The Circular Design Journal for Makers

MARCH 2024

HIGH QUALITY RESOURCE

Explore circular strategies in this personal journal for makers developed by DDC - Danish Design Center

Distributed Design

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Forewords

This publication is a high quality resource developed by DDC - Danish Design Center - one of the member organisations of the Distributed Design Platform.

The resource is aiming to provide makers and designer with an overview and inspiration source containing different circular strategies that encourage all creatives to have in the back of their mind when working on projects and initiatives.

The resource is set up as a personliased journal, giving you the opportunity to reflect upon your project, generate new ideas and keep track of relevant circular strategies and initiaitves in your practice.

You can apply it in the very beginning of your project(s), which could help you kickstart circular initiatives or you can apply it later in the process - it is never to late to start considering new circular aspects and incorporate them into your practice.

Below, you can draw and/or describe the project you are working on where you would like to explore and reflect upon circular opportunities.

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This Circular Design Journal belongs to:

About my project/work:

Here you can insert a photo or draw what you are working on

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What is Circular Economy?

In our current economy, we take materials from the Earth, make products from them, and eventually throw them away as waste – the process is linear. In a circular economy, we stop producing waste in the first place. A circular economy is based on four principles, driven by design:

Circular economy is in theory simple, but can be very complex and difficult to carry out in real life as the world is now. If you want to learn more about circular economy, you can visit Ellen MacArthur Foundation's website. You can also read DDC's article 'Debunking Misconceptions on Circular Economy'. Feel free to reflect upon the question below before moving on to get familiar with the Circular Strategies on the next pages.

Four principles

Eliminate waste and pollution

Circulate products and materials (at their highest value)

Regenerate nature

Redefine meaningful life with less consumption

Do you already work with circular economy in your project? If yes, how and in what way? You can write, sketch, calculate - you name it!

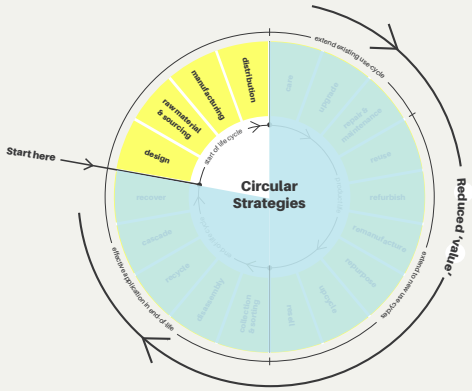
Circular Strategies

The circular strategies are strategies you can consider throughout the development of circular products and business models.

On the next page, you find The Circular Strategies Wheel. This is divided into three overall stages i.e.: 1) Start of life, 2) Product Life & 3) End-of-life. As a rule of thumb, the more you move clock-wise in the wheel, the more value of the product and/or material is being lost. Therefore, consider working as "upstream" as possible meaning that it is (in most cases) better to prioritise the first strategies (starting with the design phase) than some of the last strategies like cascading and recycling.

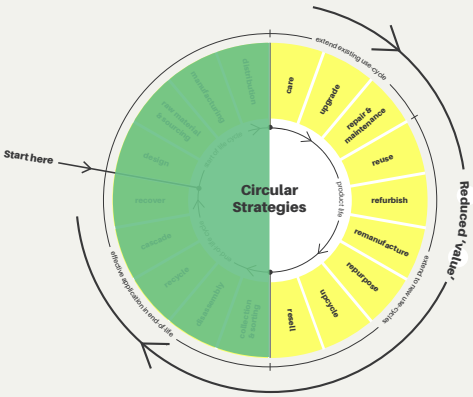
1) Start of life

The start of the life stage commences with the design phase. This is where up to 80% of a product's enviromental impact is determined as a product e.g. can be designed for (easy) disassembly that can be carried out later in the product's life. Subsequently, the start of life also includes considerations about choice of material e.g. where and how these are sourced, manufactured, labeled, packed and distributed.



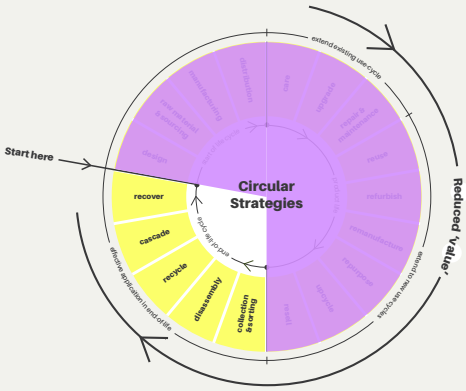
2) Product life

The product life stage is where the product/materials are considered to be in use. The first three strategies are about how to extend the exisiting/initial use-cycle. The remaining strategies in the product life phase is about how to extend for new use-cycles. The strategies to be applied in the product life can depend a lot on the context, as well as where and how the product/materials are being used. Therefore, keep potential rebound effects and trade-offs in mind whilst exploring the different stategies in the product life stage.



3) End-of-life

The end-of-life stage is when products and materials can no longer be used and when there is no more value to be extracted from these in the use phase. In a circular economy, it is always the aim to extend the lifetime as much as possible and keep products and materials in use for as long as possible. Though, when/if the products and materials eventually do end their lives, it is important to consider how to deal with this and take responsibiltiy for this stage to the greatest extent possible e.g. by establishing take-back systems etc.



Circular strategies wheel

Distribution

Considerations about distribution are e.g.: design for effective loading and transport, which concerns transport of larger quantities at a time and stackable products. It also concerns return logistics, reduction of emissions linked to transport, choosing local suppliers, minimisation of the weight of components and selection of strong, robust and durable packaging with long lifespan that do not degrade during multiple transportation.

Care

Caring is about how to extend the lifetime of products as much as possible by (continuously) taking care of them during their use phase.
This is done by e.g. considering effective use along with procedures for caring to facilitate the extension of the lifetime of products.
Examples of this could be facilitation of emotional/personal attachment to products, educational videos, provision of care kits, guides, manuals etc.

Upgrade

When upgrading, the product is still functional, but new changes, evolution and/or new features are added to extend the lifetime of products.
Upgrades can extend the product value by enhancing the function of an existing product to even beyond its original design condition. Potentially, upgrading can also reduce value loss from continued use of parts and products.
Rebound effects are important to take into consideration when considering whether it pays off to upgrade or not.

Repair & Maintenance

Repair and maintenance involve thinking about how to correct, replace and/or fix broken/damaged components of a defective product aiming to maintain the original functionality to the same user and thereby extend the life time of products and reduce the need for new resources, avoiding waste and producing fewer emissions. Repairing and maintenance can happen with different frequences and also be part of a product/service-system.

Manufacturing

Manufacturing concerns improvement of circularity, efficiency and effectiveness in the product manufacturing and you can consider the following: favor cleaner production, efficiency, processes, equipment toxicity and other environmental aspects of handling waste orginating from production of materials and products.

Finally, you can also consider social sustainbility aspects (e.g. working conditions), design for reduced energy consumption and prioritising renewable energy.

Reuse

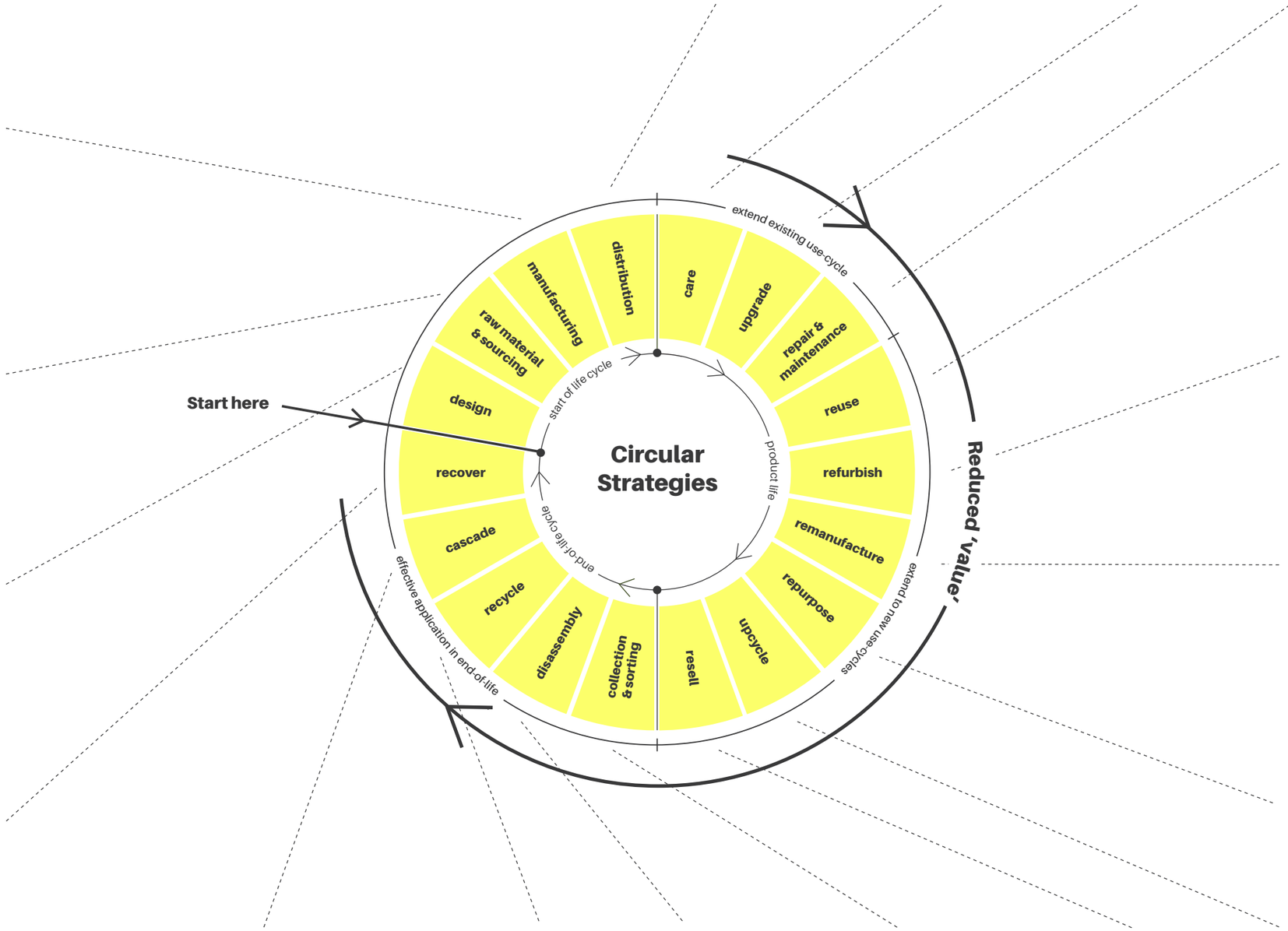
(Direct) reuse of (discarded) products involves that the products are still in good condition and fulfill original functions that aims to keep the product attractive to as many different users as possible for as long as possible and prevent that they turn into waste. Reuse may involve minimum cleaning and repackaging. The reused product should still be functional, efficient, and attractive. People might reuse preowned products due to lower prices, patina or if they are better than new ones.

Raw Material & Sourcing

Raw materials covers the selection of resources and materials that go into the products that is to become a part of your product system.
When choosing materials, consider: durability, renewablity, recyclability & secondary recyclability.
You can also consider aspects such as where the materials originate from and how the working conditions are for the people dealing with the materials (i.e. social sustainability aspects).

Refurbish

Refurbishing is about repairing a returned product after a certain period of use so that it satifies certain mechanical specifications and operating conditions within the limitations of what is considered acceptable by rebuilding or repairing major components that are close to failure - even if there are no reported failures in the components. The main difference from remanufacturing is that refurbishment is usually less rigorous and costly and involves less dis/re-assembly.



Design

Design of products is considered the first circular strategy and therefore priority as well as it influences the rest of the life cycle of products and materials.
Circular design/eco-design involves the application of guidelines that involves a variety of guide of how to e.g. design for/with: disassembly, timelessness, emotional attachment, easy recognisition of materials, non-toxic and renewable/recycable materials, digital elements, as few incampatible and dissimilar materials as possible and more.

Remanufacture

Remanufacturing involves collecting and returning used products, disassembling, sorting, cleaning, inspecting, repairing and reconditioning, assembly, testing and finally combining and upgrading them with new parts to make products that both look and perform as new and can be sold as new.
Designing for remanufacturing involves considering design for disassembly aspects such as speed of disassembly, cost, etc. during the product development stages.

Recover

Energy recovery happens by incinerating materials since the material characteristics no longer satisfy any application whatsoever.

The recovery must happen only after materials have been recycled more than once.

The main problem when recovering materials is toxic smoke emitted by certain materials and additives that was added to the product.

Repurpose

Repurposing is about identifying new use phases for products (discarded/not in use) or their parts and use them in new/different contexts.

Repurposing requires to think outside the box and possibly outside your industry.
When working with repurposing aspects consider e.g.: use of durable and robust components and materials, easy and non-distructive disassembly and provision of manuals and relevant documentation.

Cascade

When cascading, new applications of processed materials usually have a lower demand for resource quality. It is important to consider the cascading process early in the design process.
A material starts its lifetime at the highest quality possible, and the quality of the material naturally declines over time. Every step of the cascade has a certain lifetime. The resource should be used in a new application before the quality is too low.

Recycle

Recycle concerns recovery of waste material where it is being reprocessed into (new) products, materials or substances - either for their original or another purpose.
Recycling destroys the energy and value that were placed into the product originally and adds additional energy and resources for the recycling process required.
Finally, even more additional energy and resources are required to transform the recycled materials back into a new product.

Disassembly

Design for disassembly makes it easier for products to prolong its useful life. It can also help ensure that products are being recycled and enables entire components to be reused. In fact, the degree to which your product can be disassembled often determines how the product will end its life. You can consider: as few parts and use of tools as possible, integrated instructions and minimal time for disassembly, easy inspection and identification of materials, direct reuse of parts etc.

Collection & Sorting

Consideration about collection and sorting of products after the use stage(s).
These aspects are (and will be) inevitably influced by laws and regulations on a domestic, european and international level.

Societies are moving in a direction towards increased demands within collection and sorting of different materials e.g. textiles, plastic, metals etc.

Resell

Strategies for reselling can e.g. involve collaborations with partners about enabling reverse logistics aiming to achieve e.g. take-back systems or establishing sharing economies, which are examples of business models that operate within the resell strategy.

Reselling can be placed earlier in the strategies wheel and be a part of several steps in a circular business model.

Upcycle

Upcycling is about reusing or redesigning products, which often involves working in a creative manner in order to identify the second use scenarios or functions that the products/materials will become a part of in its new use phase.

Upcycling is about transforming bi-products, waste materials and/or unwanted products into new materials, components or products of same or even higher quality or value.

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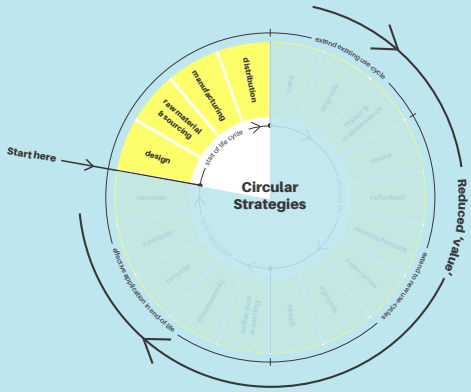
Design

Design of products is considered the first circular strategy and therefore priority as it influences the rest of the life cycle stages of products and materials.

Circular design/eco-design involves the application of guidelines that involves a variety of guides of how to e.g. design for/with: dis- and reassembly, timelessness, standarization, ease of maintenance and repair, upgradability, emotional attachment, easy recognisition of materials, non-toxic and renewable/recycable materials, digital elements, as few incampatible and dissimilar materials as possible etc.

You can learn more about circular design by looking at e.g. the Circularity Deck Cards, the Circular Design Guide by the EMF or CIRCit Nord's product Guidelines.



How have you considered the design phase in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

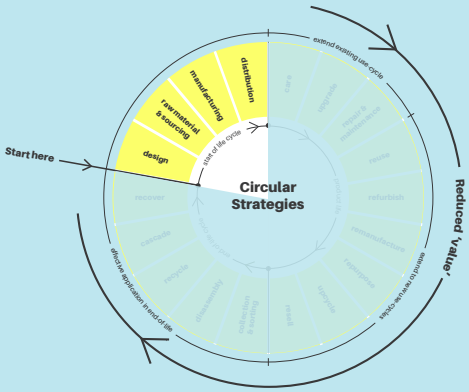
Raw Materials & Sourcing

Raw materials and sourcing covers the selection of resources and materials that go into the products that will become a part of your product system.

When choosing materials you can consider e.g. durability, renewablity, recyclability and secondary recyclability.

You can also consider aspects such as where the materials originate from and how the working conditions are for the people dealing with the materials (i.e. focus on social sustainability).

You can learn more about materiality by e.g. having a look at the Material Pathways cards.



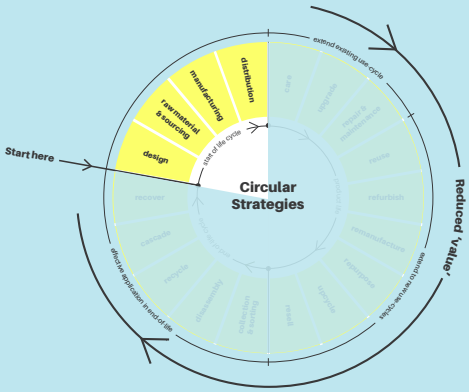
How have you considered raw materials and sourcing in your work/ project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Manufacturing

Manufacturing concerns improvement of circularity, efficiency and effectiveness in the manufacturing phase of products. You can e.g. consider the following: favor cleaner production, efficiency, processes, eliminate equipment toxicity and other environmental aspects of handling waste orginating from production of materials and products.

Finally, if you are operating on a bigger scale, you can also consider social sustainbility aspects (e.g. working conditions), design for reduced energy consumption and prioritising renewable energy.

You can read more about circular principles for manufacturing on the Circular City Funding Guide here.

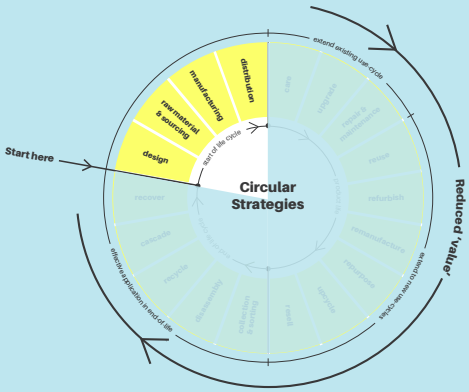


How have you considered manufacturing in your work/project?
You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Distribution

Considerations about distribution are e.g.; design for effective loading and transport, which concerns transport of larger quantities at a time and stackable products. It also concerns return logistics, reduction of emissions linked to transport, choosing local suppliers, minimisation of the weight of components and selection of strong, robust and durable packaging with long lifespan that do not degrade during multiple transportation.

You can read more about distribution in the Sustainability Guide.



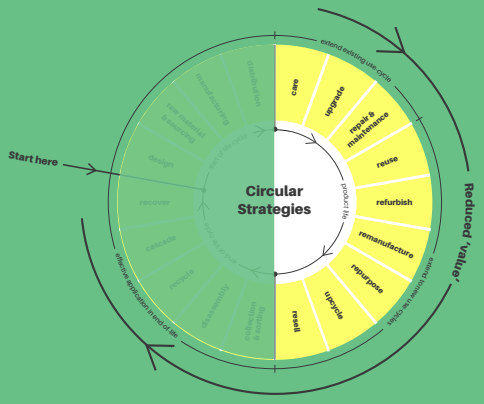
How have you considered distribution in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Care

Caring is about how to extend the lifetime of products as much as possible by (continuously) taking care of them during their use phase.

This is done by e.g. considering effective use along with procedures for caring to facilitate the extension of the lifetime of products.

Examples of this could be facilitation of emotional/personal attachment to products, educational videos, provision of care kits, guides, manuals etc.



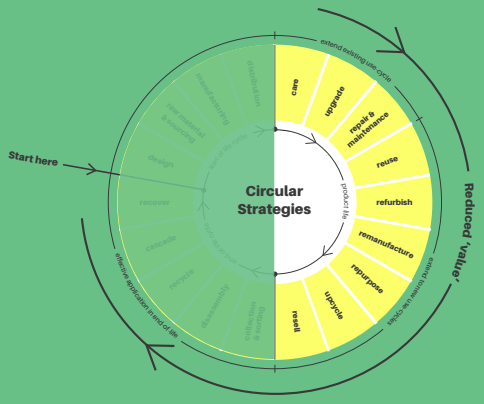
How have you considered care in your work/project?
You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Upgrade

When upgrading, the product is still functional, but new changes, evolution and/or new features are added to extend the lifetime of products.

Upgrades can extend the product value by enhancing the function of an existing product to even beyond its original design condition. Potentially, upgrading can also reduce value loss from continued use of parts and products.
Rebound effects are important to take into consideration when considering whether it pays off to upgrade or not.

You can read more about a suggestion for a process for how to design for upgrade here.

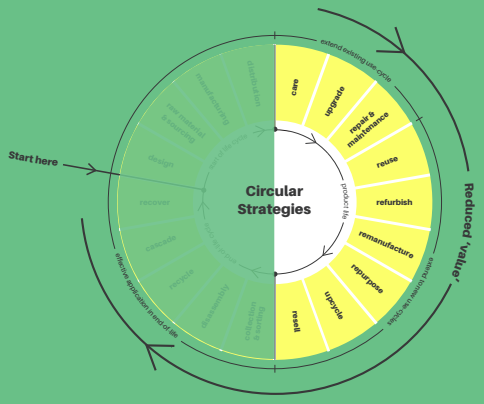


How have you considered upgrade in your work/project?
You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Repair & Maintenance

Repair and maintenance involve thinking about how to correct, replace and/or fix broken/damaged components of a defective product aiming to maintain the original functionality to the same user and thereby extend the life time of products and reduce the need for new resources, avoiding waste and leading to fewer emissions. Repairing and maintaining can happen with different frequences and also be part of a product/service-system.

You can learn more about repair by having a look at the repairable by design guidelines or going to page 24 in CIRCit Nord's guidelines.



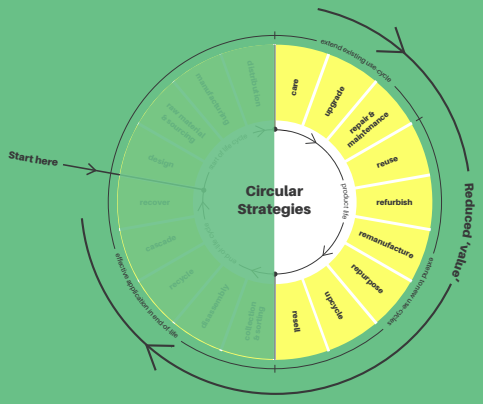
How have you considered repair and maintenance in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Reuse

(Direct) reuse of (discarded) products involves that the products are still in good condition and fulfill original functions that aim to keep the product attractive to as many different users as possible for as long as possible and prevent that they turn into waste.

Reuse may involve minimum cleaning and repackaging. The reused product should still be functional, efficient, and attractive. People might reuse preowned products due to lower prices, patina or if they are better than new ones.

You can learn about design for reuse going to page 28 in CIRCit Nord's guidelines.

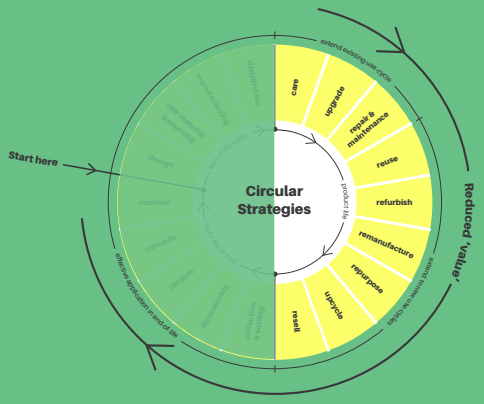


How have you considered reuse in your work/project?
You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Refurbish

Refurbishing is about repairing a returned product after a certain period of use so that it satifies certain mechanical specifications and operating conditions within the limitations of what is considered acceptable by rebuilding or repairing major components that are close to failure - even if there are no reported failures in the components. The main difference from remanufacturing is that refurbishment is usually less rigorous and costly and involves less dis/re-assembly.

You can learn about design for reuse going to page 32 in CIRCit Nord's guidelines.



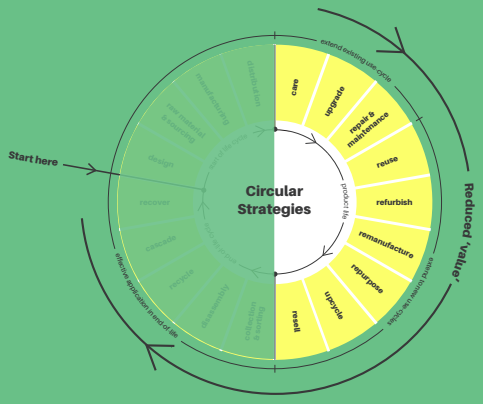
How have you considered refurbishment in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Remanufacture

Remanufacturing involves collecting and returning used products, disassembling, sorting, cleaning, inspecting, repairing and reconditioning, assembly, testing and finally combining and upgrading them with new parts to make products that both look and perform as new and can be sold as new.

Designing for remanufacturing involves considering design for disassembly aspects such as speed of disassembly, cost, etc. during the product development stages.

You can learn about design for remanufacturing by going to page 36 in CIRCit Nord's guidelines.



How have you considered remanufacturing in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

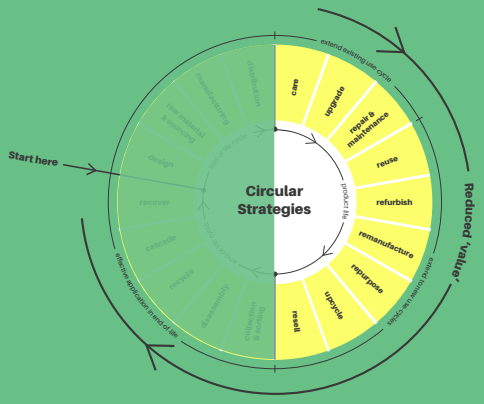
Repurpose

Repurposing is about identifying new use phases for products (discarded/not in use) or their parts and use them in new/different contexts.

Repurposing requires to think outside the box and possibly outside your own industry.

When working with repurposing aspects consider e.g.: use of durable and robust components and materials, easy and non-distructive disassembly and provision of manuals and relevant documentation.

You can dive deeper into the repurpose strategy in the guidelines in Design for Repurpose.

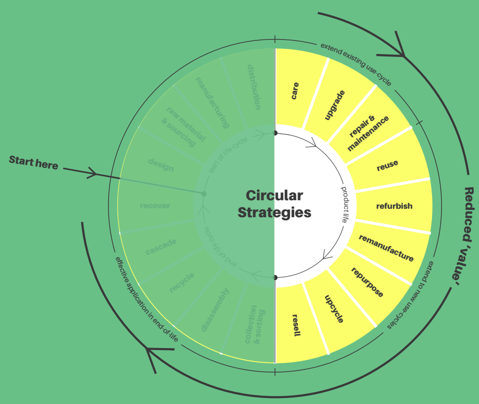


How have you considered repurposing in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Upcycle

Upcycling is about reusing or redesigning products, which often involves working in a creative manner in order to identify the second use scenarios or functions that the products/materials will become a part of in its new use phase.

Upcycling is about transforming bi-products, waste materials and/or unwanted products into new materials, components or products of same or even higher quality or value.

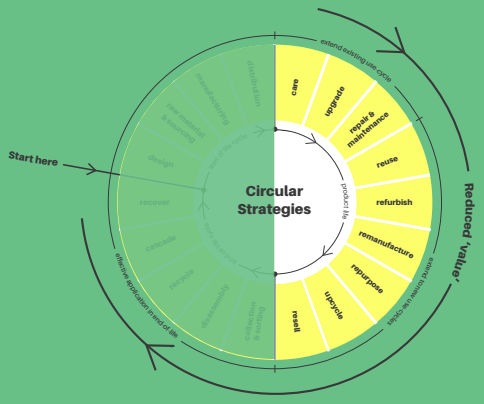


How have you considered upcycling in your work/project?
You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Resell

Strategies for reselling can e.g. involve collaborations with partners about enabling reverse logistics aiming to achieve e.g. take-back systems or establishing sharing economies, which are examples of business models that operate within the resell strategy.

Reselling can be placed earlier in the strategies wheel and be a part of several steps in a circular business model.



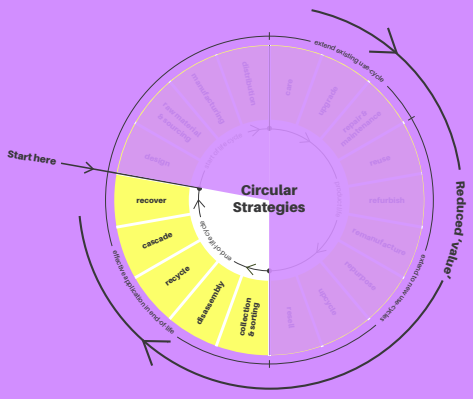
How have you considered reselling in your work/project?
You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Collection & Sorting

Consideration about collection (and sorting) of products and materials after the use stage(s).

Aspects around collection and sorting are (and will be) inevitably influced by laws and regulations on a domestic, European and international level.

Societies are moving in a direction towards increased demands within collection and sorting of different materials e.g. textiles, plastic, metals etc.



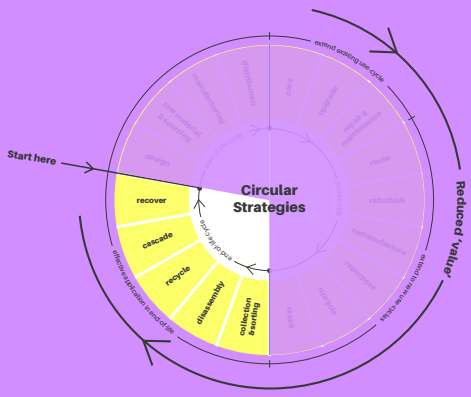
How have you considered collection and sorting in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Disassembly

Design for disassembly makes it easier for products to prolong its useful life. It can also help ensure that products are being recycled and enables entire components to be reused. In fact, the degree to which your product can be disassembled often determines how the product will end its life.

You can consider: as few parts and use of tools as possible, integrated instructions and minimal time for disassembly, easy inspection and identification of materials, direct reuse of parts etc.

Disassembly is closely related to many of the other strategies like repair and maintenance, refurbishment, and remanufacturing. The strategy, collection, is crucial if a take-back system is desired to be established and subsequently being able to sort the materials aiming for as clean fractions as possible.



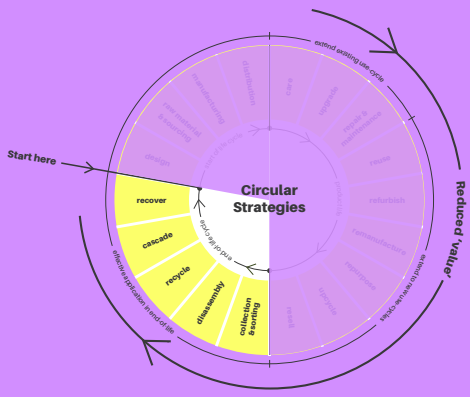
How have you considered disassembly in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Recycle

Recycling concerns recovery of waste material where it is being reprocessed into (new) products, materials or substances - either for their original or another purpose.
Recycling destroys the energy and value that were placed into the product originally and adds additional energy and resources for the recycling process required.

Finally, even more additional energy and resources are required to transform the recycled materials back into a new product.

Read more about recycling by going to page 41 in CIRCit Nord's Guidelines.



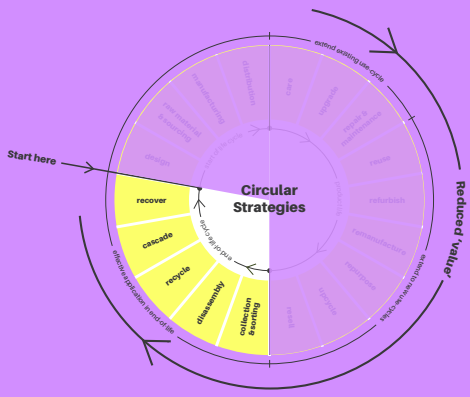
How have you considered recycling in your work/project?
You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Cascade

When cascading, new applications of processed materials usually have a lower demand for resource quality. It is important to consider the cascading process early in the design process.

A (natural) material starts its lifetime at the highest quality possible, and the quality of the material naturally declines over time. Every step of the cascade has a certain lifetime. The resource should be used in a new application before the quality is too low - a good example of a material where cascading should be considered is wood.

Read more about cascading on page 44 in CIRCit Nord's guidelines.



How have you considered cascading in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

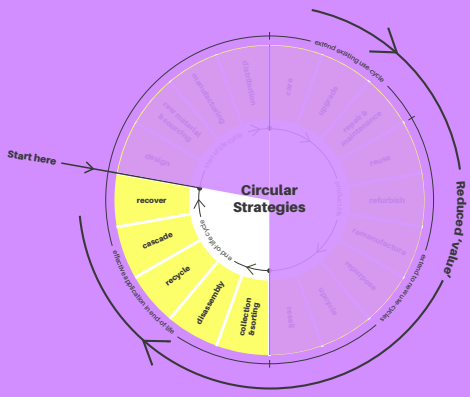
Recover

Energy recovery happens by incinerating materials when the material characteristics no longer satisfy any application whatsoever.

The recovery must happen only after materials have been recycled more than once.

The main problem when recovering materials is toxic smoke emitted by certain materials and additives that was added to the product.

Read more about the recover strategy on page 47 in CIRCit Nord's guidelines.



How have you considered recovering in your work/project? You can note what you've already implemented, potentials, what to explore further as well as obstacles.

Notes

If you have additional notes / thoughts, feel free to write them here.

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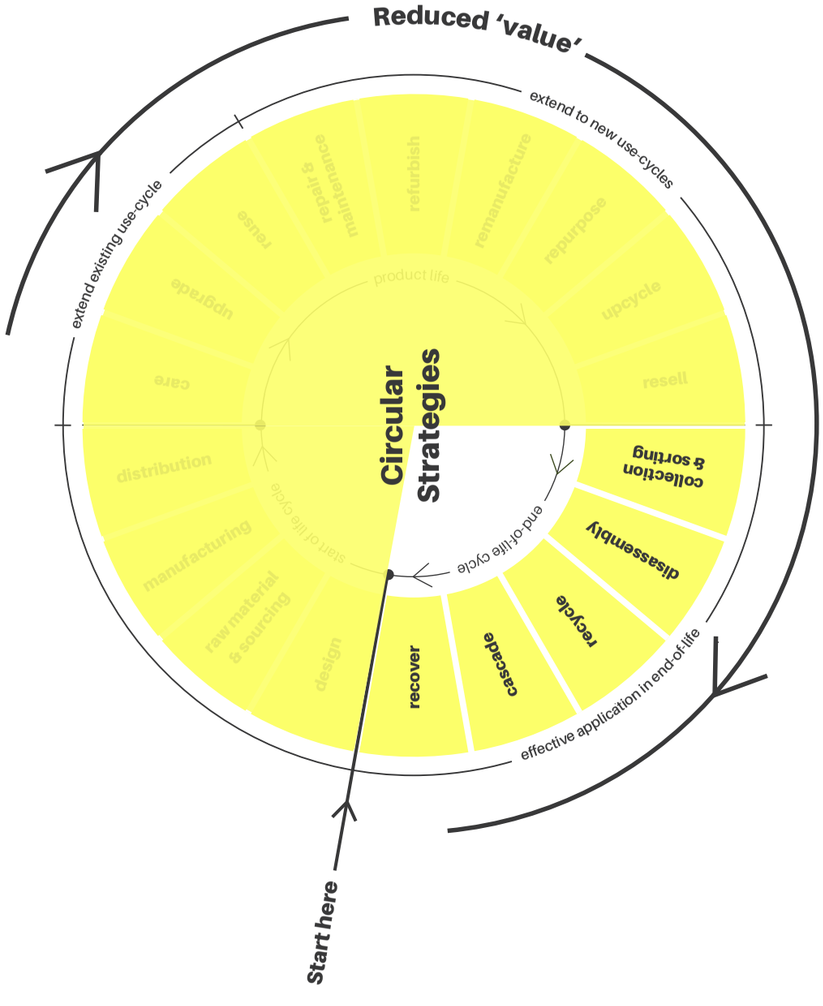
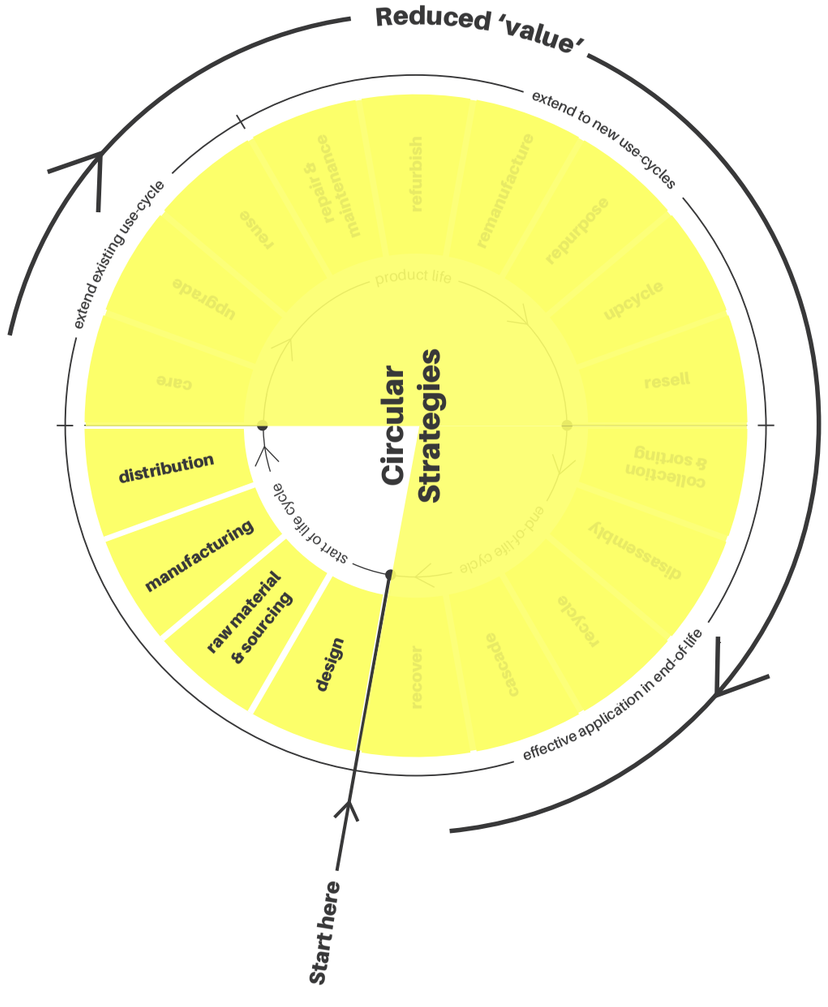
Photo by Nicola König on Unsplash

Distributed Design

Co-funded by the European Union

DDC


Reduced 'value'
extend to new use-cycles
extend existing use-cycle
effective application in end-of-life
product life
end-of-life cycle
start of life cycle
Circular Strategies
resell
upcycle
repurpose
remanufacture
refurbish
repair & maintenance
reuse
upgrade
care
collection & sorting
disassembly
recycle
cascade
recover
design
raw material & sourcing
manufacturing
distribution
Start here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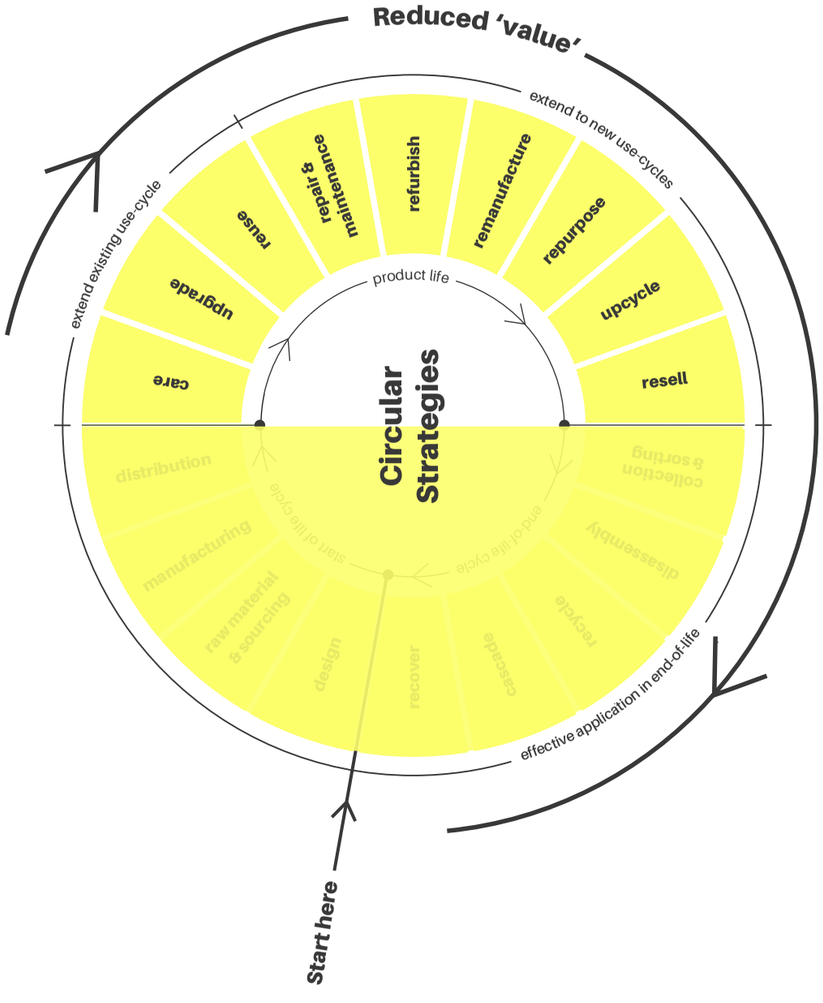
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