



CIRC-PACK value chain map based on CEIS

Deliverable 2.5

SOFTWARE MANUAL

CIRC-PACK - Towards circular economy in the plastic packaging value chain


Prepared by: CIRCE

Date: 31/04/2020

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	Document:	D2.5 CIRC-PACK value chain map based on CEIS software. Software manual		
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DELIVERABLE FACTSHEET

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Approvals

	Company
Author/s	CIRCE
Task Leader	CIRCE
WP Leader	CIRCE
Reviewer	-

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ABBREVIATIONS

CPI: Confederation of Paper Industry
CEIS: Circular Economy Indicator System
CMU: Circular Material Use rate
EASAC: European Academies' Science Advisory Council
EC: European Commission
EMF: Ellen McArthur Foundation
LFI: Linear Flow Index
MCI: Material Flow Index
RECOUP: Recycling of Used Plastic

PARTNERS SHORT NAMES

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AITIIP: Fundación AITIIP
NOVAMONT: NOVAMONT SPA
MATER: MATER-BIOTECH SPA
MBP: MATER-BIOPOLYMER SRL
BUMAGA BV: BUMAGA BV
TECNOPACKAGING: NUEVAS TECNOLOGIAS PARA EL DESARROLLO DE PACKAGING Y PRODUCTOS AGROALIMENTARIOS CON COMPONENTE PLASTICA SL
MI-PLAST: MI-PLAST DOO ZA PROIZVODNJU TRGOVINU I PRUZANJE USLUGA - MI-PLAST LLC
 MANUFACTURING, TRADING AND SERVICES MIPLAST
GRUPO SADA: GRUPO SADA P A SA
SAPONIA D.D.: SAPONIA KEMIJSKA, PREHRAMBENA I FARMACEUTSKA INDUSTRIJA D.D.
FATER: Fater S.p.A.
CRF: CENTRO RICERCHE FIAT SCPA
UNE: ASOCIACION ESPANOLA DE NORMALIZACION
RINA-C: RINA CONSULTING – D'APPOLONIA SPA
EKODENGE: EKODENGE MUHENDISLIK MIMARLIK DANISMANLIK TICARET ANONIM SIRKETI
ECOEMBES: ECOEMBALAJES ESPANA, S.A.
CITY OF RIJEKA: GRAD RIJEKA-GRADSKO VIJECE
KARTALMUN: KARTAL BELEDIYE BASKANLIGI
CALAF IND: CALAF TECHNIQUES INDUSTRIALS SL
OCU EDICIONES: OCU EDICIONES SA
ICLEI EURO: ICLEI EUROPEAN SECRETARIAT GMBH (ICLEI EUROPASEKRETARIAT GMBH)
PLASTIPOLIS: PLASTIPOLIS

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PUBLISHABLE SUMMARY

The plastic sector is on the focus of the European Green Deal, a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use [1].

As one of the main blocks of the European Green Deal, the new Circular Economy Action Plan will boost the transition of the EU's economy from a linear to a circular model, focusing in particular on resource-intensive sectors such as plastics and targeting for example their design and promoting circular economy measures. In this vein, it is an objective of the commission to develop requirements to ensure that all packaging in the EU market is economically reusable or recyclable by 2030 [2].

Aligned with this vision, the objective of the software is to help packaging manufacturers and designers in the transition to more sustainable packaging, and to raise awareness and disseminate on how to improve the circularity and recyclability of packaging by means of ecodesign actions.

The tool is accessible online in this link: <https://circpack.fcirce.es>



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INTRODUCTION


This deliverable is the user manual of the software tool developed within task 2.5: "Development of the CIRC-PACK interactive and dynamic virtual map" in the frame of Work package 2 "Baseline and circularity improvement evaluation methodologies".

The tool is based on the knowledge gained during the project, on packaging formats and their recyclability, indicators assessing circularity and the potential options of improvement. Under this perspective, it analyses both packaging typologies tackled in the project: plastic/bioplastic and cardboard packaging.

It first starts with the definition of the packaging in the context of the circular economy, providing as a result a customized diagram. Then, depending on the specific features of the packaging selected in the first step, a set of data is required, such as the packaging's mass, % of recycled content and efficiency of the recycling process or the % of biobased content, etc. The following set of questions aims at evaluating the recyclability of the packaging analysed, according to the current State of the Art.

With the information provided so far, a first set of results is provided: recyclability-spider diagram, ranking and recommendations; compatibility (for recycling) matrix and circularity indicators calculation (such as Material Circularity Index).

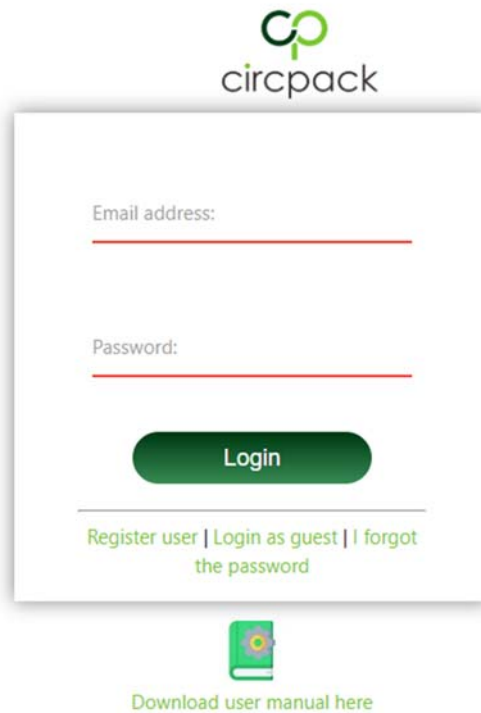
In addition, after this initial assessment, the chance to improve the previous design is provided. To this end, several ecodesign measures are provided along the life cycle of the product and evaluated thereafter.

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1 TOOL ACCESS. USER AREA.

The access screen asks for an email address and a password for already registered users, that can do it in the "Register user" link. It is also possible to "login as guest", without providing an email address or any other information. In this case, the results' pdf cannot be downloaded.


The use of Safari, Mozilla Firefox or Google Chrome browsers is recommended



In the user area, you can find three options:

- *New project* to create and start a new project.
- *Previous projects* to check the projects you have already done.
- *Profile Setting* to edit your personal information.





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1.1 New project


To start using the web, to start analysing a product, you have to create a new project.


New Project


Logo

 Name of the project:

 Code:

 Description:





Only the field Name of the project is mandatory, the rest are optional and all of them can be changed afterward as it was explained in Edit the information of a project and an improvement.


Once the required information has been completed you can start to analyse the product.

You can create an improvement from the results area of the tool, and from the *Previous projects* section. When you create a new improvement, you will be directed to this screen:


New Improvement

 Name of the Improvement

 Description

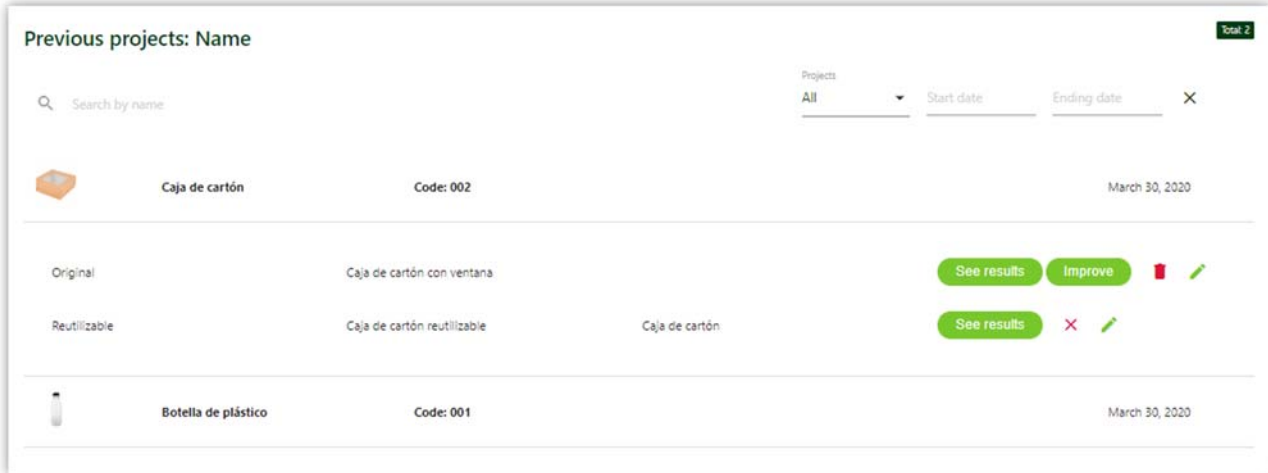


The field Name of the improvement is mandatory, the field description is optional. Once provided the required information you can start the improvement by click on the icon +.

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1.2 Previous projects

On Previous projects you can see a list of the projects you have already done.



The projects are ordered by creation date, you can see the name, the code and the creation date of the project.


If you click on the project's name, for example on the project named *Cardboard box*, you will see the original version with its description and the options:

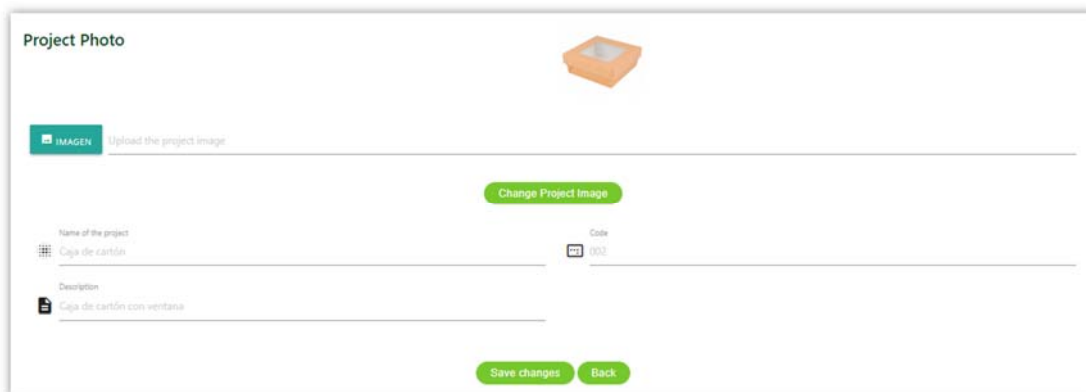
- *See results.*
- *Improve.*
- Delete, red bin icon (if you delete a project all the improvements associated will also be deleted).
- Edit, green pencil icon.

Additionally, on the top you can find a counter of the number of projects realised and three searchers:

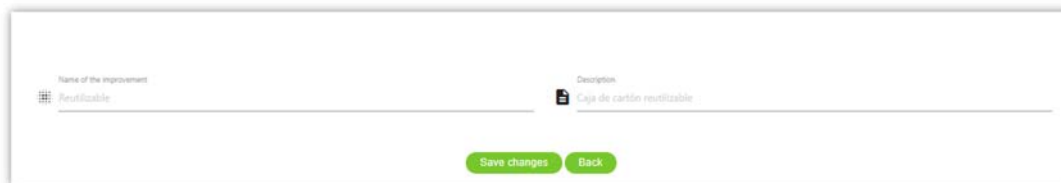
- On the top left, a searcher by words included in the name or description of the project, you can also introduce the project's code to find it.
- On the top right, a searcher by the state of the project, complete or incomplete.
- On the top right, a searcher by the creation date of the project.

If you click on the green pencil of the original version of a project you will be able to change its image, name, description and code as you can see in the image:

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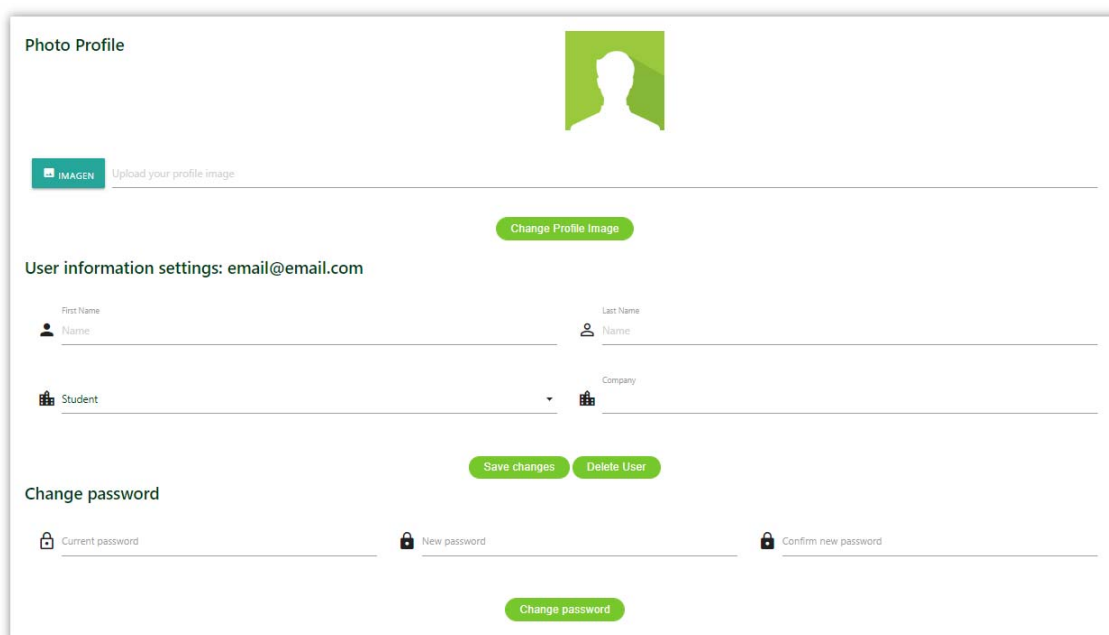



If you click on the green pencil of an improvement, you will be able to change its name and description as you can see in the image:



1.3 Profile settings


In this section you can delete your account, all your projects and improvements would also be deleted, and change the following information:



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- Add or change your profile image
- First name
- Last name
- Status
- Company
- Password

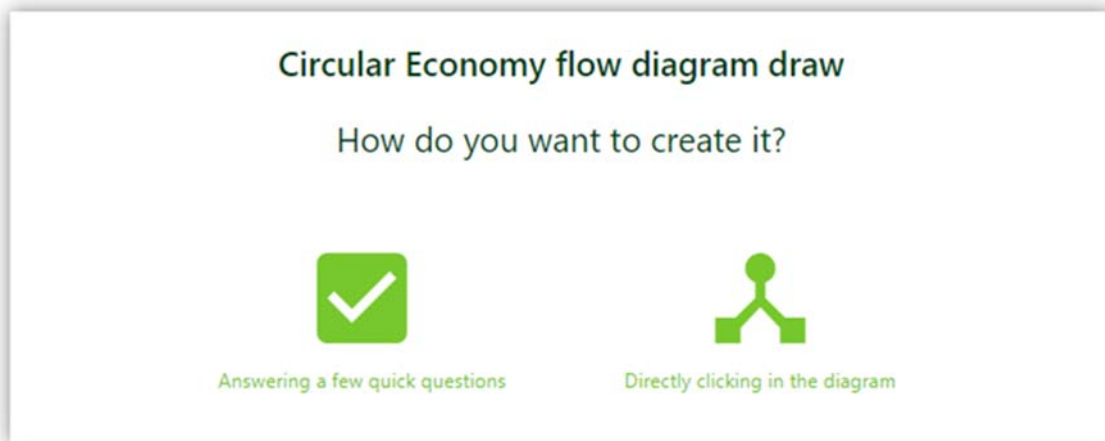
The email cannot be changed as it is the unique identifier of each registered user.

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2 START A NEW PROJECT

2.1 Circular Economy flow diagram draw

If you use the platform as a guest or as a registered user after creating a new project, you will be directed to this site:




In this site you will be asked how do you want to create the diagram, you have two options, answering a few questions and directly clicking in the diagram.

Throughout the entire analyse of the product you will see at the top of the page the icons of the different stages of the process, the icon of the actual stage will be highlighted. You will be able to return to any of the previous completed stages by clicking on the corresponding icon.




2.1.1 Answering a few quick questions

If you opt for answering a few questions, you will be directed to this page:

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You have to ask the current question to be able to continue to the next one, if you want to change any of the answers or check any of them you can use the arrows on the bottom right corner, in the image it is shown the case where you have returned to the first question and you have answered Yes. The circles on the top right corner shown the stage of the questionnaire, how many questions have already been asked and which is the current question, in the image you have answered the first question and you are in the first question.

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2.1.2 Clicking in the diagram


If you opt for directly clicking in the diagram you will be directed to the following screen:



In this case you can activate and deactivate the grey icons and the arrows, once you have your desired diagram you can continue by clicking on *Ok*.

2.2 Materials and components

Once defined the diagram, you have to choose the main material of the product, plastic or paper/board.

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If you choose plastic, you will have to choose the materials of the main body, the closure and the labelling among the displayed options. Please note that biobased plastics are included in the options "other recyclable" and "other non-recyclable", depending on its recyclability. This selection of materials is used to evaluate its compatibility in a recycling system, since there are combinations with better performance than others. If the plastic is biodegradable/compostable, wherever it is biobased or not, the option must be selected. consequently, the compatibility of materials for recycling won't be assessed.

If you choose paper/board you will have to choose between paper and board, the barrier and other non-paper/board parts.

The different stages for plastic and paper/board are shown on the following images:

2.2.1 Mainly Plastic/Bioplastic

Main body	Closure / Sealing	Labelling / Decoration
		

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2.2.2 Mainly Paper/Board

Main body



PAPER
(Paper <200g/m²; board >200g/m²)



BOARD

Barrier


ALUMINIUM FOIL


PLASTIC FILM


WAX COATING


POLYMER COATING


OTHER BOARDS


OTHER


NONE

Other non-paper/non-board parts

Yes

No

(Including labelling, decoration, tops, windows, etc.)

Once you have selected the material a resume will be displayed where you will have two options, redoing the material selection, Back and continue, *Ok*.

Main body: **Paper**
 Barrier: **Aluminium foil**
 Other non-paper/non-board parts: **Yes**


OK


Back

2.3 Data input

The next stage of the analyse is the data input where you have to provide the numeric data corresponding to the different parts of the diagram, the mass field is mandatory, the rest will appear depending on the answers in the first stage, where the diagram that represents the packaging is draw.

There are three different phases of data input, each one corresponding to a life stage of the product: design and manufacturing, commercialisation and use and end of life, the current phase of the data input is highlighted in the diagram.

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Design and manufacturing

Mass of the packaging: 0 kg

Fraction of mass of the packaging from recycled sources: 0 %

Efficiency of the process to obtain recycled feedstock for the product: 0 %

Fraction of mass of the product's feedstock from reused sources: 0 %

< 1 2 3 >

Commercialisation and use

Lifespan of the product, in comparison with industry average edit: 1 x industry average

Functional units during the use phase of the product, in comparison with industry average: 1 x industry average

< 1 2 3 >

End of life

Fraction of mass of the packaging being collected to go into a recycling process: 0 %

Efficiency of the recycling process used for the portion of a product collected for recycling: 0 %

Fraction mass of a product going into composting/biodegradation/biological route: 0 %


< 1 2 3 >

OK

2.4 Recyclability check


The next stage of the process is the recyclability check where you have to answer several questions about some characteristics of the product; the questions will be different depending on the materials (plastic/cardboard) of the product.

In the images below you can see the questions for a mainly plastic/bioplasic packaging, based on the Recycling of used plastics limited (RECOUP) guidelines [3] and "Design for recycling" initiative's outcomes from Ecoembes:

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For a paper/cardboard packaging, mainly the Confederation of Paper Industries (CPI) Packaging recyclability guidelines were consulted:

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Recyclability check ●●●●●●

1. Size


 Large format


 No large format

Is it easy to fold?


Yes
 No


< >

Recyclability check ●●●●●●

2. Decoration/metallic block printing

Is the packaging metallic block printed?


 Yes
 surface >30%


 No
 or surface <30%

< >

Recyclability check ●●●●●●

3. Adhesives

Hot melt / pressure sensitive or any other water-insoluble.

Cold set / curable or any other water-soluble/adhesives that can be removed from the Pulp at typical temperatures in the packaging recycling mill environment.

I do not know / none of the above.

Adhesives not used.

< >

Recyclability check ●●●●●●

4. Varnishes/coatings

Cured UV varnished material and varnishes that break down into small or microplastic particles.

Water soluble coatings.

I do not know.

Varnishes / coatings not used.

< >

Recyclability check ●●●●●●

5. Other features

Waxed / waxed coating.

Silicone, greaseproof or glassine papers.

None of the previous.

< >

Recyclability check ●●●●●●

6. Food contact


 Food*
 staining


 Food**
 contamination

Non food
 contact

* 2D stains
 ** 3D food content

< >

Recyclability check ●●●●●●

7. Plastic laminations


Single side laminated

Two-sided laminated

Not laminated

< OK



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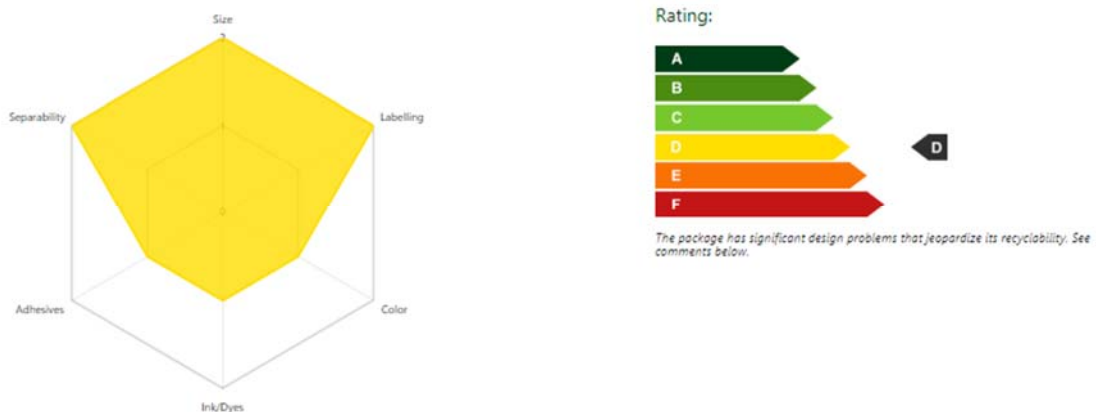
2.5 Results

When the analysis of the product is completed the results are displayed. Firstly, you will see the diagram of your packaging in the context of circular economy:




Secondly, you will see the recyclability check results; the diagram shows the different criteria and their level of compliance. On the right you can see the recyclability rate which determines the colour of the diagram.

In the image, the product has met the criteria of size, labelling and separability, the rest criteria can be improved, and consequently the recyclability rate is a *D*.



Next, there are some comments explaining why the corresponding criteria have not been achieved and how they could be improved.

In the example of the image, the criteria of colour, ink and adhesives have not been met, the labelling criteria has been met, however, in the comments you can see how it could be also improved.

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Comments

Labelling

The packaging will be correctly sorted. However, in terms of recyclability, there are certain combinations of label-packaging that are better recycled than others. As a rule of thumb, in small labels, it is better to use the same plastic material (except for PET) or another one with different density than the packaging, so that they can be easily separated in the recycling process itself, hence not affecting the quality. See Recyclability check!

Color

Strongly-coloured plastic materials have a much lower economic value than non-pigmented plastics. This is mainly due to the lower number of final applications as compared to non-pigmented materials. Additionally, they can interfere with the common optical sorting systems (NIR) used to identify the type of plastic.

Ink/Dyes

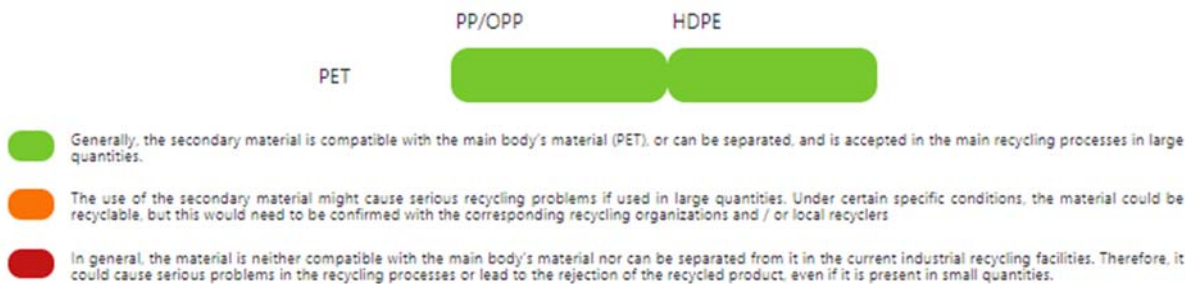
Hazardous substances should be avoided and inks containing heavy metals, since they can contaminate the recycled plastic. Thus, it is recommended to comply with the Exclusion List for Printing Inks and Related Products, prepared by the European Technical Committee for Printing Inks (EuPIA).

Adhesives

Water-soluble (or dispersible) adhesives at temperatures between 60 and 80°C and hot melt-soluble adhesives are the best option, since they are the ones that are most easily removed in the recycling process. In any case, the amount of adhesive used and its area of application should be minimized, in order to maximize performance and facilitate the recycling process.


Next, just in the case of plastic packaging, you can see the compatibility matrix where it is analysed the compatibility of the main material and the closure and labelling materials in the common recycling process of the main body's material.

Compatibility Matrix



Finally, the packaging is assessed by means of a mix of indicators including a set of indicators based on Ellen McArthur Foundation (EMF) methodology and the most relevant indicators proposed by the Circular Economy Indicator System (CEIS) developed by the European Academies' Science Advisory Council (EASAC) as an initiative of the European Commission (EC). By mousing over the indicator's name, a brief explanatory text will be displayed:




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The selected indicators provide the following information:

- Material Circularity Index (MCI): assesses the level of circularity of a given product or process. How far are they in the transition from 'linear' to 'circular'.
- Linear Flow Index (LFI): shows the level of linearity of the packaging. A completely linear process would mean LFI = 1. The objective is to reduce the LFI.
- Recycling Input Rate: shows the amount of secondary raw materials.
- Circular Material Use Rate (CMU): measures the rate of material recovered and fed back into the packaging. It considers both the recycling and the reuse paths.
- Compostability Rate: shows the portion of the packaging that can be transformed into compost through a composting process.
- Biobased input Rate: shows the portion of the packaging made from renewable raw material source instead of fossil based raw materials.
- Unrecovered waste related to the packaging: measures the amount of waste generated along the product's manufacturing, use and end-of-life, including waste generated in the recycling processes.

At the bottom there are three icons with three different options, download a PDF with the results, improve the product and go back to the user area.

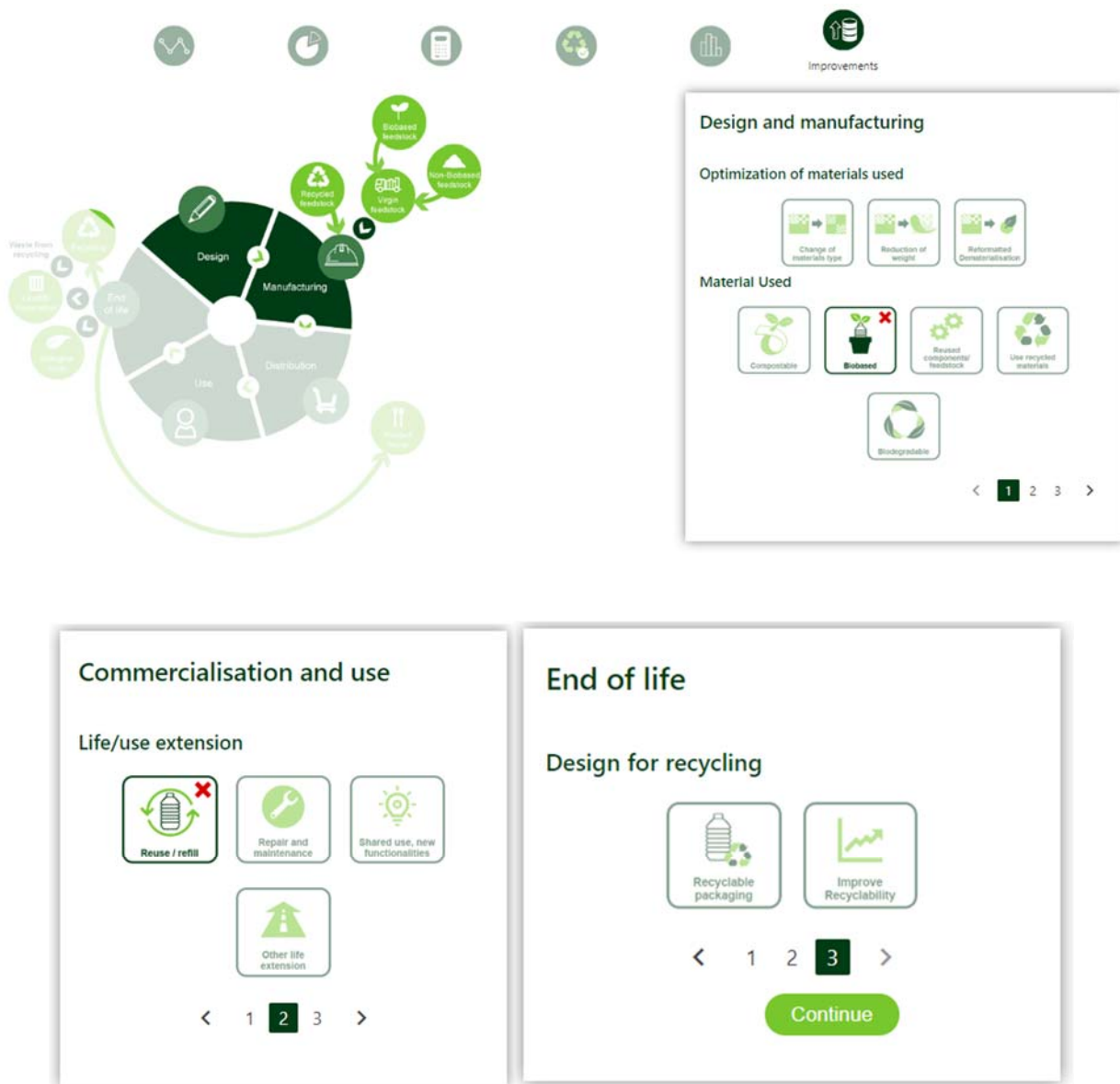


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3 ECO-DESIGN IMPROVEMENTS APPLICATION

Once the analysis of a product has been completed, improvements can be applied.

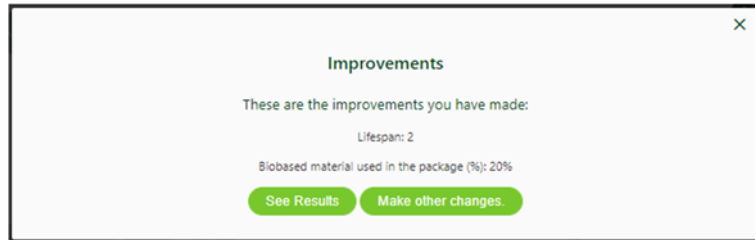
The improvements are divided into the three phases of the product's life. When you mouse over each of them, a brief explanation appears. Every time an improvement is applied, the corresponding icon is activated in the diagram on the left. In the example in the image, the biobased material improvement has been applied, showing the corresponding icons. The improvements can be undone as indicated by the red cross in the upper right corner of the improvement made, just click on the image to get it.



Once the three phases of the product's life have been covered, the improvement process can be completed, a summary box will be displayed indicating the improvements that have

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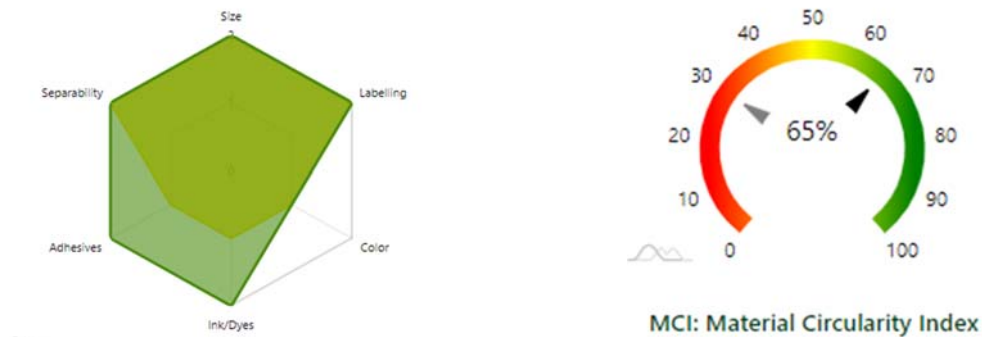
been made and asking the user if they want to make any further improvement or to see the results.




3.1 Results of the improvements

The results of the improvement show the results of the original product first, the base case, each of the sections was explained in the Results section, then the results of the improvement that have the same sections as the base case are shown below .

In the case of the radial diagram related to recyclability, the diagram of the base case and that of the improved case appear overlaid in order to compare both more easily, likewise, in the indicators of the improved case, the value of this case appears and the base case value.



As in the base case, you can download a PDF document with the results of the improved case. In this document, in addition to each of the sections commented in Results, the explanations of the improvements applied appear.

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4 REFERENCES

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[4] "Paper and Board Packaging Recyclability Guidelines". Confederation of Paper Industries (CPI)