

D1.3: Description of the Building Blocks and Pillar Actions methodology



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List of acronyms / abbreviations used in this document

Acronym / abbreviation	Definition
BB	Building Blocks
PA	Pillar Actions
CE	Circular Economy
WP	Work Package

Summary

This deliverable describes the work achieved in T1.3 on the Building Blocks and Pillar Action Methodology definition and validation. The outcomes are based on the previous inputs provided by D1.1 and are enriched by the results of the expert workshop led in Lyon in M3, the content of the Rome's workshop that was organized in the framework of WP1 and T1.2, and several internal discussions within WP1 partners. The report starts with an introduction regarding the context and the objectives of Building Blocks, Pillar Actions, as well as the impacts that are expected to reach by shifting to a Circular Economy in Europe. It also explains how the Lyon's workshop was organized by T1.3 participants. Then, the second section details the methodology that was designed and implemented to run the expert workshop. The third section reports the workshop, in particular the different sessions that were organized and the results of the meeting. Finally, in the conclusion, the deliverable presents the reference scheme of Building Blocks and Pillar Actions that were validated by all WP1 participants and that will be used as a tool for the next WP in the FUTURING projects.

1 Introduction

This deliverable D1.3 is part of WP1 dealing with setting-up the framework, vision and canvas of analysis of Circular Economy (CE) that will be achieved in the next WPs. Since CE covers a broad range of dimensions and thematic, from technology, business, environment to regulations, it is very important to build a methodology that will enable to properly select, describe and map the different inputs gathered all along the FUTURING project. More generally, the Circular Economy approach developed in FUTURING is based on the concept of “House of Circular Economy” which relies on Building Blocks (BB), Pillar Actions (PA) and impacts on Profit / Planet / People¹ as described in Figure 1.

Circular Economy approach : Building Blocks / Pillar Actions and impacts, towards the “House of Circular Economy”

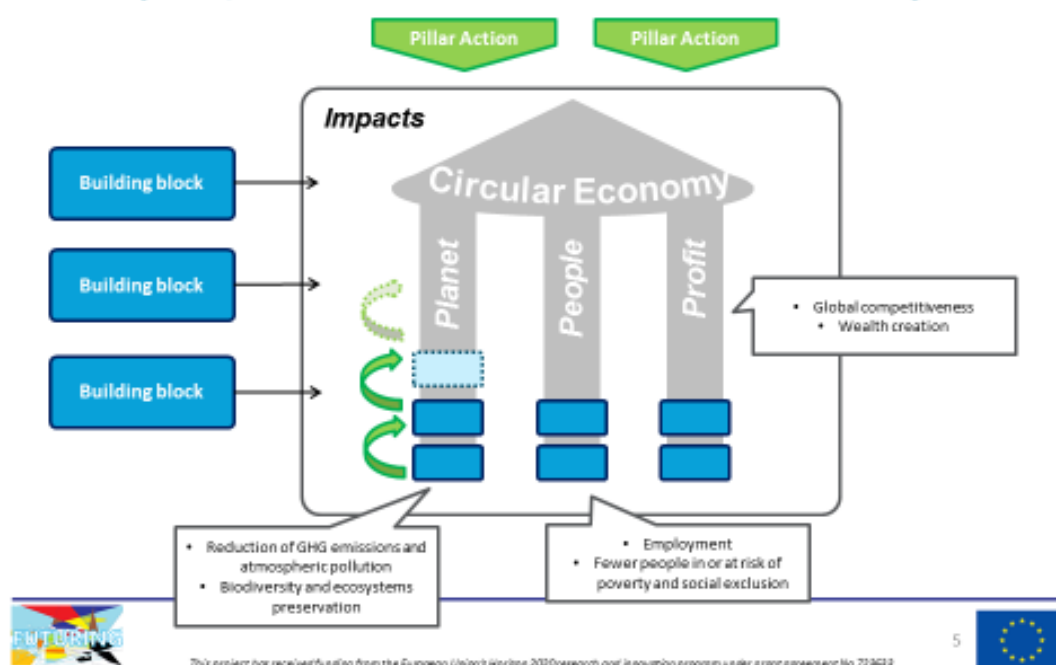


Figure 1: “House of Circular Economy” based on Building Blocks, Pillar Actions and illustrating impacts on Planet / People / Profit

Task T.1.3 has the goal to propose a reference scheme for the Building Blocks (BB) and Pillar Actions (PA). As described in the DOW and Figures 2 and 3, BB represent the different dimensions of CE, whereas PA describe some complementary ways to implement CE. To keep

¹ Planet: Efficient & effective use of natural resources minimizing the ecological footprint of production & consumption ;

People: fair & beneficial business practices toward labour and the community and region in which a corporation conducts its business ;

Profit: following economic principles, profit is the entrepreneurial incentive for value creation.

the metaphor of the House of CE, BB will represent the different type of bricks needed to the construction and PA will represent the work necessary to put these bricks together to build the whole House.

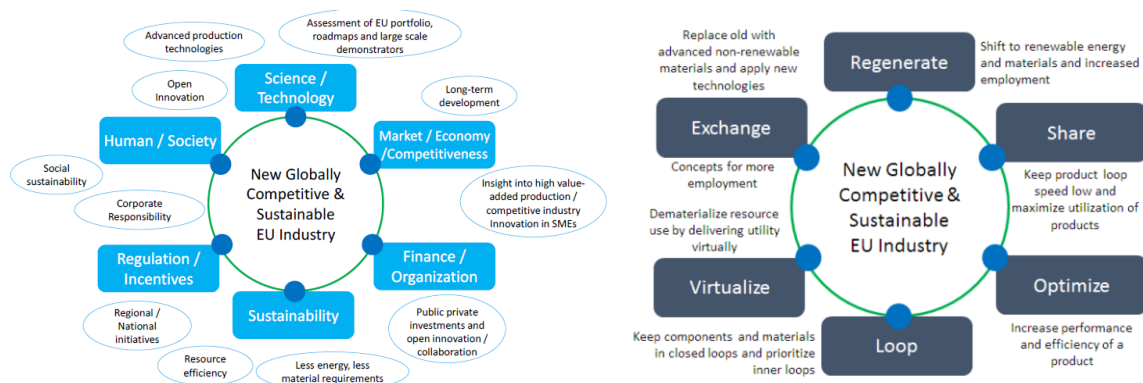


Figure 2 and 3: Building blocks for developing the vision of EU re-industrialization. Pillar Actions for developing the vision of EU reindustrialization in a circular economy

1.1 Aim of the report

This report will explain the process of identification, selection and validation of the BB and PA. It will serve as a grounding reference for the next WPs in order to have a common tool to map the different projects / initiatives / programs or any other input linked with CE during the project. This will ensure a good consensus of understanding of the topics to avoid out of scope, misinterpretation, overlap, or gaps in the analysis toward consistent and robust recommendations.

1.2 Link with other FUTURING WPs and tasks

Task 1.3 is strongly connected with T1.1 and T1.2 within the same WP1 dealing with setting-up a common framework of CE, though it will specifically focus on the BB and PA. Therefore, it is a complementary task that must derive from the perimeter of CE (D1.1) and be consistent with the different scenarios envisaged in the future (D1.2)².

Task 1.3 will also have a strong link with WP2, especially T2.1, T2.2 and T2.3. The outcomes presented in this deliverable D1.3 will be used as a reference scheme to illustrate the different interconnections between BB and PA, as well as the impact of digitalization on them (D2.1). Besides, a selection of 20 EU-projects will be mapped according to the BB and PA methodology to be analyzed and deepened by interviews in order to identify the barriers and enablers of CE (D2.2). Finally, a business and civil survey will complete this institutional overview of T2.2

² Related workshop was held in Rome in January, organized by COTEC as T1.2 leader

by a field analysis that will also rely on the segmentation of CE based on BB and PA (D2.3). This systematic canvas of work will enable to make comparison and will ease a clear presentation.

Task 1.3 will be used for WP3 and WP4 as a reference tool to run the international benchmark of cases, ensuring a common mapping with WP2 and thus will enrich the EU scope with other return of experiments, which will feed the reflection for the recommendations to be built in WP4.

Finally, Task 1.3 will be useful for the WP5 Dissemination since it will be a practical tool to clearly present and explain CE to a non-expert panel.

1.3 Workshop organization

In complement of desk research and the work done in T1.1 and T.1.2, the BB and PA methodology has been developed thanks to the organization of a workshop that was held in Lyon on the 1st of December. The workshop was organized by CEA and TECNALIA, with the support of LMS. The team has identified and invited a panel of 18 experts and stakeholders from all across Europe who were selected on the basis of the background and experience in the field of Circular Economy. The meeting lasted a full day and the agenda was composed of two sessions that will be presented in details in this deliverable. The objectives of the workshop was to identify and validate BB and PA by this panel in order to have a common and approved understanding of the CE canvas that could be used for the next tasks in the project. Apart from that, the Lyon's workshop was a great occasion to gather a great amount of cutting-edge information about CE (like projects or contacts) that can be directly used in other tasks and WPs in the project. As an example, some experts quoted very relevant EU projects that will be added to the portfolio in T2.2.

2 Methodology

This section will describe the methodology that has been designed and implemented for the Lyon's workshop on December 1st. According to the DOW, T1.3 has planned to organize a workshop in M3 in order to validate the different BB and PA to build a robust methodology for analyzing CE. This workshop relied on a methodology based on some preliminary work and a structured agenda using advanced tools for brainstorming and for reaching consensus amongst a wide panel of expert and stakeholder. To achieve this goal, a task force has been set gathering CEA and TECNALIA efforts, with the support of LMS.

2.1 Preliminary work from FUTURING consortium

Location and participants

CEA proposed to host the workshop in France in a convenient location so that the event was attractive for participants coming from all across Europe. Thus, it was hosted at Lyon's airport

and CEA took in charge the logistics of the event to welcome the 18 participants (the list is presented in Annex C). TECNALIA and LMS greatly contributed to identify within their network a number of experts to be invited. CEA proposed also several contacts that are involved in Research & Innovation (R&I) collaborations in the field of CE. Considering the constraints of time and focused scope of background targeted, it was difficult to respect a fair balance of gender (only 3 women for 15 men), but FUTURING is aware of this issue and the consortium will try to take it more into account during the next tasks and events for example by planning invitations more in advance if possible.

First draft of Building Blocks

Based on the DOW, D1.1, Task 1.2 and an extensive review of literature, it was possible to build a first draft of Building Blocks. TECNALIA checked key sources and provided a synthesis of several publications (see Annex A). The intention of the literature review was two-fold. Firstly, it was aimed at assuring a common understanding of what each building block is about and thus contributing to an effective discussion among the workshop participants. For that purpose, a definition for each building block was elaborated. These definitions were included as headlines on the posters displayed on the walls. Secondly, it was intended to help the FUTURING partners to facilitate the discussion of the groups. Therefore, it contained some key topics and/or challenges for each building block that the facilitators used as a reference document during the poster session. Two conference calls were organized between CEA, TECNALIA and LMS in order to collectively brainstorm and design a set of basic ideas on which the workshop would run.

Basically, the preliminary work outcomes were the five draft BBs:

Science & Technology
Business & Innovation
Human being & Society
Policy & Finance (a cross-cutting BB)
Environmental sustainability (a cross-cutting BB)

First draft of Pillar Actions

Pillar Actions are derived from the report “Delivering the Circular Economy: a toolkit for policy makers” by the Ellen Mac Arthur Foundation³ which stands as a worldwide reference in the domain of CE. Instead of brainstorming about new types of actions, CEA, TECNALIA and LMS decided to start from this existing consensus of PA to elaborate a questionnaire for the Lyon’s workshop asking the experts and stakeholders to give practical return of experiment and / or example of projects / initiatives / organization that fit for each type of PA, as Table 1 explains.

³ https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_PolicymakerToolkit.pdf

In FUTURING, these PA will be challenged, exemplified throughout the WPs, thanks to the EU-projects portfolio assessment (T2.2), the business and civil society consultation survey (T2.3), the benchmark of cases / strategies for CE (WP3) and it could be possible to recommend in WP4 a set of policy recommendations that could derive from the FUTURING outcomes, as an extension of the grounding PA created by Ellen Mac Arthur Foundation. Of course, to ensure an adhesion of these Key Actions toward Reindustrialization in Europe, FUTURING will have to argue on their soundness and reach a consensus amongst experts and stakeholders. As a conclusion, one must take PA as a starting point to map the different ways to implement CE rather than a fixed strategy.

Pillar Actions description

Pillar Action	Description (according to Ellen Mac Arthur Foundation)
REGENERATE	<ul style="list-style-type: none"> Shift to renewable energy and materials; Reclaim, retain, and regenerate health of ecosystems; Return recovered biological resources to the biosphere.
SHARE	<ul style="list-style-type: none"> Keep product loop speed low and maximize utilization of products by sharing them among users (peer-to-peer sharing of privately owned products or public sharing of a pool of products), reusing them throughout their technical lifetime (second-hand), and prolonging their life through maintenance, repair, and design for durability.
OPTIMISE	<ul style="list-style-type: none"> Increase performance/efficiency of a product; Remove waste in production and the supply chain (from sourcing and logistics to production, use, and end-of-use collection); Leverage big data, automation, remote sensing, and steering. None of these actions requires changing the product or technology, as exemplified by the lean philosophy made famous by Toyota.
LOOP	<ul style="list-style-type: none"> Keep components and materials in closed loops and prioritise inner loops. For finite materials, this means remanufacturing products or components and as a last resort recycling materials, as e.g. Caterpillar, Michelin, Rolls Royce, and Renault are doing. For renewable materials, this means anaerobic digestion and extracting bio-chemicals from organic waste.
VIRTUALISE	<ul style="list-style-type: none"> Deliver utility virtually – books or music, online shopping, fleets of autonomous vehicles, and virtual offices.
EXCHANGE	<ul style="list-style-type: none"> Replace old materials with advanced renewable materials; Apply new technologies (e.g. 3D printing and electric engines); Choose new products and services (e.g. multi-modal transport).

NB : This segmentation is a starting point in FUTURING, as a well-known and agreed reference in CE, and will be exemplified, challenged and enriched by WP2 / WP3 and WP4 works.



Table 1: the 6 Pillar Actions according to the Ellen MacArthur Foundation

Finally, CEA created and printed 5 posters (one per each BB) and a template questionnaire on the PA that was printed to be filled by the workshop participant. CEA proposed an ad-hoc methodology to lead the workshop based on its previous experience in several CSA. This methodology is described in the next paragraph.

2.2 Workshop

2.2.1 Poster Session

A poster session intends to offer a structured and pleasant methodology to animate a brainstorming with experts. Instead of a face to face meeting with a moderator and participants that bring ideas, it enables a collective interaction that goes beyond simple ideas collection. It is a tool to reach a consensus by cross-analyzing opinions, identifying gaps, reformulating rough ideas, focusing on common concepts etc... Apart from that, it is a more dynamical way to participate, thus ensuring that all participants remain active until the end of the workshop. Figure 4 summarize the overall methodology of the poster session. It was divided into two parts:

Part I (90 minutes): After set-up of the posters, all participants were asked to walk around the meeting room and discover the different Building Blocks. In order to stimulate ideas, some criteria were already written on poster by the moderators, but without any obligation for the experts and stakeholders to limit or agree with these. Then, two groups were formed (see Annex D) and the participants were asked to write their ideas on paper labels that they could stick onto the corresponding poster. Two rules were proposed: (i) 1 label = 1 key driver according to the Building Block on the poster and (ii) any amount of label per participant permitted. At this stage, there was no restriction or attempt to reach a consensus, just putting rough ideas together on the posters.

Part II (30 minutes): Once all posters were filled with labels, participants were asked to vote for the labels they agree the most with (and not only theirs!). For this purpose, a “budget” of dots was distributed: a total of 6 dots / poster / participant. The rules to follow were: (i) top 1 priority = 3 dots, top 2 priority = 2 dots and top 3 priority = 1 dot; (ii) it is not obliged to spend all dots (a participant can simply give one priority, thus putting 3 dots out of the 6 potential for a poster). All participants put their dots on each poster and at the end, the moderators added all dots to rank the criteria. When some criteria were very close in meaning / topic / idea, the moderators merged the criteria and corresponding votes to form a new family of criteria.

Conclusion: After the two parts, the moderators have quickly reported the results onto slides so that experts and stakeholders were able to comment during the general discussion in order to reach a consensus before ending the workshop. This analysis was done during the individual worksheet session (60 minutes) that is described in the next paragraph.

Poster session : methodology

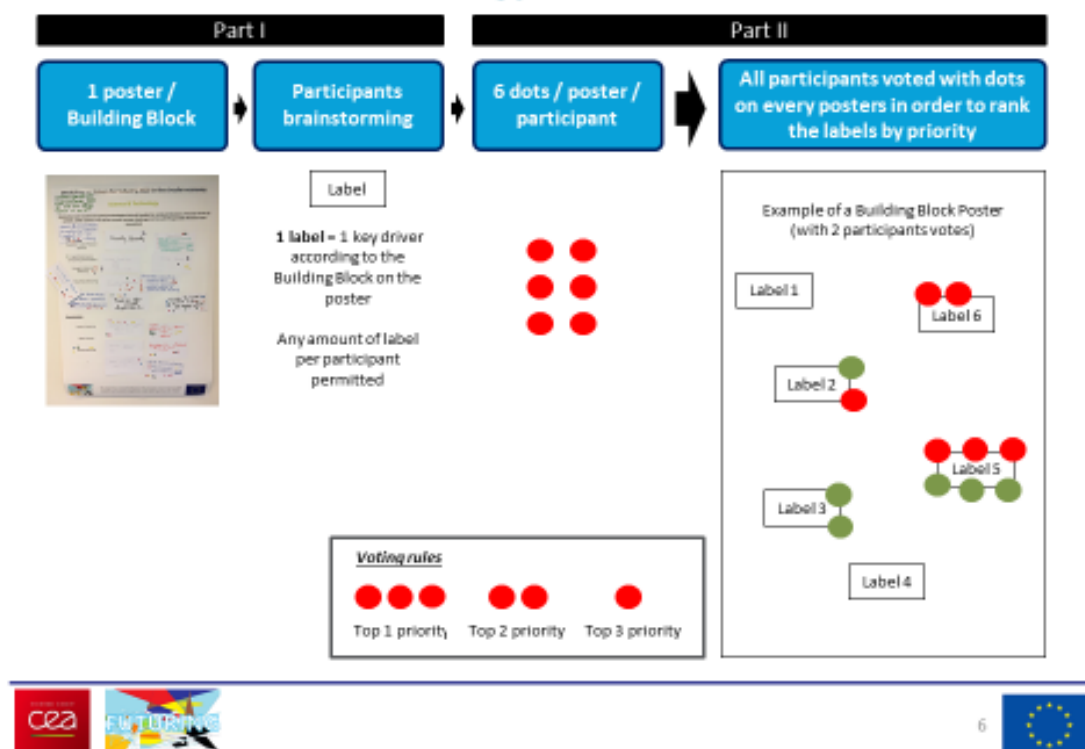


Figure 4: Overview of the poster session methodology

Rule for selection - threshold: since it is neither convenient nor relevant to keep all criteria (even those with very low ranks), a rule is proposed to set-up a threshold. Only criteria with >5% of votes will be kept: it represents at least 4 dots⁴, thus at least 2 second-choice from two different participant. Therefore, it will not be possible for a criterion to be selected for the final ranking if it was chosen just by one participant, even if it was on his top1 priority (3 dots). This rule aims to ensure a minimum of consensus in the selection of the criteria.

2.2.2 Individual Worksheet session

The workshop offered the opportunity not only to lead a collective brainstorm with experts from CE to validate BBs, but also to gathered qualitative and more personal return of experiment. Of course, this was not possible to do it during the poster session because organizational issue, number of participants, disposition to speak in public etc... That is why the moderators proposed to work individually on questionnaires (paper or electronic format) based on a questionnaire that was elaborated before the workshop. This questionnaire is presented in Annex E. The objectives were (i) to ask participants to describe in a more qualitative way for each BB his personal view of barriers, as a complement to the poster

⁴ Per poster: 14 participants (we exclude the 4 moderators that didn't vote) with 6 dots = 84 dots. 4 votes out of 84 result in about 5% of votes

session, and also to provide with practical feedback from his own experience in previous / on-going projects. The participants were also asked to note references of projects, contacts, initiatives that might be interesting to dig further in FUTURING; (ii) to ask participants to exemplify Pillar Actions (PA) – the difference between BB and PA will be described in the next paragraphs – based on return of experiment or knowledge. This will be useful to challenge the current common definition of CE and to illustrate theoretical concepts with real concrete cases in order to analyze the barriers / limitations to the current trends of CE in Europe. This questionnaire will also enable FUTURING partners to refer to a specific expert in case of doubt or need for a precision about a given input; that would not have been possible only by the poster session.

3 Minutes of the Lyon Workshop

This section will describe the content of the workshop meeting that occurred on December 1st in Lyon, following the agenda that is represented in Annex B.

3.1 Introduction to FUTURING and RESCOM projects

LMS opened the workshop by welcoming the participants and presenting an overview of the FUTURING project. FESTO took this opportunity to show the results from the very first task T1.1 based on the outcomes of D1.1. A preliminary exchange between experts and stakeholders started about the relative importance of several dimension in CE, such as Technology, Human Being, Policy & Finance, which was totally in line with the upcoming exercise of the day to define and validate a common canvas of BB to lead an accurate analysis of CE.

Then, Mr Amir Rashid, coordinator of the EU-funded project RESCOM (Resource Conservative Manufacturing), made a very interesting presentation, which closely deals with the topic of Circular Economy. Therefore, it was a very relevant example of implementation of CE, also participating to stimulate ideas from the group for the upcoming exercise. The main objective of the project is the development of the ResCoM software platform: a collaborative decision-support platform based on product lifecycle management (PLM) and material information management software modules. The platform complimented by further circular design tools will help guide company decisions by illustrating the benefits of closed-loop product design in terms of economic impact, resource efficiency, CO2 emissions and energy use.



Figure 5: Presentation of the FUTURING project

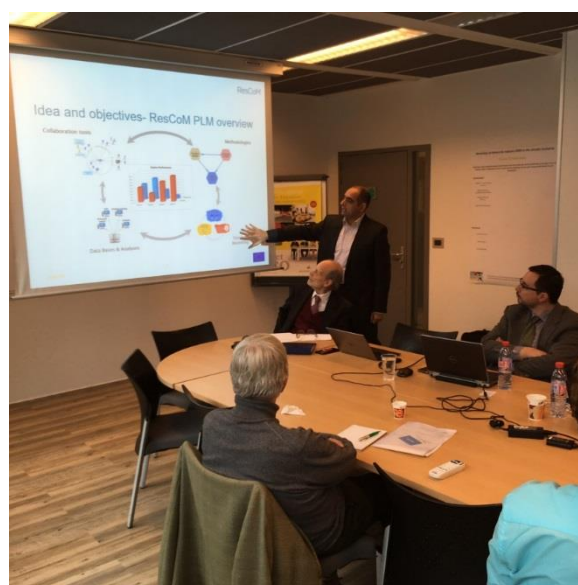


Figure 6: Presentation of ResCoM project

3.2 Introduction to Experts

After the introduction by LMS, a round table enabled all participants to introduce themselves, in particular the experts that highlighted their specific field of expertise. This has been helpful to the moderators to form the two groups (see Annex D) according to the complementarity of background of the participants.

<i>Name</i>	<i>Organization</i>	<i>Country</i>	<i>Field of expertise</i>
Nicolas DEFRENNE	PV Cycle	FRANCE	Take-back scheme of photovoltaics
Bertrand FILLON	IPC	FRANCE	Polymers and composites
Amir RASHID	KTH	SWEDEN	Production engineering
Koen DITTRICH	Erasmus RSM	NETHERLANDS	Innovation management + circular economy + smart city

Jan MENEVE	VITO	BELGIUM	Materials technology for Circular Economy (technical +non-technical background)
Luc FEDERZONI	CABRISS EU-project	FRANCE	Recycling of photovoltaics. Scarce materials' reuse, refurbishment
Minna LANZ	Tampere Univ.	FINLAND	Production, sustainable manufacturing
Tommy HÖGLUND	Acreo	SWEDEN	Printed electronics

Table 2: List of experts and their fields of expertise

3.3 Building Blocks analysis

As described in 2.1, the building blocks analysis was led during the poster session. 5 posters were set up in the meeting room so that experts and stakeholders could brainstorm collectively and complete each poster with their ideas. The hosts (CEA, TECNALIA) have helped to guide the participants (split in two groups) and animate the session.

3.3.1 Science & Technology

This Building Block aims to describe distinctive (and market disruptive) technologies (at different TRLs) that will enable the reindustrialization of Europe in the CE context, while solving some of the current societal challenges (in line with Responsible Research and Innovation). The poster was split into two sections: key technologies and characteristics. The first section intends to gather practical examples of technologies and / or processes (such as Cyber Physical Systems), whereas the second section aims to describe the important features of these technologies to ensure their transfer to the CE (such as the level of maturity). Figure 7 is a photograph of the poster at the end of the session that shows all contributions from experts and stakeholders.



Figure 7: Poster session (1/2)



Figure 7: Poster session (2/2)

The table 3 represents the results of the Science & Technology Building Block based on the ranking of the different criteria. Some comments in the right column illustrate that many criteria can be gathered into new created families or merged with other criteria from different Building Blocks. This analysis will be led further in the conclusion (section 4).

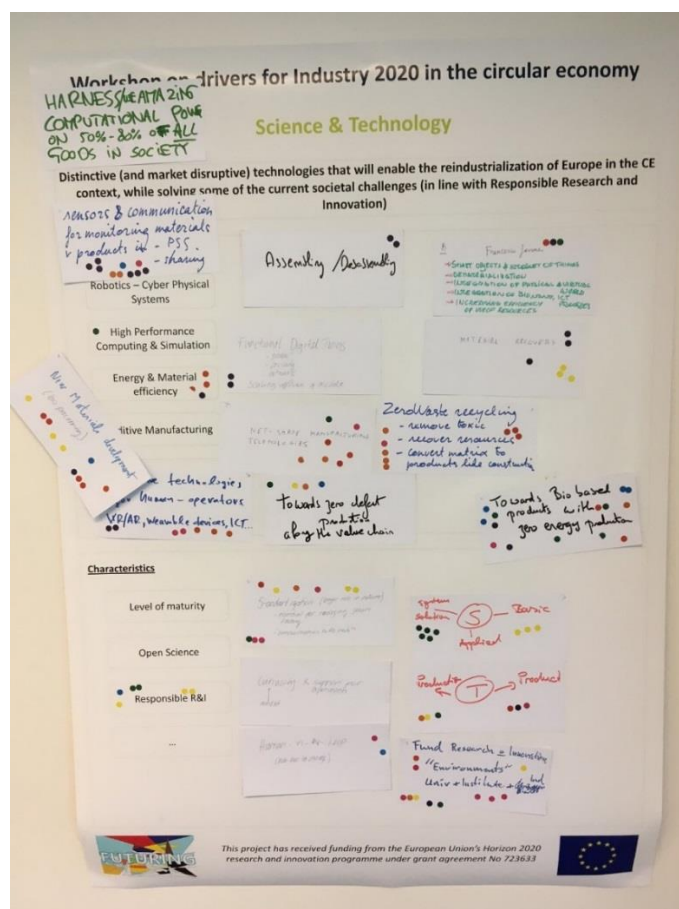


Figure 8: Science & Technology Building Block

<i>Criteria</i>	<i>#dots</i>	<i>% votes</i>	<i>Rank</i>	<i>Comment</i>
Key technologies				
Towards bio-based product with zero energy consumption	14	17%	1	-
Sensors and communication for monitoring materials and products in PSS (Product Service System) and sharing	10	12%	2	This can be linked with “traceability” (#1 criterion) in “environmental sustainability” BB
New materials development (bio-processing)	10	12%	2	This can be linked with “towards bio-based product with zero energy consumption” above.
Zero waste recycling (remove toxic; recover resources; convert matrix to products like contruction)	8	10%	3	-
Net-shape manufacturing technologies	7	8%	4	-
Assistive technologies for human-operator (VR/AR, wearable devices, ICT)	7	8%	4	-
Material recovery	6	7%	5	It could be linked with “zero waste recycling”
Technology for production and product	6	7%	5	This one is quite generic to the whole BB, so it doesn’t really bring any value added to the analysis.
Energy and material efficiency	4	5%	6	This can be partially linked with “material recovery” since recovering material is a way to increase material efficiency by limiting the amount of raw material consumption.
Towards zero defect production along the value chain	4	5%	6	This can be merged with “near net shape technologies” as the common goal is to limit the scrap rate and therefore increase the yield efficiency.
Below the threshold⁵				
<i>Smart objects and Internet of Things; dematerialization; integration of physical and virtual world; integration of bio,</i>	3	4%	7	-

⁵ According to the methodology described in 2.1.2.1, only criteria with >5% of votes have been selected, representing at least two votes of second priority order by two participants.

<i>nano, ICT processes; increasing efficiency of use of resources</i>				
<i>Functional Digital Twins: product, facility, network. Scaling up/down of models</i>	2	2%	8	-
<i>Assembling/Disassembling</i>	2	2%	8	-
<i>High performance computing and simulation</i>	1	1%	9	-
<i>Harness amazing computational power 50%-80% of all goods in society</i>	0	0%	10	-
<u>Characteristics</u>				
Fund R&I “environment” -> university + research institutions + industry	11	13%	1	This can be merged / displaced with / to criteria #1 of “Business and innovation”
Standardization (bigger role in the future)	9	11%	2	This one should probably be moved to “Policy & Finance ” BB and merged with criteria #1 about standardization
Science (oriented to understand the complex system we develop): system solution (learn from history, philosophy) ; applied; basic	8	10%	3	-
Responsible Research and Innovation	6	7%	4	This must be linked with CSR in “Environmental sustainability” BB
<i>Below the threshold⁶</i>				
<i>Human in the loop (role has to change)</i>	2	2%	5	-
<i>Curiosity ⇔ Mindset and support for experiments</i>	0	0%	6	-

Table 3: Science & Technology Criteria

3.3.2 Business & Innovation

This Building Block is about how European Industry should transform (business model, organization / governance / management and skills / capabilities) to seize the opportunities offered by digitalization of industry and the circular economy.

⁶ Refer to paragraph 2.1.2.1 for more details about how the threshold has been set.

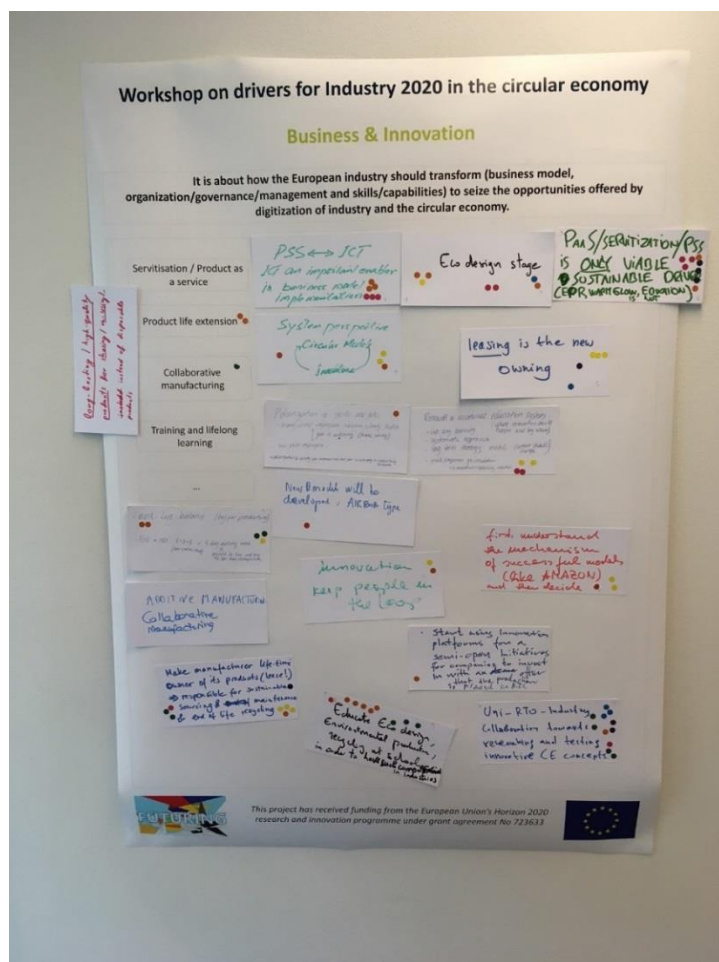


Figure 9: Business & Innovation Building Block

The table 4 below represents the results of the Business & Innovation Building Block based on the ranking of the different criteria. Some comments in the right column illustrate that many criteria can be gathered into new created families or merged with other criteria from different Building Blocks. This analysis will be led further in the conclusion (section 4).

Criteria	#dots	% votes	Rank	Comment
Univ + RTO + Industry collaboration towards researching and testing CE concepts	11	13%	1	This can be linked with systemic perspective as it relies on the collaboration of multiple players.
Educate eco-design, environmental production, recycling at school in order to have such competences in industry	9	11%	2	There is a strong link with BB "Human being & Society" => Education (criteria #1)

PAAS/Servitization/PSS is only viable sustainable driver (EPR, warm glow is; education is not)	8	10%	3	-
Eco-design stage	7	8%	4	At the industrial process level (different from education)
Make manufacturer life-time owner of its products (lease)- responsible for sustainable sourcing and maintenance and end-of-life recycling	7	8%	4	This criterion has a strong link with servitization as mentioned above: they can be merged.
PSS⇌ICT. ICT an important enabler in business model implementation	6	7%	5	This has already been taken into account in “Science & Technology” (criteria #3) and environmental sustainability (criteria #1)
Work-life balance	5	6%	6	This criteria doesn’t really fit to this BB, it should preferably been moved to “Human being & Society”, especially in link with attractive workplace for example.
Leasing is the new owning	5	6%	6	This criteria is very close to the servitization concept as well as PaaS mentioned above.
Renewal of vocational education system (where innovation should happen and by whom)	4	5%	7	This should be linked with “Human being and Society” => Education
Systemic perspective: circular models ⇌ innovation	4	5%	7	-
<i>Below the threshold</i>				
<i>First understand the mechanism of success models (like amazon) and then decide</i>	3	4%	8	-
<i>Product life extension</i>	2	2%	9	-

<i>Innovation: keep the people in the loop</i>	2	2%	9	-
<i>Collaborative manufacturing</i>	1	1%	10	-
<i>Polarization of skills and jobs</i> - highly skilled employees problem solving skills - low skill employees <i>The gap between them is widening (PIAAC study)</i> <i>(Polarization of society, gap between rich and poor is widening => productivity decreases)</i>	1	1%	10	-
<i>New models will be developed: AirBnB type</i>	1	1%	10	-
<i>Start using innovation platforms for a semi-open initiative for companies to invest in with an offer that the production is placed in Europe</i>	1	1%	10	-
<i>Additive manufacturing/Collaborative manufacturing</i>	0	0%	11	<i>This should probably be in "Science and Technology" BB</i>
<i>Long-lasting/ high-quality products for sharing/reusing instead of disposable products</i>	0	0%	11	-

Table 4: Business & Innovation Criteria

3.3.3 Human being & Society

This Building Block is deeply rooted into how future European industry is expected to solve key societal challenges (while being competitive and socially environmentally sustainable): Health, demographic change and wellbeing (shrinking of the middle class, decline of the buying power) ; food security ; inclusive, innovative and reflective societies ; secure societies.

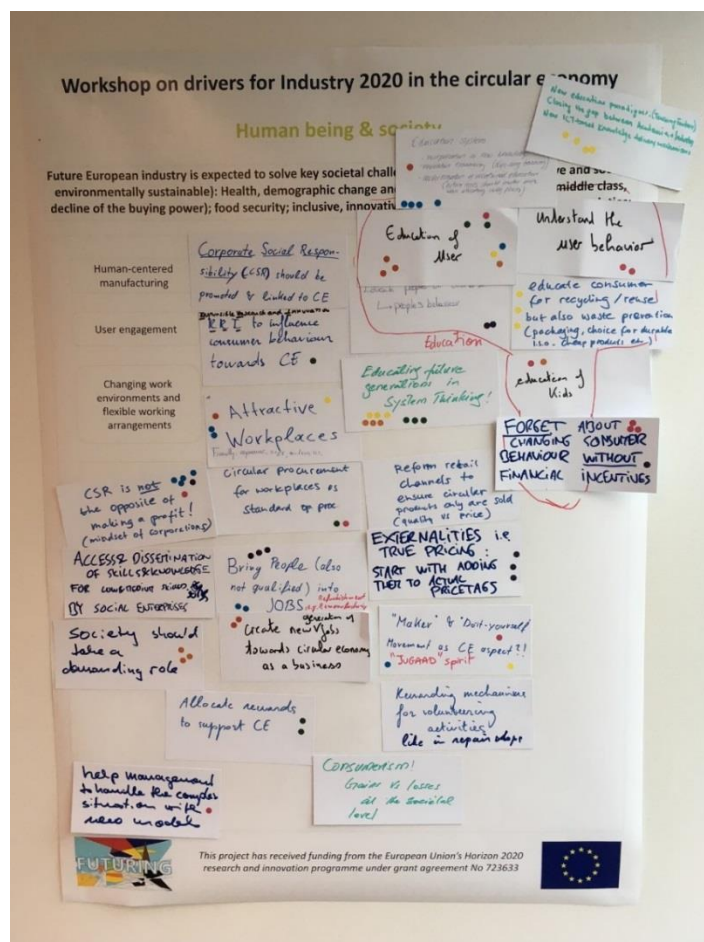


Figure 10: Human being & Society Building Block

The table 5 below represents the results of the Human being & Society Building Block based on the ranking of the different criteria. Some comments in the right column illustrate that many criteria can be gathered into new created families or merged with other criteria from different Building Blocks. This analysis will be led further in the conclusion (section 4).

Criteria	#dots	% votes	Rank	Comment
Education	30	36%	1	<p>- Incorporation of new knowledge, innovation training (life-long training), modernization of vocational education (future needs should matter more when allocating study places)</p> <p>New education paradigms (teaching factory). Closing the gap between Academics and Industry, new ICT-based knowledge delivery mechanisms</p> <p>Education of kids</p>

				<p>Educating future generations in system thinking</p> <p>Educate consumer for recycling / reuse but also waste prevention (packaging, choice for durable instead of cheap products)</p> <p>Educate people on CE => people's behavior</p> <p>Education of user / understand the user behavior</p>
Corporate Social Responsibility (CSR) is not the opposite of making a profit (mindset of corporations)	6	7%	2	-
Bring people (also not qualified) into jobs ie refurbishment, remanufacturing	5	6%	3	-
Attractive workplaces (friendly, ergonomic, safe, modern ICT)	4	5%	4	-
Forget about changing consumer behavior without financial activities	4	5%	4	<p>It is more a subjective point of view rather than a criterion so it seems to be difficult to take this into account, although one understands that CE must be economically viable (for producers and consumers) to spread into society. It could better fit with the BB "Policy and Finance" instead.</p>
<i>Below the threshold</i>				
<i>Society should take a demanding role</i>	3	4%	5	-
<i>Externalities ie true pricing : start with adding them to actual pricetags</i>	3	4%	5	-

<i>Maker & Do-It-Yourself Movement as CE aspect => Jugaad spirit</i>	3	4%	5	-
<i>Circular procurement for workplaces as standard operational procedures</i>	2	2%	6	-
<i>Create new generation of jobs towards CE as a business</i>	2	2%	6	<i>This criteria can be linked with #3</i>
<i>Allocate rewards to support CE</i>	2	2%	6	-
<i>Responsible Research and Innovation to influence consumer behavior towards CE</i>	1	1%	7	-
<i>Help management to handle the complex situation with “?” model</i>	1	1%	7	-
<i>Reform retail channels to ensure circular products only are sold (quality vs price)</i>	0	0%	8	-
<i>Rewarding mechanisms for volunteering activities like in repair shops</i>	0	0%	8	-
<i>Access and dissemination of skills and knowledge for low and medium skilled jobs by social enterprises</i>	0	0%	8	-
<i>Consumerism! gains vs losses at the societal level</i>	0	0%	8	-
<i>CSR should be promoted and linked to CE</i>	0	0%	8	<i>To be linked with #2</i>

Table 5: Human being & Society Criteria

3.3.4 Policy & Finance (cross-cutting)

This Building Block is about fulfilling the goals of reindustrialization and growth (not just economic), while decoupling growth from resource constraints. In short, it is about where to put the money to drive the reindustrialization of Europe in the circular economy context. Conversely to the three above, Policy & Finance is a cross-cutting thematic since it can affect all dimensions.

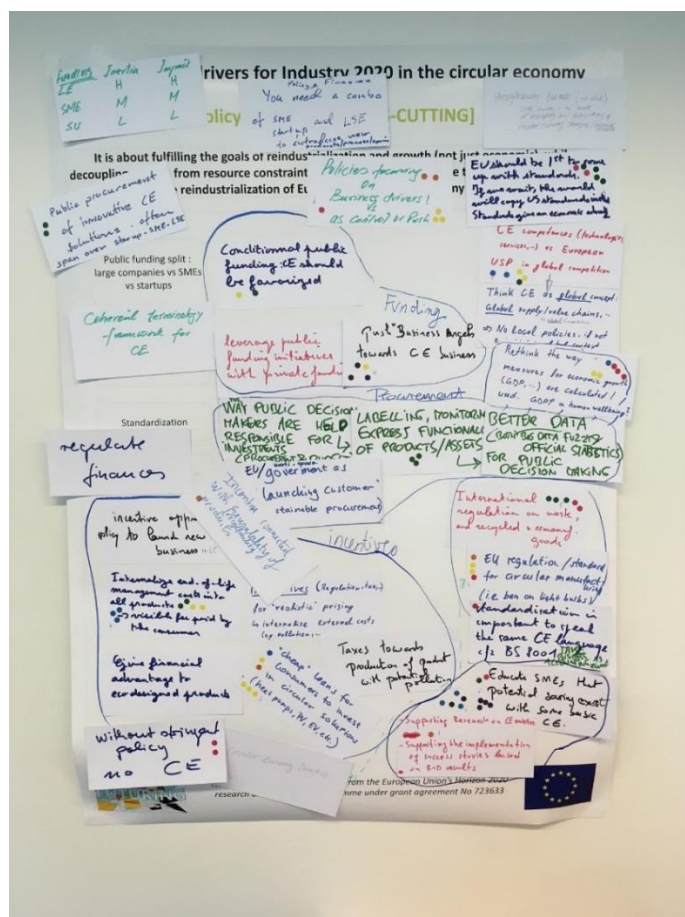


Figure 11: Policy & Finance (cross-cutting) Building Block

The table 6 below represents the results of the Policy & Finance Building Block based on the ranking of the different criteria. Some comments in the right column illustrate that many criteria can be gathered into new created families or merged with other criteria from different Building Blocks. This analysis will be led further in the conclusion (section 4).

Criteria	#dots	% votes	Rank	Comment
Regulation and standards for CE	16	19%	1	<ul style="list-style-type: none"> - Circular Economy Directive International regulation on waste and recycling and Remanufactured goods - EU the first one to come up with standards

				<ul style="list-style-type: none"> - Standards to speak the same language within the EU, e.g. BS8001 - regulation / standard for circular manufacturing (ie ban of light bulbs)
Incentives for CE	14	17%	2	<ul style="list-style-type: none"> - “Incentives” and “take business as accounting example” are highly interrelated - Cheap “loans” for consumers to invest in CE solutions (heat pumps, PV, EV etc...); - externalities included in the price - taxes to production with potential pollution - give financial advantage to eco-designed products - incentives connected with reusability and recyclability of products - incentive approach for policy to launch new business in CE <p><u>Extra-comments from questionnaires:</u></p> <ul style="list-style-type: none"> - public funding and subsidies for companies and consumers
Take business as accounting example , support implementation of R&D based success stories	11	13%	3	<ul style="list-style-type: none"> - Educate SMEs with some potential with some basic CE - Support research on CE enablers <p><u>Extra-comments from questionnaires:</u></p> <ul style="list-style-type: none"> - especially first entrants - change financing evaluation of the businesses interested in the CE - take business as accounting example including pilot lines <p>These criteria can be reformulated and enlarged to fit with incentives, as favorable notably for business that want to switch to CE</p>
Sustainable/Circular Procurement	9	11%	4	<ul style="list-style-type: none"> - EU government as launching customer - Labelling, monitoring express functionality of products / assets

				<ul style="list-style-type: none"> - Better data for public decision making - The way public decision makers are held responsible for investments (procurement and budget)
Policies focusing on business drivers as first option Vs. policies as control or push/regulatory (last option)	6	7%	5	This could be merged with CE competences as European Unique Selling Point, as measures to promote CE in Europe instead of hindering its development in a global competition
Access to finance	6	7%	6	<ul style="list-style-type: none"> - Conditional public funding in order to favor CE - push business angels to the CE business - combination of public-private funding
CE competences (technologies, services) as European Unique Selling Point (USP) in global competition	5	6%	7	-
<i>Below the threshold</i>				
<i>Without stringent policy, no CE</i>	2	2%	8	-
<i>Public procurement of innovative CE solutions often span over start-up-SME-LSE</i>	2	2%	8	<i>Can be made one with the following one and put under "Business and Innovation"</i>
<i>Combination of SME/start-up and LSE to introduce new products/process</i>	1	1%	9	<i>This may fit better in "Business and Innovation"</i>
<i>Strengthening of Europe (a single country is too small for developing and benefitting of CE strategies / business models</i>	1	1%	9	<i>This item and the next one can be brought together. Very related to the one about "CE competences as European USP" (which could be 7 dots all together and move two steps ahead in the ranking)</i>
<i>Think CE as a global concept: global supply chains, no local policies if not embedded in a global context</i>	1	1%	9	<i>This item and the previous one can be brought together. Very related to the one about "CE competences as European USP" (which could be 7 dots all together and move two steps ahead in the ranking)</i>
<i>Regulate finances</i>	1	1%	9	<i>This can be grouped under "regulation and standards"</i>
<i>Inertia and impact of funding is high in LE, medium in SMEs and low in star-ups</i>	1	1%	9	-

Coherent terminology framework for CE	1	1%	9	-
Leverage public funding initiatives with private funding	0	0%	10	-

Table 6: Policy & Finance (cross-cutting) Criteria

3.3.5 Environmental sustainability (cross-cutting)

This Building Block is acting and depending on all other BB. Future European Industry is indeed expected to solve key environmental challenges, while being competitive and socially responsible. As for “Policy & Finance”, this BB is a cross-cutting one, since it is affected by all dimensions: Science & Technology, Business & Innovation, Human being & Society as well as Policy & Finance.

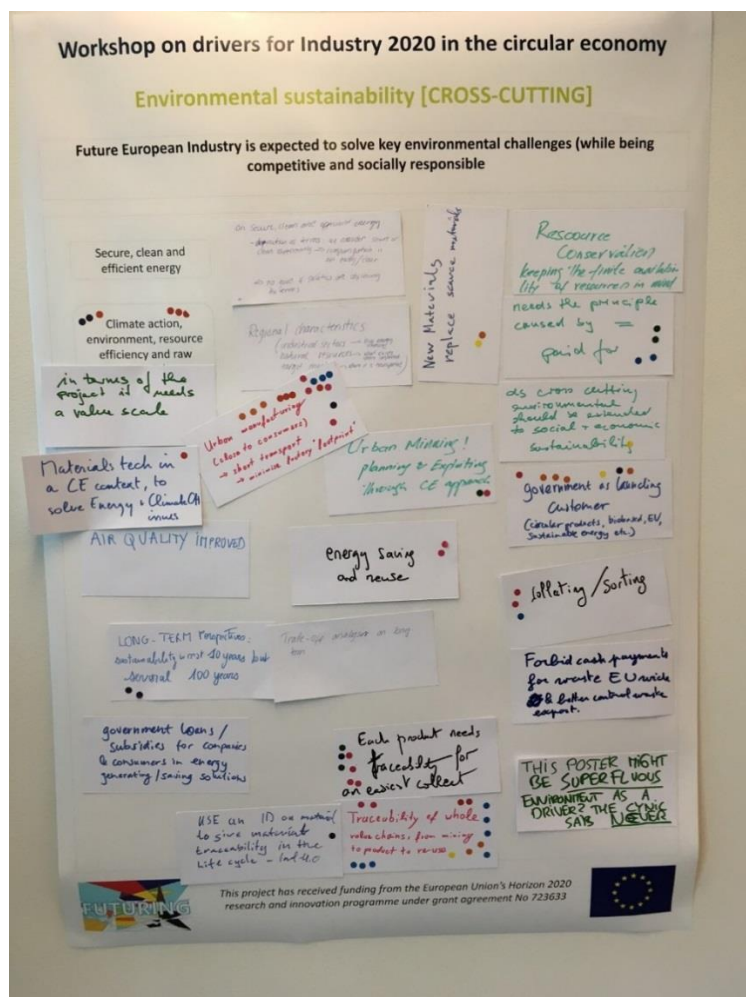


Figure 12: Environmental sustainability (cross-cutting) Building Block

The table 7 below represents the results of the Environmental sustainability Building Block based on the ranking of the different criteria. Some comments in the right column illustrate that many criteria can be gathered into new created families or merged with other criteria from different Building Blocks. This analysis will be led further in the conclusion (section 4).

Criteria	#dots	% votes	Rank	Comment
Traceability	21	25%	1	- Each product needs traceability for an easiest collect - Traceability of whole value chains, from mining to product to reuse
Urban manufacturing	15	18%	2	- Close to consumers => short transport and minimize factory footprint
Government as launching customer	7	8%	3	- To be linked with the criteria “Sustainable/Circular Procurement” in Policy and Finance BB
Climate action, environment, resource efficiency and raw material	6	7%	4	- This criterion is quit generic, gathering a broad set of programs in H2020. This must be better specified during the interviews in WP2
Needs for the principal caused by = paid for	4	5%	5	-
<i>Below the threshold</i>				
<i>Collating / sorting</i>	3	4%	6	-
<i>Long term perspectives : sustainability is not 10 years but several 100 years</i>	2	2%	7	-
<i>Energy saving and reuse</i>	2	2%	7	-
<i>Urban mining : planning and exploiting through CE approach</i>	2	2%	7	-
<i>New materials replace scarce materials</i>	2	2%	7	-
<i>As cross cutting, environmental should be extended to social and</i>	1	1%	8	-

<i>economic sustainability</i>				
<i>Materials tech in a CE context, to solve Energy, Climate change issues</i>	1	1%	8	<i>To be linked with criteria ranked #4</i>
<i>Use an ID on material to give material traceability in the lifecycle (Industry 4.0</i>	0	0%	9	<i>To be linked with criteria ranked #1</i>
<i>Resource conservation : keeping the finite availability of resources in mind</i>	0	0%	9	-
<i>Regional characteristics (industrial sectors => how energy intensive / natural resources => what exists where imported / target markets => where it is transported</i>	0	0%	9	-
<i>Secure, clean and efficiency energy : definition of terms : we consider secure of clean differently => comparison is not easy / clear => no good 4 politics are defining the terms</i>	0	0%	9	<i>To be linked with criteria ranked #4</i>
<i>Air quality improved</i>	0	0%	9	-
<i>Trade-off analysis on long term</i>	0	0%	9	-
<i>Government loans / subsidies for companies and consumers in energy generating / saving solutions</i>	0	0%	9	-
<i>Forbid cash payments for waste</i>	0	0%	9	-

<i>EU wide & better control waste export</i>				
<i>This poster might be superfluous, environment as a driver? the cynic says never</i>	0	0%	9	-

Table 7: Environmental sustainability (cross-cutting) Criteria

3.4 Pillar Actions analysis

This analysis is based on the exploitation of the questionnaires filled by the participants during the individual worksheet session. It was mainly asked the experts and stakeholders to provide with practical return of experiment or to give example from their knowledge about contacts / projects / initiatives / organization that already implement such actions toward CE. The main outcomes presented here will be used later on in the FUTURING project such as in tasks T2.2, T2.3 and WP3.

3.4.1 Regenerate

The definition of “Regenerate”, according to Ellen Mac Arthur Foundation⁷ is: “Shift to renewable energy and materials; reclaim, retain, and regenerate health of ecosystems and return recovered biological resources to the biosphere”.

<i>Examples of projects and / or contacts</i>	<i>General comments</i>
<ul style="list-style-type: none"> • CEA is launching projects on SMART FARMING, promoting the use of autonomous robots to clean the earth, in replacement of pesticides, this is based on a panel of innovative technologies (IoT, robotics, vision, IR sensors, etc...). Contact: Pascal Sire (CEA). • biototal.se • Vretaklusten.se • ENIAC Greenelec project (Hans van Viet, TNO) • Biobased materials (UnilaSalle Roter (Richard Gattin) ; • BOJAN SLAT / PLASTIC SOUP • Soil Pedia, NL • Carlo Polidori (VELTHA ivzw) • PlasmaNice : http://www.tut.fi/plasmanice/ 	<ul style="list-style-type: none"> • Regenerate a reliable financial market • Conversion of CO2 to Ethanol (process discovered “accidently”) is an interesting example of search for technological solutions besides socio-economic approach, for regenerating or conserving our environment. • PV CYCLE France manages used photovoltaic equipment and is very involved in renewable energy. One of the best use of solar PV that we see is the regeneration of old industrial land or airports. Those lands may be polluted and not turned to agricultural use. Installing PV power plants allow the land to regenerate over time, while at the same time using it in a meaningful and productive way. • circular fish farming

⁷ https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_PolicymakerToolkit.pdf

	<ul style="list-style-type: none"> • biohub (waste reprocessing for high value applications) • Anatium • PEF bottle • Carbon capturing buildings
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Table 8: Regenerate Pillar Action feedbacks

3.4.2 Share

The definition of “Share”, according to Ellen Mac Arthur Foundation is: “Keep product loop speed low and maximise utilisation of products, by sharing them among different users (peer-to-peer sharing of privately owned products or public sharing of a pool of products), by reusing them through their entire technical lifetime (second hand), and by prolonging their lifetime through maintenance, repair, and design for durability.”

<i>Examples of projects and / or contacts</i>	<i>General comments</i>
<ul style="list-style-type: none"> • Project SoSmart indicates fields of action by which economics can be improved by a shared effort of employees and management • stadium.se/cms/reactivate • Greenelec (Hans Van Viet (TNO)) • Peerby • Branch initiative to share construction equipment (Bouwend, NL) • Share NL • BMIX Business Model Innovation grid : http://www.plan-c.eu/bmix/ • PlanC Circular Economy hub in Flanders : http://www.plan-c.eu/en 	<ul style="list-style-type: none"> • Recent, technology enabled car-sharing (constantly growing business- http://carsharing.org/csa-members-2/) and taxi services such as Uber are excellent examples of maximizing resource utilization business cases.

Table 9: Share Pillar Action feedbacks

3.4.3 Optimize

The definition of “Optimize”, according to Ellen Mac Arthur Foundation is: “Increase performance/efficiency of a product; remove waste in production and supply chain (from sourcing and logistics, to production, use phase, end-of-use collection etc.); leverage big data, automation, remote sensing and steering. All these actions are implemented without changes to the actual product or technology.”

<i>Examples of projects and / or contacts</i>	<i>General comments</i>
<ul style="list-style-type: none"> • Mixing different polymer with specific grinder offers a new generation of polymer with better properties (METEOR project, IPC) • Polfree (contact: Koen Dittrich / Tom Bastein (TNO)) 	<ul style="list-style-type: none"> • EU Knights has developed a catalogue of 10 rule which help to understand innovation and the effective use of new technologies • See SPIRE Waste2Resource theme • Biohub

<ul style="list-style-type: none"> • Biorizon (Jan Harm Urbandis (TNO)) • H2020 Ruggedised project (Koen Dittirch) • Acewikkeltechniek.nl • Rentaltracker.com • Recam (Minna Lanz) : energy monitoring, reconfigurable manufacturing systems • Cabriss project 	<ul style="list-style-type: none"> • Smart city with smart grid, smart energy management, smart mobility • Smart phone • Fee paid to retailers to collect used products (WE cycle) • "Longer life-time for products" by C. Montalvo (Chapter 3)
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Table 10: Optimize Pillar Action feedbacks

3.4.4 Loop

The definition of “Loop”, according to Ellen Mac Arthur Foundation is: “Keep components and materials in closed loops and prioritise inner loops. For finite materials, it means remanufacturing products or components and recycling materials.”

<i>Examples of projects and / or contacts</i>	<i>General comments</i>
<ul style="list-style-type: none"> • EUPASS and IDEAS developed reusable modular stations for production systems • INASHVO • PROTIX • Kargo tyre recycling • Prison inmate cotton recycling (North Carolina) • Cabriss EU-project • Zero defect manufacturing (Pr Marcello Colledani (Polimi) and Ane Irazustabarrena (TECNALIA)) • Recover energy (e.g. heat from machines to heat/cool buildings) in FESTO (Scharnhausen plant) • https://www.festo.com/gro-up/en/cms/10967.htm • http://www.emc2-factory.eu/en/home 	<ul style="list-style-type: none"> • Google as an emerging example of an industrial giant in this area: https://www.ellenmacarthurfoundation.org/casestudies/circular-economy-at-work-in-google-datacenters. More for inspiration can be the Toronto Tool Library initiative : https://www.ellenmacarthurfoundation.org/casestudies/how-tool-sharing-could-become-a-public-utility) • PV modules use rare earth and strategic materials. While those are currently available, it is likely that increasing demand will create tension on some materials. For the time being, new raw materials also tend to be cheaper than recycling raw materials. But if the paradigm changes, then there is a market based business case for a circular economy. • There are also strategic interests that a circular economy would help protect. In regard to the PV industry, there are very few integrated PV manufacturers left in Europe, and the others import the most expensive parts from Asia. If those companies were allowed to source their raw materials, at competitive market price in Europe, it would drive reindustrialization, which in turn would drive more innovation.

Table 11: Loop Pillar Action feedbacks

3.4.5 Virtualise

The definition of “Virtualise”, according to Ellen Mac Arthur Foundation is: “Dematerialise resource use by delivering utility virtually: directly, e.g. books or music; or indirectly, e.g. online shopping, autonomous vehicles, virtual offices.”

<i>Examples of projects and / or contacts</i>	<i>General comments</i>
<ul style="list-style-type: none"> • RUGGEDISED • Energy transparency system in FESTO, using intelligent components providing information for the virtual management system (MetamoFAB project) 	<ul style="list-style-type: none"> • We need to understand better what we are of a point in time above the physical and the virtual become interchangeable in system development • Kindle and Spotify may be used for analysis of their systemic impact and useful innovations should be reused in other areas

Table 12: Virtualise Pillar Action feedbacks

3.4.6 Exchange

The definition of “Exchange”, according to Ellen Mac Arthur Foundation is: “Replace old with advanced non-renewable materials, apply new technologies (e.g. 3D printing or electric engines) and choose new products/services (e.g. multimodal transport).”

<i>Examples of projects and / or contacts</i>	<i>General comments</i>
<ul style="list-style-type: none"> • mKETs projects (Carlos Montalvo, TNO & Tommy Hoglund, Acreo) • Rotterdam 3D company using secondary material • Urban transport by shoes-wittweels, e-bikes, covered carriages foldable • LCV = recent VITO spin-off (http://www.lcv.be/en) • Project JU FCH nanoCAT (Replacement of PT catalysts by organic materials for fuel cells). Contact : PA jacques • Project European H2020 “BonVoyage”: multimodal transport. Contact Bernard STREE, CEA • https://www.festo.com/group/en/cms/10275.htm 	<ul style="list-style-type: none"> • 3D printing technology offers opportunities to replace specific metals with other metal and also decrease the amount of material use in such product • printedelectronicsarena.com • this is printed electronics • save energy and save the environment

Table 13: Exchange Pillar Action feedbacks

3.5 General discussion

After the poster session and the individual worksheet session, during which CEA and TECNALIA consolidated the results from the collective brainstorming, the draft outcomes were presented to all participants in plenary session. The objective was to get the perception of the two groups in common about the results, and to amend them if necessary towards consensus. Although some remarks were observed during this discussion, it appeared that the experts

and stakeholders agreed with the ranking of criteria and there was no debate about keeping or removing any of them. The core of the discussions was mainly about precisising / reformulating some confusing criteria, or adding correlated interpretations.



Figure 13: Presentation of the results / collective consolidation towards consensus

3.5.1 Science & Technology

- Correct in the slide: Zero energy consumption, not production ;
- Zero waste recycling ;
- We should forget talking about waste management and talk about value management instead.
- There is not mentioned the opportunities that ICT offers for sharing economy⁸.

3.5.2 Business & Innovation

- Eco-design stage means integrating the eco-design approach in production, at industrial level ;
- In the collaboration between university, RTOs and industry, the public administration should also be involved ;
- Be careful when considering ICT an enabler in industry. It needs to be specified what can ICT do and what ICT cannot do.

3.5.3 Human being & Society

- Add social enterprises to education items ;

⁸ Note of the author: this is taken into account in the criteria sensors and communications and assistive technologies in the BB "Science & Technology", as well as in "Quality of work life" thanks to ICT tools in "Human being & Society" BB. It is also included in servitization in "Business & Innovation" since most of these services rely on ICT. Same remark for "traceability" in "Environmental Sustainability" BB.

- CSR is actually a branding tool. Do not compare CE with CSR because there is the risk of converting CE in a branding tool as well ;
- Add co-creation (related to Responsible Research and Innovation), it is important to include the vision of the society.

3.5.4 Policy & Regulation (cross-cutting)

- Need for better data, more detailed data from societal point of view, not that much from the perspective of companies (OEMs).

3.5.5 Environmental sustainability (cross-cutting)

- Precision on a label : *“There is a need to put in practice the following principle: caused by → pay for (it)”*
- Close to the consumer is also related to
 - Smart factory
 - Flexible production, customization, personalization→ smaller production slots (downscaling production). Additive manufacturing technology is one of the enablers.
 - Mobile manufacturing units

3.5.6 Other comments

- Measure to what extent Europe is the best spot to invest in Circular Economy (attract investors)
- Take into account China’s initiative/leadership in CE (regulation in 2009)

4 Conclusion: Building Blocks and Pillar Actions reference scheme

To conclude D1.3, BB and PA methodology has been built on the common analysis led all across WP1 based on T1.1, T1.2, and mostly T1.3 as its core objective. As presented by Figure 14, T1.3 has relied on the inputs and discussion with T1.1 (FESTO), T1.2 (in particular the outcomes of the Rome’s workshop organized by COTEC in January) and the Lyon’s workshop organized by CEA and TECNALIA to define and validate the methodology with a panel of experts and stakeholders.

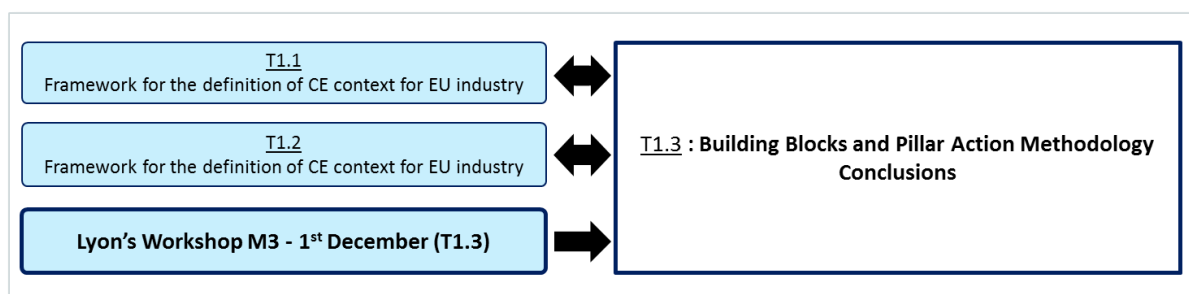


Figure 14: Consolidation of inputs from WP1 toward conclusions of T1.3

4.1 Building Blocks

The tables 14 to 19 summarize the results of the poster session and the general discussion that have led to the definition and validation of the most important criteria (i.e. drivers) according to each BBs. It also integrates the inputs provided by the T1.2 expert workshop held in January by COTEC discussing among others on the strategic vision for EU Reindustrialization (see D1.2). A two level post-analysis took place:

- **At the Building Block level :**

By comparing the inputs from the Lyon's workshop (WP1/T1.3) and the Rome's workshop (WP1/T1.2), and by ranking the relative importance of each BBs, it was decided to select six final BBs. The four first ones "Science & Technology", "Business & Innovation", "Human being & Society" remained as they were. However, "Environmental sustainability" was modified into "Environmental responsibility" in order to turn the formulation more as an action, than an impact. Since Education & Training appeared as a very high importance topic within Human being & Society, it was decided to make it a dedicated BB (also cross-cutting).

Science & Technology
Business & Innovation
Human being & Society
Policy & Finance (a cross-cutting BB)
Environmental responsibility (a cross-cutting BB)
Education & Training (a cross-cutting BB)

- **At the criteria level:**

Based on the different comments and analysis of the criteria in each BBs, it was possible to merge some of them into broader categories. The next Tables 14 to 19 will sum-up the main criteria to be used as reference scheme for each BBs.

4.1.1 Science & Technology

Based on the compilation of Table 3 (see different comments on the right column), the criteria have been selected above the threshold and gathered into 5 main criteria presented in the Table 14 below. These criteria actually represent some promising fields of technologies as key enablers of the implementation of CE.

Criteria	Definition
Bio-based product	<ul style="list-style-type: none"> • Towards bio-based product with zero energy consumption • New materials development (bio-processing), in replacement to existing one based on mineral resources: bio based materials, bioinspired materials...

	<ul style="list-style-type: none"> • Decarbonization
Material / Energy efficiency	<ul style="list-style-type: none"> • Material recovery / efficiency and energy efficiency • Net-shape manufacturing technologies • Towards zero defect production along the value chain
Sensors and communication	<ul style="list-style-type: none"> • Monitoring materials and products in PSS (Product Service System) and sharing. • Smart objects and Internet of Things, as well as big data
Recycling	<ul style="list-style-type: none"> • Zero waste recycling (remove toxic; recover resources; convert matrix to products like construction)
Assistive technologies	<ul style="list-style-type: none"> • For human-operator (VR/AR, wearable devices, ICT)

Table 14: Science & Technology Building Block and criteria

4.1.2 Business & Innovation

Based on the compilation of Table 4 (see different comments on the right column), the criteria have been selected above the threshold and gathered into 3 main criteria presented in the Table 15 below. These criteria actually represent some business and innovation trends on which relies the implementation and growth of CE.

Criteria	Definition
Servitization	<ul style="list-style-type: none"> • Make manufacturer life-time owner of its products (lease) - responsible for sustainable sourcing and maintenance and end-of-life recycling • Consumption patterns : “leasing is the new owning” • Platform As A Service / Servitization / Product Service System as a viable sustainable driver
Systemic perspective	<ul style="list-style-type: none"> • Circular models for innovation that involve a constellation of several specialized partners (Large firms, SMEs, R&D centers, academics, civil society etc...) • University + RTO + Industry + public administration collaboration towards researching and testing Circular Economy concepts
Eco-design	<ul style="list-style-type: none"> • Make manufacturer life-time owner of its products (lease) - responsible for sustainable sourcing and maintenance and end-of-life recycling

Table 15: Business & Innovation Building Block and criteria

4.1.3 Human being & Society

Based on the compilation of Table 5 (see different comments on the right column), the criteria have been selected above the threshold and gathered into 3 main criteria presented in the Table 16 below. Initially, another criterion was part of this BB: “Education”. However, due to the crucial importance of education in all field linked with CE, it was decided to dedicate a single BB to Education & Training. This new BB will be presented in a further paragraph. The remaining criteria from Human being & Society actually represent societal trends and major issues that CE will need to solve and / or embrace to ensure its wide adoption by the people.

Criteria	Definition
Corporate Social Responsibility	<ul style="list-style-type: none"> Warning: this must not be limited to just branding for companies. CE goes beyond that: it is more linked with Research and Responsible Innovation which is not the opposite of making a profit (mindset of corporations). It must also include co-creation (involvement of civil society, policy makers etc..., not only business)
Employment	<ul style="list-style-type: none"> Bring people (also not qualified) into jobs i.e. refurbishment, remanufacturing...
Quality of work life	<ul style="list-style-type: none"> Attractive workplaces (friendly, ergonomic, safe, modern ICT)

Table 16: Human being & Society Building Block and criteria

4.1.4 Policy & Finance (cross-cutting)

Based on the compilation of Table 6 (see different comments on the right column), the criteria have been selected above the threshold and gathered into 5 main criteria presented in the Table 17 below. These criteria actually represent legal and financial mechanisms that are mandatory in order to ensure the rise of CE in Europe.

Criteria	Definition
Incentives	<ul style="list-style-type: none"> Incentives for Circular Economy (funds / loans / subsidies, in particular for SMEs...), especially for first entrants and with convenient financing evaluation of business interested in CE Support research on CE enablers
Regulation and standards	<ul style="list-style-type: none"> Regulation (and enforcement of legislation, not only policy) and standards (bigger role in the future, for example the upcoming eco-design directive, also accounting standards for social and environmental impacts needed, not only business) for Circular Economy (such as International regulation on waste and recycling)

	and Remanufactured goods, and “to speak the same language within the EU”) <ul style="list-style-type: none"> • EU single digital market • Well-designed product-policies • Green taxation and carbon pricing
Competitiveness	<ul style="list-style-type: none"> • CE competences (technologies, services) as European Unique Selling Point (USP) in global competition • Build European industry’s competitive edge upon circular economy related technologies and business models as a way to reinforce European industry in global markets • Policies focusing on business drivers as first option Vs. policies as control or push/regulatory (last option)
Public procurement	<ul style="list-style-type: none"> • Government as launching customer, supporting first entrants in CE
Access to finance	<ul style="list-style-type: none"> • Giving business, in particular SMEs, the opportunity to raise fund and to invest to create jobs

Table 17: Policy & Finance Building Block and criteria

4.1.5 Environmental responsibility (cross-cutting)

Based on the compilation of Table 7 (see different comments on the right column), the criteria have been selected above the threshold and gathered into 5 main criteria presented in the Table 18 below. Initially, this BB was named “Environmental sustainability”, however it was decided to change the name “sustainability” to “responsibility” in order to turn it more as an action than the result of a systemic change of paradigm. Besides, we can consider that sustainability must address all dimensions: economic, societal and not just environmental. These criteria actually represent some major shifts in supply chain and responsible innovation management that will drive the sustainability of CE with regard to the respect of environment in the future.

Criteria	Definition
Traceability	<ul style="list-style-type: none"> • Traceability of whole value chains, from mining to product to reuse. Each product needs traceability for an easiest collect
Urban manufacturing	<ul style="list-style-type: none"> • Close to consumers => short transport and minimize factory footprint. An example of smart factory should be based on flexible production, customization, personalization, smaller production slots (downscaling production) and mobile manufacturing units.
Climate action, environment,	<ul style="list-style-type: none"> • Generic set of programs as defined in H2020 Societal Challenges

resource efficiency and raw material	
Responsibility	<ul style="list-style-type: none"> Needs for the principle “caused by = paid for”

Table 18: Environmental responsibility Building Block and criteria

4.1.6 Education & Training (cross-cutting)

This BB was formally a criterion that belonged to the “Human Being & Society” BB. However, due to the importance of education, it was decided to put it as standalone to reinforce the criticality of this aspect which covers all fields, therefore it is also a cross-cutting BB.

Definition
<ul style="list-style-type: none"> On kids / students / manufacturers / retailers / consumers / entrepreneurs, in particular in the social economy, about waste prevention, acquire new skills at school in eco-design, environmental production, recycling, system thinking, but also life-long training, teaching factory, renewal of vocational education system, co-creation with civil society...)

Table 19: Education & Training Building Block (single criteria)

4.2 Pillar Actions

It was decided for the moment to keep the Ellen MacArthur definition of Pillar Actions as a reference scheme for the rest of the projects and to investigate the different inputs that the experts have provided during the Lyon’s workshop regarding the different PA. This analysis will be led in WP2 and WP3 and it will be possible in WP4 to reorganize / merge / add potential other actions that could be supported by policy recommendation as a conclusion of the FUTURING project. The analysis led in FUTURING will also enable to identify the current relative weight between these PA and to identify priority actions to be launched for some PA that could not be enough developed for the moment. The different PA used as reference scheme are reminded in Figure 15.

Pillar Actions

Pillar Action	Description (according to Ellen Mac Arthur Foundation)
REGENERATE	<ul style="list-style-type: none"> Shift to renewable energy and materials; Reclaim, retain, and regenerate health of ecosystems; Return recovered biological resources to the biosphere.
SHARE	<ul style="list-style-type: none"> Keep product loop speed low and maximize utilization of products by sharing them among users (peer-to-peer sharing of privately owned products or public sharing of a pool of products), reusing them throughout their technical lifetime (second-hand), and prolonging their life through maintenance, repair, and design for durability.
OPTIMISE	<ul style="list-style-type: none"> Increase performance/efficiency of a product; Remove waste in production and the supply chain (from sourcing and logistics to production, use, and end-of-use collection); Leverage big data, automation, remote sensing, and steering. None of these actions requires changing the product or technology, as exemplified by the lean philosophy made famous by Toyota.
LOOP	<ul style="list-style-type: none"> Keep components and materials in closed loops and prioritise inner loops. For finite materials, this means remanufacturing products or components and as a last resort recycling materials, as e.g. Caterpillar, Michelin, Rolls Royce, and Renault are doing. For renewable materials, this means anaerobic digestion and extracting bio-chemicals from organic waste.
VIRTUALISE	<ul style="list-style-type: none"> Deliver utility virtually – books or music, online shopping, fleets of autonomous vehicles, and virtual offices.
EXCHANGE	<ul style="list-style-type: none"> Replace old materials with advanced renewable materials; Apply new technologies (e.g. 3D printing and electric engines); Choose new products and services (e.g. multi-modal transport).

NB : These PAs have been sourced from the Ellen Mac Arthur Foundation



This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 723622

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Figure 15: Reference scheme for PA (source: Ellen MacArthur foundation)

5 Annexes

5.1 Annex A: References

- Bratislava Summit (2016), “The Bratislava Declaration and Roadmap”
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5.2 Annex B: Lyon workshop agenda

The agenda (see Table 20) was prepared by CEA and completed by LMS, as coordinator, so that the consortium took the opportunity to make an overall presentation of the FUTURING project, its objectives, as well as a review of the first task achieved (D1.1). Apart from that, LMS took the opportunity to invite the coordinator of RESCOM EU-project which brought the experts and stakeholders a very interesting and complementary insight on CE, using ICT tools in particular. This introduction enabled also to warm up the collective so that after the brief presentation of the methodology of the workshop, all participants were ready to actively brainstorm.

Agenda

Thursday 1st of December 2016

09h30	Coffee and Welcome	
10h00	Start of meeting	
10h00	1. Introduction to FUTURING and Workshop objectives <ul style="list-style-type: none"> • Presentation of the FUTURING project (15') • Presentation of the Workshop's objectives, organization, expected outcomes (15') • Introduction of Experts (organization / background / expertise) (15') • Presentation of ResCoM project (15') 	LMS CEA Experts KTH
11h00	2. Poster Session Part I <ul style="list-style-type: none"> • Poster presentation (30'). Posters with the main drivers/enablers for EU reindustrialization in the circular economy context. • Collective brainstorming (60'). Experts provide their own ideas for each poster. 	FUTURING ALL
12h30	Lunch break	
13h00	3. Poster Session Part II <ul style="list-style-type: none"> • Poster ranking/prioritization (30') Experts prioritize the ideas listed in the posters. 	Experts
13h30	4. Individual Worksheet Session <ul style="list-style-type: none"> • Experts will provide qualitative feedback using a template (60'). Based on the ideas expressed so far, each expert will use a template to answer some key questions on the relation of this idea to the objectives of FUTURING. 	Experts
14h30	5. Discussion <ul style="list-style-type: none"> • Presentation of the results / collective consolidation towards consensus and discussion (30') 	FUTURING
15h00	6. Closure & Next Steps <ul style="list-style-type: none"> • Review outputs of workshop (15') • Final comments and some feedback (15') 	Experts FUTURING
15h30	End of meeting	

Table 20: Agenda of the Lyon Workshop

5.3 Annex C: List of experts

The Lyon's workshop has gathered 18 participants from all across Europe⁹. Figure 16 is the list of attendees.



FUTURING EUROPEAN INDUSTRY
WP1 Workshop, 01 December 2016

List of FUTURING Partners

Groups:	Name	Organization
A	1. Arnaud Witomski	CEA
B	2. Loukas Rentzos	LMS
A	3. Konstantinos Georgoulas	LMS
B	4. Mirari Zaldia Urretabizkaia	TECNALIA
A	5. Izaskun Jimenez Iturriza	TECNALIA
A	6. Elmer Rietveld	TNO
A	7. Björn Sautter	FESTO
B	8. Christoph Hanisch	FESTO
B	9. Francesco Jovane	COTEC
B	19. Simon Perraud	CEA

List of Experts

Name	Organization
10. Nicolas Defrenne	PV Cycle
11. Bertrand Fillon	IPC (Technical Centre of Plastics Engineering)
12. Amir Rashid	KTH
13. Koen Dittrich	Erasmus RSM
14. Jan Meneve	VITO (Flemish Institute for Technological Research)
15. Luc Federzoni	CABRISS EU-project coordinator
16. Minna Lanz	Tampere University
17. Tommy Höglund	Acreo
18. ?	PLASTIPOLIS

Figure 16: List of Workshop participants

⁹ All invited participants that confirmed their attendance were present. Plastipolis was also proposed to join, without confirming, but no representative was finally available on the 1st December to join the workshop. However, Bertrand Fillon (from IPC, which has close collaborations with Plastipolis, and very well aware of their activities) was able to represent them for the workshop, even it was not considered for the votes during the poster session.

5.4 Annex D: Groups for poster session

According to the background and field of expertise of the experts and stakeholders, two groups were designed during the session. Each group was moderated by two organizers from FUTURING (led by CEA, TECNALIA and LMS, and respecting a gender balance approach).

Group A		Group B	
Name	Organization	Name	Organization
Nicolas DEFRENNE	PV Cycle	Amir RASHID	KTH
Bertrand FILLON	IPC	Luc FEDERZONI	CABRISS EU-project
Koen DITTRICH	Erasmus RSM	Minna LANZ	Tampere Univ.
Jan MENEVE	VITO	Tommy HÖGLUND	Acreo
Konstantinos GEORGOULIAS	LMS	Christoph HANISCH	FESTO
Elmer RIETVELD	TNO	Francesco JOVANE	COTEC
Björn SAUTTER	FESTO	Simon PERRAUD	CEA
Izaskun JIMENEZ ITURRIZA (moderator)	Tecnalia	Mirari ZALDUA URRETABIZKAIA (moderator)	Tecnalia
Arnaud WITOMSKI (moderator)	CEA	Loukas RENTZOS (moderator)	LMS

Table 21: Breakdown of participants for the poster session

5.5 Annex E: Worksheet questionnaire

All worksheet were collected at the end of the session and were filled either on paper or electronically by the experts and stakeholders.

WP1 workshop – 1st December 2016 – Lyon

First name		Function	
Last name		Email	
Organization		Tel	

1. Building Blocks

→ *Following our poster session, please describe qualitatively the importance of each drivers based on some practical return of experiment that you faced in some previous projects / initiatives. (ie cite projects, explain how the drivers influenced the results – positively or negatively -, what dimensions should have been more taken into account, etc...)*

Drivers	Qualitative description of return of experiment
Science & Technology	
Business & innovation	
Human being & society	
Environmental sustainability	
Policy & Finance	
Other?	

2. Pillar Actions

→ Please cite some examples of projects / initiatives (of your knowledge or where you are / were involved) linked with Circular Economy and match them accordingly to the proposed Pillar Actions

Pillar Action	Description	Example of projects / initiatives (give a contact person if possible)
Regenerate		
Share		
Optimise		
Loop		
Virtualise		
Exchange		
Other?		