# A circular economy approach for lifecycles of products and services

# Report on the activities of exploitation and disseminations

## Deliverable 8.3

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# Summary

This report surveys the activities of exploitation and dissemination, training, teaching and education of the CIRC4Life project. It concludes all relevant activities taken for the promised transition towards a circular economy (CE) and a circular business logic. On the whole, this transition has shown for all partners involved a complex process, especially for the non-academic partners and companies as their own business pillars were affected. Long before the activities for exploitation and dissemination in CIRC4Life started in the middle of the project period, the transition itself commenced in the very project beginning with the creation of three Circular Economy Business Models (CEBMs). The CEBMs were developed in WPs 1-3 and followed by their piloting in several small use-cases demonstrated in WP 6 Demonstrators (DEMOs) by key actors through the value chains of the: a) electrical and electronic products and b) farming/ agri-foods (vegetable food and meats).

The key-role of the exploitation task 8.2 together with the task leader's mission was to examine the success of the different strategies envisaged by the partners and the under-pinning activities in achieving broader use and market acceptance.

For this report D8.3 the key findings and results from the CEBMs were collected, clustered, assessed and compiled into a framework. This framework can serve as a blue-print to involve large numbers of stakeholders needed to apply new CE tools and processes to support activities in order to achieve the UN Sustainable Development Goals – in the first place SDG 12: "Ensure sustainable consumption and production patterns". With this background of scalability and transferability in each of the CEBMs, a great variety of barriers was identified, and market opportunities were evolved but also digital enablers were developed and tested as well as policy enablers identified and addressed. CIRC4Life partners can thus go beyond their specific local context and expand their market presence with CE after the project phase.

From the perspective of the three CEBMs and their individual exploitation strategies for upscaling to other areas and for market uptake, the partners pursued basic orientations with different weighting: i) onsite demonstration and commercialisation, ii) implementation with exemplary character, iii) deployment in cities or local areas and iv) open access for ICT solutions. Other fundamental leverages for upscaling investigated in T 8.2 consist in future funding sources by the EU and its member states as well as in an early definition of intellectual property to come and their protection and especially the role of interoperability and respective standardization. The close relation with external stakeholders during the project and their direct feedback were very valuable for further exploitation, i.e. for the determination of policy recommendations and future R&I projects. Finally, the report includes the documentation of endowers taken for dissemination, e.g. publications, conferences, workshops and seminar presentations as well as for training, teaching and education. Of course, since the beginning of 2020, these activities have been hampered by the COVID-19 pandemic and therefore postponed - but all in all, they have still been successful.

# Table of Contents

## List of Figures

## List of Tables

## Acronyms and Abbreviations

| Abbreviation | Description |
| --- | --- |
| B2B2C | Business-to-Business-to-Consumer |
| CE | Circular Economy |
| CEBM | Circular Economy Business Model |
| CEBMs | Circular Economy Business Models |
| DEMO | Demonstrator |
| DEMOs | Demonstrators |
| CO2 | Carbon Dioxide |
| D X.Y | Deliverable X.Y |
| DoA | Description of Action |
| EC | European Commission |
| EU | European Union |
| EEE | Electrical and Electronic Equipment |
| EoL | End of Life |
| EPCIS | Electronic Product Code Information Services |
| EU | European Union |
| FMCG | Fast-moving Consumer Goods |
| GHG | Greenhouse Gas Emissions |
| GS1 | Global Standards One |
| GSMP | Global Standardization Management Process (coordinated by GS1) |
| ICT | Information and Communication Technology |
| IP | Intellectual Property |

| Abbreviation | Description |
|---|---|
| IPR | Intellectual Property Rights (measures to protect) |
| KPI | Key Performance Indicator |
| LCA | Life Cycle Assessment |
| LED light | Light Emitting Diode |
| PDS | Product Design Specification |
| OIC | Open Innovation Camp |
| QR code | Quick Response code |
| R&I | Research & Innovation |
| SDG | Sustainable Development Goals |
| SME | Small and Medium-sized Enterprise |
| WEEE | Waste of Electrical and Electronic Equipment |
| WP X.Y | Work package X.Y |
| WPs X.Y | Work packages X.Y |

# 1    Goal and Motivation

The CIRC4Life project is to enable the transition towards a circular economy (CE) through the development of a systemic and eco-innovative CE approach for sustainable products and services. This will consist of three new circular economy business models (CEBM), supported by an ICT platform that will connect and share data among a large number of stakeholders (e.g. producers, consumers, policy-makers). CIRC4Life has an EU-funded project that during its course of 42 months developed and demonstrated new CEBMs in two sectors: the EEE and the agri-food/ farming sectors. The new business models targeted four different product groups namely tablets, LED lights (for the EEE sector), organic vegetables and meat products (for the agri-food/ farming sector) and involved various activities including improved production methods, leasing models, take-back systems and digital tools supporting consumption of sustainable products (Wilson & Lindén, 2021a). The objective of this report is to document recent activities to exploit results during the project phase, and to prepare further ones to come beyond the project has finished. A strong focus will be put on the implementation of the CIRC4Life CEBMs in businesses.

Even though circularity is a business model by itself, changed customer and employee expectations, stricter regulations and increasing pressure of financiers influence the entrepreneurial act for quite some time and leave many managing directors puzzling over how they can lead their company to become more environment- and resource-friendly. Today, around half of the consumers pay attention on the social and environmental manufacturer's responsibility when purchasing products or services.

This is where the CIRC4Life key innovations come into play, aiming at ensuring better circulation of products and incorporated materials in a CE. As CE targets on less waste in the first place, and an absolute reduction of resource use at the level of a circular system and the economy as a whole, CE does not necessarily have its focus on the level of an individual product. So how do companies and entrepreneurs have to decide and act. According to many actual surveys, the core circular strategy consists in different dimensions: maintain and upgrade, repair, reuse, remanufacture and recycle (Circular Economy Initiative Deutschland (Ed.) 2020). The three CEBMs envisaged in this project were originally described in the year 2015/2016 and they all have their roots in the above-mentioned core strategy. In addition, individual strategies to bring the CEBM to the market have the same history. Many years have passed by since the start of CIRC4Life and now the exploitation plan has to ensure that the promised uptake and perpetualisation of the project results by industry (professionals and companies), academia, and policy-makers take place and are successful. Only the usage of achieved project results of CIRC4Life will ensure innovation and thus new approaches or solutions address the call challenges described and finally reach the planned impact.

With the focus on maximising the expected impacts of the call bundles of shared IP resulting from collaborative work in the project were identified and put into place by their convinced owners. There is no doubt that in CIRC4Life the different project partners (mostly DEMO and CEBM owners) are proud enough to bring their solutions directly to the market by themselves and stimulate new business or follow-up in their domain indirectly by partner using licences or similar. As many of the project partners are companies and not only researchers, many innovators will act as "take-to-market partners" and have their own strategy for knowledge management and protection including open access to research publications and data.

In addition, the role of consumer engagement and co-creational products and processes in the field of CE becomes more prominent and will be supported by governmental activities. The developed CIRC4Life app with associated methodology and services behind is one of the major outcomes of the project to collect and manage eco-credits in the eco-cost concept (formerly eco-point methodology) as incentives to new business and individual benefits.

## 1.1  Introduction

As dissemination and exploitation go together, this deliverable D8.3 contains a common report on Dissemination and Exploitation. The strategy for knowledge management and protection of innovative solutions is an integral part including open access to research publications and data. Different tasks from the DoA and project partners contribute to this document.

In **Task 8.1 Planning the dissemination and exploitation** the aim was to plan the completion of the dissemination and exploitation activities covering the following core components which were reported in an early stage of the project. The deliverable D8.1 Plan of exploitation and dissemination presented the orientation for the later activities, i.e. with the:

- Developed strategies to engage the targeted audiences to finally increase awareness, understanding for adoption, internalization and/or integration of results.
- Identified channels and tools for the dissemination and exploitation.
- Planned resources and schedule activities for the dissemination and exploitation.

In **Task 8.2 Exploitation**, the aim is to ensure the uptake and exploitation of the project results by industry (professionals and companies), academia and policy-makers from the consortium, and outside the consortium. Thus, strategies have been planned and will be implemented to facilitate and ensure the exploitation of the results of the project by these stakeholders. The development of CEBMs for the electrical/electronic products and agri-food sectors, is one of the key outputs of this project. A generic business model framework will incorporate the different business models approaches presented and will describe the main underlying activities and interactions between the stakeholders (e.g. producers, consumers, policy-makers) that intervene in the whole supply chain. The business model approaches presented will then be optimized and demonstrated for the electrical/electronic products and agri-food sectors. In order to ensure these business model approaches and demonstrations are adopted and used to achieve the impact expected, different strategies will be implemented. The aim of the **Task 8.3 Participation in Publications, Workshops, Seminars, Conferences** is to disseminate the outcomes of the project to different targeted audiences. This will involve the implementation of a number of dissemination activities such as presentations at scientific conferences, workshops, seminars, EU policy-related events, and trade-fairs, as well as publications in international peer-reviewed journals, books, reports, standards and regulatory instruments and directives. These activities will be targeted at the following key audiences: general public, academia, industry, and policy-makers. In order to ensure that all of the above mentioned dissemination activities are carried out on time, and target the right audiences, a dissemination manager will be appointed, who will coordinate an annual publication plan, which will list all the relevant dissemination activities, and the relevant project partner(s) intending to publish at each of them. The dissemination manager will regularly screen upcoming and new events, based on their suitability for CIRC4Life outcomes, and the potential impact that could be achieved. The publication plan will be presented and refined at the General Assemblies, with the intention of developing a coherent dissemination strategy. The preliminary initial dissemination plan will include the following dissemination activities: Presentations in International Conferences, presentations in International Seminars, Presentations in International/national Workshops, Presentations in International/ national Trade-fairs, Presentations in EU policy-related events, Publications in International peer-reviewed journals with open access. The above-mentioned dissemination activities are explained in more detail in Section 2.2.1 'Dissemination and Exploitation' of the DoA. Findings and results from **Task 8.4 Policy alignment** are reported separately in another deliverable (D8.2) two months earlier than D8.3. The aim of **Task 8.5 Training, Teaching and Education** will be reported in this document in a specific section 4 below.

In the middle of the project plans arose to elaborate and then use a common "**General Visualisation**" representing all CIRC4Life outcome. This was developed during the demonstrators (WP6) as well as during the implementation of the CEBMs in the demonstrations. At the first Open Innovation Camp (OIC) in Krakow, diagrams on the value chains where developed. CIRC4Life built on that with the support of WP9. In the

subsequent work done, a "Four Layers Approach of Results" was figured out and discussed among the partners from CEBMs and DEMOs to cover all relevant perspectives:

- Technology (e.g. IT-Platform; Traceability; App; Brokerage) for Lifecycle Management of Goods and Services
- CEBMs in the lifecycle – three clouds/sections in different colours with titles
- DEMOs in the lifecycle – represented by small icons (food, LED, tablets …)
- Policy Recommendations to public and private policy makers – for different resource flows in other domains and regions

Right from the start of its existence, the general visualisation (see Figure 1) was used intensively for the invitation for the virtual OIC2 in 2021 because it was so appealing to other organisations and companies.
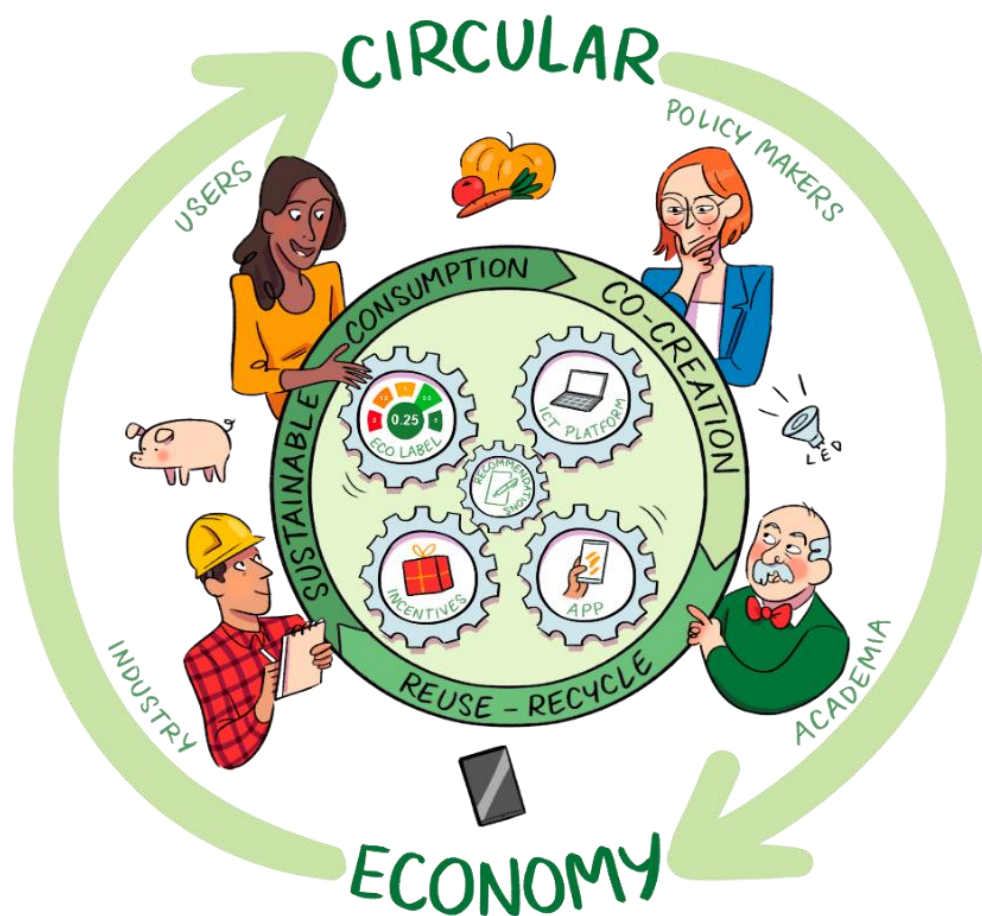


Figure 1: General visualisation of CIRC4Life results and solutions
(Designed by CIRC4Life)

## 1.2 Methodology and Delimitation

The strategy for the management and protection of Intellectual Properties (IP) is part of the Dissemination and Exploitation Plan. These two main tracks were in the middle of the related activities during the whole CIRC4Life project lifetime: dissemination and exploitation. Exploitation strategy is "The utilisation of results in further

research activities other than those covered by the action concerned, or in developing, creating and marketing a product or process, or in creating and providing a service, or in standardisation activities" (EC Reference Terms) regarding **any type of innovation** (commercial or technical) **or any type of benefit (impact) –** financial or societal, research, environmental etc. As the protection of IP has to be addressed when there is a potential for commercial or industrial exploitation, see also ARTICLE 28 — EXPLOITATION OF RESULTS of the Grant Agreement says under paragraph 28.1, each beneficiary must […] take measures aiming at ensuring his 'exploitation' of its own results – either directly or indirectly, in particular through transfer or licensing by different means or a combination of them:

- using them in further research activities (outside the action);
- developing, creating or marketing a product or process;
- creating and providing a service, or
- using them in standardisation activities.

In month 3 of the project, D8.1 Plan of exploitation and dissemination was executed and developed as an initial step into the long-lasting usage of results from the project. This early plan of D8.1 now also builds the basis for the final comprehensive report D8.3 in the phase-out of the project – which, in contrast to the earlier one, is now even a public document.

## 1.3    Impacts and Changes to the Plan due to COVID-19

The scope of the results from the CIRC4Life project are a combination of the existing Description of Activities (DOA) and at the same time showcase novel innovations. This is entirely appropriate to the development of the subject and the current changes in society because (a) it was nearly 5 years since the DoA was written – thus much has changed, (b) circularity issues and solutions show a mature attitude in constant innovation, and (c) we've had Coronavirus which has turned our plans upside down.

Due to Covid-19, unfortunately several exhibitions were cancelled last minute. Thus, planned activities could not take place, e.g. the International Trade Fair for Lighting in Frankfurt (Germany) and even the Facility Show in London planned in 2021 is uncertain. However, all demonstration material was prepared and is ready to be used. As a consequence of COVID new approaches to get feedback and interaction from end-users had to be developed – development of a feedback system covering feedback, surveys, error reporting and video introduction for the users of the different systems and evaluation of new approaches for remote demonstrations. The developed feedback system is integrable with the other solutions in the CIRC4Life ICT environment.

# 2    Exploitation

This chapter summarizes the efforts undertaken on exploiting the CIRC4Life project results. The structure of the following chapters is based on the so-called exploitation strategies defined in the DoA which are in line with the three following CEBM models (see Figure 2):



Co-Creation of
Products and Services

Sustainable
Consumption

Collaborative
Recycling and Reuse

Figure 2: Overview of CIRC4Life CEBMs
(Own design)

Chapter *2.1* introduces the approach chosen by the authors to collect the results of the individual exploitation strategies, to cluster them in a meaningful way, and to assess their respective impact on market uptake and scalability. Based on this, the Framework for Scalability and Transferability (chapter *2.2*) as well as the three CEBMs (chapters 2.3 to 2.5) are described in more detail. Chapter *2.6* is devoted to the individual exploitation strategies themselves, first providing a general overview before describing more in detail the specific strategies assigned to each CEBM. To take the project results to the next level, chapter *2.7* outlines potential national & regional funding sources and chapter *2.8* highlights promising key innovations for protection (IPR). In addition, chapter *2.9* focusses on standardization and interoperability in order to build a bridge between the project results and GS1 standards. Chapter *2.10* contains an overview and an evaluation of the results by the second Open Innovation Camp (OIC) regarding the experts' perspectives and opinion on exploitation. Chapter *2* is rounded off by a short summary of a preparation for a policy recommendation in chapter *2.11*, also a link to the respective deliverable of the dedicated task in WP8 is described.

## 2.1    Approach

The CIRC4Life project focuses on several exploitation strategies in order to ensure the uptake by different stakeholders coming from the industry, policy and academia institutions. These strategies will support and facilitate the implementation of the CIRC4Life project results beyond the project duration – see section *2.6 Individual Exploitation Strategies*. As stated in the DoA, the CIRC4Life consortium focuses in this context on eight different strategies whereby the realization of these planned activities remains in the hands of the responsible partners (see Table 1):

**Table 1: Overview of exploitation approach according to industry and partner (own design)**

| Industry | Partner Responsible | Action Framework for the Future |
|---|---|---|
| Lighting | NTU, KOS and ONA | Preparation for commercialisation by dedicated exhibitions during fairs and conferences. Further development with professionals and industry experts through demonstrations, standardisation, and capacity building. |
| Agri-food | ALIA | Implementation of the CEBM in the agri-food industrial sector, especially together with ALIA's association members. |

| Small-scale vegetables Farming | JS | Deployment of the CEBM in local farms together with their business partners and followed by an up-scaling through industry networks all across Europe. |
|---|---|---|
| Recycling | IND and REC | Implementation of the recycling-reusing system in cities: in regional schools, public buildings and street locations followed by the plan to implement it in other EU countries. Also, the recycling incentive scheme developed will be implemented and followed-up in the same way. |
| Technology | ICCS, ENV, EECC and GS1G | Results will be prepared for Open Access, e.g. the ICT platform developed, tools and apps. Further the traceability system will be implemented to be piloted in the relevant market. |

Looking at the skills and prerequisites that are important for an exploitation of project results, it quickly becomes clear that the holistic basis of the findings must be scalable and transferable – see section *2.2 Framework for Scalability and Transferability*. Therefore, the approach of Task 8.2 requires an iterative way of steps, that need to be done by the involved partners within different stages. Only then a holistic view of the overall exploitation possibilities can be achieved. *Figure 3: Exploitation process-flow chart* (Own design) demonstrates the approach which the authors of this deliverable have set up to structure the results for exploitation. In a first step the general information of the partners and their plans within the exploitation strategies have been gathered. In order to build a solid foundation that meets the expectation of the CEBMs within Task 8.2, it was necessary to start with inputs, information and plans coming from the partners based on the described exploitation strategies.
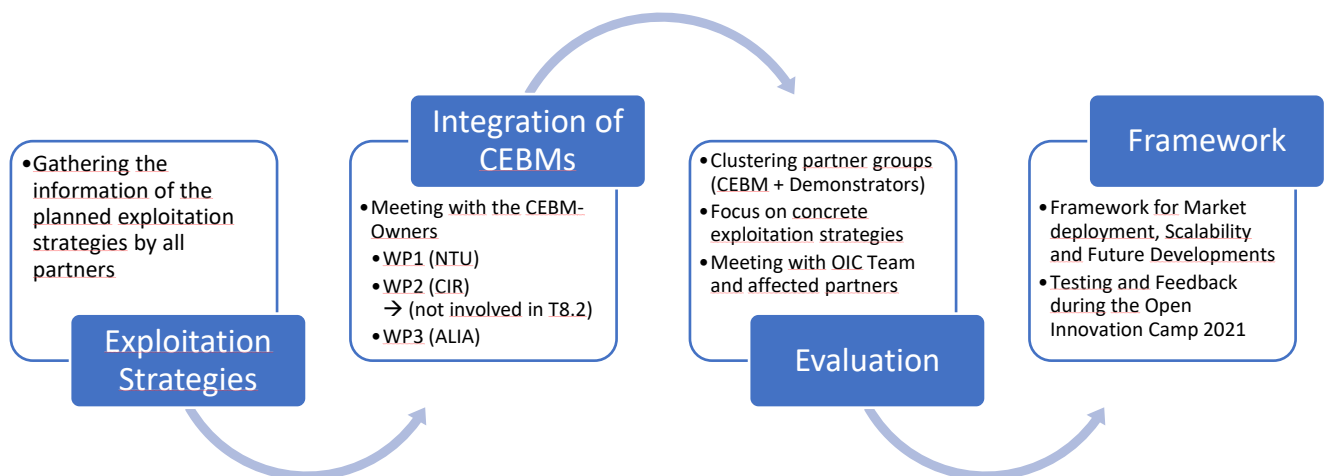


Figure 3: Exploitation process-flow chart
(Own design)

In the next step, this information was shared with the CEBM owners in order to have a clear vision on the developed solutions within the CIRC4Life project. In addition, meaningful cluster groups were formed for the individual exploitation strategies in order to identify the most important and relevant results for each strategy and to prepare them for the description in this deliverable. As a final stage, the OIC 2021 helped to test and

evaluate the CIRC4Life solutions, especially with regard to the exploitation possibilities beyond the project duration. During the OIC, the clear message "Bring CEBM to the market" was explicitly addressed to the audience and supported by showing the 17 SDGs of the UN (see Figure 4Figure 1) as a major directive for the market uptake. This OIC feedback coming from a broad sustainability expertise will be crucial for taking up the next steps regarding transferability and scalability into different sectors or regions. Further insights on the OIC-results are presented in chapter *2.10 Feedback from the OIC 2021 as input for further exploitation*.



Figure 4: SDGs as major directive for the market uptake
(Source: United Nations, 2015)

## 2.2    Framework for Scalability and Transferability

Scalability means the expandability of a business model - through higher sales and profits or new customers, e.g. in international markets. The expansion of sales channels or products and services also has to be mentioned here - the business model itself is then scalable. Scalability as such has different dimensions:

- to what extent can a growth in sales or new markets be increased without the need for further substantial investments in infrastructure, production, or the hiring of new employees
- at the same time, it also means that the effort required for this expansion must be in proportion to the growth
- in digital business models, the product can usually be used or consumed independently of the creator, which makes it possible to reach as many people as possible without being physically present. In this way, an entrepreneur is neither limited in terms of time (resources such as working time) nor in material terms (machine hours, lot sizes of machines).

Table 2 below shows the scalability of the three CEBM in CIRC4Life, according to five main factors (red = low; yellow = medium; green = high).

**Table 2: Scalability of the three CIRC4Life CEBMs in comparison (own design)**

| Factor | Description | *CEBM* Co-Creation of Products and Services | *CEBM* Sustainable Consumption | *CEBM* Collaborative Recycling & Reuse |
|---|---|---|---|---|
| High expandability | A solution is relatively easy to expand into new markets; its sale works practically without any problems in international markets - mostly through translation into other languages and through minor regional adjustments. | Leasing service agreement needs to be adapted to different national or regional markets | No national limitations, but regional obstacles due to the need of an extended infrastructure, including communication; suitable standardization is needed | No national or regional limitations |
| Low initial investment | Solutions with relatively small, fixed assets tend to be better able to increase their sales without major investments. | Sales increase without major investments | Technological up-take (information, packaging, and labelling) | Bins are expensive |
| Low fixed costs | Fixed costs do not increase significantly even in the case of high expansion. The ratio of fixed costs to total costs is and will remain low. Ergo, these scalable business models have a high proportion of variable costs. | Only need to invest in ICT environment | Low fixed costs after technological up-take | Expenses depend highly on surface of the region - distances |
| High level of automation and standardization | Very highly automated processes - optimized and standardized – enable fast expansion and more efficient execution. Automation through the application of algorithms or the use of software support easy adaptions and releases. | Automation is very manageable once the ICT environment is set up | High degree of individuality, regional conditions, and personal consumer preferences; Automation is possible once the ICT environment is set up | One system serves many users in different regions |
| No (or high) capacity limits | Offer can be used by many people at the same time, regardless of location - particularly with digital products that can be distributed infinitely often without any loss of quality. | No capacity limitation | Low capacity limitations | No high through-put, thus no local bottleneck |

## 2.3    CEBM Co-Creation of Products and Services

The main focus of this CEBM is to bring key stakeholders of supply chains together to create products and services with sustainable features. Hence, providing state of the art technology, integrating them in sustainable product development solutions, and minimizing the ecological impact by increasing both energy and resource efficiency are the thematical elements under this CEBM, which aims to be applicable for recycle/reuse materials, production and logistics stages (see Figure 5). Key solutions, e.g. like the Eco-cost approach, data mining technologies and Leasing solution, underpinning this CEBM are described as follows:



Figure 5: Illustration of co-creation business model (Designed by CIRC4Life)

**Eco-cost approach:** In order to allocate the ecological impact of products and services, e.g. in the lighting sector, to the individual objects, it has been decided to create an eco-accounting platform for costs and credits described in *Figure 6: Architecture of eco-accounting platform* providing an overview of their main terms and characteristics together with their interrelationships:

- The **Eco-cost** is a cumulative value, which accounts for an aggregate of the ecological impacts throughout the product life cycle. The eco-cost value is obtained via utilising the method of life cycle impact assessment (LCIA).
- The **Eco-credit** is a concept focussing on the reuse and recycling stage. Eco-credits are obtained and recorded in the consumer's eco-account when the customer returns a product to a collection facility for its reuse or recycling.
- The **Eco-accounting** platform is developed to implement the eco-point method, with the special concerns on the product's sustainability. The eco-accounting platform utilises the information and communication technologies to collect and process the data for the calculation of eco-points, and then apply the eco-points obtained into the different areas, including eco-shopping, recycling/reuse, consumer's eco-account, and product sustainability assessment.
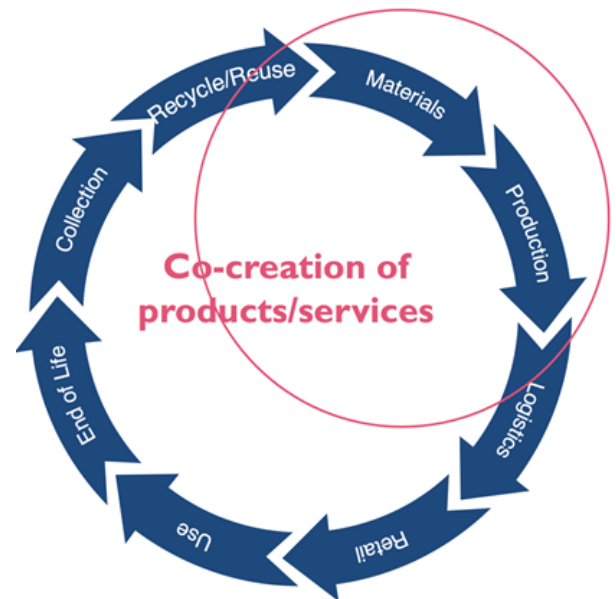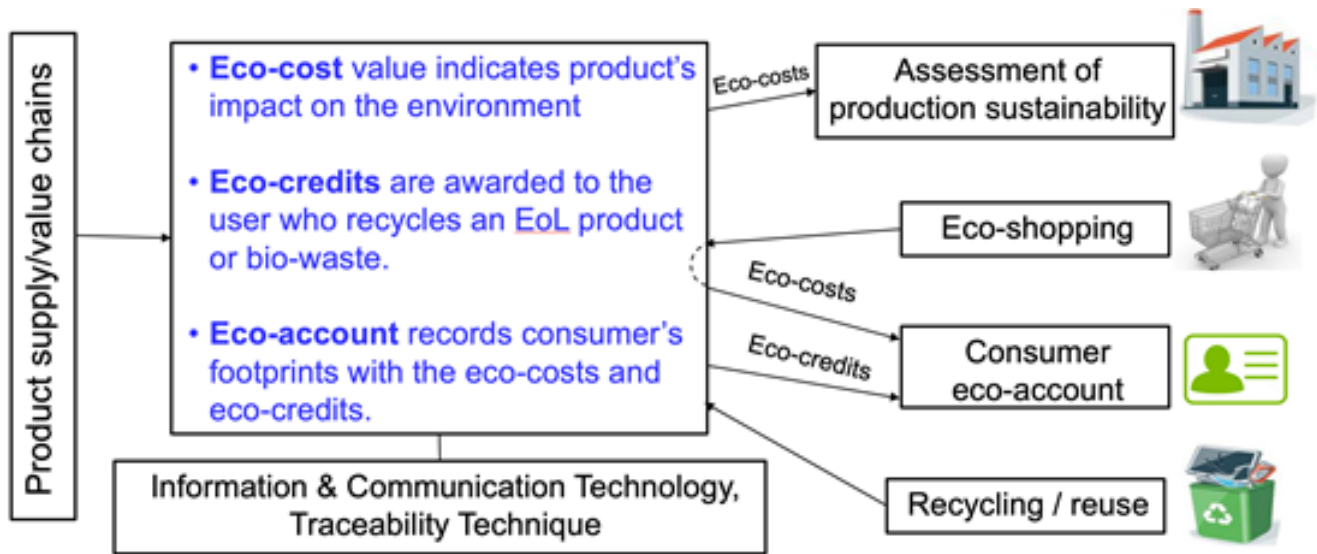
Figure 6: Architecture of eco-accounting platform
(Designed by CIRC4Life)

In the eco-accounting platform, there are large amounts of dynamic data required for the eco-point calculations. This data is usually dispersed in different locations, which restrict data capture, and hence, affect the quality of eco-points resulted. This work develops a novel dynamic data management method, based on tracking and monitoring each stage at supply chain, which overcomes the problem of massive data acquisition throughout a product's life cycle. Regarding the above-mentioned challenge to gather relevant data along the whole supply chain, the integration of the following two fundamental tools is a fundamental step forward:

- **Environmental and social life cycle assessment (LCA tool)**: For businesses, the ability to reduce environmental impacts means a route towards a lower carbon footprint, reduced resource use, less waste produced, more socially responsible products, and opportunities to gain business in the established 'circular economy'. Social LCA provides information on social and socio-economic aspects for decision making, instigating dialogue on the social and socio-economic aspects of production and consumption, with the prospect to improve performance of organizations and ultimately the well-being of stakeholders.
- **Set of impact assessment tools:** The Online LCA tool is to implement eco-cost calculation, while the Impact Assessment tool is to implement eco-credit calculation. The eco-cost is used to guide consumers to buy sustainable products, and the eco-credit is used to encourage citizens' recycling behaviours.

**Co-creation approach by using data mining technologies:** Brings the end-users/consumers preferences closer to the beginning of the product development, which is achieved via co-creation activities with the means of an online data mining method (see D1.4 and D3.3 for details). The obtained results are applied into the product design specification (PDS), with a view to develop a framework for product creation in a CE context and to enable sustainable product design and sustainable production.



Figure 7: Schematic approach for mining online reviews to improve product design specifications (PDS)
(Designed by CIRC4Life)

While *Figure 7: Schematic approach for mining online reviews to improve product design specifications (PDS)* shows a general process flow of the above explained key solution, *Figure 8: Flowchart for demonstrating co-*

*creation approach by using data mining technologies* specifies the relevant process steps in the use case of domestic lighting owned by ONA. Firstly, ONA designers and engineers define a series of common PDS items. Afterwards, key elements from consumer requirements mined from online reviews are re-written in a technical PDS format, for example life in service; quantity; manufacturing facility; materials; timescales; safety, which are necessary to specify the product. Based on those established PDS items, the lighting product is prototyped and introduced to stakeholders from the lighting sector, where living lab framework-based validation and testing methods are used to gather comprehensive feedback. Then ONA converts this gathered feedback into the PDS improvement and applies them into the next version of product manufacturing.
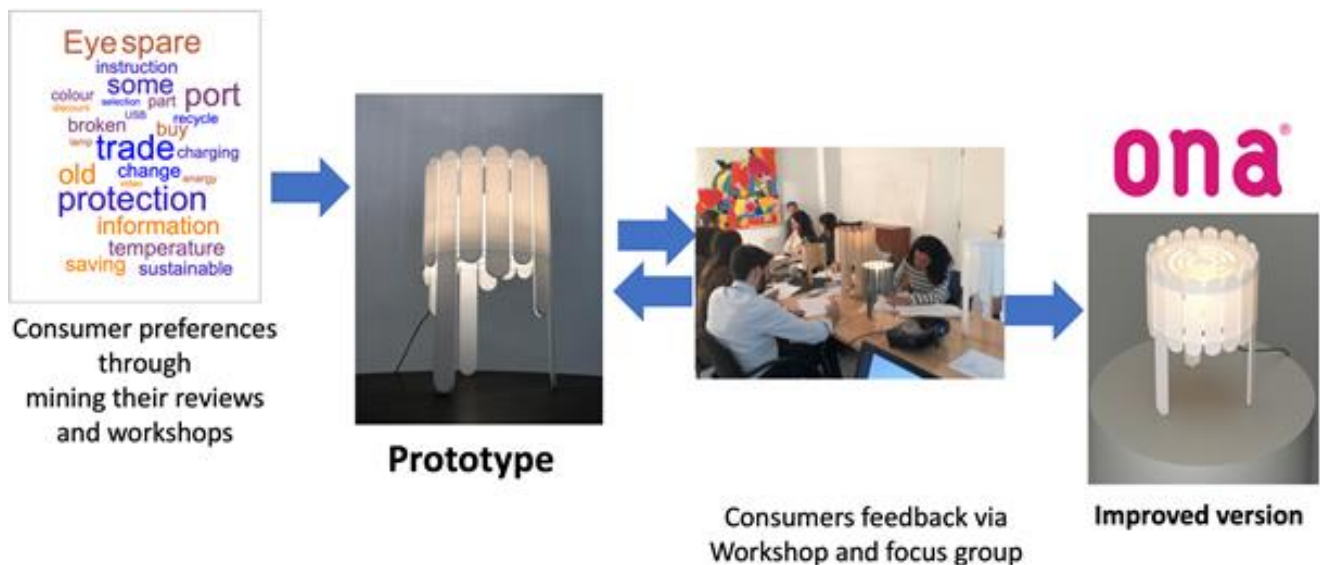


Figure 8: Flowchart for demonstrating co-creation approach by using data mining technologies
(Designed by CIRC4Life)

**Leasing solution and potential service for industrial lightings - "Pay per Lux"**: An essential aspect for reuse of the EoL LED lighting products is to return the products to the manufacturer, so that the manufacturer can replace the default components to make the product reusable; or, in the case that the majority of the components of the product have failed, the product can be disassembled in order to keep the parts which are still in a good working condition. However, in some cases, it is difficult to ensure that the EoL products are returned to the manufacturer, but leasing can resolve this problem, because the leased products are in the care of the leasing company who has the capacity to repair the products. Therefore, a leasing service is an important means for reuse of EoL LED lighting products, in addition to its benefit for longer use of the products because it leads to better maintenance during the leasing. The idea of leasing products instead of selling them came out of the strategy of producers to lengthen the product lifetime while keeping the ownership of the product and benefiting from longer lease or rent periods. Leasing promotes the use of products which are otherwise expensive for customers. This service helps in saving on a client's electricity bill and avoid big financial investment by providing flexible payment plans that can be provided to suit the customer's individual financial situations. The tenant and the landlord could also document the sustainability of the property through certification. Due to the vast energy savings that LED lighting can offer (especially within the industrial sector), the estimated saving on a client's electricity bill should be able to cover the leasing service charge without extra financial burden.
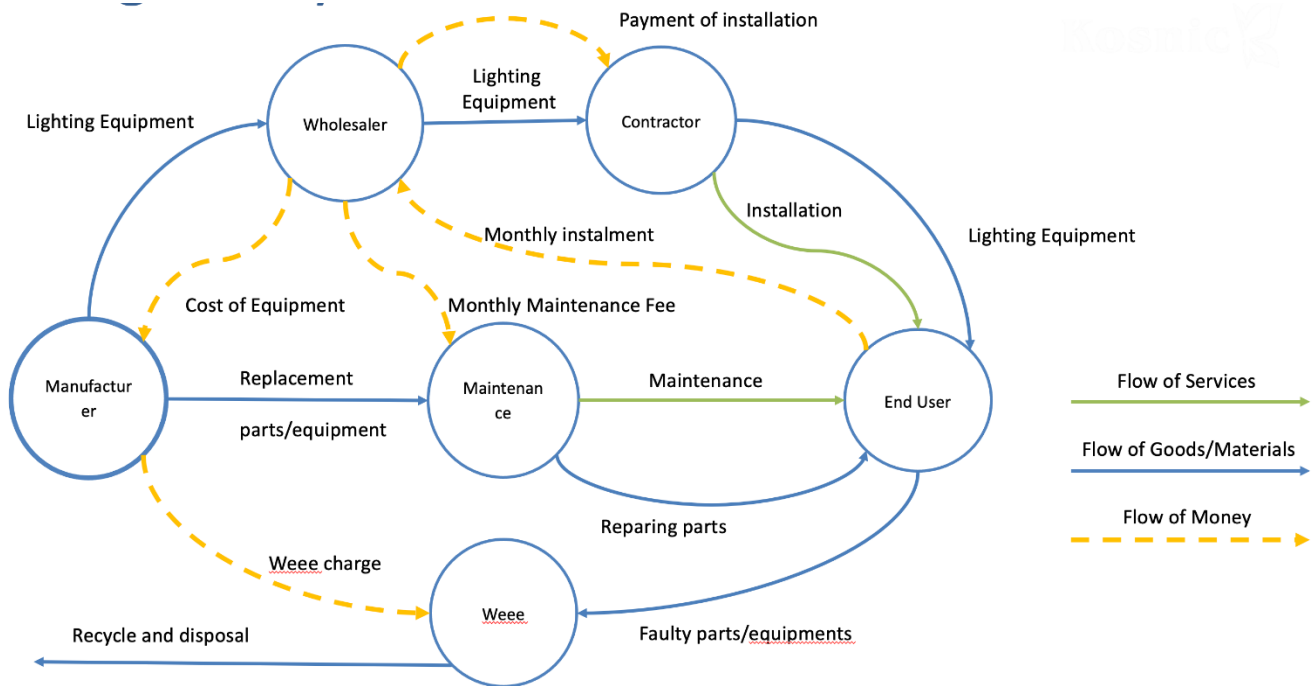
Figure 9: Illustration of LED lighting product leasing service
(Designed by CIRC4Life)

The above *Figure 9: Illustration of LED lighting product leasing service* illustrates the eco-system of the LED lighting product leasing service. Herein, the wholesaler brokers and manages the lease service to the end-user, the manufacturer supplies the lighting equipment and parts, the contractor is responsible for the installation, and the maintenance company supervises the equipment. Additionally, the manufacturer uses the waste electrical and electronic equipment (WEEE) service to recycle and dispose faulty and End of Life (EoL) products. The wholesaler collects the payments in instalments to pay the other business partners. The leasing contract term is of five years with payment considered for 20 quarters. The leasing service includes the illumination plan, providing the lighting equipment, installation, maintenance, and EoL take-back services. The company uses technical expertise to develop a bespoke plan, producing the required lighting equipment that best suits the application and conforms to all necessary standards and regulations. The wholesaler leads the commercial activities in identifying local business opportunities. After finalising the leasing contract, the electrical wholesaler works with other partners to deliver the equipment and services accordingly.

As *Figure 9: Illustration of LED lighting product leasing service* shows, the owner of the lighting equipment is the industrial lighting manufacturer Kosnic. Therefore, Kosnic reclaims the lighting equipment at the end of the leasing contract. Owing to the novel modular design, numerous components can be recycled, reused, and re-engineered to extract the maximum residual value of the used lighting equipment. Moreover, the disposal of fewer parts of the lighting equipment reduces the WEEE charges.

**How does this CEBM benefit the targeted supply chain actors?** The co-creation business model focuses on material, design, and manufacturing stages in the CE context. The aim of this CEBM is to develop approaches for implementation of Co-Creation of Products and Services with sustainable features, throughout the product development process. Therefore, key partners in the supply chain have been identified, and their role in this CEBM are also examined to describe the potential benefits for them to adapt these approaches under this business model, which are reported in table below (see Table 3).

**Table 3: Key partners, roles, and benefit (own design)**

| Stage | Key partners | Roles | Benefits |
|---|---|---|---|
| Materials sourcing | Eco-procurement companies | Incorporate eco-concept in the real business | Sustainable performance enhancement |
| Materials sourcing | Local administrations | Implement eco-procurement | Impacts reduction, resource efficiency improvement |
| Materials sourcing | Warehouse operating companies | Lease LED lighting products and services | Maintenance and recycling convenient, flexible payment, energy bill reduction |
| Design & Retail | e-commerce companies | Provide latest consumer feedback to major actors of the supply chain | Quick adapt to new business situation |
| Design & Manufacturing | LED lighting companies | Implement sustainable design methods & refurbishing recycled products | Reduce waste costs, improve profit ratio, and beautify company reputation |
| Manufacturing | Under Eco-certificate regulating companies | Eco-certificate/labels promotion | Impacts reduction, sustainable performance improvement |

The value of this CEBM is to explore the more eco-innovative models, and to highlight the barriers and assumptions they experience. This CEBM allows supply chain actors to start from their current knowledge and experience, and further trigger and possibly adapt these approaches to lead new knowledge or learning experiences related to eco-innovation.

**How do supply chain actors earn revenue?** One of the key goals of this CEBM is to reduce the environmental impact, which is highly dependent on how the product is manufactured and the associated service is linked to the product. In practice, the relation between a business model and its environmental impact is not absolute. The business models must perform in a context and are applied and built up based on assumptions and aspirations. While implementing new business models, these assumptions must be validated and updated, and business models fine-tuned accordingly. Based on the above, CIRC4Life project partners worked with some industry stakeholders to clarify the earning logic and revenue generation route in order to help supply chain actors to earn revenue by adapting this CEBM, which is described in the table below (see Table 4).

**Table 4: Earning and revenue logic at different supply chain stages (own design)**

| Stage | Key partners | Earning logic | Revenue |
|---|---|---|---|
| Materials sourcing | Eco-procurement companies | Competing with eco-procurement regulating contracts | Higher profits |
| Materials sourcing | Local administrations | Competing with eco-procurement regulating contracts, and is able to promote/demonstrate eco-products at a larger multi-stakeholder platform (i.e. local administration level) | Higher profits |
| Materials sourcing | Warehouse operating companies | Usually, massive orders | Product profits, and service charges (e.g. maintenance) |
| Design & Retail | e-commerce companies | Accurately capture consumers' demands, then adjust product design or marketing strategies | Profits |

| Design & Manufacturing | LED lighting companies | Manufacture more products but with same materials (recycling/refurbish); | More profits, but less costs; additional added value from service charge |
|---|---|---|---|
| Manufacturing | Under eco-certificate regulating companies | Added value from eco-certificate label | Higher profits |

*Table 4: Earning and revenue logic at different supply chain stages* (own design) illustrates that this CEBM leads to eco-innovation providing significant environmental impact reductions. This can be related to increased resource efficiency (by applying CE concepts) as well as to improved energy efficiency. It became evident that synergies can be found between product design and business model design. The revenue earning logic shows that it is possible to generate sustainable revenue stream with long lasting energy and resource efficient products and services.

## 2.4 CEBM Sustainable Consumption

This CEBM covers CE strategies with regard to sustainable consumption in the value chain stages of distribution and sales as well as consumption and use. There are several more, but the developments in CIRC4Life focused on the following topics:

- **Optimized packaging design**: Efficient packaging design strategies abiding regulations and utilizing end-of-life packaging material.
- **Eco-labelling**: A voluntary environmental protection certification of proven environmental preference of a product/service within its respective category. Credible and impartial labelling of product/service is usually overseen by public or private third parties.
- **Product labelling**: Aimed to guarantee that consumers have full information on the constituents, origin of raw materials etc. to enable them to make informed decisions. Indicates no environmental or otherwise preference for certain products, in contrast to Ecolabelling.
- **Socially responsible consumption**: A socially responsible consumer purchases products and services that are perceived to have less negative influence on the environment and/or that support businesses that also have positive social impact.
- **Product as a service or Product Service System**: The ownership of the product rests with the producer who provides design, usage, maintenance, repair, and recycling throughout the lifetime of the product. The customer pays a service fee for the time of its usage.
- **Community involvement**: The voluntary involvement of community and different stakeholders in organizing sharing platforms and providing guidance on product repair and replacement.

The above list contains generic approaches to Sustainable Consumption. CIRC4Life focuses on the application of this CEBM to specific industries and product groups, so individual aspects have not been considered further in CIRC4Life. In terms of CIRC4Life, this means that the objective of this CEBM is to change consumer awareness, attitudes, and habits towards more sustainable consumption. To achieve that, the information about the sustainability performance on product level needs to be provided for efficient use and comparability. The core component of this CEBM is to provide full traceability along the value chain to empower the consumer at the point of sale in terms of decision-making processes. This collected data serves as guidance for the consumer to be able to act in a more sustainable way. From a brand owner or a retailer perspective it is also about marketing to sell sustainable products. Therefore, it is essential to design an attractive logo and awareness campaigns. An eco-friendly, socially responsible, and at the same time economically attractive business model helps all stakeholders to initiate, underpin and even extend circularity in the food sector, depending from their starting position. The benefits on the different levels of the production and for each partner may be different according to their specific company situation, but a general opportunity for all of them will rise from this business model and a more customer-oriented approach.

Suppliers and consumers especially will be able to improve their situation by making an increased circularity in production and consumption accountable and referable to certain factors. These new ways of production will also increase the transparency among them, creating new business opportunities in this line as well. There are also other benefits for consumers. They receive healthy and high-quality products and contribute to the fight against climate change, which goes beyond simply buying goods. They also know they are doing the right thing when they buy sustainable products. Ethical commitment is linked to consumption habits. Focusing on consumers who do not trust in sustainable products, this CEBM will help increase identification with local food producers, conduct tastings of sustainable food, promote regional products over other/foreign products and more. In addition, it will increase their trust and awareness of sustainable products.

As this CEBM is only successful as long as the end user/consumer will benefit from the system in general, it is very important to design and develop the solutions of this CEBM in a customer centric way. For this reason, it is very important to analyse in a first step the customer at the point of sale. There are different kinds of consumers regarding the customer segment:

- **Sustainable consumers** who care about sustainability issues and tend to buy sustainable products,
- **Non-sustainable consumers** who do not care about these aspects.

These concepts should address the non-sustainable consumers as well as the sustainable consumers in order to exploit this CEBM to as many consumers as possible and to achieve the biggest impacts in terms of sustainable consumption. With regard to the use of a service, it is always advised to check which users are those who would accept it first, the so-called early adopters. In the context of the CEBM Sustainable Consumption the sustainable consumers can be divided into two groups of shoppers who:

- … already buy **sustainable products**: *Ecological consumers* tend to adopt ecological habits as recycling, sustainable and responsible consumption, etc. because of environmental awareness whereas *uninvolved consumers* buy sustainable products because it is trendy. They are not fully involved in environmental issues. *Convinced consumers* have high environmental awareness and practice a sustainable life daily and *healthy consumers* consume sustainable and local products in order to continue with its healthy lifestyle.
- … who tend to buy **local products**.

In a general view, early adopters tend to be young, with high educational level and live in urban areas. In addition, they tend to buy the products in organic stores. They are regular users of smartphones and other devices and can afford buying more expensive products. Furthermore, those who are more likely to buy local products tends to live in rural areas with a higher age. They are less interested in qualified organic products, prefer to buy products at local markets and do not use smartphones or other devices. They follow the principle of buying local products with the aim of continuing to buy traditional products. This is a very high-level differentiation as it has to be based on socio-demographic research studies. In addition, it is important to mention that consumer segments and characteristics may vary across countries and cultures.

Next to the determination of target segments it is helpful to analyse which kinds of current problems, challenges the customers are facing today without having a provided solution. In terms of the CEBM Sustainable Consumption, there are especially the following challenges from the consumers' perspective:

- **Lack of trust**: Consumers do not trust some sustainable labels. The eco-labels indicate that a product meets certain parameters regarding sustainability. However, the existence of eco-labelled products with plastic packaging and which come from the other side of the world make some consumers doubt its relevance and genuineness. Consumers may doubt about whether or not an eco-label is associated to the environmental footprint of a product, or just associated to following some specific procedures which actually do not make the product more sustainable. Furthermore, there is a lack of data transparency over the life cycle of each individual product. Today, we are unable to determine where the underlying data comes from, or whether it is primary or industry average data, i.e. secondary data. With full transparency over the whole lifecycle, the impact of sustainable consumption will increase as

the consumer is able to use this for decision making processes and has the opportunity to act in a sustainable way.

- **Missing comprehension:** Difficulties of understanding the sustainable information of products. First of all, it should be highlighted that many people actually do not recognize the existing eco-labels on products. There are some successful cases, such us the efficiency labels in appliances, however, this is not extended to the rest of them. The existence of different eco-labels at European, national, and regional level makes it difficult to control them all and understand what is behind them.

- **Prices too high:** Sustainable products are in many cases too expensive. As a result, sustainable consumption is associated with environmentally conscious upper middle-class consumers, not just those with environmental awareness. This is a pattern which needs to be modified. Climate change is the greatest threat we face as a society and also one of the greatest injustices. On a global level, Oxfam Intermon points out that the highest income countries produce 44 times more emissions than the less developed ones, and that the richest 10% of the population emit 50% of all emissions (Gore, Alestig and Ratcliff, 2020). This is also happening at the national level in every country in the world. The ecological transition should have the principle of leaving no one behind and having affordable sustainable products for everyone should be a priority for us as a society.

- There is **no comparable data** existing for decision-making processes at the product level at the point of sale: As consumers we still face the challenge of not being able to directly compare two products at the point of sale, which means that we are unable to make an informed, sustainable purchase decision today due to a lack of information. The reason for this is the lack of data transparency over the life cycle of each individual product. Today, we cannot determine where the underlying data comes from and whether it is primary or average data from the industry, i.e. secondary data. So, it is currently not possible to compare two products quickly and easily, preferably in a digital way. A sustainable purchase decision can therefore not be made by any customer segment. The current situation is therefore not customer-centred, not very sustainable, and above all hardly standardized.

The CEBM Sustainable Consumption is based on five essential technical developments which pave the way to an accountable and more transparent eco-oriented processing in the value chain from food to the end consumer. All five components flow together in the overarching CEBM, which can be implemented at many different stages from primary production through retailer to the end consumer:

- **Traceability architecture:** A method was developed to track the impacts of individual production and transport steps for individual products or batches of products. An extension to GS1's global EPCIS standard has been developed to capture and share data on ecological impacts. Since EPCIS is widely used for tracking supply chain events, this implementation enables straight forward integration of impact tracking into existing traceability systems. The traceability module developed by the EECC demonstrates how this extension can be used to track farming and meat production impacts as part of the CIRC4Life prototypes and demonstrations. The aggregated data for each product can then be rated to obtain a comprehensive KPI such as $CO_2$ or water food print or the eco-debit. In CIRC4Life, EECC and Scilly Organics have demonstrated how static data, i.e. information about a product class collected once, e.g. through questionnaires, can be combined with the dynamic data collected from the real production process of a single batch of a product, and how this combined data can be used to automatically generate a batch-specific carbon footprint. This enables, for example, the comparison of the same type of product from different producers or the change in impact for the same producer over time. This can lead to more sustainable purchasing decisions and successive improvements in the production process if the information is transferred to the end consumer or supply chain actors in a suitable form.

- **Eco-shopping system:** The eco-shopping system allows consumers to check the sustainability impact of their consumption habits at the point of sale while buying them. Thus, in addition to the regular ticket with the economic information, people receive an additional one showing the environmental impact of the acquired products. This will enable consumers to compare the environmental impact of the

different products, promoting the consumption of the more environmentally friendly ones. There are some existing limitations which would be necessary to address in a further stage. The first one is related to the eco-cost concept, as there is a lack of a standardized scale of this value and just comparison between similar products are offered. The second one is about the physical and technological features of the equipment, as it is not convenient for them to install a parallel system in order to offer the eco-information of the purchase. The eco-shopping system should be integrated in the existing ones of the different companies as an extension of it.

- **Eco-account:** The eco-account allows consumers to compare the impacts between their consumption (eco-cost) and their recycling habits (eco-credits). This supports the environmental awareness of consumers, as they can check whether or not their daily life is having a positive or negative impact on the environment, making it possible to identify the best and good practices followed by them so a continuous improvement process is possible. The main limitation of the eco-account is the lack of data regarding the eco-cost and eco-credit value of products. The eco-account has a lot of potential, as it presents an innovative way of tracking people's habits in the environmental area. For a large-scale exploitation, to increase the database of products is needed. The increase of the database would also lead to the standardization of an eco-cost and eco-credit scale.

- **Sustainability label:** In order to communicate to the end user, the eco-cost value and how sustainable a product is compared to similar products, requires an easily understandable visual representation. This is essential to the goal of leading end consumers to a more sustainable buying decision based on the measured impact of a product (see traceability architecture). Based on a design created by project partner LAUREA, and iteratively improved through evaluations involving end-users, EECC has implemented a tool that automatically generates a label which displays an ecological food print ($CO_2$, water, eco-debit, etc.) on a coloured gauge which makes it comparable to a market average for the respective type of product. This idea is similar to the well-established EU energy labelling. In CIRC4Life, it was shown that such a label can be automatically generated from a combination of static and dynamic data (see [ref. 1]) and then printed on the product packaging (demonstrated with ALIA) or displayed at the point of sale.

- **End-user's app:** It is important to provide the consumer with a basis of information. This is already required by the Circular Economy Action Plan. This end-user app (namely CIRC4Life App) ensures this flow of information directly to the customer. It is developed by implementing the eco-cost/eco-credit approach in order to incentivise consumers' sustainable consumption and enhance their environmental awareness. The eco-cost value is used to record the consumer's footprint, resulted from shopping, and the eco-credit is used to record and incentivise the consumer's recycling activities, and provides a personal eco-account to the individual consumer. This means that the end-user app can be used to manage the eco-account, making it easy for consumers to check the information. More detailed information on the eco-cost/eco-credit approach can be found in chapter *2.3 CEBM Co-Creation of Products and Services*. The CIRC4Life App enables sustainable consumption which covers eco-shopping, collaborative recycling, and eco-incentives. This app is comprehensive and provides a systematic solution to accommodate consumers' recording, monitoring, and retrieving behaviours for ecological impacts. Therefore, it can also be used for managing the sustainable decision-making by consumers. Deliverable 3.1 provides further background information, explanations, and impressions of the CIRC4Life App.

The Sustainable Consumption CEBM thus provides many innovative essentials which go beyond the state-of-the-art, such as collaborative sharing cost and revenues, innovative approaches, and low hurdles to start, described as follows.

This CEBM involves many actors among the supply chain, such as retailers, technical partners, schools, consumer associations and other associations, industry partners and marketing partners. All of them are needed. With only one type of partner, the experience would not be successful. You can only achieve those new business opportunities through cooperation. As a result, access to structured data brings benefits to the

entire value chain. The increased costs related to the development of sustainable products throughout the supply chain are shared by the different actors. However, this is offset by the increase in the final product price and the different parts of the products acquired during the supply chain. Additional costs related to marketing, awareness campaigns, ICT or data transparency would also be covered by the end product price.

In the past, sustainable consumption was promoted in different ways but was a little practised model. However, this CEBM introduces a new way of presenting sustainable information of products in a clear way that is very different from existing eco-labels. This CEBM is about showing the sustainable information in a ranking which offers transparency and provides relevant information for decision-making through the use of new eco-labels and apps. By applying this CEBM, each stakeholder involved will increase their benefits when people start consuming sustainable products. In this way, both the users of the CEBM and the customers benefit. For sure, this CEBM has various competitors at local, regional, national, and international level. However, it offers a new concept, eco-cost, which aims to give relevant information about the sustainability of the products in a clear and transparent way together with the use of an app. This is a new concept which should be exploited. Furthermore, the already explored possibility of including the S-LCA and E-LCA in the eco-cost value to calculate the sustainability information of the products, is something that should be further investigated, as this would mean a new concept which would be totally unique in the context of this CEBM. Users of the CEBM can use two main places to start. The first approach concerns eco-shops, where sustainable consumers who are more likely to be interested in the products can be targeted. In addition, the second main entry point focuses on regular and local supermarkets where the products have added value compared to others.

In summary, the CEBM Sustainable Consumption offers some innovative aspects, such as a traceability infrastructure (Data gathering with EPCIS ECO Extension), sustainable data for decision making processes at the point of sale, and the ability for suppliers and retailers to be part of a sustainable solution (transparency all over the value chain).

## 2.5    CEBM Collaborative Recycling & Reuse

The objective of this CEBM was to implement the recycling-reusing system of the CIRC4Life project for used tablets in cities. Demonstrations taking place in Spain were accompanied by a plan of how to implement the system in other EU countries, and to find answers to the question on what terms purchasing or acceptance as a donation could be feasible. The following picture (see Figure 10) includes a schematic summary of the overall CEBM:
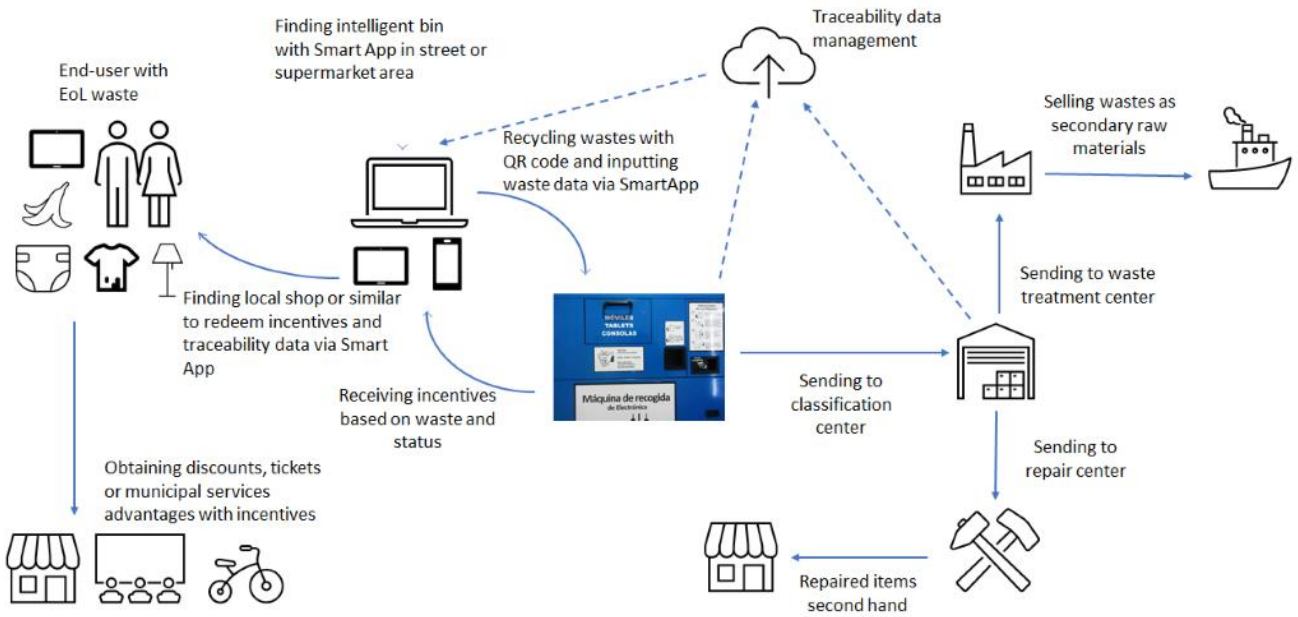
Figure 10: Schematic representation of the processes in Collaborative Recycling & Reuse
(Designed by CIRC4Life)

The initial plan for the implementation of the system consisted in three steps:

1. Contacting both educative and collecting system of a city, in a county or in a region, for a presentation of the successful experience,
2. Diagnosis of the introduction of tablets and/or other EEE in an educative system,
3. Elaboration of a roadmap for setting up the system if accepted.

Consequently, the system was demonstrated in different local and regional institutions in Spain, like a regional school in Getxo (see Figure 11 below) and public buildings and street locations. This CEBM pathed the way for tablets to be re-used utilising the system. Finally, re-manufactured tablets in the project were a) returned to schools that have participated in the project, then b) provided with the regular software and c) checked against their specifications. By definition and linked to several regulations, the paths of reuse and recycle have to be treated differently. Regular stances in CE refer to the high importance of prioritized wastes by means of a hierarchical structure starting from direct reuse, then recycling, valorisation, and finally landfilling. Considering that reuse and recycling now are at the same time in one CEBM starting both from a) home collection and b) public collection, they will result in two different alternatives which will be presented separately with each having its own actors in the Business Model.

Figure 11: Geography of the CEBM for Recycling and Reuse in Getxo/ Spain
(Source: Google Maps, n.d.)

In the framework of collaborative reuse and recycling, numerous business models were discussed, like:

- Renting and leasing like those for car renting and leasing
- "as-service" like those for software (SaaS), platforms (PaaS) or infrastructure (IaaS)
- Regular recycling for plastics or cardboard and paper collected by means of bins
- Direct reuse by selling in secondary markets by means of online marketplaces (eBay, Wallapop, etc.) or second-hand stores (cloths, WEEEs, etc.)
- Repairing centres run by private or public initiatives focusing on capabilities and spare parts

Considering all five demonstration areas (DEMO) in the CIRC4Life project, the main aim was to identify that CEBM that is most compatible with the DEMOs to ease the implementation during the demonstrations:

1. KOSNIC: lighting service.
2. INDUMETAL/RECYCLIA: collection of electric and electronic wastes for recycling purposes
3. ALIA: collection of biowaste for recycling and/or valorisation purposes
4. ONA: generation of a direct collection system (client to company) for ONA's used lamps for reusing/repairing or recycling purposes.
5. Organic Scilly: Involvement of farms and restaurants for collecting biowaste for recycling and/or valorisation purposes

This new generic product should now be focused also in the collaborative reuse and recycling. When the demos were analysed, three of these five (2, 3 and 4) are mainly focused on involving "regular citizens" and not necessarily on companies while even four of them (2, 3, 4 and 5) had one core process in common: the collection. In this way, the selected product should have a strong focus on an innovative way of collecting wastes where regular citizens are able to deposit their wastes: an "Intelligent Bin". Consequently, the main objectives of the Intelligent-Bin-based CEBM were to ensure into three directions that the model is:

i.   **Attractive** – to customers and an alternative to current existing collection methods
ii.  **Powerful** – to change to circular behaviour that is sustainable for all the actors involved

   iii.     **Replicable** – in different sectors, also beyond urban biowaste, electric or electronic wastes and also applicable to other regular urban wastes as plastics, clothes, etc.

Up to four different businesses with individual stakeholders have to be distinguished in the field of the CEBM of "collaborative recycling and reuse". Each can be represented by its Business Model Canvas which is depicted individually - see the four canvases listed in section *7 Appendices*. With the aim to structure all information gathered to lay the basis for an intelligent bin solution, the selected Business Model Canvas methodology was capable of putting together all relevant factors:

- Expected customers and their problems related to waste collection, existing solutions, and exploitation for business purposes
- Value proposition and its uniqueness or advantages in comparison to existing solutions
- Technical requirements, cost structure and stakeholders involved
- Revenue streams for the business exploiter
- Channels to customers, how to avoid being copied, why this solution is interesting for customers and success indicators (KPIs).

A first step towards a holistic business model for recycling and reuse consists of an analytical identification of the main actors and business owners through the **three phases** (see Figure 12 below): waste generation, waste collection and waste post-collection.



Figure 12: Three step business model for recycling and reuse (own design)

Considering the **generation** of wastes phase, the focus will be on regular citizens (as previously stated) and their behaviour related to their habits and waste disposal. Independently of the kind of regular citizens, urban or rural, citizens will cause urban biowaste (rest of food), plastics, paper, glass, electric and electronic waste, clothes, and others (furniture, paint, etc.) at home. We can also consider other activities (going out for restaurants/bars, shopping, working, sports, cinema, etc.) where citizens can also generate waste, but in general citizens are not responsible for managing the waste created outside their houses.

Considering only wastes generated at home, two different alternatives of **collection** can be taken into account: a) citizens sort different residues in dedicated bags and containers or b) wastes are put in all together without any kind of sorting. Depending on the country or region, no sorting waste will result in no consequences or possible sanctions. If regular incentives are provided to citizens for sorting domestic wastes, they will do so more or less. This will be one of the approaches to be considered for citizens as customers in the new CEBM: the provision of incentives associated to sorting and collection. Once the wastes are (pre-) collected at home, we can find two different scenarios: a) door-to-door collection or b) deposit bags and containers. In the later version b) wastes are sorted (or not) into bins usually located publicly in the street. Depending on the kind of waste the bin can be managed by different parties, e.g. the municipality or another company that usually takes care of the emptying and collection of plastic, glass or paper and cardboard. Related to bin location, two frequent barriers appear when municipalities and citizens are consulted: on the one hand, municipalities complain about the large number of bins in their cities; on the other hand, citizens complain about bins for depositing sorted wastes too far away from their homes.

In a third **post-collection** phase where waste is finally treated, the actors being in charge of managing the wastes have different options: a) wastes are sorted and then sold later to business partners for valorisation or recycling or b) wastes are not commercialised and thus sent to landfilling.

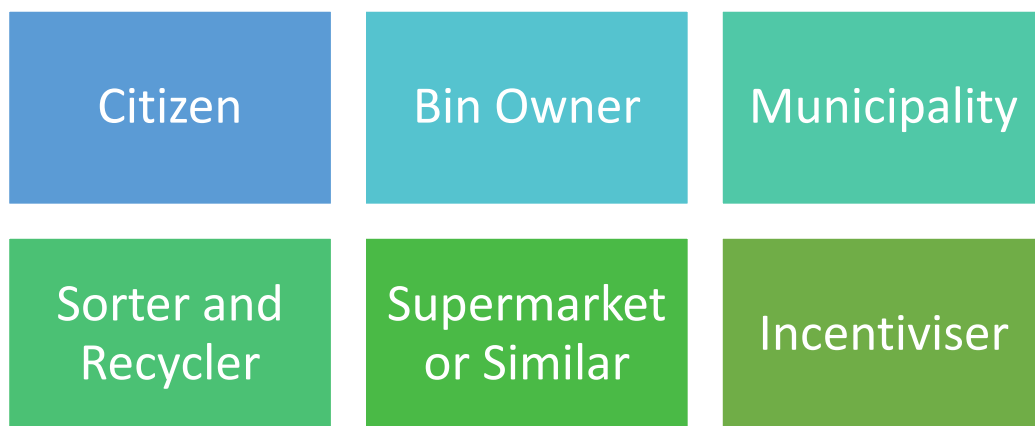| Citizen | Bin Owner | Municipality |
| Sorter and Recycler | Supermarket or Similar | Incentiviser |

Figure 13: Core groups of recycling and reuse process
(Own design)

When considering this scenario of actors and phases above in combination with an intelligent bin as a product, it is now obvious to identify several core groups of customers for the bin benefiting differently depending on the scenario: citizens, recycling or valorisation companies, a business owner that owns and manages the bin and in the end the municipality that could rather be considered as a necessary stakeholder than a customer. But two additional customers also come into play with the location, respectively the motivation behind the installation of the intelligent bin: first e.g. supermarkets by renting or selling intelligent bins to them and similar; second companies or stores that want to promote own products by incentivising the return of used consumer goods (see Figure 13 above). In a more detailed consideration these customers with their current problems can be addressed with individual business activities.

**Citizens:** In the focus of the intelligent bin will be every citizen ranged from 18 to 65 years having access to a smartphone. At this moment, the main issues for citizens to avoid sorting could be related to:

- Missing routine – glass, paper, and plastic are being collected in dedicated bins other wastes not causing cognitive dissonances with e.g., WEEE, bulbs, oil, painting, etc.
- Lack of trust – no transparency about recycling (where will finish my waste) or safety issues
- Convenience – no need or rule for sorting waste depending on country
- Uncertain benefits – What can I do with my incentives? Where can I redeem them?

Early adopters in this case potentially are on the one hand, citizens that are used to sorting and prefer practical ways of doing so, on the other, technologically oriented citizens with lots of apps to monitor lifestyle and habits. Solving their issues with wastes, those citizens usually use regular dedicated bins without obtaining any incentives or just the rest bin for unsorted wastes.

**Supermarkets or similar:** Stakeholders that want to show a greener attitude could rent a bin to offer the possibility of recycling of some wastes e.g., WEEEs, clothes, plastics, knowing that issues may occur like:

- Contradictious perception – no consequent commercial image
- Increasing costs – collection of different wastes affords more expenses
- Unclear installations – lack of regulation or infrastructures for bins Uncertain future – change and investment without revenue logic and success
- Companies pushing their Corporate Social Responsibility or those being obliged by regulations are the forerunners.

Media campaigns and advertising could be appropriate to close the gap.

**Incentivizers:** Any commerce that could be interested in increasing their green image or their number of clients because of redeeming incentives i.e. commercial discounts but also municipalities that want to impulse sorting by providing discounts in public service can issue incentives. Their issues with the service remain:

- Integration in existing programs – compatibility with e.g., loyalty card
- Issues with GDPR – traceability conflicting with privacy

Early adopters are again those companies caring about Corporate Social Responsibility and regulations. But also already existing discount applications or websites can be used for further business. For them it is easier to extend their current clientele to new customers and additional domains.

**Recycling companies or secondary raw material suppliers:** Companies originally operating in the market for secondary raw materials or recycling materials will be the first business owners once the raw materials are collected. These recycling or secondary raw material suppliers will face the following issues:

- Incomplete sorting – odd materials mixed while take-back services have better results
- Volatile demand and supply – no ensured amounts and additionally virgin content regulations in new products vary by changing policy

No specific early adopters are identified in this category.

Resuming the innovative essentials of such a "collaborative recycling and reuse" system, it cannot use classic bins dedicated to paper, glass, plastic, or organics. Even though citizens nowadays are used to those bins which can be found in every country in different colours providing sometimes discounts. As the main purpose of this CEBM and its specific scope is to increase the collection of specific waste that is usually not collected in a sorted way or simply stored at home (i.e. electronic devices), the outstanding property which makes this CEBM unique is the answer to the question HOW? In order to impulse the collection and make it attractive for users and efficient for managing entities, the innovation consists in a fourfold combination of an intelligent bin plus a smartphone app plus a tracing tool and an incentives scheme – building the basis for a multilateral exploitation and business model – see below in *Figure 14 Innovative essentials of the recycling and reuse*.
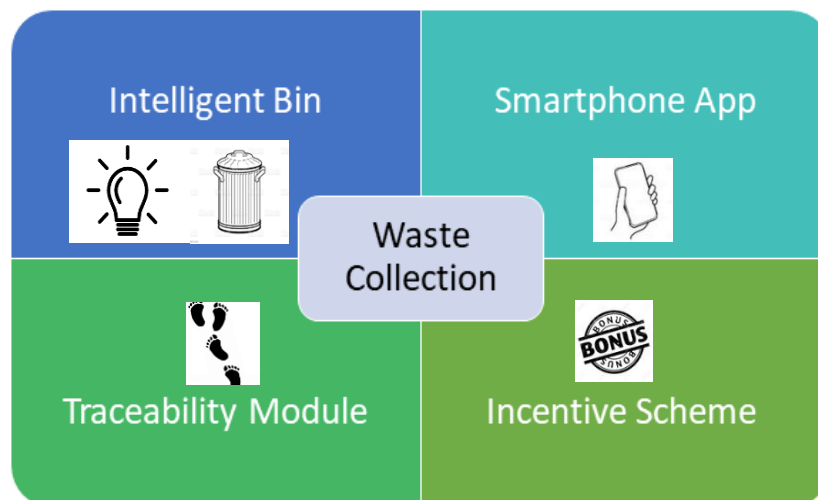


Figure 14: Innovative essentials of the recycling and reuse
(Own design)

**Intelligent Bin:** The intelligent bin will be able to connect a user account which serves as an opener for the intelligent bin to dispose of the bags and boxes with waste. In this way, after the collection of the waste and the evaluation of the waste, regarding typology and status in the case of reusable/repairable wastes, users may receive incentives and will be enabled to follow digitally the future with every current location of his/her waste. In addition, the intelligent bin will also transmit the status of the bin to the business owner or operating

company, regarding whether it is working or not, including its load and capacity. Daily operation is supported with the help of the traceability module at the business owner or operator and he is warned when the intelligent bin is full.

**Smartphone App:** The intelligent bin will be going together with a dedicated smartphone application which will allow the following functionalities to the citizens:

- Generation of a QR code to open the door of the intelligent bin
- Showing the status of wastes deposited by users on different levels, and at various sites, like in the bin, in the classification company, and being already reused or recycled
- Showing the wastes history
- Showing the amount of incentives accumulated in the account
- Showing the location of nearest intelligent bins; also useful for supermarkets and similar
- Showing the stores/companies that are offering products for redeeming incentives

**Traceability module**: The integrated to the waste collection specified traceability module will have the following features to different customers in this business model:

- Citizens can use the smartphone app to check the status of the waste and the expected time for receiving the incentives
- Business owners or operator companies can observe the current status of the bin
- Companies, where the wastes are received, will indicate the status of the wastes and the incentives to be provided
- Incentivisers will have the information from the citizen account and will remove the incentives from their account when they are redeemed

**Incentive Scheme:** Here incentives can be provided by different stakeholders and will be added to the citizens' accounts after each interaction with the intelligent bin. These incentives will be redeemed in regional distance and in different commerce or by means of municipalities for public services or discounts.

In a first step, the scope of the CEBM is to convince and involve incentivisers, companies, or municipalities that are interested in installing intelligent bins. In a second step, companies that also want the wastes as supply for their own processes (reusing, recycling, or valorisation) are addressed to realise their businesses. Finally, a complete incentive scheme supported by means of an application is offered to citizens. The collaborative reuse and recycling CEBM thus serves as the starting point of both paths: a) the sorted collection, by adding additional features able to solve main issues of citizens, supermarkets, municipalities, small stores and b) companies that trade with secondary raw materials.

## 2.6   Individual Exploitation Strategies

As described in the introduction to chapter *2.1 Approach*, eight individual and two general exploitation strategies were defined by the project partners in the course of the DoA for Task 8.2 in WP2 – see DoA on page 51/ 52 of 72. The individual strategies are described more in detail in the following chapters *2.6.1* to *2.6.8*. Chapter *2.7 Potential funding sources* and chapter *2.8 Intellectual Property Rights (IPR)* are dedicated to the more general aspects of exploitation which apply to each of the partners.

*Table 1: Overview of exploitation approach according to industry and partner (own design)* provides an overview of the eight exploitation strategies and lists the assignment of the CEBM owners and demonstrators to the associated strategies (see cluster groups mentioned in chapter 2.1 Approach). The main goal of the exploitation strategies is to ensure that the developed and demonstrated business model approaches are adopted and used to achieve the impact expected.

**Table 5: List of exploitation strategies and associated cluster groups (own design)**

|   | Exploitation Strategy (adapted title to the text in the DoA) | KOS | NTU | ONA | ALIA | JS | IND | REC | ICCS | ENV | EECC | GS1G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Commercialisation strategy for lighting industry | X | X | X | | | | | | | | |
| 2 | Onsite demonstration strategy in the lighting sector | X | X | X | | | | | | | | |
| 3 | Implementation strategy in the agri-food industrial sector | | | | X | | | | | | | |
| 4 | Deployment in local farming and scaling-up strategy | | | | | X | | | | | | |
| 5 | Implementation strategy for a recycling-reusing system in cities | | | | | | X | X | | | X | |
| 6 | Open access-Strategy for ICT solutions | | | | | | | | X | X | X | |
| 7 | Implementation strategy of traceability techniques and market uptake | | | | | | | | | X | X | X |
| 8 | Implementation strategy for the recycling incentive scheme | | | | | | X | X | | | | |

In order to structure the results of the individual exploitation strategies and to create comparability, the six following guiding key questions (see listing 1 to 6 below) were defined and sent out to the responsible CEBM owners and demonstrators (see chapters 2.6.1 to 2.6.8) to collect their authentic input:

1. **Which results/CE solutions/demo activities should be deployed to the market after the project duration?**

   *Please describe your exploitation strategy. Briefly comment on the initial situation (without CIRC4Life results) before explaining why and which CE solution/demo activity or other CIRC4Life results will be used beyond the project duration with regard to your exploitation statement. Try to make the reference to the different CEBMs when describing your exploitation plans:*

   - *In what context did you consider CEBM Co-Creation of Products and Services in your exploitation strategy?*
   - *In what context did you consider CEBM Sustainable Consumption in your exploitation strategy?*
   - *In what context did you consider CEBM Collaborative Recycling and Reuse in your exploitation strategy?*

2. **What needs to be done to make the achieved results scalable?**

   *Please mention which activities are planned to make the results usable beyond the project duration. Describe the open topics (e.g. technical challenges, missing regulations, missing collaboration/networks) that need to be done or developed (possibly after the project duration) to make the results scalable in terms of transferring it to (1) other regions or countries as well as (2) other industry sectors. It would be great if you could make a list of examples, which sector/which kind of target groups you would like to address first and with what kind of method you would like to proceed.*

3. **What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?**

   *Please explain why CIRC4Life was important for your sector/technical innovations and how your industry can benefit from it in the long term. Please describe the impact with regard to the different stakeholder groups (1) the industry, (2) the end users/society, (3) academia and (4) policy makers.*

4. **What activities have you planned to publish your results accordingly?**

   *Disseminate results: marketing, public relations, new funding, events…. (format and the right language are to be considered)*

5. **Define Intellectual Properties and protect them by appropriate means (IPR)**

6. **Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)**

### 2.6.1    Commercialisation and demonstration strategy for lighting industry

**"Two lighting products-services-systems will be prepared for commercialisation by the lighting companies of the consortium. In addition, they will be exhibited in lighting fairs and presented in conferences (KOS, ONA, NTU)."** For this exploitation strategy the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 51 of 72.

### 1. Which results/CE solutions/demo activities should be deployed to the market after the project duration?

The CE solutions developed by Kosnic and ONA in the CIRC4Life project will be introduced to the market through potential project installations with selected business partners. Specifically, the modular industrial and domestic LED lighting solutions will be specified in future projects. Initially, a trial project was to be included in the CIRC4Life project as a DEMO event, but Covid-19 and its impact led to unforeseen challenges. Nevertheless, key business partners for industrial lighting (e.g. wholesalers, contractors, building owners for

lighting leasing services) and key business partners for domestic lighting (design and restoration sector: architects, designers, interiors, hotels, restaurants, shops, etc.) have been identified, and the aim will be to launch this solution in the market after the project duration.

All three CEBMs are considered in the following ways. Co-Creation of Products and Services is included, as the modular product allows complete flexibility to meet the product requirements of a particular client or location. This flexibility is also provided by the leasing service and the options to implement it. In addition, co-creation is possible even after the product has been launched, as there is always the possibility to get feedback from customers/stakeholders and make necessary changes or additions to the product or service. Feedback from customers/stakeholders is usually fed back to the company once projects are completed, and this will only increase with lighting leasing projects as the communication channels between all parties are kept more open than with a traditional linear route to market or business model. For the domestic lightings, the data mining technology is applied, and the results obtained are used to improve the product design specification, reflecting the concept of co-development. In addition, society is increasingly concerned about the environment. Therefore, it is necessary to establish CE solutions as a business strategy so that companies do not lose touch with consumers. The most important thing is to listen to consumers. They are very concerned to know what happens to the products that end up in the waste and want to know more every day. For this reason, ONA's approach is to report on the environmental impact of products (LCA) and facilitate the consumer to contact the company to recycle the product correctly.

The Sustainable Consumption CEBM has also been considered, as the results of the LCA studies carried out throughout the CIRC4Life project will be incorporated into our project proposals for potential future projects using the modular fitting. Sustainable consumption is taken into account by introducing an eco-account for registered online shop users. The eco-costs of the products they buy are credited to the account and recycled lighting products receive eco-credit (i.e. discount voucher).

Collaborative Recycling and Reuse is also considered, as the CEBM, created during the CIRC4Life project, is intrinsically linked to the solutions developed by Kosnic. The modular product strongly encourages reuse and improved recyclability through its very purpose, as modules can be easily removed and replaced when a failure occurs, making it easy to reuse fittings. The leasing service furthers this by creating an eco-system that incentivises all parties to take advantage of the modular nature of the product and prioritise reuse and recycling through the built-in maintenance aspect of the service. The collaborative recycling and reuse model is implemented under two aspects: Reusing materials to manufacture new lighting products; and encouraging consumers to send discarded lighting products to ONA by turning in their eco-credit, which can be redeemed for discounts when purchasing ONA lighting product.

## 2. What needs to be done to make the achieved results scalable?

**Kosnic:** In order to make the results scalable, the product and the service must be used in a real scenario, with a real project between lighting companies, business partners, and an interested customer. Until this happens, it is only possible to work with theoretical results based on what has already been created and how popular the idea is.

The results of the CIRC4Life project should be transferable to other regions or other industry sectors. Both the product and the service are relatively universal, so introducing them to other regions or countries would only be a matter of finding suitable business partners to work with in these areas. This could be explored through the Kosnic France division and/or export departments, but as mentioned above, it would largely depend on finding the right business partners. This would require a broader range of modular products, but this is something that Kosnic already has and plans to expand in the future. School installations could be an extremely popular lighting sector that would like to take advantage of the financial benefits of a leasing service. Leasing is already becoming more popular in other industries, and the results of this project show that it can also be used very well in other industries that may not yet have the necessary infrastructure.

D8.3 - Report on the activities of exploitation and disseminations

**ONA:** ONA's target groups are primarily the design and restoration sector (e.g. architects, designers, interiors, hotels, restaurants, shops, etc.) as well as clients who are looking for a design product in small editions (rather than a mass-produced product as is usually found today). The CIRC4Life domestic lighting demonstrators are sold in the ONA online store and other project results are also implemented in the store, e.g. eco-costs for environmental communication with consumers. When considering making these results scalable, the first thing to do is to clearly demonstrate the benefits for other companies to integrate the CIRC4Life results into their existing business model. The benefits can be introduced by conducting the comparative analysis for similar solutions in the market and demonstrated through successful business cases where revenues have increased.

### 3. What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?

**Kosnic:** Kosnic's involvement in the CIRC4Life project has not only been important for the inherent industry as a whole but has also helped drive technical innovation that is geared towards the future of the industry. New regulations coming into force later in 2021, in particular the Single Light Regulation (SLR), are going to redefine what is a light source and what is a luminaire. Luminaires will therefore be referred to as a containing body. The new regulations state that anything in a containing body, such as the light source or control gear, must be replaceable with a common tool. If the light source is not removable, the containing product (luminaire) is considered the light source itself and is subject to the new Energy Labelling Requirements (ELR). This change in regulations is clearly aimed towards making light sources or control gear units in luminaires more accessible and easier to replace. The modular product that Kosnic has worked on and developed throughout the CIRC4Life project was designed with these very principles in mind. The issues and topics such as reuse and sustainability that the modular product addresses will have a big impact on the industry in the coming years. These regulatory changes will also have an impact on certain stakeholders such as end users/society, academia and policy makers.

**ONA:**
- From an industrial point of view, this forces to control all factors that are involved in the production of a product in order to avoid excessive consumption of energy, water, transport, etc. and thus reduce environmental impact.
- For academia, the feedback of exploitation strategy helps them to look in depth at what is needed in terms of communicating eco-information to consumers and to encourage them to implement sustainable consumption and recycling behaviour.
- For policy makers, the eco-credit practices and rewarded incentives provide an alternative framework for the collection of end-of-life products.
- For end users/society, the implementation of eco-cost and eco-credit concept gives online store users the opportunity to understand the information on the environmental impacts of the product and how to conduct sustainable consumption and collaborative recycling.

### 4. What activities have you planned to publish your results accordingly?

As part of the CIRC4Life demonstration plans, Kosnic and ONA have produced several videos detailing the contribution to the CIRC4Life project. These document the processes that they have gone through during the last few years while working on the CIRC4Life project and how they have addressed all three CEBMs with the modular LED luminaires. These videos will be shown to participants of the virtual showcase event and can also be used for future marketing activities.

Hopefully, Kosnic and ONA will also be able to exhibit at trade fairs in the coming years when events start up again. Prior to Covid-19, the main route for dissemination was planned to be Frankfurt Light + Build. This is now scheduled to take place again in March 2022. Everything that has been worked on during the CIRC4Life project can then be shown and the results disseminated at the largest lighting fair in Europe. Additionally, in the case of ONA, the work carried out in the CIRC4Life project has been promoted in the media such as magazines, blogs and websites promoting both the product developed for the demonstrator and the project itself.

**5. Define Intellectual Properties and protect them by appropriate means (IPR)**

ONA has applied for an industrial model pattern for the CIRC4Life demonstrator in Spain at the Spanish Patent and Trademark Office (SPTO), registered under number D0531121. The content of the pattern is available at: http://www.oepm.es/en/disenos_industriales/index.html

**6. Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)**

The involvement in the CIRC4Life project has had a great impact on Kosnic as a company and also taught many lessons about CE and its importance. As a company, Kosnic was already developing products along the modular route before joining the CIRC4Life consortium, knowing the importance of not only reducing the amount of stock required, but also making it more accessible and usable for relevant stakeholders and consumers. The CIRC4Life project has shown that this is definitely the right path to pursue in product development, as it also relates strongly to improved sustainability and the incentivisation of reuse. With the introduction of new regulations to further encourage modularisation and accessibility of light sources and control gear in lighting products, it becomes clear that the industry seems to be moving in this direction.

The CIRC4Life project has not only confirmed Kosnic's modular product development approach mentioned above, but also taught him how to implement the CE approach on the way to market. Over the last few years, while taking an initial idea for "lighting as a service" and developing it throughout the co-creation CEBM, Kosnic has discovered that a leasing service, if done right, could be a very popular idea in the lighting industry. There are already a handful of examples of leasing in the lighting industry, but these are usually focused on a financier or a loan company, which means that the customer just borrows the money and then pays it back. This keeps the supply chain very linear. The CIRC4Life project and the emphasis on the CE forced Kosnic to look at things differently while developing its service ecosystem. By keeping all relevant parties involved (manufacturer, wholesaler, contractor/maintenance), Kosnic was able to provide a holistic approach that encourages and incentivises all parties to work towards achieving a circular business model that emphasises sustainability and reuse/recyclability in a way that traditional leasing models cannot today.

The CIRC4Life project has trained ONA to better understand the CE processes and explain them clearly and truthfully to consumers. ONA needs to identify the possible problems that consumers encounter and solve them. For example, if consumers think that the products are not recycled, it must be explained to them that they are recycled, and this action must be made easy for them. In the case of ONA demonstration units, the customer is given the opportunity to return the product to the company so that it can take responsibility for recycling. From the lighting industry's point of view, processes need to be improved to get a better product taking into account the environmental impact. This will mean that many processes will have to be changed and teams trained. Priorities will have to be changed and environmental aspects will have to be put before economic ones. In manufacturing products, low-cost processes are often prioritised over other processes with lower environmental impacts in order to achieve greater benefit**.**

### 2.6.2   Onsite demonstration Strategy in the lighting sector

**"The findings related with EEE (lighting sector) will be exploited with lighting professionals and industry through a number of onsite demonstrations, events, reports, standards and educational courses imparted/informed by a list of EU lighting associations (NTU, KOS, ONA)."** For this exploitation strategy the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 51 of 72.

In addition to the preparations for commercialisation outlined in *2.6.1 Commercialisation and demonstration strategy for lighting industry*, and in addition to the exhibitions, other activities were undertaken for exploitation such as on-site demonstrations, events, reports, standards and educational courses.

**1. Which results/CE solutions/demo activities should be deployed to the market after the project duration?**

D8.3 - Report on the activities of exploitation and disseminations

The process of implementing these CEBMs at Kosnic and carrying out the various activities to ensure successful implementation has led to the discovery of some further recommendations for market introduction. These include:

- Co-Creation and especially the LL methodology are very useful tools to ensure that customer and key stakeholder requirements are identified at the very beginning of product development.
- These methods also help to build more rewarding relationships with supply chains and key stakeholders, which can lead to the development of important key relationships and the discovery of further opportunities for collaboration.
- LCA studies, both environmental and societal, can provide key technical insights into how to improve not only the environmental impact and sustainability of a product, but also the impact and sustainability of a company as a whole.
- Specifically, these studies can identify hotspots of environmental and societal impact which allow a company to explore alternative methods of improvement.
- The caveat for this is that one must have a certain level of technical knowledge to understand and effectively implement these changes.

Regarding the feedback obtained in the ONA demonstration events, some suggestions gathered can be considered in future go-to-market strategies:

- The of eco-cost and eco-credit method are innovative, could work and could promote an improvement of society. Applying the LCA methodology requires knowledge of all data about the product development process. It has been essential for ONA to know the suppliers working with the company, as in many occasions suppliers had to change their processes to obtain different and more positive data for the LCA results.
- Some stakeholders contemplate the possibility of improving the information and capturing it in a more interactive and visual way, as they consider that many consumers do not pause to read the information carefully when visiting websites. One possible solution would be to use some kind of eco-label, like the one used for household appliances, so that it would be possible to see in a quick and visual way whether the product is more or less eco-friendly.

Regarding the possibility of recycling, there were different opinions. Some of the attendees would take the time to recycle with ONA and participate in the take-back system, while others considered to throw the product directly into the trash.

## 2. What needs to be done to make the achieved results scalable?

**Kosnic:** Although Kosnic has not had the opportunity to showcase the product and service developed in a real trial project due to Covid-19 restrictions, the validation Kosnic has received for what has been developed has shown a great level of success and acceptance. As a business, Kosnic would strongly recommend that other companies explore the power and potential of CEBMs and see what they can offer, not only for them as a business, but also in terms of sustainability for everyone's future. In terms of planned activities, Kosnic will continue to reach out to potential business partners to realise some projects using both the modular industrial lighting system and the leasing ecosystem developed in the CIRC4Life project. This will also be scalable to other products within the Kosnic product range, which should open up the leasing business model to more projects that fall under different sectors (e.g. education and academic buildings).

This will continue to be a challenge as the UK is still slowly recovering from the effects of the Covid-19 pandemic and lockdowns. However, this will also be an opportunity as many businesses may consider a leasing service for a new lighting installation as they may have less cash flow in the current climate.

**ONA:** Important actions and insights developed during the ONA demonstration are summarized below and suggested for further investigation:

- Investigation how closed loop criteria fit into the original lighting procurement specification.

- Determining the customer segments that are open to product stewardship concepts, purchase of refurbished products, take-back warranty, etc.
- Exploring concepts to incentivize take-back scheme.
- Quantification of future revenue streams related to reuse, refurbishment, recycling of materials.
- Developing modular product designs that allow for second use and valorisation of the components (e.g. sales of spare parts…) or materials.

**3. What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?**

**Kosnic statement:**

- **Industry:** Over the last few years, while taking a very initial idea for "lighting as a service" and developing it throughout the co-creation CEBM, Kosnic has discovered that a leasing service, if done right, could be a very popular idea in the lighting industry. There are already a handful of examples of leasing in the lighting industry, but these are usually focused on a financier or a loan company, which means that the customer just borrows the money and then pays it back. This keeps the supply chain very linear. The CIRC4Life project and the emphasis on the CE forced Kosnic to look at things differently while developing its service ecosystem. By keeping all relevant parties involved (manufacturer, wholesaler, contractor/maintenance), Kosnic was able to provide a holistic approach that encourages and incentivises all parties to work towards achieving a circular business model that emphasises sustainability and reuse/recyclability in a way that traditional leasing models cannot today.
- **End users**: The LCA Comparison Descriptor was created to be used within Kosnic project proposals. This allowed Kosnic to communicate sustainable consumption and product sustainability directly to all parties involved in specific lighting projects that required industrial LED lighting. This includes key stakeholders throughout the supply chain such as wholesalers, contractors, and most importantly, end users/building owners, who are the actual end users of the industrial lighting product. This meant that sustainable consumption could be effectively communicated to the relevant key stakeholders.
- **Academia:** The sustainable production conducted by CIRC4Life covers the product design and manufacture stages of the product life cycle. Future research could cover the remaining stages of the product life cycle, including retail, consumption, repair, maintenance, recycling, reuse and end-of-life treatment of the product. This will complete the loop of the product lifecycle with sustainability consideration in order to fulfil an integrated sustainability investigation across the whole life cycle of lighting products.
- **Policy makers**: Comparative lifecycle assessments of various lighting technologies suggest that all the environmental impacts of future LED generations will be much lower than those of older lighting technologies. Kosnic assumes that forthcoming LED innovations will be eco-innovations, namely that for the same service, in this case providing a certain amount of lumens per watt, they will generate less ecological impacts throughout their life cycle than existing alternatives. Therefore, it would be helpful if policy would provide incentivise for end-users to replace the old generation of lighting products in order to reduce environmental impacts.

**ONA:**

- **Industry**: ONA believes that companies should implement CEBMs so that they themselves participate in the objective of reducing both the entry of virgin materials and waste production and solving the problems that society faces. This is about the sustainability of our planet. Using the LCA methodology requires knowledge of all data related to the product development process. It has been essential for ONA to know the suppliers that work with the company, because in many occasions suppliers had to change their processes to obtain a different and more positive data for the LCA results. ONA as a company has learned that the working processes of certain suppliers, such as ceramics companies, are

very handcrafted meaning that this methodology is difficult to apply with them, as it involves an additional effort that the suppliers in many cases do not want to make.

- **End users**: The LCA Comparison Description is a step in the right direction to help end users to realise the possible environmental impacts associated with their consumption behaviours. One thing that became apparent throughout the stakeholder engagement was that there is a real, growing need for this sort of information to be readily available for consumers to help them make sustainable purchasing decisions. This is great because it shows that the need for a CEBM, such as the one developed in the CIRC4Life project, is desired and this desire will only grow.
- **Academia**: The integrated approach adopted for the eco-design of the ONA demonstrator covers product design specification, conceptual design and detail design. The eco-design also includes prototyping, testing and manufacture, the results of which validate the designed product. An eco-PDS is developed that describes the eco-characteristics of the product that the product must meet at each stage of the eco-design process. Although the PDS method has been used in product design for many years, not enough attention has been given to the incorporation of eco-constrains in the PDS. Therefore, this is another novelty in eco-design, but also a confirmation of theoretical knowledge in a real business context.
- **Policy makers**: Policy makers and industry representatives will eventually support eco-innovative LED companies in the form of improved standards and product quality checks or public supports to eco-innovation.

## 4. What activities have you planned to publish your results accordingly?

Kosnic and ONA have planned some activities to publicise their findings accordingly. As can be seen from the list below, ONA is focusing mainly on print and online publications, while Kosnic is targeting mainly on-site activities and further research projects.

**For Kosnic:**

- Attendance at the Frankfurt Light + Build, the biggest lighting trade show in Europe.
- Attendance at the Facility Show London.
- Participate in the Green Week with the theme 'Zero Pollution Ambition'.
- Apply for UK Smart Grant for further research and technology development.

**For ONA:**

- Advertisements in trade journals.
- Campaign in the online shop.
- Promote the demonstrators in the online sales portal.

## 5. Define Intellectual Properties and protect them by appropriate means (IPR)

ONA has applied for an industrial model pattern for the CIRC4Life demonstrator in Spain at the Spanish Patent and Trademark Office (SPTO), registered under number D0531121. The content of the pattern is available at: http://www.oepm.es/en/disenos_industriales/index.html

## 6. Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)

**Impacts and lessons for Kosnic:** After face-to-face meetings with Kosnic's business partners about the proposed leasing service, there seems to be much optimism that a leasing service project could be identified and jointly developed. Unfortunately, due to the COVID-19 lockdown from March 2020 in the UK, business partners shifted their priorities to other projects rather than testing the leasing service, so the situation has not improved to date. However, Kosnic intends to continue looking for leasing opportunities that may arise. Pandemic risk management may need to be included in any future project, although this kind of natural disaster is very difficult to predict.

It is quite clear that all the groundwork for a successful service has been developed in accordance with the CEBM for collaborative recycle and reuse developed as part of the CIRC4Life project. Collaborative recycle and reuse is intrinsically linked to the solutions created by Kosnic. The modular product strongly encourages reuse and improved recyclability through its very purpose, as the modules can be easily removed and replaced if a failure occurs, making it easy to reuse fittings. The leasing service promotes this by creating an ecosystem that encourages all parties to take advantage of the modular nature of the product and prioritise reuse and recycling through the built-in maintenance aspect of the service.

**Impacts and lessons for ONA:** The CIRC4Life project has offered ONA the opportunity to develop a new online store concept based on the CE strategy, allowing it to better define the objectives required for its implementation and to seek for a new market niche. CIRC4Life helped ONA overcome the misconception that the introduction of new business models requires the rejection of current practices. In particular, it recognised that business models can mature by first experimenting on a small scale and validating their assumptions. The possibility that new business models can be introduced in addition to the current business models increased the perceived feasibility of action. The introduction of CIRC4Life solutions and methods and the eco-innovation process behind these experiments, which start from service or product design, can lead to an increase in the companies' sphere of influence.

Before CIRC4Life project, ONA paid more attention to commercials, salespeople in lighting stores, etc. and it was they who conveyed the needs of the market to ONA, but now ONA has understood the need to think outside the box to influence manufacturing and consumption. The LCA not only provides very interesting information for the sustainability-conscious customer, but also allows the company to connect with him by providing this data in each product. Another very important aspect of implementing this concept in ONA's products has been to establish a new way of understanding the manufacturing processes with suppliers in order to improve their impact and manufacture products that are in demand in the sector targeted by ONA.

### 2.6.3    Implementation Strategy in agri-food industrial sector

**"The implementation of the CEBM related with the agri-food industrial sector within ALIA's association members (ALIA)."** For this exploitation strategy the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 51 of 72.

This chapter describes the implementation of the CEBM in relation to the agri-food industrial sector within ALIA's association members (ALIA). In doing so, valuable lessons are reflected that can be further used after the project period.

**1. Which results/CE solutions/demo activities should be deployed to the market after the project duration?**

ALIA has been a company involved in several research and development projects mainly focused in the animal feeding elaboration. ALIA was mainly focused in the by-products inclusion in the nutritional formula, reduction of antibiotics through new diets and the reduction of slurry pollutant charge through the new diet. In addition, the slurry management was the other area in which ALIA made their research and development efforts.

During CIRC4Life project implementation, ALIA has addressed the three CEBMs and has demonstrated them in the agri-food sector. Regarding the CEBM Co-Creation of Products and Services, ALIA has achieved the co-creation of two meat products from the beginning of the supply chain and the animal feeding production, until their final elaboration. During this co-creation of the meat products, ALIA has implemented several techniques (LCA, workshops, surveys, etc.) which will be important for the future of the company and which were not present on its nature before CIRC4Life. In addition, these techniques have already been transmitted to ALIA's associations members for its future exploitation.

As one of the main achievements of ALIA in this CEBM is the elaboration of a soybean free nutritional formula, which has reduced the impact of the animal feeding stage (the one with the biggest environmental impact) and the whole value chain. In a market in which environmental issues are each day more important, the exploitation

of this result will be a priority for ALIA. These results have been already transmitted to ALIA's associations members for its future exploitation as well.

Regarding the CEBM Sustainable Consumption, ALIA has elaborated an eco-label which shows the environmental impact of the product, this label is not standardized, but will be relevant for the promotion of the sustainable products elaborated. This eco-label is useful for the final meat products but will also be relevant for the labelling of the animal feeding.

Finally, ALIA has implemented two pilots in two different municipalities for the collection and recycle of biowaste under the CEBM Collaborative Recycling and Reuse. Although this part of the DEMO is not part of ALIA's regular activities, the main aspects of the initiative (incentives scheme and smart bin for user identification) will continue to be used by the two participating municipalities beyond the duration of the DEMO, and they may expand the scope of the two pilots developed.

## 2. What needs to be done to make the achieved results scalable?

In conference and trade fairs of the farming sector, ALIA will continue exploiting the results related to the CEBM Co-Creation of Products and Services and the CEBM Sustainable Consumption. The target groups will be the farmers as well as feed producers and other actors along the meat supply chain.

In order to make the pilot scalable, ALIA will continue to improve its sustainable practices and efficiency during the process. In addition, ALIA is constantly substituting the environmentally harmful protein sources with local by-products and ingredients. In any case, the sustainable formula and the methodology used are economically feasible and nutritionally excellent, making this type of formula suitable for exploitation. The sustainable nutrition formula offers the potential of high scalability. This also applies for the methodology and the results achieved, such as the substitution of by-products from soy, although the choice of by-products is different for each sector. So is the eco-label, although it would need some standardisation via the eco-cost/ eco-points concept. At the moment, however, ALIA's goal is not to create an official eco-label, but to promote sustainable products.

It must be assumed that the end products must be competitive. Therefore, it has to be weighed up which environmental efforts are feasible from an economic point of view in order to be competitive on the market. ALIA's product is about 10 % more expensive. Some organic products are so expensive that they are not affordable for many people. This problem has to be taken into account.

## 3. What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?

CIRC4Life has enabled ALIA and the farm sector to innovate the way things are done in such a traditional sector. The inclusion of technical aspects such as the environmental and social LCA, the traceability architecture or the app are examples or tools which have been included thanks to the CIRC4Life project.

In addition, the Living Lab (LL) methodology has given ALIA a new way of developing things and an approach which will remain in the nature of the company after the project is completed. The LL methodology has shown that considering different actors from the quadruple helix is a suitable and valuable way to co-create new solutions in this sector.

Of ALIA's various stakeholders, the main impact of the exploitation strategy concerns the industry, as ALIA has developed its pilot activities from this vision and the companies in the meat sector are the ones that will implement the aspects on which ALIA has focused its exploitation strategy.

However, society as a whole is also relevant, as all aspects are based in a co-creation methodology and the CEBM for sustainable consumption developed by ALIA is focused on citizens. Lastly, policy makers and academia can also be relevant for the continuation the developed aspects, such as the refinement of the nutritional

formula or the inclusion of regulations for a more sustainable farming sector and the valorisation of by-products, although they are not the most relevant actors within the present exploitation strategy.

Considering the large environmental impact that the sector, and feed production in particular, has, policy makers could introduce both supportive and restrictive regulations. Examples include limiting imported protein sources, incentives to buy regional ingredients or facilitating the use of by-products as a resource (sometimes there are many difficulties in using a 'resource' that is classified as 'waste' under current legislation). To make the eco-label scalable, the eco-cost concept would first have to be standardised. Then discussions with public bodies and policy makers would be needed to make it a useful tool for consumers. When politicians advocate for the eco-label in this way, they act as multipliers.

**4. What activities have you planned to publish your results accordingly?**

ALIA regularly uses its website and social media to publicise the CIRC4Life results. The company also participates in conferences and trade fairs. Its presence allows the company to share the results with the public. The achievements of CIRC4Life can also be used for new funding and next projects. For a structured overview of ALIA's measures, see chapter 3 Dissemination .

**5. Define Intellectual Properties and protect them by appropriate means (IPR)**

The soybean-free diet formula developed by ALIA is not unique and would vary depending on the availability of by-products and the particular region. Thus, there is no need to define Intellectual Properties for the exploitation of the mentioned results.

**6. Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)**

The CE in the agri-food sector offers great potential for creating local and regional synergies. In particular, with regard to feed production, the analysis of the agri-food sector of each territory to valorise by-products and substitute environmentally harmful proteins such as soybeans should be a priority for the sustainable development of this sector, which is closely linked to the contribution to climate change. In addition, the increase in the population aware of the environmental impact of the meat sector makes it necessary to focus on sustainability.

ALIA was able to gain a number of valuable lessons learned, which are presented in D6.4 in detail (subchapters 2.4; 3.4 and 4.4). Their experience, according to the results of the E-LCA and S-LCA, led to products that are more than 30 % more sustainable than the average and about 15 % more sustainable than the traditional version (which was already more sustainable than the average). At the same time, it was possible to achieve that the additional costs for the end product are only about 10 %. The findings resulted in a complete reduction of soybean consumption, use of local ingredients and a CE approach that improved sustainability in a relevant way. Further learning came from the feedback collected during the Open Innovation Camp (see chapter 2.10 Feedback from the OIC 2021 as input for further exploitation).

### 2.6.4    Deployment in local farming and scaling-up Strategy

**"The deployment of the CEBM in small scale vegetable products farming and vegetable in Scilly Organics and their business members, and subsequently scale up via existing networks of vegetable growers across Europe (JS)."** For this exploitation strategy the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 51 of 72.

**1. Which results/CE solutions/demo activities should be deployed to the market after the project duration?**

Prior to the CIRC4Life project, Scilly Organics (SO) was aware of CE as a concept but had not implemented any approaches, techniques or solutions in its business per se. For many years the business had environmental,

carbon and waste strategies, but had not brought these together in one defined strategy that influenced all areas of operations. During the project, Scilly Organics tested and implemented various solutions, split in to three main Business Models.

## i.   Co-Creation of Products and Services

To engage customers in the journey of product development and on-going interaction through the product cycle, Scilly Organics implemented and would recommend the following solutions:

- Developed an apple juice from excess apples. This was well received by customers and adds value to farm produce. This is an example of simple processing of raw farm produce to create extra value and ensure that any "waste products" have a role to play in farm profitability, as well reducing waste and therefore the environmental impacts of production.
- Engagement of customers through surveys and interviews. Understanding the wants and needs of customers had a positive impact both in terms of Scilly Organics really getting close to its customers and ensuring a direct line of communication, but also in enabling customers to understand more about what the business does and why. This approach is more pro-active than traditional means of communication, which tends to be more one way or top down.
- Production of a video about the process of implementing CE at Scilly Organics. This can be seen here https://www.youtube.com/watch?v=-OgoB28Cks0 (Scilly Organics, 2021)
- A handbook for farmers and growers outlining tried and tested CE business solutions - learnings from the project. This will be published online in September 2021.

## ii.   Sustainable Production and Consumption

Sustainable Production is at the heart of CEBMs for food production. This should also be reflected in sustainable consumption for customers. Scilly Organics implemented the following solutions:

- Carbon footprint of salad and potatoes, resulting in a carbon label that is placed on products to inform customers about the carbon impacts of their products. The full carbon footprint of the farm is available on the Scilly Organics website to ensure transparency https://scillyorganics.com/carbon-negative-fruit-and-veg/ (Smith, 2021)
- Life Cycle Analysis of salad and potatoes, the results of which were developed as an eco-label and put on packaging. More work is required to communicate the meanings behind this, but the symbol is fairly user friendly and shows a positive result to consumers – I.e. that the products are low impact

## iii.   Waste, recycling and reuse

New solutions for waste are vital to the success of a CE approach. Scilly Organics implemented the following solutions:

- Waste management system overhaul – to increase recycling rates and reduce the amount of waste being produced in the first place through working with suppliers to reduce packaging of bought in products and encourage them to use compostable and recyclable packaging themselves.
- Trial of new packaging for perishable farm products, such as salads. Conventional plastics are cheap, functional, and widely available, but are made of oil-based plastic and often recycling facilities don't exist. Scilly Organics has sourced and used 100 % compostable, plant-based plastics to replace these bags, resulting in a much better waste and resource outcome.

The greatest positive environmental impacts will come from farmers embracing Sustainable Production/Consumption initiatives, such as improving soil health and organic matter, measuring their environmental impacts, planting trees, and promoting environmentally positive products.

## 2. What needs to be done to make the achieved results scalable?

Scaling up CE solutions to more farmers and growers would get more businesses to engage, learn and refine approaches. A project might look like this:

- A range of farms – geographic spread and a range of enterprises
- Test CE solutions
- Collate, refine and test approaches with businesses
- Disseminate approaches amongst many farmer and grower groups, companies, and associations

A lower cost version would be to disseminate results from Demo 3 to other businesses via webinars, websites, events, partners, magazines, etc. This would be lower cost but with less control or measurable results/impacts.

Transfer to other industry sectors is achievable in part. The food sector is more complex than many, as it involves the production of food from biological systems, which are inherently complex as well as being seasonal in nature. Some industrial processes are simpler in many ways, relying on the same or similar raw materials on a more regular basis.

Many of the learnings from this project are transferable, such as:

- Carbon and eco foot printing products and services, making a plan to reduce the environmental and social impacts, and communicating this to customers
- Engaging with customers in co-creation, ensuring their views and needs are part of the production process
- Transforming packaging and minimising waste
- Producing new products and/or services to suit the needs of customers

## 3. What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?

The main impacts will be for industry – as outlined above. It must be stressed that there are significant market opportunities for companies embracing and promoting CE solutions. This can be summarised on two fronts:

- A reduction in the use of resources and materials, as well as a reduction in waste should lead to reduced costs. Potentially more profitable products if co-creation is undertaken and consumers respond positively to new products and/or services
- The market for ethical products is substantial and growing. The annual Ethical Consumer Market report in the UK has found that ethical food and drink products alone are worth £12.5bn a year in the UK, up over 13% year on year (Ethical Consumer, 2020)

Consumers will be positively impacted by a greater availability of products with lower environmental and social impacts, including more information about the benefits, how it impacts on their own eco footprint, and what more they can do to reduce their impacts through food shopping.

Academia will benefit from data collected by the project, enabling some assessment of the impacts of CE on businesses and the potential impacts if scaled up to a wider section of business and society. Researchers would also benefit from liaising with policy makers to understand the future direction of policy which will define the needs for research in the sector.

**4. What activities have you planned to publish your results accordingly?**

Scilly Organics has undertaken or is planning several activities to disseminate the results more widely. Among other things, the company shared its experience with the public in a webinar on 12 May 2021. Online dissemination of the results was also promoted by embedding them on the Scilly Organics website. Another dissemination channel will be a handbook to be published in September 2021, which will be available for download on the Scilly Organics website and promoted on social media, networks and organisations.

**5. Define Intellectual Properties and protect them by appropriate means (IPR)**

The main intellectual property is surrounding the results from the carbon footprint and LCA (environmental and social) studies. The transparency each company decides to release to the public is ultimately their choice, but a greater level of detail and transparency aids confidence from consumers and buyers of the integrity of the studies/results.

The results from Scilly Organics' carbon footprint and LCA results are public through Deliverables 1.2 and 6.3.

**6. Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)**

Scilly Organics has looked closely at the longer-term changes required to further reduce resource use and lower carbon emissions. This requires investments in solutions such as electric tractors, various electric power tools, and solutions to replace horticultural plastics. Some of these solutions are either in development or not yet ready for the market, so a challenge to adoption on a wider scale is the availability and cost of such solutions.

For consumers there needs to be both greater knowledge about eco- and carbon footprint and clear steps about how to take positive action. Fundamentally some of this will centre around prices, and it is likely that food with lower environmental and social impacts will simply cost more, mainly because the current food system externalises the true costs of production – with significant negative impacts such as carbon emissions, pollutants in soil and water, lower food quality and negative impacts on human health.

### 2.6.5    Implementation strategy for the recycling-reusing system in cities

**"The implementation of the recycling-reusing system in cities. The system will be demonstrated in a Spanish regional school, where tablets will be re-used using the system. This demonstration will be followed by a plan of how to implement the system in other EU countries (IND, REC)."** For this exploitation strategy the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 51 of 72.

The implementation of the recycling-reusing system in cities will be demonstrated in a Spanish regional school in the city of Getxo and other municipal institutions, where tablets will be re-used using the system. These demonstrations will be followed by a plan of how to implement the system in other EU countries and how it should be deployed to the market after the project duration.

Collaborative Recycling and Reuse is the main CEBM considered in this Demo. All the developments of this CEBM in the project have been considered in the Demo. Various results can now be deployed to the market.

In the first place the WEEE indicators have to be highlighted here: kg per habitant and year obtained in the city and in the schools observed. From there a derived ratio of reusable WEEE can be used as an indicator or benchmark in horizontal or vertical studies. Leading measure points here can be a) the number of devices disposed in the containers, b) the amount of app downloads from the internet, c) the quantified or qualitative impact of the on-line and off-line campaign in the region itself and d) the scaled and documented satisfaction in the city council and in schools.

The initial situation on WEEE collection in Getxo before CIRC4Life project was as such to be described: There were no intelligent bins deployed with any fully traceability of the waste (from end-user to the treatment plant). In addition, neither involvement of end-users in the whole process, nor incentives for end-users did exist. Also, involvement of other stakeholders from local businesses, city council or schools took place. To summarise, there was no potential reuse of WEEE in massive collection in that region at all and citizens and end-users were left alone. A final conclusion by end-users about his/ her waste and which management (reuse/ recycling) consist in a fundamental lack of information to them about what achievements they contributed and what other parties have carried out to reduce WEEE.

## 1. Which results/CE solutions/demo activities should be deployed to the market after the project duration?

As a result of reuse and recycling targets stated in WEEE legislation in Europe, as well as to foster CE, a full package of CE solutions and Demo activities was developed in this recycling and reuse use case in Spain which can be easily transferred and scaled up to other regions and cities. This package of CE solutions is built by many different elements:

- Involve end-users to prevent keeping used devices at home
- More effective collection in intelligent bins to prevent potential break of devices disposed (WEEE)
- Increase collection ratio
- Reward end-users to motivate to more recycling actions
- Create new opportunities of businesses based on CE approach
- Promote environmental and social initiatives as a result of recycling activities
- Give a second life to recovered WEEE which still work
- Get feedback from end-users
- Train next generations in schools in good practice about recycling

The exploitation plan which is already in place and executed includes different kinds of activities like presentations, communication and personal engagement with representatives of the target group and stakeholders:

- Present the Demo and its developments to key stakeholders in the area (City council, local businesses, schools, citizens, etc)
- Present the features of intelligent bins and its advantages versus traditional ones
- Present the incentive scheme proposed and options to reward end-users
- Present the App and Traceability module and how the user interacts with the system
- Present the activities and results of the Demo carried out in Getxo during this period
- Promote the collaboration between key stakeholders
- Use of Communication campaign to publish the initiative and involve more stakeholders
- Search of potential investors to keep the initiative alive

Collaborative Recycling and Reuse is the main CEBM considered in this Demo. All the developments of this CEBM in the project have been considered in the corresponding Demo; measurable results developed to be deployed to the market consist in:

- To fundamental WEEE indicators:
    1. Kg/ hab/ yr (kilogram per habitant and year) obtained in the city and in the schools;
    2. Ratio of reusable WEEE
- Number of devices disposed in the containers
- Number of app downloads
- Impact in form of feedback of the on-line and off-line campaigns
- Satisfaction as a survey in the city council and in schools

## 2. What needs to be done to make the achieved results scalable?

Several activities were planned to make the results usable beyond the project duration. For all partners involved and the stakeholders around it was clear from the beginning that typical measures have to be undertaken for a certain roll-out.

First it would be highly necessary to convince the municipal administration of the good approach of CIRC4Life project and its results. Followed by an increase of the local commitment in all the related aspects: players, investment, supporters, acceptance and early adopters. Finally, massive publicity campaigns have to be executed to raise awareness and increase interest at citizens to finally generated a substantial basis for understanding and trust

Despite the successful implementation of the Demo in the Basque Region of Spain, a handful of pen topics remains, e.g., technical challenges, missing regulations, missing collaboration and networks to scale and transfer the results to (1) other regions or countries as well as (2) other industry sectors. A crucial aspect for improvement is the fact that the incentives for recycling and reuse should be extended to more environmental motivations: planting trees, using/ purchasing bikes, promotion of local sport activities, etc. Because citizens acknowledged their preferences in this direction. Another revision to better acceptance and higher usage is the minimizing of existing legal and fiscal barriers in the City Council because they are perceived as burdens and hurdles by especially by businesses and institutions. A real step forward would be a closer involvement of local shops and in a bigger scale – intensification and expansion with businesses. As a supportive activity on the local level it was identified to promote the general attitude to re-use assets from "neighbours" and in parallel to enhance the second-hand market in the same regional and social context. A final aspect that was recognised with room for upgrading and thus raise the likability to adapt the new circularity modules was the ICT system itself where more reliable and stable communication to the end-user was desired.

A couple of core users a) public bodies, b) industry, policy makers and also d) academia, last but not least e) end-users were identified to first address the new CE solutions:

a) Public bodies such as local administrations, city councils, regional administrations, etc. These entities should be contacted in an early stage of the exploitation phase to get them on board and closely develop with them the main goals and strategy to be carried out in each city, region, or any other place in which this approach can be implemented.

b) All value chain partners in the EEE industry have to be addressed – with different priorities:

- Producers of EEE at first place: Producers and manufacturers of electric and electronic equipment are key agents because of they have the knowledge, the capacity and the possibility to co-create their products together with end-users. They also can facilitate the availability to their products to be remanufactured and potentially part of a second-hand market. The method to involve them should be through a plan in which they could find advantages to participate in the whole system. New regulations and policies could also trigger their participation in the initiative.

- Distributors, local businesses and other entities: Similar to the previous point, these agents should find the benefits of taking part of the initiative by reaching new customers, new businesses models (second-hand markets) or new capacities to their activities. The involvement of public administration and city council is one of the potential methods to get them on board.

- WEEE managers and treatment plants: The method to involve them is through the possibility to get more materials for their businesses or a good quality of it through a different way to collect WEEE. Also, to get a better reuse/recycling ratio WEEE should motivate them to participate in the model. New regulations and policies could also trigger their participation in the initiative.

- Collective schemes: as an intermediate body in the whole EEE/WEEE chain, the participation of collective schemes could improve the efficiency of the system by action along the chain, together with

the rest of the agents previously above-mentioned. They can also contribute to reach end-users by communication and dissemination campaigns. The method to involve them is through the benefits of this initiative to get a better reuse/recycling ratio of WEEE. New regulations and policies could also trigger their participation in the initiative.

c) Policy makers: Their involvement should be distinguished between new policies at European level which can promote a change in the current framework by fostering actions aimed to reach a more circular business models and, on the other hand, new regulations at local level that enable the adoption of measures by other agents of the chain to enhance and reach the goals, as the adoption and promotion of incentives given by local entities.

d) Academia: Participation through different actions in schools and educational centres to present the benefits of the initiative and potential second use of recovered materials.

e) End-users/society: As for administration, the involvement of end-users and society in general should be in an early stage due to the need of co-creation of developments based on their feedback. This involvement would be through massive communication campaigns and events conducted together with local entities to facilitate their participation

## 3. What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?

The CIRC4Life project was important for your sectoral and technical innovation in the field of recycling because the opportunity to first reuse and only in case of failure or mismatch recycling came into play. Changing attitudes and habits of citizen is supported by easy to learn processes and readily available infrastructure – private and public. In the long term the industry for recycling can benefit from its results because more used WEEE goes back into the circle where the use of resources can be reduced.

The impact with regard to different stakeholders differs strongly:

a) With the industry on the one hand the long-term effect is hardly not measurable because EEE producers unfortunately were not involved. On the other hand, WEEE managers could be enhanced to use the system if municipal administrations decide to contract them for assuring collection of WEEE. Changes in the logistics, reception and reusing activities are to be expected for companies in the recycling sector. Also, for a regional second-hand market a positive direct impact if reusing achieved by CIRC4Life is significant. An additional positive impact to the success of the CEBM could derive from the integration of local distributors because they could be interested as collaborators for the broad implementation of intelligent bins, especially those with big stores.

b) The group of the end users and the society is relevant in terms of acceptance of the system. Since they build the focus of the CIRC4Life Project the actors that have to dispose off the WEEE stored at home are the one who are touched most and therefore have the greatest impact. Their awareness and taking over of new procedures and tools are imperative for the success of the CEBM.

c) When it comes to academia as stakeholders in the CEBM they are relevant for exploitation part and strategy not only through their strong intellectual commitment but in the first place by their capacity building being done for education in primary and secondary schools. Here the grounding for future generations of WEEE collection with the following up reuse or recycling has to be laid.

d) Ultimately, policy makers play a distinctive role as they form the legislative where the civil and the formal society depend on. Administrations of regions, municipalities and cities are the 'real' customers of the Demo about Collaborative Recycling and Reuse. As highly potential contractors of services for collecting WEEE in a community they decide on how to set the rules and allocate the collection bins. Policy makers could help to facilitate this process where and whenever possible by innovative financial, fiscal and legal support. Even the

accounting for WEEE reuse and recycling may it be in absolute terms or in comparison with other regions could accelerate the implementation of new CEBM.

## 4. What activities have you planned to publish your results accordingly?

The success of the results achieved with the CEBM for Collaborative Recycling and Reuse also depends on the public perception and acceptance. The dissemination of the results by partners involved and the stakeholders around is fundamental. As public authorities and municipalities do not tend to run their own marketing for the societal and environmental progress, the other affected parties take over this role from their intrinsic motivation. In the case of the Basque Region several activities as well on the level of schools as on the level of immediate contact like in the streets helped to published the presentable results with the two main points: first, a general publication with classical instruments, so that the public got to know about the quality and trust-worthiness of the system in a general way, but secondly also material of specific interest for Environmental Departments of City Councils and Administrations was disseminated with a roadmap for implementation including the outlook of potential public relations, public funding opportunities and dedicated events.

## 5. Define Intellectual Properties and protect them by appropriate means (IPR)

The definition of Intellectual Properties (IP) and their protecting by appropriate means (IPR) in this context was not relevant for the Demo owners in the Basque Region so that their protection does not need to be discussed further. For other stakeholders it may apply and they could derive their properties if interesting.

## 6. Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)

Concluding the experience after closing the Demo and lessons learned with regard to the changes that are coming with the CE approach regarding this specific CEBM of Collaborative Recycling and Reuse it is highly significant that reusing of post-consume WEEE stays difficult on regional level – even when massive collection as proposed by CIRC4Life is performed. To be optimistic, the possibility of noticeably increasing collecting ratios is the perspective for the future with more materials available for the industry and less burden for the environment, while consumers and business have to benefit from future developments equally.

### 2.6.6    Open Access-Strategy for ICT solutions

**"The preparation for open access of the ICT platform developed in the project (ICCS, ENV, EECC)."** For this exploitation strategy the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 51 of 72.

### 1. Which results/CE solutions/demo activities should be deployed to the market after the project duration?

The goal of the exploitation strategy described is to ensure that the CIRC4Life services are accessible and reusable even beyond the completion of the project. In order to ensure that, most importantly, ICCS will maintain the infrastructure and the services deployed on it for a duration of three years after the end of the project. This will allow partners to continue using the services after the end of the project, enabling further exploitation of all business models developed within CIRC4Life. ICCS will offer access to the platform and all necessary web services (on demand) in order to facilitate integration with third party systems after the end of the project. ICCS has made selected data (samples) available to the public repository Zenodo: DOI: https://doi.org/10.5281/zenodo.5530274 (Koutsokeras, 2021).

The provision of data to public repositories and to non–CIRC4Life stockholders only concerns data to which ICCS has the right to provide access to. Private data (such as identities and contact details of people participating in

workshops, project events and Living Labs, unless they have given explicit consent) and algorithms and tools used for the generation, image annotation or flood modelling, many of which fall under the IP of the project's industrial partners according to the consortium agreement, will not be made available.

The systems and solutions developed by Enviro Data (interoperability layer, administrative tools, feedback system, remote demo) will be accessible and re-usable by CIRC4Life partners at least three years after the completion of the project. Especially the interoperability tools and the escrow approaches, which are the first approach for more extensive solutions, are and will form the foundation for further project proposals and development efforts. The tools centred on feedback, remote demo etc. will also be available for future development efforts.

## 2. What needs to be done to make the achieved results scalable?

The ICT platform is scalable by design and could be further expanded if needed. One potential limitation that should be considered is the compatibility of the ICT platform with products/processes that were not part of the CIRC4Life demonstrations. Although an effort was made at the project level to involve demonstrators from different sectors and offering diverse products, there would obviously be differences between sectors which should be considered. However, the exploitation strategy assures that continuous development and improvement of the applications will be possible even after the end of the CIRC4Life project.

## 3. What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?

The ICT Platform serves all the CEBMs developed within CIRC4Life. It supports CEBM actions throughout the value chain by serving stakeholders in their purchasing and recycling behaviour. The ICT platform collects the necessary information and offers tools that enable activities related to the CEMBs: sustainable consumption, collaborative recycling and reuse, traceability of product's sustainability along the value chain and actor's cooperation in terms of circular economy. The accessibility of the services hosted in the ICT platform beyond the project will allow further discussions based on the demand of future industrial partners.

There are several key innovations within the ICT platform: eco-balance of the user introduction, linkage between product and its environmental impact, the option for the retailer to update the customer's eco balance, calculation of eco-credits for recycling actions based on the CIRC4Life concept, the option for the recycling company to update the user's eco-balance. The exploitation plan allows the implementation of these innovations in other industrial settings.

Other areas of innovations include the first core approaches to a combined interoperability and escrow management system supporting a highly flexible, scalable and neutral information context storage system, which is currently the basis for a number of proposals. These proposals will be based on significantly more comprehensive data storage and exchange capabilities for very complex information contexts. Obviously, the impact of the exploitation plan presented here is also of value for academia for educational reasons. Offering ICT platform services even after the project enables the continued exploitation of CIRC4Life CEBMs. As a result, the end user and society as a whole will benefit in a wider context - in terms of transition to the CE.

## 4. What activities have you planned to publish your results accordingly?

In order to disseminate the results, following activities have been taken (see chapter *3 Dissemination* for more details):

- Presentation on the Data Management for CEBMs and the data formats used in CIRC4Life during the 9th International Conference on Life Cycle Management in Poznan, Poland in September 2019

- Poster presentation "An ICT platform facilitating Circular Economy Business Model" during Portoroz 2nd International Conference on Technologies & Business Models for Circular Economy in Portorož in Slovenia in September 2019 (Tsimiklis et al., 2020)
- CIRC4Life dissemination presentation, including the ICT platform, during the online symposium on CE and sustainability organized by INFER-International Network for Economic Research, Department of Environmental Engineering; Democritus University of Thrace in July 2020.

The ICT platform is one of the solutions that was presented during the second Open Innovation Camp. Further research on topics related to ICT use for CEBM is ongoing and is planned to be used as a basis for further proposals in the field of CE. The following topics have been studied:

- Data management platforms for CEBMs
- The usage of ICT technology for CEBMs
- Semantic annotation of data needed for CEBM, taxonomy of data, dynamic data models
- Regional support for CE solutions

**5. Define Intellectual Properties and protect them by appropriate means (IPR)**

An online platform is created with access on demand that provides full documentation of the entire ICT platform. The solutions for the interoperability layer / escrow approaches and feedback systems represent core functions that do not need more qualified IP protection at this stage. The more comprehensive IP protection approaches are reserved for future efforts.

**6. Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)**

An online platform is created that provides full documentation of the whole ICT platform, including the source code and instructions on how to replicate it. Further research in the following areas will be conducted in parallel and beyond the project duration:

- Data management platforms for CEBMs
- The usage of ICT technology for CEBMs
- Semantic annotation of data needed for CEBMs, taxonomy of data, dynamic data models

The ICT platform is scalable by design and could be further expanded as needed. Based on demand of industrial partners, further exploitation is being discussed. Digitalisation is considered as an enabler for CE. In this context, the research activities of ICCS are very applicable and form an inherent aspect of the circular transition. ICCS is participating in several projects implementing CE, some examples are Accelwater, B-WaterSmart, CIRC4Food, CORALIS. Participation in these projects offers the opportunity to use and develop the knowledge gained from CIRC4Life. Enviro Data will combine the knowledge gained from CIRC4Life with the experiences and solutions from the EU FP 7 project myEcoCost (Díaz, 2012) to create the foundation for further proposals and projects – specifically to expand the role of qualified information logistics in CE.

### 2.6.7   Implementation strategy of traceability techniques and market uptake

**"The implementation in the market of the Traceability techniques EPCIS with CEBM developed in the CEBM approaches (EECC, GS1G, ENV)."** For this exploitation strategy the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 51 of 72.

The exploitation strategy with regard to the traceability techniques of the EPCIS developed in the different CEBM approaches has a strong focus on the implementation in the according markets. The partners EECC, GS1G and ENV substantially follow a market orientation for many purposes in various industries. Current customers and potential customers will have the opportunity to benefit in their business and processes of the CIRC4Life

results after their incorporation as buildings blocks for technological solutions. In the initial situation without CIRC4Life results before there was no way to collect data during the lifecycle of products on the basis of events in a standardised form.

## 1. Which results/CE solutions/demo activities should be deployed to the market after the project duration?

After the successful completion of the CIRC4Life activities beyond the project duration, several achievements will become incorporated into existing or new products offered by the partners involved, such as

a) Preparation of EPCIS 2.0: eco-impact on article level made measurable with ECO-Extensions, eco-labelling based on data collected
b) Preparation of further standardisation on international level, e.g. GSMP for GS1 community
c) Integration of results in existing demonstrators in own premises or those to come
d) Results achieved with traceability along the production of goods made reusable for developments for a material passport, e.g. plastics, electronics, batteries

Both, traceability and tracing technics are cross-cutting solutions to all CEBM where a first foundation for a general and interoperable concept was found and prototypically tested. Real tools as marketable products still have to be developed.

Regarding the CEBM of Co-Creation of Products and Services it is clear that maintenance and also asset management can be included in the whole lighting service to create a fully new business model-based leasing and more only selling. That would make resource and labour allocation much more efficient because of several reasons. In addition, the impact assessment with near real-time output based on real traceability data can be brought to the market. Eco-labelling is a consequent result of traceable data along the lifecycle which builds a fundamental part of the CEBM of Sustainable Consumption. Here consumers can get an assistant to decide on the basis of real data at the shelf in a POS about products in a fully new dimension apart from only pricing or brand – it is the Eco-impact.

## 2. What needs to be done to make the achieved results scalable?

The CEBM of Collaborative Recycling and Reuse which also uses Eco-points is also very closely related to traceability techniques. Solutions in that way with standardised processes and data are highly attractive to different stakeholders like brand-owners and retailers but also public authorities. Consumer of course are interested too into reducing their eco-footprint. With a certain incentive scheme, they will unquestionably higher appreciate integrated systems for recycling and reuse than only providing a new bin for recycling. Coupons and vouchers for recycling become more individual and thus attractive for consumers and other users. Finally, the recycling with intelligent bins can also be further developed to the tracking of bio waste and electronics from the collection to the recycling; even a possible tracking to 2nd life phase is possible and can be experimented together with customers.

Especially the balance of cost and benefits for the recycling has to be analysed more in detail as the figures of costs for bin + system etc. are reasonably high while the savings from getting purer waste streams do not weigh so much financially. Certainly, the quality aspect of higher quality secondary materials in parallel with a substantial higher recycling rate from homes impresses municipalities and policy makers at the same time.

## 3. What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?

Not only the immediate market uptake but also a comprehensible increase of TLR to marketable product/ service of a CIRC4Life developed ICT/Traceability solutions in follow up projects is a clear perspective for exploitation. Then of course again the market uptake builds the core for a later transfer and up-scaling. Scalability of the developed ICT/Traceability System is not an issue as first and foremost it is about software. As consequence of the business plans of the partners involved, the grow of the user community and of interested

partners represents an essential part of their own marketing and selling strategies on the one hand. On the other hand, public authorities, policy makers and societal forerunners are always in the centre of campaigns to raise awareness for sustainability topics in general.

The CIRC4Life results in the field of traceability techniques are important as a sectoral and technical innovation with focus on the core industries of agri-food and EEE because different stakeholders along the value chain will benefit. Previously not existing lifetime data from production, over-usage to reuse or recycling can be made available. Furthermore, the ongoing development of concepts about dynamic certificates, e.g. GHG emissions, in other projects, e.g. nationally funded project IDideal builds on results found in CIRC4Life. But also, the improved awareness for dynamic solutions with traceability in different target groups is a substantial progress and incentivises imitators to learn from such project results and set up a B2B2C transparency solution.

But for a major break-through the tracing of eco impacts along value chains needs regulation to really get a high coverage of all stages with their process. The upcoming product or material passport in the EU is a real chance and will lead together with the CIRC4Life result also to an increased recyclability and reusability because raw materials and components of products are better and even traceable. If the knowledge and the consciousness about eco-Labels gets increases in the population and reaches more and more customers that will potentially have also huge impact on users and the society as a whole and would entail further regulations with higher acceptance.

### 4. What activities have you planned to publish your results accordingly?

The dissemination of corresponding results via marketing and public relation activities by involved companies is an essential key; elements like demonstrations in own premises such as labs and knowledge centres for customers and other stakeholders, the co-authorship in related science papers and conferences as well as business-oriented publications within own media and customer publications (print and online) are planned.

### 5. Define Intellectual Properties and protect them by appropriate means (IPR)

The creation of intellectual properties and their corresponding protection by appropriate means (IPR) often is driver of privately owned companies. But for dissemination purposes of such traceability techniques in this case it is far better to share them in form of standards and alignments. The standardisation becomes the most important means for publication and dissemination. Norms will be respected widely and used in many countries at the same time to make results attractive to a greater audience. The IP policy of the GSMP at GS1 is intended to publish new results to a broad audience among technology providers and applicants.

### 6. Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)

The CE approaches in combination with the traceability techniques led in summary to new insights about their acceptance in different industry sectors, like e.g. interest in distributed ledger or blockchain technologies, the importance of related rights and roles in IT systems as well as governance rules, not to forget the trusted frameworks among stakeholder where verifiable data lead to confidence and trust; and in the upshot that hurdles for further development and implementation still remain in form of a feared loss of control what can only be solved by a system of a controlled transparency with an explicit data ownership.

For GS1 and EECC with its EPCIS standard together with the new functionalities of eco-extensions, they will tread new path for the future for the sake of their community like, e.g. calls to action for new project initiation within the GS1 Community, results of the project are used as basis for future input at the GS1 standardization processes (GSMP) and the implementation of a CIRC4Life Demo Use Case in the GS1 Shopper Experience and EECC InnoLab in Germany beyond the project duration.

### 2.6.8    Implementation Strategy for the recycling incentive scheme

**"The recycling incentive scheme developed will be implemented and followed-up. (REC, IND)."** For this exploitation strategy the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 51 of 72.

Collaborative Recycling and Reuse is the main CEBM considered in the Recycling Incentive Scheme. All the developments of this CEBM in the Project have been considered for the development of the incentives. Some other considerations from Sustainable Consumption have been considered in addition, such as the possibility to donate eco-credits for social/ environmental actions.

**1. Which results/CE solutions/demo activities should be deployed to the market after the project duration?**

The main achievements and results to be deployed to the market and supporting their marketability are manifold:

**Intelligent Bins** – With regards to the features and potential impact of intelligent bins, the provision by municipalities and others and use by households of intelligent bins instead of the use of common bins.

**Incentives** – The effectiveness of developed incentives for end-users enhances the reuse/recycling ratios in two main dimensions: a) the number of "working" devices recovered increases versus the total devices collected (ratio of reusable WEEE); while b) also other WEEE indicators show improved performance not only such as kilograms per inhabitant and year collected WEEE using intelligent bins and the incentive scheme of each demo but also the number of devices disposed in the intelligent bins overall.

**Eco-Parameters** – The monitoring and survey of different types of eco-accountable parameters like, e.g. incentives offered to end-users and their acceptance as percentage of the overall offering or the number of eco-credits used overall and/ or also in comparison to the eco-credits given in the same period.

**Communication** – the impact of the on-line and off-line campaign can be measured by the number of app downloads and the number of surveys received.

**Involvement** – Finally the number and the characteristics of the stakeholders as type of agents taking part of the activity. Or even the use of the APP and ICT platform as the tools to rule the system are indicators for the success.

**2. What needs to be done to make the achieved results scalable?**

The up-scaling of achieved results heavily depends on various parameters to involve and convince public administrations of this new approach. Therefore, different activities are necessary and taken into consideration to make the results usable beyond the project duration – some may be influenced by project partners involved, other not – directly or indirectly. The following elements were prioritised:

- New circularity oriented legislation as support and a bundle of public incentives to boost the adoption of this system for other agents and stakeholders.
- Wide range of incentives offered to end-users as well as the participation of other local/regional stakeholders offering incentives.
- Strong integrated communication and awareness campaign by stakeholders and agents to involve end-users – in an early stage innovators and later adopters.
- Feedback system for end-users.
- Powerful cooperation and strict coordination of different agents.
- Free APP, ICT platform and IT support for the management of the system.
- Local promotion of a 2nd hand market as a new trading platform for recovered devices still working.
- Public procurement of intelligent bins for local waste management facilities by municipalities and cities in order to make this initiative massive for waste collection.

**3. What impact has your exploitation strategy for the different stakeholders like the industry, the end users/society, academia and policy makers?**

This new initiative with different achievements has individual impact for the any type of stakeholder in the different domains where innovation consists in, for e.g.:

**Industry** – several parties will benefit in different ways like:

- EEE producers will benefit of new customers resulting from direct discounts or vouchers to end-users who want to spend the eco-credits obtained in the recycling/reuse process to purchase new producer´s products. In parallel they could also gain additional information about the recyclability or lifetime of its products.
- WEEE managers will conquer new streams of waste as well as more quality in the collection. Changes in the logistic, reception, and reusing activities are to be expected.
- Collective schemes for WEEE could enhance the amount of waste collected and help to achieve targets set out by law in an easier way. Also, a better quality of the waste collected can facilitate the achievement of the targets for reuse hardly achievable nowadays.
- Second hand market for EEE may be significant creating new business for established companies.
- Distributors and retailers may benefit by discounts or vouchers comparable to "EEE producers" from new customers spending eco-credits and purchasing new products in their shops.

**End-users/Society** – they are the main actors standing in the focus of the project as they dispose the WEEE into the intelligent bins. They primarily benefit from the incentives obtained by the disposal of EEE waste. In parallel they also benefit from the new techniques which allow to collect information about the recycling process including not only the traceability of their waste but also the final result of the management. Additional collection points available in their area is also valuable for them. End-users are the target audience of the communication and awareness campaign by the project and the public authorities.

**Academia** – here innovation takes place with different focus, e.g. potential of new features, improvements to the recycling process, but also collaboration with the stakeholders or participation in the communication and awareness campaign through schools and other education centres.

**Policy makers** – have to discuss and set up new rules for circularity legislation to boost innovative approaches. Their commitment with the goals of the project at a low level of bureaucracy is crucial for the success of the initiative and the engagement of new agents.

**4. What activities have you planned to publish your results accordingly?**

For the dissemination and publication of the results several activities and events were carried out and are to be carried out in the future as follows:

- The repeated showcase of this Demo 2 is the main leverage to publish the results, see section on events below. Especially during the second Open Innovation Camp by CIRC4Life in May 2021 main results were presented.
- The planting tree day: one event in which both public bodies and end-users, as well as other stakeholders, are invited to attend a planting tree activity to underline the environmental incentive in place.
- In periodical press releases the demo-owners (IND and REC) published their news and main results through their own channels and with the help of corporative webpages.
- CIRC4Life newsletter and other resources (webpage, etc.) presented the results of Demo 2.
- A strong communication and awareness campaign was executed by social media with results and news in order to incentivize end-users to participate.
- Also other potential activities were analysed, such as videos showing the opportunity to redeem vouchers and create new purchases in local shops.

**5. Define Intellectual Properties and protect them by appropriate means (IPR)**

The results of the Recycling Incentive Scheme are hardly to protect by IPR; some developments in the project may flourish under certain IPR, e.g. the "CIRC4Life App", ICT platform, eco-shopping system or Traceability module. Other equipment in the Demo 2 used by the owners IND and REC such as Intelligent bins are under the IPR of the original manufacturer.

Impacts and lessons learned with regard to the changes by the Recycling Incentive Scheme are various:

- Involvement and commitment of local authorities is essential for the success of the approach.
- Incentives enhance the collection of small devices nowadays kept at home by end-users.
- New key actors in the process are possible such as policy makers, producers and local/ regional stakeholders introducing incentives or becoming partners in the process.
- Massive communication and awareness campaigns are compulsory to inform end-users about their benefits as they are the first to take new decisions on the use of WEEE.
- Supporting APPs have to be intuitive and the ICT platform complete to guide end-users through the interaction with the bins and the according incentives.
- The use of intelligent bins in combination with a traceability module to collect WEEE leads to higher ratios of devices to be reused which can be part of obligations in future waste laws and normatives.
- A better quality of the waste collected may generate new business models and/or new second-hand markets.
- A Higher number of wastes collected implies more materials available for the industry.
- Demo 2 showed for all partners involved positive results for: a) collective schemes (REC) and recyclers/remanufacturers (IND); b) for the municipality (meeting collection targets per inhabitant) and c) for incentivizers in CIRC4Life, more sales thanks to the incentives.

**6. Impacts and lessons learned with regard to the changes that are coming with the CE approach in your own industry sector/ company (e.g. employees, customers, own organization, etc.)**

Certain next steps towards the implementation of the system are planed:

- First, it is agreed to prepare an operational plan to expand the collection to the entire municipality of Getxo for a longer-term comprehensive pilot with a full and predictable public tender for the WEEE collection leading to a contract.
- Finally, it is intended to draft a study for the expansion of the system into the established business region of IND and REC as the province of Bizkaia, the area of the Basque Country and Spain.

## 2.7   Potential funding sources

**A plan will be devised with potential national and regional funding sources that could be considered for application to follow up CIRC4Life project outcome".** For this general exploitation strategy, the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 52 of 72.

Horizon Europe consists of three pillars and one horizontal activity within those, Pillar 2 "Global Challenges and European Industrial Competitiveness", is the most appropriate to look for. There are six clusters from which Cluster 6 (CL6) offers the most fitting topics to be addressed for follow-up research and innovation activities:

1. Health
2. Culture, Creativity and Inclusive Society
3. Civil Security for Society
4. Digital, Industry and Space
5. Climate, Energy and Mobility
6. Food, Bioeconomy, Natural Resources, Agriculture and Environment

## The European Green Deal

Figure 15: The European Green Deal
(Source: European Commission, 2019)

According to the presentation "Circular Economy funding opportunities in Horizon Europe" held on Friday, 28th May 2021, by Hans-Christian Eberl (Policy Officer at European Commission) during the CIRC4Life OIC, the EU has its strong focus for the progress of research and innovation in The European Green Deal and its own public funding (see Figure 15). National sources for funding and other support depend on the countries and their governments. There is a broad variety of funding and support opportunities in each country. Each partner of the CIRC4Life consortium may have his own history, relations, and strategy for funding on national level. A proof of these is left to their individual responsibility. Multinational consortia founded by former CIRC4Life partners may focus on existing or upcoming calls and topics on European level. Also the EU highlighted Circular city initiatives and resources offers information and access about the CE in cities and how best to start the circular transition; several initiatives and resources are marked helpful on their own webpage: https://www.circularcityfundingguide.eu/circular-city-initiatives-and-resources/.

The following *Table 6: EU funding opportunities for Circular Economy* (actual status by 24. June 2021) shows the main opportunities for follow-up projects with granting by the EU, e.g. with Horizon Europe (HEU) within the next two years. Cluster 6 (CL6) offers twelve different topics in the upcoming years 2022 and 2023 to start new projects with granting by the EU in the Horizon Europe Programme for 2021-2027, the other two clusters with lesser importance are cluster 4 (CL4) with eight and cluster 5 (CL5) with one topic.

**Table 6: EU funding opportunities for Circular Economy**

| Topic Name | Programme ID in Horizon Europe (HEU) | Types of action | Dead-line model | Opening date | Dead-line date, (17:00 h Brussels time) |
|---|---|---|---|---|---|
| Functional electronics for green and circular economy (RIA) | HORIZON-CL4-2021-DIGITAL-EMERGING-01-31 | RIA | single-stage | 22.06.2021 | 21.10.2021 |
| Ensuring circularity of composite materials (Processes4Planet Partnership) (RIA) | HORIZON-CL4-2021-RESILIENCE-01-01 | RIA | single-stage | 22.06.2021 | 23.09.2021 |
| Innovative solutions to over-packaging and single-use plastics, and related microplastic pollution | HORIZON-CL6-2021-CIRCBIO-01-03 | IA | single-stage | 22.06.2021 | 06.10.2021 |
| Digital permits and compliance checks for buildings and infrastructure (IA) | HORIZON-CL4-2021-TWIN-TRANSITION-01-10 | IA | single-stage | 22.06.2021 | 23.09.2021 |
| Academia-Industry Forum on Emerging Enabling Technologies (CSA) | HORIZON-CL4-2021-DIGITAL-EMERGING-01-13 | CSA | single-stage | 22.06.2021 | 21.10.2021 |
| Evidence-based decision-making to change social norms towards zero food waste | HORIZON-CL6-2021-FARM2FORK-01-13 | RIA | single-stage | 22.06.2021 | 06.10.2021 |
| Increasing the circularity in textiles, plastics and/or electronics value chains | HORIZON-CL6-2021-CIRCBIO-01-04 | IA | single-stage | 22.06.2021 | 06.10.2021 |
| Integrated urban food system policies – how cities and towns can transform food systems for co-benefits | HORIZON-CL6-2021-COMMUNITIES-01-05 | IA | single-stage | 22.06.2021 | 06.10.2021 |
| Common European Green Deal data space to provide more accessible and exploitable environmental observation data in support of the European Green Deal priority actions | HORIZON-CL6-2021-GOVERNANCE-01-17 | IA | single-stage | 22.06.2021 | 06.10.2021 |
| Circular Cities and Regions Initiative's project development assistance (CCRI-PDA) | HORIZON-CL6-2021-CIRCBIO-01-02 | CSA | single-stage | 22.06.2021 | 06.10.2021 |
| Circular Cities and Regions Initiative (CCRI)'s circular systemic solutions | HORIZON-CL6-2021-CIRCBIO-01-01 | IA | single-stage | 22.06.2021 | 06.10.2021 |
| Modelling the role of the circular economy for climate change mitigation | HORIZON-CL5-2021-D1-01-02 | RIA | single-stage | 24.06.2021 | 14.09.2021 |
| Digital tools to support the engineering of a Circular Economy (Made in Europe Partnership) (RIA) | HORIZON-CL4-2022-TWIN-TRANSITION-01-07 | RIA | single-stage | 12.10.2021 | 30.03.2022 |
| Circular and low emission value chains through digitalisation (Processes4Planet Partnership) (RIA) | HORIZON-CL4-2022-RESILIENCE-01-01 | RIA | single-stage | 12.10.2021 | 30.03.2022 |
| Demonstrate the use of Digital Logbook for buildings (IA) | HORIZON-CL4-2022-TWIN-TRANSITION-01-09 | IA | single-stage | 12.10.2021 | 30.03.2022 |

| | | | | | |
|---|---|---|---|---|---|
| Boosting green economic recovery and open strategic autonomy in Strategic Digital Technologies through pre-commercial procurement (PCP action) | HORIZON-CL4-2022-RESILIENCE-02-01-PCP | PCP | single-stage | 12.10 .2021 | 30.03 .2022 |
| Integrated solutions for circularity in buildings and the construction sector | HORIZON-CL6-2022-CIRCBIO-02-01-two-stage | IA | two-stage | 28.10 .2021 | 15.02 .2022 |
| Sustainable biodegradable novel bio-based plastics: innovation for sustainability and end-of-life options of plastics | HORIZON-CL6-2022-CIRCBIO-02-03-two-stage | IA | two-stage | 28.10 .2021 | 15.02 .2022 |
| Circular Cities and Regions Initiative's project development assistance (CCRI-PDA) | HORIZON-CL6-2022-CIRCBIO-01-01 | CSA | single-stage | 28.10 .2021 | 15.02 .2022 |
| Social innovation in food sharing to strengthen urban communities' food resilience | HORIZON-CL6-2022-COMMUNITIES-01-04 | IA | single-stage | 28.10 .2021 | 15.02 .2022 |
| European Partnership for a climate neutral, sustainable and productive Blue Economy | HORIZON-CL6-2022-GOVERNANCE-01-02 | PCA | single-stage | 28.10 .2021 | 15.02 .2022 |

(source: Horizon Europe by European Commission)

RIA = Research and Innovation Actions
IA = Innovation Actions
CSA = Coordination and Support Actions
PCA = Programme Cofund Actions
PCP = Pre-Commercial Procurement

## 2.8   Intellectual Property Rights (IPR)

**The IPR agreement will be prepared to facilitate the exploitation of the project results.** For this general exploitation strategy, the above adapted title of the chapter is used to represent the full text in the DoA – see the DoA on page 52 of 72.

Intellectual Property (IP) from the CIRC4Life project – results including products of the mind, products of research & experimentation or products of creativity – is a valuable asset which, like physical property, can be used and traded/bought, sold, or leased and used in joint ventures. But, unlike physical property there are many more ways of extracting value. At the end of the day, a go-to-market strategy is to enhance the overall customer experience by offering a superior product and/or more competitive pricing. For the three CEBM in CIRC4Life, their go-to-market strategy cannot be a given plan for other organizations as successors to use their inside and outside resources (e.g. sales force and distributors) because conditions are different in various countries and industry sectors. Early adaptor companies may use the CEBMs as blueprints but they will have to follow their own strategy with the aim to deliver a unique value proposition to their customers and thus achieve competitive advantage.

According to the CIRC4Life Consortium Agreement in Section 8 Results (page 15 of 49), concerning the "Ownership of Results" the CIRC4Life partners agreed that results are owned by the party that generates them; "Joint ownership" is governed by Grant Agreement Article 26.2 with additions; for the transfer of results section 8.3 has five sub-sections clarifying specific cases. In Section 9.4 Access Rights for Exploitation the access rights to results if needed for exploitation of a party's own results shall be granted on fair and reasonable conditions or even royalty-free conditions. After having identified **pre-existing knowhow**, the turning of results from the project into individual intellectual properties was part of **the innovation process**, e.g. as: provisional patent

applications classified, competing patents explored, setting down the basic rules for the sharing of IP and finally the IPR for exploitation prepared.

During the project phase the partners discussed IPR as legal tools to support their commercial exploitation of the assets (IP): How to protect with IPR? What is possible with, e.g. Patents (technical inventions), Copyright (Software code, Written works, Engineering drawings, Semiconductor Topologies, etc.), Design Rights (functional or aesthetic), Database Rights (organizing, querying and retrieving data), Trademarks, Utility Models /petty patents and many others more? But not only patents came into play considering IPR. Also, some legal rights come into existence automatically, other need only registration, even confidentiality agreements (Know-how) may align between partners knowing each other or finally other IP can be kept as secrets (Trade Secrets) without sharing them. Taking these arrangements into account, they all have in common their national and timely legal force or validity.

The project partners of CIRC4Life were always unanimous on the overall **Innovation Management** and all activities related to understanding market needs, with the objective of successfully identifying new solutions and ideas in order to develop new products and services which satisfy these needs. The management of those new ideas consists in a three steps approach: 1) Secure the foundations for an uncritical use of background and existing Know-how; 2) Capture the IP (project results) by identifying all relevant IP (software, papers, know-how, etc.) together with its ownership and finally 3) Assess and Protect the IP. The following table (see Table 7) shows the potential of Intellectual Property (IP) derived from activities in the work packages:

**Table 7: CIRC4Life Solutions and Intellectual Property (own design)**

| | Name (nice and short) | Description | Owner | Protection (IPR) (open source, license, patent, etc.) | Status (demo, pilot, prototype, etc.) | Format (code, API, Paper, etc.) | Date (valid from…, submitted on…) | Purpose/ Follow up (Product/ service, company etc.) | Rollout to (industry, country, other domain) | Other developments to come | Explanation (even if IPR is not applicable) | Link (the content of the pattern is available at) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Key innovations (DOA)** | | Big data-based system to collect consumers' review data | NTU | Specific use by the CIRC4Life consortium | Applied for the project (pilot) | Software package | Oct 2019 | Software programme | N/A | N/A | software specific for this project | N/A |
| | | An innovative incentive scheme for promoting end-users to recycle and reuse their products | CIRCE | Open source | Demo | N/A | N/A | Product/ company | End-users | N/A | This is an equation able to calculate eco-credits and to link them with incentives by anyone interested in providing them in the framework of a recycling CEBM | N/A |
| | | An innovative tool for impacts' accurate measurement and decision making for circular economy, | NTU (see explanation) | See explanation | See explanation | See explanation | See explanation | See explanation | See explanation | See explanation | This covers a range of tools. Please see LCA, eco-cost/eco-credits, Mobile App, eco-incentive tools (NTU); and decision-making tools (JS/ICCS) below. | See explanation |
| | | A novel ICT platform facilitating data exchange between stakeholders along the value chain | ICCS | An online platform with access on demand | Prototype | API | Feb 2020 | For project use | N/A | Scalable by design and could be further expanded, if needed | ICCS will maintain the infrastructure and services that are deployed on it, for the duration of 3 years after the end of the project. This will allow the partners to use the services even after the project has ended, enabling further exploitation of the | https://circ4life.iccs.gr/ |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | business models developed within CIRC4Life | | |
| | First simple version of a combined interoperability / information logistical layer / escrow system for management of resource / impact / support resources data | ENV | N/A | Prototype | End-user interface, DB models | | Part of proposals covering CE information / data logistics | Proposals participation in EU Horizon Europe calls | More advanced versions supporting large scale deployment and wide use across supply chains / challenge contexts. | First version covers simpler product data entry with multiple information types. Same structure also able to support escrow / brokerage / market structures for CE solutions after additional development efforts. | http://envirodata.se/c4l_data_entry/ |
| Other CIRC4Life solutions | Online LCA | NTU | Licensed | Prototype | Software | Oct 2019 | For project use only | N/A | N/A | This software tools have been used for the project to conduct LCA | http://h2020.circ4life.net/ |
| | Social LCA | CIRCE | Open source | Demo | ISO 14040 and 14044 methodology | | Product or service | End-users, industry or public bodies | | Aplying ISO 14040 and 14044 to products or services by applying PSILCA database indicators | Deliverable D 1.2 |
| | Impact Assessment Tool | JS/ICCS | The tool is free to use by public. | Applied for the project | Web application | Oct 2019 | For project use | N/A | N/A | | https://circ4life.iccs.gr/ImpactAssessmentTool/ |
| | Eco-costs and eco-credits | NTU | Open | Published | Articles | Oct 2019 | Methods | Open to public | N/A | The methods have been published in deliverables, and papers | Deliverable D 1.3 in CIRC4Life Website and EU portal |
| | Consumer app | NTU | The app is free to use by public. Source | Published in Google play store for free download | Mobile app | Oct 2019 | App open to public | N/A | N/A | App open to public | 'CIRC4Life' App in Google store |

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| | | | | code is protected | | | | | | | | |
| | | Eco-incentive software (discount/ refund at a shop, ticket exchange, tree planting donations) | NTU | The software is free to use. The source code is not open to public | Applied for the project (pilot) | Software tool | (1) May 2021: discount at a shop; (2) Feb. 2021: ticket exchange; (3) Aug 2021: tree planting | For project use | N/A | N/A | The software tool is used to implement eco-incentives. | CIRC4Life project SharePoint |
| | | Traceability Module | EECC | API: Published  Implementation: Copyright by EECC, closed source | Pilot | RESTful Web Service + application specific user interfaces | First releases from final CI/CD pipeline in July 2019. Development finished in December 2019. | Software as a Service base module for further development | N/A | Further development in follow up projects planned | The Traceability Module has been used throughout CIRC4Life, but further development is needed for a marketable product | API document-tation: https://circ4life.eecc.info/doc/oas/  Implementation report (deliverable 5.3) and validation/evaluation report (deliverable 5.4) published |
| | Eco-label | Product eco-information available to end-users | ALIA | Methodology for eco-cost calculation public.  Eco-label generator: public access but not public source | Demo | Physical eco-label generated through web application | First release March 2020, improved versions based on LL results and internal | Product or service | End-users, industry or retailers | Further development in follow up projects planned | The eco-label was developed for the promotion of sustainable consumption to end-users. A scalation of the values for the eco-label improvement would be needed. | https://circ4life.eecc.info/access/ecolabel |

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| | | | | | | work; final version March 2021 | | | | | | |
| | | Brokerage tool (CE Marketplace) | ALIA/ICCS/ GS1G | The tool is free to use by public. | Applied for the project | Web application | May 2020 (deliverable submission) | For project use. | N/A | N/A | N/A | https://circ4life-brokerage.iccs.gr/ |
| | | Consumer eco-credits awarding scheme | CIRCE | Open source | Demo | ISO 14040 and 14044 methodology | N/A | Product or service | End-users, industry or public bodies | N/A | Aplying ISO 14040 and 14044 to products or services by applying PSILCA database indicators | Deliverable D 1.2 |
| | | Feedback / Remote Demo infrastructures to support effective end-user feedback and demonstrations | Enviro Data | N/A | Operational | End-user interfaces, DB models | N/A | Generic support structures to be used in future proposals, services and product offerings | Proposals participation in EU Horizon Europe CIRC calls | More advanced services for external access and statistics analysis etc. | Feedback / remote demo structures developed to support more efficient end-user feedback and demonstration participation for the project. Can be integrated into other external systems and allows analysis of end-user interactions for a wide range of external systems. | http://envirodata.se/c4l_data_entry/feedback.htm, http://envirodata.se/c4l_data_entry/remotedemo.htm |

After the development of CEBMs, demonstrators and solutions during the project phase of CIRC4Life and thereafter during a certain period to protect individual IP, some industry partners have the plan to check their relevant IP identified in order to undertake market or competitor surveys. But also the opportunity of creating open source licences which just form another type of licence will be taken into account for further exploitation. For standard based solutions three advantages of open source are obvious: a) the easier access to source code, b) commercial use is welcome, even intended and c) community building by developers, added-value suppliers and users is included supporting the approach of blue-printing CE solutions in general.

## 2.9   Interoperability and the role of standardization

In the core of the CIRC4Life project stands the ICT platform and with its connected other technology solutions.

An important factor for exploitation of CIRC4Life results is the interoperability of the ICT platform developed within the project with different processes and products that can be found through different sectors and countries. The consortium has made strong efforts in defining solutions to this barrier by bringing on the one hand as demonstrator's products of very different characteristics and requirements, which will ensure that CIRC4Life outputs cope with a wide number of specifications and on the other hand by integrating established standards for the management of product lifecycle assessment and the sharing of captured data.  For this reason, and as CIRC4Life results are opposite to fragmentation and are based on standards, they have a huge potential and will be at the forefront of CE solutions in the future.

The use of standards and software packages that enable the traceability of products, components and materials along the value chain has enabled the industry-wide introduction of distributed ledger technologies (e.g. blockchain). This was made possible by supporting the development of secure standards for open data formats (e.g. product passports) and the associated exchange of circularity-related data (e.g. product exchange / status, maintenance, repair). Standard-based and collected traceability data (e.g. product history, product passport) were used to improve statements on the condition of reused, refurbished and reconditioned products / components on online platforms and to strengthen the confidence of market participants. Through the development of quality standards and labels for the reliability of remanufactured products and their built-in components, it was possible to gain further confidence in their use. From this standardization perspective, it was a challenge to integrate existing GS1 standards into the ICT platform of CIRC4Life for the different demonstrators with their CEBMs. Finally, the resulting multifaceted processes and products with their need of different types of standards are a blueprint for their coming application in other countries and industry sectors.

### Interoperability

Proprietary and non-coordinated standards make it difficult to integrate additional companies into the supply chain and require a high degree of coordination. For the interoperable sharing of information among stakeholders, data must be exchanged via a standardized, international and industry-independent interface, such as the EPCIS interface standard (ISO/IEC 19987). GS1, as a neutral and non-profit standardization organization with its global outreach, strongly recommends commonly accepted and standardized models and syntactic structures to increase interoperability in logistics. While it is impractical to mandate or even enforce a common data model for all information exchange over the CIRC4Life network now and in the future, it certainly makes sense for organizations exchanging information over the CIRC4Life network to voluntarily use common semantic models and also syntactic structures in their exchanges. In this way, these organizations would be able to communicate with all other organizations over the CIRC4Life network that also use the same models and structures, without requiring any additional effort to initiate communication related to semantic and/or syntactic differences.

The EPCIS data model (ISO/IEC 19987 and ISO/IEC 19988) is designed to include all the relevant what, when, where, and why information so that a business application can understand what is happening in a business process step. However, sometimes a business application needs information beyond the data elements defined in the EPCIS standard, such as in the CIRC4Life project for recycling/reuse. However, the EPCIS standard has

been built to be modular, extensible, and in different layers so that some flexibility for extension is possible, including for industry-specific data. Thus, an EPCIS message can be extended by further information at any time. The main point regarding EPCIS further development are the EPCIS "ECO" Extensions developed by the EECC. These have been described in detail in D5.2 and D5.3, especially section 2.1, for the "application" in CIRC4Life. However, developing your own extension has the disadvantage that these extensions are not standardized and, for example, can only be interpreted in one industry. In order to be able to network across application boundaries and to ensure an exchange of information in the different applications, the information must be semantically interoperable.

An internationally valid GS1 standard and also an extension of a standard can be initialized by submitting a corresponding work request. Among other things, this must not only specify the user requirement, but should be characterized by a sufficiently high level of support from companies, solution providers and GS1 country organizations (among other things, GS1 requires twelve representative companies and six GS1 country organizations to ensure the relevance of a work request). Ideally, the supporting companies here should represent multiple industries and come from different geographic regions of the world. In order to spread the idea of further developing the EPCIS standard, an initiative called Cyclance was founded at the EECC to bundle EPCIS solutions on the topic of sustainability and to further disseminate the information. The idea here is to show how standardization can easily transfer sustainable processes from one industry to another (meat to fish or fruit...). The conclusions drawn from the project regarding the Eco Extensions will be used to test them in further applications and research projects, and to transfer them to standardization in the future.

In addition, an own test EPCIS was installed at the EECC to make the backend visible for interested parties. The demonstrator is also used to present the CIRC4Life story and especially the topic of sustainability in the EECC InnovationLab and in seminars and to draw attention to the project in detail. In collaboration with Enviro Data, it was possible to develop a link with a web interface for tracing a product - using an internal web-based tool from EPCIS - for another visualization. Another option evaluated in parallel were the use of EECC SOAP services and approaches using JSON. These two additional approaches can be managed through information types and end-user GUI in the interoperability interface. In terms of exploitation, these core functionalities in the interoperability layer in combination with additional functionalities form the basis for a number of EU H2020 / Horizon Europe proposals for a wide variety of sectors.

Due to the current situation, the visualization of the developed solutions could not be demonstrated to the general public at the InnovationLab in the EECC. In order to spread the CIRC4Life idea, the production of a small film was initiated in November 2021, which will be completed in the coming months. This will be done with the involvement of the English and Spanish partners.

**Standardization**

The term "standards" must be distinguished from the term "standardization". This is important because colloquially these terms are sometimes confused or used as synonyms:

- Standardization is the process of developing, defining and establishing standards, while
- Standards are the result of this process.

In the CIRC4Life context, it is primarily the standards that are the focus, not the standardization process. CIRC4Life is not about developing standards, it is more about using standards, and although CIRC4Life is not focused on developing new standards, the work done in the project will certainly lead to working out where there is still a need for standardization. This will allow gaps in processes to be analysed and feedback on existing or new standards to be provided, which can be valuable input for further standards development.

The CIRC4Life project does not undertake standardization rather the project explores the need for standards within the use cases of the project. CIRC4Life identifies through the use cases, the relevance and need, and the benefits of adopting standards. Rather, recommendations for the use of standards are developed to support

implementations. For example, existing standards are adopted and implemented more broadly. This helps to strengthen the impact of these standards, which in turn helps to secure investments.

## 2.10  Feedback from the OIC 2021 as input for further exploitation

The second OIC was held on May 27 and 28, 2021 and led by LAUREA. Due to the Covid-19 pandemic, it was conducted digitally. While on day one the consortium partners dealt with the evaluation of the DEMOs, on day two external experts were invited to discuss and evaluate the CEBMs. For the exploitation strategy, the results of the second day are important as they highlight the potential of the CEBMs. The participants shared both positive aspects of the models and potential for further development. In addition, critical voices were also collected, which should be taken into account exploiting the results.

### CEBM Co-Creation of Products and Services

The potential of the CEBM Co-Creation of Products and Services was perceived as very positive for product design specifications and as important for achieving SDGs. It was stated that it is systemic and that a top-down-bottom-up model is required. The experience was shared that the Living Lab approach to facilitating co-creation was extremely beneficial in facilitating product/service development in alignment with key stakeholder requirements. It also helped develop key relationships with potential business partners.

This CEBM was evaluated as an excellent idea for everyone, including consumers and producers which could be implemented in different sectors or industries. Co-creation is perceived as crucial in terms of circular products, while it must be practical and economical for consumers.

It was suggested to further develop the Impact Assessment Tool and the online LCA to ensure that they are ready for the market. Only if these tools can be used by industry the CEBM can be successful. It was asked if it would be useful limiting the eco-credits to be used only for recycled/reused products to avoid increased consumption of new products. It was also suggested that the online LCA tool could be used to offer instant results and provide simulation tools to companies by changing parameters and getting instant results based on different parameters. Another question was if companies can reduce the cost of production and if the products and services will be relatively cheaper for the consumers when co-creation is adopted by them. In addition, the hope was expressed that co-creation will substantially reduce the expenditure spent on ads.

There was some doubt among participants that the business model would work in all cases. Some participants were sceptical about the practicality of the tool, as most clients want to maintain their consumption habits. Some of them may not have a choice because of the price. Moreover, according to the participants, it is important to consider the aspect of convenience. This was assessed sceptically, as this CEBM seems to be too complex to explain. A few participants state that this type of solution would be an incentive for excessive consumption. One critical comment addressed the question of whether end consumers had enough knowledge to participate in the design of sustainable products. Some participants had the opinion that the impact assessment tool and online LCA are not market ready, yet. They say that the success of this CEBM being widely adopted does depend on large part about these tools being ready to use by industry.

### CEBM Sustainable Consumption

This CEBM is seen as encouraging in terms of transparency and motivation. The eco-label is evaluated as a good tool to make all necessary information transparent to the customer. According to some participants, the incentives offered by CEBM Sustainable Consumption are very important because the majority of the population is not driven by the well-being of the planet.

Advice was given to find strong partners, such as powerful retailers, organized farmers as suppliers, regional authorities and public procurement to spread the system. Some participants argued that the incentives offered by this CEBM should be complemented by raising awareness because it is crucial to inform consumers. At the same time, the challenge is to engage all affected consumers, not just the interested ones. The demand was

D8.3 - Report on the activities of exploitation and disseminations

expressed to offer a robust open office software for LCA. Furthermore, regulations on mandatory labelling are needed at a central level (globally) to get many companies on board in order to ensure comparability between products.

It was criticised that this CEBM contains another eco-label, although there are already too many. A few participants asked about the financial model to sustain this tool and who the owner of this tool is going to be. They also asked how to ensure that this CEBM covers the traceability of products not made in countries which are not part of the system or products that are produced in different places. From the perspective of some participants, consumers need awareness rather than incentives to participate. Some doubts were raised about the wording, especially the use of the words "circular" and "sustainable". It was not clear whether this business model aims to promote circular approaches to consumption or sustainable consumption, which some participants felt were quite different concepts and could lead to confusion.

## CEBM Collaborative Recycling & Reuse

In general, this CEBM was rated as the most mature. During the OIC, it was praised that it is good to promote reuse and recycling of products, especially reuse and remanufacturing. It was also noted that a clear goal and dedicated activities are visible here to achieve this goal. The business potential was valued as high.

The advice was given to analyse the bins usage ratio (efficiency and effectiveness) per location (rural, urban, different countries) and kind of waste or other KPIs. The praise was expressed that this CEBM is good to encourage reuse and recycling of products, especially reuse and remanufacturing. The recommendation was given to ensure that the environmental benefits are not offset by the supply chain logistics implications.

At first, it was not clear to everyone that recycle and reuse also covers remanufacture, repurpose and repair. A few participants argued that the application is very difficult for the users. At the same time, it was seen critically that the incentive system is dependent on the user's data usage. The question was asked if a deposit return scheme for electronic products would be a simpler and more effective solution. It was not clear how the credits are calculated to make it worthwhile for a wasteholder to return their appliances. As with CEBM Co-Creation of Products and Services, it was again criticised that this solution is also rather consumer-oriented, although it is primarily intended to help companies in the transition to a (more) CE. It has been said that more incentives could lead to more waste. In the case of electronics, this is even intentional, as they are usually left in a drawer.

## Conclusion

With the help of the OIC, valuable insights were gained that CEBM owners in particular can use for further exploitation. The internationality of the participants and the diversity of the sectors were also beneficial to the results of the event. All in all, the experts provided mostly positive feedback on the CEBMs (see Figure 16 below). For this reason, all three business models were fully validated. In addition to the positive aspects, the participants identified further valuable development potential that can be used for an optimised exploitation in the future. The critical feedback and questions should also be considered.
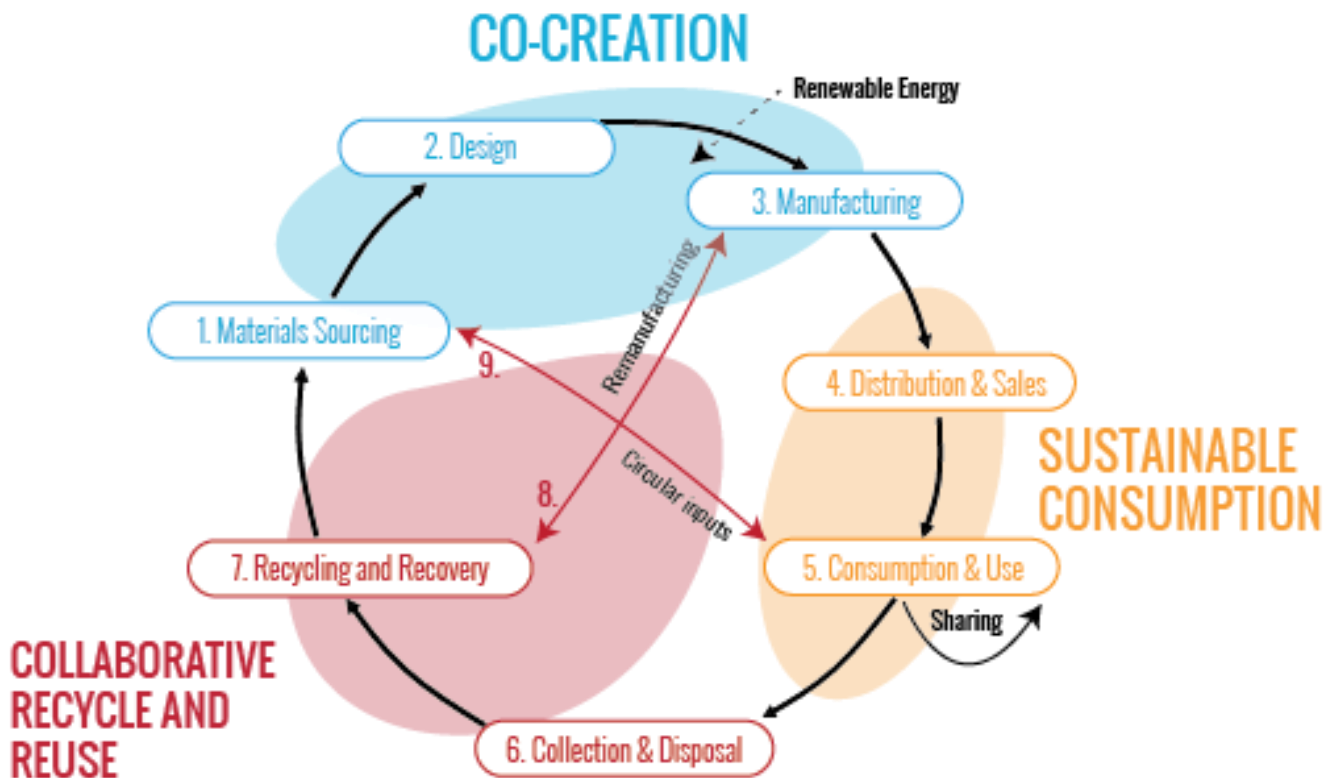
Figure 16: Architecture of the CEBMs
(Designed by CIRC4Life)

By applying the business models, companies can achieve significant competitive advantages. It is important to bear in mind that the three CEBMs are optimally not applied separately for business, but in a jointly applied cycle. Therefore, they must function in their entirety without leading to inefficiencies. This is only possible through collaborations and common standards, as well as through joint product and service design. For this reason, the requirement for policy is to create the necessary framework conditions, such as infrastructure for collaboration.

This approach was also discussed by the experts. It was remarked that all three CEBMs are smoothly interconnected and thus contribute greatly to CE. However, they are not only interrelated, but are a prerequisite for each other to function optimally. The application of only individual CEBMs, on the other hand, makes little sense. Depending on the industrial sector, however, different emphases and characteristics can make sense.

## 2.11  Preparation for Policy Recommendation

In the DoA of the CIRC4Life project in WP8 Exploitation and Dissemination it is described that task T8.4 Policy Alignment task lead CEPS with partners involved reviews current policies and regulations as well as identifies barriers and enablers of the circular business models. They were developed and demonstrated in this project in order to serve as a foundation for cross-cutting policy recommendations what also is part of exploitation. Regarding this deliverable D8.3 here, T8.4 thus will facilitate its own exploitation and implementation of the outcomes of the project with policymakers, the industry and academia in its specific deliverable D8.2 Report on policy alignment including: i) Inventory of policies and regulation, ii) Barriers and enablers to the implementation of CEBMs and iii) Policy insights including recommendations. Recommendations to policy makers and related institutions about the CEBMs are best to be founded on real and concrete intentions from

stakeholders during the project phase. The three CEBMs and the related Demos therefore form the basis of the inquiries by T 8.4 which are now compiled in the respective report D8.2. In this case D8.3 here referrers to the corresponding results of T 8.4. This public report D8.2 which will be freely available is structured in three sections – see above i) to iii) – and provides in the first section i) an overview of relevant policies and legislation at the EU level, as well as within Spain and the UK where CIRC4Life demonstrations took place. The second section ii) is devoted to an analysis of barriers and enablers to the implementation of CEBMs. This section presents trends in both the EEE and agri-food sectors before moving on to describe the methodology used for the analysis and evidence from the analysis of case studies of firms implementing CEBMs. Section three iii) concludes with policy messages and recommendations.

From the perspective of interoperability and standardisation (see section 2.9) there is a huge potential for policy makers to raise the awareness for standards to interlock CEBMs with the achievements of the SDGs. CEPS already highlighted some of the interlocking elements and draws the attention to weaknesses in their implementation, e.g. weak enforcement of WEEE requirements, limited use of circularity criteria in public procurement tenders, lack of rules for transparency of across supply chains, limited circularity requirements in existing eco-design rules, lack of international standards for circularity practices and lack of strict rules and incentives for collecting small electronics are among the key identified policy-related gaps raising challenges for businesses operating CBMs. On the other hand, provision of funding for R&D projects, launch of awareness-raising campaigns, support for knowledge sharing platforms and business partnerships, development of enhanced product labels including CE information, provision of tax incentives for circular processes and products, development of international forums for policy dialogue and expertise exchange, establishment of standards for recycling and refurbishment and support for developing technical capacities are some suggested policy options for boosting CE business practices.

Renown experts proactively reinforce the CEBMs to policy-makers because of their role as an important success factor for companies:

- costs and cost reduction
- risks and risk reduction
- sales and profit margin
- reputation and brand value
- attractiveness as an employer, and
- innovation and innovativeness (Circular Economy Initiative Deutschland (Ed.) 2020).

To summarize, overarching policy recommendations for successful implementation of CEBMs are in different categories of regulations, standardisation, incentives, infrastructure and public services:

1. Invest in experimentation with new CEBM and related radical innovations in products, processes, and organisational forms
2. Develop an economic market framework with true-cost pricing and provide targeted support for advanced CEBM practices
3. Further develop CEBM regulatory framework and remove related barriers
4. Support the development and harmonisation of product and material-level for CEBM
5. Strengthen user competency and information availability regarding CEBM in the market
6. Make public institutions lead by example for CEBM through government procurement
7. Institutionalise a long-term transition to CEBM by a national and European central body

# 3 Dissemination

This report D8.3 document is the logical progress of the previous deliverable D8.1 Plan of exploitation and dissemination released in July 2018. The D8.1 reports the dissemination and exploitation plan of the CIRC4Life project and covered the dissemination and exploitation strategies, channels and activities to implement the strategies, and other related issues including resources and schedule for the implementation, as well the risks and mitigation measures. D8.1 was the first task of WP 8 Dissemination and Exploitation. The rest tasks of WP 8 were also covered in Section 3 of this document, including 'Exploitation', 'Participation in publications, workshops, seminars, conferences and trade fairs/exhibitions', 'Policy alignment', and 'Training, teaching and education'.

It should be emphasised that a large part of the planned activities was scheduled for a period when a global pandemic limited many of the possibilities for implementation (Further explanation of the impact of the Covid-19 pandemic can be found in chapter *1.3 Impacts and Changes to the Plan due to COVID-19*). Nevertheless, many of the activities could be carried out as planned or in an adapted version. Thus, the initial planned result of dissemination was achieved.

By disseminating the results achieved through CIRC4Life, different stakeholder groups are addressed. These include policy makers and schools (see tables below for more), who received interim results and were sensitised, interested and informed about CE with the help of the project. The main target groups are businesses, public organisations and customers. The needs that will be addressed are CE as well as saving resources (consuming less and using reusable raw materials). Another component is the communication about how the project has proceeded and thus what share it has in consumption. Measurable results are achieved. Stakeholder benefits are made up of various attributes. For example, CEBMs become an integral part of business management through measurability and controllability and serve to guide new investments. In addition, CEBMs become an essential component of risk management and a unique selling proposition that can achieve competitive advantages.

The general objective for contacting each target group is that they apply the findings of the project (e.g. municipalities and schools). In this way, the intelligent bins that were applied in Getxo could serve as a model for other cities in the Basque Country or for Spain and the whole of Europe. The general message to be conveyed is about circularity in business. You have to start at one point and expand from there with systematic management. This also includes strategically acquiring multipliers one by one.

How the messages are conveyed can be seen in the tables below. Here you will find all the information about scientific conferences, workshops, seminars, trade fairs and exhibitions that have taken place, as well as social media posts, press releases and publications in international peer-reviewed journals, books, reports, standards and regulatory instruments and directives. These activities targeted at the following key audiences: general public, academia, industry, and policy makers. Any interest will be followed up through the CIRC4Life website, research publications, trainings, consulting activities of DEMO partners and others. Through this broad use of different communication channels, the project ensures an effective exploitation and dissemination scheme for the follow-up.

According to the dissemination plan developed in D8.1, the following dissemination activities (see Table 8 to Table 12) have been conducted during the CIRC4Life, e.g. publications in international peer-reviewed journals with open access, presentations in international conferences, presentations in international seminars, presentations in international/national workshops, presentations in international/national trade-fairs. All publications are of open access (Gold or Green) and the EU funding have been acknowledged.

## 3.1 Scientific Publications

**Table 8: Scientific Publications (as of 06/09/2021) (designed by CIRC4Life)**

| No. Item | Publication Team | Publication Title | Issue No., Volume No., DOI | ISSN or eSSN | Authors | Title of the journal or equivalent | Publication Date/ Month/ Year | Publisher | Place of publication | Page Number | Open Access (Gold/ Green/ not) | Impact factor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Articles in journals | | | | | | |
| 1 | CIRCE | Eco-credit system to incentivize the recycling of waste electric and electronic equipment based on a thermodynamic approach | 35 | 1742-8300 | Alicia Valeroa, Ricardo Magdalenab, Guiomar Calvoc, Sonia Ascasod, Fernando Círeze, Abel Ortego | International Journal of Exergy | 05/2021 | Inderscience | | 132-154 | Green | 1.383 |
| 2 | ICCS, GS1G, Alia | Circular Economy Matchmaking Framework for Future Marketplace Deployment | 10.3390 /su1310 5668 | | Lekawska-Andrinopoulou L., Tsimiklis G., Leick S., Moreno M. and Amditis A. | Sustainability | 18/05/2021 | MDPI | | | Gold | 2.576 |
| 3 | NTU | Lifecycle assessment of domestic lighting products | 10.1007 /s41207 -020-00180-0 | | Shuyi Wang, Daizhong Su, You Wu and Zijian Chai | Euro-Mediterranean Journal for Environmental Integration | 08/2020 | | | Article 41 | Gold | |
| 4 | NTU | Development of a mobile application system | Issue 22, Volume 12, doi:10.3 390/su1 2229675 | | Hua Huang, Daizhong Su, Wenjie Peng and You Wu | Sustainability | 19/11/2020 | | | Page 1-24 | Gold | 2.798 |

| # | | Title | DOI/ISBN | | Authors | Journal/Conference | Date | | | Pages | Access | IF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | NTU | Sustainable Product Development and Service Approach with its Application in Industrial LED Lighting Products | 27 (2021), 10.1016/j.spc.2021.04.003 | | Shuyi Wang, Daizhong Su, Ming Ma and Wentao Kuang | Sustainable Production and Consumption | 04/06/2021 | | | 1808-1821 | Green | 3.77 |
| 6 | NTU | LCA of an industrial luminaire using product environmental footprint method | 305 (2021), 10.1016/j.jclepro.2021.127159 | | You Wu, Daizhong Su | Journal of Cleaner Production | 19/04/2021 | | | Article No. 127159 | Gold | 7.491 |
| 7 | IEIA | Sustainable solutions for fresh vegetable packaging in organic farming. | | | B. Michaliszyn, J. Krupanek, M. Kalisz. | Sustainability | | | | | Gold | 2.576 |
| 8 | IEIA | Environmental Life Cycle Assesment of meat productss and the potentioal of its improvement | | | B. Michaliszyn, J. Krupanek. | Sustainability | | | | | Gold | 2.576 |
| **Publications in conference/workshop proceedings** | | | | | | | | | | | | |
| 1 | ICCS, ENV, NTU, GS1G, EECC | An ICT Platform Facilitating Circular Economy Business Models | 10.18690/978-961-286-353-1 | | Georgios Tsimiklis, Miltiadis Koutsokeras, Stenerik Björling, Wenjie Peng, Sebastian Schmittner, Tim Bartram & Angelos Amditis | Second International Conference on Technologies & Business Models for Circular Economy: Conference Proceedings | 05/2020 | | | Pages 35-46 | Gold | |

| 2 | NTU | Advanced integrated manufacture by application of sustainable technology through product lifecycle: a circular economy approach | 10.1145 /335833 1.335836 0 | | Daizhong Su, You Wu, Zijian Chai | Proceedings of the 2019 international Conference on Artificial Intelligence and Advanced Manufacturing, Dublin | 17-19/10/2019 | | | Paper number AM19436 | Green | |
| 3 | LAU | Open Innovation Camp (OIC) – A Tool For Solving Complex Problems Rapidly. | | | Santonen, T.; Nevmerzhitskaya, J. ; Purola, A. & Haapaniemi, H. | Proceedings of the OpenLivingLab Days Conference. Co-creating Innovation: Scaling-up from Local to Global. Brussels: European Network of Living Labs, 226-241 | 09/2019 | | | 226-241 | | |
| 4 | LAU | Mind The Gap: Understanding and communicating the business value of co-creation. | | | Seikkula, S., Nevmerzhitskaya, J., Purola, A. | In Digital Open Living Lab Days proceedings, p. 38. | 09/2020 | | https://issuu. com/enoll /docs/proc eedings_final | 38-48 | | |
| 5 | NTU, KOS | Environmental impact analysis through the industrial lighting product life cycle' | 10.1007 /978-3- 030- 51210- 1_40 | | Shuyi Wang, Daizhong Su, You Wu, Shifan Zhu, Wentao Kuang and Ming Ma | Proceedings of the EU-Mediterranean Conference on Environmental Integration | 10-13/10/2019 | | | 239-243 | Green | |
| 6 | NTU | Life cycle assessment-based method for sustainable consumption and product service | | | Shuyi Wang, Daizhong Su | Proceedings of the 26th IEEE internaional conference on automation and | 31/08-01/09/2021 | | | | | |

D8.3 - Report on the activities of exploitation and disseminations

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| | | | | | computing (ICAC'21) | | | | | | |
| 7 | NTU | Application of LED Lighting in Ultraviolet Curing with Circular Economy Benefits | | | Wenjie Peng, Daizhong Su | Proceedings of the 26th IEEE International conference on automation and computing (ICAC'21) | 09/2021 | | | | Green |
| 8 | LAU | Board game for co-creating ecosystem based circular economy business models | | | Santonen T., Purola A., Nevmerzhitskaya J. | Bitran I., Conn S., Gernreich C., Heber M., Huizingh K., Kokshagina O., Torkkeli M. (Eds.)., ISPIM Connects Bangkok: Partnering for an Innovative Community - Bangkok, Thailand, 1-4 March 2020., International Society for Professional Innovation Management. | 03/2020 | | | | |
| 9 | NTU | Comparative material selection for sustainable design of lighting product underpinned by life cycle assessment (510) | | | Zijian Chai, Daizhong Su | Proceedings of EMCEI-2021 | 10-13/06/2021 | | | Paper no. 510 | |

| 10 | LAU | Living labs and Circular Economy: A multiple case study. | | | Santonen, Teemu | Proceedings of ISPIM Connects Global 2020: Celebrating the World of Innovation - Virtual | 06-08/12/2020 | | | | | |
| | | **Chapters in books** | **Issue No., Volume No., DOI** | | | | | | | | | |
| 1 | NTU | Review of Life Cycle Impact Assessment (LCIA) Methods and Inventory Databases | 10.1007 /978-3-030-39149-2_3 | ISBN 978-3-03-039148-5 | You Wu, Daizhong Su | in Daizhong Su (ed.) 'Sustainable Product Development: Tools, Methods and Examples', Springer. DOI: 10.1007/978-3-030-39149-2_3 | 05/2020 | Springer | | Pages 39-55 | Green |
| 2 | NTU | Eco-accounting ifrustracture | 10.1007 /978-3-030-39149-2_5 | ISBN 978-3-03-039148-5 | Daizhong Su, Wenjie Peng | in Daizhong Su (ed.) 'Sustainable Product Development: Tools, Methods and Examples', Springer. DOI: 10.1007/978-3-030-39149-2_5 | 05/2020 | Springer | | Pages 72-84 | Green |
| 3 | NTU | Application of Information and Communication Technologies for Eco-Accounting | 10.1007 /978-3-030-39149-2_6 | ISBN 978-3-03-039148-5 | Wenjie Peng, You Wu and Daizhong Su | in Daizhong Su (ed.) 'Sustainable Product Development: Tools, Methods and Examples', Springer. DOI: | 05/2020 | Springer | | Pages 85-126 | Green |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 10.1007/978-3-030-39149-2_6 | | | | | |
| 4 | NTU, JS | Environmental Impact Assessment of Farming with Combined Methods of Life Cycle Assessment and Farm Carbon Calculator | 10.1007/978-3-030-39149-2_12 | ISBN 978-3-03-039148-5 | Daizhong Su, Jonathan Smith, You Wu and Zhongming Ren | in Daizhong Su (ed.) 'Sustainable Product Development: Tools, Methods and Examples', Springer. Pages 249-270 DOI: 10.1007/978-3-030-39149-2_12 | 05/2020 | Springer | | Pages 249-270 | Green |
| 5 | LAU | Ethical considerations in Living Labs | 144 | ISBN: 978-951-799-580-1 | Nevmerzhitskaya, J | Ethics as a resource in RDI projects and educational development, Nikula, Sari Sarlio-Siintola & Valdemar Kallunki (eds.), Laurea publications | 2020 | Laurea | https://www.theseus.fi/bitstream/handle/10024/346440/Laurea%20julkaisut%20144.pdf?sequence=5&isAllowed=y | 89-96 | |
| | | **Others** | | | | | | | | | |
| 1 | LAU | Living Labs: from abstraction to implementation. Case CIRC4LIFE Living Labs. | | | Nevmerzhitskaya, J, Purola, A, Santonen, T | Laurea Journal | 31/05/2019 | | https://journal.laurea.fi/living-labs-from-abstraction-to-implementation-case- | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | circ4life-living-labs/ | | | |
| 2 | LAU | From project-based thesis to the best research paper award – success story of RD&I and education integration | | | Nevmerzhitskaya, J | Laurea Journal | 01/10/2020 | | https://journal.laurea.fi/from-project-based-thesis-to-the-best-research-paper-award-success-story-of-rdi-and-education-integration/ | | |
| 3 | LAU | CELLL – a toolkit for co-creating circular economy business models. | | | Purola, A., Nevmerzhitskaya, J, Santonen, T | Laurea Journal | 27/11/2019 | | https://journal.laurea.fi/celll-a-toolkit-for-co-creating-circular-economy-business-models/ | | |
| 4 | LAU | Hankkeen tuotoksesta oppimisen välineeksi (Example of project results transferred into educational tools - CELLL-toolkit) | | | Purola, A., Anttonen M. | Laurea Journal | 03/03/2021 | | https://journal.laurea.fi/hankkeen-tuotoksesta-oppimisen-valineeksi/#d364cd90 | | |
| 5 | LAU | Experiences in facilitating the CIRC4Life OIC | | | Purola, A. Lähdeoja S., Hannula J. | Laurea Journal | tbd | | | | |

## 3.2    Conferences, workshops and seminars

**Table 9: Dissemination and Exploitation activities (as of 07/09/2021) (designed by CIRC4Life)**

| No. Item | CIRC4Life team participated | Participation in conferences, workshops and seminars | Dates/Month /Year | Location | Organizer | Estimated Number of persons reached | Notes |
|---|---|---|---|---|---|---|---|
| 1 | ALIA | Kick-off meeting MED RE-LIVE WASTE project | 25-27/07/2018 | Sassari, Italy | University of Sassari | 30 | ALIA presented the CIRC4Life project in the general presentation of the company in the kick-off meeting |
| 2 | ALIA | Conference on Rural Economy. An opportunity for rural development. The circular economy as an engine of progress. | 29/03/2019 | Abarán (Region of Murcia), Spain | A.D.R.I (Association for the Integrated Rural Development of the Municipalities of La Vega del Segura) | 35 | Juan Carlos Segura participated in a roundtable called "Circular Economy and rural development".  In there, CIRC4Life project was presented and explained. |
| 3 | ALIA | DayOne Innovation Summit Murcia | 10/03/2020 | Murcia (Region of Murcia), Spain | CaixaBank | 50 | Participation in a round table about « Innovation in the Agri-Food sector» together with two other companies. |
| 4 | IEIA | IEIA Seminar: Innovative solutions supporting circular economy, CIRC4Life project example | 16/09/2021 | Online | Institute for Ecology of Industrial Areas | 35 | Presentation of the project and our activities supporting two demonstrators, including environmental assessment of selected meat products and the aspect of packaging to be used by organic farms. The seminar will be conducted in Polish. |
| 5 | ALIA | Sustainable Development and Climate Change Awards of the Region of Murcia | 07/05/2021 | Murcia, Spain | Government of the Region of Murcia | 500 | ALIA was one of the winners: https://www.agrodiario.com/texto-diario/mostrar/2876274/trece-distinciones-x-edicion-premios-desarrollo-sostenible-cambio-climatico |
| 6 | ALIA | Workshop with the municipality of Lorca for the explanation of biowaste pilot project and the donation of the incentives to the citizenship | 04/06/2021 | Lorca, Spain | Municipality of Lorca, ALIA | 50 | |

D8.3 - Report on the activities of exploitation and disseminations

| 7 | ENV | Digital Roadmap for Circular Economy | 23/12/2018 | Brussels | EPC | 30 | Presenting information logistics challenges for CE and examples from CIRC4Life concepts. |
|---|---|---|---|---|---|---|---|
| 8 | ENV | Sustainable Products in a Circular Economy - Circular Products in a Digital Age | 26/09/2018 | Brussels | EU Commission, EPC, IEEP | 200 | Presenting overall information CIRC4Life, covering challenges for ICT and information logistics for CE solutions |
| 9 | ENV | Omnis Regional Development Conference - Europe | 22/05/2019 | Wesel, Germany | Omnis Software - European Office | 80 | Presented CIRC4Life as a project, use of Innovation Camps, Living Labs and initial prototypes for consumer toolsets and interoperability systems. |
| 10 | ENV, LAU, MMM | WCEF 2019 | 04/06/2019 | Helsinki | SITRA, Finland | 15 | Contact made and strong interest from EU Support Group G7 / G20 – CE workgroup - presented potentials with Innovation Camp, eventual policy development track and future exploitation abilities. MMM with the support of Laurea organised a campfire discussion on how to engage end-users on the development of business models and presented the CIRC4Life activities in this respect. 12 persons attended. |
| 11 | ENV, CEPS | Seminar on the role of families in the CE during EU Green Week - Make Mothers Matter | 14-15/05/2019 | Brussels | Make Mothers Matter and European and Economic and Social committee | 50 | Technical concepts support covering CIRC4Life, initiated contacts and great interest from Head of Unit Multilateral Environmental Cooperation and actors from EASME developing future work programmes. |
| 12 | LAU | OLLD2019 | 3-5/09/2019 | Thessaloniki, Greece | ENoLL | 100 | Organizing and facilitation workshop on CEBM |
| 13 | LAU | OLLD2019 | 3-5/09/2019 | Thessaloniki, Greece | ENoLL | 1000 | Innovation paper: Open Innovation Camp as a tool for stakeholder engagement |

| 14 | LAU | OLLD2019 | 3-5/09/2019 | Thessaloniki, Greece | ENoLL | 100 | Doctoral consortium paper on CEBM |
| 15 | LAU | ISPIM Connects Bangkok | 01-04/03/2020 | Bangkok | ISPIM | 1000 | Santonen presented a paper: Santonen, T., Purola, A., Nevmerzhitskaya, J. 2020. Board game for co-creating ecosystem based on CEBMs |
| 16 | LAU | DLLD2020 | 02-04/092020 | online | ENOLL | 800 | Presentation of the paper: "MIND THE GAP: Understanding and communicating the business value of co-creation", by Seikkula, Nevmerzhitskaya, Purola (top contribution session) |
| 17 | LAU | Laurea Reserach and Development Days | 02.10.2019 | Espoo, Finland | LAU | 100 | Presentation by Nevmerzhitskaya and Santonen on CIRC4Life Living Labs |
| 18 | RISE and LAU | The 9th international conference on Life Cycle Management | 04/09/2019 | Poznan, Poland | Poznan University of Technology | 1000 | Focus of the presentation is on the Innovation Camp method as enabler of CE approaches. We plan to present some overall information/slides on CIRC4Life (e.g. from template PPT) but mainly focus on the Innovation Camp method as enabler for circular economy. We will also communicate with ICCS as they also have an abstract accepted for this conference (although with another focus). |
| 19 | NTU | Symposium on CE and Sustainable Development in Collaboration | 11/01/2019 | Shanghai, China | Sustainable Development Forum of China and Ecovene | 150 | Invited speech entitled 'Circular economy and an eco-accounting infrustructure approach of the CIRC4Life project supported by the European Commission H2020 programme' (Authors: Professor Daizhong Su and Dr Wenjie Peng) |
| 20 | NTU | Living Lab workshop | 28/05/3019 | Telford, UK | Lau, KOS | 40 | Introduction to the CIRC4Life project presented by D Su |

| 21 | NTU | Living Lab workshop | 29/05/2019 | Telford, UK | Lau, KOS | 40 | Sustainable product development |
|----|-----|---------------------|------------|-------------|----------|-----|--------------------------------|
| 22 | NTU | International Conference on Artificial Intelligence and Advanced Manufacture, | 18/10/2019 | Dublin, Ireland | Conference scientific and organising committees | 250 | Professor Daizhong Su gave an invited speech entitled 'Circular economy approach for sustainable product development' which presented the CE approach, business models, and examples of the CIRC4Life project. |
| 23 | NTU | International Workshop on Advances in Cleaner Production, | 13-15/11/2019 | Sanya, China | Beijing Normal University ,China and Puaulista University, Brazil | 500 | Give a presentation entitled ' integrated approach for sustainable production of LED lighting products' where the CIRC4Life project outcome is presented. |
| 24 | NTU, | Workshop on sustainable development | 06/06/2019 | NTU | Business School of Nottingham Trent University | 100 | Presentation 'The EU H2020 supported CIRC4Life project: CE business module, demonstrations and supporting techniques' presented by D Su |
| 25 | NTU, KOS | Webinar 'Incentivising new circular economy business models' | 14/10/2020 | online https://www.ceps.eu/ceps-events/incentivising-new-circular-economy-business-models/ | CEPS | 25 | Professor Daizhong Su (NTU) gave a presentation about the CIRC4Life project and Dr Ming Ma give a presentation about CIRC4Life approach in industrial lighting products. |
| 26 | NTU, ICCS | World Circular Economy Forum | 22-24/10/2018 | Yokohama, Japan | Finnish Innovation Fund Sitra and Japan's Ministry of the Environment | 400 | CIRC4Life was invited to participate by EC. |
| 27 | NTU | 3rd Euro-Mediterranean Conference for Environmental Integration | 10-13/06/2021 | Sousse, Tunisia | EMCEI Conference Organiser | 800 | Presentation "Comparative material selection for sustainable design of lighting product underpinned by life cycle assessment" |
| 28 | NTU | 2nd Euro-Mediterranean Conference for Environmental Integration | 10-13 /10/2019 | Sousse, Tunisia | EMCEI conference organiser | 700 | |
| 29 | NTU | ADBE Research Conference, Nottingham Trent University | 08-09/07/2021 | Nottingham, UK | School of Architecture, Design and the Built Environment, Nottingham Trent University, UK | 200 | A panel session 'EU H2020 CIRC4Life project present edition', which consists of five presentations presented by the NTU team of the CIRC4Life project. The presentations included the major |

D8.3 - Report on the activities of exploitation and disseminations

| | | | | | | | outcomes of the EU H2020 CIRC4Life project. |
|---|---|---|---|---|---|---|---|
| 30 | EECC, GS1G | EECC Innovation Day | 10/10/2019 | Neuss, Germany | EECC | 200 | CIRC4Life was presented on an information stand. Audience: 120 German managers from different industries (Photo from this: https://files.eecc.info/f/51156384f1cf447182ef/) |
| 31 | GS1G | GS1 Germany Solution Partner Day | 11/09/2018 | Cologne, Germany | GS1 Germany | 140 | CIRC4Life project was part of an information stand of GS1G´s funded projects |
| 32 | GS1G | GS1 ECR Day | 19-20/09/2018 | Wiesbaden, Germany | GS1 Germany | 800 | CIRC4Life project was part of an information stand of GS1G´s funded projects |
| 33 | GS1G | GS1 Germany Advisory Board Sustainability | 26/09/2018 | Cologne, Germany | GS1 Germany | 30 | speaker slot, information about project and invitation of members (retailer and manufacturer) to innovation camp in Krakow |
| 34 | GS1G | Handelslogistikkongress 2019 | 26-27/03/2019 | Cologne, Germany | GS1 Germany | 1500 | Interactive presentation of the CIRC4Life project at the market place |
| 35 | GS1G | GS1 ECR Day | 18/09/-19/09/2019 | Essen, Germany | GS1 Germany | 800 | CIRC4Life was presented on an information stand, in addition the survey was disseminated |
| 36 | GS1G | GS1 Supervisory Board | 29/09/2020 | Cologne, Germany | GS1 Germany | 20 | CIRC4Life was presented. Audience: C-Level (Industry and Retailer) |
| 37 | GS1G, EECC | GS1 Solution Partner Day 2019 | 30/03/2019 | Cologne, Germany | GS1 Germany | 140 | CIRC4Life project was part of an information stand of GS1G´s funded projects |

| 38 | GS1G, EECC | Branchendialog Fleisch und Wurst | 04-05/06/2019 | Cologne, Germany | GS1 Germany | 250 | CIRC4Life was presented on an information stand |
| 39 | GS1G, EECC | GS1 Solution Partner Day 2019 | 04/02/2020 | Cologne, Germany | GS1 Germany | 140 | CIRC4Life project was part of an information stand of GS1G´s funded projects |
| 40 | IND and REC | "ECOENCUENTRO 2019" Annual congress of Recyclia | 05/11/2019 | Madrid, Spain | RECYCLIA | 200 | Information about the progress of the project and the main results at this time. 200 audience estimated |
| 41 | REC | "Congreso Nacional de Medio Ambiente (CONAMA)" Environmental National Congress of Spain (CONAMA) | 28/11/2018 | Madrid, Spain | CONAMA Foundation | 8700 | REC takes part in "CONAMA CONECTA", an specific area of the congress devoted to environmental projects with the aim of sharing experiences, know-how and creating networks between the actors. |
| 42 | REC | "Congreso Nacional de Medio Ambiente (CONAMA)" Environmental National Congress of Spain (CONAMA) | 23-26/11/2018 | Madrid, Spain | CONAMA Foundation | 8700 | REC submit a "Technical Communication" in the specific area of CONAMA in which researchers, companies and other entities can present their projects and studies for dissemination purposes. |
| 43 | REC | "ECOENCUENTRO 2018" Annual congress of Recyclia | 20/11/2018 | Madrid, Spain | RECYCLIA | 200 | Presentation of the project and distribution of leaflets. 200 audience estimated |
| 44 | ONA | Workshop in CEU University with Design students | 01-04/07/2019 | Valencia, Spain | ONA | 30 | Co-creation workshop: Introduction to the CIRC4Life project and new product concepts development with university students |
| 45 | ONA | Workshop in ONA's office | 26/11/2019 | Valencia, Spain | ONA | 30 | Co-creation workshop with end-users about product concepts (DEMO) |
| 46 | ICCS | The 9th international conference on Licfe Cycle Management | 04/09/2019 | Poznan, Poland | Poznan University of Technology | 50 | Chairing the conference session entitled: "Creating the Data Infrastructure for Circular Economy and LCM based strategies". Presentation on the Data Management |

| | | | | | | for CEBMs and the data formats used in CIRC4LIFE |
|---|---|---|---|---|---|---|
| 47 | ICCS | TBMCE2019 | 16-17/09/2019 | Portoroz | University of Maribor | 50 | Presentation of the work on ICT system for CEBMs |
| 48 | ICCS | Online Symposium on Circular Economy and Sustainability | 01-03/07/2020 | Alexandroupolis, Greece/online | INFER-International Network for Economic Research, Department of Environmental Engineering; Democritus University of Thrace | 200 | CIRC4Life dissemination presentation. |

## 3.3    Trade fairs and exhibitions

**Table 10: Trade fairs and exhibitions (designed by CIRC4Life)**

| No. Item | CIRC4Life Team participated | Title of Trade Fair/Exhibition | Date/Month/ year | Location | Organizer | Estimated Number of persons reached | Notes |
|---|---|---|---|---|---|---|---|
| 1 | ALIA | "SEPOR: Feria ganadera, industrial y agroalimentaria". "SEPOR: Cattle, industrial and agro-food fair". | 05-08/11/2018 | Lorca, Murcia (Spain) | Ayuntamiento de Lorca | 200 | In SEPOR, CIRC4Life project was presented to those attending the fair. in ALIA's stand. About 180 CIRC4Life leaflets were provided to the attendance. |
| 2 | ALIA | "SEPOR: Feria ganadera, industrial y agroalimentaria". "SEPOR: Cattle, industrial and agro-food fair". | 04-07/11/2019 | Lorca, Murcia (Spain) | Ayuntamiento de Lorca | 300 | In SEPOR, CIRC4Life project was presented to those attending the fair. in ALIA's stand. Furthermore, the project was presented in an international symposium about the pork sector. |
| 3 | ALIA | "SEPOR: Feria ganadera, industrial y agroalimentaria". "SEPOR: Cattle, industrial and agro-food fair". | 26-29/10/2020 | Lorca, Murcia (Spain) | Ayuntamiento de Lorca | 100 | In SEPOR, CIRC4Life project was presented to those attending the fair in ALIA's virtual stand. The event was developed online |

## 3.4    Social Media Posts

**Table 11: Social Media Posts (designed by CIRC4Life)**

| No. Item | CIRC4Life team participated | Social Media Posts | Dates/Month/Year | Location | Estimated Number of persons reached | Web link |
|---|---|---|---|---|---|---|
| 1 | CIRCE | Post on Twitter about consortium meeting | 31/01/2019 | | 3519 | https://twitter.com/fCIRCE/status/1090954769559154693 |
| 2 | CIRCE | Post on Linkedin about consortium meeting | 31/01/2019 | | 2120 | https://www.linkedin.com/feed/update/urn:li:activity:6496723511350951936 |
| 3 | CIRCE | Post on Facebook about consortium meeting | 31/01/2019 | | 563 | https://www.facebook.com/fcirce/posts/2499807063367255 |
| 4 | CIRCE | Post on Twitter about reuse survey | 30/07/2019 | | 2198 | https://twitter.com/fCIRCE/status/1156111664212828160 |
| 5 | CIRCE | Post on Linkedin about reuse survey | 30/07/2019 | | 1344 | https://www.linkedin.com/feed/update/urn:li:activity:6561884093980774400 |
| 6 | CIRCE | Post on Facebook about reuse survey | 30/07/2019 | | 856 | https://www.facebook.com/fcirce/posts/2815001135181178 |
| 7 | CIRCE | Post on Facebook about a contest on sustainable design | 08/08/2019 | | 276 | https://www.facebook.com/fcirce/posts/2832093676805257 |
| 8 | CIRCE | Post on Linkedin about a contest on sustainable design | 08/08/2019 | | 1026 | https://www.linkedin.com/feed/update/urn:li:activity:6565154322592731136 |
| 9 | CIRCE | Post on Linedin about a workshop in Getxo | 30/09/2019 | | 1573 | https://www.linkedin.com/feed/update/urn:li:activity:6584334120225251329 |
| 10 | CIRCE | Post on Twitter about a workshop in Getxo | 30/09/2019 | | 1516 | https://twitter.com/fCIRCE/status/1178565405809500160 |
| 11 | CIRCE | Post on Facebook about a workshop in Getxo | 30/09/2019 | | 293 | https://www.facebook.com/fcirce/posts/2937429996271624 |
| 12 | CIRCE | Post on Linkedin about a presentation video | 04/12/2019 | | 913 | https://www.linkedin.com/feed/update/urn:li:activity:6607947245180592128 |
| 13 | CIRCE | Post on Facebook about a presentation video | 04/12/2019 | | 172 | https://www.facebook.com/fcirce/posts/3087283564619599?__tn__=-R |
| 14 | CIRCE | Post on Twitter about a presentation video | 04/12/2019 | | 1582 | https://twitter.com/fCIRCE/status/1202181625431363584 |
| 15 | CIRCE | Post on Linkedin about EASME workshop | 21/02/2020 | | 939 | https://www.linkedin.com/feed/update/urn:li:activity:6636562389670211584 |

D8.3 - Report on the activities of exploitation and disseminations

| 16 | CIRCE | Post on Twitter about EASME workshop | 21/02/2020 | | 1546 | https://twitter.com/fCIRCE/status/1230796660256706561 |
| 17 | CIRCE | Post on Facebook about EASME workshop | 21/02/2020 | | 345 | https://www.facebook.com/fcirce/photos/a.676324879048825/3272361599445127/?type=3&__tn__=-R |
| 18 | CIRCE | Post on Twitter about the Innovation Camp | 25/09/2018 | | 907 | https://twitter.com/fCIRCE/status/1044542072269746176 |
| 19 | ICCS | Post on Twitter about survey for companies concerning the marketplace concept | 24/11/2020 | | 1200 impressions & 26 engagements | https://twitter.com/ISENSE_GROUP/status/1331337461943963653 |
| 20 | ICCS | Post on Linkedin about survey for companies concerning the marketplace concept | 25/11/2020 | | 226 impressions & 7,06% engagement rate | https://www.linkedin.com/posts/isensegroup_methodology-circulareconomy-research-activity-6737380247039156224-QU-E/ |
| 21 | GS1G | facebook. GS1 Germany - Circular Economy with standards | 21/04/2020 | Germany | 279 impressions | https://www.facebook.com/GS1.Germany/posts/2968222489883639 |
| 22 | Indumetal | Getxo city council: tweet about Demo starting (Basque) | 15/02/2021 | Spain | | https://twitter.com/GetxoUdala/status/1361293869183365126 |
| 23 | Indumetal | Getxo city council: tweet about Demo starting (Sapnish) | 15/02/2021 | Spain | | https://twitter.com/GetxoUdala/status/1361301232413904898 |
| 24 | Indumetal | Google Ads campaign for Getxo Citizens | 1st half 2021 | Spain | | (more information in deliverable of demo 2) |
| 25 | Indumetal | Facebook Ads campaign for Getxo citizens | 1st half 2021 | Spain | | (more information in deliverable of demo 2) |
| 26 | Indumetal | Twitter. Indumetal in CIRC4Life project | 23/09/2020 | Spain | | https://twitter.com/IndumetalN/status/1308680470582964225?s=20 |
| 27 | Indumetal | Twitter. Indumetal in CIRC4Life project | 22/10/2020 | Spain | | https://twitter.com/IndumetalN/status/1319241468293353475?s=20 |
| 28 | Indumetal | Twitter. Indumetal in CIRC4Life project | 20/10/2020 | Spain | | https://twitter.com/IndumetalN/status/1318497179992993793?s=20 |
| 29 | Indumetal | Twitter. Indumetal in CIRC4Life project | 04/12/2020 | Spain | | https://twitter.com/IndumetalN/status/1334806623861288961?s=20 |
| 30 | Indumetal | Twitter. Indumetal in CIRC4Life project | 21/11/2020 | Spain | | https://twitter.com/IndumetalN/status/1330164688034934784?s=20 |
| 31 | Indumetal | Twitter. Indumetal in CIRC4Life project | 25/11/2020 | Spain | | https://twitter.com/IndumetalN/status/1331523232059547648?s=20 |
| 32 | Indumetal | Twitter. Indumetal in CIRC4Life project | 06/11/2020 | Spain | | https://twitter.com/IndumetalN/status/1324657370656579584?s=20 |
| 33 | Indumetal | Twitter. Indumetal in CIRC4Life project | 14/10/2020 | Spain | | https://twitter.com/IndumetalN/status/1316326370402873347?s=20 |

D8.3 - Report on the activities of exploitation and disseminations

| 34 | Indumetal | Twitter. Indumetal in CIRC4Life project | 15/10/2020 | Spain | | https://twitter.com/IndumetalN/status/1316721926761517056?s=20 |
| 35 | Indumetal | Twitter. Indumetal in CIRC4Life project | 21/11/2020 | Spain | | https://twitter.com/IndumetalN/status/1330165196082597892?s=20 |
| 36 | Indumetal | Twitter. Indumetal in CIRC4Life project | 25/11/2020 | Spain | | https://twitter.com/IndumetalN/status/1331524082467287045?s=20 |
| 37 | Indumetal | Twitter. Indumetal in CIRC4Life project | 20/11/2020 | Spain | | https://twitter.com/IndumetalN/status/1329747529647480833?s=20 |
| 38 | Indumetal | Twitter. Indumetal in CIRC4Life project | 22/10/2020 | Spain | | https://twitter.com/IndumetalN/status/1319183254453428224?s=20 |
| 39 | Indumetal | Twitter. Indumetal in CIRC4Life project | 25/11/2020 | Spain | | https://twitter.com/IndumetalN/status/1331525773648334849?s=20 |
| 40 | Indumetal | Twitter. Indumetal in CIRC4Life project | 21/11/2020 | Spain | | https://twitter.com/IndumetalN/status/1330167675084009480?s=20 |
| 41 | Indumetal | Twitter. Indumetal in CIRC4Life project | 12/01/2021 | Spain | | https://twitter.com/IndumetalN/status/1348922861235408896?s=20 |
| 42 | Indumetal | Twitter. Indumetal in CIRC4Life project | 15/02/2021 | Spain | | https://twitter.com/IndumetalN/status/1361295648390316032?s=20 |
| 43 | Indumetal | Twitter. Indumetal in CIRC4Life project | 11/05/2021 | Spain | | https://twitter.com/IndumetalN/status/1392067841520807936?s=20 |
| 44 | Indumetal | Twitter. Indumetal in CIRC4Life project | 02/02/2021 | Spain | | https://twitter.com/IndumetalN/status/1356543773635977221?s=20 |
| 45 | Indumetal | Twitter. Indumetal in CIRC4Life project | 09/03/2021 | Spain | | https://twitter.com/IndumetalN/status/1369237273884164096?s=20 |
| 46 | Indumetal | Twitter. Indumetal in CIRC4Life project | 29/06/2021 | Spain | | https://twitter.com/IndumetalN/status/1409799565423828992?s=20 |
| 47 | Indumetal | Twitter. Indumetal in CIRC4Life project | 31/03/2021 | Spain | | https://twitter.com/IndumetalN/status/1399339646526578694?s=20 |
| 48 | Indumetal | Twitter. Indumetal in CIRC4Life project | 27/04/2021 | Spain | | https://twitter.com/IndumetalN/status/1386975728286240769?s=20 |
| 49 | Indumetal | Twitter. Indumetal in CIRC4Life project | 22/04/2021 | Spain | | https://twitter.com/IndumetalN/status/1385165026751827968?s=20 |
| 50 | Indumetal | Twitter. Indumetal in CIRC4Life project | 18/05/2021 | Spain | | https://twitter.com/IndumetalN/status/1394578958356828163?s=20 |
| 51 | Indumetal | Twitter. Indumetal in CIRC4Life project | 08/06/2021 | Spain | | https://twitter.com/IndumetalN/status/1402183495561187328?s=20 |
| 52 | Indumetal | Twitter. Indumetal in CIRC4Life project | 07/01/2021 | Spain | | https://twitter.com/IndumetalN/status/1347210161027502080?s=20 |

D8.3 - Report on the activities of exploitation and disseminations

| 53 | Indumetal | Twitter. Indumetal in CIRC4Life project | 05/01/2021 | Spain | | https://twitter.com/IndumetalN/status/134648819576 1008641?s=20 |
|---|---|---|---|---|---|---|
| 54 | Indumetal | Twitter. Indumetal in CIRC4Life project | 08/06/2021 | Spain | | https://twitter.com/IndumetalN/status/140218743010 7701248?s=20 |
| 55 | Indumetal | Twitter. Indumetal in CIRC4Life project | 18/03/2021 | Spain | | https://twitter.com/IndumetalN/status/137249565103 7134850?s=20 |
| 56 | Indumetal | Twitter. Indumetal in CIRC4Life project | 15/02/2021 | Spain | | https://twitter.com/IndumetalN/status/136129629312 1970178?s=20 |
| 57 | Indumetal | Twitter. Indumetal in CIRC4Life project | 22/04/2021 | Spain | | https://twitter.com/IndumetalN/status/138516640153 5623171?s=20 |
| 58 | Indumetal | Twitter. Indumetal in CIRC4Life project | 11/06/2021 | Spain | | https://twitter.com/IndumetalN/status/140326132025 0769409?s=20 |
| 59 | Indumetal | Twitter. Indumetal in CIRC4Life project | 26/03/2021 | Spain | | https://twitter.com/IndumetalN/status/137538574202 5895937?s=20 |
| 60 | ALIA | Twitter. ALIA in CIRC4Life project | 04/06/2021 | Spain | 922 impressions | https://twitter.com/AliaPiensos/status/1400799838380 466179?s=20 |
| 61 | ALIA | Twitter. ALIA in CIRC4Life project | 07/05/2021 | Spain | 401 (impressions unit for this one and the ones below) | https://twitter.com/AliaPiensos/status/1390682366360 932353?s=20 |
| 62 | ALIA | Twitter. ALIA in CIRC4Life project | 24/03/2021 | Spain | 269 | https://twitter.com/AliaPiensos/status/1374676861192 658946?s=20 |
| 63 | ALIA | Twitter. ALIA in CIRC4Life project | 09/11/2020 | Spain | 353 | https://twitter.com/AliaPiensos/status/1325812721200 279553?s=20 |
| 64 | ALIA | Twitter. ALIA in CIRC4Life project | 17/06/2020 | Spain | 601 | https://twitter.com/AliaPiensos/status/1273235919764 676608?s=20 |
| 65 | ALIA | Twitter. ALIA in CIRC4Life project | 11/06/2020 | Spain | 547 | https://twitter.com/AliaPiensos/status/1271044226009 174016?s=20 |
| 66 | ALIA | Twitter. ALIA in CIRC4Life project | 28/04/2020 | Spain | 1011 | https://twitter.com/AliaPiensos/status/1255155361754 918916?s=20 |
| 67 | ALIA | Twitter. ALIA in CIRC4Life project | 10/03/2020 | Spain | 667 | https://twitter.com/AliaPiensos/status/1237374103180 509185?s=20 |
| 68 | ALIA | Twitter. ALIA in CIRC4Life project | 19/02/2020 | Spain | 1409 | https://twitter.com/AliaPiensos/status/1230111496434 311174?s=20 |
| 69 | ALIA | Twitter. ALIA in CIRC4Life project | 07/11/2020 | Spain | 2057 | https://twitter.com/AliaPiensos/status/1192487710604 308480?s=20 |
| 70 | ALIA | Twitter. ALIA in CIRC4Life project | 07/11/2020 | Spain | 1920 | https://twitter.com/AliaPiensos/status/1192474315687 632901?s=20 |

| 71 | ALIA | Twitter. ALIA in CIRC4Life project | 29/10/2019 | Spain | N/A | https://twitter.com/LahilaDesola/status/1189200400336994304?s=20 |
| 72 | ALIA | Twitter. ALIA in CIRC4Life project | 25/09/2019 | Spain | 1126 | https://twitter.com/AliaPiensos/status/1176842670825758721?s=20 |
| 73 | ALIA | Twitter. ALIA in CIRC4Life project | 26/07/2019 | Spain | 694 | https://twitter.com/AliaPiensos/status/1154687400855121920?s=20 |
| 74 | ALIA | Twitter. ALIA in CIRC4Life project | 21/05/2019 | Spain | 1420 | https://twitter.com/AliaPiensos/status/1134404720158814209?s=20 |
| 75 | ALIA | Twitter. ALIA in CIRC4Life project | 19/12/2018 | Spain | 2327 | https://twitter.com/AliaPiensos/status/1075418358458257410?s=20 |
| 76 | GS1G | facebook. GS1 Germany - Circular Economy with standards | 16/11/2018 | Germany | 91 impressions | https://ar-ar.facebook.com/GS1.Germany/posts/raus-aus-der-wegwerfgesellschaft-hin-zu-langlebigeren-produkten-mehr-recycling-u/3037123042993583/ |
| 77 | GS1G | facebook. GS1 Germany - Circular Economy with standards | 24/07/2019 | Germany | 6 impressions | https://www.facebook.com/GS1.Germany/posts/2391814854191075 |
| 78 | GS1G | facebook. GS1 Germany - Circular Economy with standards | 17/09/2019 | Germany | 271 impressions | https://www.facebook.com/GS1.Germany/posts/2489459211093305 |
| 79 | GS1G | facebook. GS1 Germany - Circular Economy with standards | 05/03/2020 | Germany | 207 impressions | https://www.facebook.com/GS1.Germany/posts/2857150057657550 |
| 80 | GS1G | facebook. GS1 Germany - Circular Economy with standards | 18/05/2020 | Germany | 225 impressions | https://www.facebook.com/GS1.Germany/posts/3037123042993583 |
| 81 | GS1G | XING. GS1 Germany - Circular Economy with standards | 22/04/2021 | Germany | 344 impressions | https://www.xing.com/home/stories/5391378100?back_to=%2Fpages%2Fgs1germanygmbh%2Fnews |
| 82 | GS1G | XING. GS1 Germany - Circular Economy with standards | 18/05/2020 | Germany | 64 impressions | https://www.xing.com/home/stories/4412311849?back_to=%2Fpages%2Fgs1germanygmbh%2Fnews |
| 83 | GS1G | XING. GS1 Germany - Circular Economy with standards | 21/04/2020 | Germany | 262 impressions | https://www.xing.com/home/stories/4318672871?back_to=%2Fpages%2Fgs1germanygmbh%2Fnews |
| 84 | GS1G | XING. GS1 Germany - Circular Economy with standards | 17/09/2019 | Germany | 245 impressions | https://www.xing.com/home/stories/3583080053?back_to=%2Fpages%2Fgs1germanygmbh%2Fnews |
| 85 | GS1G | XING. GS1 Germany - Circular Economy with standards | 24/07/2019 | Germany | est. 230 impressions | https://www.xing.com/home/stories/3458468768?back_to=%2Fpages%2Fgs1germanygmbh%2Fnews |
| 86 | GS1G | XING. GS1 Germany - Circular Economy with standards | 16/11/2018 | Germany | est. 230 impressions | https://www.xing.com/home/stories/3020230158?back_to=%2Fpages%2Fgs1germanygmbh%2Fnews |
| 87 | GS1G | LinkedIn. GS1 Germany - Circular Economy with standards | 16/11/2018 | Germany | est. 700 impressions | https://www.linkedin.com/posts/gs1-germany-gmbh_gs1-gs1germany-circ4life-activity-6469150678861299712-cWLj |

D8.3 - Report on the activities of exploitation and disseminations

| 88 | GS1G | LinkedIn. GS1 Germany - Circular Economy with standards | 24/07/2019 | Germany | est. 700 impressions | https://www.linkedin.com/posts/gs1-germany-gmbh_circ4life-gs1-gs1germany-activity-6559690762160750592-GZtX |
| 89 | GS1G | LinkedIn. GS1 Germany - Circular Economy with standards | 21/04/2020 | Germany | est. 700 impressions | https://www.linkedin.com/posts/gs1-germany-gmbh_circ4life-circulareconomy-ecoaccount-activity-6658308654539780096-Fw-y |
| 90 | GS1G | LinkedIn. GS1 Germany - Circular Economy with standards | 17/09/2019 | Germany | est. 700 impressions | https://www.linkedin.com/posts/gs1-germany-gmbh_circ4life-circulareconomy-gs1germany-activity-6579708128957349888-HnXl |
| 91 | GS1G | LinkedIn. GS1 Germany - Circular Economy with standards | 18/05/2020 | Germany | est. 700 impressions | https://www.linkedin.com/posts/gs1-germany-gmbh_presenting-circ4life-activity-6668124587579977728-iNUT |
| 92 | GS1G | LinkedIn. GS1 Germany - Circular Economy with standards | 05/03/2020 | Germany | est. 700 impressions | https://www.linkedin.com/posts/gs1-germany-gmbh_circulareconomy-circ4life-eugreendeal-activity-6641335852205125632-wovO |
| 93 | GS1G | LinkedIn. GS1 Germany - Circular Economy with standards | 22/04/2021 | Germany | 726 impressions | https://www.linkedin.com/posts/gs1-germany-gmbh_circulareconomy-sustainability-recycling-activity-6790885122070642688-yJW5 |
| 94 | NTU | NTU Website. 'EU H2020 Project: CIRC4Life - A Circular Economy Approach for Lifecycles of Products and Services' | 01/10/2018 | UK | 20,000 | https://www.ntu.ac.uk/research/groups-and-centres/projects/eu-h2020-project-circ4life-a-circular-economy-approach-for-lifecycles-of-products-and-services |

## 3.5    Press Releases

**Table 12: Press Releases (designed by CIRC4Life)**

| No. | Responsible CIRC4Life Team | Description Press release | Date/Month/Year | Country | Web link | Estimated Number of persons reached | Notes |
|---|---|---|---|---|---|---|---|
| 1 | NTU | East Midlands Business Link Magazine | 12/07/2018 | UK | https://www.eastmidlandsbusinesslink.co.uk/mag/featured/nottingham-trent-university-leads-major-project-to-develop-circular-economy-for-everyday-items/ | 10,000 | Media article entitled 'Nottingham Trent University leads major project to develop circular economy for everyday items' |
| 2 | NTU | News, Nottingham Trent University | 11/07/2018 | UK | https://www.ntu.ac.uk/search?category=News&query=Major+European+project | 5,000 | News articale entitled 'Major European project underway to develop circular economy approach for everyday items' |
| 3 | NTU | Resource Magazine, Summer 2018, Issue 92 | 17/07/2018 | UK | https://resource.co/article/nottingham-trent-university-leads-64m-circular-economy-project-12746 | 10,000 | Article: 'Nottingham Trent University leads £6.4m circular economy project' |
| 4 | CIRCE | Article on CIRCE's web about a workshop in Getxo | 16/09/2019 | | https://www.fcirce.es/evento-es/workshop-en-getxo-vizcaya-enfoques-innovadores-de-economia-circular-y-sus-aplicaciones-practicas | 229 | |
| 5 | CIRCE | Article on CIRCE's web about the Innovation Camp | 25/09/2019 | | https://www.fcirce.es/economia-circular-es/un-innovation-camp-en-economia-circular-busca-expertos-para-desarrollar-nuevos-modelos-de-negocio | 156 | |
| 6 | LAU | ARticle about co-creation workshops for CIRC4Life project (in Finnish and in English) | 01/10/2019 | | https://www.laurea.fi/ajankohtaista/uutiset/ideointityopaja-toi-uusia-oivalluksia-yhteiskehittamisen-eduista-liiketoiminnalle/ https://www.laurea.fi/en/current-topics/news/ideointityopaja-toi-uusia-oivalluksia-yhteiskehittamisen-eduista-liiketoiminnalle/ | 2000 | |
| 7 | CIRCE | Article on FuturEnergy magazine | 02/07/2019 | | https://futurenviro.es/la-economia-circular-le-da-la-vuelta-a-los-residuos/ | $\simeq 7000$ | |

| 8 | CIRCE | Futurenviro | 02/07/2019 | Spain | https://futurenviro.es/en/circular-economy-turns-waste-around/ | ≃ 7000 | General Article on project in Spanish |
|---|---|---|---|---|---|---|---|
| 9 | LAU | Article about Laurea CE JAM | 20/03/2019 | | https://www.laurea.fi/ajankohtaista/tapahtumat/circular-economy-jam-laureassa-27.-282.3/ | 2000 | |
| 10 | LAU | Articles (in English and in Finnish): Laurea team successfully run international Innovation Camp in Krakow, Laurea intranet | 23/11/2018 | | | 2000 | |
| 11 | LAU | Article: Ideation workshop brought insights on communicating business benefits of co-creation | 01/10/2019 | | https://www.laurea.fi/en/current-topics/news/ideointityopaja-toi-uusia-oivalluksia-yhteiskehittamisen-eduista-liiketoiminnalle/ | 2000 | |
| 12 | LAU | Articles (in English and in Finnish): On CIRC4LIfe Design Challenge, LAurea intranet | 12/08/2019 | | | 2000 | |
| 13 | LAU | Article (in Finnish) on CIRC4Life SHOWROOM, Laurea intranet | 22/09/2020 | | | 2000 | |
| 14 | LAU | Description of Education integration opportunities for CIRC4Life | | | https://www.laurea.fi/koulutus/avoin-ammattikorkeakoulu/yamk-polkuopinnot-projekteissa/ | 600 | |
| 15 | LAU | Summary article about Laurea CE jam | 28/03/2020 | | https://www.laurea.fi/en/current-topics/news/circular-economy-jam-brainstorming-innovative-circular-economy-solutions/ | 600 | |
| 16 | LAU | Article (in Finnish and English) at LAU intranet about OIC results | 31/05/2021 | | https://www.laurea.fi/en/current-topics/news/laurea-team-successfully-ran-virtual-open-innovation-camp/ | 600 | |
| 17 | LAU | Article in Finnish and ENG at LAU webpages about OIC results | 31/05/2021 | | https://www.laurea.fi/ajankohtaista/uutiset/laurean-tiimi-jarjesti-onnistuneen-virtuaalisen-open-innovation--leirin/ | 600 | |
| 18 | ONA | Article (Spanish) about the MEDUSA luminaire/CIRC4Life | 14/06/2021 | Spanish media (Design Boom) | https://www.designboom.com/shop/design/medusa-ona-10-06-2020/ | 290,000 | |

| 19 | ONA | Article (Spanish) about the MEDUSA luminaire/CIRC4Life | 15/06/2021 | Spanish media (Experimenta) | https://www.experimenta.es/noticias/industrial/con-medusa-ona-ilumina-el-camino-hacia-un-mundo-mas-sostenible/ | 28,000 | |
| 20 | ONA | Article (Spanish) about the MEDUSA luminaire/CIRC4Life | 15/06/2021 | Spanish media (Diario Design) | https://diariodesign.com/2021/06/iluminacion-de-bajo-impacto-medioambiental-con-ona/ | 34,000 | Article on Medusa Lamp and CIRC4Life |
| 21 | ONA | Blog (Spanish) about luminaires | 27/04/2021 | Spanish media (Decofilia) | https://decofilia.com/iluminacion-led/ | 35,000 | |
| 22 | LAU | CIRC4Life project description on Laurea webpages (in Finnish and in English) | 01/05/2018 | | https://www.laurea.fi/hankkeet/a/a-circular-economy-approach-for-lifecycles-of-products-and-services/ https://www.laurea.fi/en/projects/a/a-circular-economy-approach-for-lifecycles-of-products-and-services/ | 50000 | |
| 23 | LAU | Internal announcement at LAU intranet for staff and students | 31/05/2021 | Finland | | 6000 | Newsletter about OIC in ENG and FIN |
| 24 | LAU | Open Living Lab days blog: Laurea Living Lab approach for CE projects | 11/06/2019 | | https://openlivinglabdays.com/2019/06/11/how-to-apply-living-lab-approach-in-circular-economy-collaborative-projects/ | 10000 | |
| 25 | RISE | Diva portal | | Sweden | http://www.diva-portal.se/smash/get/diva2:1353844/FULLTEXT02.pdf | 1000+ | Finding tool and an institutional repository for research publications and student theses: presentation innovation camp |
| 26 | MMM | SDG Watch Europe | 06/05/2019 | EU | https://www.sdgwatcheurope.org/circ4life/ | 500 | EU platform on SDGs: general article on the project |
| 27 | MMM | Social Platform | 17/12/2019 | EU | https://www.socialplatform.org/news/make-mothers-matter-circ4life-calls-for-your-input-on-consumer-surveys/ | 1000 | Article dissemination of the survey by the Social Platform (which is the largest network of civil society organisations in the European Union advocating for a social Europe). |
| 28 | MMM | Ale listens and Draws | 01/22/2019 | Belgium | http://www.alelistens.com/fr/project/circ4life-video-presentation-2/ | 1000 | Page including general video |

| 29 | LAU | Article on CIRC4Life approach on developing CEBMs: CELLL toolkit used as a tool for education | 04/03/2021 | Finland | https://journal.laurea.fi/hankkeen-tuotoksesta-oppimisen-valineeksi/#d364cd90 | 10000 | |
| 30 | RISE | CIRC4Life description in Swedish and English on RISE webpages | Since 08/2018 | Sweden | | 3000 + | |
| 31 | RISE | Press release about CIRC4Life project | 08/2018 | Sweden | | 3000+ | |
| 32 | Recyclia | Futurenviro | 03/10/2019 | Spain | https://futurenviro.es/recyclia-esta-trabajando-intensamente-en-el-proyecto-circ4life/ | 17000 | Article on meeting in Bilbao |
| 33 | Recyclia | Futurenviro | | Spain | https://futurenviro.es/un-innovation-camp-en-economia-circular-busca-expertos-para-desarrollar-nuevos-modelos-de-negocio/ | 17000 | Article on innovation camp |
| 34 | IND/REC | Elespanol | 02/01/2021 | Spain | https://www.elespanol.com/invertia/disruptores-innovadores/innovadores/empresas/20210102/contenedores-inteligentes-recompensan-buenos-habitos-reciclaje/546945633_0.html?fbclid=IwAR2fvNuie4HIBavRN_5jbEE2mPWJoMp5QYyzCsHP_d8smGyyyD-cQRDeDJY | 1000000+ | Article on demo 2 on intelligent bins pilot |
| 35 | Indumetal / Recyclia | Residuos profesional | 05/11/2020 | Spain | https://www.residuosprofesional.com/contenedores-recompensan-reciclar-residuos-electronicos/ | 6570 | |
| 36 | Indumetal / Recyclia | Futurenviro | 22/04/2020 | Spain | https://futurenviro.es/contenedores-inteligentes-que-recompensaran-a-los-ciudadanos-por-reciclar-residuos-electronicos/ | 17000 | |
| 37 | ALIA | Lorca's city council website | 26/07/2019 | Spain | http://www.agenda21.lorca.es/noticiasDetalle.asp?id=163 | 200 | dedicated article about the project and ALIA's participation |
| 38 | ALIA | La opinion de Murcia | 23/11/2018 | Spain | https://mas.laopiniondemurcia.es/especiales/mundo-cooperativo/2018/11/23/la-economia-circular-involucra-a-productores-y-usuarios-para-un-consumo-mas-responsable/ | 62330 | Dedicated article about the project and ALIA's participation |

| 39 | ALIA | Parque Científico de Murcia = "Murcia Science Park" | 19/06/2019 | Spain | http://www.parquecientificomurcia.es/eurovertice-conduce-al-grupo-alia-a-la-economia-circular-en-el-porcino-con-un-proyecto-unico-en-europa-parque-cientifico-murcia/ | 1900 | Dedicated article about the project and ALIA's participation |
| 40 | ALIA | Abarán día a día | 25/02/2021 | Spain | https://abarandiaadia.com/art/8242/el-contenedor-marron-comienza-una-experiencia-piloto-en-el-municipio-de-abaran | 50000 | Article on demo 4 intelligent bin launch event |
| 41 | ALIA | Radio Abarán | 25/02/2021 | Spain | https://radioabaran.com/abaran-se-convierte-en-municipio-pionero-en-el-reciclaje-organico/ | 50000 | Article on demo 4 intelligent bin launch event |
| 42 | ALIA | Newsletter Eurovertice | 04/2021 | Spain | https://www.eurovertice.eu/que-son-los-living-labs-y-como-innovar-localmente-con-ellos/?utm_source=sendinblue&utm_campaign=Newsletter_Abril_2&utm_medium=email | 80000 | Article on Living Labs in CIRC4Life |
| 43 | ALIA | La Opinion de Murcia | 09/12/2018 | Spain | https://mas.laopiniondemurcia.es/especiales/mundo-cooperativo/2018/12/09/839/ | 60000 | Examples of CE approaches in the food sector in which CIRC4Life and ALIA were included |
| 44 | ALIA | Murcia Economia | 19/06/2019 | Spain | https://murciaeconomia.com/art/63662/eurovertice-conduce-al-grupo-alia-los-quijales-a-la-economia-circular-en-el-sector-porcino | 60000 | |
| 45 | ALIA | Eurovertice | 03/2019 | Spain | https://www.eurovertice.eu/eurovertice-asesora-a-la-sat-alia-y-a-la-universidad-de-ciencias-aplicadas-laurea-en-el-proyecto-circ4life/ | 80000 | Article on demo 4 meeting with Alia and Laurea |
| 46 | ALIA | Sustainable Development and Climate Change Awards of the Region of Murcia | 09/05/2021 | Spain | https://www.agrodiario.com/texto-diario/mostrar/2876274/trece-distinciones-x-edicion-premios-desarrollo-sostenible-cambio-climatico | 50000 | |
| 47 | ALIA | Sustainable Development and Climate Change Awards of the Region of Murcia | 07/05/2021 | Spain | https://www.murcia.com/region/noticias/2021/05/07-la-comunidad-entrega-13-distinciones-en-la-x-edicion-de-los-premios-de-desarrollo-sostenible-y-cambio-climatico.asp | 50000 | |

| 48 | ALIA | Sustainable Development and Climate Change Awards of the Region of Murcia | 08/05/2021 | Spain | https://www.laverdad.es/murcia/premios-desarrollo-sostenible-20210508003617-ntvo.html | 50000 | |
| 49 | REC and IND | Article (Spanish) on CIRC4Life demo in Getxo and other initiatives | 02/01/2021 | Spanish media | Contenedores inteligentes que recompensan los buenos hábitos de reciclaje (elespanol.com) | | |
| 50 | REC and IND | Article (Spanish) on CIRC4Life demo in Getxo and other initiatives | 28/11/2020 | Spanish media | Reducir, reutilizar, reciclar y ahora también recompensar y retornar \| Compañías \| Cinco Días (elpais.com) | | |
| 51 | Indumetal | Mineria urbana blog | 30/05/2018 | Spain | https://mineriaurbana.org/2018/05/30/el-proyecto-circ4life/ | | General article on the project and indumetal's role |
| 52 | Indumetal | Es Smart City | 06/11/2020 | Spain | https://www.esmartcity.es/2020/11/06/contenedores-inteligentes-recompensan-reciclaje-residuos-electronicos-getxo | | Article on demo 2 on intelligent bins pilot |
| 53 | Indumetal | Electro Imagen | 05/11/2020 | Spain | http://electro-imagen.com/articulo/recyclia-participa-en-una-experiencia-piloto-que-premia-las-buenas-practicas-ambientales | | Article on demo 2 on intelligent bins pilot |
| 54 | Indumetal | Retema | 11/11/2020 | Spain | https://www.retema.es/noticia/contenedores-inteligentes-recompensaran-a-los-ciudadanos-por-reciclar-residuos-electr-Dfjj | | Article on demo 2 on intelligent bins pilot |
| 55 | Indumetal | Interempresas magazine | 06/11/2020 | Spain | https://www.interempresas.net/Reciclaje/Articulos/318283-Por-primera-vez-contenedores-inteligentes-recompensaran-ciudadanos-reciclar-residuos.html | | Article on demo 2 on intelligent bins pilot |
| 56 | Indumetal | Marron y Blanco | 05/11/2020 | Spain | https://www.marronyblanco.com/recyclia-colabora-en-una-revolucionaria-experiencia-piloto-de-reciclaje-que-recompensara-a-los-usuarios/ | | Article on demo 2 on intelligent bins pilot |
| 57 | Indumetal | Bilbao hiria | 05/11/2020 | Spain | https://bilbaohiria.com/bizkaia/getxo-pone-en-marcha-contenedores-con-recompensa/ | | Article on demo 2 on intelligent bins pilot |
| 58 | Indumetal | It reseller | 05/11/2020 | Spain | https://www.itreseller.es/al-dia/2020/11/recyclia-promueve-el-reciclaje-de-aparatos-tic-con-contenedores-inteligentes | | Article on demo 2 on intelligent bins pilot |

D8.3 - Report on the activities of exploitation and disseminations

| 59 | Indumetal | Electro market | 05/11/2020 | Spain | https://www.electromarket.com/noticia/22159/reciclar-residuos-electrnicos-tiene-recompensa-en-getxo-?utm_source=news_2020-11-05&utm_medium=Email&utm_campaign=mailing&email=mjveleiro@recyclia.es | | Article on demo 2 on intelligent bins pilot |
| 60 | Indumetal | El agora | 06/11/2020 | Spain | https://www.elagoradiario.com/desarrollo-sostenible/economia-circular/contenedores-inteligentes-residuos-electronicos/ | | Article on demo 2 on intelligent bins pilot |
| 61 | Indumetal | News Agency Efeverde | 06/11/2020 | Spain | https://www.efeverde.com/noticias/contenedores-inteligentes-reciclaje-proyecto/ | | Article on demo 2 on intelligent bins pilot |
| 62 | Indumetal | ACLIMA (http://www.aclima.eus/en/we-are/) | 30/05/2018 | Spain | http://www.aclima.eus/indumetal-paticipa-en-circ4life-un-proyecto-europeo-para-desarrollar-nuevos-modelos-de-negocio-basados-en-la-economia-circular/ | | Publication of press release describing the project and the activities on which Indumetal is involved |
| 63 | Indumetal | Lean and Green Blog | 02/06/2018 | Argentina | https://lean-green-argentina.blogspot.com/2018/06/el-proyecto-circ4life-busca-nuevos.html | | Publication of press release describing the project and the activities on which Indumetal is involved |
| 64 | Indumetal | Residuos profesional | 30/05/2018 | Spain | https://www.residuosprofesional.com/circ4life-modelos-negocio-economia-circular/ | | Publication of press release describing the project and the activities on which Indumetal is involved |
| 65 | Indumetal | MINERÍA URBANA, 28.05.18 | 28/05/2018 | Spain | https://mineriaurbana.org/2018/05/28/indumetal-participa-en-proyecto-europeo-sobre-negocios-de-economia-circular/ | | Publication of press release describing the project and the activities on which Indumetal is involved |
| 66 | Indumetal | FINANZAS.com, 28.05.18 | 28/05/2018 | Spain | http://www.finanzas.com/noticias/economia/20180528/indumetal-participa-proyecto-europeo-3848516.html | | Publication of press release describing the project and the activities on which Indumetal is involved |
| 67 | Indumetal | ROBINSPOST, 28.05.18 | 28/05/2018 | Spain | https://www.robinspost.com/news/noticias/negocios/716881-negocios-noticias-indumetal-participa-en-proyecto-europeo-sobre-negocios-de-economia-circular.html | | Publication of Press release describing the project and the activities on which Indumetal is involved |
| 68 | Indumetal | LA VANGUARDIA, 28.05.18 | 28/05/2018 | Spain | http://www.lavanguardia.com/vida/20180528/443911041228/indumetal- | | Press release describing the project and the activities on which Indumetal is involved |

D8.3 - Report on the activities of exploitation and disseminations

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| | | | | | participa-en-proyecto-europeo-sobre-negocios-de-economia-circular.html | | |
| 69 | Indumetal | Residuos profesional | 20/10/2020 | Spain | https://www.residuosprofesional.com/contenedor-inteligente-raee/ | | Article on real life tests (Living Lab) in Getxo in oct'20 |
| 70 | Indumetal | Deia (basque written press) | 20/10/2020 | Spain | https://www.deia.eus/bizkaia/eskuinaldea/2020/10/20/romo-prueba-contenedor-inteligente-electronica/1072695.html | | Article on real life tests (Living Lab) in Getxo in oct'20 |
| 71 | Indumetal | Indumetal Blog | 15/10/2020 | Spain | http://www.indumetalnews.com/es/uso-de-contenedores-inteligentes-para-el-fomento-de-la-recogida-y-reutilizacion-de-aparatos-electricos-y-electronicos | | Article on intelligent bins |
| 72 | Indumetal | Ecoticias | 26/10/2020 | Spain | https://www.ecoticias.com/residuos-reciclaje/205655/proyecto-CIRC4Life-propone-ofrecer-incentivos-fomentar-reutilizacion-reciclaje-RAEEs | | jcompany@ecoticias.com |
| 73 | Indumetal | Onda Vasca (Broadcast Radio) | 22/10/2020 | Spain | https://www.linkedin.com/posts/indumetal-recycling-sa_esta-semana-nuestra-compa%C3%B1era-maider-arieta-araunabe%C3%B1a-activity-6725005358730887169-4Spf | | Interview in the local radio about the Living Lab (real life test) in Getxo in September 2020 |
| 74 | Indumetal | Indumetal Blog | 23/09/2020 | Spain | http://www.indumetalnews.com/es/incentivos-trazabilidad-mejorar-la-recogida-reutilizacion-aparatos-electronicos | | Article on incentives and traceability within CIRC4Life |
| 75 | Indumetal | Newsletter Service of 'Zicla' company | 10/12/2019 | Spain | private email | | Brief note about results of the survey about recycling/reuse. Spanish and Basque languages |
| 76 | Indumetal | Newsletter Service of 'Zicla' company | 05/09/2019 | Spain | private email | | Brief note about end-users's participation in the project to 70 industrial and administration agents in the Basque Country. Includes the survey about recycling/reuse. Spanish and Basque languages |
| 77 | Indumetal | Newsletter Service of 'Zicla' company | 06/05/2019 | Spain | private email | | Brief note about the project to 70 industrial and administration agents in the Basque Country |

| 78 | Indumetal | Residuos profesional | 31/07/2019 | Spain | https://www.residuosprofesional.com/circ4life-encuesta-reciclaje/ | | Article on surveys |
| 79 | Indumetal | Residuos Profesional | 24/09/2020 | Spain | https://www.residuosprofesional.com/circ4life-incentivos-reciclaje-raee/ | | Article published and 2 tweets to give visibility |
| 80 | Indumetal | LA VANGUARDIA, 28.05.18 | 28/05/2018 | Spain | http://www.lavanguardia.com/vida/20180528/443911041228/indumetal-participa-en-proyecto-europeo-sobre-negocios-de-economia-circular.html | | Press release describing the project and the activities on which Indumetal is involved |
| 81 | Indumetal | Zicla' company website | 30/08/2019 | Spain | https://www.zicla.com/eu/blog/circ4life-eta-azken-erabiltzaileak/ ; https://www.zicla.com/blog/circ4life-reciclaje-reutilizacion-los-usuarios-finales/ | | Dedicated article to end-users' participation in the project. Includes the survey about recycling/reuse. Spanish and Basque languages |
| 82 | Indumetal | Summer location of bins: Indumetal's blog and news' service | 29/06/2021 | Spain | http://www.indumetalnews.com/es/los-contenedores-inteligentes-recogida-aparatos-electricos-electronicos-se-colocan-fadura-villamonte | | |
| 83 | Indumetal | 3rd School: Indumetal's blog and news' service | 08/08/2021 | Spain | http://www.indumetalnews.com/es/colegio-larranazubi-ultimo-getxo-utilizar-contenedor-inteligente-indumetal-depositar-aparatos-electricos-electronicos | | |
| 84 | Indumetal | Cocreation processes: Indumetal's blog and news' service | 18/05/2021 | Spain | http://www.indumetalnews.com/es/las-metodologias-co-creacion-desarrollo-proyectos-economia-circular-la-experiencia-indumetal-proyecto-circ4life | | |
| 85 | Indumetal | 2nd School: Indumetal's blog and news' service | 27/04/2021 | Spain | http://www.indumetalnews.com/es/getxo-instituto-julio-caro-baroja-segundo-centro-educativo-acoge-contenedor-inteligente-indumetal-depositar-aparatos-electricos-electronicos | | |
| 86 | Indumetal | 1st container in the streets: Indumetal's blog and news' service | 09/03/2021 | Spain | http://www.indumetalnews.com/es/instalado-contenedor-inteligente-recogida-pequenos-aparatos-electricos-electronicos-getxo | | |

| 87 | Indumetal | Results in 1st School:  Indumetal's blog and news' service | 02/02/2021 | Spain | http://www.indumetalnews.com/es/primera-recogida-residuos-aparatos-electricos-electronicos-romo-eskola-contenedor-inteligente-da-primeros-resultados | | |
| 88 | Indumetal | 1st School: Indumetal's blog and news' service | 12/01/2021 | Spain | http://www.indumetalnews.com/es/getxo-contenedor-inteligente-depositar-aparatos-electricos-electronicos-ya-esta-colocado-colegio-romo-romo-eskola | | |
| 89 | Indumetal | Real life test in the shop: Indumetal's blog and news' service | 04/12/2020 | Spain | http://www.indumetalnews.com/es/nuevo-test-piloto-funciona-sistema-incentivos-la-recogida-residuos-electricos-electronicos-getxo | | |
| 90 | Indumetal | Real life test in the container: Indumetal's blog and news' service | 06/11/2020 | Spain | http://www.indumetalnews.com/es/realizada-la-prueba-piloto-uso-del-contenedor-inteligente-la-recogida-residuos-electricos-electronicos-getxo | | |
| 91 | Indumetal | Gestion ayudas y subvenciones | 26/10/2020 | Spain | http://gestionidi.blogspot.com/2020/10/indumetal-avanza-para-incorporar-robots.html | | |
| 92 | Indumetal | Residuos profesional | 14/12/2020 | Spain | https://www.residuosprofesional.com/colegio-getxo-contenedor-inteligente/ | | |
| 93 | Indumetal | Ecoticias | 10/12/2020 | Spain | https://www.ecoticias.com/residuos-reciclaje/206665/Indumetal-Recycling-presenta-contenedor-inteligente-depositar-aparatos-electricos | | |
| 94 | Indumetal | COPE Radio Broadcast interview: intelligent bin and schools | 05/01/2021 | Spain | https://www.linkedin.com/posts/indumetal-recycling-sa_garbiker-copeabreuskadi-activity-6752252009853808640-u1ik/ | | |
| 95 | Indumetal | Aclima newsletter: intelligent bin in the 1st school | 14/01/2021 | Spain | https://aclima.eus/el-contenedor-inteligente-para-depositar-aparatos-electricos-y-electronicos-ya-esta-colocado-en-la-romo-eskola/?utm_source=mailpoet&utm_medium=email&utm_campaign=newsletter-aclima_3 | 1000 | |

| 96 | Indumetal | El Correo (local newspaper): 1st container in Getxo (Spanish) | 16/02/2021 | Spain | https://www.elcorreo.com/bizkaia/margen-derecha/getxo-cuenta-primer-20210216000218-nt.html | | |
| 97 | Indumetal | Deia (local newspaper): 1st container in Getxo | 16/02/2021 | Spain | https://www.deia.eus/bizkaia/eskuinaldea/2021/02/16/getxo-apuesta-reciclaje-residuos-electronicos/1099573.html | | |
| 98 | Indumetal | TV7 (local TV): 1st container in Getxo | 15/02/2021 | Spain | https://tele7.tv/instalan-en-getxo-dos-contenedores-inteligentes-para-depositar-pequenos-aparatos-electronicos/ | | |
| 99 | Indumetal | Getxo City Council (press release): 1st container in Getxo | 15/02/2021 | Spain | https://www.getxo.eus/es/servicios/comunicacion/notas-prensa/2602 | | |
| 100 | Indumetal | EyS Municipales (City Councils' news blog): 1st container in Getxo | 16/02/2021 | Spain | https://www.eysmunicipales.es/actualidad/getxo-participa-en-una-nueva-prueba-piloto-para-la-recogida-de-dispositivos-electronicos-mediante-contenedor-inteligente | | |
| 101 | Indumetal | El Correo (local newspaper): 1st container in Getxo (Basque) | 16/02/2021 | Spain | https://www.elcorreo.com/zurekin/edukiontzi-adimendu-baten-20210215125953-nt.html | | |
| 102 | Indumetal | Getxo Berri (Getxo City Council weekly magazine): campaign for the demo | 18/02/2021 | Spain | https://www.getxo.eus/DocsPublic/revistas/castellano/getxoberri/getxoberri_1625_cas.pdf | | |
| 103 | Indumetal | Ingurumen Aretoa (Getxo environmental School news): announcement of CIRC4Life training | 16/03/2021 | Spain | http://www.ingurumenaretoagetxo.eus/jornada-tecnica-de-agenda-2030-escolar/ | | |
| 104 | Indumetal | Deia (local newspaper): collecting results in 1st school | 14/06/2021 | Spain | https://www.deia.eus/bizkaia/eskuinaldea/2021/06/14/getxo-recoge-72-kilos-aparatos/1128058.html | | |
| 105 | Indumetal | Radio Bilbao (local Radio broadcast): schools training | 07/01/2021 | Spain | https://www.linkedin.com/posts/indumetal-recycling-sa_radiobilbao-activity-6752973004810014720-fv7M/ | | |
| 106 | Indumetal | Aclima newsletter: intelligent bin in the 3rd school | 17/06/2021 | Spain | https://aclima.eus/el-colegio-larranazubi-es-el-ultimo-de-getxo-en-utilizar-el-contenedor-inteligente-de-indumetal-para-depositar-aparatos-electricos-y-electronicos/?utm_source=mailpoet&ut | | |

| | | | | | m_medium=email&utm_campaign=newsletter-aclima_3 | | |
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| 107 | Indumetal / Recyclia | Leaflets for Getxo Citizens | 2021 | Spain | (examples in Deliverable of the Demo) | | |
| 108 | Indumetal / Recyclia | Roll ups and ads in public spaces in Getxo | 2021 | Spain | (examples in the Deliverable of the Demo) | | |
| 109 | REC | Electroimagen | 01/11/2020 | Spain | - | 29822 | |
| 110 | REC | FuturENVIRO.es | 04/11/2020 | Spain | futurenviro.es/contenedores-inteligentes-que-recompensaran-a-los-ciudadanos-por-reciclar-residuos-electronicos/ | 17000 | |
| 111 | REC | El Candelero Tecnológico.es | 04/11/2020 | Spain | elcandelerotecnologico.com/2020/11/04/por-primera-vez-contenedores-inteligentes-recompensaran-a-los-ciudadanos-por-reciclar-residuos-electronicos/ | 17546 | |
| 112 | REC | Silicon.es | 04/11/2020 | Spain | www.silicon.es/getxo-inicia-programa-piloto-de-contenedores-inteligentes-que-recompensan-por-reciclar-residuos-electronicos-2421005 | 61065 | |
| 113 | REC | msn.es | 04/11/2020 | Spain | www.msn.com/es-es/noticias/tecnologia/getxo-inicia-programa-piloto-de-contenedores-inteligentes-que-recompensan-por-reciclar-residuos-electr%C3%B3nicos/ar-BB1aGOco | 1000000+ | |
| 114 | REC | Residuos profesional.com | 05/11/2020 | Spain | www.residuosprofesional.com/contenedores-recompensan-reciclar-residuos-electronicos/ | 6570 | |
| 115 | REC | marrón y blanco.com | 05/11/2020 | Spain | www.marronyblanco.com/recyclia-colabora-en-una-revolucionaria-experiencia-piloto-de-reciclaje-que-recompensara-a-los-usuarios/ | 32829 | |

D8.3 - Report on the activities of exploitation and disseminations

| 116 | REC | marrón y blanco.com | 05/11/2020 | Spain | www.marronyblanco.com/recyclia-colabora-en-una-revolucionaria-experiencia-piloto-de-reciclaje-que-recompensara-a-los-usuarios/ | 32829 | |
| 117 | REC | Electromarket.com | 05/11/2020 | Spain | www.electromarket.com/noticia/22159/reciclar-residuos-electronicos-tiene-recompensa-en-getxo | 111972 | |
| 118 | REC | Electromarket.com | 05/11/2020 | Spain | www.electromarket.com/noticia/22159/reciclar-residuos-electronicos-tiene-recompensa-en-getxo | 111972 | |
| 119 | REC | Bilbaohiria.com | 05/11/2020 | Spain | bilbaohiria.com/bizkaia/getxo-pone-en-marcha-contenedores-con-recompensa/ | 120240 | |
| 120 | REC | Electro-imagen.com | 05/11/2020 | Spain | electro-imagen.com/articulo/recyclia-participa-en-una-experiencia-piloto-que-premia-las-buenas-practicas-ambientales | 29822 | |
| 121 | REC | Electro-imagen.com | 05/11/2020 | Spain | electro-imagen.com/articulo/recyclia-participa-en-una-experiencia-piloto-que-premia-las-buenas-practicas-ambientales | 29822 | |
| 122 | REC | it Reseller.es | 05/11/2020 | Spain | www.itreseller.es/al-dia/2020/11/recyclia-promueve-el-reciclaje-de-aparatos-tic-con-contenedores-inteligentes | 12121 | |
| 123 | REC | Bhalia.com | 06/11/2020 | Spain | www.bhalia.com/recyclia-contenedores-inteligentes-061120/ | 4290 | |
| 124 | REC | eSMARTCITY.es | 06/11/2020 | Spain | www.esmartcity.es/2020/11/06/contenedores-inteligentes-recompensan-reciclaje-residuos-electronicos-getxo | 15252 | |
| 125 | REC | RETEMA.es | 06/11/2020 | Spain | www.retema.es/noticia/contenedores-inteligentes-recompensaran-a-los-ciudadanos-por-reciclar-residuos-electr-Dfjj | 40000 | |
| 126 | REC | Interempresas.net | 06/11/2020 | Spain | www.interempresas.net/Smart_Cities/Articulos/318283-Por-primera-vez-contenedores-inteligentes-recompensaran-ciudadanos-reciclar-residuos.html | 1000000+ | |
| 127 | REC | el Ágora diario del agua.com | 06/11/2020 | Spain | www.elagoradiario.com/desarrollo-sostenible/economia- | 4290 | |

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| | | | | | circular/contenedores-inteligentes-residuos-electronicos/ | |
| 128 | REC | economíadehoy.es | 06/11/2020 | Spain | www.economiadehoy.es/por-primera-vez-contenedores-inteligentes-recompensaran-a-los-ciudadanos-por-reciclar-residuos-electronicos | 6960 |
| 129 | REC | EFEverde | 06/11/2020 | Spain | www.efeverde.com/noticias/contenedores-inteligentes-reciclaje-proyecto | 617489 |
| 130 | REC | INDUMETAL RECYCLING.com | 06/11/2020 | Spain | www.indumetalnews.com/es/realizada-la-prueba-piloto-de-uso-del-contenedor-inteligente-para-la-recogida-de-residuos-electricos-y-electronicos-en-getxo | 4290 |
| 131 | REC | ZONA MOVILIDAD.com | 07/11/2020 | Spain | www.zonamovilidad.es/reciclar-residuos-electronicos-tiene-recompensa | 78926 |
| 132 | REC | IndustriAmbiente.com | 09/11/2020 | Spain | www.industriambiente.com/noticias/20201110/contenedores-inteligentes-recompensaran-por-vez-primera-ciudadanos-reciclar-residuos-electronicos#.X6pyNWhKiUk | 19620 |
| 133 | REC | it TRENDS.es | 10/11/2020 | Spain | www.ittrends.es/negocios/2020/11/contenedores-inteligentes-que-recompensaran-a-las-personas-que-reciclen-tecnologia | 4290 |
| 134 | REC | SOGAMA.gal | 11/11/2020 | Spain | www.sogama.gal/gl/noticia/contedores-intelixentes-que-recompensar%C3%A1n-aos-cidad%C3%A1ns-por-reciclar-residuos-electr%C3%B3nicos | 6463 |
| 135 | REC | SOGAMA.gal | 11/11/2020 | Spain | www.sogama.gal/es/noticia/contenedores-inteligentes-que-recompensar%C3%A1n-los-ciudadanos-por-reciclar-residuos | 6463 |
| 136 | REC | ciencias Ambientales.com | 18/11/2020 | Spain | www.cienciasambientales.com/es/noticias-ambientales/contenedores-inteligentes-recompensaran-a-los-ciudadanos-por-reciclar-residuos-electronicos-19452 | 60120 |
| 137 | REC | confemetal.es | 20/11/2020 | Spain | confemetal.es/index.php?mid=niv67-con4283 | 7530 |

| 138 | REC | Apiem.org | 23/11/2020 | Spain | apiem.org/noticias/item/3983-arrancan-las-pruebas-del-contenedor-inteligente-para-peque%F1os-aparatos-electr%F3nicos | 5400 | |
| 139 | REC | Cinco Días | 28/11/2020 | Spain | - | 912000 | |
| 140 | REC | Cinco Días.El País.com | 28/11/2020 | Spain | cincodias.elpais.com/cincodias/2020/11/28/companias/1606581066_499016.html | 1000000+ | |
| 141 | REC | msn.es | 28/11/2020 | Spain | www.msn.com/es-es/dinero/empresa/reducir-reutilizar-reciclar-y-ahora-tambi%C3%A9n-recompensar-y-retornar/ar-BB1brIvo?li=BBpm8Mj | 1000000+ | |
| 142 | REC | Residuos profesional.com | 14/12/2020 | Spain | www.residuosprofesional.com/colegio-getxo-contenedor-inteligente/ | 6570 | |
| 143 | REC | EL ESPAÑOL.com | 02/01/2021 | Spain | www.elespanol.com/invertia/disruptores-innovadores/innovadores/empresas/20210102/contenedores-inteligentes-recompensan-buenos-habitos-reciclaje/546945633_0.html | 1000000+ | |
| 144 | REC | Tele7.tv | 15/02/2021 | Spain | tele7.tv/instalan-en-getxo-dos-contenedores-inteligentes-para-depositar-pequenos-aparatos-electronicos/ | 4290 | |
| 145 | REC | Deia | 16/02/2021 | Spain | - | 1000000+ | |
| 146 | REC | Deia.eus | 16/02/2021 | Spain | www.deia.eus/bizkaia/eskuinaldea/2021/02/16/getxo-apuesta-reciclaje-residuos-electronicos/1099573.html | 1000000+ | |
| 147 | REC | El Correo.com | 16/02/2021 | Spain | www.elcorreo.com/bizkaia/margen-derecha/getxo-cuenta-primer-20210216000218-nt.html | 1000000+ | |
| 148 | REC | El Correo.com | 16/02/2021 | Spain | www.elcorreo.com/zurekin/edukiontzi-adimendu-baten-20210215125953-nt.html | 1000000+ | |
| 149 | REC | EyS Municipales.es | 16/02/2021 | Spain | www.eysmunicipales.es/actualidad/getxo-participa-en-una-nueva-prueba-piloto-para-la-recogida-de-dispositivos- | 2015 | |

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| | | | | | electronicos-mediante-contenedor-inteligente | | |
| 150 | REC | eSMARTCITY.es | 18/02/2021 | Spain | www.esmartcity.es/2021/02/18/getxo-participa-nuevo-piloto-contenedores-inteligentes-reciclar-residuos-electronicos | 15252 | |
| 151 | REC | Gestores de RESIDUOS.org | 25/02/2021 | Spain | gestoresderesiduos.org/noticias/pais-vasco-el-reciclaje-de-raee-se-transforma-en-nuevos-arboles-en-getxo-biskaia | 6340 | |
| 152 | REC | europa press | 15/04/2021 | Spain | www.europapress.es/epsocial/responsables/noticia-incentivo-ciudadano-reciclar-aparatos-electricos-mejora-cantidad-calidad-recogida-recyclia-20210415133937.html | 1000000+ | |
| 153 | REC | Qué.es | 15/04/2021 | Spain | www.que.es/2021/04/15/incentivo-reciclar-aparatos-electricos-calidad/ | 266490 | |
| 154 | REC | Diario Siglo XXI.es | 15/04/2021 | Spain | www.diariosigloxxi.com/texto-ep/mostrar/20210415133935/incentivo-ciudadano-reciclar-aparatos-electricos-mejora-cantidad-calidad-recogida-segun-recyclia | 216930 | |
| 155 | REC | Stick noticias.com | 15/04/2021 | Spain | sticknoticias.com/el-incentivo-al-ciudadano-para-reciclar-aparatos-electricos-mejora-la-cantidad-y-calidad-de-la-recogida-segun-recyclia/ | 19950 | |
| 156 | REC | EFEverde | 15/04/2021 | Spain | www.efeverde.com/noticias/recyclia-piloto-contenedores-inteligentes-efecto-tesoro-raee | 617489 | |
| 157 | REC | FuturENVIRO.es | 15/04/2021 | Spain | futurenviro.es/la-prueba-piloto-de-contenedores-inteligentes-de-recyclia-confirma-que-recompensar-a-los-ciudadanos-favorece-la-reutilizacion-de-aparatos-electronicos/ | 17000 | |
| 158 | REC | marrón y blanco.com | 16/04/2021 | Spain | www.marronyblanco.com/la-prueba-de-contenedores-inteligentes-de-recyclia-confirma-que-recompensar-a-los-usuarios-favorece-la-reutilizacion-de-aparatos/ | 32829 | |

| 159 | REC | marrón y blanco.com | 16/04/2021 | Spain | www.marronyblanco.com/la-prueba-de-contenedores-inteligentes-de-recyclia-confirma-que-recompensar-a-los-usuarios-favorece-la-reutilizacion-de-aparatos/ | 32829 | |
| 160 | REC | Electromarket.com | 16/04/2021 | Spain | www.electromarket.com/noticia/22971/la-recompensa-con-incentivos-favorece-el-reciclaje-de-aparatos-electr | 111972 | |
| 161 | REC | Electromarket.com | 16/04/2021 | Spain | www.electromarket.com/noticia/22971/la-recompensa-con-incentivos-favorece-el-reciclaje-de-aparatos-electr | 111972 | |
| 162 | REC | economíadehoy.es | 16/04/2021 | Spain | www.economiadehoy.es/la-prueba-piloto-de-contenedores-inteligentes-de-recyclia-confirma-que-recompensar-a-los-ciudadanos-favorece-la-reutilizacion-de-aparatos | 6960 | |
| 163 | REC | Electro-imagen.com | 16/04/2021 | Spain | electro-imagen.com/articulo/recyclia-demuestra-que-recompensar-a-los-ciudadanos-favorece-la-reutilizacion-de-los-aparatos-electronicos | 29822 | |
| 164 | REC | Smart Lighting Home.com | 19/04/2021 | Spain | smartlightinghome.com/contenedores-inteligentes-recyclia-recompensar-ciudadanos/ | 7290 | |
| 165 | REC | Residuos profesional.com | 19/04/2021 | Spain | www.residuosprofesional.com/recompensa-aparatos-electronicos-favorece-reutilizacion/ | 6570 | |
| 166 | REC | EL INDEPENDIENTE.com | 19/04/2021 | Spain | www.elindependiente.com/futuro/medio-ambiente/2021/04/19/incentivar-al-ciudadano-para-reciclar-aparatos-electricos-mejora-la-cantidad-y-calidad-de-la-recogida-segun-recyclia/ | 478410 | |
| 167 | REC | muy canal.com | 22/04/2021 | Spain | https://www.muycanal.com/2021/04/22/tecnologia-sostenible-compromiso-futuro | 64852 | |
| 168 | REC | confemetal.es | 23/04/2021 | Spain | confemetal.es/index.php?mid=niv67-con4682 | 7530 | |
| 169 | REC | El Correo.com | 11/06/2021 | Spain | www.elcorreo.com/zurekin/kzgunea-romo-kultur-20210612194137-nt.html?ref=https%3A%2F%2Fwww.elcor | 1000000+ | |

| | | | | | reo.com%2Fzurekin%2Fkzgunea-romo-kultur-20210612194137-nt.html | | |
|---|---|---|---|---|---|---|---|
| 170 | REC | Deia.eus | 14/06/2021 | Spain | www.deia.eus/bizkaia/eskuinaldea/2021/06/14/getxo-recoge-72-kilos-aparatos/1128058.html | 1000000+ | |
| 171 | REC | radionervión.com | 14/06/2021 | Spain | www.radionervion.com/2021/06/14/getxo-recoge-72-kilos-de-aparatos-electronicos/ | 38067 | |
| 172 | GS1G | GS1 Germany Website - cirucularity and new sustainability strategy with standards | 2020 | Germany | https://www.gs1-germany.de/gs1-solutions/nachhaltigkeit/circular-economy/ | 371 | |

# 4    Training, Teaching and Education

As described in the Grand Agreement under Task 8.5 "Training, Teaching and Education", training materials were developed on the basis of the CIRC4Life project results with which the business audience can update their knowledge of the circular economy. All the training materials can be found from the project website (https://www.circ4life.eu/industrytrainingmaterials). Regarding the training to business audience a lot of training material has been created and a couple of sessions to companies with the specific tittle "Circular economy approach for circular business development" have been executed by RISE.

The material is used in RISE workshops and presentations on circular economy follows a modular structure (see Figure 17: Training material in modular structureFigure 17 above) that all CIRC4Life partners can use according to their needs and the needs of their partners/ customers.
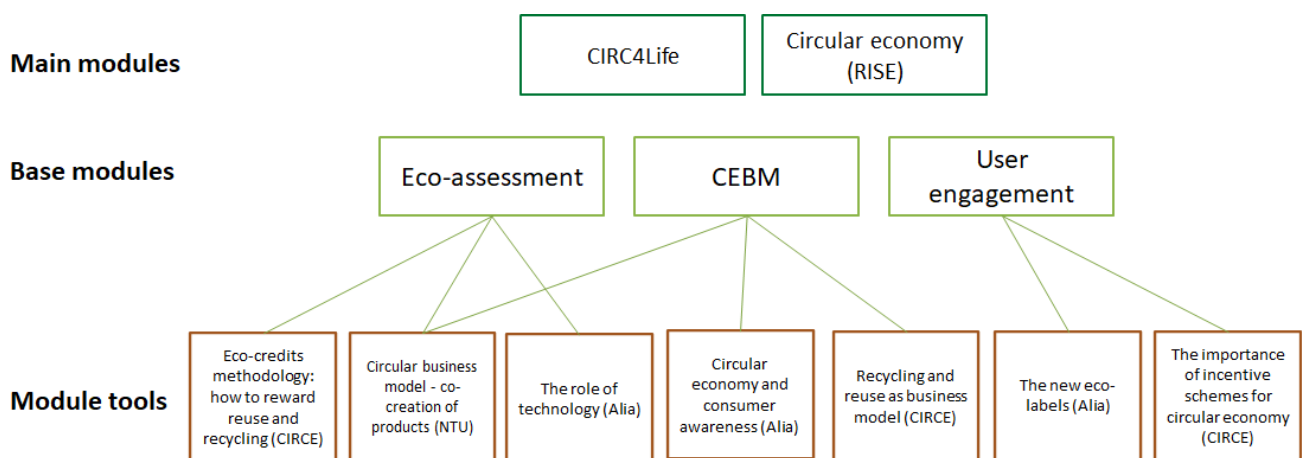


Figure 17: Training material in modular structure
(Designed by CIRC4Life partners)

**Current structure of educational package (modules can be combined for specific needs)**

The idea is that different modules can be combines in different versions depending on context and audience.

- **Main modules:** Can be used as introduction or main focus, and combined or used separately e.g. to exclude Circular Economy if the audience is already well acquainted with the topic
- **Base modules:** One or several main modules can be combined with one or several module tools depending on context and audience (e.g. start the education from the perspective of CEBM or from the perspective of Eco-assessment).
- **Module tools:** A larger amount of module tools that contain the main results of CIRC4Life and that can be combined with part/base/main modules

As further described in the Grand Agreement, the academic partners of the consortium (NTU, LAU, CIRCE and RISE) have disseminated the knowledge gained from this project at their respective institutes and universities mostly in form of academic teaching and education (ACADEMIC) but also as training to business audience (BUSINESS). The following tables (see Table 12 to Training to business audience is described in Task 8.5 in the DoA (Training, Teaching and Education). Here it is stated that training materials will be developed based on the CIRC4Life project outcome and to be available as training courses or workshops. For this task, RISE has coordinated the development of a training material available for project partners to utilize. It consists of a Power Point material containing modules that can be combined in different versions to best suit the one conducting the workshop and to the specific audience in question. The specific modules have been developed

by project partners with relevant competence in different areas, see Figure 17. As the material can be used for e.g. SME that are interested in circular economy and/or have an interest in the project outcomes, a session was organized with representative of Enterprise Europe Network (EEN) (https://enterpriseeurope.se/in-english.html) who gained knowledge of the material and also provided insights on how it best could be utilized. Issues brought up was e.g. that it is positive that the one holding the workshop could mix and match modules and/or slides to suite the specific audience in question. Also, that such workshops need to be pre-analyzed to ensure that the content suites the need of the participants depending on their interests and pre-knowledge. The workshop exercises were also considered valuable, as they help the company from 1) receiving information, to 2) beginning to apply it to their own company setting and business network. Furthermore, it was advice to combine the training material with an analysis of the company's existing or non-exiting innovation strategy as a way to ensure continued development and innovation in the sustainability area.

Table 16 in sections 4.1 to 4.4) show the success of these two types of sessions distinguished according to their TARGET GROUP.

Due to Covid 19 it has been difficult to gather a lot of SMEs for workshops. But insights and parts of the developed material from CIRC4Life have been used during frequently when coaching Swedish SMEs in a number of research projects.

The results of the project were used to inform and teaching in an academic way organised and executed by NTU, LAU, CIRCE and RISE in postgraduate and undergraduate courses in the fields of sustainable design, production, ecology, circular economy, business models and innovation and other related areas. This included contributions to the internships, teaching-related aspects such as teaching materials for taught modules, group / individual projects, theses, etc.

## 4.1 LAU

**Table 13: LAU academic teaching and education (designed by CIRC4Life)**

| TARGET GROUP | TYPE OF ACTIVITY | WHEN- DURATION | NUMBER OF PEOPLE | SPECIFIC TOPIC |
|---|---|---|---|---|
| **ACADEMIC** | Master courses | 90 ects | 18 | Facilitation of co-creation events: Open Innovation Camp, LAUREA CE Jam |
| **ACADEMIC** | Master thesis | | 3 | Business Benefits of Co-creation and How to Effectively Communicate Their Value to SMEs Developing Circular Economy Business Models |
| **ACADEMIC** | Info sessions for three master level groups | 2019 | +100 | Info session continue in 2020 |
| **ACADEMIC** | Engagements of bachelor students in Laurea CE Jam | 2019 | 30 | CIRC4Life challenges:<br>• Food waste solutions<br>• Visualisation of sustainable information<br>• Development of a UI for consumer app<br>• E-waste solutions |
| **ACADEMIC** | Engagement of students in testing of CIRC4Life solutions | 2019-2020 | +50 | ONA website usability testing, ONA lamp testing and CIRC4Life App testing |

## 4.2 NTU

**Table 14: NTU academic teaching and education (designed by CIRC4Life)**

| TARGET GROUP | TYPE OF ACTIVITY | WHEN- DURATION | NUMBER OF PEOPLE | SPECIFIC TOPIC |
|---|---|---|---|---|
| ACADEMIC | Project for EU Erasmus Programme | Sept 2019 – Feb 2020, full time | 5 | Intelligent bin design for recycling end-of-life electronic products |
| ACADEMIC | BSc Product Design project | One term, Sept 2019 – July 2020 | 1 | Sustainable domestic lighting product design |
| ACADEMIC | Lecture | 5th December 2019 | 50 | Circular economy approach for sustainable product development |
| ACADEMIC | PhD projects | PhD awarded in Jan 2021 (PhD project 1) and project on-going till the end of the CIRC4Life project (PhD project 2) | 2 | Circular economy and product development |
| ACADEMIC | BSc final year major study project | One term, Sept 2019 – July 2020 | 1 | Sustainable domestic lighting product design |
| ACADEMIC | Project for EU Erasmus programme | Sept 2020 – Feb 2021 | 4 | Group project: Mobile APP and intelligent bin for circular economy |
| ACADEMIC | Industrial design student projects | Dec. 2017-Apr.2018 Dec. 2018-Apr.2019 Dec. 2019-Apr.2020 | 6 | Project titles include (1) social LCA of lighting products, (2) Big data for mining consumer views, (3) Development of PDS based on online data mining and sustainable product design |
| ACADEMIC | Visiting scholar project | Oct. 2019 - Oct. 2020 | 1 | Mining consumer preferences from consumer reviews posted in Ona online shop Website |
| ACADEMIC | PhD project: An integrated approach for sustainable product development | PhD awarded in July 2021 (PhD project 3) | 1 | The contents of the PhD research are relevant to the CITC4Life project related to E-LCA and S-LCA of lighting products |
| ACADEMIC | European Project semester programme | Sept 2020- Jan 2021 | 4 | Survey of mobile App for the CIRC4Life recycling and intelligent bin design |

## 4.3 CIRCE

**Table 15: CIRCE academic teaching and education (designed by CIRC4Life)**

| TARGET GROUP | TYPE OF ACTIVITY | WHEN- DURATION | NUMBER OF PEOPLE | SPECIFIC TOPIC |
|---|---|---|---|---|
| ACADEMIC | Course | June 2019 | 19 | Circular economy and CIRC4LIFE project |
| ACADEMIC | Training course + practical cases | 22/11/2019 - 4 hours | 6 | Circular economy packaging and eco-labelling |

## 4.4 RISE

Training to business audience is described in Task 8.5 in the DoA (Training, Teaching and Education). Here it is stated that training materials will be developed based on the CIRC4Life project outcome and to be available as training courses or workshops. For this task, RISE has coordinated the development of a training material available for project partners to utilize. It consists of a Power Point material containing modules that can be combined in different versions to best suit the one conducting the workshop and to the specific audience in question. The specific modules have been developed by project partners with relevant competence in different areas, see Figure 17. As the material can be used for e.g. SME that are interested in circular economy and/or have an interest in the project outcomes, a session was organized with representative of Enterprise Europe Network (EEN) (https://enterpriseeurope.se/in-english.html) who gained knowledge of the material and also provided insights on how it best could be utilized. Issues brought up was e.g. that it is positive that the one holding the workshop could mix and match modules and/or slides to suite the specific audience in question. Also, that such workshops need to be pre-analyzed to ensure that the content suites the need of the participants depending on their interests and pre-knowledge. The workshop exercises were also considered valuable, as they help the company from 1) receiving information, to 2) beginning to apply it to their own company setting and business network. Furthermore, it was advice to combine the training material with an analysis of the company's existing or non-exiting innovation strategy as a way to ensure continued development and innovation in the sustainability area.

**Table 16: RISE academic teaching and education and training of businesses (designed by CIRC4Life)**

| TARGET GROUP | TYPE OF ACTIVITY | WHEN- DURATION | NUMBER OF PEOPLE | SPECIFIC TOPIC |
|---|---|---|---|---|
| **BUSINESS** | Presentation of CIRC4Life at the spring meeting of the Ecodesign Network hosted by RISE | March 2019 | 10 companies | Exclusive Topic of the network meeting: Live cycle management and collaboration in the value chain |
| **ACADEMIC** | Lecture for master students at Chalmers University of Technology in Sweden | February 2019 | 25 | Life cycle management and circular economy |
| **ACADEMIC** | Training course + practical cases | 4 hours (2020-02-27) | 19 | Circular economy approach for circular business development |
| **ACADEMIC** | Training course + practical cases | 5 hours (2020-03-03) | 25 | Circular economy approach for circular business development |
| **ACADEMIC** | Training course + practical cases | 2 hours (Feb 2021) | 1 company | Circular economy approach for circular business development |
| **ACADEMIC** | Training course + practical cases | 2 hours (Feb 2021) | 1 company | Circular economy approach for circular business development |
| **BUSINESS** | Workshop with SME for coaching in circular economy | 3 hours, January 2021 | 1 company | Circular economy approach for circular business development |
| **BUSINESS** | Workshop with SME for coaching in circular economy | 3 hours, February 2021 | 1 company | Circular economy approach for circular business development |
| **BUSINESS** | Workshop with SME for coaching in circular economy | 3 hours, February 2021 | 1 company | Circular economy approach for circular business development |

| BUSINESS | Workshop with SME for coaching in circular economy | 3 hours, March 2021 | 1 company | Circular economy approach for circular business development |
|---|---|---|---|---|
| BUSINESS | Workshop with SME for coaching in circular economy | 3 hours, March 2021 | 1 company | Circular economy approach for circular business development |
| BUSINESS | Workshop with SME for coaching in circular economy | 3 hours, April 2021 | 1 company | Circular economy approach for circular business development |
| BUSINESS | Workshop with SME for coaching in circular economy | 3 hours, May 2021 | 1 company | Circular economy approach for circular business development |
| BUSINESS | Workshop with SME for coaching in circular economy | 3 hours, May 2021 | 1 company | Circular economy approach for circular business development |
| BUSINESS | Workshop with SME for coaching in circular economy | 3 hours, August 2021 | 1 company | Circular economy approach for circular business development |

# 5    Outlook

Looking into the future, the results of the CIRC4Life project will continue to foster the transition for the CIRC4Life partners towards a CE through their systemic and eco-innovative CE because of their strong mode of operation. Especially regarding the 17 Global Goals (officially known as the Sustainable Development Goals or SDGs) the three CEBM, supported by the ICT platform and several other key solutions will lead the general stakeholders in Europe like scientific and technological leaders, the research and academia, the supply chains partner, policy makers and the society to adjust their business and all their activities for more sustainable products and services. This includes also dissemination activities as well as training and teaching for academic and business target groups.

The implementation of the Sustainable Development Goals (SDGs) based on the three CEBM will of course have a strong focus on **SDG 12 Responsible Consumption and Production**. Many of the factors investigated in the CEBM and shown in the CIRC4Life demonstrators flow into this direction as SDG combines the two sides of our daily work and use in a world of fast-moving consumer goods. Going deeper in its targets (see https://www.globalgoals.org) there are three to be prioritised where CIRC4Life can be a forerunner to achieve easier success and more realistic impact:

- 12.2 SUSTAINABLE MANAGEMENT AND USE OF NATURAL RESOURCES
- 12.6 ENCOURAGE COMPANIES TO ADOPT SUSTAINABLE PRACTICES AND SUSTAINABILITY REPORTING
- 12 C REMOVE MARKET DISTORTIONS THAT ENCOURAGE WASTEFUL CONSUMPTION

The creation of new markets for CE oriented products/services to empower end-users for more sustainable consumption is one mayor outcome of CIRC4Life which will last into the future. Also, the new CIRC4Life approaches for designing products/services collectively considering end-users, brand owners, as well as entrepreneurs and researchers define innovative ways to satisfy needs from cradle to cradle. This also includes the reduction of the length of the corresponding supply chains. Finally, the inclusion of resource or materials criteria in designing products/services contributes to an increase in resource and energy efficiency and leads to reduced environmental impacts.

Looking at **SDG 9 Industry, Innovation and Infrastructure** goal and its three main targets, the CIRC4Life innovative solutions clearly support the creation of new business opportunities for industry and SMEs in the EU and thus improving the competitiveness of EU enterprises in the global market:

- 9.4 UPGRADE ALL INDUSTRIES AND INFRASTRUCTURES FOR SUSTAINABILITY
- 9.5 ENHANCE RESEARCH AND UPGRADE INDUSTRIAL TECHNOLOGIES
- 9 C UNIVERSAL ACCESS TO INFORMATION AND COMMUNICATIONS TECHNOLOGY

In the context with the third major dimension among the predominant SDGs, **SDG 17 Partnerships for the Goals** and worldwide collaboration the CIRC4Life results stand for best practice: here for an economic, social, cultural and environmental sustainability in the future. In a global economy supply chains have to integrate partners from all over the world as sustainable sourcing and distributing under circularity aspects only take place in good partnership sharing data and knowledge:

- 17.7 ENCOURAGE EFFECTIVE PARTNERSHIPS
- 17.18 ENHANCE AVAILABILITY OF RELIABLE DATA
- 17.7 PROMOTE SUSTAINABLE TECHNOLOGIES TO DEVELOPING COUNTRIES

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# 7    Appendices

**Business Model Canvases – listed according four target groups**
Four different business models in the field of the CEBM of "collaborative recycling and reuse" can be depicted individually, for a) Citizens; b) Supermarkets or similar; c) Incentivisers and d) Secondary raw materials trading companies:
a)



b)

c)

### CIRC4Life – Secondary raw materials trading company

| PROBLEM | SOLUTION | UNIQUE VALUE PROPOSITION | UNFAIR ADVANTAGE | CUSTOMER SEGMENTS |
|---|---|---|---|---|
| Lack of ensured sources of wastes to recover secondary raw materials | Cheaper raw materials | We provide you a well sorted raw material (or devices) at low cost | | Specific wastes (WEEEs, cloths, plastics, etc.) companies looking for secondary raw materials |
| Some sorting methods are not providing high grade of separation | Well sorted raw materials | | | |

| | KEY METRICS | | CHANNELS | Early Adaptors |
|---|---|---|---|---|
| **Existing alternatives** | Companies adhered to CEBM | | PR | Companies that already are in touch with other(s) waste managers |
| Already existing providers | Tons of material provided and purity | **High level concept** | | |
| | | Like your other secondary raw materials suppliers | | |

| COST STRUCTURE | REVENUE STREAMS |
|---|---|
| Bins (buying and maintenance) Legal costs Waste transportation costs and storage facilities | Selling wastes to third parties |

d)

### CIRC4Life – incentivizers

| PROBLEM | SOLUTION | UNIQUE VALUE PROPOSITION | UNFAIR ADVANTAGE | CUSTOMER SEGMENTS |
|---|---|---|---|---|
| Supermarket or some specific commerce doesn't have a green image | You just pay a small amount of money and we announce you as a incentivizer | We allow local commerce to be more visible just by implementing a discount program to redeem incentives. | | Local commerce related to wastes that are collected in the bins |
| Lack of clients or competitiveness | We ensure that your loyalty program is compatible with our system | | | |
| | You control your discounts | | | |

| | KEY METRICS | | CHANNELS | Early Adaptors |
|---|---|---|---|---|
| **Existing alternatives** | Local commerce participation | | PR and social media Word of mouth | Commerce used to another discounts apps/websites |
| PR and media | Number of incentives redemption | **High level concept** | | Greener small commerce that want to increase their CSR |
| Discounts | Number of IT calls because of systems integratrion | Like your publicity costs but with a greener image | | |
| Greener attitude than competence | | | | |

| COST STRUCTURE | REVENUE STREAMS |
|---|---|
| Bins (buying and maintenance) Marketing, media and legal costs App development and infrastructure Waste transportation costs and storage facilities | Small fee for participation Selling wastes to third parties |