A circular economy approach for lifecycles of products and services

Report on the lessons learned from the Demonstrators of CEBMs and recommendations

Deliverable 6.6

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Document Responsible	Karin Wilson and Hanna Lindén, RISE
Contributors	NTU, ONA, KOS, IND, REC, JS, IEIA, ALIA, CIRCE, LAU
Reviewed by	IND, LAU, NTU, and TM (CIRCE)
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Summary

The lessons learned and recommendations from the implementation of the three Circular Economy Business Models (CEBMs) developed in CIRC4Life, are described in this deliverable. The present document, in conjunction with the on-site demonstration deliverables, D6.1 On site demonstration of CEBM for industrial and domestic lights, D6.2 On site demonstration of CEBM for tablets, D6.3 On site demonstration of CEBM for vegetable food, and D6.4 On site demonstration of CEBM for meat supply chain, and the deliverable D6.5 Report on the demonstrations of CEBMs address the tasks described in Description of Action (DoA) for Work Package (WP) 6 Demonstrators. Learnings from the demonstrators are also collected through final interviews with all demonstration owners and input about learnings was also collected from project partners developing CEBMs and Information and Communication Technology (ICT) tools.

The three CEBMs: Co-creation of products/services; Sustainable consumption; Collaborative recycling/reuse, was demonstrated in two industrial sectors: electronics and farming/agri-foods. Demo 1 includes LED lights, both domestic (ONA; Demo 1a) and industrial (Kosnic, Demo 1b). Demo 2 includes tablets (Indumetal and Recyclia). Demo 3 includes vegetable food (Scilly Organics), and Demo 4 includes the meat supply chain (Alia). The activities during the CIRC4Life project have generated a wide range of learnings, and some key generic learnings are identified, on the topics of.

- **The transition towards a circular economy**

Engaging in a transition toward a circular economy and a circular business logic can be experienced as a complex process that requires many different parts and that requires the involvement of many actors. In doing so, it is advised to start the process by taking actions in small steps, and to adapt tools and processes to the specific local context in which they are to be implemented.

- **Co-creation**

To co-create with end users or other stakeholders has been noted as having very positive outcomes for the project partners, and which have provided many new learnings for those involved. These learnings related both to new knowledge gained concerning products and services, but also regarding the way to involve and engage with other actors. It is also considered a possibility to ensure that stakeholders requirements are identified and included from the start of product development.

- **LCA and S-LCA**

Results from Life Cycle Assessments (LCA) and Social LCA (S-LCA) provided partners with new ways of communicating with stakeholders, and new content for this communication. Additionally, it provided partners with new knowledge critical for improving product development and related processes. Obviously, it also provides possibilities for companies to develop more sustainable products, services and/or processes.

- **The importance of communication and engaging stakeholders**

Throughout the project, the importance of communication has been apparent. This relates to communicating LCA results and using eco labels and eco-information. It also relates to e.g. awareness campaigns. These activities have been noted as providing important learnings for the partners.

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Acronyms and Abbreviations

Abbreviation	Description
CEBM	Circular Economy Business Model
CSR	Corporate Social Responsibility
DoA	Description of Action
ICT	Information and Communication Technologies
LCA	Life Cycle Assessment
LL	Living Lab
PDS	Product Design Specification
S-LCA	Social Life Cycle Assessment
WEEE	Waste of Electrical and Electronic Equipment
WP	Work Package

1   Introduction

For a large-scale demonstration project like CIRC4Life, it is important to reflect on the developed models and tools when implementing them in different companies and sectors; what have worked well and what improvement would be needed to develop tools and companies even more in order to transit to a circular economy. It is important to use the experiences and results from the involved companies and research partners to exploit the result in other companies, but also to other sectors. These experiences will also be valuable for policy making.

The demonstrators in CIRC4Life have been implementing the three developed Circular Economy Business Models (CEBMs), developed in Work Packages (WPs) 1-3, see D1.3 Report on development of eco-points methods, D2.3 Development of the Information and Communication Technologies (ICT) system for reuse/recycling, D2.5 Incentive schemes for collaborative reuse/recycling of products, and D3.1 Development of eco-shopping and eco-account tool. The activities for each demonstrator and each CEBM have many times been different, as they by necessity have been adapted to different local contexts and to the specific industry sector. It has included a variety of types of activities, such as demonstrating eco-labels on products and engaging customers for feedback, demonstrating eco-shopping in physical stores and in online web shops, return systems of products for reuse and recycling and related incentive schemes, co-creating new products and modular products, and development of leasing models for LED lightings instead of sales of products. The different activities have provided feedback from a variety of stakeholders to the demonstration owners, which they have used to continuously develop their activities to improve the implementation of the CIRC4Life CEBMs and ICT tools.

This deliverable includes a summary of experiences mainly from the demonstration owners, but also valuable insights from research partners that can be used to disseminate results and further engage new stakeholders for circular economy. That means the deliverable summaries all type of experiences gained in the CIRC4Life project and include conclusions drawn from these insights. Figure 1 below show a developed visualisation for the CIRC4Life project on how the CEBMs, and ICT platform developed in the project, (see e.g. D4.1 System specification including traceability matrix, and D4.2 Report on information logistic systems development and resulting systems and processes) and the stakeholders are connected.

During the demonstration phase, less physical events took place than planned, due to Covid-19 restrictions. The pandemic situation postponed activities, and also created a need to rethink activities overall, and to assess which activities that could be performed as digital events. It created a need to generate ideas for new type of activities, as an alternative to originally planned activities. In such situation, large scale demonstration proved difficult. However, what was obvious is the continued interest in sustainability actions and engagement shown by the demonstration companies, and the interest of the stakeholders involved, as a part of their way to become a more sustainable company. Overall, all partners have gained insights on what it takes to be more sustainable as a company and on CEBM development and how it would be possible to implement. These insights and recommendations are compiled and shared in the current deliverable.
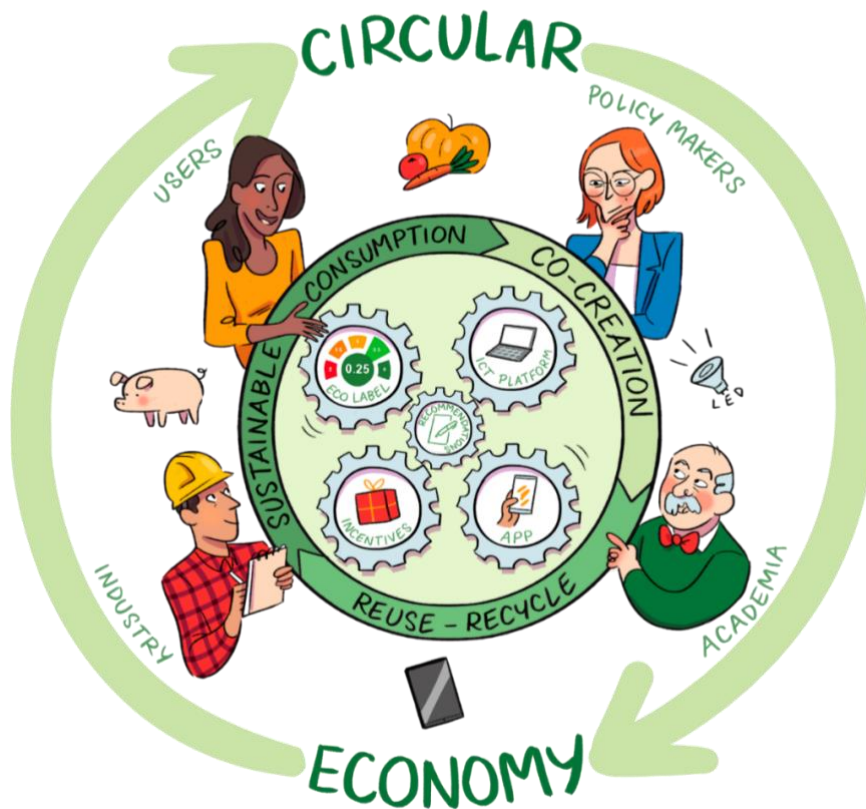
Figure 1: Visualisation of the CEBMs and tools developed in CIRC4Life in relation stakeholders (for details see D8.3 Report on the activities of exploitation and disseminations)

1.1   Short Overview of the CEBMs and the Demonstrators

Within the CIRC4Life project, three CEBMs have been developed in WP 1-3, see Figure 2:

- Co-creation of Products/Services model
- Collaborative Recycling/Reuse model
- Sustainable Consumption model

Figure 2: Illustration of the three CEBMs developed in CIRC4Life

Figure 3 presents the relation between the three CEBMs, developed in WP7, see D7.4 Eco systemic business models.

Figure 3: Illustration of the relation between the three CEBMs (see D7.4)

These CEBMs has been demonstrated in two industrial sectors:

- Electronics (with the products of LED lights and computer tablets)
- Farming/agri-food (for vegetables and meat)

The demonstration period of the project reached from month 19 to month 41[1]. During that period, the demonstration owners have practiced an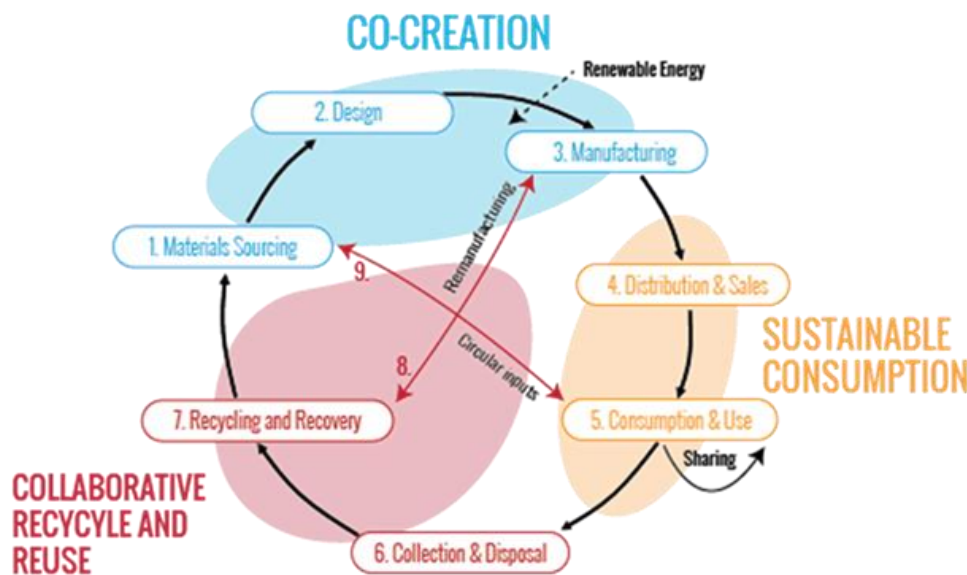d demonstrated the CEBMs to their stakeholders and end-users by a full scale go to market demonstration. The demonstration is conducted through the product lifecycles and supported by the ICT platform developed in the project. Implemented demo activities have been preceded by Living Lab (LL) testing activities (for detailed reporting see D7.2 Report of implementing LLs and ACSI-events and recommendations in the circular economy efforts and D7.3 Report on stakeholder involvement along the supply chain).

1.2   Objectives for WP6 Demonstrators Task 6.6

The demonstrations activities conducted in Task 6.2 to 6.4, as described in the Description of Action (DoA), have provided valuable experiences which be found in the corresponding deliverables D6.1 On site demonstration of CEBM for industrial and domestic lights, D6.2 On site demonstration of CEBM for tablets, D6.3 On site demonstration of CEBM for vegetable food, and D6.4 On site demonstration of CEBM for meat supply chain, but also in overall WP6 deliverable D6.5 Report on the demonstrations of CEBMs. In order to best utilize these experiences, the aim of Task 6.6 is to report on learnings related to implementing the three CEBMs and ICT tools. These learnings can be used as a base for further improvements and applications of the CEBMs and the

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[1] Although, the timing of the deliverables, after the prolongation of the project, is a bit different for the different demonstrators.

developed ICT platform in industry and in other sectors. Activities for utilizing these experiences and outcomes include:

- The experiences gained, and the lessons learned related to the demos, have been summarised and analysed (current deliverable).
- This report is a base for further improvement and guidance of the result and developed and applied into industry and other sectors.
- The results summarised in the report can be utilised for exploitation.

The document report on the experiences and learnings from the four demonstrators regarding the new CEBMs developed but also insights collected from other project partners. The report is based on the deliverables of each demonstrator (D6.1, D6.2, D6.3, D6.4, and D6.5). Furthermore, interviews have been conducted with representatives for each demonstrator in order to collect and discuss important learnings (see Appendix A, Interview guide). Responses has also been collected from e.g. CEBM owners and project partners. Additionally, work done within e.g. Task 8.5 on Training, Teaching and Education, and during project meetings have in part been utilized for this report.

2   Lessons Learned on Implementation of CEBMs and ICT Tools into the Demonstrators

This chapter includes a compilation of key learnings from all the demonstrators on what the companies have learnt during the process and what recommendation that the participating companies can pass on to other companies and sectors. There are also key learnings from other project partners around what have been working and what have proven difficult or needed to be adjusted.

The first section contains insights regarding the developed CEBMs and ICT tools, based on insights from CEBM partners and demo owners.

Following sections are key learnings from the four demonstrators, represented by the five industry companies. All involved partners have contributed with learnings from the project, both from development and implementation of CEBMs and related tools.

2.1   Lessons Learnt of CEBMs and Developed ICT Platform and Tools

The following sections include a summary of development in the CEBMs from D6.5 and lessons learnt from development and implementation of CEBMs and ICT tools in the demonstrators and from CIRC4Life research partners. Summaries are included to facilitate reading of the current deliverable and to highlight previous developments and results, in combination with experiences from implementing CEBMs and ICT tools in the demonstrators.

CEBM Co-creation of Products/Services

The co-creation CEBM in CIRC4Life have developed tools and services related to materials and production in the supply chain. Key tools developed and used for this CEBM is[2]:

- Product Design Specification (PDS): Integration of PDS with eco-constrains, sustainable design and manufacture. This approach demonstrates that sustainable design measures start at the planning and design stages, which can ensure that the environmental and social impacts of products are reduced.
- Online Life Cycle Assessment (LCA) tool and Impact Assessment Tool: Online LCA tool is to implement eco-cost calculation, while 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 behaviour.
- Eco-point method and the eco-accounting platform: The eco-point method is to account the sustainability of products purchased and recycled, which includes the basic items: eco-cost and eco-credit. Eco-accounting platform utilises the information and communication technologies to collect and process the data for the calculation of eco-costs and eco-credits, and then apply the eco-costs and eco-credits obtained into eco-shopping, recycling/reuse, consumer's eco-account, and product sustainability assessment (see Figure 4 below (D1.3).
- Leasing service for industrial lightings: For the new modular design based on industrial lighting LED luminaire, accordingly, a leasing service is developed, in which a full maintenance cover and flexible payment options are included.
- Co-creation approach: Brings the end-users/consumers closer to the beginning of the product development, which is achieved via co-creation activities, including online data.

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[2] The following bullet list about Co-creation CEBM is a summary from D6.5.
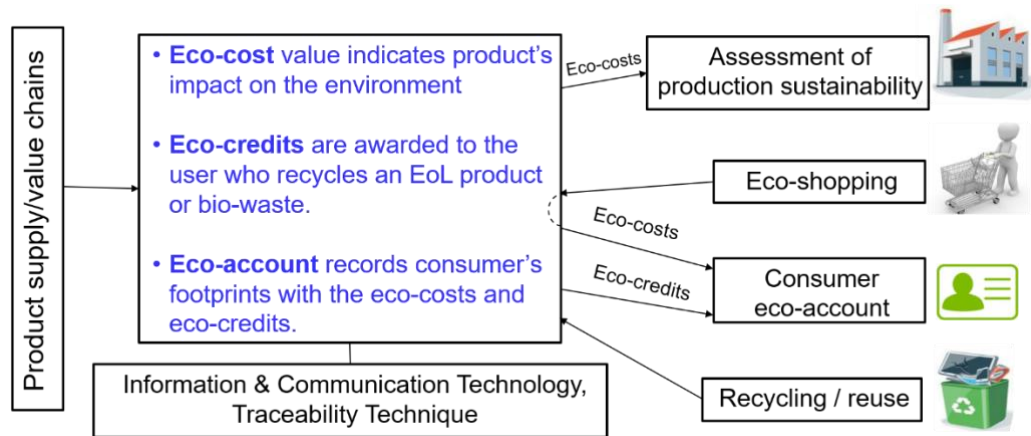
Figure 4: Summary of the key parts of the CEBM Co-creation of Products/Services developed within WP1

Learnings from CEBM partners regarding this CEBM:

LCAs and social life cycle assessments (S-LCAs) has been used in the project to assess the environmental and social impact of products and services developed. These tools have provided valuable information about where products and service should be improved for the demonstrators. These methods can also gain knowledge about the companies and on how to improvement internally, for example, how to be more energy efficient and how staff is treated.

Conducting LCAs and S-LCAs during the project thus provided business owners with relevant information. This information was also communicated in companies' websites as well as the project's website to facilitate socially responsible manufacturing and purchasing. By displaying company social performance related to the relevant sector's performance, comparisons could be made and provides users with information to make sound decisions. This is a recommendation also for other industries to engage in.

LCA was highlighted by all the companies and the CIRC4Life demonstrators as a valuable technique to inform and help shape sustainable products and services. However, difficulties were spotted in the implementation of LCA among enterprises and communication with consumers to inform their purchasing decision-making. Enterprises often have difficulties in accessing suitable LCA tools and lack the know-hows to perform the LCA, and in improving the effectiveness of communicating the LCA results to their consumers.

Customer understanding plays an important role in market-driven product design, for example, since as more consumers like to post and share product reviews online. Big consumer review data provide new opportunities for product manufacturers and designers to explore the value of fulfilling customer requirements. The CIRC4Life project developed an approach to deal with the big online consumer reviews data for customer requirements understanding, which would be valuable for other companies and sectors to explore.

Regarding food products and production, this CEBM could help to prevent food waste, as the developed products are delivered in the taste preferred by consumers. At the same time, the manufacturer then probably has a guarantee that the products will find buyers. A generic learning is also that by engaging the consumers, it provides the opportunity to build positive relationships in the value chain. An important learning about co-creation of a product is that it should include the full life cycle of the designed products. Also, it should consider the impact on consumer behavior regarding waste disposal as well as opportunities and impacts on recycling options.

CEBM Collaborative Reuse/Recycling

The Collaborative Reuse/Recycling CEBM in CIRC4Life have developed tools and services related to products reuse and recycling of material. Key tools developed and used for this CEBM is[3]:

- Intelligent bin: The intelligent bin connects a user account (i.e. eco-account through the smartphone app) which serves as opener to the intelligent bin to dispose the bags and boxes with wastes.
- Smartphone app: The intelligent bin goes together with a dedicated smartphone application which provide a series of functionalities to the citizens, e.g. showing the status of wastes deposit by users.
- Traceability module: It is integrated to the waste collection system and provide solutions to the citizens (by means of the Smartphone app the status of the wastes and the expected time for receiving the incentives is shown), business owners (i.e. waste receivers, indicate the status of the wastes and the incentives to be provided) and incentivisers (process the information from the citizens account and remove the incentives from their account when they are redeemed).
- Incentive scheme: Incentives is provided by different stakeholders and added to the citizens' accounts after each interaction with the intelligent bin. These incentives are redeemed in regional distance and in different commerce or by means of municipalities for public services or discounts. Its aim is to incentivize costumers to perform a proper disposal of a product after its lifetime.

Learnings from CEBM partners regarding this CEBM:

Use of an incentive scheme is seen as a way of pushing the consumer to sort waste, not just threw it away, but to instead hand in WEEE and sort bio-waste. This way circular economy can prolong the products lifetime and minimise the waste streams. Even if the products are not reusable the material can be recycled and reduce the need for virgin resources.

It is considered that the ICT platform is necessary for the innovative CEBM Collaborative Reuse/Recycling since it provides the end-user with information about the disposed Waste of Electrical and Electronic Equipment (WEEE) or bio-waste, but also the eco-account were eco-costs and eco-credits are displayed. It is a common point for information from manufacturers, recycling companies and end-users. This type of innovation is therefore one of the outcomes of the project, and a recommendation for other companies and sectors is to further explore this CEBM in their settings. On another note, the eco-credit calculation developed within this CEBM is considered applicable to all kinds of products, however, adaptations are needed to suit specific contexts and setting.

The CIRC4Life mobile app have been used in several of the demonstrators for example when returning WEEE or disposing bio-waste and gain eco-credits in the eco-account, see Figure 5. It has also been used when eco-shopping to see eco-cost of a product. Through the eco-account in the app the end-user is able to track their environmental impact when buying product and recycling process. During the project it has been discovered that if a company mainly communicate and interact with the consumer through a mobile app, it is important to develop the mobile application according to end-users needs to ensure acceptance. For further exploitation it is necessary that the app is available on all type of platforms in order to reach as many end-users as possible.

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[3] The following bullet list about Collaborative CEBM is a summary from D6.5.
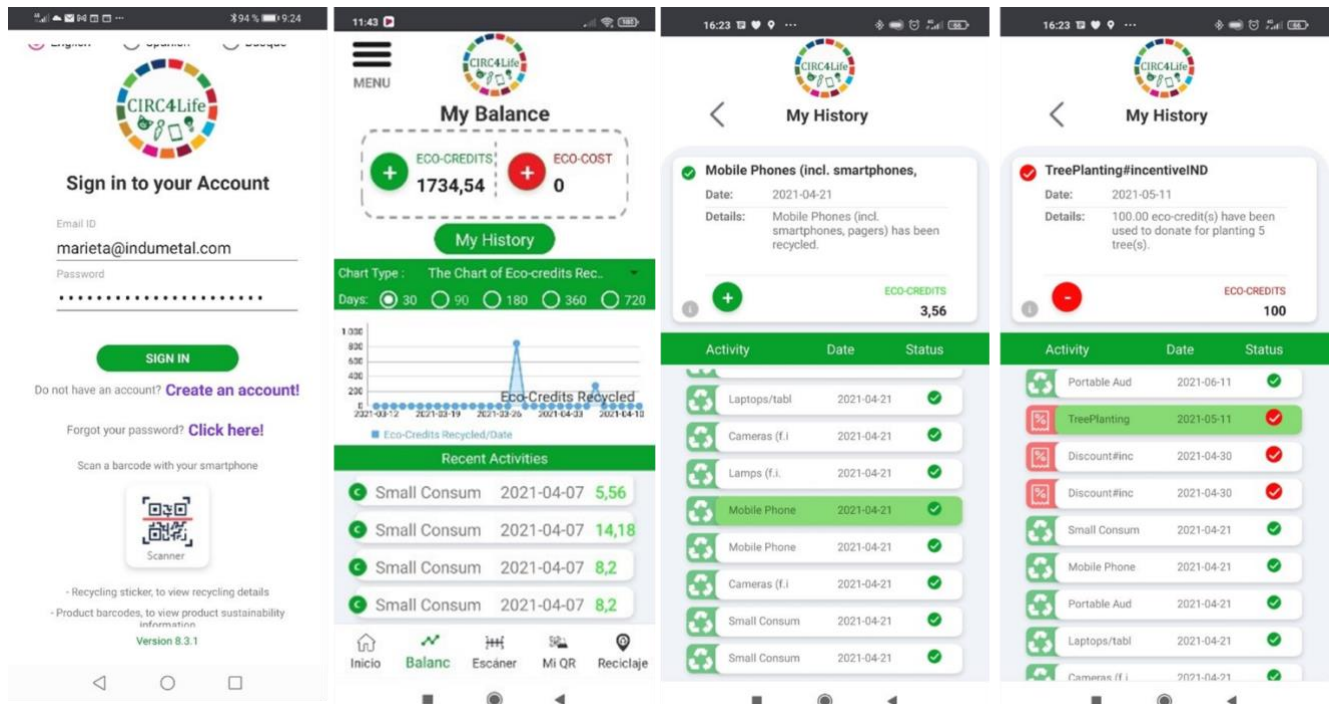
Figure 5: Visualization of the CIRC4Life App eco account (see D6.2 and D7.2)

The acceptance of this CEBM can differ depending on the country and depending on the type of waste. It is considered easy to find acceptance for packaging, but for WEEE and textiles, it can differ depending on how trusted the recycler or companies working with reuse of WEEE and textile is. For example, regarding WEEE, customers worry about security of data for example erased from the device or not before it maybe will be repaired and reused. On the other hand, acceptance for packaging and bio-waste is high, due the environmental impact. This can also depend on the country in question, where some countries have come further in recycling for citizens, with easy access to recycling points and use of awareness campaigns, which means that incentives are not as important as it might be in other countries.

Explaining to the end-user, why, how, by who, when, etc. their wastes are treated, and the final purpose of it, is something that is not provided to end-users and it is probably the higher expectation of an innovative CEBM based on collaborative reuse/recycling, which is why future applications of this CEBM needs to advance on this topic. As the system of waste management in the local community is needed, this requires the involvement of multiple stakeholders, in particular local authorities, business and the entire local community, who are committed to the sustainable management of compostable waste. Therefore, collaboration and communication are key in relation to different stakeholders.

Another learning regarding this CEBM is that there is a need of sorted fractions in the collection of WEEE, but from there it will be different routes depending on the type of end-user, for example consumers, industry, and service provider companies.

Other issues noted with this CEBM, and that need attention in the future work and development, involves:
- The importance of interaction with stakeholders.
- Ensuring that the system is easy to understand, with transparent conditions.
- Clearness about how to achieve the incentive, the reasons to be offered and how the system of rewards work are essential to create trust from the users.
- To focus on promoting circular economy principles, and not incentivising consumption.

- Ensure adequate amount of incentives. If the amount is too low, citizens may not be motivated, but if it is too high the system can promote unsustainable behaviours.
- The temporal distance to the reception of the incentive. If the time elapsed is too long, end-users can loss the motivation and incentives may be useless.
- Also, cultural, economic, and social aspects can appear as challenges.

CEBM Sustainable Consumption

The CEBM Sustainable Consumption in CIRC4Life have developed tools and services related to consumer behaviour and to promote more sustainable products. Key tools developed and used for this CEBM is[4]:

- An eco-shopping system in order to provide information at the point of sale on the sustainability of the products.
- An eco-account which shows the sustainable behaviour of consumers: The eco-account allows consumers to compare the impact of their consumption and recycling habits.
- A sustainable label to check the eco-cost value of the products: Selling sustainable products is also about marketing. Designing an attractive label which enables consumers to compare the environmental impact of different products, is essential.
- An end-user's smartphone app: for managing the eco-account so the information can be easily checked by consumers; for managing the sustainable decision-making by consumers.

Learnings from CEBM partners regarding this CEBM:

Consumers have a very important role in influencing companies to move to more sustainable products, and services but also towards a more sustainable production. For this to become a reality, a company have to analyse all their products and services, but also analyse the different stages along the whole supply chain, in order to identify strengths, weaknesses and opportunities for improving sustainability performance. This CEBM is thus key in providing customers with sustainability information and a recommendation for more companies to engage in similar activities.

Raising awareness is thus an important factor in changing consumer behavior. However, it is important to also encourage customers by providing the appropriate conditions and infrastructure for doing so. As an example, in the demonstrators, the ecolabels presenting the eco-cost value were used, which allowed consumers to compare the environmental performance of different products and make the informed choices.

During the project, demo owners have applied the eco label and eco-information to raise awareness among their end-user's during the project. When doing so, they experienced that it can be difficult to make the information clear and visual for the end-user to understand. For example, an eco-label should show not only if the product or service is certified according to some parameters, but to show its sustainability along the whole supply chain. The visual appearance of an eco-label is considered very important, as consumers should be able to judge the sustainability through looking at the visual, like energy-label for home appliances. An eco-label also needs to be trusted by consumers, for example include the EU flag as a guarantee. Standardisation is another important aspect, like having the same label for the whole Europe, to avoid dividing into national/regional levels.

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[4] The following bullet list about Sustainable Consumption CEBM is a summary from D6.5.

2.2 Insights from Demonstration Owners including Summary of Implemented Activities by CIRC4Life Demonstrators

Below descriptions include short summaries of implemented parts and tools related to the CEBMs, by each demonstrator. Each section also includes lessons learnt regarding key insights identified related to the three developed CEBMs (WP1-3) and developed ICT tools from demonstration owner and other CIRC4life partners and recommendations for companies and to other sectors. It also includes impacts and benefits for businesses on environmental impact, social impact, financial impact and technology where this is possible to identify. Table 1 below show a summary of methodologies used in the Demonstrators, for more detailed information see D6.5 and also in the deliverables for each Demonstrator (D6.1, D6.2, D6.3, and D6.4).

Table 1: Summary of Methodologies applied in the Demonstrators

	Methodologies applied in Demonstrator 1(a) Domestic lighting products
CEBM 1	Develop modular lamp, Data mining technique for requirements, PDS, LCA, S-LCA
CEBM 2	Eco-shopping in web-shop, Eco-cost, and Eco-credits
CEBM 3	Take-back scheme

	Methodologies applied in Demonstrator 1(b) Industrial lighting products
CEBM 1	Develop modular lamp based on feedback, PDS, LCA, S-LCA
CEBM 2	LCA, LCA Comparison Descriptor, and Eco-cost information
CEBM 3	Leasing model including take-back

	Methodologies applied in Demonstrator 2 Tablets
CEBM 1	Data mining of consumer preferences (WEEE and reuse), Develop incentive scheme
CEBM 2	Intelligent Bin, CIRC4Life App, Eco-account (eco-cost and eco-credits), Awareness Campaign
CEBM 3	Intelligent Bin, CIRC4Life App, Eco-account (eco-cost and eco-credits), Awareness Campaign

	Methodologies applied in Demonstrator 3 Vegetable food
CEBM 1	New product based on survey (consumer preferences), Eco-label based on LCA
CEBM 2	Study new packaging material, LCA and S-LCA on farm
CEBM 3	Study of plastic recycling (farm and local businesses)

	Methodologies applied in Demonstrator 4 Meat supply chain
CEBM 1	Data mining consumer preferences, PDS for developing new products, LCA, S-LCA
CEBM 2	Eco-shopping (eco-costs and eco-credits), CIRC4Life App, Eco-label, Traceability module, Awareness Campaign
CEBM 3	Intelligent Bin, Eco-account (eco-credits)

2.2.1 Lessons Learnt and Further Recommendations, ONA Demo 1a

Short Summary of Implemented Activities by CIRC4Life Demonstrators
- Development of a new modular LED lamp with industrial scrap material based on consumer feedback, available for sales on the ONA web shop.
- Improved knowledge on environmental impact through use of LCA, used in product development and communicated to customers via information in the online shop form, in the form of eco-cost and eco-credits.

- Take-back scheme developed, including
  - discount on new purchase based on eco-credits for the lamp
  - System for remanufacturing of returned lamps

From the experiences obtained in the CIRC4Life project, ONA has seen that not only should a material be chosen that can be recycled or is recycled, it is also important to know if suppliers, and the machinery they have, can handle these materials. It does not make any sense to propose a product with sustainable materials that requires a machining or transformation system that is not common in manufacturing processes. This type of communication in the value chain is one learning that ONA has identified during the project. This would also ensure that ONA does not enter a situation where they develop a product that later generates problems when it is manufactured, which in turn would risk that the product will not go on the market in the end.

Another important factor ONA have discovered in project is to have more knowledge of the recycling process and the companies that carry out the recycling. If this is not taken into account, the product will not be recycled correctly, causing that the components or materials cannot be reused.

Lessons learnt: CEBM Co-creation of Products/Services
When implementing the CEBM Co-creation of Products/Services, ONA made use of LCA and S-LCA for improving their PDS when developing a new modular LED lamp. This provided ONA with the possibility to develop a product with less environment impact. This type on learning is something that proved to be useful and valuable, and LCA and S-LCA also proved to be good tools to use in further product development of new product types.

According to ONA, it is necessary to know your supply chain well when developing a product and analyse its manufacturing processes in order to develop a product that does not generate problems and in this way guarantee its manufacture and a competitive cost. The project has provided ONA with important learnings, but also provided their suppliers with knowledge of circular economy, and they have seen the possibilities of reuse and not only recycling.

Lessons learnt: CEBM Sustainable Consumption
During the project, ONA revised and updated their online web shop with information on environmental impact, eco-scheme information and other project related developments. From this activity, ONA drew the conclusion that when applying something unknown, or that has never been incorporated previously into the company web page, implied the need for a pre-study of how the consumers need to view the information and how it should be expressed in a way that the information is clearly understood by the customers.
When implementing CEBM Sustainable Consumption, ONA realized that the consumers want to know the impact of the products they buy. In turn, this means, ONA have to see to that this information is available and easy to understand for the consumer. One way to obtain this information is to use LCA result and make the information available on the webpage and maybe through a label. A learning that ONA gained from the project.

Lessons learnt: CEBM Collaborative Reuse/Recycling
In relation to the reuse, ONAs main insight related to the possibility of using waste material from their suppliers as part of ONAs new product development. Another alternative developed in the project was to offer consumers the possibility of using ONAs new take-back scheme. Customers can then send back products for ONA to reuse components in the production of new lamps, or recycle the material, in exchange for eco-credits. This idea gave ONA the insight that it is important to pay attention to what happens to the materials once the consumer does not want the product anymore and how ONA can then find ways to improve environmental performance through the life cycle of their products.

According to ONA, that companies that produce products taking into account the concept of CEBM Collaborative Reuse/recycling should not only make a product that can be recycled, but should also be part of the process and be directly involved in the actual process and help the consumer in this action.

Conclusions and recommendations by ONA
- CIRC4Life has offered ONA the opportunity to develop a new online store concept based on the circular economy strategy and a new market niche.
- ONA have also learned that they must listen to the comments made about the products, and that the webpage provides information clearly and briefly.
- The co-creation process provided ONA a better understanding of customer's needs; problems and concerns and using this to develop new products.
- The use of LCA provided information for the customers to raise their awareness of sustainability, but also allowed ONA to connect with customers.
- LCA is also important when using the co-creation process in ONAs products and working with the supply chain and gives an understanding of the manufacturing processes to improve their impact.
- From feedback ONA have received, ONA identifies that end-user would like more visual information, like Eco-Label similar to those for house appliances.
- ONA also identifies that it can be difficult to get the right data for the LCA calculation, if you as a company don't have close contact with your supply chain.
- A learning related to ONAs take back system is that the costumer needs to send the lamp to ONA on their own expense without knowing how many eco-credits they will receive until ONA have checked the lamp, and some customers would like to know that already when the buy a lamp, which is not possible since ONA don't know the condition of the lamp when it is returned.
- As a company, ONA believes that companies should implement CEBMs so that they themselves are parties involved in the objective of reducing both the entry of virgin materials and the production of waste and can help to solve the problems that society faces.
- In the work going forward, ONA will use their learnings in discussions with suppliers, but also try to influence the external designers that they have (e.g. relation to hotels) so that they include a more sustainable approach in their design.

Recommendation to other companies in the same and other sectors, ONA believe that in both cases, they should get involved and participate in the process directly and encourage their clients to contact them in order to carry out a CEBM procedure well.

ONA believe that the experiences from the project can help companies go from a linear to a circular business model through a closer link with the consumer and in this way the developed product really covers the needs that are detected through this dialogue. This is also anticipated to increase sales.

2.2.2 Lessons Learnt and Further Recommendations, Kosnic Demo 1b

Short Summary of Implemented Activities by CIRC4Life Demonstrators
- Development of a new modular LED industrial lamp based on feedback from workshops, and surveys, which provides easily assemble and disassemble.
- Improved knowledge on environmental impact through LCA, used in product development and communicated to customers via LCA Comparison Descriptor included in in project proposals.
- Co-creation of a leasing service, via survey and workshops with companies, of new and used LED light products.

Lessons learnt: CEBM Co-creation of Products/Services
Regarding the CEBM Co-creation of Products/Services, Kosnic identified several lessons learnt. For example, the co-creation process was considered useful as a way to make sure that stakeholders' requirements were identified from the start of product development. The method also made it easier to build relationships through the supply chain. LCA and S-LCA provided insights on how to improve a products environmental and social impact as well as the company's sustainability. A challenge identified with LCA and S-LCA was however that a

certain degree of technical knowledge is needed in order to understand and implement these changes effectively.

Before Kosnic got involvement in the CIRC4Life Project, they were already developing products along the modular route as they understood its importance in not only reducing required stock lines, but also, its much-improved access and usability for relevant stakeholders. The CIRC4Life project has taught Kosnic that this is definitely the correct route to continue pursuing with product development, as it also strongly relates to improved sustainability and the incentivisation of reuse. This is also the way that the lighting industry seems to be moving, with new regulations being brought in to further encourage modularisation and accessibility for light sources and control gear within lighting products.

Lessons learnt: CEBM Sustainable Consumption
Kosnic identified that the Sustainable Consumption CEBM has been challenging for them since the route to market for an industrial lighting product is not as straight forward as business to consumer supply chains. Instead, this approach requires an altered method for communicating sustainability. Kosnic developed a LCA Comparison Descriptor which is considered a step in the right direction to achieve this communication and interaction with the customer. During CIRC4Life, Kosnic realised the importance of LCA studies, both environmental and societal, which can provide key technical insights into how to improve not only a products environmental impact, but also the impacts and sustainability of a company. However, a big challenge identified here is to make the result available and understandable for all stakeholders.

One thing that became apparent throughout Kosnics validation interviews was that there is a real, growing interest for sustainability related information to be readily available for consumers so that it can help them to make sustainable buying choices. This shows that the need for a CEBM, such as the one developed in the CIRC4Life project, is desired and will continue to grow. For this to really take off and be successful, Kosnic notes that it will have to become an industry standard, as they believe that there is little use for information like this if only a handful of manufacturers implement it. For consumers to make truly informed buying decisions when it comes to sustainability, a scheme like this needs to be adopted by all so that products can be truly compared.

Lessons learnt: CEBM Collaborative Reuse/Recycling
Kosnic concludes that Collaborative reuse/recycle is linked to the product solutions created by Kosnic, including the modular light and the leasing service as a complement. The availability of the modular lamp is considered to incentivize all parties to take advantage of the modular product and to prioritise reuse and recycling through the built-in maintenance aspect of the service.

CIRC4Life have given Kosnic the experience that it is possible to implement the circular economy approach within the lighting sector. When developing "lighting as a service" during the project, Kosnic discovered that a leasing service could work well in the lighting industry. Kosnics leasing service is considered to be more of an eco-system (manufacturer, wholesaler, contractor/maintenance) then the current business options, which are focusing more on financing, as part of the linear economy.
Regarding technology and ICT in the project, Kosnic has not used the developed ICT platform and tools directly but explored how traceability could be applied in relation to the possibilities that modularity and circularity provides. From these investigations, they see that traceability is something to further explore when going forward. Traceability could then provide the possibility to collect more data e.g. on temperatures, health of drivers and similar. In best case scenario, it would provide the possibility to identify faulty components before the light breaks. Traceability provides a producer or maintenance company with important data. Industry is moving towards more and more traceability and smart control devices. Existing now is e.g. both batch and serial numbers as a way of tracing components, but individual tracking would provide possibilities of repairing products, and have a more circular system.

Conclusions and recommendations by Kosnic

- CIRC4Life helped Kosnic to address key stakeholder needs from the start and develop relationships with key stakeholders to collaborate with in the future.
- LCA studies provided Kosnic a deeper understanding for the sustainability of both their products and their company. Highlight hotspots of environmental and societal impacts throughout a products lifecycle and remedy them from the start.
- Lessons learns also include to find relevant ways of communicating LCA and sustainability result to the specific industry setting.
- Modular product design is important in the future for luminaire development, shown for example through new regulations.
- Sustainable consumption CEBM has shown that there is a growing interest for more sustainable options, and the introduction of an indicator to show a products sustainability, and impact on the environment, could be a key selling point since a lot of companies work with their internal sustainability. However, regulation and help of industry standards would be needed to compare one product to the next.
- CEBM Collaborative recycle and reuse, the project made Kosnic consider their route to market, Lighting as a service, or leasing, by keeping all relevant parties involved (manufacturer, wholesaler, contractor/maintenance), a more truly holistic approach which emphasises circularity, sustainability, and reuse/recyclability.

Kosnics involvement in the project has given them the chance to gain a much deeper understanding for the idea of circular economy, and a solid foundation to continue implementing the ideas developed within the project, and the three CEBMs, in the future.

From Kosnics discussions with stakeholders during the project they see interest in the leasing model, which then can provide a new format for income. It is considered unlikely to be the sole format of business model, but a complement to the regular sales model, and something that Kosnic will suggest to their customers. Having both business models then ensure that there is a good cash flow in the company. Kosnics developed leasing model include a circular approach with e.g. leasing of both new and used products, maintenance of products etc. However, they see that this circular approach needs to be highlighted in business models discussed by their stakeholders, and here they can help to provide their experiences. However, they also note that a change of a business models in not done within a short period of time, instead changes in business habits takes time.

Kosnic would strongly recommend that other companies explore the power and potential of circular economy business models and what they can offer, not only for them as a company, but also in terms of sustainability for the future.

2.2.3 Lessons Learnt and Further Recommendations, IND/REC Demo 2

Short Summary of Implemented Activities by CIRC4Life Demonstrators
- Use of intelligent bins in several places, including schools, to increase the collection of small electronic devices for reuse or recycling.
- Development of a business model on the recycling and reuse of tablets by incentivizing end-users, raising awareness and getting consumer's preferences on reused / refurbished WEEE.
- Awareness campaigns for example in schools on the circular economy and sustainable consumption and the role students have in it.

Lessons learnt: CEBM Co-creation of Products/Services
During the project, Indumetal and Recyclia gathered references from consumers to develop the concept of incentives and a communication campaign. Through this information, the final incentive scheme included donation of tree planted in Getxo municipal and discount on a purchase in one store for the eco-credits obtained after the WEEE was put in the intelligent bin and assessment has been conducted. By engaging in a

co-creation process, Indumetal and Recyclia ensured that the developed concepts were relevant for the stakeholders. In this process, Indumetal and Recyclia also learnt that monetary incentives were not of interest when recycling. Instead, it was the opposite when consumers were asked about import reasons for buying food or electronics, in that case the price was very important. Thus, the co-creation activities proved to be very important, in order to take into account, the opinions of end-users and other stakeholders. During the project, Indumetal and Recyclia gained valuable experiences from collaborating with e.g. the city council, local retailers, and schools. For more details around collaboration with stakeholders see D6.2

Surprisingly, the incentive of tree planting, which was suggested by stakeholders in the co-creation processes, seemed to not have been used as much as expected. However, more results are to come, and which will shed light on the level of usage of this incentive. However, it might show the importance of diversifying incentives to suit a variety of stakeholders.

An additional learning was that the CIRC4Life app and eco-shopping module need to include all options on how to spend the eco-credits obtained when recycling WEEE.

Some problems were encountered, e.g. to engage the city council the way they wanted regarding incentives, which was e.g. due to tax related issues.

Lessons learnt: CEBM Collaborative Reuse/Recycling
The traceability related aspects of Demo 2 are perceived to have worked well in the project and made it possible e.g. to trace devices and engage end-users in the incentive scheme. Overall, the use of the intelligent bin was a valuable experience, which included learnings e.g. on how to engage end-users, schools and other stakeholders in relation to its usage.
Reuse proved more difficult than expected from the outset. Better rates of working devices were expected, that could be reused at a secondary market. This relates both to the state of the device, as well as the processes related to taking a product back to the market, e.g. restrictions to unlock a device. In reality this means more downcycling of the products.

A learning from Demo 2 is that there need to be co-creation activities related to all tools developed. Another learning relates to the incentive scheme, and the fact that there need to be a continued dialogue with the users, e.g. to inform them about the stages of the process and notifying them on the status of the assessment of the devises. The availability of tools is also to consider, as e.g., it was very good to have the development of the app but would have been even more useful if it would have been also to use also for iPhones.

Lessons learnt: CEBM Sustainable Consumption
When the intelligent bin has been installed in the schools an awareness session focused on the circular economy and the sustainable consumption has been conducted. The functioning of the intelligent bin, the eco-credits and incentive system was also explained, and a brief tablet dismantling workshop was also carried out. Indumetal and Recyclia saw this is an important activity to raise the awareness among the younger generation and learn about how to live and consume more sustainably.

Conclusions and recommendations
- Co-creation activities proved to be very important in order to take into account the opinions of end-users and other stakeholders.
- The traceability related aspects of Demo 2 are perceived to have worked well in the project and made it possible e.g. to trace devices and engage end-users in the incentive scheme.
- A learning from Demo 2 is that there need to be co-creation activities related to all tools developed.
- Important to ensure that a simplified process for the end-users.

- Another learning relates to the incentive scheme, and the fact that there need to be a continued dialogue with the users, e.g. to inform them about the stages of the process and notifying them on the status of the assessment of the devises.
- Awareness campaigns on circular economy were valuable activities that provided Demo 2 partners with insights and raised awareness among users.

Indumetal and Recyclia notes that CIRC4Life is innovating the field of circular economy, and that the final results of that is difficult to establish already now, but that new areas of circular economy are explored and advanced. E.g. the activities of connecting traceability with the intelligent bin.

Overall, Indumetal and Recyclia recommend engaging end-users and other stakeholders in co-creation processes and also to involve public bodies and local shops for alternative incentives. The active work with schools and feedback from and to them has been very perceived as very positive and resulted in an extended social network and increased communication activities.

General recommendations in the transition towards circularity is to collaborate with peers and your stakeholders, and to hold a life cycle perspective, and to engage in communication in order to influence others. As Indumetal is the leader to this type of activates in the Basque country, they would like more fellow companies to join these circular economy activities.

Some challenges also exist, that are worth contemplating. The intelligent bins used, and the massive engagement with stakeholders, makes these activities expensive. There is probably a need of additional push for these types of activities, e.g. more demand from the public or similar. A reflection is that it might be better to have the bin in school for a while and then change to another place, then to have then a longer time in the streets. It also implies additional costs of preparations (communication/dialogue), transport etc.). Also, Indumetal and Recyclia contemplate the fact that if there would have been no new system for collection, the devices would not have reentered the systems, instead they would be left in drawers for a long time. However, it would be relevant to conduct an LCA of the whole system to see if the collection activities out ways the increased environmental impact from the system.

2.2.4 Lessons Learnt and Further Recommendations, Scilly Organics Demo 3

Short Summary of Implemented Activities by CIRC4Life Demonstrators
- Development of new products such as organic apple juice based on excess fruit and developed as a response to requests from customers.
- Use of Ecolabel on product packaging based on LCA, that indicates the environmental impact of the product to the customers.
- Conducted testing of new biodegradable packaging for salads in own production and together with farmers in farmer network.
- Improved waste sorting and plastic recycling at the farm, and active support to a local pub in waste reduction.

Lessons learnt: CEBM Co-creation of Products/Services
Scilly organics have identified the following positive impacts and challenges when demonstrating CEBM Co-creation of products and services:

- The LCA gave valuable result to be used on the label for the vegetable, even if Scilly Organic believe that it is more valuable for a supermarket then for a micro farm.
- Using Co-creation can connect businesses better to their customers and enables a different approach of seeing feedback and communication as a two-way relationship.

- Ability to tailor products better to the needs of customers, which gives opportunity to develop new products and services.
- Engagement with customers in a specific way, such as not asking leading questions and allowing all thoughts on business direction to flow from participants in co-creation, focus on end-users but also extend to e.g. suppliers.
- Recommendations to include 1-2-3 scope of environmental impact, and thus look at the stakeholders relevant in these scopes and start to co-create with them.
- S-LCA provide results/figures that are relevant and can be communicated, but they are more "internal" the company, should not forget about the "external" aspect of e.g. local food-biodiversity-public good etc.
- Further work with the online LCA could provide be of great value for onward market acceptance of automate results and eco labels.

Lessons learnt: CEBM Collaborative Reuse/Recycling

Scilly organics have gained the following experiences when trying to implement CEBM Collaborative reuse and recycling (waste and recycling) on the farm:

- One way of reducing waste is to limit the waste from the beginning in product and process development. For a farm, packaging is important part of the business. Therefore, there is an opportunity to look at reducing the generation of waste in the first place through product design, packaging, usability, recyclability, etc. - It's an alternative and complementary approach to encouraging the consumers to recycle for a micro farm.
- CEBM Collaborative Reuse and Recycling is what really makes a business look at its production systems and production cycles in a more holistic way.
- Important to re-assess best practice when it comes to waste management, both in terms of supply chain (suppliers) and manging waste within your own business.
- Challenging to apply an incentive scheme developed for recycling and reuse on a micro farm.

Lessons learnt: CEBM Sustainable Consumption (Production)

When Scilly organics implemented CEBM Sustainable Production the following was concluded:

- Measuring the environmental impacts of production (and products) is the first stage in taking steps to reducing impacts.
- Communicating the values behind the business and production system can be done through various mediums, including product labels and through websites and social media.
- Setting targets to reduce impacts by focussing on the goals of businesses.
- Timing is important given the global focus on climate emergency, resource use etc.
- Consumer expectations for products with lower environmental impacts is very strong. Businesses not embracing this will get left behind in the marketplace, and/or face regulation in due course.
- For farms this is by far the most important CEBM – and it should be called "sustainable production". The potential for reductions in emissions and resource use is all centred here in a farming system. Sustainable production and recycle/recycle more of "loop" than co-creation which is more of an approach.
- The Brokerage tool turned out to be of limited use for this for a micro farm with vegetables.

Conclusions and recommendations by Scilly Organics
- Co-creation connects businesses better to their customers and enables a different approach of seeing feedback and communication as a two-way relationship.
- Co-creation provides ability to tailor products better to the needs of customers.
- Co-creation provides opportunity to develop new products and services.
- Measuring the environmental impacts of production (and products) is the first stage in taking steps to reducing impacts.

- Communicating the values behind the business and production system can be done through various mediums, including product labels and through websites and social media.
- Setting targets to reduce impacts by focusing on the goals of businesses.
- Timing is important given the global focus on climate emergency, resource use, etc.
- Consumer expectations for products with lower environmental impacts is very strong. Businesses not embracing this will get left behind in the marketplace, and/or face regulation in due course.
- There are opportunities to investigate the reduction of the generation of waste in the first place through product design, packaging, usability, recyclability, etc.
- The Collaborative reuse/recycle CEBM makes a business look at its production systems and production cycles in a more holistic way.

Scilly Organics conclude that the CEBM structure can be helpful in transitioning businesses towards circularity. However, they could also be more flexible since they in many cases seems to be better designed for industrial systems. To be really useful a CEBM needs to be locally adapted. Farming as a sector has a more circular approach from the beginning, compared in other industrial systems, which means that not all methods and tools are applicable.

For other farmers, Scilly Organic conclude that they should embrace circular approaches, at least to understand the impacts of the business and how to better communicate with customers. Looking at for example lower resource use, carbon emissions, and more environmental products, to be better prepared for the future. In competitive markets those who innovate and embrace new realities will be best placed to thrive. For businesses in other sectors Scilly Organics highly recommend focusing on Sustainable Production, because this is probably the area that will give biggest benefits in terms of resource use and carbon emissions.

Regulations, particularly around carbon, will likely be coming at national and perhaps international level, within the next few years. Businesses that set and meet zero carbon targets will be much better placed to avoid punitive measures, as well as meeting market expectations.

Contemplating the ICT platform, it is considered to need to be a more flexible in order to accommodate small farms. A recommendation for other companies and industries is to ensure that developed tools are developed with the specific sector in mind and co-created with users.

From the perspective of Scilly Organics, the main opportunities of circular economy for farm businesses are:
- Reduction in environmental and social impacts.
- Improved engagement of customers, suppliers, and supply chain partners.
- Minimisation of waste, maximisation of recycling and a return of nutrients to land.
- Marketing and business opportunities to tap into new markets for ethical and environmental products.
- Produced an Action Plan to reduce environmental impacts further.
- Measured and communicated the impacts of the products.

2.2.5 Lessons Learnt and Further Recommendations, Alia Demo 4

Short Summary of Implemented Activities by CIRC4Life Demonstrators
- Co-creation through integration of consumer's sustainability preferences into the production of two new meat products.
- Modification of the process with feedstock in a more optimal way and development of a sustainable nutritional formula.
- Implementation of environmentally friendly techniques along the whole values chain.
- Encouraging sustainable consumption by showing the eco-costs and sustainability information of the new products, and via awareness campaigns.
- Development of an Eco-label for the meat products.

• Collaborative recycling using eco-credits as incentives for citizens to foster bio-waste recycling.

Lessons learnt: CEBM Co-creation of Products/Services

During the development of the two sustainable products, Alia has focused on reducing their environmental impacts for the product's whole lifecycle*.* The LCA and S-LCA result were a part of developing the new sustainable products and as such proved very valuable. Additionally, they discovered that this was possible with a minor increase of production cost and also by using local products/ingredients instead of imported. One conclusion from this development is that for companies offering sustainable products, there will be new markets.

Alia have several insights from implementing CEBM co-creation:

• Technical knowledge on how to do an LCA and analyse the result. The LCA result have been used to make sustainability improvements in the most important stages of their processes.
• A deeper analysis of the market opportunities of the sustainable products for economic sustainability for the company. It is important to find a way to combine sustainable processes and keep the cost of the product down to make sustainable products affordable for everyone.
• S-LCA showed positive results that was shared with customers and internally. More sustainable products also positive for customers and society as a whole.
• It is possible for companies to reduce the environmental impact of their processes by small improvements.
• Important to consider the consumers preferences from start of the product development and taking into account the opinions and possibilities.
• The extended collaborations with other stakeholders in the value chain was a positive experience for Alia and where they learnt a lot. Also, the extended focus on communication and awareness campaigns proved to be very valuable and provided new learnings that will be put to use in upcoming activities at Alia.
• Alia have taken the co-creation process one step further through the CIRC4Life project.

Lessons learnt: CEBM Sustainable Consumption

In the Sustainable Consumption CEBM demonstration, Alia has several achievements and lessons learnt:

• Communication materials are important for awareness campaigns, to raise the awareness about sustainability and circular economy. This is a way to implement the Corporate Social Responsibility (CSR).
• The eco-label provided possibility to show the sustainable information of the products and makes it easy to understand the sustainability of products (Figure 6). The QR code directs consumers to Alia's webpage where it is possible to get more information about the reasons which made the products sustainable. The eco-label is something that Alia found valuable and will continue to develop and to continue to engage customers in this process.
• Eco-cost value is not an official figure to measure the sustainability of products, so a learning was that it is difficult to understand for end-users. A standardization of the value and regulations to make it applicable at large scale of them should be needed. If implemented at large scale, it would allow consumers to compare the sustainability of the products among those of their sector and in a general view.
• The eco-accounting system needs to be well integrated to existing shops' infrastructure to reach exploitation potential. Having two different systems is not feasible.
• The mobile app needs to be available for all type of mobile phones for further exploitation.
• This CEBM involved some difficulties, e.g. related to the technical side, however, Alia managed to involve customers in these activities, and made use of the communication and co-creation activities to do so.
• The mobile app has been used to inform customers about the products and show sustainable action in the eco-account when they have been bought a product.

Figure 6: Final version of the eco-label (D6.4)

Lessons learnt: CEBM Collaborative Reuse/Recycling

Regarding CEBM Collaborative reuse/recycling Alia lessons learnt are:

- Alias engagement with bio waste was a new experience which has provided a lot of new insights, and where they managed to involve several actors, such as politicians, waste management companies and customers.
- The intelligent bin provides extensive options for traceability. However, other closed bins could be more feasible to implement as they also work well and are cheaper to purchase.
- Regulations may make it difficult to use by-products from bio waste.
- It can be difficult using a system if different tools like an app is needed, as utilization of specific digital tools can raise the threshold of broad user appetence. A combination of possibilities like an app and/or e-cards would be an optimal solution.
- There is a challenge in making easy instructions in for a process, especially in the beginning. Therefore, the awareness campaigns have to address many actors and with different perspectives and channels, and also the visual layout is of importance.
- Traceability activities was implemented in e.g. the reuse and recycling activities and worked well.

Conclusion and recommendations by Alia

Alia concludes from theCIRC4Life project that they have gained a deeper knowledge of all their processes in the field of sustainability, identifying strengths and weaknesses and that it has provided them with the appropriate tools to be able to act in certain phases in a process of continuous improvement. This is considered a key aspect for the implementation of the CEBMs in any organization.

During the project Alia have been able to involve administrations, legislators, people from the academic world, companies, and society in general, creating a social fabric more committed to sustainability. The conclusion is that all the involved actors need to be involved from the beginning of the implementation of new CEBMs.

Learnings from the work with implementing the CEMBs is that some of the ICT tools need further development to be relevant and easy to use for the customer. Standardization is also an issue to consider here, so that products are comparable across products and product groups.

What Alia would say to other companies is that it is time to take steps, even small, in meeting the sustainable development goals, humanity and the planet will be immensely and eternally grateful.

3   Conclusions

The CIRC4Life project has involved many tools and activities in each of the three CEBM developed in the project, and these have been implemented in two different sectors, and within different type of companies within these sectors. For this deliverable, the aim has been to collect lessons learnt and recommendations based on the implementation in these demonstrators. For such a large project, several perspectives may exist, and learnings that can be similar or sometimes different, for project partners. However, in the following section, some key generic learnings are highlighted.

- **The transition towards a circular economy**

The project has resulted in useful outcomes for circular economy, including three CEBMs, eco-cost/eco-credit themes, eco-accounting method, eco-incentive approach, as well as their enabling technologies such as the ICT platform, the consumer mobile app and the traceability techniques. The outcomes have not only been applied by the project consortium members, but also disseminated nationally and globally via open innovation camps, LLs, show cases, research publications, conferences, and workshops.

However, engaging in a transition toward a circular economy and circular business logic can be experienced as a complex process that requires many different parts and that requires the involvement of many actors. In doing so, it is advised to start the process by taking action in small steps, not to be overwhelmed by all activities at once. The CEBMs in CIRC4Life provide tools and guidance on actions. However, these probably need to be adapted to the specific local context in which they are to be implemented, which could e.g. relate to differences in legislations, culture, and language in different countries or regions. Similarly, project partners see the value in co-creating tools that are developed, to ensure best relevance.

Also, in some cases, certain CEBMs might be more prominent than in other settings. As an example, concerning small scale farming, activities within recycling might be close at hand and an area that customers associate with circular economy. However, in the farming sector, the sustainable production approach might bring about larger values, in conjunction with a closer connection with customers.

In this transition towards circularity, it is also noted that a life cycle perspective is needed, in order to see the bigger picture, and to identify the hotspots, challenges and opportunities that exists. When doing to, engagement with other stakeholders in the business ecosystem and/or value chains is considered necessary.

- **Co-creation**

To co-create with end users or other stakeholders has been noted as having very positive outcomes for the project partners, and which have provided many new learnings for those involved. These learnings related both to new knowledge gained concerning products and services, but also regarding the way to involve and engage with other actors. It is considered a possibility to ensure that stakeholders' requirements were identified and included from the start of product development. It is also seen as an enabler of a different approach of viewing feedback and seeing communication as a two-way relationship.

The co-creation approach also provides a possibility to gain a better understanding of your supply chain, which makes for a better collaboration. It also ensures that new developments in e.g. products are operational also for e.g. component manufacturers or other actors in the supply chain.

- **LCA and S-LCA**

Another way of involving and engaging stakeholders has been the use of LCA and S-LCA. Results from these assessments have provided partners with new ways of communicating with stakeholder, and new content of for this communication. Additionally, it has provided partners with new knowledge critical for improving product development and related processes. Obviously, it also provides possibilities for companies to develop more sustainable products, services and/or processes. LCAs and social life cycle assessments (S-LCAs) have been used in the project to assess the environmental and social impact of products and services developed. These tools have provided valuable information about where products and service should be improved for the demonstrators. These methods can also gain knowledge about the companies and on how to improvement internally, for example, how to be more energy efficient and how staff is treated.

- **The importance of communication and engaging stakeholders**

Throughout the project, the importance of communication has been apparent. However, the way to communicate with stakeholders is not always obvious. One aspect relates to communicating LCA results in an understandable way, which in the project e.g. has involved graphs on webpages, LCA data in business project proposals, eco-labels on products in stores or stalls. As mentioned earlier, the concept of local adaption is again relevant to suit the stakeholders in question.

Another take on communication with stakeholders within the project includes awareness campaigns that have taken place in e.g. radio commercials, social media, school classes and in relation to e.g. demonstration activities. These activities have been noted as providing important learnings for the partners, and a way to engage stakeholders in taking action, and in turn hopefully contributing in the transition towards a circular society.

In the project, eco labels and eco-information have been used to raise awareness among end users. During LL activities in Demonstrator 4, eco-label was raised as a way to communicate the environmental impact and promote sustainable products to the consumers, but it is important to highlight that the creation of the eco-label was not a project objective itself. Although the eco-label method developed by this project is a valuable attempt, it could be further refined/improved. The two demonstrators in the food segment tried the concept of Eco-label with different appearance to see how the end-users reacted on visual label, if it was appreciated and if it was informative. When doing so, it has been clear that it can be difficult to make the information clear and visual for the end-user to understand. Again, here a collaborative approach, and knowledge of end user needs are visible. To implement an Eco-label for different products, more exploration of standardization is important to make it easy for a consumer to know environmental impact of a product and make the label trustable. It was also clear that a label probably needs to be issued by an independent organization to be trustable, for example the EU. Similar to this, relevant incentives, that are easy access, is considered important. Good results are achieved by the use of reliable scientific evidence, therefore, cooperation with science is needed.

Appendix A, Interview Guide for Lessons Learnt and Recommendations

1. Based on your experiences in CIRC4Life, what are your key insights* (related to the demonstration of the CEBMs) in general?

2. What key insights did you identify specifically for CEBM Co-creation?

3. What key insights did you identify specifically for CEBM Collaborative reuse/recycling?

4. What key insights did you identify specifically for CEBM Sustainable consumption?

5. What key insights did you identify related to the developed ICT platform?

6. What recommendations do you have for other companies in
   a) the same industrial sector, or
   b) other sectors?

7. Have the CIRC4Life project developments and results benefited your business (and how) regarding
   a) Ecological impacts?
   b) Financial impacts?
   c) Social impacts?

8. How can these experiences help companies go from a linear to a circular business model?

Positive and challenges