Circularity Compass

An Introduction

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The Circularity Compass | Structure

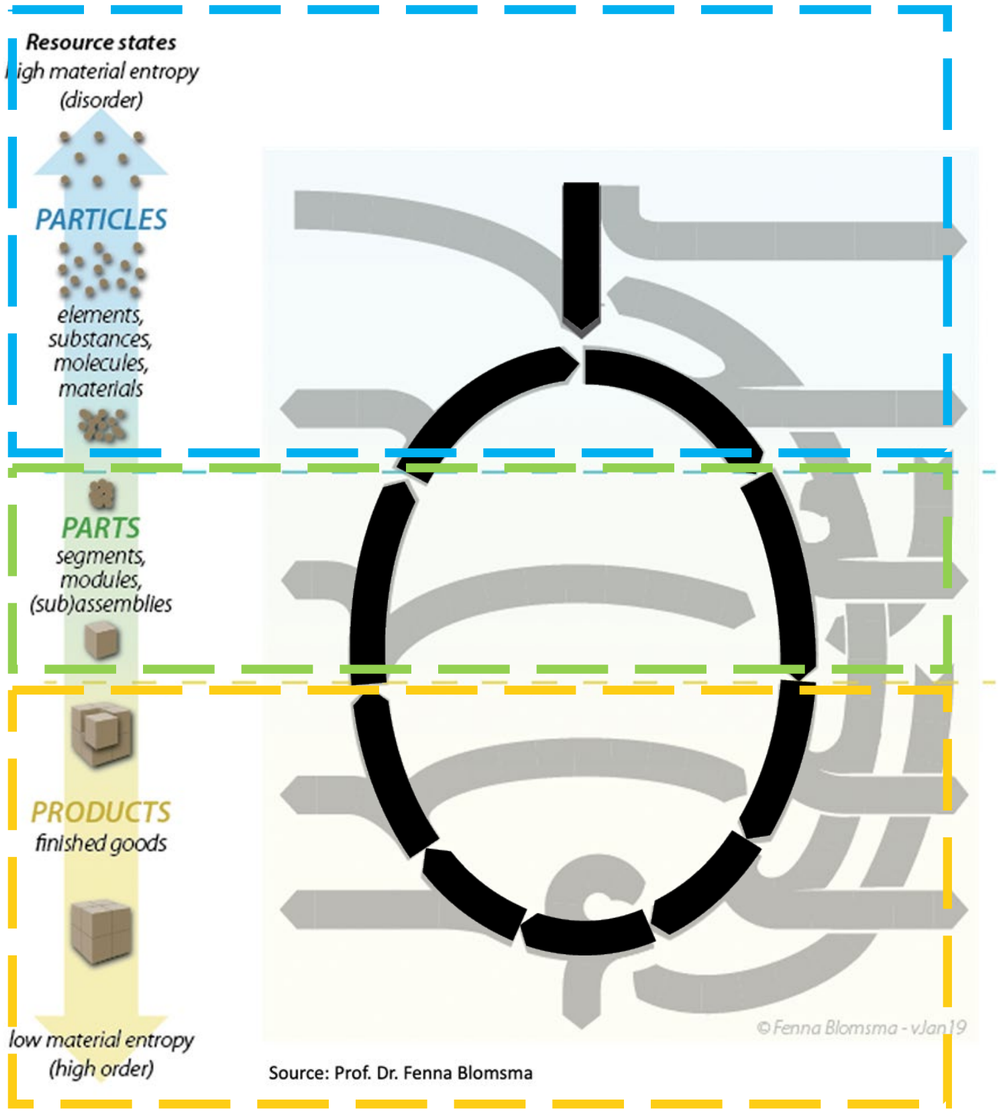
The Circularity Compass provides a way to illustrate how resources flow through our economy.

Resources don‘t exist in a fixed form within our economy. They flow through the economy and they change form as they do so (upstream / top-hill / downstream).

They first exist as molecules / materials / substances and we make bulk materials from them.

From the bulk materials, we make components. Then we assemble components and parts into the finished goods, prepare them for the market (e.g. packaging) and distribute them to the users.

In a circular economy, at the end-of-use/life, this process then is reversed and prepare the resources to become the next generation of products.



Source: Prof. Dr. Fenna Blomsma

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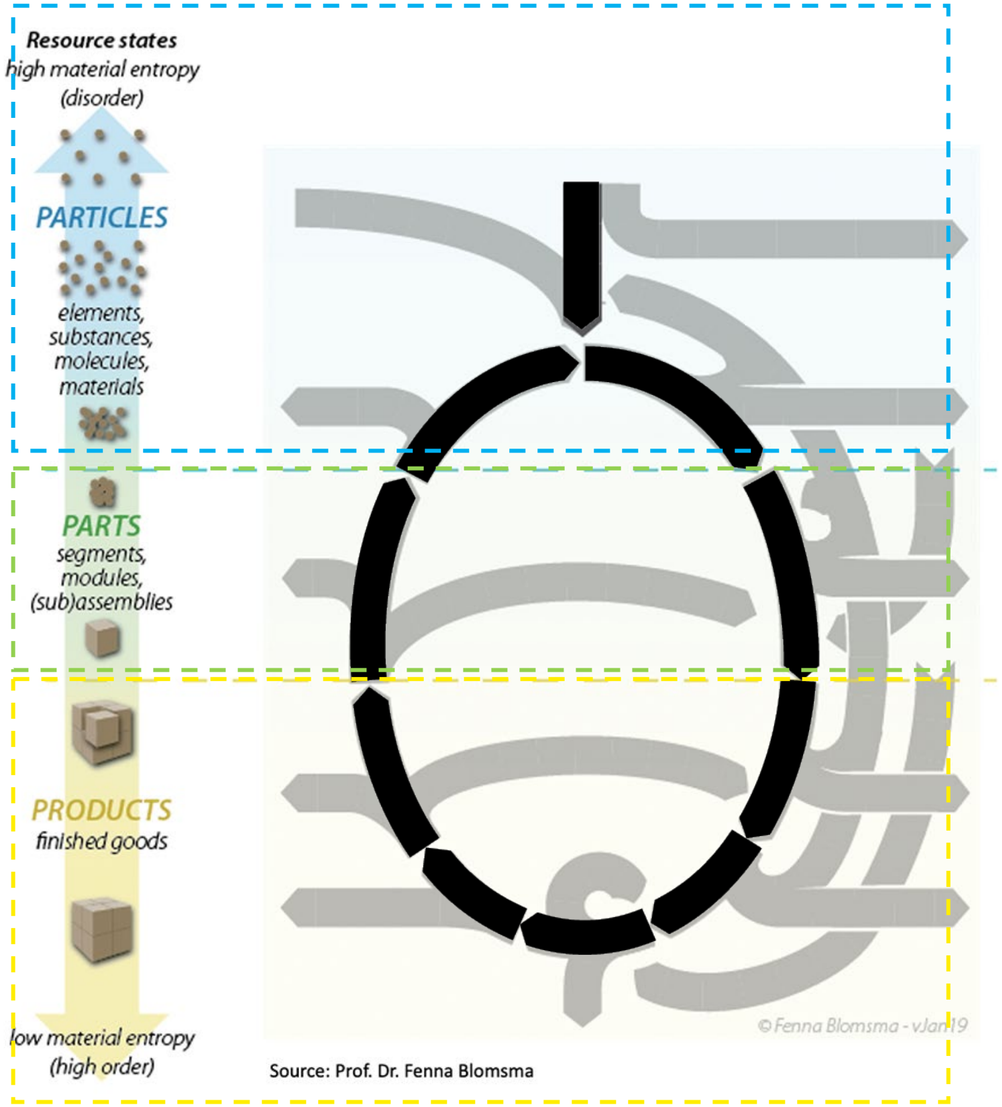
The Circularity Compass | Structure

The resource state indicator on the left-hand side of the framework shows how the resource states relate to industrial processes.

The Compass has three ‘layers’ that indicate where a resource is on its journey to becoming a finished product. These three layers, the resource states, are: ***particles, parts and products.***

1. The **particles** state indicates a phase where we speak of resources in terms of elements, molecules, substances, or (bulk) materials. The operations in this state are primarily aimed at concentrating particles: purifying them and making them suitable for use. For example, the mining, smelting and manufacture of aluminium ingots and sheets.
2. Particles are given an intermediary form in the **parts** state. This is where parts or components, intermediates, (sub)assemblies, or modules are created. In the example of aluminium, this would be when it is used to create the various parts of a car, such as the chassis and the doors and other parts are added to it to create sub-assemblies.
3. In the lower segment, parts are assembled to form **finished goods** that end users can extract value and utility from in the products state. This is when the complete car is assembled from the parts, it is sold or in some other way made accessible to the end-user.

And these stages also apply at the end-of-life stages as the product is re-used, or disassembled, or its material is recycled into particles



Source: Prof. Dr. Fenna Blomsma

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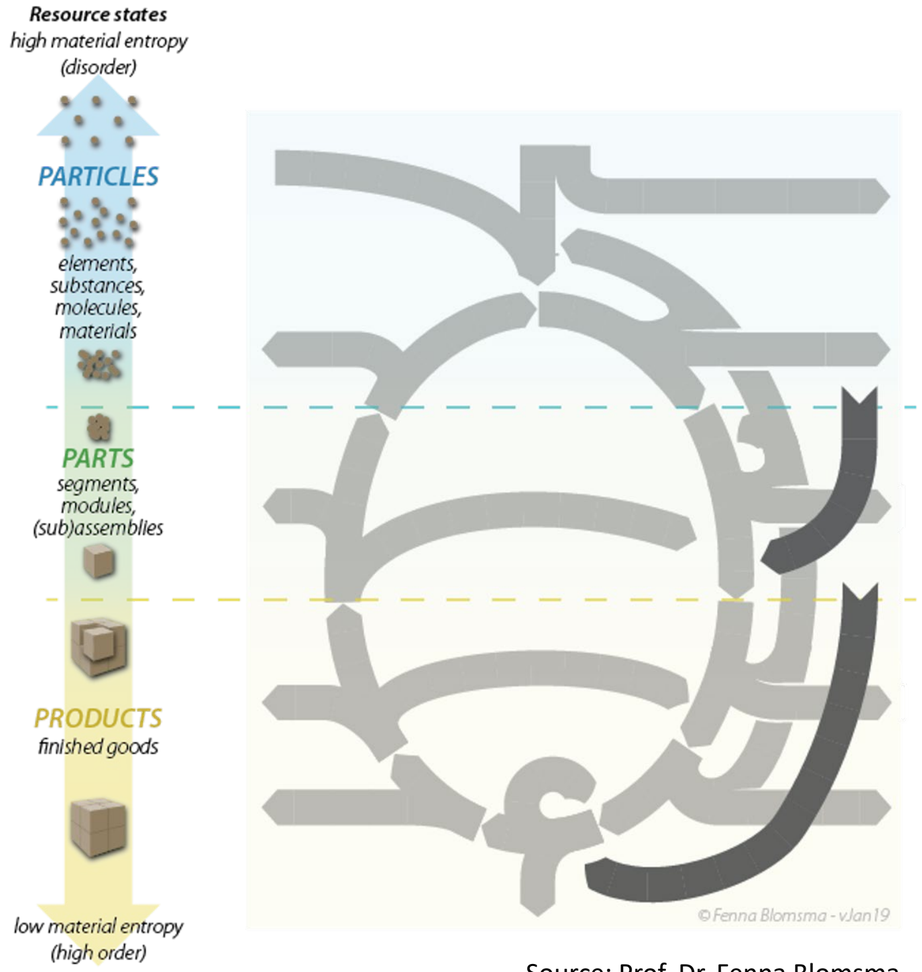
- Input-arrows (not just the marked ones on this illustraion) indicate resources that enter the system.
- That can be raw virgin materials to begin with or materials that are re-used or cascaded from another system, and also other products, finished parts, ingredients and additives that are applied to, or with the product.
- In our imagination, these are final products from another Compass, e.g. if you draw from the perspective of one company, these would be components that are not produced in-house (e.g. buttons to a jacket), but are brought in, or are not that relevant to discuss in the first place.



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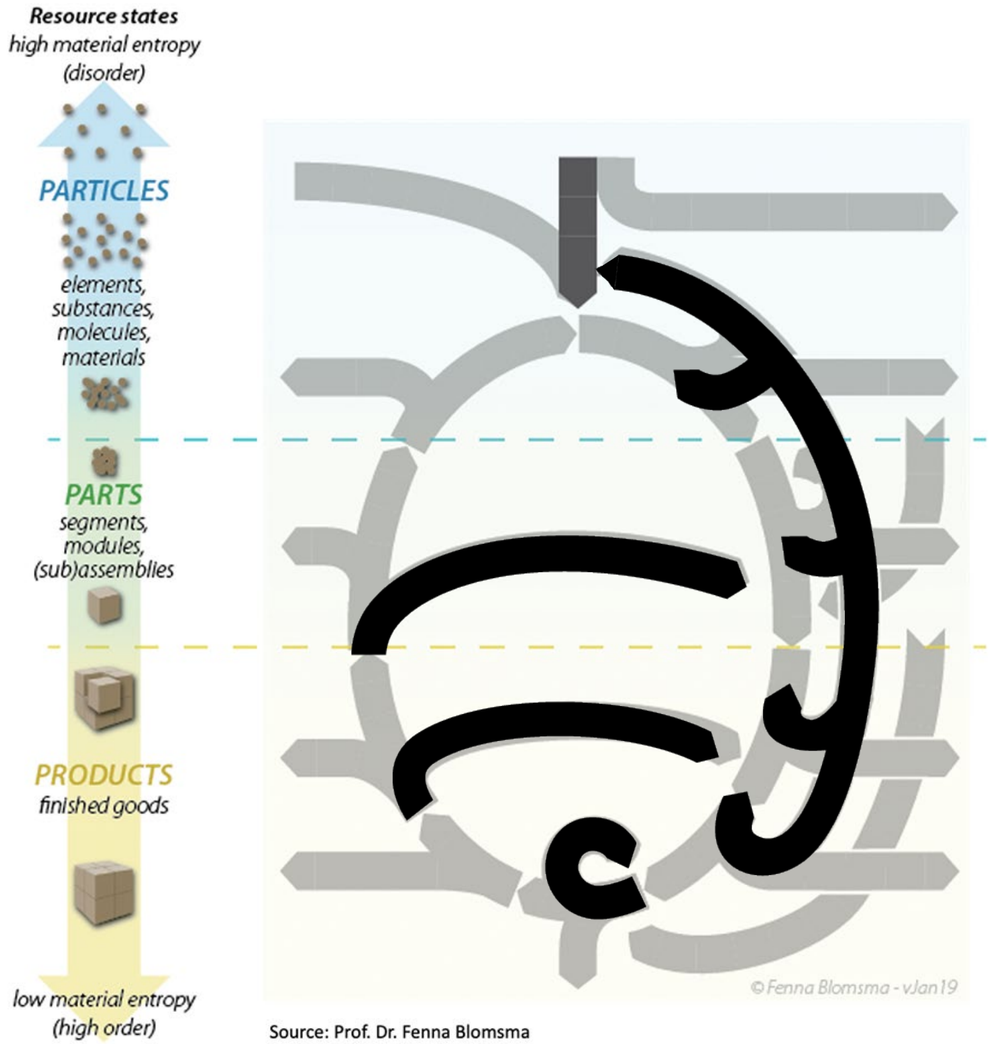
Breaking resources down into substances is not the only way to realize circular economy. The Circularity Compass provides many other routes to depict potential circular strategies:

Resources can be re-routed and circled within the same system.

The products can be used longer by the same customer, re-used or share-used between customers (e.g. pass clothes / toys to little siblings, share tools / kitchen utensils within a neighbourhood).

Products could be taken back by the company and re-used directly by another customer, without further treatment.

Parts could be upgraded or remanufactured to be fit for a new cycle.



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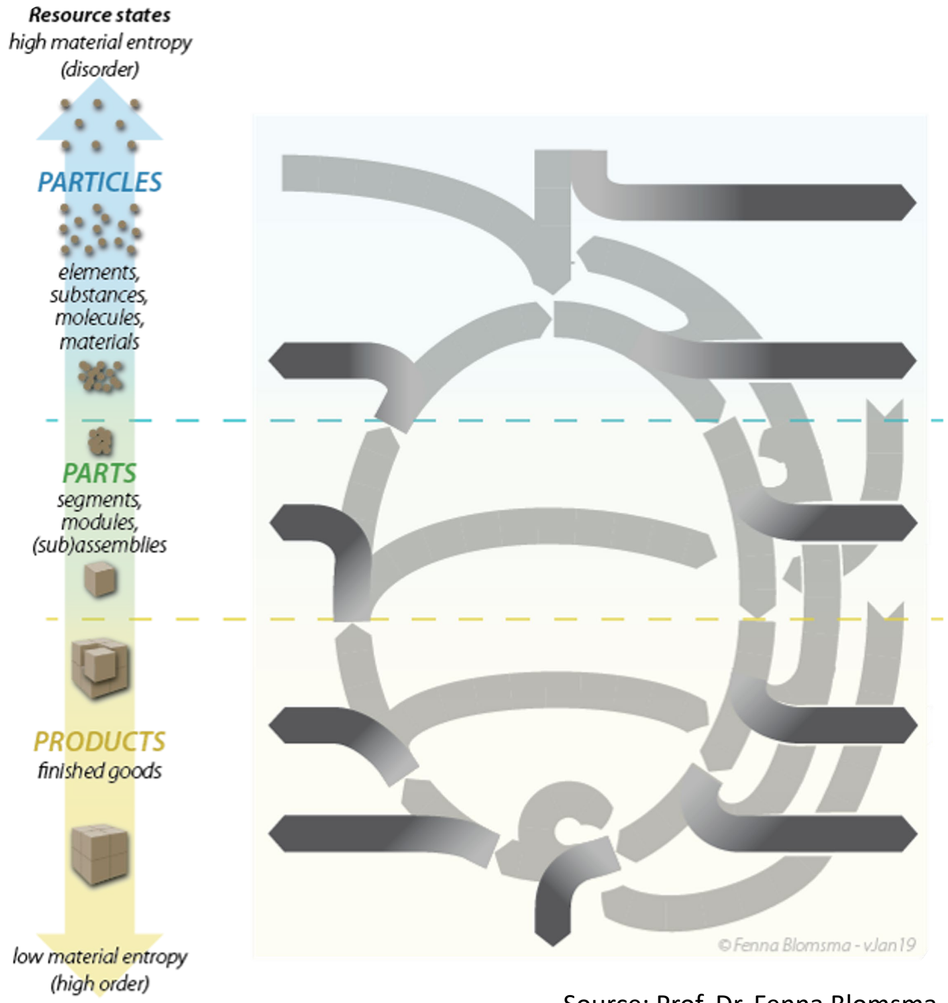
The Circularity Compass | Structure

- Output-arrows do not necessarily designate something as waste – materials might not be able to be re-used within the same system, but within another.

- If something is waste or productive resource is defined by the destination of the resource (e.g. agricultural residues could be defined as waste and be treated as such, or be an input-material, for example to produce paper).

- The arrows indicate, how the resources leave the current system. They then would be illustrated as input flows in another Circularity Compass. Something could be waste in this system, but product or resource in another.



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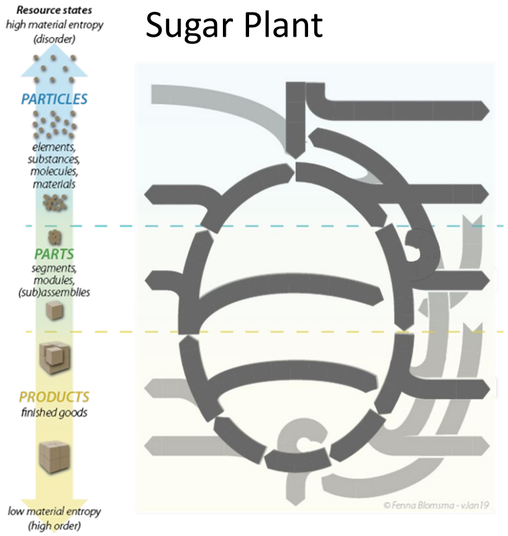
The Circularity Compass | Structure

The Circularity Compass can be used on a product level (e.g. Illustrated the resource flow for the production of sugar on the left side example with all its inputs and outputs).

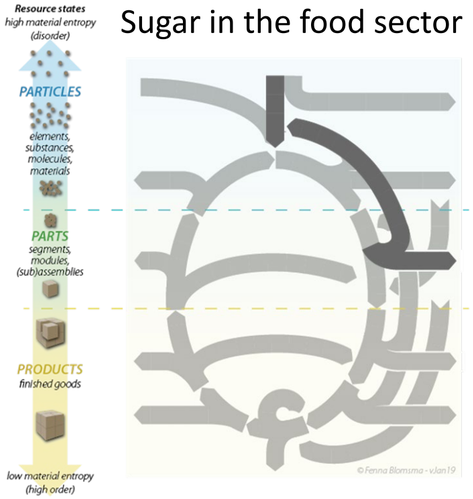


Sugar Plant

Don´t worry if you don´t understand everything right now. Just keep going through the explanation of the tools. As you get all of the tools to know better and have see all the explanations and examples, it will become clearer. Also, we will cover all of that in the training. Remember: this is just a light introduction to get you started.

It can also be used on sector, industry or economy level (e.g. illustrate the location of sugar production in the overall food-system on the right side, where sugar is just a part of the whole system. For example, if you wish to illustrate a cookie manufacturer, you'd mark sugar only as part of the system, because the final product is not the sugar, but the cookie).

Depending on what you wish to focus on and disect, you can illustrate a material, a product, a plant, or larger systems.



Sugar in the food sector

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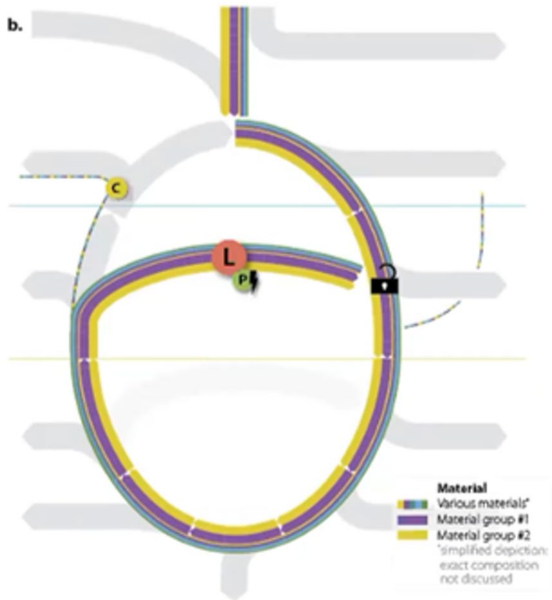
The Circularity Compass | Structure and application, rules

- **The flows should be considered as an ‘order of magnitude‘.** The relative line-thickness can indicate the mass (or importance!) of a substance / material.
- **Flows are simplifications.** They can represent a single material, a group or same type of material. Complex flows of different substances can also be simpflified by grouping (e.g. five toxic materials or three types of leather as one line).
- **Flows can be split**, e.g. indicating different distribution routes (e.g. 10% goes out as waste, 20% gets recirculates, 70% goes into the product).
- **Flows can skip states**, if a manufacturing state is not applicable in a case.
- **Flows can be merged**, if they cannot be meaningfully seperated, or for example when parts become a product.
- **Minimal line thickness applies**, if the line would be too thin to be clearly visible (proportion to other flows).
- Start with production steps, then the use phase, then end-of-life stages in their logical order.

Similarly to Life Cycle Analysis, the purpose of the resource flow illustration has to be defined beforehand, including the level of analysis (sugar or cookie?) as well as the system boundaries.



Proposed solution
The situation the company was attempting to create.

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The Circularity Compass | Structure and application, rules

There are two main ways to use it as a team for the analysis of flows.

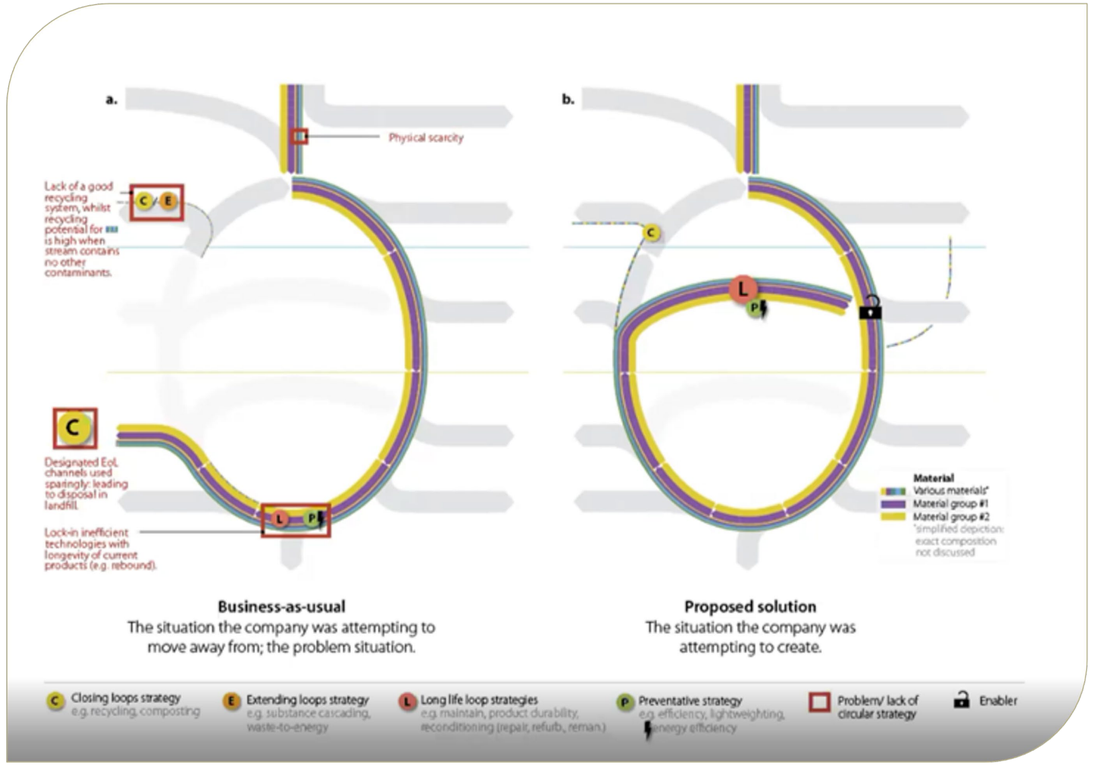
1) To see what is going on:

You can use it to analyze the current system by mapping the resource flows of a selected product, then identify where important wastes occur, where things are circular and linear

2) To imagine how it should be:

You can use it to explore different solutions, by mapping how resource flows could be looped back, redirected, and where circular strategies can be applied or combined.

In both cases, you can use it for '**quick and dirty' analysis** to identify hotspots, or **deepen it with numbers and hard data.**



Source: Prof. Dr. Fenna Blomsma

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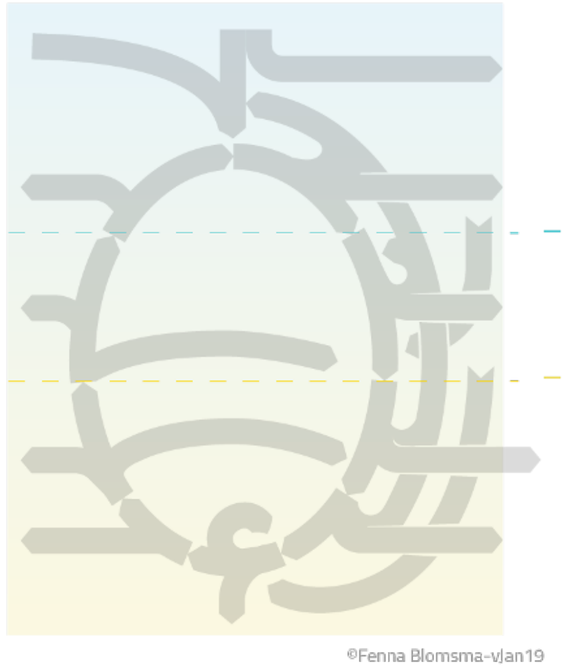
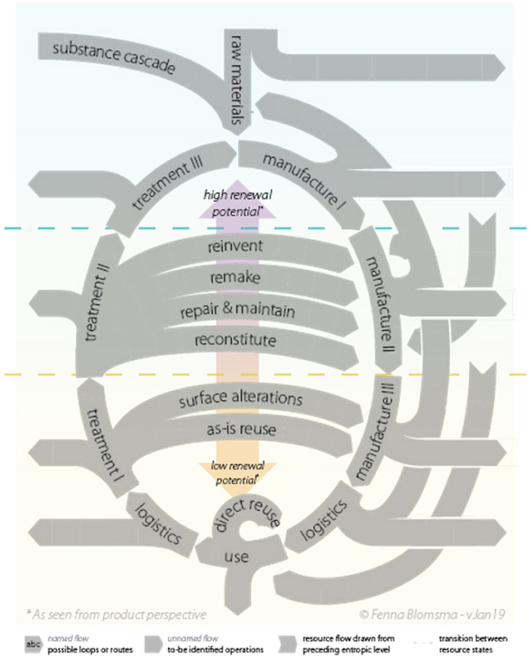
The Circularity Compass | Structure

There are two different versions of the Compass around. A simple version and a more extensive version.

To map resource flows, e.g. in workshops or draw ideas upon, usually the simple version is used, because it makes the tool more applicable.





The more extensive version is mostly used to illustrate and explain. In a later stage, it will help to ideate solutions in a more differentiated way.

There is no right or wrong use. You just should know about the two versions so you don´t get confused if you meet either one of them in your introductory journey

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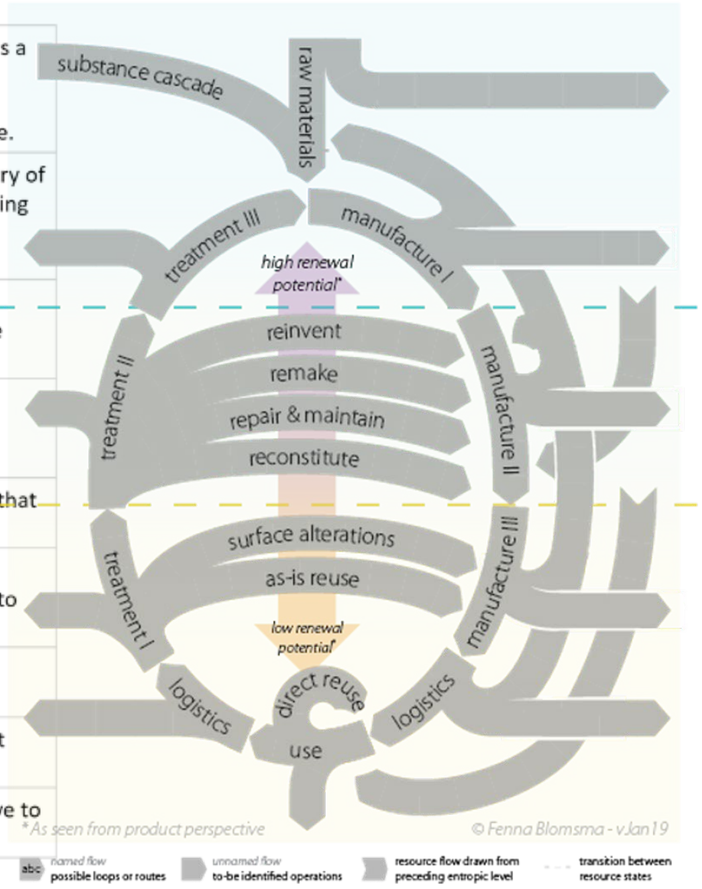
The Circularity Compass | Structure

This is a more **complex version** of the Compass. In a later stage, it will help to ideate solutions in a more differentiated way, as within each resource state the Compass indicates a number of opportunities for the technical renewal of the resource.

For example, in the case of as-is reuse, no alterations take place to the product, but the process of redistribution allows a product to regain functionality by changing its user. Recycling, in contrast to as-is reuse, is placed at the other end of the spectrum. In this process, the product form and function is completely lost, and its constituting materials are turned into a new product.

The simplified version usually is sufficient to draw the ideas. upon

Recycling	The process where a material undergoes a chemical transformation or changes its physical state to return to a 'virgin-like' state, or as close to this state as possible.
Cascading	Value/ utility extraction along a trajectory of increasing entropy, by means of redefining the value/ utility at each stage of the trajectory.
Reinvention	Creating the product and its properties anew within the confines offered by the modules it consists of.
Remake	Restoring or improving (parts of) the product through refurbishment, remanufacturing and upgrading.
Repair & maintenance	Operations such as cleaning and repair that require (partial) disassembly.
Reconstitution	Allowing for the flexible use of product capacity by returning parts or modules to their predefined positions.
Surface alterations	Alterations to the product that do not require disassembly.
As-is reuse	Reuse of the product without significant alterations (i.e. redistribution).
Direct reuse	Direct reuse by user that is an alternative to single use.



Source: Prof. Dr. Fenna Blomsma

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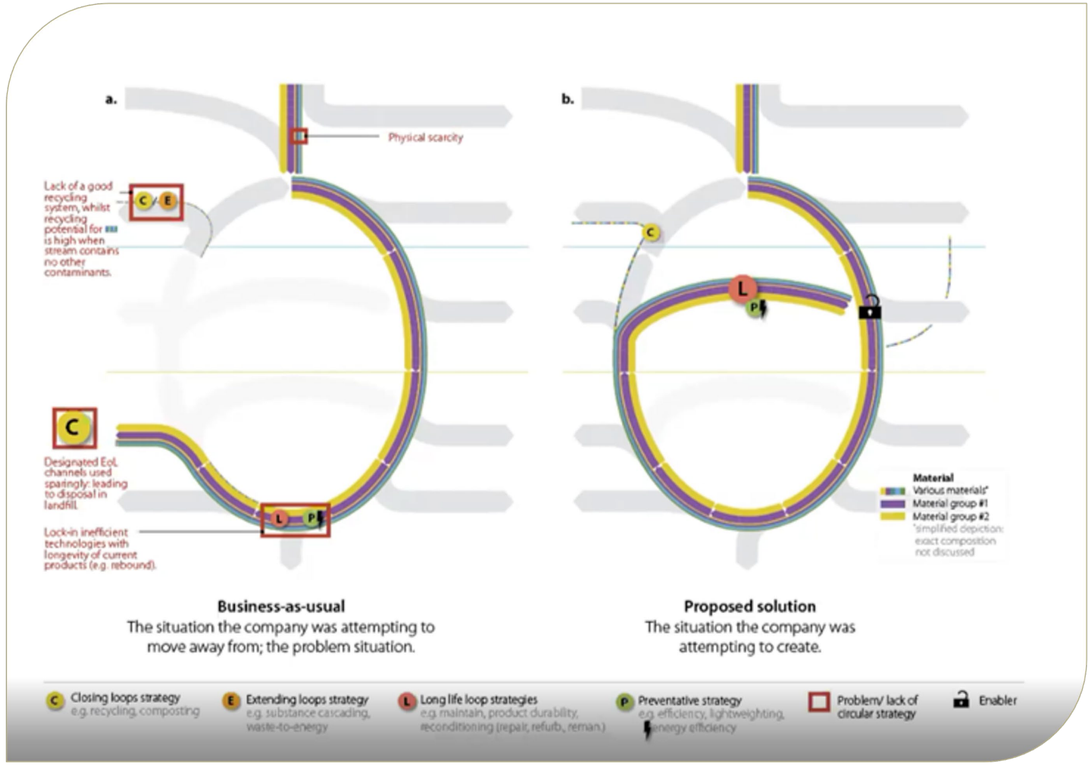
The Circularity Compass | Why do we map the resource flows?

Knowing the resource flow is the basis for discovering structural waste and developing circular strategies to tackle this.

We need to know the resource flow situation we try to move away from, to identify :

1. **Problems / risks, e.g. which materials (will soon):**
   - cause environmental problems
   - be scarce (supply shortages / price volatilites)
   - become expensive to dispose of
   - face regulatory changes
   - become a danger to the brand image
2. **Opportunities, e.g. to :**
   - cut costs
   - make use of hidden value
   - expand into new market
3. **Potential solution strategies and barriers/enablers, e.g. :**
   - Recycling
   - Long-life strategies



Source: CKIC Dec 15th, 2020. Innovation Through Circular Economy, Prof. Dr. Fenna Blomsma

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Use the tool – step by step

Define system boundaries (level) you want to map

*Mapping any **system starts with understanding the level you want to capture** with the tool. Is it a product, or production line you would like to explore? What shall be part of the system, what not?*

Start with mapping initial resource flow

Map the resource flow along the life cycle - maybe start on the top. What materials are used in the product? Group materials where you think this makes sense (e.g. plastics, metals, etc.). Highlight materials that are of special interest e.g. because of their scarcity, value or environmental impact (e.g. gold or toxics). Include relative size of flows where possible. But don´t worry about the exact details (yet).

Pay attention to co-used materials or produced by-products

Pay attention to co-used materials or resources. What materials or resources are co-used with the product? Cleaning agents, transporting material, cooling or consumables (e.g. refills); does the product need bottling, does it consume energy or water during the use phase or does it need special attention during waste collection and treatment?
Are there significant streams?

Pay attention (re-check) to end-of-life treatment scenarios

*Here you are going to assess what is happening with a **product/resource after it served it primary purpose (waste?)** – is it going on landfill, or it is burned, or maybe there is some recycling character and/or is it used as a resource for another system, or for the same (some supermarkets have option delivering back glass bottles from beer and juice).*

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How to use the tool – case example

Find inspiration on real life case examples how the tools can help to develop circular solutions on the following pages. These include some examples developed by the project team and some developed by training participants during the delivery of Circularity Thinking training courses.

Disclaimer: none of the companies mentioned in any of our case examples made their own use of the Circularity Thinking tools. We applied the tools in hindsight and based on available information from the companies. We only show how the Circularity Thinking tools can be applied on company cases to support the circular innovation process.

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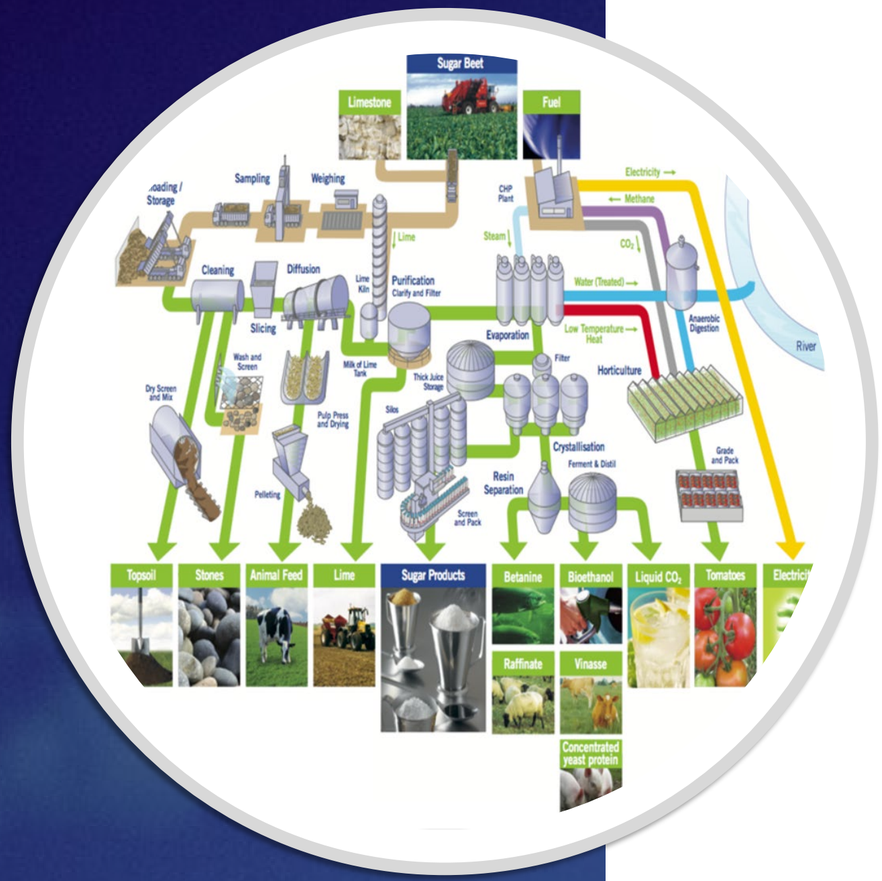
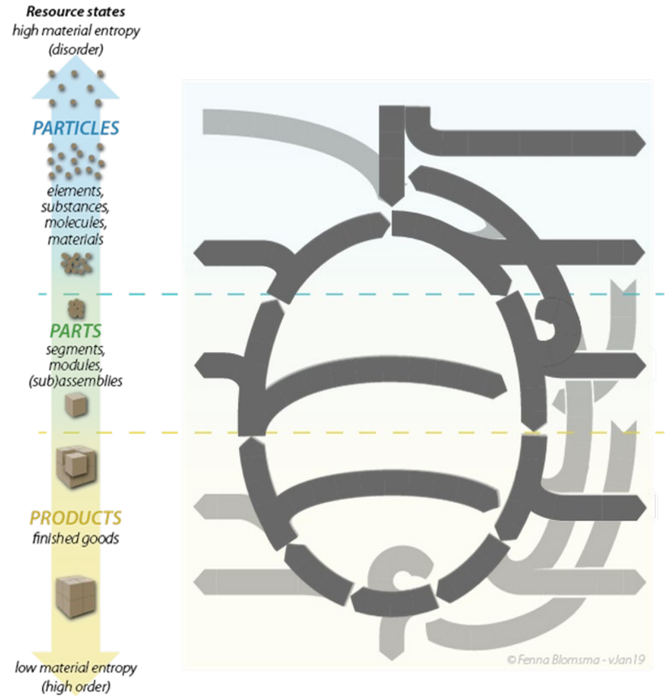
Case example | British Sugar



British Sugar's business model focusses on the following points on the Circularity Compass:

CASCADING

An advanced manufacturing model that avoids waste by turning process outputs into inputs for a wide range of co-products: from power generation and biogas, to animal feed and much more.
These processes result in less than 200 grams of waste for every tonne of sugar produced – virtually zero waste, making British Sugar one of the most efficient sugar processors in the world.



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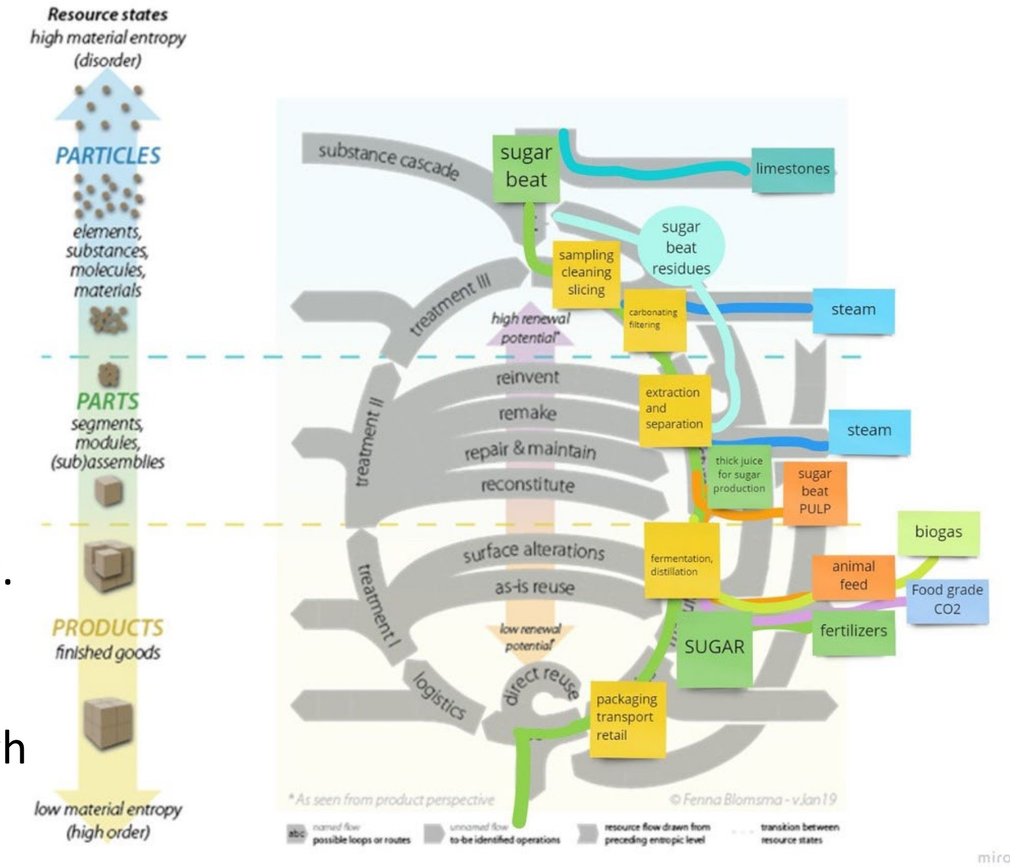
Circulatory Compass in British Sugar case

Simplified Version

From sugar beet to sugar and co-products:

- Aggregate and topsoil – 150,000 tonnes of stones and soil removed during beet cleaning
- Animal feed derived from yeast
- Bioethanol
- Food grade CO_2 used for industrial refrigeration
- Lime
- Excess heat is used by a large local nursery to grow tomatoes.

Co-products present CASCADED substances – outflow from one system becomes inflow for another. New value is captured through resource circulation.



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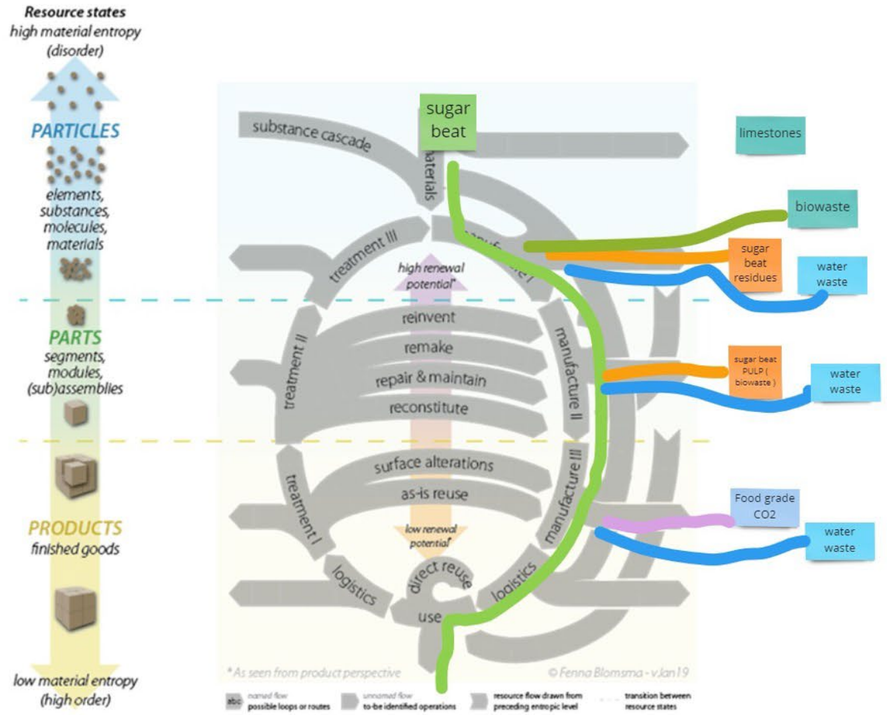
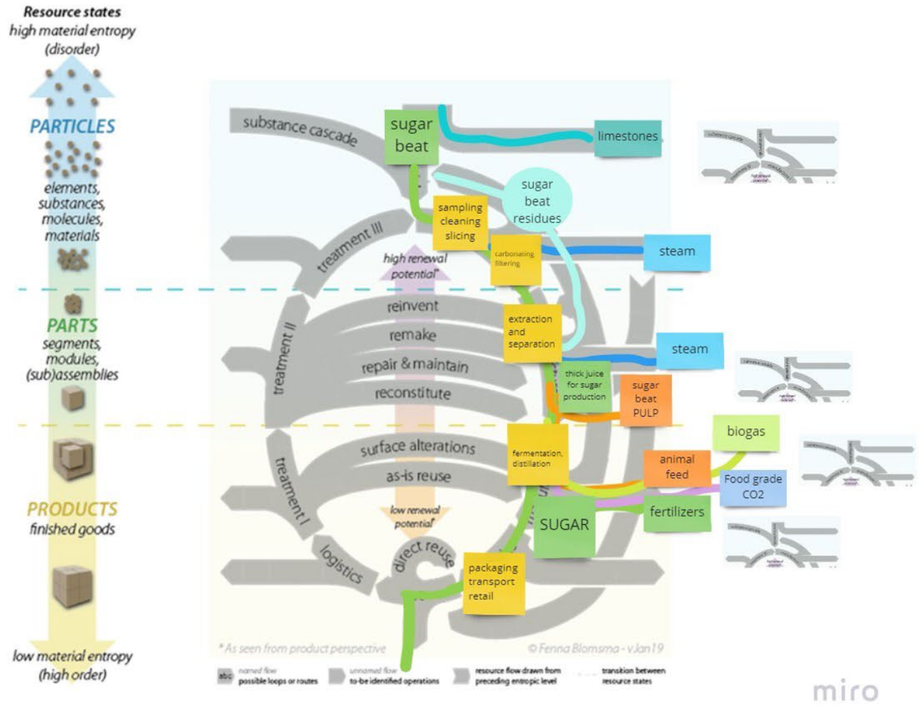
Circulatory Compass in British Sugar case

Linear



Circular



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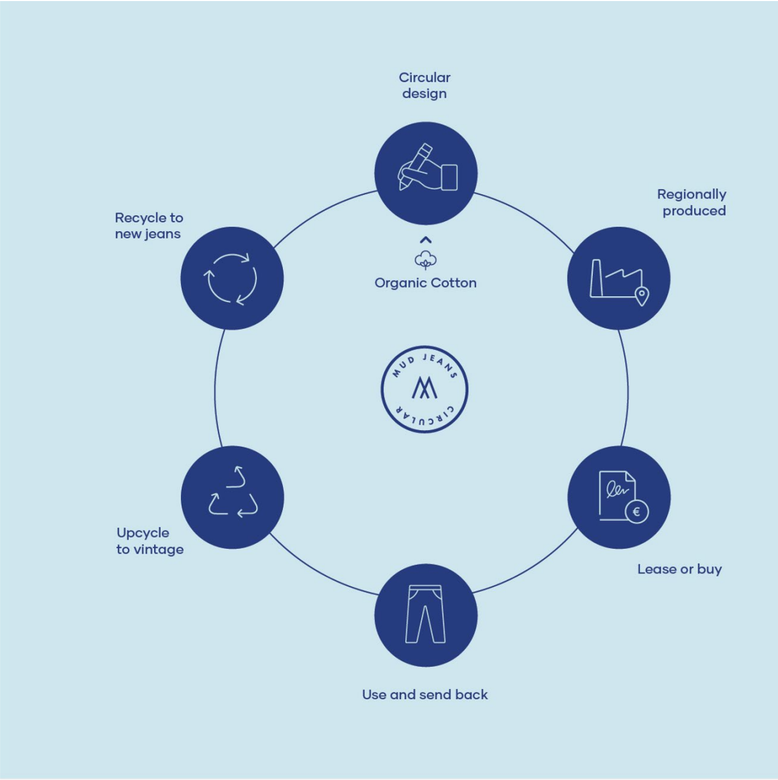
Case example | MUD Jeans

Jeans have one of the largest carbon footprints in the fashion industry due to water depletion.

MUD Jeans has a business model based on:

- Lease
- Reuse
- Repair
- Recycle

The world's first 100% circular denim brand - designed, produced, sold and collected back based on circularity principles.



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Case example | MUD Jeans

Lease

MUD Jeans is unique for its Lease a Jeans model, while they have full sale as well as an option. At the end of lease, customers are encouraged to send back their old jeans and get a new one if they wish. Both leasers and buyers are given a discount when they return an old pair of jeans with their new purchase

Upcycle

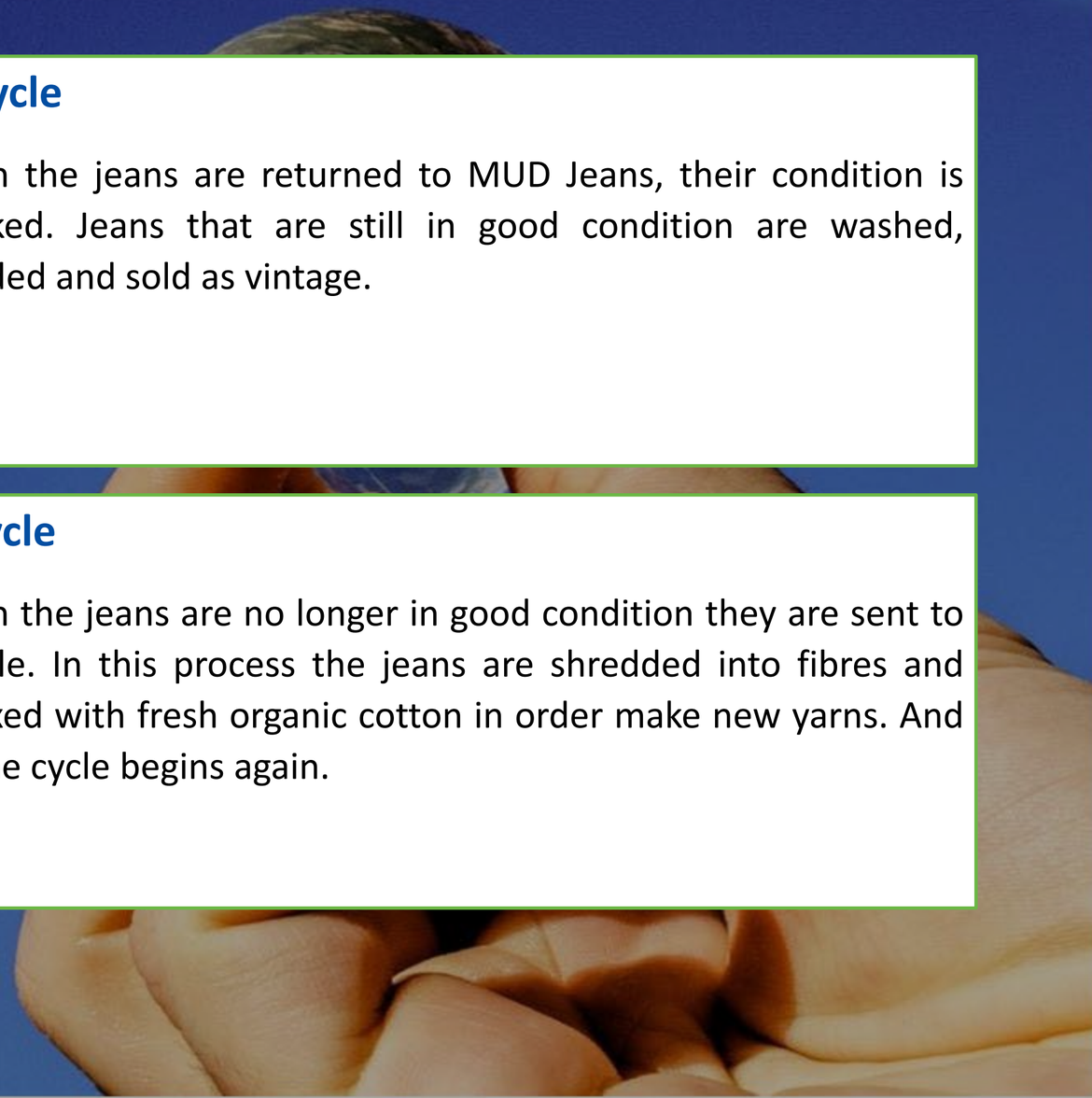
When the jeans are returned to MUD Jeans, their condition is checked. Jeans that are still in good condition are washed, mended and sold as vintage.

Repair

Customers are given access to a free repair service during the first 12 months of their lease or purchase.

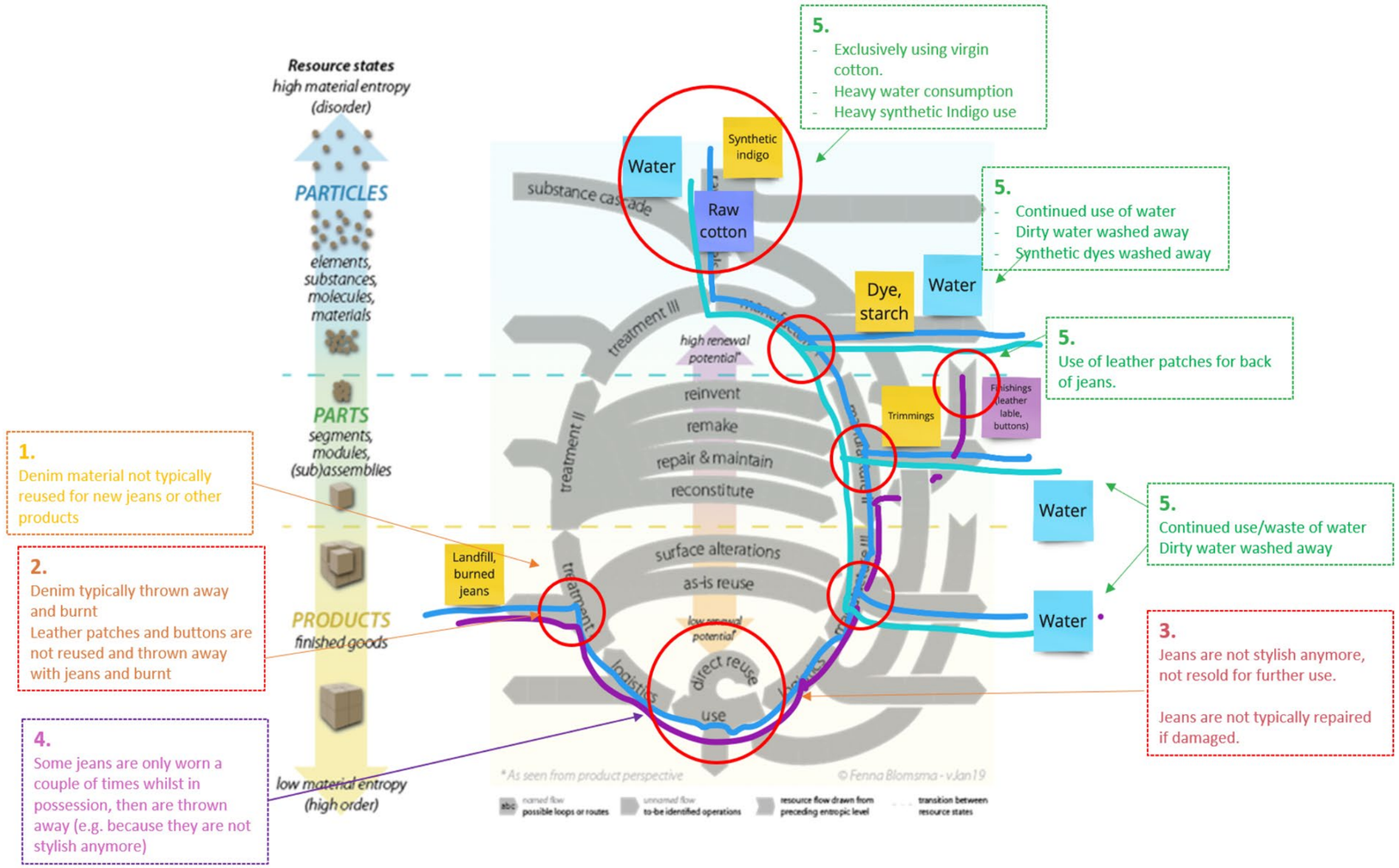
Recycle

When the jeans are no longer in good condition they are sent to recycle. In this process the jeans are shredded into fibres and remixed with fresh organic cotton in order make new yarns. And so, the cycle begins again.



Case example | MUD Jeans

Example of a non-circular business model in the jeans production industry – ‘waste hunt’



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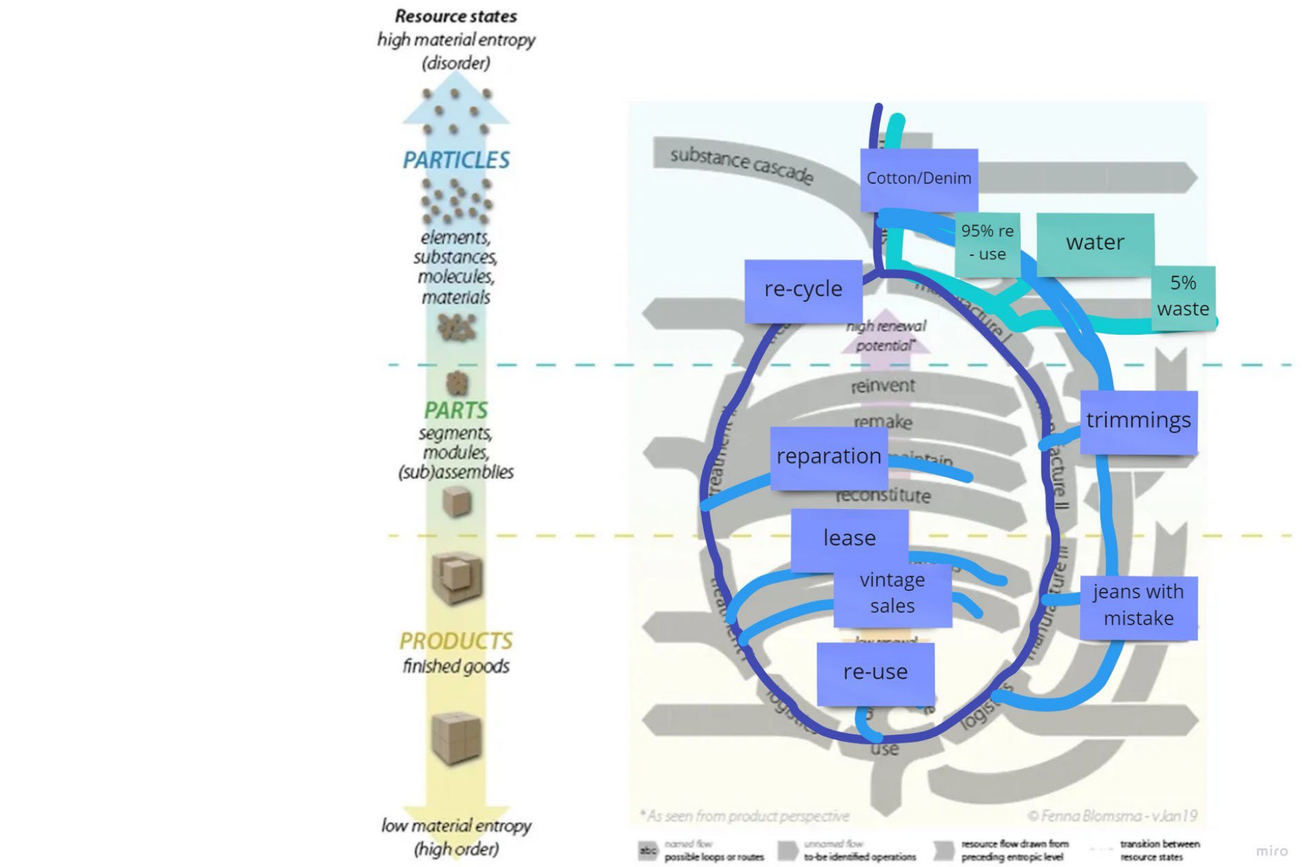
Circularity Compass in MUD Jeans case (simplified version)

Mud Jeans has a circular service based business model, ‘product life extension’ based on:

- Lease
- Reuse
- Repair
- Upcycle
- Recycle

This has a significant positive environmental impact with 95% water re-usage.



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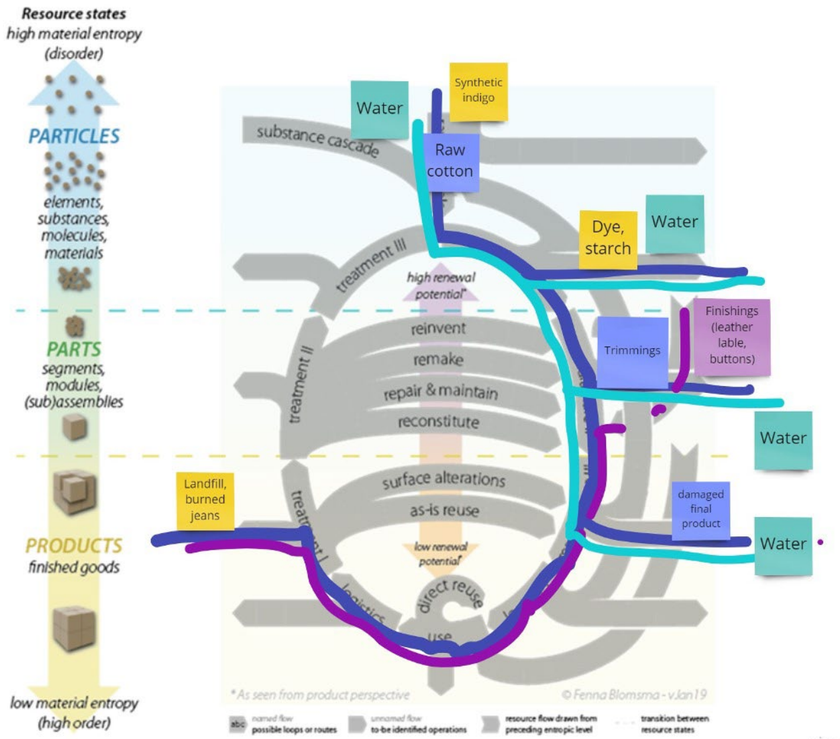
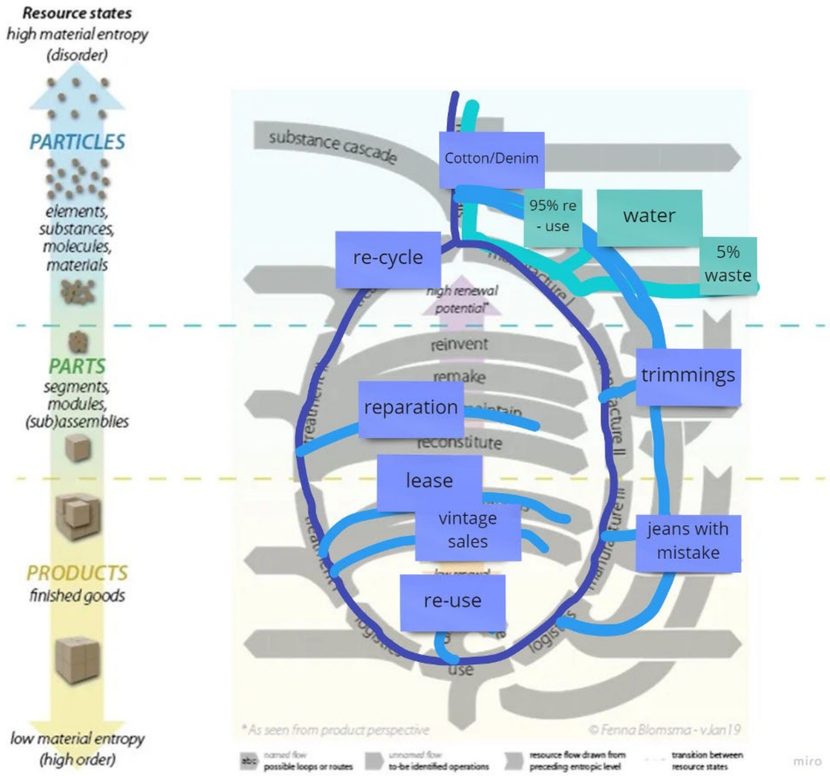
Linear versus circular business model

Linear



Circular



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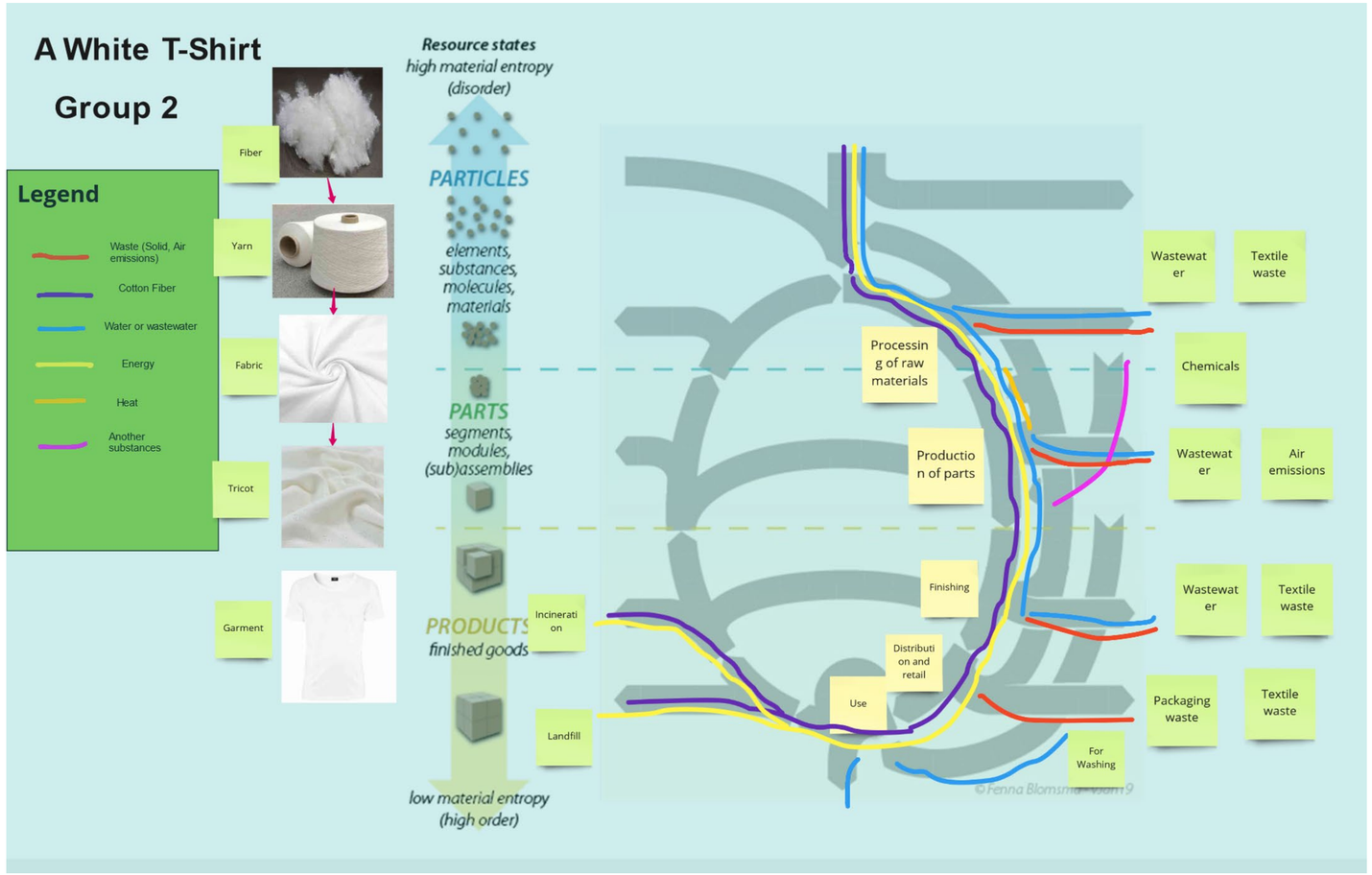
Examples how the Circularity Compass is used | From training courses

This is an example of a train-the-trainers workshop in October 2021. The group mapped a business-as-usual resource flow system as they understood it. This is a good first capture of the current resource flows to use as foundation for the next step – to ‘Hunt the Waste’ (see next tool ‘Big Five Structural Wastes’).



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Examples how the Circularity Compass is used | From training courses

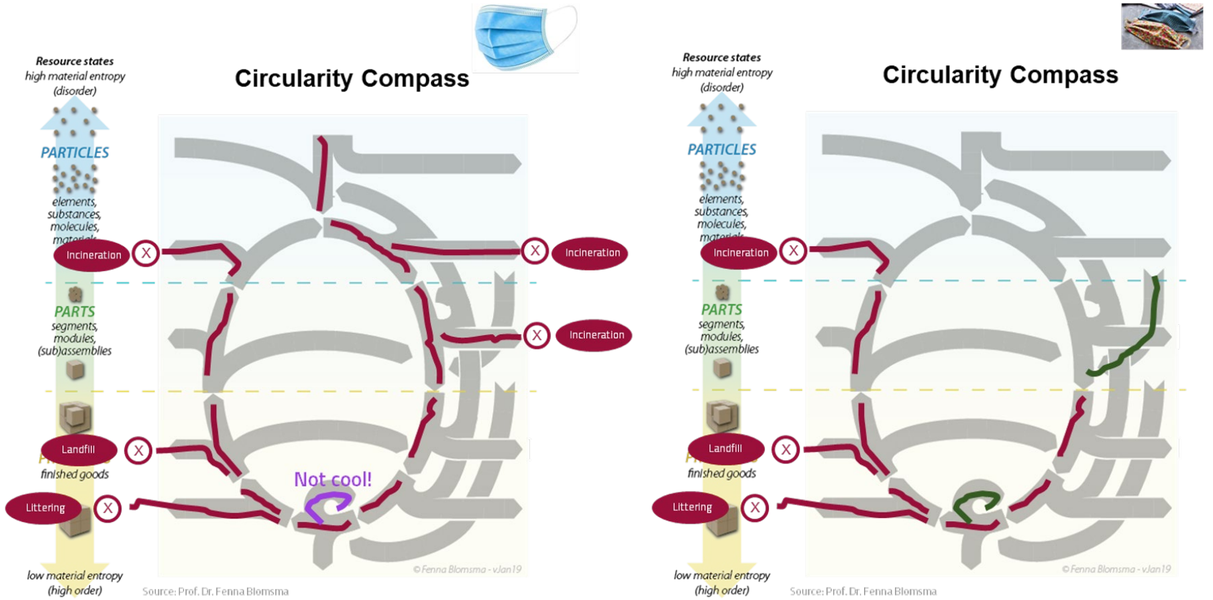
Here you can see an example from an educational presentation for a train-the-trainers. The graphics of the Circularity Compass how the difference between the mappings of a single-use and an ‘upcycling’ face mask (which we naively used in the beginning of the pandemic).

For the sake of simplification, we ignore that each of the masks consists of many different textiles but map only the main materials.

Disposing systems can be different in different countries. Some countries still use landfills, others would incinerate their waste.

One could (and should) also add percentages of what proportion (or mass/volume) is ending up in which kind of end-of-life scenario. That helps to apply the next step of Circularity Thinking.

What should be mapped and how? In general, we can say: stick to what is necessary/useful for your purpose.



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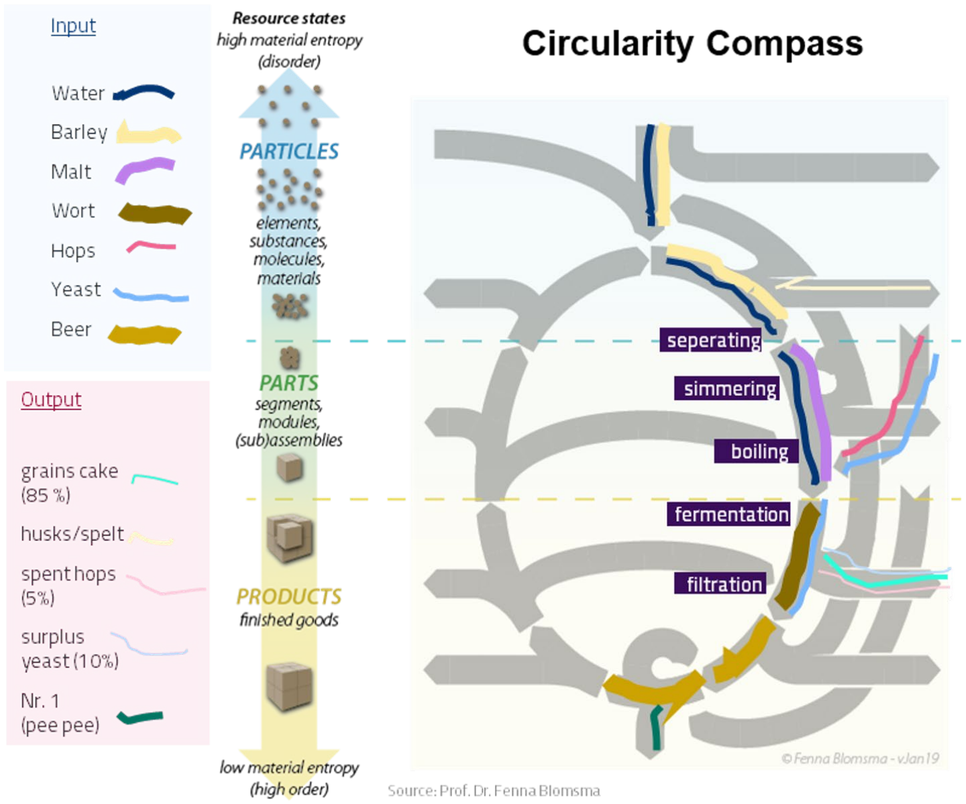
Examples how the Circularity Compass is used | From training courses

This is also an example from an educational presentation for a train-the-trainers. The graphics shows the basic resource flows of brewing beer.

The process is kept simple. Amongst others, the transportation of materials or the bottling of the beer as well as anything else related to the handling of the bottles (e.g. end-of-life treatment scenarios) is not considered.

Is this scope a good scope? Are the resource flows illustrated in enough detail? Well, this depends. It depends on the purpose of our mapping – on the underlying question.



Source: Prof. Dr. Fenna Blomsma

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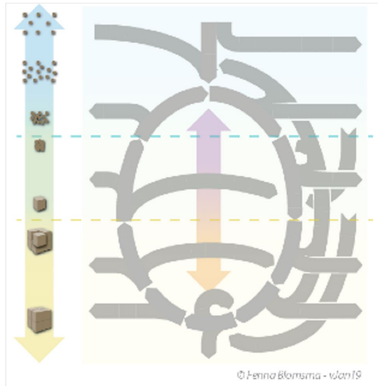
Connection to other tools

This is a very simple illustration of how the tools are connected. In reality, the connection is a little bit more complex. Also, we iterate frequently.

CIRCULARITY THINKING

Starting point

Circularity Compass



Map the resource flows

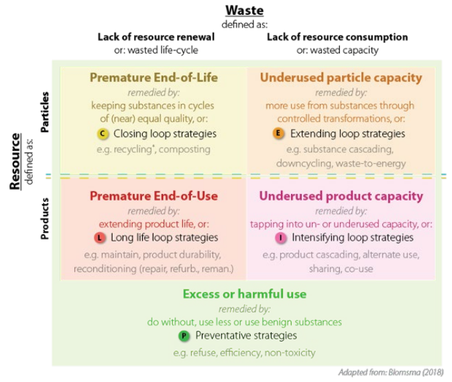
The Circularity Compass is at the very heart of the Circularity Thinking Tools. We **use it all the time** along the innovation process and for different purposes.

The Circularity Compass helps us to map any resource flows of e.g. product systems – current ones or those of our new and shiny circular solutions.

We **also use it as starting point** of the Circularity Thinking process, where we first of all map the resource flows of a certain (product) system as they are. And this is also the purpose at the core of this introductory explanation. Everything else you will learn in the training.

output

Big 5 Structural Wastes



Hunt the waste

We know, what the resource flows of the current (product) system look like. Now we are going to hunt the waste.

First, we learn what ‘waste’ actually is.

Then we find out what is actually wasteful along the value chain and what kind of waste is hidden. We also learn which strategies can address this specific kind of waste.

The better we understand the waste, the better we can address it effectively and with an appropriate combination of circular strategies.

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Circularity Thinking tools are a valuable resource for developing and practicing **System Thinking skills**, which are the ultimate mental attribute for complex problem solving. The tools that you are going to be introduced to, throughout the workshop, presents the groundwork in catalysing and scaling your capacity to think both critically and creatively.

Even though that it can look complicated, it is rather complex, and remember that **practice makes perfect**!

Best of luck with your training!

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