



# Overview of the KATCH\_e Modules and Tools



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KATCH\_e: Knowledge Alliance on Product-Service  
Development towards Circular Economy and Sustainability in  
Higher Education

## Overview of the KATCH\_e Modules and Tools

This summary is part of the training materials developed in the KATCH\_e Project, Knowledge Alliance on Product-Service Development towards Circular Economy and Sustainability in Higher Education.

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More information about the project, training materials and contacts, available at:

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# Overview of the KATCH\_e Modules and Tools

## Introduction

KATCH\_e stands for “Knowledge Alliance on Product-Service Development towards Circular Economy and Sustainability in Higher Education”. This is a 3-year EU funded project that was launched in January 2017 and is part of the ERASMUS+ programme of Knowledge Alliances, aiming to address the challenge of reinforcing skills and competences in the field of product-service development for the circular economy and sustainability, with a particular focus on the construction and furniture sectors.

The figure below shows the KATCH\_e main results.



This document describes the theoretical modules (in the figure referred to as “Product-service development for CE and Sustainability Course”) and the practical tools that are currently being finalised. The materials are meant to be used in academic teachings, in-classroom context, as well as in companies:

- Eight KATCH\_e learning modules, that are linked to each other but can also be used as stand-alone learning and teaching elements;
- Seven KATCH\_e tools, that support the practical implementation of the knowledge acquired with the modules. They are the main element for the implementation of the knowledge and building up skills in companies.

The development approach of the modules and tools is framed by the following understanding of circular economy in KATCH\_e:

***Circular economy (CE) is a system that is restorative and regenerative by intention and design, which maximizes ecosystem functioning and human well-being with the aim of accomplishing sustainable development. It replaces the end-of-life concept with closing, slowing and narrowing the resource flows in production, distribution and consumption processes, extracting economical value and usefulness of materials, equipment and goods for the longest possible time, in cycles energized by renewable sources. It is enabled by design, innovation, new business and organizational models and responsible production and consumption.***

Following this understanding, the modules and tools have been developed according to a framework organized in four main areas:

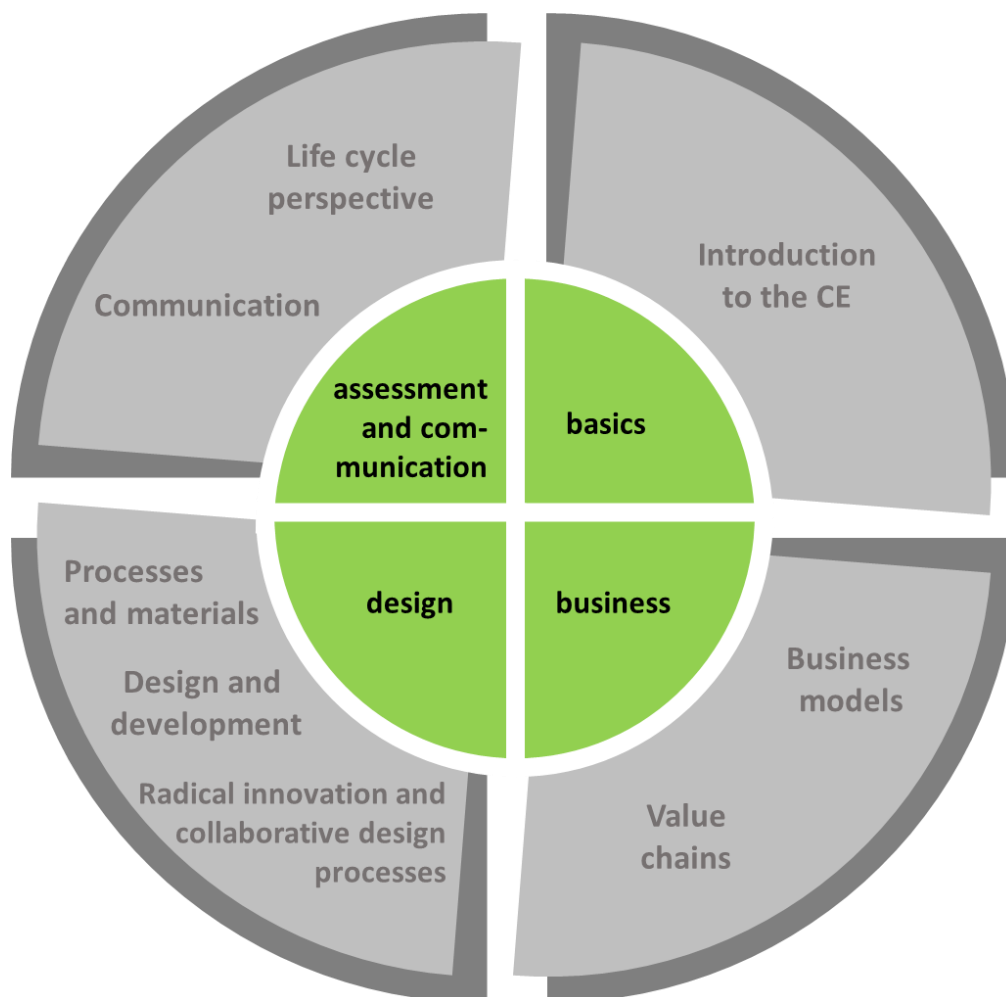
1. **Basics:** Basic knowledge on circular economy that supports the understanding of the other materials;
2. **Business:** The business approach, required for the success of new, more circular and sustainable products or product-service;
3. **Design:** Product and product-service system design according to circularity and sustainability criteria; and
4. **Assessment and communication:** A support area with contents regarding assessment and communication in circular economy with a life cycle perspective.

	<b>Modules</b>	<b>Tools</b>
<b>Basics</b>	<ul style="list-style-type: none"> <li>• Introduction to the circular economy</li> </ul>	<ul style="list-style-type: none"> <li>• KATCH-Up Board Game</li> </ul>
<b>Business</b>	<ul style="list-style-type: none"> <li>• Business models</li> <li>• Value chains</li> </ul>	<ul style="list-style-type: none"> <li>• CE Strategist</li> <li>• Value chain and stakeholder analysis</li> </ul>
<b>Design</b>	<ul style="list-style-type: none"> <li>• Processes and materials</li> <li>• Design and development</li> <li>• Radical innovation and collaborative design processes</li> </ul>	<ul style="list-style-type: none"> <li>• CE Designer</li> <li>• CE Journey</li> </ul>
<b>Assessment and communication</b>	<ul style="list-style-type: none"> <li>• Life cycle perspective</li> <li>• Communication</li> </ul>	<ul style="list-style-type: none"> <li>• CE Analyst</li> <li>• KATCHing Carbon</li> </ul>

## The KATCH\_e Modules

There are eight KATCH\_e modules and they all start with the main question they aim to answer. Each module is organized in chapters and includes several assignments and examples to support the preparation of lectures by the teachers or the self-learning exercise by students.

The modules are not numbered on purpose, because there is no predetermined order except in the case of the “Introduction to the circular economy” module, which would be the first, especially to someone who is not familiar with the circular economy concept. Nevertheless, each module includes an advice of the required previous knowledge, which might have been achieved elsewhere or through another KATCH\_e module.



## Introduction to the circular economy

### What is circular economy and what is needed to work from a circular approach?

**Chapter 1: The global sustainability challenge and why we need a new approach to production and consumption** establishes a basic understanding of the main challenges and why we need a new approach to production and consumption. Humanity is exceeding the Earth's carrying capacity and it can have severe consequences for our living conditions. This is partly a result of the increasing resource consumption linked with the linear economy or the take-make-waste paradigm. Thinking circular can help to address many of these challenges. The legislation is both an enabler and a barrier for the transition towards a circular economy, and the chapter highlights the main EU policies and regulation influencing the development in general, and for the construction and the furniture sectors.



**Chapter 2: Defining circular economy and the underlying principles and strategies:** There is not one common definition of circular economy, but a large number with different foci. The consortium has defined how circular economy and the underlying principles and strategies are understood in the KATCH\_e project.

Since KATCH\_e targets the construction and furniture sectors, **chapter 3: Circular economy in the construction and furniture sectors** presents the two sectors and the main circular economy challenges.

Design and innovation for a circular economy is the core of the KATCH\_e materials. **Chapter 4: Design and innovation for a circular economy** presents the main design strategies for a circular economy in our two target sectors – based on the principles of slowing, narrowing and closing material and energy loops.

Circular economy also calls for new business models since it represents a new way of understanding value in the economic system. **Chapter 5: Circular economy requires new business models** introduces some main aspects to consider when developing circular business models and related value chains.

Circular economy as an idea and a concept is not new, and many companies have already come to know both challenges and enablers. **Chapter 6: Main challenges and drivers in shifting to a circular economy** gives an overview of the main types of barriers and drivers on three levels: society, market, and organization.

**Chapter 7: The 10 Essentials of working with circular economy** concludes the introduction by pointing at ten essentials of working with circular economy from a more practical perspective.



## Business models

### How can companies work towards the aims of CE by adopting circular strategies within their business model?

A CE builds on new business models. **Chapter 1: What is a business model?** therefore starts with an introduction to the different elements constituting a business model using the framework of the Business Model Canvas (BMC). This is followed by showing how outside forces shape business models and lead to changes, especially in the context of the forces that shape the circular economy. The chapter is completed by reflecting on the shortcomings related to sustainability concerns of the BMC-model and presents similar sustainability-related BM-frameworks.



**Chapter 2: The circular business model** describes strategies for CBMs. To do so, CBMs are framed within the wider discussion of strong sustainability. The chapter describes the economic conditions necessary for a CE to thrive, and the need for a broader meaning or the term “value”. The concept of the Value Hill then shows how value is typically lost in linear life cycle and showcases opportunities of value capture. Based on where in the life-cycle of products the value is mainly captured, the framework differentiates between three groups of circular business strategies: Uphill (production and design-focused), Tophill (focused on the use-phase) and Downhill (focusing on the End-of-life-phase). The resulting twelve strategies are further explained and categorized with best-practice examples.

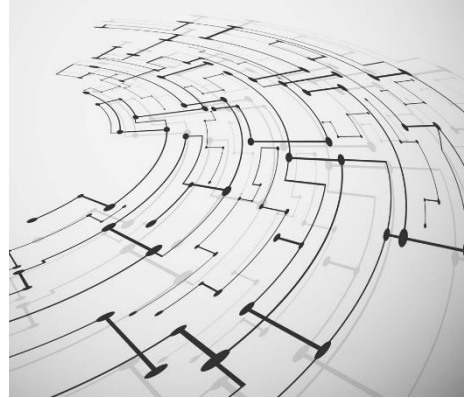
**Chapter 3: Revenues and costs – financial implications of CBMs** describes the main economic benefits that CBMs entail, along with the explanation of how the main financial elements of business models may differ in a circular and in a linear economy. Business models applying a circular approach may have some financial implications that may difficult its practical implementation. These main implications are described in the chapter, including as well some financial resources that may minimize these difficulties and therefore, facilitate the financeability of CBMs.

**Chapter 4: From linear to circular business models** describes the typical process of creating or changing the business model with the four phases of Initiation, Ideation, Integration and Implementation and links the assignments and tools of this module to the process.

## Value chains

### How should value chains and value networks be understood and managed to get benefited from a CE?

As explained in **Chapter 1 – Introduction to the concept of circular value chains and networks**, a circular value network is understood as a dynamic co-creation network that is based on the engagement and interaction of stakeholders from the business world and other societal stakeholders, to guarantee the circular flows of both tangible and intangible values. Different circular value network strategies can be developed by companies and organizations, including among others, “take back management”, “platform approaches”, “industrial symbiosis” or “value network collaboration”.



But, why change to a circular value network? **Chapter 2 – Why change to a circular value network?** highlights some clear benefits of establishing a value network for circular chain cross collaboration. However, establishing a circular value network may be quite challenging, as several barriers may arise; among others, barriers related to data, relational, cultural or personal conflicts.

One key aspect to optimize supply chains and to make them more circular, as presented in **Chapter 3 – How to optimize supply chains through reverse networks**, is the development of reverse networks and logistics. Reverse logistics is a key step in capturing the value of end-of-life goods and facilitating the reuse and recycle pillars of the circular model. This covers not only the collection and transport of materials and products but value-added activities such as testing, sorting, refurbishing, recycling and redistribution.

Additionally, **Chapter 4 – Business strategies/models that support the implementation of circular value networks** aims to provide a link to the “Business Models” module. It addresses the questions of how value networks are related to the Business Model Canvas (BMC) and what influence circular business strategies (CBS) have on the value networks.

### **Chapter 5 – Stakeholders engagement and management: how to establish a circular value network.**

In this context, getting the involvement of relevant stakeholders as key partners is an essential requirement towards the sustainability and circularity of value chains. (Establishing a value network through the engagement of key stakeholders allows the creation of closed loops, and at the same time, reinforces the corporate social responsibility (CSR) policy of companies and organizations.

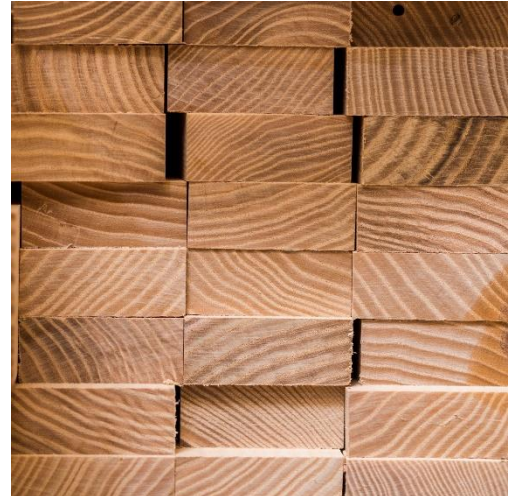
Finally, **Chapter 6 – Existing tools for the management of value chains towards sustainability** gives an overview of the main tools that are available currently in the market to manage value chains towards sustainability, paying special attention to Achilles and Eco-Vadis tools.



## Processes and materials

### Which are the most relevant characteristics of materials and processes to carry out circular economy strategies for product and product service development?

One of the first points designers and planners need to consider when developing circular solutions is to identify which processes and materials enable or hamper circularity approaches. Some questions a designer needs to address are: What characteristics make a product suitable for the CE? What needs profile do consumers have when we talk about products within a CE perspective? What materials and contents encourage circularity? What processes are relevant to consider?



This module provides the necessary information to answer these and other related issues from a conceptual and practical perspective.

**Chapter 1: Introduction** presents a contextualization of the role played by processes and the characteristics of materials in the development and design phase of products in the target sectors. This section presents a circular economy overview and what is understood here as processes and materials could be influenced in a vision of the CE.

**Chapter 2: Characteristics of materials and processes from a circular economy perspective.** The selection of materials and processes involves the search for the best match between the design requirements, the characteristics of the materials and the properties of the processes that could be used to manufacture the product. This chapter helps to reflect on issues that designers and planners should address for achieving a better performance along the whole life cycle of products or systems, e.g. a façade or a house, and finally, it lists some characteristics of materials and processes that play a key role in the transition to a circular economy.

**Chapter 3: Design and development strategies vs. characteristics of materials and processes** presents the relation between the circular design strategies (see the “Design and development” module) and processes and characteristics of materials from a CE point of view. This relation can be used as a guide for choosing the most appropriate material and/or process characteristics for each circular design and development strategy of products and products-services belonging the furniture and construction sectors.

**Chapters 4 and 5** consist of a compilation of processes and characteristics of materials examples and references.

**Chapter 6** addresses the subject of possible trade-offs when making decisions and creating potential contradictory effects. Some methods used to deal with these trade-offs and to achieve a balanced compromise are listed.

## Design and development

### How can the design of products and services contribute to the circular economy (CE)?

The module answers the question both from a conceptual and from a practical implementation perspective.

#### Chapter 1: Concept: From ecodesign to design for the circular economy and sustainability:

While the relationship between CE and sustainability is not well established, the KATCH\_e project adopted a broad definition of the former, and thus design for the CE is here defined as “a product-service design and development that replaces conventional end-of-life concept by closing, slowing and narrowing the resource flows in production, distribution and consumption processes. It is enabled by innovation and novel business models and aims to accomplish sustainable development through maximising of ecosystem functioning and human well-being, and through responsible production and consumption”. The chapter also includes one section about product-service systems, as the transition from selling products to adding and providing services is essential in a circular economy.

**Chapter 2: The role of design in circular economy:** Chapter 2 is short but important for design students and professionals to reflect on their role to promote circular economy. As Michael Braungart and William McDonough put it, “We don’t have a waste problem, we have a design problem”.

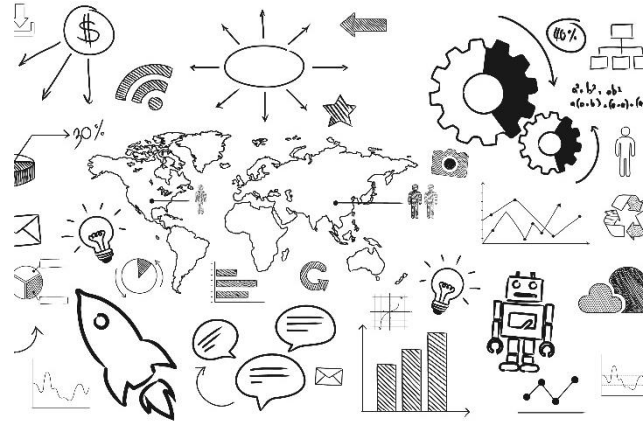
**Chapter 3: KATCH\_e design strategies for a CE:** Within the project, eight design strategies have been developed for product and service development and are explained in this chapter. They are in line with the project’s understanding that the circularity concept needs to be placed within the overall goal of sustainable development. Therefore, there are social sustainability criteria integrated in the different strategies.

**Chapter 4: Product and service design step-by-step:** This chapter proposes a methodology based on eight general steps, describing the process of circular product design and service design.

**Chapter 5: Design for CE in the building sector:** This chapter discusses the characteristics of products to be integrated in buildings where circularity is an objective. The challenge of combining long life spans with adaptability in buildings is reflected on building products’ design.

**Chapter 6: Tools for product and service design for CE:** Within KATCH\_e, a dedicated tool is under development: The CE Designer. Additionally, other circular design tools are presented.

**Chapter 7: Examples and case studies:** Examples, both from the building and furniture sectors, complemented by case studies developed in the context of students’ internships in partner companies, are provided in this chapter.



## Radical innovation and collaborative design processes

**Considering the impacts of the design activity on industry and society at large, how can radical innovation change behaviours and mind-sets, specially related to sustainable consumption and environmental education?**

This module aims to highlight the concepts of innovation applied to sustainability, as well as presenting different forms of innovation and their impacts on the development of products and services. Through different examples, the concepts of co-creation and open source are presented, trying to facilitate, in a structured way, tools for this type of activities.



### **Chapter 1: Introduction to innovation**

This chapter gives a comprehensive review of what is innovation and explores different types of innovation and their relationship with product-service development, contributing to the thematic of the project.

### **Chapter 2: Circular economy as an input for the innovation process**

Considering the strategies associated to sustainability and circular economy implementation in product and service development, this chapter reasons how these concepts can give resourceful inputs and guidelines for innovation.

### **Chapter 3: Product-service system design**

Referring to the Design and development module, this chapter introduces product-service systems design and its relevance for circular development, through considering sustainability and circular economy principles, stakeholders and business model.

### **Chapter 4: Collaborative and participatory design for innovative processes**

This chapter addresses collaborative and participatory design processes, including several tools applied to product/service development.

### **Chapter 5: Open-source as a mean to feed innovation and disseminate results**

The final chapter discusses how can open source provide tools and means to potentiate sustainable and circular development, and suggests reflecting in examples that can provide open source outcomes.

## Life cycle perspective

### What information is needed to assess circularity along the life cycle of products or services?

Transformation towards a more circular business requires information about inputs and outputs of systems and processes, measuring their impacts, management of data and data exchange across the value chain. How to assess and communicate impacts? Based upon the concept and importance of Life Cycle Thinking the assessment of environmental, economic and social aspects on product-service and building level are covered.

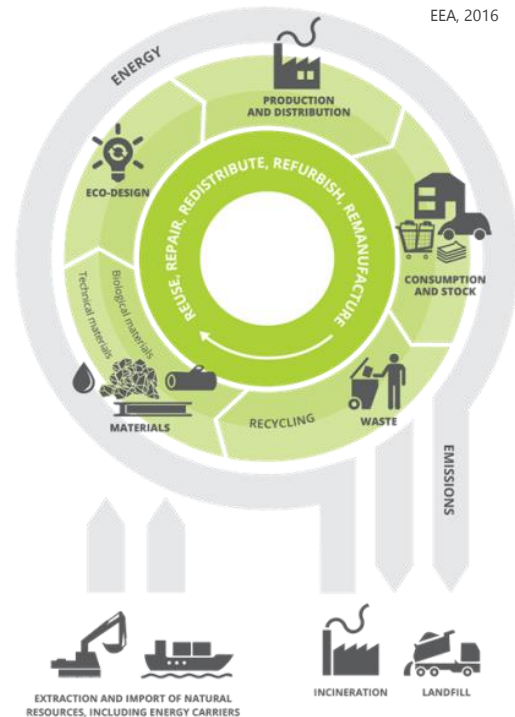
**Chapter 1: Introduction:** Life cycle thinking (LCT) is a concept that considers all life stages of a product or service including their interdependencies from the very beginning to the very end. LCT is crucial when establishing a Circular Economy as it takes positive and negative impacts of the entire life cycle into account and prevents burden shifting from one life stage to another. Because of the high complexity and the extremely long lifetime, LCT is particularly important when working on the construction sector.

**Chapter 2: Impact assessment along the life cycle:** To enhance positive and minimise negative impacts of products or processes, the environmental, social and economic performance along the life cycle has to be assessed. Life Cycle Assessment, Life Cycle Costing and Social Life Cycle Assessment are introduced.

**Chapter 3: The life cycle of products and assessing its circular loops:** Discussions on the impact of furniture and building products along their life cycle are held, as well as reflections on necessary and possible steps towards reaching a more circular level. Specific examples visualise the present situation and the improvement potential towards a more circular approach.

**Chapter 4: Assessment of the life cycle of buildings:** As buildings can be considered as very complex and long life products involving many different actors along the life cycle, a special focus is laid on the life cycle of buildings and building components. The framework for the Life Cycle Sustainability Assessment is determined by the European Standards for Sustainability of Construction Works as well as several building certification schemes. The environmental impact of a product can be communicated by means of Environmental Product Declarations (EPD), which contain detailed information on the environmental performance of a product based on Life Cycle Assessment.

The module includes **case studies of construction and furniture products**.



## Communication

### How could the advantages of circular products and services be communicated?

**Chapter 1: Introduction to communicating circularity** reflects on why communication of circular products and services is important. It aims to demonstrate the practical application of circular economy (CE), to increase awareness and to change perceptions. Communication also plays a role during co-creation of CE solutions and models, inspiring and encouraging knowledge sharing. Designers have to think about the product/service and about how communicating it during the design process. For an effective communication, companies need to apply the communication strategies both internally and externally considering their supply chain and stakeholders.

**Chapter 2: Guidelines and techniques for communicating circularity** is the most extensive chapter. It explains the British Standard 8001:2017 part on developing a marketing approach for CE in organisations. These guidelines aim at making sure that the perceived value equals or exceeds costs, providing warrants and advantages of services against ownership; making sure that the product/service fits in users' lifestyle; communicating every emotional benefit that can be a value-driven factor for the user and using claims and declarations truthfully. This chapter also describes the main general techniques for communicating circularity: Circular Economy Communication Canvas, creative narration through storytelling and storyboards, educational messages, calls to action and cognitive dissonance. Every technique contains at least one example. Then, it shows some recommendations for effective information representation, such as the use of statistics and numerical data, infographics and butterfly diagram.

The module follows with **specific circular communication tools in Chapter 3**. Firstly, it describes the Cradle to Cradle design certification communication tool and the C2C Communication Strategy Tool to help identifying the value priorities within the C2C vision. Then, the chapter presents the Circle Assessment Tool and the Material Circularity Indicator. The next section describes sector specific communication tools, as the Green Furniture Mark. The chapter finishes with short presentation for assessment tools for buildings that communicate environmental issues related to circularity, as BREAM, LEED, or EGB.

**Chapter 4: Environmental labelling and product declarations and their relation to CE** presents labels and product declarations somehow related to Circular Economy. It describes type I, II and III labels. The chapter depicts how the Nordic Swan Ecolabel considers circular economy. Finally, it presents a lifespan labelling proposal to communicate lifetime of products.

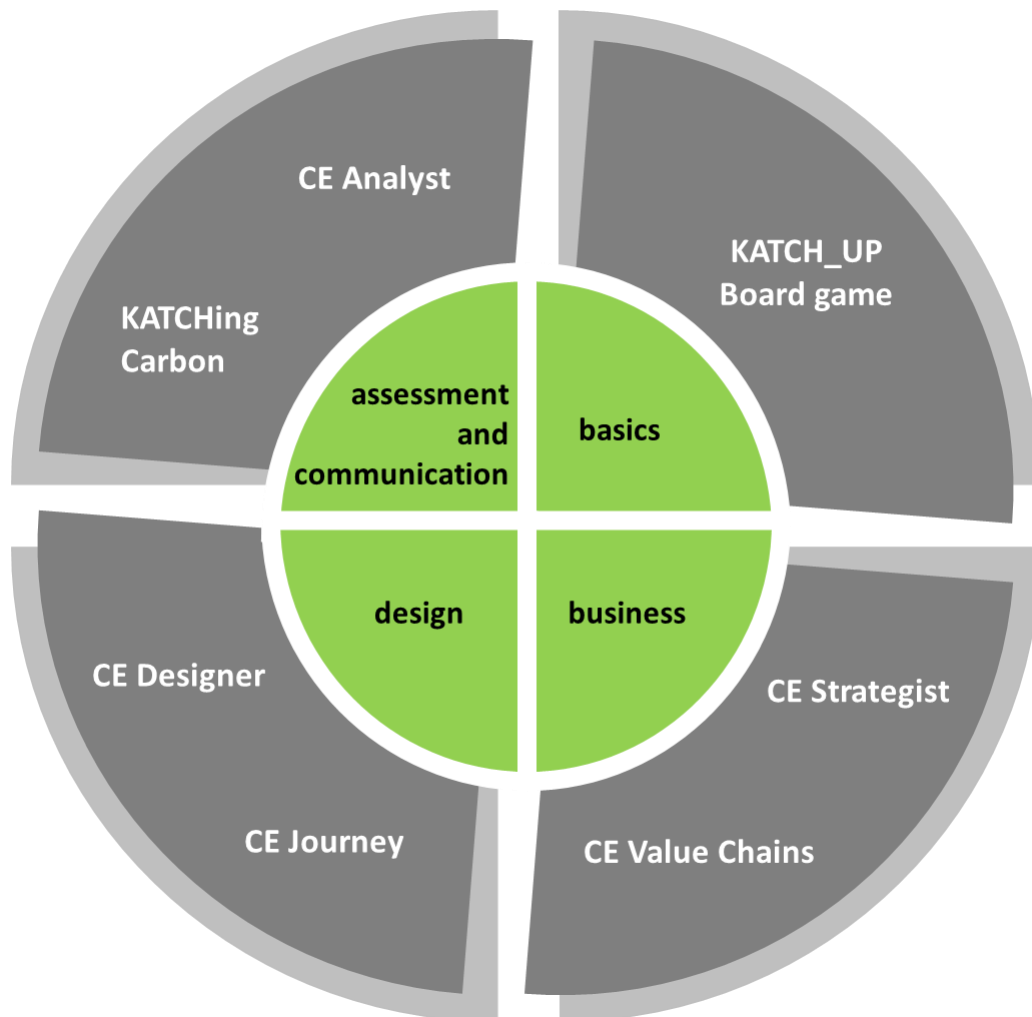
In **Chapter 5, examples of circularity communication** in the furniture and construction sectors are provided.





## The KATCH\_e Tools

The following tools were developed with the intention to complement the theoretical inputs of the modules. However, the tools can also stand on their own and can be applied individually without the background information in the modules. The graphic below shows how the seven tools developed, relate to the framework. The following short descriptions allow the reader to get a sense of how the tools function, which challenges they address and what results can be expected.





## KATCH-Up Board game

### What is the tool for?

The objective of this game is to stimulate the users to generate value ideas from a business challenge, applying circular design and circular business strategies. The game acts as a guide to get an idea about an innovative product-service or to solve a real business problem and generate opportunities.

### What information is needed before using the tool?

No previous knowledge of circular economy (CE) is required, however, having knowledge about CE design and business strategies is preferred, as the application of the tool will be more agile, efficient and effective, leading to better defined ideas.

### What results can be expected?

Creation of a product-service idea applying circular design and circular business strategies to solve problems from case studies or your own company issues.

### How is the tool used?

This tool can be applied under different situations: Company, academia and workshops. When this game is played in companies, real cases can be applied, i.e., to a specific product-service category and to solve specific company challenges. When this game is played in classrooms or workshops, the game offers hypothetical contexts to work on them.

**PREPARATION:** Form groups of 3-4 people and prepare the board and its elements

**PLAYING:** The game has 6 basic steps:

**Step 1 – Problem context:**

Presentation of the product-service category, business challenge and target group;

**Step 2 – Way to the solution:**

Presentation of CE strategies that can be used to deal with the problem context;

**Step 3 – Idea creation:**

Development of the innovative idea that will solve the initial problem;

**Step 4 – Business model:**

Definition of the most appropriate business model;

**Step 5 – Market launch:**

Definition of how your product-service will be launched to the market;

**Step 6 – Presentation and scoring:**

CE ideas got as a result of the game should be pitched by the groups and scored using a Likert scale (1-5).

## CE Strategist

### What is the tool for?

The tool should help the user identify Circular Business Opportunities and provide ideas and inspiration along the process of defining a Circular Business Model.

### What information is needed before using the tool?

The user should have a specific product in a specific context (company, market, region, customers, and production) in mind, which is then analysed further.

### What results can be expected?

A description of the business model, based on the Circular Economy Canvas template.

### How is the tool used?

#### **Step 1 – Evaluating circular opportunities**

To start the process the user assesses a product or business to identify circular strategies that fit best to the predefined 11 circular business strategies.

#### **Step 2 - Finding circular strategies, examples and design strategies**

After assessing the opportunities the tool proposes a number of strategies to choose from (multiple choices are possible and encouraged). The tool shows a definition of each strategy, provides existing business examples and shows how the strategies are connected to certain Design Strategies (which can then be further assessed with the CE Designer tool).

#### **Step 3 – Defining a Circular Business Model**

The last step concerns the definition of a business model. For this purpose, an adapted version of the Business Model Canvas framework is used. This Canvas also highlights the implications and effects of circular models in the form of questions. Furthermore, the template shows typical influences to consider which relate to the selected strategies from Step 2.

## CE Value Chains

### What is the tool for?

The aim of this tool is to help designers and other company professionals to analyse the current value chain of the company, in order to identify the external and internal stakeholders that should be prioritized and involved to develop and implement the circular economy strategy decided in a previous stage. The answers the following questions: "Which stakeholders should we prioritize to develop and implement our circular economy strategy / approach? Which steps should we define to engage them?"

### What information is needed before using the tool?

This tool should be used after the circular economy strategy to be developed has been assessed and decided, in order to analyse potential interactions with stakeholders of the value chain.

### What results can be expected?

An action plan in order to establish some next steps to carry out in order to involve the prioritized stakeholders and establish the required collaboration relationship. This plan will work as a roadmap for establishing the necessary contacts for a real involvement in the circular strategy of the company.

### How is the tool used?

#### **Step 1 – Current stakeholder mapping and qualitative assessment:**

To analyse the different elements and links of the value chain of the company, in order to identify the main stakeholders, both external and internal, involved within this value chain. Once main stakeholders are mapped along the value chain, they are qualitatively assessed in relation to their relevance for the implementation of the circular economy strategy or approach, as not all of them will be relevant. The purpose of their involvement will be specified when assessing their relevance level.

#### **Step 2 – New stakeholder mapping and qualitative assessment:**

To identify new stakeholders that would be needed to collaborate with to implement the circular economy project or approach. The purpose of their involvement will be specified too.

#### **Step 3 – Stakeholders prioritization:**

Stakeholders identified as relevant in previous steps will be quantitatively assessed this time, according to the level of relevance to implement the circular strategy/approach and to the level of capacity of the company to establish a new or different form of collaboration with them. The result of this assessment will be visualized through a scatter plot.

#### **Step 4 – Action plan:**

To define an action plan to establish the steps that need to be carried out in order to involve the prioritized stakeholders and establish the required collaboration relationship.

## CE Designer

### What is the tool for?

The CE Designer checklists are a semi-quantitative tool for prioritization, assessment and idea finding of circular solutions for product and/or service (re)design. They are organized according to 8 strategies that address the most relevant issues a design team needs to consider in the development process of new products or services to support the transition to a more circular society.

### What is the information needed before using the tool?

The user should have a good knowledge of the sustainability profile of the reference product or service along the life cycle, or be provided with such information (in the case of the tool being used in an academic context). Previous knowledge about CE and the strategies is recommended.

### What results can be expected?

- A prioritization of applicable design strategies for a more circular and sustainable product/ service;
- The analysis of a reference product or service according to the chosen circular design strategies;
- Immediate improvement ideas and opportunities, through the reflection and assessment of each strategy and related criteria;
- Background information for a brainstorming or other creativity session;
- A graphic comparison between the reference product or service and the new one(s). With this feature, the team can communicate where and how the new solution performs better.

### How is the tool used?

**PRIORITIZATION OF STRATEGIES:** The user evaluates the importance of each of the 8 strategies according to the requirements of the project, the company and its business strategy etc. and selects the ones that go to the next phase. This can be linked to the results of the CE Strategist tool.

#### **ASSESSMENT:**

- **Step 1:** for each strategy, the user indicates the importance of each criterion. By default, all are rated as very important.
- **Step 2:** the user evaluates each applicable criterion with an ABC scoring system. The weighted sum of the performance of all criteria results in the final score of the strategy for the reference product/service.
- **Step 3:** the user inserts improvement ideas or measures linked to each criterion. This can be used in a brainstorming session after filling the tool for the reference product or service. After the filling in of all relevant strategies, the user can go the results spreadsheet, in which a chart with the score of the strategies is displayed, plus the information resulting from the analysis. This information may then be used to support a creativity session to define a new concept for a product and/or a service.
- **Step 4:** After the development of a new product and/or service, the analysis according to what was described in step 2 is repeated. This will allow a comparison between the reference situation and the new one, also displayed graphically in the Results spreadsheet.

## CE Journey

### What is the tool for?

The tool should help the players and/or stakeholders to assess the overall Product / Service / System journey, in the three stages (uphill, top hill and downhill) and along with the several factors: materials, producers, stakeholders and users. Through a visual representation of the journey, it aims to identify the touchpoints between the factors identified: materials, producers, stakeholders and users, providing a model for analysis and identification of opportunities to optimize the journey and to enhance the closing of the loops to present a more circular solution.

### What information is needed before using the tool?

The user should have a specific product/service in a specific context (materials, producers, stakeholders and users) in mind, which is then analysed further.

### What results can be expected?

A visual canvas that allows you to see the journey and touchpoints of the products, producers, stakeholders and users in order to optimize the journey and closing of the loops.

### How is the tool used?

**Step 1.** Print all the cards and canvas and gather necessary materials per group.

**Step 2.** Gather the group/groups in a room and explain the activity, tasks and overall goals.

**Step 3.** Identify each participants role and link them with the possible cards and material(s).

**Step 4.** Introduce task by task:

**1<sup>st</sup> SUPERPOWERS (30 minutes)** Identify major actors and resources in terms of materials, producers, partners and users;

**2<sup>nd</sup> CHALLENGES (30 Minutes)** Each actor should get familiar with the different types of challenges and resource in terms of materials, producers, partners and users;

**3<sup>rd</sup> JOURNEY Canvas (60 minutes)** In collaboration, participants must fill the canvas based on the journey identified, where they must try to identify their touchpoints. Aim for optimizing the solution in its economic, environmental and social dimensions.

During the process, always keep in mind the Circular Economy focus (purple card).

**Step 5.** In the end, you can redo the canvas aiming to optimize the solution in order of: closing loops, waste as resource, assets sharing and feeding loops.

## CE Analyst

### What is the tool for?

The CE Analyst quantifies the potential improvements of the environmental profile of a given "linear" product, when different circular scenarios (such as share, repair, and reuse) are applied. Exemplary questions the tool addresses are: Which strategies are most relevant for my product, given its environmental profile? If a circular product design leads to higher impacts, does the measure still pay off over time?

### What information is needed before using the tool?

A basic environmental profile of a "linear" products' over the five life cycles (raw materials, manufacturing, distribution, use, disposal) is needed. Linear in that regard means that it is modelled with virgin material use and no recycling is taking place at the end of its life. Additionally, the products' lifetime is essential for providing a basis for comparing the impacts of different scenarios and defining a functional unit.

### What results can be expected?

The results show the effects of applying certain circular strategies to a given linear product, in terms of its changing LCA profile.

### How is the tool used?

#### Step 1 – Defining the linear product system

Based on the impacts of a product over the different life cycle stages and its use time the functional unit of the product system is defined (=product impacts/year). It forms the basis for the following evaluations and comparisons with circular scenarios. The life cycle data is also used to quantify the Maximum Circular Value Capture (MCVC). The MCVC (a ratio between 0 and 1) describes the maximum share of the environmental burden that can be influenced by a certain circular strategy. A ratio of 1 means that impacts from all life cycle stages can theoretically be mitigated with a given strategy (e.g. through product pooling).

#### Step 2 – Defining a circular scenario and comparing results

With the linear product system defined, the user can then define and calculate the effects of eight different circular scenarios. The tool allows the user to calculate the effects on the footprint and compares the resulting circular scenario with the reference product. Furthermore, the tool calculates, how much of the MCVC is realised under the defined conditions. The results page provides an overview of all scenarios.



## KATCHing Carbon

### What is the tool for?

KATCHing Carbon tool is an easy-to-use Product Carbon Footprint calculation for products from the building and furniture sector. It is intended to support students and industrial professionals to estimate the CO<sub>2</sub> equivalent emissions associated with the life cycle of a typically linear products. The results can be used to select the most appropriate circular economy strategy using the KATCH-e tool "CE Analyst".

### What information is needed before using the tool?

In order to obtain an estimation of the CO<sub>2</sub> equivalent emissions associated with a product, it is necessary to quantify the main inputs and outputs of material and energy at each stage of the life cycle of the product. This information can be taken directly from companies, in the best of cases, or in its absence, it can be taken from bibliography.

### What results can be expected?

The results provide an estimation of the equivalent CO<sub>2</sub> emissions for each stage of the life cycle of the target product. The results are shown quantitatively and graphically.

### How is the tool used?

#### **Step 1 – Defining the Functional Unit and scope**

The first step is to define the lifespan and functional/declared unit of the product. If This information is not known, EDPs or bibliography of the same or similar products can be consulted.

#### **Step 2 – Quantification of inputs/outputs of the life cycle**

Users should estimate the amount of material and energy consumed and wasted during all the stages of the life cycle of the product. The tool contains a spreadsheet for each stage of the life cycle. For a better estimation of the environmental impacts, it is recommended to enter the data in the tool already referred to the functional/declared unit.

#### **Step 3 – Results**

From the data entered for each stage of the life cycle, the tool calculates the equivalent CO<sub>2</sub> emissions and displays them numerically and in bar graphs.

The results are based on the life cycle assessment methodology, taking into account the data entered by the user, as well as the associated indirect data obtained from the databases GaBi, Ecoinvent and ELCD adapted for this tool. Emission factors used: IPCC. Note that the results of this tool are relative expressions and do not predict the consequences of impacts, nor do they exceed certain levels, safety margins or risks.