Meeting Venue

Textile Fashion Center

Skaraborgsvägen 3 a

Sverige

Borås, Sweden

http://textilefashioncenter.se/?lang=en

Contact person for any need

–

WS11 SCHEDULE
Start: June 11th gathering at 08.0 0; End: June 12th at 18.00

Monday the 11th of June 2018 | 08.30/13.00 – 14.00/18.00

08.00 – 09.00 **Set up of an informal-draft internal exhibition**
Facilitated by UAL, MCI, designers
All material will be grouped and organized: Master Cases A3 posters,   draft brand DNA posters, product drawings and/or patterns, draft business models A3s, primary P3 prototypes + other P1 & P2 prototypes, material samples, etc.
The set up will be l ocated into the WS space and will be useful for session A and B and during the whole workshop.

09.00 – 09.30 Registration and gathering [RISE staff] - Welcome coffee and
Partners will add materials into the   internal -exhibitions set up

09.30 – 10.00 Agenda presentation, project re-cap, WS10 feedback
Led by Christian -MCI and Marjaana -AA
info about facilities , agenda presentation: intro to workshop and feedback survey from previous WS10

10.00 – 10.20 WP presentations/1st round: WP3, WP5
- WP3: Quick and brief presentation about **next steps** and status [10 min.] – AA
- WP5: Quick and brief presentation about **next steps** and status [10 min.] – Cidetec

10.20 – 13.00 SESSION A – MCs UPDATING: STATUS & PRODUCT STORIES – 1st part
- **Designing and prototyping status**
Facilitated by Elina -AA, Virginie -Cidetec [about 60 min.]
Quick common re-cap and review of status and possible issues about Master Cases made by WP3 and WP5 leader , using the internal exhibition as basis of   presentation and discussion

11.20 – 11.40 Coffee break/fresh air (20   min) + check the internal exhibition: free discussion about prototypes: to write down considerations (20 min)

- **Primary findings/inputs about consumer barriers and communication strategies**
Led by CBS [30 min.]
Presentation + Q&A about the forthcoming results from CBS research and to use new inputs into the Brand DNA activities (next slot).
- **Parallel Sessions [50 min.]**
The partners will be divided in 2 groups: designers+ manufacturers, R&D+tech. experts
<u>Designers+manufacturers G roup</u>
Facilitate by Julie 6 Jelske -Vanberlo, Wencke -CBS
Refinement session of (MCs*)   **Product Stories**: checking with partners for each master case what is available yet and see how this works (impact) as a coherent and whole product story (from sorting, to regene rations processing technologies,   to final sale, to collection, etc.).
*1-Mono-aesthetic Shirt [GZI]; 2 -Eco-Fleece [REIMA]; 3 -Active shirt [REIMA]; 4 -Active Denim [REIMA]; 5 -Recyclable Rainwear [REIMA]; 6   -Laser -Mised/Relief [MAIER]
<u>R&D+tech. experts G roup</u>
Facilitated by Emma -RISE
The representative of the 3 **Processing Technologies** (regenerated CL, regenerated PET, upgraded PET plastic) will have about 20 min. each to inform and discuss   about the other R&D people about final findin gs, tech-issues, final tech -deliverables, the presentation of the 2nd day, etc.

13.00 – 14.00 Lunch break

14.00-14.10   Quick recap of the previous parallel discussion s
Led by Emma -RISE, Julie -Vanberlo

14.10 – 15.30 SESSION A – MCs UPDATING: PRODUCT STORIES – 2nd part
Facilitate by Julie & Jelske -Vanberlo + designers
All partner will be divided in small groups to go through the MCs*: the previous groups can discuss with technical people about specific tech. questions/issues, including them into the

discussion of product stories.
*1-Mono-aesthetic Shirt [GZI]; 2-Eco-Fleece [REIMA]; 3-Active shirt [REIMA]; 4-Active
Denim [REIMA]; 5-Recyclable Rainwear [REIMA]; 6-Laser-Mised/Relief [MAIER]

15.30 – 16.10 Coffee break/fresh air (20min) + check the internal exhibition: free discussion about WS12
exhibition: to write down considerations (20 min)

16.10 – 18.00 SESSION B – EXPLOITING & DISSEMINATING: LAST STEPS
Led by Becky UAL
• Exhibition design concept: look and feel + Q&A session to provide inputs [Julie & Jelske - Vanberlo – 30 min.]
• Quick and brief presentation about WP8 status, issues/solutions [UAL – 10 min.]
• Exhibition design concept: preparation, roles & expectations [UAL – 30 min.]
• Final dissemination plans: publishing, exhibiting, other [UAL – 20 min.]
• Final exploitation plans: what is new? more detail [UAL – 20 min.]

18.00   Closure 1st day

18.00-19.00   Steering Committee meeting [only the WP Leaders]
Led by Emma-RISE

Tuesday the 12th of June 2018 l 08.30/13.00 – 14.00/18.00

08.00 – 08.30 Gathering and welcome coffee

08.30 – 09.30 WP presentations/2nd round: WP 6, 7, 2
• WP2: New findings about material properties and news about processing technologies [30 min.] – Aalto+IVF+Softer
• WP6: Quick and brief presentation about **next steps** and status [10 min.] – CBS
• WP7: Quick and brief presentation about **next steps** and status [10 min.] – GZI

09.30 – 13.00 SESSION C – MCs UPGRADING: FINALIZING BUSINESS MODELS & INDUSTRIAL PROCESSES

• **Updated LCA flowcharts**
Led by Gustav and Bjorn-Rise [30 min.]
Presentation of the updated LCA flowcharts related to the 4 selected Master Cases* in order to point out missing info and mainly to provide input to the partners for the next slot.
*MonoAesthetic-Men's Shirt, Active Denim-Junior's jeans, Recyclable Rainwear-Kit's rain cape, Laser Mised- Automotive interior central console fascia

• **Parallel sessions**
Short explanation of the sessions
Partners will be divided in two big groups considering their competences
Business models/services table [120 min.]
Facilitate by Dawn-UAL, note takers: table3 Virginie-Cidetec table4 Kirsi-Reima
Tool: pre-filled business model canvas (already used in WS 10 and available onto the project place, see homework).
Designers, manufacturers, and suitable experts will work on the creative level of the business models and services level. These partners will be divided in 2 small groups to work on 2 of the 4 Canvas of the MCs before to work on the other 2 after the first round. (1 round will take about 1 hour). It will be considered a LCT approach, using the T2C LCT tool as map of reference.
Industrial processes/logistics table [120 min.]
Facilitate by Enrico-GZI, note takers: table1 Ahmed-Soktas, table2 Lucija-Tekstina
Tool: industrial process flowcharts (already used in WS 10 and available onto the project place, see homework)
R&D people, material, manufacturing processes experts and technical partners will work on the industrial processes and logistics related to the selected MCs. These partners will be divide on 2 smallest groups to work on 2 of the 4 flowcharts of the Master Cases before to work on the other 2 after the first round. (1 round will take about 1 hour).

11.20 – 11.40 [after the 1st round] Coffee break/fresh air (20 min.) + check the internal exhibition: free discussion about Master Cases Status and previous considerations: to write down new considerations

• **Quick recap [10 min.]**
Enrico-GZI and Wencke-CBS will made a quick sum-up of the session.

13.00 – 14.00 Lunch break

14.00 – 17.00 SESSION D – DDMI METHODOLOGY: BUILDING A MODEL
[Facilitated by Rosie-UAL and Marjaana-AA]
• Intro to task5 of WP3: steps and aims
• Methodology research: key findings and main outputs
• Looking for the DDMI approach: through the Master Cases and personal perspective

15.40 – 16.20 Coffee break/fresh air (20 min) + check the internal exhibition: free discussion about Master Cases and DDMI: to write down new considerations

17.00 – 17.30 WP presentations/4th round: WP9
WP9: Quick and brief presentation about general project issues (amendments?) and Steering Committee discussion: 20 minute – RISE

17.30 – 18.00 Tops of WS11 and tips about final showcasing [RISE, MCI]

18.00   Workshop Closure

Optional Visit to Swerea IVF: Wednesday the 13th of June 2018 l 09.00-12.00
Gothenburg - Mölndal, Sweden [30 min. from Göteborg Landvetter airport]
For info check the pdf file into the project place: https://service.projectplace.com/pp/pp.cgi/r1285978298

Annexes 3 – List of publications

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T2C DDMI PAPERS

Circular Economy Innovation & Design (Biological Systems)
Prof Rebecca Earley
2016
https://www.youtube.com/watch?v=oF_cnXv-0Sc

Dynamic Duos: exploring design-science material innovation partnerships (event report)
Hornbuckle, R.
Report from the Dynamic Duos event: UAL, London
2017
https://issuu.com/trash2cash/docs/event_report_1/1?ff=true
&e=30581983/58614403

Outside the "Comfort Zone"; Designing Unknown in a Multidisciplinary Setting
Niinimäki, K. Tanttu, M. Kohtala, C.
The 12th European Academy of Design Conference: Design for next: Rome. (The Design Journal; vol. 20, no. Supplement 1)
2017
https://doi.org/10.1080/14606925.2017.1352940

Colours in Circular Economy
Eugenia Smirnova, Elina Ilén, Herbert Sixta, Michael Hummel, Kirsi Niinimäki
Circular Transitions conference: London
2016
http://circulartransitions.org/media/downloads/Circular-Transitions-
Proceedings.pdf

Can Design-Driven Material Innovation Also Drive Circularity?
Tanttu.M., Kohtala, C., Niinimäki, K.
Circular Transitions conference: London
2016
http://circulartransitions.org/media/downloads/Circular-Transitions-
Proceedings.pdf

Designing in a Circular Economy Context (chapter)
Niinimäki, K., Tanttu, M., Smirnova, E. Lost in the Wood(s): The New Biomateriality in Finland. Kääriäinen, P. & Tervinen, L. (eds.), Aalto Arts Books
2017
https://research.aalto.fi/files/17189302/7.7.17_Designing_for_the_circular_
economy.pdf

Postcards from Across Europe: Exploring the Edges of Regenerated Fibre Development and Design Driven Material Innovation
Earley, R. & Hornbuckle, R.
IOP Conference Series: Materials, Science and Engineering, Autex, Greece
2017
http://iopscience.iop.org/article/10.1088/1757-899X/254/21/212002/pdf

YABBA DABBA DOO: Boosting Multidisciplinary Innovation through Design-driven Approach
Niinimäki, K
21st DMI: Academic Design Management Conference: Ravensbourne University, London, UK
2018. https://www.dmi.org/page/ADMC2018Proceedings

Face-ing Collaboration: A Meditation on the Faces of Circular Fashion Research
Earley & Hornbuckle
Journal of Textile Design Research and Practice, Taylor & Francis
2018
https://www.tandfonline.com/doi/full/10.1080/20511787.2018.1478703

Material Liaisons: Facilitating Communication in Design-Driven Material innovation (DDMI) Projects
Hornbuckle, R.
Design Research Society (DRS) Conference: Limerick, Ireland
2018
http://www.drs2018limerick.org/participation/proceedings

Circular Textile Design: Old Myths and New Models (chapter)
Earley, R. and Goldworthy, K.
Designing for the Circular Economy: Routledge
2018

What Else Do We Know? Exploring Alternative Applications of Design Knowledge and Skills in the Development of Circular Textiles
Hornbuckle, R.
Journal of Textile Design Research and Practice
2018

Building Bridges: Design Researchers Making Podcasts to Support Internal Collaboration in an EU Horizon 2020 Scientific Programme
Earley, R.
European Academy of Design (EAD13), Dundee University (Routledge)
2019

Collaborative Circular Design. Incorporating Life Cycle Thinking into an Interdisciplinary Design Process
Goldsworthy, K. & Ellams, D.
European Academy of Design (EAD13), Dundee University (Routledge)
2019

Addressing the Dialogue between Design, Sorting and Recycling in a Circular Economy
Karell, E. & Niinimäki, N.
European Academy of Design (EAD13), Dundee University (Routledge)
2019

Renewing technology-driven materials research through an experimental co-design approach
Niinimäki, K.
European Academy of Design (EAD13), Dundee University (Routledge)
2019
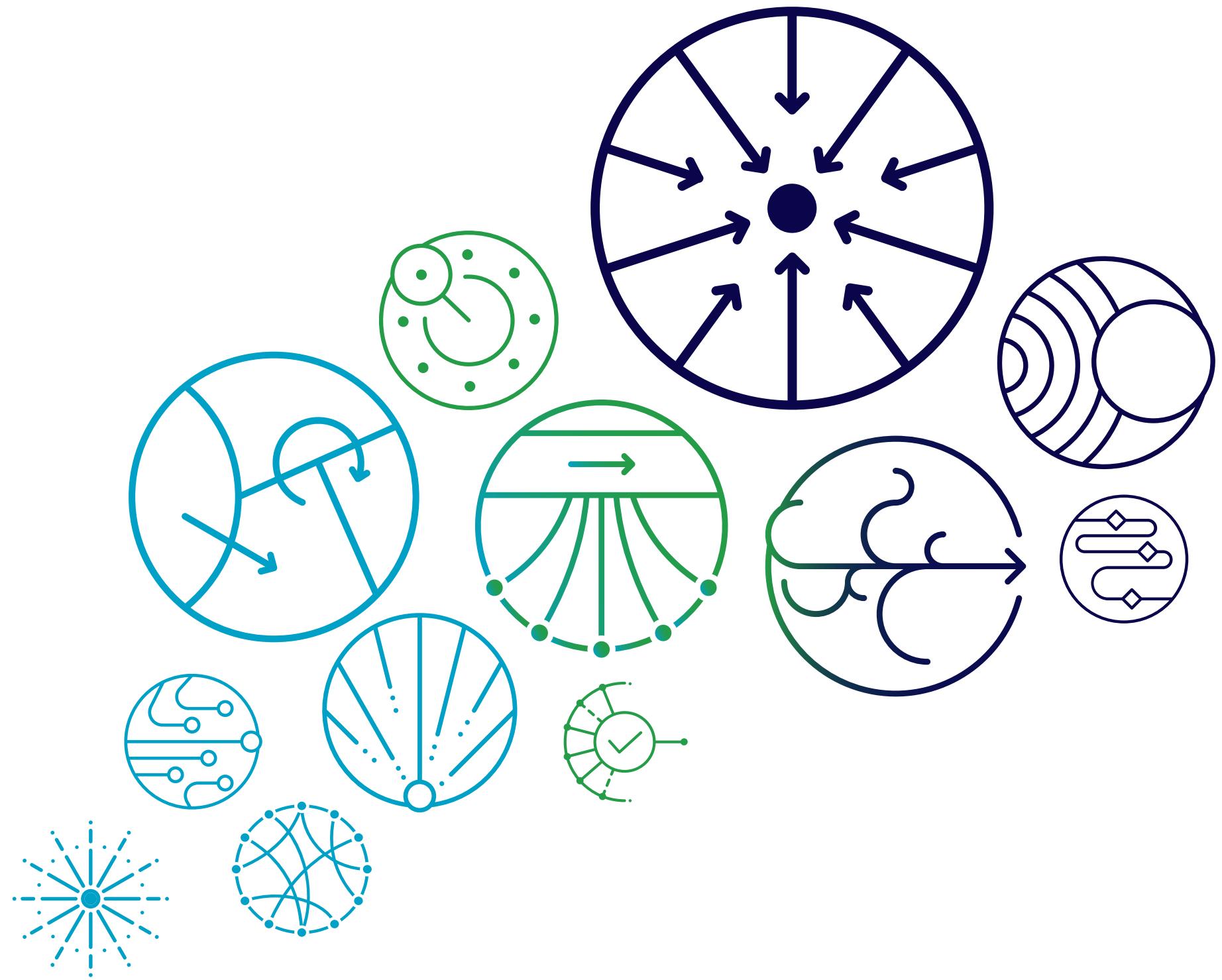
For further information, please visit:
www.trash2cashproject.eu

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