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**Creating Circular Value  
Chains Between design,  
Manufacturing and Logistics**





# Circularity is rising up the corporate agenda

**Value chains are straightforward, right?** It is just a question of getting products from the source to the customers/consumer. However, that process is nowadays filled with pitfalls. Today, you need to think about climate change, material scarcity, political volatility, changes to legislation and regulations such as the upcoming CSRD and Circular Economy Action Plan (CEAP), the growing sophistication of products and consumer expectations and so on.



These factors are driving the need demand for a **circular economy** for products and value chains, and greater focus on recycling and reuse.

As a result, large enterprises are under growing pressure to demonstrate they have responsible supply chains.

**Best-in-class companies** now incorporate circularity into the strategic, tactical and operational levels of the organization. They leverage the ecosystem to maximize impact. The pay back: improved brand equity, less need for virgin materials and a better valorization of waste and by-products. The net result is a significant competitive advantage, differentiation in the market and towards your customer.

Having explained **“what”** is driving change, the next sections will address **“how”** you can change your enterprise

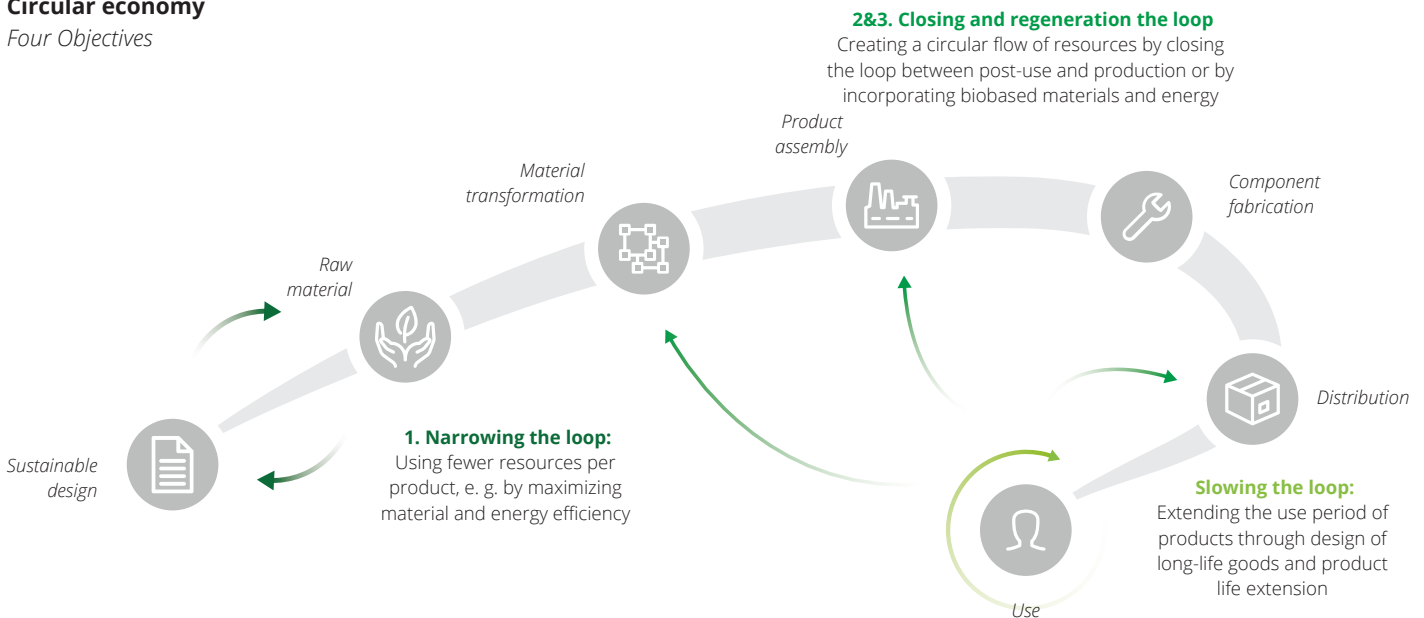


# Realizing your circular value chain

As a first step to realize your circular value chain you need to think about what circular objective would bring most value to your value chain, and what your role would be in this future circular ecosystem. There are three main circular objectives to consider as presented in the diagram.

## Circular economy

Four Objectives



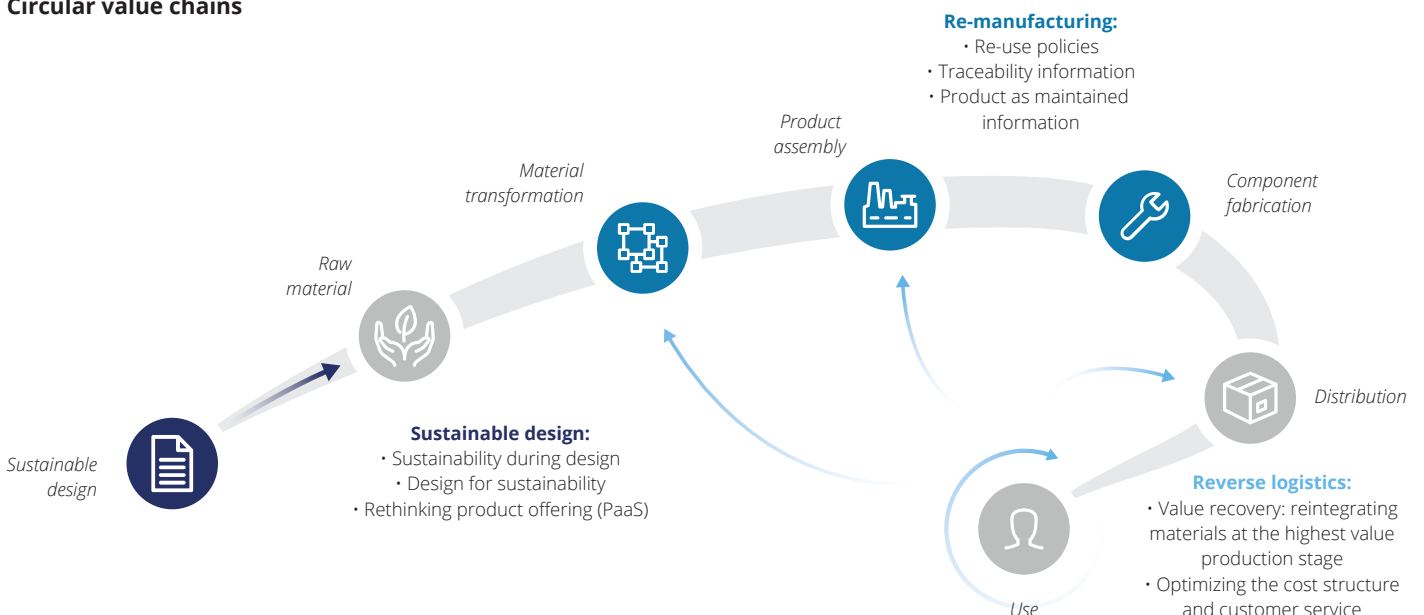
Source: Ellen McArthur Foundation; Bocken, et. al. (2018). Slowing resource loops in the Circular Economy: an experimentation in fashion retail.

You could adopt a new business model, such as product-as-a-service (PaaS), introduce sharing economy concepts or customer-to-customer re-sales. These are examples of a changed (circular) value chain model, combined with repositioning of a company's role within that ecosystem.

Once you have identified your circular strategy and business model, you need to build the right capabilities to make a holistic shift to circularity. Creating a circular value chain requires transparency across the lifecycle of a product. This transparency will yield value chain intelligence.

Value chain intelligence also depends on the physical and technological infrastructure. It comes down to closing the loop between (sustainable) design, manufacturing and logistics, as depicted in the diagram. This concept is explained further below.

## Circular value chains



# Sustainable design

Did you know that the design of a product determines 80% of its lifecycle costs?<sup>1</sup>  
 The way a product is designed directly impacts its production costs, how it is used and its reusability.

In recent years, design has become increasingly data-driven – using data and software tools to enhance and reimagine products. To achieve circularity however, both the product and process design also need to facilitate sustainable sourcing, manufacturing and logistics (in both directions), as well as effectively reintegrating products into the production process.

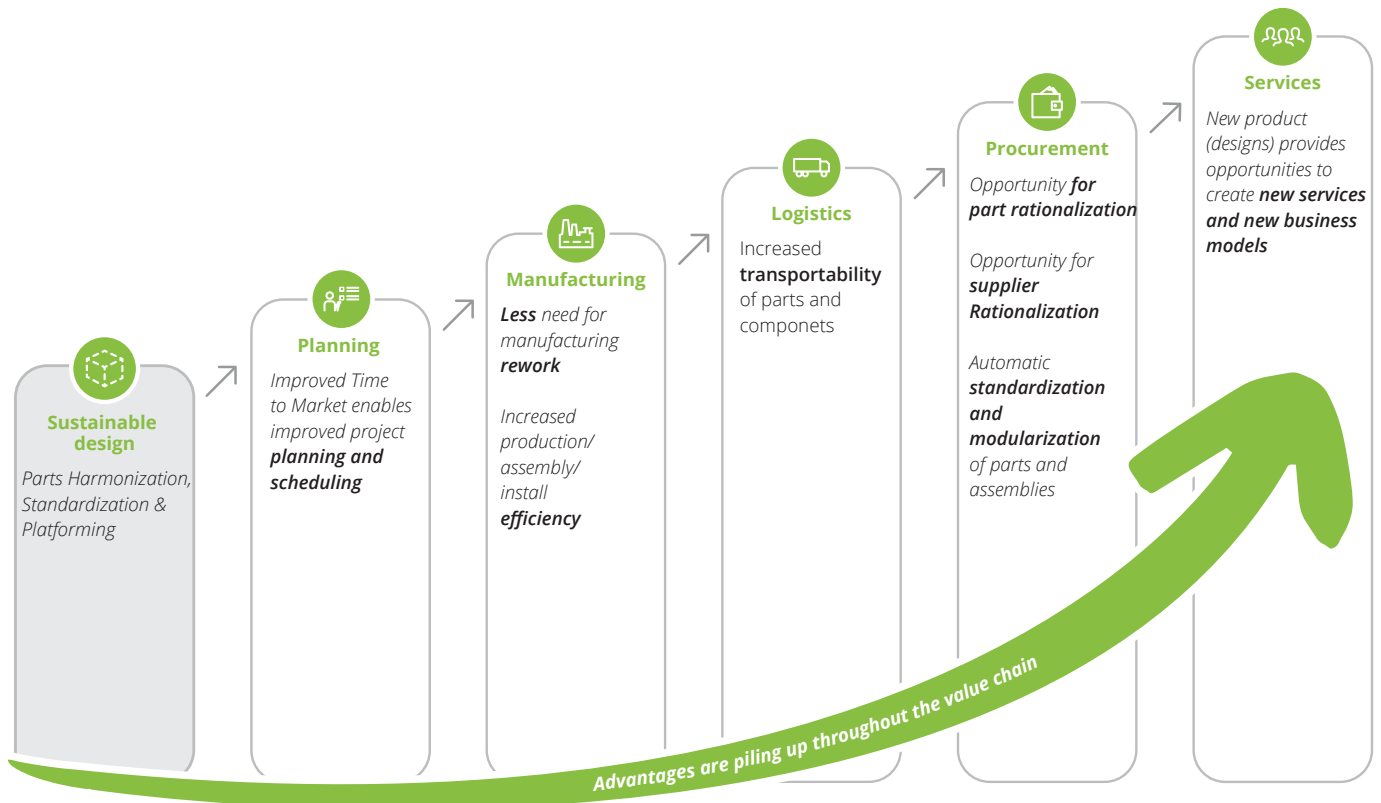


## It comes down to four considerations:

- **Product life extension:** Enabling (easy) repairs and upgrades to slow the depletion of virgin materials.
- **Smart material usage:** Reduce the need for physical samples, cut material waste and validate product performance (through additive manufacturing and topology optimization, etc.)
- **Commonality:** Module harmonization and standardization across the portfolio enables rapid product development, replacements and lowers resource waste.
- **Embedding intelligence:** The use of IoT and digital twin technologies to predict cost drivers, such as energy consumption and future maintenance.

**Best-in-class companies** continuously use technology and data to drive decisions that foster circularity throughout the entire product lifecycle. For example, a data-driven validation of potential benefits prompted a Chemicals company to introduce a new ingredient to reduce livestock methane emissions. To what extent is your product design driven by embedded intelligence? And are you maximizing the product lifecycle at minimal cost, waste and manufacturing complexity?

## Advantages of sustainable design throughout the value chain



# (Re-)manufacturing

*A series of data-driven events is commonly referred to as the digital thread: a single, seamless strand of data that stretches from the initial design concept to the finished part, constituting the information that enables the design, modeling, production, use, and monitoring of an individual manufactured part.*



The best way to enable remanufacturing is to create a **digital thread** and digital twin of all your products. These tools will enable your organization to extend product life, better understand the quality of reusable components and trace critical products and components. Further, building the re-manufacturing capabilities, to ensure the right new and re-used parts and recycled materials fit together, can generate crucial intelligence for the efficient handling of future take-backs and for future design improvements.

**Best-in-class companies** understand and manufacture product revisions in real-time. For example, one High Tech company developed product and process structures to support the full end-to-end manufacturing, installation and services cycle, thereby achieving greater solution standardization and faster manufacturing throughput. How are you maintaining your product information? Can you take back (parts of) your manufactured



# Reverse logistics

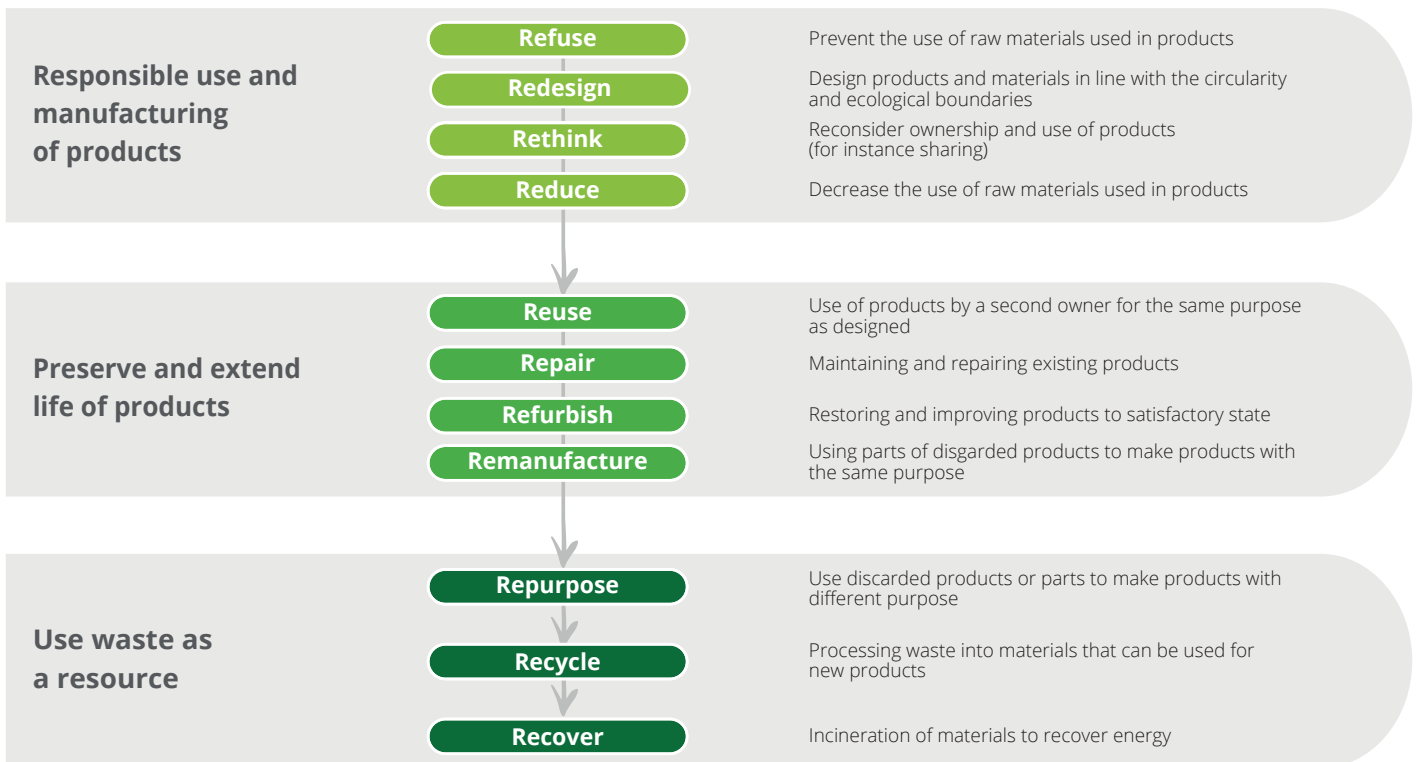
"e.g. IT, ERP, control frameworks, the financial flow of ownership, tax, customs, regulations"



The final crucial consideration is reverse logistics. **Existing forward infrastructure** often does not facilitate the reverse logistics operations. Moreover, integration of different (reverse) data, systems and physical flows in the ecosystem is complex. Outsourcing to external service providers can alleviate this complexity and allows for economies of scale. Insourcing, however, can drive a competitive advantage in the long term, due to the unique end customer interaction and through maintaining ownership over increasingly scarce and virgin materials.

To determine the right solution for your reverse logistics, it is important to evaluate which take-back strategy and model fits your earlier defined circular objective. You need to align your logistics network with your circularity and reverse logistics strategy. This will allow for optimal take-back and feedback of products and parts into the forward manufacturing cycle. Product value, volume and the cost of value recovery will determine the economic viability of the take-back model(s). Essentially, three circular strategies exist as shown in the diagram:

## Circular strategies (R-ladder)



Source: Potting, J. and Hanemaaijer, A., 2018. Circular economy: what we want to know and can measure.

**Best-in-class companies** persuade high levels of item value retention, for example a Swiss manufacturing company set up a centralized inspection early in the reverse chain. The company could then gauge at which production stage the product could successfully be reintegrated into the value chain to maximize product value retention. How well are your re-use strategies set-up for products/modules? Are you able to track modules during the reverse cycle?

# Where to start? **Close the loop!**

Circularity is a key differentiator in the short term, but a qualifier in the mid-to-long term. Next to developing the capabilities discussed in this paper, you need to break down all the silos within your company, to foster end-to-end collaboration among value chain stakeholders.

This can be achieved by embedding circularity into every layer of the company: set a compelling collaborative vision/strategy, define an aligned operating model, introduce the right cross-organization governance and KPI model, develop seamless processes, and establish an appropriate physical and digital infrastructure.

**The best starting point is to evaluate your company's business and supply chain strategy to ensure the circularity of your products is part of your winning aspiration. After that, key questions you should address are:**

- What circular strategy and business model are you going to adopt?
- How should you structure the organization and governance to enable collaboration between design, manufacturing and (reversed) logistics for the company, customers/consumers and suppliers?
- Do your systems support closed loop data flows and what information are you missing?
- Do you have a full end-to-end (upstream and downstream) value chain understanding of your entire product portfolio?

Assessing your baseline and market positioning helps to answer these questions.

**Contact us** to participate in Deloitte's upcoming **value chain benchmark** study and begin to **discover your winning formula** for **circular and value chain-driven market differentiation**.





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