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A circular economy approach for lifecycles of products and services

Experience and recommendations of end-user engagement across circular economy business model development

Deliverable7.4

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Summary

This deliverable includes ecosystemic business model concept and a strategy designed for circular economy and utilized in WP1, WP2 and WP3, as well as coordination of end-user engagement and co-creation tasks and the activities in a single business model development. This deliverable is a result of Task 7.5 and Task 7.6.

The ecosystemic business models are used to investigate business models of companies and other organizations for implementation of the three CEBM (circular economy business models) to be developed by the CIRC4Life project. The ecosystemic business models focus on both the firm's method of creating and capturing value as well as any part of the ecosystem method of creating and capturing the value of the ecosystem.

Ecosystemic thinking is based on the end-user engagement and co-creation in a circular economy business development. The results of end-user involvement and co-creation will be applied in latter project activities, such as demonstrations and Living Lab implementation.

This deliverable provides coordination on engagement and co-creation of tasks and activities in a single business model development, as well as across diverse business models development, and supports implementation of WP1, WP2 and WP3.

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Acronyms and abbreviations

Abbreviation	Description
CEBM	Circular Economy Business Model
CE	Circular Economy
EoL	End of Life
LL	Living Lab

1 Introduction

This deliverable defines the ecosystemic approach to developing circular economy business models (CEBM) and provides guidelines for involving end-users and other stakeholders within and across business models, both from an individual's firm perspective, and from ecosystemic perspective.

The aim of the deliverable is to coordinate participation of end-users covering the whole CIRC4Life innovation process, from co-creation of products and services to sustainable consumption and collaborative recycle and reuse, according to the Living Lab approach and methodology defined in D7.1.

Ecosystemic approach means a user-centred co-creation and innovation process which is shared among ecosystem actors: companies, research organizations, policy-makers and end-users. This approach involves consumers and end-users into co-creation in all stages of circular economy, using service design methods and deep understanding of user needs. From the business ecosystem point of view, it includes ecosystem of companies, goods and services. In this report we use Moore's understanding of a business ecosystem, based on the notion that a company should be viewed not as a member of a single industry but as part of a business ecosystem that crosses a variety of industries" (Moore 1993).

The deliverable is structured in the following way: first, results of T.7.5 are described in Chapters 2 and 3. The task developed ecosystemic business models, which are to be used to investigate business models of companies and other organizations for implementation of the three CEBMs to be developed by CIRC4Life project. The ecosystem business models focus on both the firm's method of creating and capturing value as well as any part of the ecosystem's method of creating and capturing value to the ecosystem, supporting the development and implementation of the CEBMs. The ecosystemic business models will be utilised in WP1, WP2 and WP3.
The activities to be conducted include:

- Development of ecosystemic business model elements
- Identification of joint business model opportunities for different ecosystem actors
- Investigation of the requirements for ecosystemic business models in a circular economy
- Develop concepts of ecosystemic business models in a circular economy
- Facilitation of the ecosystemic business model and the ecosystem strategy

Second, experiences of coordination of end-user involvement in ecosystemic business model development for three CEBM: co-creation of products and services; collaborative recycle and reuse; and sustainable consumption are presented as the result of T.7.6. This task comprises of coordination of end-user involvement and co-creation in a circular business model development but also activities across diverse business model developments. The results from earlier end-user involvement and co-creation will be applied in the latter end-user-involvement and co-creation activities. Task objective and responsibility is to provide professional level coordination of end-user involvement and co-creation activities to benefit co-development and co-creation activities with users and other stakeholder in circular economy ecosystems including Task 1.4 Consumer-supply chain interaction, (2) Task 2.6 End-user awareness of reuse/recycling, and (3) Task 3.5 Consumer satisfaction survey.

The activities to be conducted include:

- Coordinating on engagement and co-creation tasks and the activities in a single business model development
- Coordinating on engagement and co-creation tasks and the activities across diverse business models development

2 Ecosystemic Business Model Concept definition for CIRC4Life purposes

2.1 What is an ecosystem?

In the scientific literature, four major streams of ecosystem research have been identified, each having a different theoretical background (Tsujimoto, M., Kajikawa, Y., Tomita, J. and Matsumoto, Y., 2018). These four streams include:

1) **Industrial ecosystem / ecology**, which typically focuses on analysing and optimizing energy and/or material flow within the material flow network, but is disconnected from business studies and industrial investment,
2) **Business ecosystem** stream highlights the value capture and/or value creation as central variables and tries to understand the organizational behaviour and dynamics within the ecosystem,
3) **Platform management** focuses on platform dynamism and the mechanism of growth and/or decline of the platform itself. External (industry) platform can be defined as products, services, or technologies that act as a foundation upon which external innovators, organized as an innovative business ecosystem, can develop their own complementary products, technologies, or services (Gawer, A., Cusumano, M.A., 2014) and
4) **Multi-actor network** perspective expands the ecosystem actors beyond the private companies and basically utilises the Quadruple Helix approach (Arnkil, R., et.al. 2010), which an extension to Triple Helix (Etzkowitz, H. and Leydesdorff, L., 2000) approach. The original Triple Helix argued that the following three major parties are needed to generate innovations: 1) private sector which role is to generating wealth, 2) universities which are producing new knowledge and 3) public sector which is formulating policies and regulation to enable, support and control the ecosystem activities. Otherwise Quadruple Helix is basically the same as Triple Helix but adds also civil society (a.k.a. users / customers) as one on the core actors of the ecosystem. This theoretical addition is typically referred as user-driven and user-centric/user-oriented approach.

We argue that all four ecosystem approaches are relevant for analysing and developing novel circular economy business model in context of CIRC4Life, since in order to be successful in circular economy there is a need to 1) optimize energy and material flows, 2) value capture and value creation in the case of closed loop system (Geissdoerfer, M. et.al. 2017), which is ideally eliminating all resource input into and leakage out of the system, is only possible if multiple actors are collaborating within interconnected ecosystems via different types of platforms, 3) new (ICT and other collaboration) platforms and connections between the platforms are needed to manage and produce to enable circular economy solutions and finally 4) intensive collaboration between private companies, public sector, academia and also with end-users is needed to generate and manage successful circular economy solutions, which have market acceptance.

To conclude, in CIRC4Life WP7, we adopt and adjust Tsujimoto et. al. (2018) definition that the ecosystem objective is to provide *"a product/service system which is managerially designed (or historically self-organized) multilayer social network, which consists of actors (a.k.a. stakeholders) that have different attributes, decision principles, and beliefs"*.

2.2 The main stakeholder within in a circular economy ecosystem

By following Quadruple Helix approach in the context of CIRC4Life (WP7) development and testing activities, the following different stakeholder groups have been identified:

1) **Private companies** are responsible for developing, testing and managing interconnected circular economy solutions (including energy/material flows, value creation with other ecosystem actors, and

engaging revenant local public sector actors and users) which effective and successful operation is requiring contributions from all Quadruple Helix actors, but especially an intensive collaboration between multiple companies, who are responsible for delivering the product/service system.

2) **Public sector** is responsible for arranging political and regulation environment which is supporting and rewarding environmentally friendly and sustainable behaviour, while penalizing opposite behaviour. Public sector also provides various types of environments in which circular economy product/service system can be developed and tested with a group of companies and various types of end-users.

3) **Academia and Research Institutions** are responsible for 1) facilitating co-creation and living lab activities (LAU) among the different stakeholders and helping to identify the challenges, pain points (when customer experiences confusion) as well as possible solutions within the proposed product/service systems, 2) calculating ecological impact for the products within the ecosystem (IEIA) and developing eco-point calculation method and related ICT-solution (NTU) to be used by end-users and companies within the ecosystem, and 4) developing ICT-platform (ICCS) for interconnecting various ICT-system as a holistic platform.

4) **End-users** are actively taking part to develop and test activities and provide evidence of the market acceptance. Different types of end-user groups (Eason, K. 1987) can be identified for the product/service system to be developed during the CIRC4Life project: (1) primary users, who are frequently using the product/service system, (2) secondary users who are occasional users or use the product/service system through an intermediary, and (3) tertiary users, who are affected by the introduction of the product/service system or who will influence its usage. Other approaches to differentiate the various user groups (Arnkil, R. et.al. 2010) includes for example professional users, lead users, non-users, ordinary users, amateur users, consumers, citizens, employees, residents, hobbyists which are referring to individual persons as a user, but also firm, organization and civil society association can be referred as a user.

As a result, it has been argued (Antikainen, M. & Valkokari, K., 2016) that Circular Economy Business Model innovations are by nature networked: they require collaboration, communication, and coordination within complex networks of interdependent but independent actors/stakeholders. However, the key challenge to develop a successful ecosystem in context of circular economy is to find "win-win-win" setting among diverse group of stakeholders. (Antikainen, M., et.al. 2013)

2.3 What is a business model?

Generally speaking, a business model is a method in which an organization builds and uses its resources to offer their customers better value than their competitors, and make profit by doing so (Afuah, A., & Tucci, C. L. (2001). However, the scholars do not agree on the definition of the business model (Zott, C., Amit, R., & Massa, L. 2011), but common elements and themes can be found in the emerging literature. As a unit of analysis business model is different comparing e.g. to product, company, industry, or network. The business model analysis is centred on a focal company, but its boundaries goes beyond company and highlights the partners role and emphasizes a system-level, holistic approach while trying to explain how a company create and capture value (i.e. do business).

Currently, the Business Model Canvas (BMC) (Osterwalder, A. and Pigneur, Y., 2009) presented in Figure 1 is probably the most commonly used framework to define business models although various other canvases and other approaches have also been proposed (Maurya, A. 2012; Böhmann, T. 2014). Due the popularity of the BMC approach, it is also adopted for CIRC4Life, since it is assumed that communication relating business model development will become easier with the help of a familiar concept. Therefore, the business model definition proposed by Osterwalder and Pigneur who developed the BMC approach is adopted: *"A business model*

describes the rationale of how an organization creates, delivers, and captures value" (Osterwalder and Pigneur, 2009).

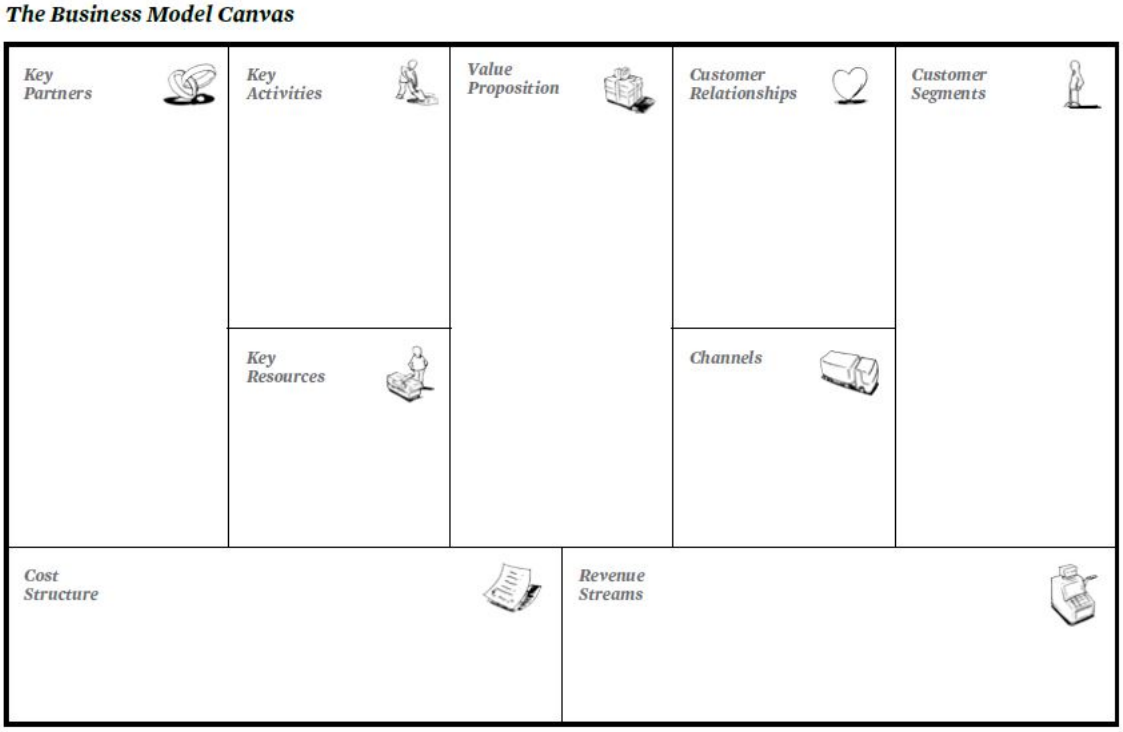

Figure 1: Business Model Canvas (Osterwalder, A. and Pigneur, Y., 2009)

As presented above, the original BMC approach includes the following nine building blocks, which are also forming the basic theoretical framework for CIRC4Life business model development, which should be addressed by CIRC4Life demonstrators when they are developing and implementing their business models.

1) **Key Activities:** The most important things, which a company needs do, to make its business model work and deliver the value for its customers.
2) **Key Resources:** The most important physical, financial, intellectual, or human assets.
3) **Partner Network:** By intelligently optimizing the partner (Howells, J., James, A., and Malik, K. 2003) and network (De Man, A. P., & Duysters, G. 2005) selection, a company can have an access to the resources and capabilities, which they themselves are lacking in order to redeem the suggested positive effects of collaboration.
4) **Value proposition:** Describes the benefits what customers can expect from a bundle services and products which a company is offering.
5) **Customer Segments**: The various sets of people and/or organizations who share one or more attributes and to whom company aims to reach and provide a set of services and products.
6) **Channels:** Different communication, distribution, and sales channels, which a company is using to reach and deliver its products and services for the customers.
7) **Customer Relationships:** An ongoing connection and management process for facilitating relationships and interactions with company's current and potential customers.
8) **Cost Structure:** Describes the most important financial consequences, which are incurred to execute the key activities and run the business model.

9) **Revenue Streams:** Several ways how a company captures value and makes income from different customer segment by meeting their expectations.

2.4 What is a Circular Economy Business Model (CEBM)?

The current dominant linear economic model is based on make, use and dispose approach in which firms make products, the consumer uses and disposes them and finally the products become waste. On the contrary, a Circular Economy Business Model (CEBM) is based on opposite approach and adopts the following three principles (Ellen McArthur & IDEO): 1) Design out waste and pollution, 2) Keep products and materials in use and 3) Regenerate natural systems.

Thus, the main goal of CEBMs is to help companies create value through using resources in multiple cycles and reducing waste and consumption (Lüdeke - Freund, F., Gold, S. and Bocken, N.M., 2019). Since the original BMC is not specifically developed to define circular economy business models, modifications have been suggested by other scholars. Recently closely related Sustainable Business Model Canvas (Bocken, N.M., Schuit, C.S. and Kraaijenhagen, C., 2018) (SBMC) as presented in Figure 2 was proposed. The suggested SBMC is closely related the original BMC, but the value proposition section is divided into three main sectors, which represents the three pillars of sustainability (Purvis, B., et.al. 2019; Moldan, B., et.al. T., 2012; Goodland, R., 1995) - economic, social and environmental – which in recent years have been associated to numerous sustainability standards and certification systems.

As a result, also we agree that true Circular Economy Business Model (CEBM) should simultaneous pursuit of economic, environmental, and social sustainability. Therefore, also CIRC4Life CEBMs development should pay attention to all these dimensions even if the importance of the three dimensions can vary in real life depending on the CEBM. To conclude, CIRC4Life is adopting the modified SBMC version which is presented in Figure 2.

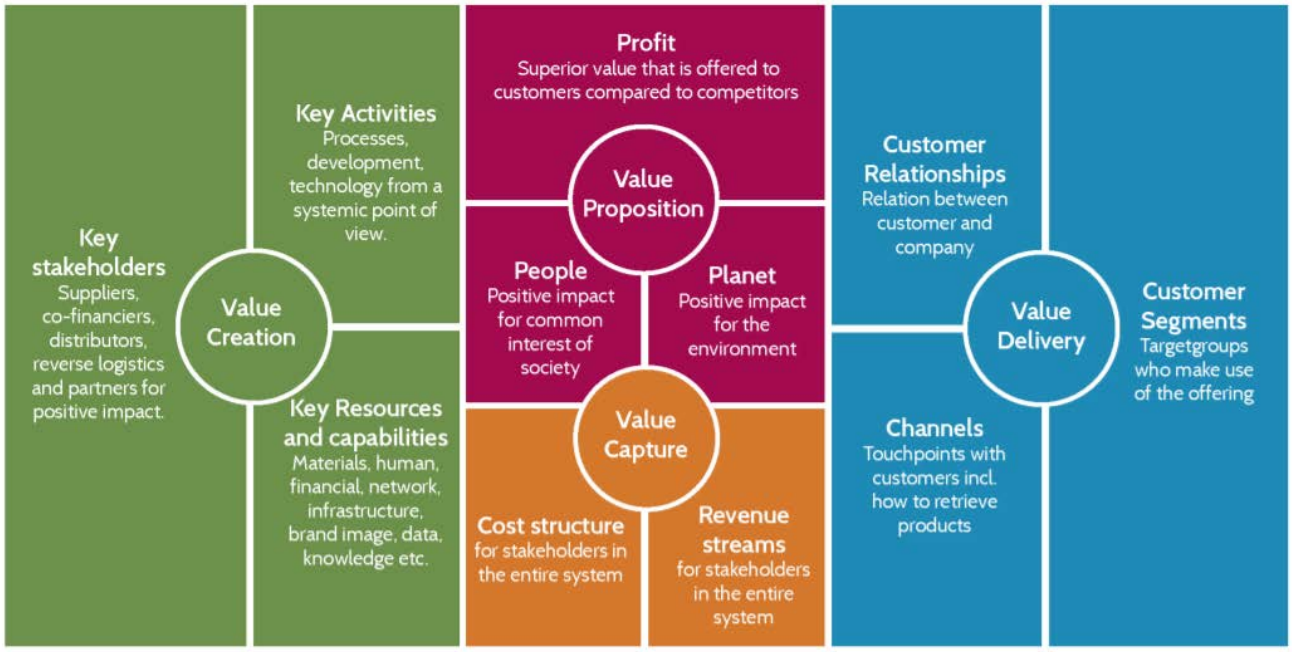

Figure 2: Sustainable business model canvas (Bocken, N.M., Schuit, C.S. and Kraaijenhagen, C., 2018)

To support SBMC, also Morphological box (Lüdeke - Freund, F., Gold, S. and Bocken, N.M., 2019) of CEBM design options grounded on value proposition, value delivery, value creation and value capture dimensions has

been proposed (Table 1). Morphological box provides a good starting point for discussing the possible CEBM options, while new options can be added based on the various co-creative activities during the CIRC4Life project.

Table 1: Morphological box for defining CEBMs (Lüdeke-Freund, F., Gold, S. and Bocken, N.M., 2019)

CEBM design option		CEBM design option								
Value proposition	Products	(1) Repaired, refurbished, remanufactured, or recycled products	(2) Reusable or recyclable products	(3) Products based on recycled waste	(4) Long lasting products	(5) Used products, components, materials, or waste as production inputs	(6) Reusable or recyclable production inputs			
	Services	(1) Facilitating collaboration	(2) Take-back management	(3) Customer education	(4) Waste handling, processing	(5) Product-/ service based functions	(6) Maintenance, repair, control	(7) Product-/ service based results	(8) Upgrading	(9) Auxiliary services
Value delivery	Target customers	(1) Quality-conscious customers	(2) Cost-conscious customers	(3) Green customers	(4) B2B customers	(5) B2C suppliers	(6) B2B suppliers	(7) C2C suppliers		
	Value delivery processes	(1) Connecting suppliers and customers	(2) Providing access to a product's functionality	(3) Providing (product-based) services and results	(4) Providing used products, components, materials, or waste	(5) Taking back used products, components, materials, or waste	(6) Sharing products, components, materials, or waste			
Value creation	Partners and stakeholders	(1) Suppliers	(2) Manufacturers	(3) Retailers	(4) Service providers	(5) Public institutions	(6) Collectors of products, components, materials, waste	(7) Others (e.g., researchers)		
	Value creation processes	(1) Maintaining or repairing products, components	(2) Refurbishing or remanufacturing products, components	(3) Recycling of products, components, materials, waste	(4) Upgrading or upcycling of products, components, materials, waste	(5) Reselling products, components, materials, waste	(6) Taking back or recapturing products, components, materials, waste	(7) Winning back base materials	(8) Using used products, components, materials, waste as input	(9) Matching over and under capacities	(1) Designing products, components, materials
Value capture	Revenues	(1) Additional product revenues		(2) Payments per unit of service		(3) Payments for functions or results		(4) Price premiums		
	Costs	(1) Labor	(2) Repair, maintenance, control	(3) Waste handling, processing	(4) Manufacturing	(5) Resource inputs	(6) Transportation, logistics	(7) Supply risks		

3 Identifying Strategy Options for Circular Economy Business Models (CEBM)

3.1 CIRC4Life CEBMs in context of CE-value chain

The objective of the CIRC4Life project is to develop and test (A) Co-creation of product and services, (B) Sustainable consumption and (C) Collaborative recycling and reuse CEBMs in context of (1) LED lighting products (ONA, KOS), (2) recycle/reuse of tablets (IND), (3) vegetable farming (JS) and (4) meat supply chain (ALIA). In Figure 3, a conceptual framework for classifying CIRC4Life CEBMs is presented in the context of a CE value chain.

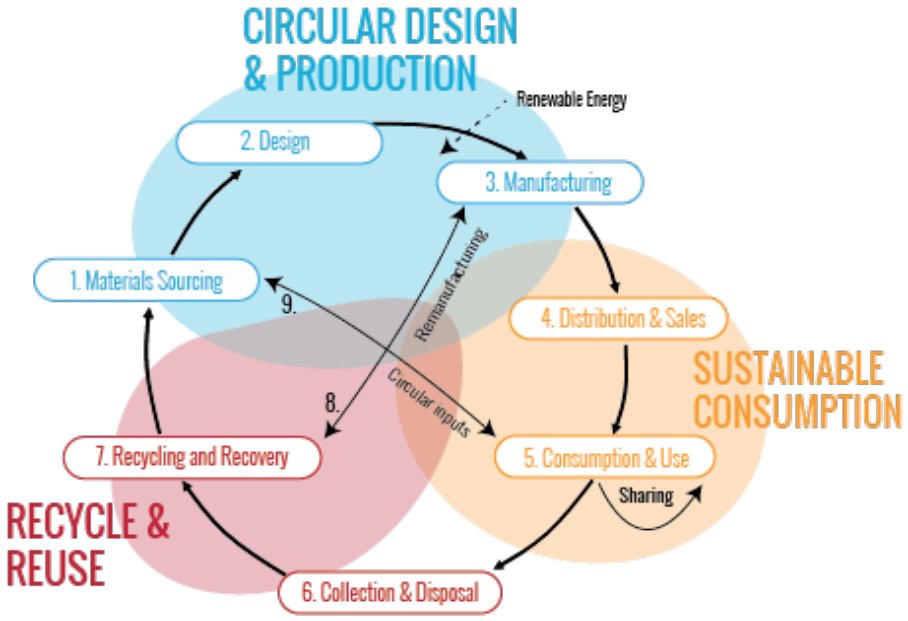

Figure 3: Classification of CIRC4Life CEBMs in context of CE value chain

As a result in context of CIRC4Life, **(A) Co-creation of product and services CEBM** (WP 1) will include following CE-phases 1) material sourcing, 2) design and 3) manufacturing phases, **(B) Sustainable consumption CEBM** (WP 3) will include 4) distribution and sales and 5) Consumption and use phases and **(C) Collaborative recycling and reuse CEBM** (WP 2) will include 6) collection and disposal, 7) recycling and recovery, 8) remanufacturing and circular inputs phases.

3.2 Possible development options for the CEBM strategies

Among the scholars, there has been multiple efforts do define CEBM strategies. In our opinion among most prominent and most useful for CIRC4Life purposes are:

(1) CE Strategies Database, which includes 45 CE strategies that are applicable to different parts of the CE value chain (Kalmykova, Y., Sadagopan, M. and Rosado, L., 2018),
(2) The sustainable business model archetype framework, which includes technological, social and organisational dimensions as main dimensions, and each of these includes three main architypes and a total of 53 example approaches (Bocken, N.M., Short, S.W., Rana, P. and Evans, S., 2014),
(3) Morphological box (Lüdeke - Freund, F., Gold, S. and Bocken, N.M., 2019) of CEBM design options grounded on value proposition, value delivery, value creation and value capture dimensions as proposed in SBMC and theoretically offering astonishing 4,445,280 possible combinations for CEBM and

(4) A total of 92 approaches for sustainability-oriented and CE-oriented BMI classified based on "Sensing" identifying opportunities and generating new BM ideas, "Seizing" systematically designing and testing new BM concepts or configurations and "Transforming" building new competences and implementing organizational renewal (Pieroni, M.P., McAloone, T. and Pigosso, D.A., 2019).

Out of these excellent options CE Strategies Database approach (Kalmykova, Y., Sadagopan, M. and Rosado, L., 2018) was adopted for CIRC4Life purposes since it was the only framework, which included clear linkage to different parts of the CE value chain. Furthermore, due the linkage, this approach is also more easies to adopt in CIRC4Life project management procedures which WP structure is grounded on (A) Co-creation of product and services, (B) Sustainable consumption (C) Collaborative recycling and reuse work packages**.** The title level descriptions of the CE strategy options are presented in Table 2, but it is encouraged to read the original publication to get better understanding of the various options.

Table 2: CE strategy options classified according to CE main phases (Kalmykova, Y., Sadagopan, M. and Rosado, L., 2018)

Co-creation of product and services	
1. MATERIALS SOURCING:	(1) Diversity and cross-sector linkage; (2) Energy production/Energy autonomy, (3) Green procurement, (4) Life Cycle Assessment (LCA), (5) Material substitution, (6) Taxation and (7) Tax credits and subsidies
2. DESIGN	(8) Customization/made to order, (9) Design for disassembly/recycling, (10) Design for modularity, (11) Eco design, (12) Reduction
3. MANUFACTURING	(13) Energy efficiency, (14) Material productivity, (15) Reproducible & adaptable manufacturing
Sustainable consumption	
4. DISTRIBUTION AND SALES	(16) Optimized packaging design, (17) Redistribute and Resell
5. CONSUMPTION AND USE	(18) Community involvement, (19) Eco-labelling, (20) Product as a service or Product Service System, (21) Product labelling, (22) Re-use, (23) Sharing, (24) Socially responsible consumption, (25) Stewardship, (26) Virtualize Dematerialization
Collaborative recycling and reuse work packages	
6. COLLECTION AND DISPOSAL	(27) Extended Producer Responsibility (E.P.R), (28) Incentivized recycling, (29) Logistics/Infrastructure building, (30) Separation, (31) Take-back and trade-in systems
7. RECYCLING AND RECOVERY	(32) By-products use, (33) Cascading Materials, (34) Downcycling, (35) Element/substance recovery, (36) Energy recovery, (37) Extraction of bio-chemicals, (38) Functional recycling, (39) High quality recycling, (40) Industrial symbiosis, (41) Restoration, (42) Upcycling
8. REMANUFACTURE	(43) Refurbishment/Remanufacture, (44) Upgrading, Maintenance and Repair
9. CIRCULAR INPUTS	(45) Bio-based materials

4 Demonstrators CE strategy and Circular Economy Business Models (CEBM)

4.1 Demonstrators CEBM objectives on the basis of CIRC4Life project proposal

It is highlighted that the key objectives of the CIRC4Life project as defined in the project proposal will significantly influence what kind of CE strategy options the demonstrators are selecting. In the following the original objectives CEBMs for each demonstrator is presented as they were described in the CIRC4Life project proposal and presented during the first Innovation Camp in Cracow (T7.3).

4.1.1 Domestic LED lightning

The main development and demonstration actions for Domestic LED lightning are illustrated in Figure below. The demonstration action will take place in Valencia (Spain) by ONA.

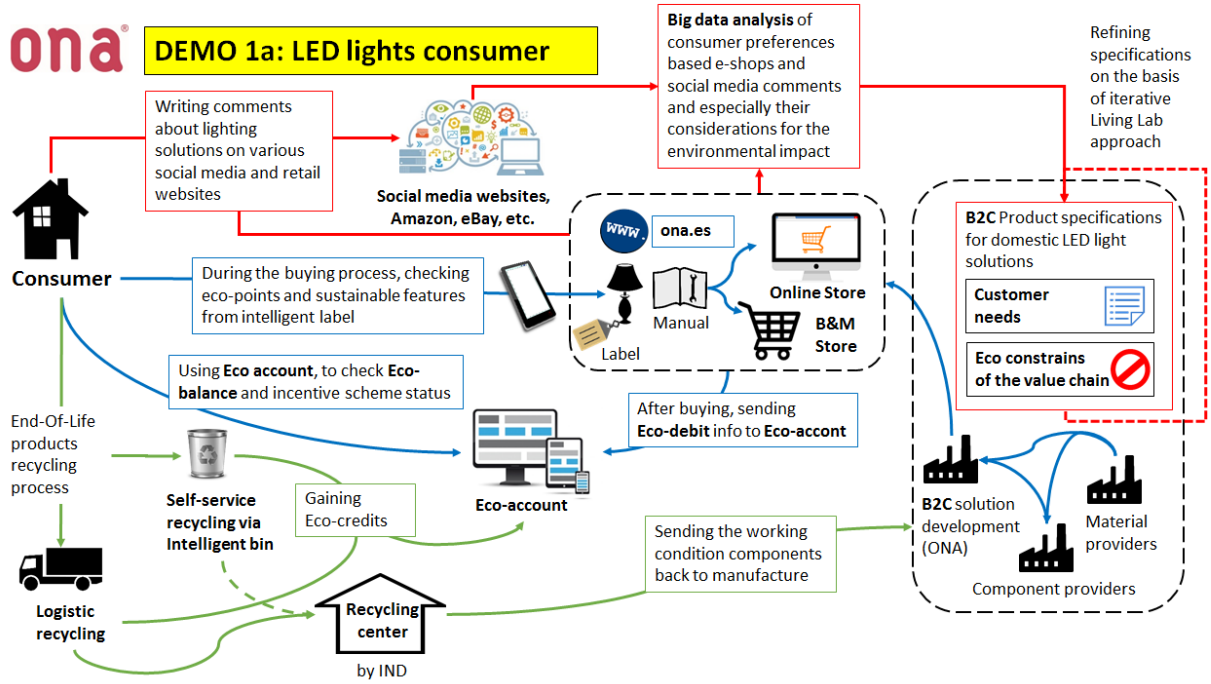

Figure 4: Domestic LED lighting development and demonstration objectives

Using big data mining and living lab tools, ONA will apply the big data technique developed in the project to mine consumer preferences via large volumes of light products' reviews and comments through social media and their own website. Sustainable consumption will be encouraged by showing the eco-points information of the new domestic lighting in Ona´s online store, providing valuable input to help consumers on their sustainable purchase decisions.

Collaborative recycling will be demonstrated by extending the lighting products recycling practices to end-users, enabling citizens to separate and recycle the products which have overpassed the expiration date through intelligent bins or via logistic recycling in which customer can recycle their products by sending them back to collection points or contacting the company for collection.

Recycling process will record the recycled product's eco-credits into the consumer's eco-account. The recycling centre will sort out end of life products and will send the components in working condition to the manufacturer to be incorporated in the production of new lights.

4.1.2 Industrial LED lightning

The main development and demonstration actions for Industrial LED lightning (B2B) are illustrated in Figure below. Demonstration will be conducted by Kosnic, Newbury, UK.

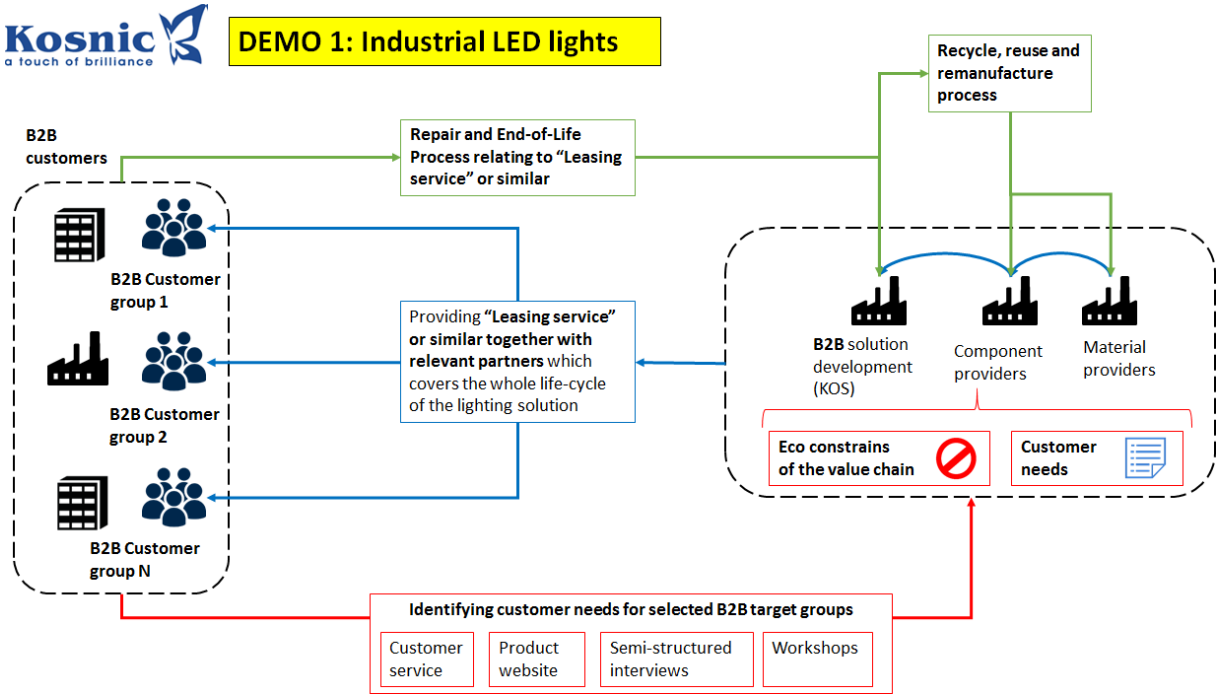

Figure 5: Industrial LED lighting development and demonstration objectives

To implement the co-creation of products model, living lab methods will be applied to address the end-users' requirements, including such as end-user and key stakeholder workshop, semi-structured interview, user feedback via the customer service and product Website, and survey through Twitter, Facebook and Emails. Sustainable techniques developed by the project will be applied in the production of industrial lights, including traceability, ICT, eco-accounting, and sustainable design and manufacture.

With the sustainable consumption model, the module design structure will be applied to make the faulty or end-of-life components easily be replaced or repaired at the use stage and, hence, to extend the product service life. Necessary information will be provided for the users to select more sustainable products, and, in particular, the product sustainability indicator, eco-points of the products, will be available for the user to make a purchase decision. Instructions will be provided to the users for sustainable consumption of the products, such as energy saving, longer service life, etc.

To demonstrate the sustainable recycling/reuse model, the company will implement the leasing service. In this service, Kosnic with its partners will look after the lights throughout their product life time, provide regular maintenance service to enable the product's performance, and take-back the products when it reaches the end of life (EoL), then the recycling, reuse and remanufacture will be implemented with those EoL products.

4.1.3 Recycle and Reuse of Tablets

The development and demonstration actions for Recycle and Reuse of Tablets illustrated in Figure below will take place in the Basque Country.

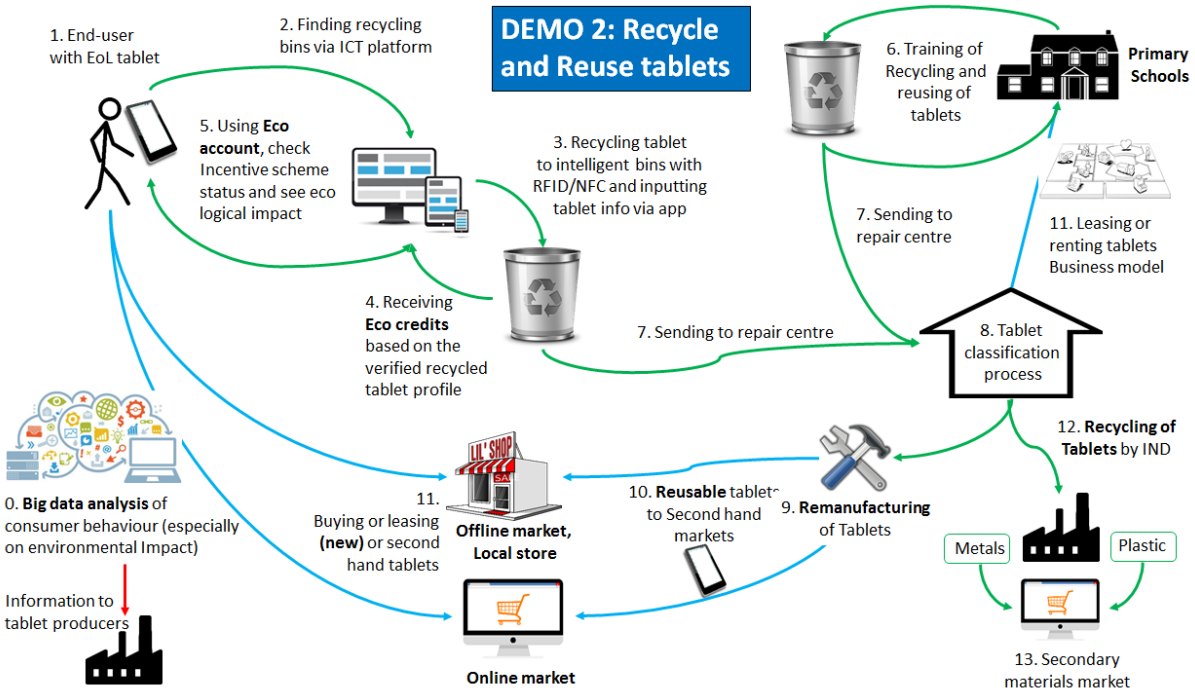

Figure 6: Recycle and Reuse of Tablets development and demonstration objectives

The main logistical challenges are focused on defining and demonstrating an efficient collection system for the reuse or remanufacturing of the tablets, which, in addition to ensuring the integrity of the equipment, allows it to be traced and allows the end user to know at all times the destination of his equipment and how his/her actions during the product life cycle are rewarded. This includes the design and implementation of an incentive scheme for improving reuse and recycling ratios.

The project includes a heavy workload in educational institutions, as a source of information for stakeholders (due to the intense use of electronic tablets in schools), and as potential mass end users of reused tablets. The information of users of interest will be transferred to the producing companies.

The innovation camp will explore these issues in greater depth, the application of which to electronic tablets is generally valid for other computer and communication equipment (mobile phones, laptops), and represents an opportunity for manufacturers of such equipment.

It is also an opportunity for collection agents, container manufacturers interested in participating in the circular economy and its reuse and remanufacturing processes, and for local institutions interested in environmental awareness for people and improving e-waste collection figures in their population. The innovation camp will address the latest methodologies in these different fields and is a unique opportunity to listen and consider the opinion of citizens regarding these products, the impression they have about their environmental performance, and the involvement and encouragement of citizens, as end users of electronic products such as tablets, at the end of their lives.

4.1.4 Micro Farming

The main development and demonstration actions for DEMO 3: Micro Farming are illustrated in Figure below. The demonstration will take place at the farm business Scilly Organics, based on the Isles of Scilly, UK coordinated by Partner Jonathan Smith.

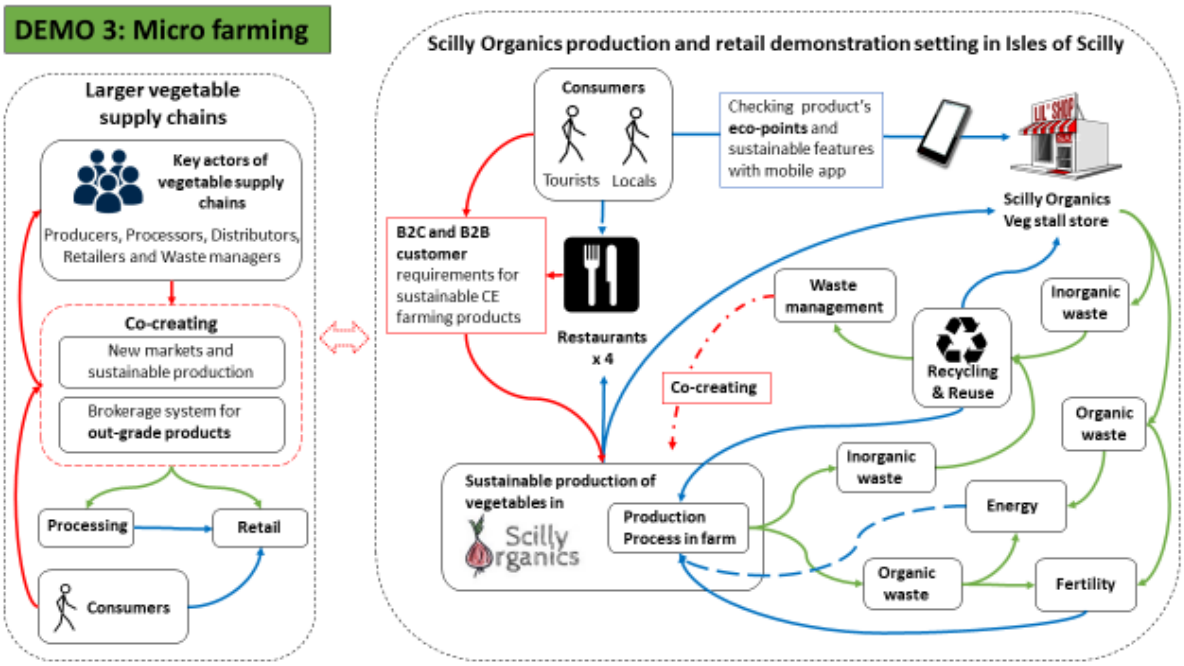

Figure 7: Micro Farming development and demonstration objectives

Incorporating the needs and desires of consumers into vegetable products, the demonstration will be based on co-creation of new markets for vegetables. This includes demonstrating and communicating the environmental and social impacts of production to consumers.

Using the Impact Analysis Tool, sustainable production of vegetables will be demonstrated at Scilly Organics. A 'before and after' approach will be used to understand how the implementation of circular economy approaches to vegetable production can reduce environmental and social impacts of production, whilst improving the offer to consumers and creating business opportunities.

Furthermore, the Decision-Making Tool will demonstrate how Scilly Organics, and other businesses, are able to make informed decisions about changes to business practices to reduce environmental and social impacts.
Reducing and recycling all forms of waste is critical in this demonstration. Of particular focus will be the reduction of waste vegetable products, assessing the ability of out graded and unsold produce to be used productively in new business opportunities.

This approach includes demonstrating how increased recycling and reused benefits consumers' eco points, and a Brokerage System to connect buyers and sellers of 'waste' vegetable products.

4.1.5 Meat Product Supply Chain

The main development and demonstration actions for DEMO 4: Meat Product Supply Chain are illustrated in Figure below. Demonstration will take place in Lorca (Spain) and will involve the companies of ALIA's holding group.

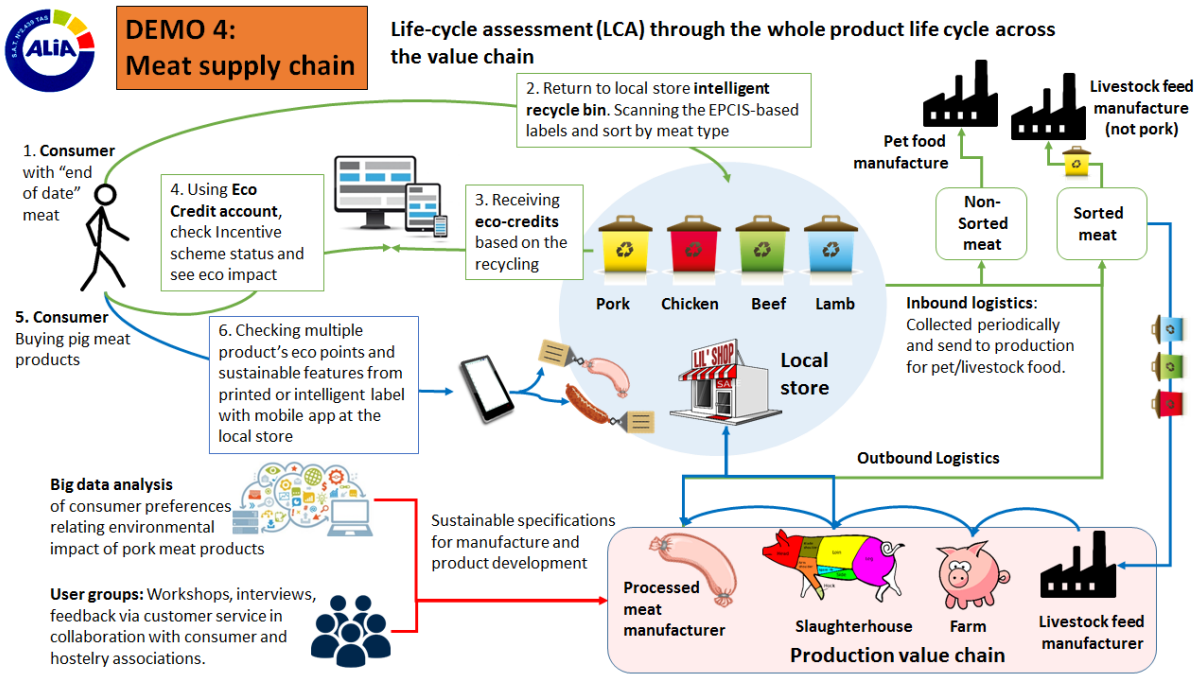

Figure 8: Meat Product Supply Chain development and demonstration objectives

Using the big data mining and living lab tools, ALIA will incorporate sustainability preferences of consumers in two new products and will implement different environmentally friendly techniques along the whole value chain (from the animal feeding to the meat elaborate manufacturing) in order to produce these products.

Sustainable consumption will be encouraged by showing the eco-points information of the new products in the retail point, at ALIAS factory's store, providing valuable information to help consumers on their sustainable purchase decisions.

Collaborative recycling will be demonstrated by extending the meat recycling practices to the end-user, enabling the citizens to separate and recycle their meat products which have overpassed the expiration date. This meat will be collected and transformed into animal fat (for cosmetics, chemical industry and animal feeding) and meat meal for animal feeding, becoming valuable raw materials for other industries.

4.2 Methodology for developing and enhancing demonstrators CE strategy and Circular Economy Business Models (CEBM)

A series of following co-creation activities were conducted to further develop and enhance the demonstrators CEBMs:

(1) First Innovation Camp (T7.3),
(2) Surveys (T3.6) and
(3) Various workshops and focus group sessions (7.4-7.6) as described in Deliverable 7.1: "Living Labs Concepts and Implementation Plan for CIRC4Life-project" and further elaborated in this deliverable document section five.

In the following modified Morphological box (Lüdeke - Freund, F., Gold, S. and Bocken, N.M., 2019) visualization approach is adopted to illustrate CE strategy selection (Kalmykova, Y., Sadagopan, M. and Rosado, L., 2018) for each demonstrator, which are defining the basic foundation for their CEBM across the CE-value chain. Green boxes represent relevant choices for CIRC4Life demonstrators among all possible CE strategies.

4.3 Domestic LED lightning CE-strategy selection for CIRC4Life project (ONA)

- *Green = selected strategy*
- *White = unselected strategy*

Co-creation of product and services	Materials sourcing	(1) Diversity and cross-sector linkage	(2) Energy production / Energy autonomy	(3) Green procurement	(4) Life Cycle Assessment (LCA)	(5) Material substitution	(6) Taxation	(7) Tax credits and subsidies				
	Design	(8) Customization / made to order	(9) Design for disassembly / recycling	(10) Design for modularity	(11) Eco design	(12) Reduction						
	Manufacturing	(13) Energy efficiency	(14) Material productivity	(15) Reproducible & adaptable manufacturing								
Sustainable Consumption	Distribution and sales	(16) Optimized packaging design	(17) Redistribute and Resell									
	Consumption and use	(18) Community involvement	(19) Eco-labelling	(20) Product as a service or Product Service System	(21) Product labelling	(22) Re-use	(23) Sharing	(24) Socially responsible consumption	(25) Stewardship	(26) Virtualize de-materialization		
Collaborative Recycle and Reuse	Collection and disposal	(27) Extended Producer Responsibility (E.P.R)	(28) Incentivized recycling	(29) Logistics / Infrastructure building	(30) Separation	(31) Take-back and trade-in systems						
	Recycling and recovery	(32) By-products use	(33) Cascading Materials	(34) Down-cycling	(35) Element / substance recovery	(36) Energy recovery	(37) Extraction of bio-chemicals	(38) Functional recycling	(39) High quality recycling	(40) Industrial symbiosis	(41) Restoration	(42) Upcycling
	Re-manufacture	(43) Refurbishment / Remanufacture	(44) Upgrading, Maintenance and Repair									
	Circular inputs	(45) Bio-based materials										

4.4 Industrial LED lightning CE-strategy selection for CIRC4Life project (KOS)

- *Green = selected strategy*
- *White = unselected strategy*

Co-creation of product and services	**Materials sourcing**	(1) Diversity and cross-sector linkage	(2) Energy production / Energy autonomy	(3) Green procurement	(4) Life Cycle Assessment (LCA)	(5) Material substitution	(6) Taxation	(7) Tax credits and subsidies				
	Design	(8) Customization / made to order	(9) Design for disassembly / recycling	(10) Design for modularity	(11) Eco design	(12) Reduction						
	Manufacturing	(13) Energy efficiency	(14) Material productivity	(15) Reproducible & adaptable manufacturing								
Sustainable Consumption	**Distribution and sales**	(16) Optimized packaging design	(17) Redistribute and Resell									
	Consumption and use	(18) Community involvement	(19) Eco-labelling	(20) Product as a service or Product Service System	(21) Product labelling	(22) Re-use	(23) Sharing	(24) Socially responsible consumption	(25) Stewardship	(26) Virtualize de-materialization		
Collaborative Recycle and Reuse	**Collection and disposal**	(27) Extended Producer Responsibility (E.P.R)	(28) Incentivized recycling	(29) Logistics / Infrastructure building	(30) Separation	(31) Take-back and trade-in systems						
	Recycling and recovery	(32) By-products use	(33) Cascading Materials	(34) Down-cycling	(35) Element / substance recovery	(36) Energy recovery	(37) Extraction of bio-chemicals	(38) Functional recycling	(39) High quality recycling	(40) Industrial symbiosis	(41) Restoration	(42) Upcycling
	Re-manufacture	(43) Refurbishment / Remanufacture	(44) Upgrading, Maintenance and Repair									
	Circular inputs	(45) Bio-based materials										

4.5 Recycle and Reuse of Tablets CE-strategy selection for CIRC4Life project (IND + REC)

- *Green = selected strategy*
- *White = unselected strategy*

Co-creation of product and services	Materials sourcing	(1) Diversity and cross-sector linkage	(2) Energy production / Energy autonomy	(3) Green procurement	(4) Life Cycle Assessment (LCA)	(5) Material substitution	(6) Taxation	(7) Tax credits and subsidies				
	Design	(8) Customization / made to order	(9) Design for disassembly / recycling	(10) Design for modularity	(11) Eco design	(12) Reduction						
	Manufacturing	(13) Energy efficiency	(14) Material productivity	(15) Reproducible & adaptable manufacturing								
Sustainable Consumption	Distribution and sales	(16) Optimized packaging design	(17) Redistribute and Resell									
	Consumption and use	(18) Community involvement	(19) Eco-labelling	(20) Product as a service or Product Service System	(21) Product labelling	(22) Re-use	(23) Sharing	(24) Socially responsible consumption	(25) Stewardship	(26) Virtualize de-materialization		
Collaborative Recycle and Reuse	Collection and disposal	(27) Extended Producer Responsibility (E.P.R)	(28) Incentivized recycling	(29) Logistics / Infrastructure building	(30) Separation	(31) Take-back and trade-in systems						
	Recycling and recovery	(32) By-products use	(33) Cascading Materials	(34) Down-cycling	(35) Element / substance recovery	(36) Energy recovery	(37) Extraction of bio-chemicals	(38) Functional recycling	(39) High quality recycling	(40) Industrial symbiosis	(41) Restoration	(42) Upcycling
	Re-manufacture	(43) Refurbishment / Remanufacture	(44) Upgrading, Maintenance and Repair									
	Circular inputs	(45) Bio-based materials										

4.6 Micro Farming CE-strategy selection for CIRC4Life project (JS)

- *Green = selected strategy*
- *White = unselected strategy*

Co-creation of product and services	**Materials sourcing**	(1) Diversity and cross-sector linkage	(2) Energy production / Energy autonomy	(3) Green procurement	(4) Life Cycle Assessment (LCA)	(5) Material substitution	(6) Taxation	(7) Tax credits and subsidies				
	Design	(8) Customization / made to order	(9) Design for disassembly / recycling	(10) Design for modularity	(11) Eco design	(12) Reduction						
	Manufacturing	(13) Energy efficiency	(14) Material productivity	(15) Reproducible & adaptable manufacturing								
Sustainable Consumption	**Distribution and sales**	(16) Optimized packaging design	(17) Redistribute and Resell									
	Consumption and use	(18) Community involvement	(19) Eco-labelling	(20) Product as a service or Product Service System	(21) Product labelling	(22) Re-use	(23) Sharing	(24) Socially responsible consumption	(25) Stewardship	(26) Virtualize de-materialization		
Collaborative Recycle and Reuse	**Collection and disposal**	(27) Extended Producer Responsibility (E.P.R)	(28) Incentivized recycling	(29) Logistics / Infrastructure building	(30) Separation	(31) Take-back and trade-in systems						
	Recycling and recovery	(32) By-products use	(33) Cascading Materials	(34) Down-cycling	(35) Element / substance recovery	(36) Energy recovery	(37) Extraction of bio-chemicals	(38) Functional recycling	(39) High quality recycling	(40) Industrial symbiosis	(41) Restoration	(42) Upcycling
	Re-manufacture	(43) Refurbishment / Remanufacture	(44) Upgrading, Maintenance and Repair									
	Circular inputs	(45) Bio-based materials										

4.7 Meat Product Supply Chain CE-strategy selection for CIRC4Life project (ALIA)

- *Green = selected strategy*
- *White = unselected strategy*

Co-creation of product and services	**Materials sourcing**	(1) Diversity and cross-sector linkage	(2) Energy production / Energy autonomy	(3) Green procurement	(4) Life Cycle Assessment (LCA)	(5) Material substitution	(6) Taxation	(7) Tax credits and subsidies				
	Design	(8) Customization / made to order	(9) Design for disassembly / recycling	(10) Design for modularity	(11) Eco design	(12) Reduction						
	Manufacturing	(13) Energy efficiency	(14) Material productivity	(15) Reproducible & adaptable manufacturing								
Sustainable Consumption	**Distribution and sales**	(16) Optimized packaging design	(17) Redistribute and Resell									
	Consumption and use	(18) Community involvement	(19) Eco-labelling	(20) Product as a service or Product Service System	(21) Product labelling	(22) Re-use	(23) Sharing	(24) Socially responsible consumption	(25) Stewardship	(26) Virtualize de-materialization		
Collaborative Recycle and Reuse	**Collection and disposal**	(27) Extended Producer Responsibility (E.P.R)	(28) Incentivized recycling	(29) Logistics / Infrastructure building	(30) Separation	(31) Take-back and trade-in systems						
	Recycling and recovery	(32) By-products use	(33) Cascading Materials	(34) Down-cycling	(35) Element / substance recovery	(36) Energy recovery	(37) Extraction of bio-chemicals	(38) Functional recycling	(39) High quality recycling	(40) Industrial symbiosis	(41) Restoration	(42) Upcycling
	Re-manufacture	(43) Refurbishment / Remanufacture	(44) Upgrading, Maintenance and Repair									
	Circular inputs	(45) Bio-based materials										

5 Coordination of end-user involvement in ecosystemic business model development in CE

5.1 End-user and stakeholder involvement plan across CIRC4Life project lifespan

The Living Lab approach utilized in CIRC4Life and described in Deliverable 7.1 requires systematic user and stakeholder engagement throughout the project lifespan, starting from ideation and concept development phases and ending with testing and validation. As shown in Figure 9, user engagement is at the core of the CIRC4Life approach. This chapter addresses user and stakeholder involvement in development of the three business models: a) **CEBM A**: Co-creation of products and services, b) **CEBM C**: Sustainable consumption, and c) **CEBM B**: Collaborative recycling and reuse. Although this chapter covers only involvement activities until M18 of the project, end-user engagement continues throughout the whole project lifespan.

Figure 9 CIRC4Life approach to user engagement

Why engage?

As CIRC4Life seeks to identify user-centric solutions, opportunities and challenges, the development processes are user-driven and based on the principals of Open Innovation. Involving the users already in the beginning of the development activities is one of the key elements of the project.

In CIRC4Life end-users are brought closer to design and production process (as a value proposition of CEBM A) to ensure that their preferences are addressed when developing new products and services. The benefits of user engagement are:

- new customer insights
- understanding of a customer journey, attitudes and preferences
- usability and functionality
- rapid testing and iterative development process.

Apart from end-users, other actors in CE also benefit from the involvement in development process. Users and citizens are able to develop solutions and innovations that meet their needs, companies receive new valuable ideas from outside, public organizations can receive added value and increased return on investment on innovation research and academia and researchers benefit from new study cases and publications.

Collaborative and open practices can lead to solutions that go far beyond the scope of what any individual actor could have achieved alone (Chesbrough, 2003; Chesbrough, 2006; Ståhlbröst, A. Holst, M. 2012).

Whom to engage?

The challenges of circular economy require multi-level solutions that involve a wide range of stakeholders with different interests. The stakeholders selected to participate in the process should be selected based on their suitability to achieve the expected output in each development phase. Companies' ability to capture and understand the different needs of the stakeholders, often expressed as suggestions or complaints, defines how much users and other stakeholders actually can contribute to the development (Sthåhlbröst, A. 2017).

User engagement starts with identifying relevant users and stakeholders within and beyond value chain. In CIRC4Life we used a balanced representation of consumers, end-users and stakeholders so that all relevant stakeholder groups will be represented (based on the Quadruple Helix approach). In the CIRC4Life project, different stakeholders are categorized under the quadruple helix actors as presented in section 4.4.

One of the main principals of user selection is to involve both the actual and existing users as well as users from possible new groups. Additionally, involvement of users who would not use services should be considered, as they are able to provide valuable controversial viewpoints. The most important part of any user/customer/stakeholder investigation is planning. Before committing time and resources to requirements capture, it is useful to plan:

- How many stakeholders are to be involved from how many different organisations?
- What type of stakeholders are to be involved?
- Are there any lead users involved?
- What mix of internal and external stakeholders?

In the beginning of the project, during the Open Innovation Camp, a total of 299 stakeholders were identified as necessary for business model development. The summary is stakeholder groups is presented in Appendix 1.

In order to be able to select people who are suitable for the development activities, few guidelines to take into consideration are suggested below (based on Sthåhlbröst, A. 2017):

- Rewarding users for their involvement is **not** recommended. Finding a combination of different motives should be considered first.
- The participation should be voluntary.
- Diversity management principles should be respected in terms of cultural, organizational, user-driver, cross-functional, disciplinarily and cross-industry diversity.
- Aiming towards a balanced gender representation is highly recommended. It has been discovered that participation of males has traditionally led into focusing more on the technical performance of the products, whereas a female participation has resulted in more focused development upon human needs.
- Users who are the least knowledgeable about the area should be focused on in the selection.
- As many different user categories should be involved as possible (not only early adopters/supporters).
- Select participants with great social competences and a flexible mind set. Lack of collaborative open attitude can ruin the whole development process.

How to engage?

There isn't one single user engagement methodology that can be applied for the CEBM development. This means that engagement tools and approaches depend on the context and the phase of innovation process. Different methods based on the innovation maturity are described in Deliverable 7.1 (Figure 11, p.21), so here we list ways and tools for user engagement used in CIRC4Life project:

- Open Innovation Camp, for identifying opportunities and co-creating ideas
- Workshops, to understand and define the actual challenges
- Observation / Shadowing to empathize with the users
- In-depth interviews to empathize with the users
- User personas, to crystallize user-understanding
- Workshops, to develop solutions together with stakeholders
- Storyboard (or other visualization), to gather feedback from users
- Workshops, physical prototyping of the solution
- Usability workshops, to try out and improve the solution
- Mock-up testing in real-world context, to gather feedback from users and to test/validate solution
- Workshops, for defining MVP's (minimum viable product) characteristics
- MVP testing in a real-world environment

A list of end-user and stakeholder engagement events both within and across CIRC4Life CEBMs development is included in Appendix 2.

5.2 Involvement plan for CEBM A: Co-creation of products and services

WP and Task engaging end-users and/or stakeholders	Description of involvement	Types of end-users/stakeholders engaged	Names of organizations, contact person details	Ways of engaging	Stage of CE
CEBM A: Co-creation of products and services					
T1.4	Define the range of consumer- and end-user groups in the supply chains of various products, allowing for an approach appropriate to any product or service. Develop an approach for co-creation of products by collaboration between end-user, producer and relevant actors/ stakeholders in the supply chain	End-user groups; Supply chain actors	Participants 1-3: Wholesalers/ lighting distributors / contractors / FM companies / industrial experts; LIA (Lighting Industry Association, UK) Participants 4: general consumers, particularly consumers with sustainable consumption awareness	1) workshop on Leasing Service Business Model co-creation 2) workshop on modular product design 3) leasing service related survey (Kosnic) 4) meat product recycling and PDS related survey (Alia)	Co-creation; Concept development

T1.5	Includes Identification of innovative businesses and business practices that pushes boundaries on sustainable production and implement them in the production process.		see Appendix 2	1) the identification of innovative business and practices will be based on literature review, online search. 2) Production will be based on responsible partners' facilities, external stakeholders probably will not be involved.	Co-creation; Product design and developme nt

5.3 Involvement plan for CEBM B: Collaborative Recycle and Reuse

WP and Task engaging end-users and/or stakeholders	Description of involvement	Types of end-users/stakeholders engaged	Names of organizations, contact person details	Ways of engaging	Stage of CE
CEBM B: Collaborative recycling/reuse					
T2.1	Provision of information for data analysis	Public and private organizations that manage environmental data	Eurostat Datapoint Corporate Marketing Deloitte University Press, European Remanufacturing Council, European Remanufacturing Network, WRAP (Waste and Resources Action Programme) RREUSE Electronic Products Recycling Association (EPRA)	Websites	Consumption and Use Collection and Disposal Recycling and Recovery
	Collection and logistics systems for tablets.	Intelligent bins producers and/or distributors	Recicla y Gana Ganemos reciclando Id&A	request for information and offer	Collection and Disposal

	Implementation of logistics systems	Local government, town halls and associations of local communities	Ihobe (Public Society of Environmental Management of the Basque Government) Getxo Town Council	Previous contact and knowledge by local partners Through Ihobe	Collection and Disposal
		Persons/Companies in charge of areas or points of collection/installation of intelligent container	To be defined. Possibilities: civic centres, sports centres, metro stations, retailers	Through the Getxo Town Hall	Collection and Disposal
T2.2	Identification of existing business practices related to Circular Economy in the food sector, and consultation of possibilities to implement innovative practices in the meat and vegetables sectors	Food sector companies, waste managers, consumers, packaging producers	ALDI, Carrefour, COPRESA, ELABORADOS CÁRNICOS DE LORCA, GRUPO ALIMENTARIO DE LORCA	In this task companies have been mainly consulted their opinion on our approach. Effectively engagement will be performed in WP6, during demonstrations, make some of them participating actively in the demo	Distribution & Sales, Consumption & Use, Collection & Disposal, Recycling & Recovery
T2.5	Background information about similar initiatives	Public and private organizations managing similar schemes of incentives.	Recicla y Gana Consorcio Valencia Interior Ganamos Reciclando Others, to be defined.	Workshops Congress Request of information Meetings Websites	Consumption and Use Collection and Disposal Recycling and Recovery
	Selection of incentives for end-users	Local government Stakeholders (producers, distributors, other agents)	Getxo Town Council Stakeholders to be defined: Shopping centers, malls, producers…	Through the Getxo Town Hall Contacts with potential stakeholders	Consumption and Use Collection and Disposal
	Selection of the place for intelligent bins to be used during the pilots	Local government Stakeholders	Getxo Town Council Other potential places regarding stakeholder´s involvement	Through the Getxo Town Hall Through the potential stakeholders	Collection and Disposal

	Verify the impact of the incentives	End-users	End-User associations Others	Surveys Website Social Networks	Consumption and Use Collection and Disposal
T2.6	Selection of schools	Town Hall authorities Schools Managers	see Appendix 2	Through the Getxo Town Hall	Consumption and Use Collection and Disposal
	Outline of the Educative Process	School Teachers	see Appendix 2	Through the School Manager	Consumption and Use Collection and Disposal
	Execution of the training process	Students	see Appendix 2	Educative activity	Consumption and Use Collection and Disposal

5.4 Involvement plan for CEBM C: Sustainable consumption

WP and Task engaging end-users and/or stakeholders	**Description of involvement**	**Types of end-users/stakeholders engaged**	**Names of organizations, contact person details**	**Ways of engaging**	**Stage of CE**
CEBM C: Sustainable Consumption					
T3.1	Retailers implementation	retailers	Carrefour Centre of Lorca	The ecoshopping will be implemented at ALIA's shop and according to the results, the eco-points information for the consumer will be later presented in Carrefour	Consumption & use. Selling point
T3.4	Information and awareness raising campaign on sustainable consumption	Consumers (Consumers Associations, Neighbourhood Associations and Schools) Business (Local Commerce Association, Industrial Associations) Public Administration Authorities (areas related to the topic)	see Appendix 2	Identifying main entities in these stakeholder categories to invite them to participate in the capacity building sessions. Furthermore, the participating Municipality will be invited also to support and promote the collaboration of actors, by using their dissemination channels and endorsing the project activities.	Method development (building awareness)
T3.6	Consumer's survey	Consumers		Three consumers surveys were conducted:	

				- Attitudes to reuse and recycling practices and product End-of-Life information - Consumers' attitudes and understanding on the eco-point calculation and their presentation method - Consumer's feedback and preferences to sustainable lighting products MMM collected 1150 responses in total from all over Europe. Surveys were mainly conducted only with some physical interviews in dedicated events or an organic shop in Brussels. MMM also conducted first round of interviews to check the understanding of the eco-points system and developed the eco-points questionnaire according to this.	

5.5 Experiences of end-user involvement across business models

Due to ecosystemic nature of Circular Economy Business Models explained in chapters 2 and 3 of this report, involvement of users and stakeholders took place both within one business model, and across business models. In the eighteen months of the business model development process all together 25 engagement activities were organized and/or coordinated by LAU, out of which only 6 activities were CEBM-specific (four co-creation workshops for CEBM A development, and 2 activities for CEBM B development). Remaining 19 activities included user and stakeholder engagement across business models.

The reason for emphasizing the engagement across CEBMs development is due to a complex and interconnected nature of CE as a closed loop process, in which design and manufacturing are directly connected to sustainable consumption and waste management models. In CIRC4Life, engagement across CEBMs allows for engaged participants to contribute with their expertise in a thematic or industry-specific area. Industry professionals and users represent various industry ecosystem expert roles in the given industry. They have profound knowledge on this specific industry field. Thematic stakeholders represent experts who have specialized skills in a specific thematic field area, which can be used in multiple industry setting. By combining industry and thematic expert in development activities, greater benefits are achieved with less resources. Cross-CEBM events are included in Appendix 2.

6 Recommendations for end-user engagement

Based on the 25 user engagement activities conducted during Task 7.6, the following recommendations have been developed based on user feedback and discussions with CIRC4Life project partners, in particular demonstrators. These recommendations are mainly targeted at CIRC4Life partners, but they can also be applied by any organization wishing to involve end-users in development process.

1) UNDERSTANDING DIVERSITY OF END-USERS

For successful involvement a key starting point is to have a comprehensive understanding of **different target groups to involve**. In CIRC4Life project stakeholders and users are a key to successful demonstration and validation, therefore engaging users which are supporters of CE are a key, but also engaging "non-users". i.e. customers who are against and/or not interested in CE is a key to scaling up and achieving societal impact of the project. We recommend using **Personas** (see Appendix 3) and **Customer Journey mapping** (see Appendix 4) as tools for understanding end-users, their needs and behaviors.

The richness of diversity among stakeholders and the multi-talented and -disciplinary teams are the strength of user engagement - the combination of participants creates a bigger and richer whole that propels the process forward. We recommend using principles of **diversity management** to ensure not only different roles based on Quadruple Helix, but also ensuring cultural diversity, different demographic, behavioral, professional etc. profiles.

2) UNDERSTANDING WHY TO ENGAGE USERS

While it is a commonly accepted knowledge that users bring insights and new ideas, there is still a resistance among experts, such as software developers or manufacturing companies, to accept results of user engagement. **User engagement is only productive, when developers are open to use the input from the user community**, and are committed to an iterative process of rapid prototyping, testing with users, receiving feedback, and further development based on the feedback. It can happen that solutions developed in-house are not accepted by users, which creates a big risk (also financial) to companies. Therefore an understanding and commitment to using the user input is a must in successful user-centered development. This issue is closely related to **ethics of user engagement**, meaning that the developers can priorities user ideas which are close to their own understanding of the development process, and ignore the input which requires changes in developed processes/products.

3) ETHICAL CODE OF CONDUCT

A jointly agreed ethical code of conduct outlines the ethical principles that govern decisions and behaviour during multi-stakeholder co-creation and experimentation. They give general outlines of how different stakeholders and individuals should behave, as well as specific guidance for handling issues like harassment, safety, and conflicts of interest. While in CIRC4Life ethical aspects of user engagement have not been an issue yet, they might arise during demonstrations, therefore we recommend taking ethics into consideration when engaging users.

4) SYSTEMATIC APPROACH TO END-USER INVOLVEMENT

End-user involvement requires different development methodology than classical liner model of in-house development, or waterfall model of software development. Systematic approach means that **users are actively involved throughout the development project/activities**. This approach includes building a common understanding of shared goals; purpose of involvement, scope of involvement, risks associated with user

involvement etc. Especially in the beginning of the project, when these aspects can be unclear to various stakeholders, we recommend putting an effort in creating a common approach.

Early and active involvement in the project is essential to ensure the shared understanding, shared goals and requirements, and that the solutions developed by the project are eventually accepted and adopted by the stakeholders. At the same time, end-user engagement should not be limited to ideation and conceptual development. Systematic planning (for example in a form of **Living Lab plans**, see Deliverable 7.1) and timely updates of the plans based on the results of previous engagement activities form the basis for systemic approach.

5) CO-CREATION METHODOLOGY

The current definition of collaboration is a transfer of knowledge from one party to another in an **open and safe environment, where all actors are giving and receiving**. This can also be referred as co-creation, which in the CIRC4Life context is defined as solving and defining shared problems with a systematic approach, in close cooperation with multiple actors with diverse backgrounds. Co-creation is based on user and stakeholder involvement and forms an integral part of systemic approach described above.

We recommend also to spent resources on creating a good understanding of co-creation process among the developers. The co-creation process aims at pro-active stage of ideating where many different goals, solutions and possibilities are co-created, **rather than merely investigating the participant's reactions and opinions towards the pre-determined solutions.** In the co-creation process, the **user is seen as an active and equal partner** participating the development alongside other actors, whereas more traditional and quantitative user-centric development methods see the user as an object of the design. (Sanders, E., Stappers, J. 2008)

6) NON-LINEAR ENGAGEMENT

User and stakeholder engagement in development process is non-linear, meaning that it is iterative and cyclical. It is common to return to the initial stages of development process phases, after an initial prototype has been built and tested. After a prototyping at an early stage of a design process, it is possible to assess if the solution actually works in the users context. At this point, returning back to the user can be helpful to be able to define on what else is needed to know about the user in order to make decisions or to prioritize development and what possible new use cases have arisen from the prototype that weren't previously investigated.

The user engagement in different stages can also be repeated (and often should). Often it is necessary to do an exercise within a phase multiple times in order to arrive at the outcome needed to move forward. During the development of CEBMs in CIRC4Life project some of the activities (such as for example conceptualization and prototyping of consumer tools) were repeated multiply times, however unfortunately not all results were users by the developers.

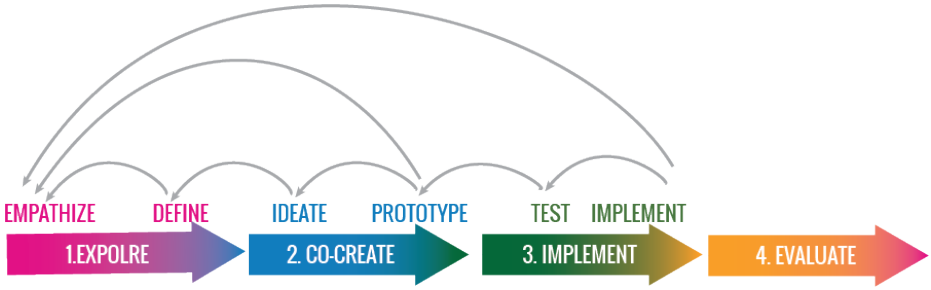

Figure 10 The non-linear development approach to user engagement in CIRC4Life

7) COMMUNICATION WITH USERS

As a part of systematic approach, we also recommend **active and systematic communication with engaged users**. Clear communication strategy is needed to keep the interest of users in the development activities; to communicate clearly the benefits of user and stakeholder engagement; to raise awareness among different user groups about ways to be engaged; to turn users into "project ambassadors" and to keep the user involved from the start until the end of the project. In order to be engages, users and stakeholders have to be interested in each other's practices and in developing common new innovations. In other words, users have to be treated as co-developers in communications.

One way communication in a form of e.g. newsletters is not enough, communication tools have to be **interactive** (i.e. allowing user to provide feedback, pose questions and ideas, and communicate with other users and developers). Our recommendation is to create a strong communication strategy which includes high level of engagement, and combine communication with development activities. A good example of such combination is CIRC4Life Design Challenge, which attracted hundreds of people globally. Another example is Open Innovation Camp as a tool for stakeholder engagement (Santonen et al, 2019).

8) ACCEPTING THE HUMAN FACTORS (when developing solutions for humans)

Human behavior can't be predicted. Based on the knowledge on cognitive science and psychology, we know the human behavior isn't always reasonable, rational, systematic, consistent and predictable. Humans also make mistakes constantly. These features have to be taken into consideration when planning the testing with stakeholders (plan as if you were right, test as if you were wrong). This is especially relevant when designing ICT solutions and consumer tools.

9) HAVING COMPREHENSIVE STAKEHOLDER MANAGEMENT TOOLS

User engagement is a complex, non-linear, long process that requires good management tools, systematic planning, regular updates, and adjustment of processes according to emerging needs and new stakeholders in the process. For CIRC4Life LAU developed a number of templates, plans, excel forms and service design games which facilitate systematic engagement. These tools include, for example, Ecosystemic Partner Identification Excel, End-User Involvement excel, Living Lab plans; CELLL - Circular Economy Laurea Living Labs tool (see Appendix 5), to mention few.

10) CREATING A COMMONG LANGUAGE AND UNDERSTANDING

As people, experts on their respective areas, often use a very specific terms and language, and are not able to take into consideration that other people might be lacking the same ground/basic knowledge and thus, it can be hard to create mutual understanding and shared goals on the complex topics, such as circular economy. This results also from the fact, that the capacity of human working memory is only 5-7 units, which means our brain only allows to us to concentrate on average on 6 things simultaneously and is easily directed to side paths while we are explaining and discussing complex topics, and as all stakeholders have varying interests inside the project and they weight topics differently. Additionally, different personality types have major impact on how a group of people is able to work together and reach the set goals.

We recommend using Design Thinking and tools that outsource thinking into tangible and visual form (infographics/templates/plans) where ideas and complex structures can easily shared and understood by diverse groups of people. For example, CELLL toolkit (see Appendix 5) is a good example of visualizing and

structuring complex process of CEBM development into simple stages. Overall using visual design and service design methodology to present complex data in a “digestible” form suitable for making decision is a key to successful co-creation and shared understanding.

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Appendix 1 User and Stakeholder Categories in CIRC4Life project

Stakeholder Category	Count of Category	Count of DEMO
ACADEMIA	**13**	**13**
PRODUCT DEVELOPERS	1	1
RESEARCH CENTERS	5	5
RESEARCHERS	6	6
RESEARCHERS / PACKAGING	1	1
B2B CUSTOMERS	**2**	**2**
PUBLIC BUILDINGS / AIRPORTS (HANGARS)	1	1
PUBLIC BUILDINGS / HOSPITALS	1	1
CIVIL SOCIETY	**2**	**2**
CITIZENS	1	1
COMMUNITIES	1	1
DISTRIBUTOR	**5**	**5**
LOGISTICS	5	5
EDUCATION SECTOR	**15**	**15**
DESIGN/ CE-STUDENTS	3	3
SCHOOL	4	4
STUDENTS	2	2
TEACHERS	5	5
END-USERS (B2B)	**22**	**22**
ANIMAL FOOD PRODUCED	1	1
CHEMICAL MANUFACTURER	1	1
FACTORIES	1	1
FARMS	1	1
FEED PRODUCERS	1	1
HOSPITALS	2	2
HOTELS	1	1
KINDERGARDENS	1	1
LIBRARIES	1	1
LOCAL SUPERMARKET	1	1
OTHER PRODUCERS	1	1
OTHER PRODUCERS / lifestock feed	1	1
OTHER PRODUCERS / micro brewery	1	1
OTHER PRODUCERS / pet food	1	1
PHARMACEUTICAL INDUSTRY	1	1
RESTAURANTS	2	2
REUSE COMPANIES	1	1
SCHOOLS / students	1	1
SMES'	1	1
TOURIST AGENCIES	1	1

END-USERS (B2C)	**9**	**9**
CITIZENS	1	1
COMMUNITIES	1	1
ECO-TOURISTS	1	1
FAITH BASED CONSUMERS	1	1
FAMILIES	1	1
KINDERGARDENS	1	1
LOCAL PEOPLE	1	1
ORGANIZERS OF TEMPORARY ACTIVITIES	1	1
UTILITY WORKERS	1	1
END-USERS (C2C)	**1**	**1**
(blank)	1	1
EXTERNAL PARTNERS (VALUE ADDING PROVIDERS)	**1**	**1**
DESIGNERS	1	1
FINANCING INSTITUTIONS	**4**	**4**
BANK	4	4
INFLUENCERS	**19**	**19**
BLOGGERS	5	5
LOBBIES	1	1
LOCAL NEWS PAPERS	1	1
MEDIA	5	5
OPINION LEADERS / AMBASSADORS	1	1
PUBLIC FIGURES	1	1
SOCIAL MEDIA INFLUENCERS	5	5
INSURANCE COMPANIES	**1**	**1**
INSURANCE COMPANIES	1	1
MANUFACTURERS	**10**	**10**
ELECTRONICS MANUFACTURERS	3	3
FACTORIES	3	3
MANUFACTURER FOR ASSOCIATED COMPONENTS	3	3
RECYCLE BIN PROVIDERS	1	1
NGO	**1**	**1**
ANIMAL WELFARE ORGANIZATIONS	1	1
Other	**125**	**125**
ACCOMMODATION OWNERS /AIR BNB	1	1
AI SERVICES	3	3
ARCHITECTS	3	3
BEHAVIOR PROFESSIONAL	1	1
BOAT TRIP COMPANY	1	1
CERTIFICATION ORGANISATIONS	4	4
CITIZENS	1	1
CIVIL SOCIETY	2	2
COLLECTING SCHEME PROVIDER	2	2
COMMUNITIES	1	1
COMPETITORS	4	4
COMPOSTING PLANTS	1	1

CONMMUNICATIONS SPECIALISTS	3	3
CONSULTING COMPANIES / BUSINESS MODEL CREATORS	3	3
DESIGNERS	2	2
ECO-DESIGNERS	1	1
ENERGY GRID PROVIDER	3	3
ENVIRONMENTAL EXPERTS	3	3
ERP SYSTEM PROVIDER	1	1
FACILITY MANAGEMENT EXPERTS	2	2
FARMERS ASSOSIATIONS	2	2
FOOD BANKS	1	1
ICT (PLATFORM PROVIDERS, DEVELOPERS)	3	3
ICT PROVIDERS	2	2
ICT PROVIDERS / END USER APPLICATION	1	1
INDUSTRIAL ASSOCIATIONS	3	3
INSTALLATION PROVIDERS	3	3
INSURANCE COMPANIES	1	1
LAMP RECYCLING EXPERT	2	2
LAND OWNERS	1	1
LEASING SERVICE OPERATORS	4	4
LOGISTIC WAREHOUSE	2	2
LOYALTY CARDS OFFERER	1	1
MANUFACTURER OF SMART CONTAINER (RECICLA Y GANA)	1	1
MARKETING/ ADVERTISING AGENCIES	2	2
MEDIA STRATEGIST COMPANY	5	5
NATURE CONSERVATION BODIES	1	1
NGO	3	3
ONLINE STORES	4	4
PACKAGING SUPPLIER	1	1
PAYMENT SOLUTION PROVIDER	5	5
PLATFORM PROVIDERS	1	1
RECYCLE BIN PROVIDERS	4	4
RECYCLING EXPERT	1	1
REFURBISHING COMPANIES	2	2
REPARING ”POINTS” / SERVICES	3	3
RESEARCH CENTERS	1	1
RESELLERS	3	3
RETAIL SOLUTION PROVIDER	1	1
SLOUGHTER HOUSES	1	1
SPONSORS	3	3
STANDARDIZATION CREATORS / PROVIDERS	4	4
THIRD SECTOR SOCIAL ENTERPRISES	1	1
TOOL MAKERS	1	1
TRACEABILITY EXPERTS	3	3
TRADE ASSOCIATIONS	1	1
URBAN PLANNERS	1	1
WARE HOUSES	1	1

WASTE MANAGEMENT EXPERT	1	1
WHOLESALERS	2	2
PERSONELL	**10**	**10**
AMBIENCE DESIGNERS	2	2
ARCHITECTS	2	2
DESIGNERS	3	3
IT DEPARTMENT	2	2
(blank)	1	1
PRODUCER	**1**	**1**
ANTIBIOTICS COMPANIES	1	1
REGULATORS	**35**	**35**
CITY LEVEL REGULATORS	3	3
ENVIRONMENTAL REGULATORS	3	3
EU LEVEL	1	1
GOVERNMENT	1	1
HEALTH REGULATORS	1	1
LOCAL COUNCIL	1	1
LOCAL GOVERNMENT /MUNICIPALITIES	1	1
MUNICIPALITY	1	1
NATIONAL REGULATOR	5	5
POLICY MAKERS	5	5
POLITICIANS	4	4
STATE	5	5
TAX LEGISTLATORS	4	4
REMANUFACTURERS	**2**	**2**
MANUFACTURERS, ECO-DESIGN SPCIALIZED	2	2
RETAILERS	**1**	**1**
LOCAL SHOP	1	1
SUPPLIER	**20**	**20**
CHEMICAL SUPPLIERS	2	2
COMPONENT SUPPLIERS	3	3
ENERGY GRID PROVIDER	1	1
FERMENTATION UNIT PROVIDER (BIOGAS & FERTILIZEERS)	1	1
FERTILIZERS PRODUCERS	1	1
MATERIAL SUPPLIERS	4	4
PACKAGING SUPPLIER	1	1
RAW MATERIAL SUPPLIER	3	3
SINGLE-USE MATERIAL SUPPLIER	1	1
SPARE PART SUPPLIER	3	3
Grand Total	**299**	**299**

Appendix 2 User and Stakeholder Engagement events in CIRC4Life CEBMs development

Activity #1 details:	
CIRC4LIFE partner(s) involved:	ALL
Engagement Activity	**Open Innovation Camp 2018**
Linkage to CEBM(s)	CEBM A), CEBM B), CEBM C)
Activity date and place	12th -15th November 2018 Krakow, Poland
Participants	80 experts took part in the Innovation Camp. Participants were experts in their respective areas and stakeholders of the specific challenges (companies, associations, universities and research institute and policy bodies), and have been selected by the organisers. Participants were divided into seven groups, each one addressing a specific demonstration or circular economy business model. Participants came from 17 different countries, including China and South Africa.
LL activity details	Participants co-created solutions for transition towards circular economy in electrical and electronic products and agri-food/farming sectors. The CIRC4Life Innovation Camp was a concept development exercise to better understand the needs and main challenges of developing circular economy business models in all stages of the circular economy.

Activity #2 details:	
CIRC4LIFE partner(s) involved:	ONA
Engagement Activity	**Co-creation with producer and suppliers relating usage of waste materials**
Linkage to CEBM(s)	CEBM A)
Activity date and place	March 2019 Valencia, Spain
Participants	4 supplier companies from Ona's value chain
LL activity details	Observations at the production scene, semi-structured interviews with suppliers to identify suitable materials from different waste streams for the development of sustainable lighting product.

Activity #3 details:	
CIRC4LIFE partner(s) involved:	ALIA, JS, ONA, IND, LAU, MMM, ENV, ECCS
Engagement Activity	**LAUREA Circular Economy JAM**
Linkage to CEBM(s)	CEBM B), CEBM C)
Activity date and place	28th-29th March 2019 Laurea Leppävaara, Vanha maantie 9, Espoo
Participants	End-users 65 participants
LL activity details	During the two-day event, participants shared insights, discovered new possibilities and developed new circular economy ideas based on the following challenges: - How can we decrease food waste? - How can we make recycling and eco-information appealing and easy to grasp? - How can we decrease e-waste?

Activity #4 details:	
CIRC4LIFE partner(s) involved:	ALIA, LAU
Engagement Activity	**Rural area municipal driven bio/meat recycling workshop with intelligent bin**
Linkage to CEBM(s)	CEBM B), CEBM C)
Activity date and place	4th April 2019 Abarán, Spain
Participants	End-users 12 participants
LL activity details	The main objective of the workshop was to evaluate the interaction with the intelligent bin of the end-users, to study which are the most appropriated incentives for the citizenship of Abarán and to define possible locations of the intelligent bin. As well, it was important to evaluate the interest of the inhabitants of Abarán towards the pilot recycling project.

Activity #5 details:	
CIRC4LIFE partner(s) involved:	ALIA, LAU
Engagement Activity	**Rural area municipal driven bio/meat recycling with intelligent bin WITH MUNCIPALITIES**
Linkage to CEBM(s)	CEBM B), CEBM C)
Activity date and place	9th April 2019 Abarán, Spain
Participants	Local authorities 7 participants
LL activity details	The main objective of the workshop was to evaluate the results obtained from the workshop with end-users to the local authorities and to obtain their feedback

Activity #6 details:	
CIRC4LIFE partner(s) involved:	ALIA, LAU
Engagement Activity	**Co-creation workshop with end-users about eco-information and product concepts**
Linkage to CEBM(s)	CEBM B), CEBM C)
Activity date and place	29th May 2019 Lorca, Spain
Participants	End-users 21 participants
LL activity details	The workshop was focused in three different themes from the end-user viewpoint: - Product development and packaging of sustainable meat product - Eco-information and visualizations - Marketing + product's story

Activity #7 details:	
CIRC4LIFE partner(s) involved:	D1 KOSNIC, NTU, LAU
Engagement Activity	**Co-creation workshop of the leasing business model**
Linkage to CEBM(s)	CEBM A)
Activity date and place	28th May 2019, Telford, UK LIA (Lighting Industry Association), Stafford Park 7, Telford, Shropshire, TF3 3BQ
Participants	Value chain partners & lighting industry specialist 12 participants
LL activity details	Identifying new business opportunities within the circular economy and helping KOSNIC to create a leasing business model, which would equally benefit all the stakeholders in the business ecosystem

Activity #8 details:	
CIRC4LIFE partner(s) involved:	D1 KOSNIC, NTU, LAU
Engagement Activity	**Co-Creation workshop for developing modular LED lamp**
Linkage to CEBM(s)	CEBM A), CEBM C)
Activity date and place	29th May 2019, Telford, UK LIA (Lighting Industry Association), Stafford Park 7, Telford, Shropshire, TF3 3BQ
Participants	Value chain partners & lighting industry specialist 15 participants
LL activity details	Topics addressed during the workshop: 1) Modularity, customizability, refurbish ability 2) Sustainability & recyclability (materials) 3) Logistics 4) Installation & demolition 5) Energy consumption

Activity #9 details:	
CIRC4LIFE partner(s) involved:	INDUMETAL, LAU
Engagement Activity	**Co-creation workshop / Community involvement**
Linkage to CEBM(s)	CEBM B)
Activity date and place	6th June 2019 Aula Ambiental (Getxo, Spain)
Participants	5 school representatives: 1 person from Udalsarea 2030 (Environment for municipalities) 2 persons from Aula Ambiental (local staff for developing environmental agenda in schools) 1 person from San Nikolas Ikastola (local school) 1 person from Trinitarias Algorta (local school)
LL activity details	Objective: Presentation of CIRC4Life proposals for activities to be carried out in Getxo schools. Obtaining answers and modifications from the schools. Expected output: Interest of schools and acceptance of participation in the project by schools. Involvement of schools in the design of necessary activities and materials

Activity #10 details:	
CIRC4LIFE partner(s) involved:	JS, LAU, NTU
Engagement Activity	**Community involvement / Semi-structured Interview**
Linkage to CEBM(s)	CEBM A) CEBM B), CEBM C)
Activity date and place	18th June 2019 Isles of Scilly
Participants	Isles of Scilly Council Members 3 participants + 4 project partners
LL activity details	Objective: Engage local stakeholder and finding out present activities of council concerning Circular Economy and Sustainable development activities

Activity #11 details:	
CIRC4LIFE partner(s) involved:	JS, LAU, NTU
Engagement Activity	**Community involvement / Semi-structured Interview**
Linkage to CEBM(s)	CEBM A) CEBM B), CEBM C)
Activity date and place	18th June 2019 Isles of Scilly, St Mary's
Participants	Island Partnership (Tourism Board) 2 participants + 4 project partners
LL activity details	Objective: Engage local stakeholder and finding out present activities of council concerning Circular Economy and Sustainable development activities Expected output: Cooperation on LL activities with Island Partnership Topic: Current activities of Island partnership on tourism and especially on sustainable tourism development •

Activity #12 details:	
CIRC4LIFE partner(s) involved:	JS, LAU
Engagement Activity	**Community involvement / Semi-structured Interview**
Linkage to CEBM(s)	CEBM A) CEBM B), CEBM C)
Activity date and place	19th June 2019 Isles of Scilly
Participants	Local commerce 2 participants + 4 project partners
LL activity details	Objective: Engage local stakeholder and finding out present activities of JS business partner concerning Circular Economy and food supply chain Expected output: Cooperation on LL activities with Seven Stones Inn

Activity #13 details:	
CIRC4LIFE partner(s) involved:	ONA
Engagement Activity	**Co-creation workshop: new product concepts developed with university students**
Linkage to CEBM(s)	CEBM A)
Activity date and place	1st – 4th of July 2019 Alfara del Patriarca, Valencia
Participants	Design Students, Master Level 11 participants
LL activity details	ONA carried out a co-creation workshop with university students focused in different themes: 1) Recycled, re-use and co-creation 2) Circular Economy 3) Lifetime of Products 4) ONA products
	The overall expected output of the workshop was to receive opinions and ideas about ONA and the philosophy applied in the sustainable lighting products.

Activity #14 details:	
CIRC4LIFE partner(s) involved:	ONA
Engagement Activity	**Survey, carried out by University Masters students**
Linkage to CEBM(s)	CEBM A); CEBM B), CEBM c)
Activity date and place	July 2019 Alfara del Patriarca, Valencia
Participants	End-User focus group: 35+ years, high income 55 participants
LL activity detail	Collecting end-user attitudes and feedback on sustainable buying and eco-design aspects related to lighting products.

Activity #15 details:	
CIRC4LIFE partner(s) involved:	ALIA, LAU
Engagement Activity	**Real-life testing of the eco-label**
Linkage to CEBM(s)	CEBM B)
Activity date and place	7th- 15th September Lorca, Spain
Participants	End-users 20 participants
LL activity details	Collecting feedback on end-user attitudes and preferences towards the eco-label concepts developed in CE Jam 2019, and end-user workshop 29th May, by applying the label on the actual packaging.

Activity #16 details:	
CIRC4LIFE partner(s) involved:	LAU, NTU
Engagement Activity	**CIRC4Life Design Challenge**
Linkage to CEBM(s)	CEBM A), CEBM B), CEBM C)
Activity date and place	Online 10th July – 24th October
Participants	End-users, 14 registered, 0 submissions + Comments and votes on the website (?ppl) On going… ?
LL activity details	Inviting citizens to participate in the development of the eco-label by encouraging them to send their ideas and proposals, and presenting label options on the project website for collecting feedback

Activity #17 details:	
CIRC4LIFE partner(s) involved:	LAU
Engagement Activity	**Series of co-creation workshops on sustainable end-user preferences**
Linkage to CEBM(s)	CEBM A), CEBM B), CEBM C)
Activity date and place	August 2019 Leppävaara, Finland Tikkurila, Finland
Participants	End-users 92 participants Service Design specialists 5 persons
LL activity details	Collecting end-user preferences and attitudes, and ideation on: 1) How to minimize and collect e-waste from end-users 2) How to encourage sustainable eating habits in restaurants 3) Concept for sustainable lighting product 4) How to encourage consumers towards more sustainable shopping behavior

Activity #18 details:	
CIRC4LIFE partner(s) involved:	LAU
Engagement Activity	**Workshop: Ecosystemic Circular Economy business model tool (CELLL)**
Linkage to CEBM(s)	CEBM A), CEBM B), CEBM C)
Activity date and place	3rd - 5th September 2019 Thessaloniki, Greece
Participants	Participants were experts in their respective areas: - business - associations - universities and research institute 17 participants
LL activity details	A concept development exercise to better understand the needs and main challenges of developing circular economy business models in all stages of the circular economy, and to test a tool (CELLL) developed to support this process in CIRC4Life project.

Activity #19 details:	
CIRC4LIFE partner(s) involved:	LAU
Engagement Activity	**Co-creation workshop: Identification of the business value of co-creation**
Linkage to CEBM(s)	CEBM A)
Activity date and place	17th September
Participants	Participants were experts in their respective areas: - business - universities and research institute - policy bodies 7 participants
LL activity details	The workshop is part of a design process where the goal is to develop an efficient model for showing the business benefits of co-creation and to define the most effective way to communicate this value to different stakeholders.

Activity #20 details:	
CIRC4LIFE partner(s) involved:	IND, REC
Engagement Activity	**Co-creation of the incentives scheme**
Linkage to CEBM(s)	CEBM B), CEBM C)
Activity date and place	24th September
Participants	Public administration, consumers associations and local commerce (?)(there were issues with lack of participant once again, we need to find out what was the actual composition of participants)
LL activity details	Capacity building on circular economy, development of the incentives scheme with the local commerce

Activity #21 details:	
CIRC4LIFE partner(s) involved:	LAU, ONA, IND, ALIA, REC, GS1G, EECC, MMM, ENVIRO, CEPS
Engagement Activity	**Business Model implementation and demonstration workshop**
Linkage to CEBM(s)	CEBM B), CEBM C)
Activity date and place	25th – 26th September Gexto, Spain
Participants	21 participant, project partners
LL activity details	Identifying implementation opportunities within the developed Circular Economy business models and defining the elements for demonstration cases, with the support of the ecosystemic circular economy business model tool (CELLL).

Appendix 3 Example of personas in CIRC4Life project

Hi, I am Gorka!

- **Personal info: Male, 24**
- **Geographic: Lives in the city center**
- **Professional: Studies sports at Uni / low income**

Lifestyle: Active and social, good with smart devices. Likes games.

Attitude towards sustainability and recycling: Positive, but haven't paid much attention

Recycling habits: I kind of recycle, like plastic bottles and cans, and it's beneficial as they have the 20c deposit..

Sustainable choices: I don't think much of sustainability right now as my parents buy most of the stuff, but when I'll live alone and have better salary I probably will. But Coca Cola bottless are recycled material, right! And I have bought some sport equiptment and my phone 2nd hand, since it's much cheaper.

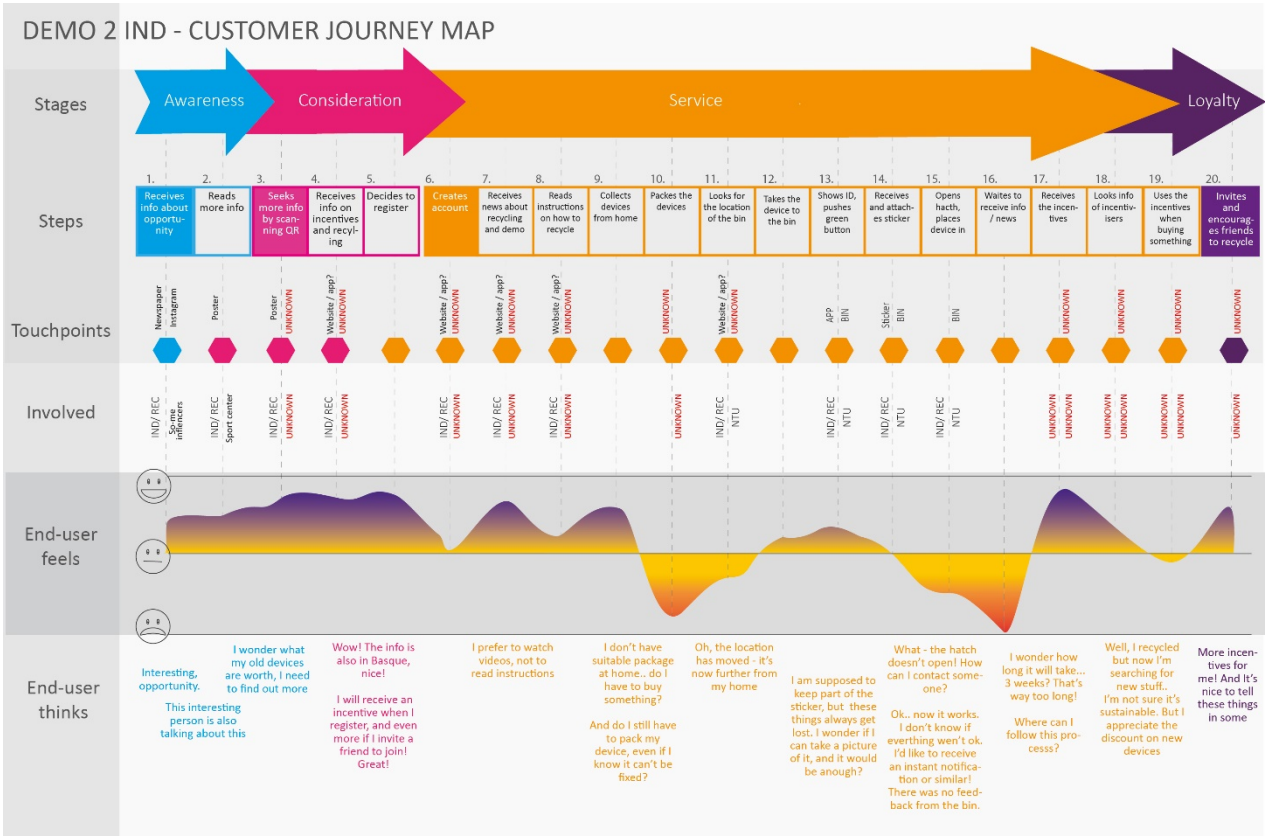
Thoughts about using APPs to support sustainability: I have an APP for public transpor-tation, where I can check schedules and buy tickets. Testing a new app would be definitely interesting, if it doesn't cost anything. I think my friends would be also interested, if it would be gamification /competition based.

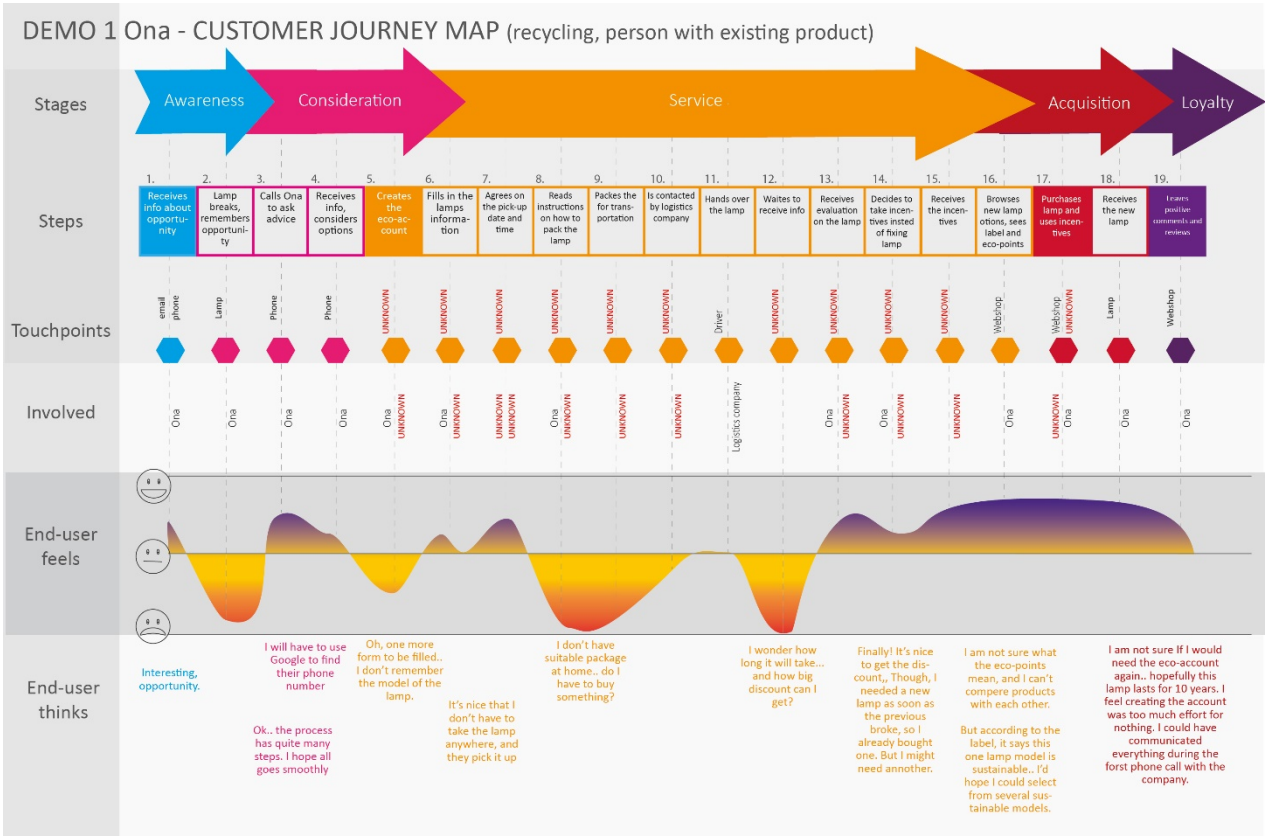
Incentives: It should be something easy for me to consume, some everyday things. Money or discount vouchers would be the easiest. Transportation discounts/ tickets would work for me also.

Goals: To be able to reach a work position with such a high salary, it would not be an issue to make more sustainable choices. Like this one guy I follow in Instagram, he has such a cool lifestyle, and he travels around the world to speak about he has transformed his life into zero waste.

Pain points: I do not think that I can afford to make sustainable choices right now, so I don't pay much attention to them. I ususally just take whatever is the cheapest. For this, I feel a little guilty. Also, I live with my parents who are quite conservative and not interested in this topic, and I don't feel comfortable bringing these thing up at home.

Appendix 4 Customer Journey map example for demonstration case





Appendix 5 CELLL tool for CEBM development

CELLL – A TOOLKIT FOR DEVELOPING AND TESTING CIRCULAR ECONOMY BUSINESS MODELS

"Circular Economy (CE) is not about one company changing one product, it's about all the interconnected companies that form infrastructure and economy, coming together and re-thinking the operating system itself". (Ellen Mac Arthur Foundation)

Circular Economy Business Model (CEBM) innovations are by nature networked since they require collaboration, communication, and coordination within complex networks of interdependent but independent actors/stakeholders. The key challenge to develop a successful CEBM for all key stakeholders within an ecosystem is to find "win-win-win" setting among diverse group of actors.

As a part of on-going H2020 project (Circ4Life) and harnessing the latest discoveries from emerging scientific CE, innovation and service design literature, Laurea University of Applied Sciences from Finland has developed CELLL toolkit for 1) co-creating shared strategic vision, 2) identifying the key stakeholders and 3) defining ecosystemic CEBMs.

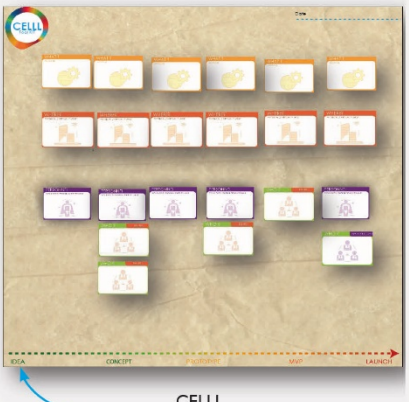
CELLL toolkit includes also project planning feature, which can be used to define end-user and other key stakeholder engagement activities for co-creating and testing the proposed CEBMs across the innovation process starting from opportunity identification to large scale demonstration and launch of the CEBM.
The CELLL toolkit is based on a facilitated group board game approach, which uses predefined cards as a visual method of blueprinting business model settings and co-creation activities across all CE and innovation process phases. CELLL is mainly designed for companies to define their CEBMs in multi stakeholder setting, but it can be used also e.g. for CE teaching.

During the facilitated workshop, a group of participants having complementary expertise across CE value chain, will together identify possible options and select the most approaches for further development. By the nature, the CELLL toolkit follows modular approach. Thus, the different game modules can also be played individually. Depending on the scope and scale, the duration of the CELLL workshop can range from half day to few days.

CELLL
Tool KIT

CELLL – A TOOLKIT FOR DEVELOPING AND TESTING CIRCULAR ECONOMY BUSINESS MODELS

Features of CELLL

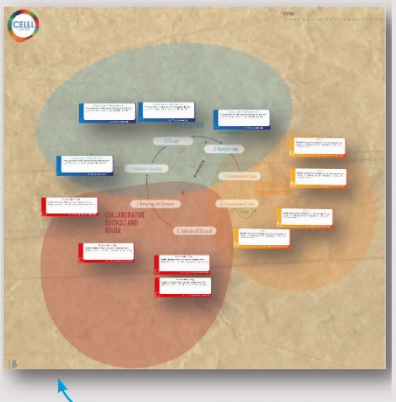


CELLL board (1A)

***Phase 1)** Ecosystem Mapping: to assess the current business value chain*

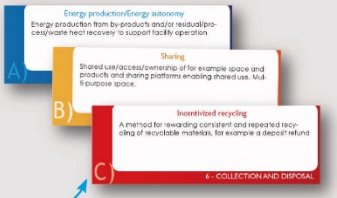
Queadruple Helix stakeholder cards

Value chain mapping cards

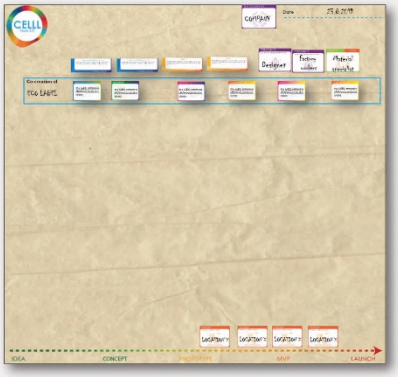


CELLL Circular board (1B)

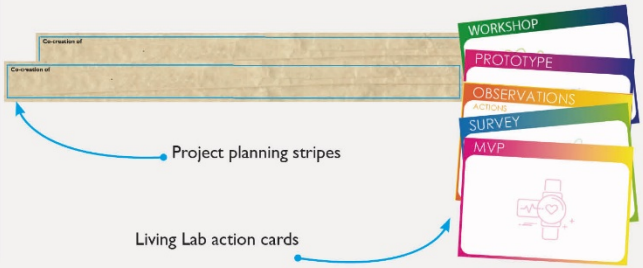
***Phase 2)** Business Model co-creation: to understand Circular Economy business opportunities*



45 different circular economy opportunities



***Phase 3)** Living Lab implementation: to understand how to co-create innovative Circular Economy business models with customers and other stakeholders*



Project planning stripes

Living Lab action cards