Cycle products and materials with the help of R-strategies

Strategies exist that reduce the consumption of natural resources and support the recycling of materials, thereby reducing the generation of waste (cf. Potting et al. 2017, p. 4). Such strategies are often referred to as R-strategies, which are seen as the core framework of the transformation towards circular value creation. In the following, the 9-R framework of Kirchherr et al. (2017, p. 224) based on Potting et al. (2017, p. 5) will be presented and an example of each strategy will be illustrated using the bicycle as a product.

Refuse

R0

The product benefit can also be fulfilled in another way, so the product is not necessary for customers and they may choose not to use it. *For example, a bicycle does not necessarily have to be used for short distances; the route can also be covered on foot.*

Rethink

The intensity of a product's use is increased by different customers using the product without purchasing it. *An example of this that is becoming increasingly popular is bicycle sharing in many large cities.*

R1

Reduse

R2

Increasing efficiency can also lead to less material being used to generate the same benefits. Here, on the one hand, it is possible to reduce the material requirements of the end product through design measures or to optimize the requirements of the manufacturing processes through process optimization. *Depending on the painting process, for example, it is possible to save paint powder and energy.*

R3 to R7

Strategies R3 to R7 aim to keep within the economic system the raw materials that are already in it in the form of products. Through the reuse or further use of products or product parts, the benefit can be provided without further raw material withdrawals.

Reuse

R3

In the process of applying the reuse strategy, a product is sold unchanged to third parties and reused by them. *In the context of private bicycle sales, flea markets are a long-established example. The eBay platform serves as a digital variant of flea markets.*

Repair

The repair strategy can be used when a product is defective and it is no longer possible to perform its function. The repair returns the product to its original state so that the function can be exercised again and thus a benefit fulfillment is possible. *Public bicycle repair shops offer the possibility of guided bicycle repair, such as patching the bicycle tire.*

R4

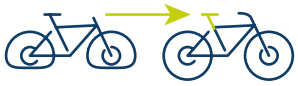
Refurbish

R5

Refurbishment describes the improvement of products. These are not only repaired, but also updated to the current state of the art. *To improve the light quality of the bicycle lamp, an LED lamp can be used.*

Remanufacture

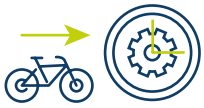
In contrast to the above strategy, remanufacturing involves integrating product components that are still perfectly intact into new products. *For example, it is quite common for cyclists to continue using their old saddle for a new bicycle.*



R6

Repurpose

R7



The Repurpose strategy describes the possibility of incorporating product components into a completely different product in order to generate a different benefit.

R0 to R7

In case R0 to R7 cannot be applied, it is possible to use the strategies R8 and R9 to secure the raw materials of a product or product parts that can no longer be used. By extracting secondary raw materials, the demand for primary raw materials can be reduced. In other words, fewer raw materials have to be removed from the environment.

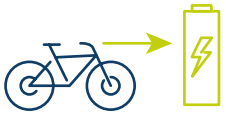
Recycle

R8

If products or components cannot be used any further, it is possible to recover the raw materials used through recycling processes. In some cases, recycling is not possible in the sense that the recyclates can re-enter the cycle in such a way that they can replace the original raw material used for the product in question. If the materials can no longer be recycled to the same high quality, this is referred to as „downcycling." *By recycling the bicycle inner tube, it is possible to recover butyl rubber for the production of new bicycle inner tubes. While a bicycle frame made of aluminum can be recycled in such a way that the aluminum can be used again for the production of a new bicycle frame, only „downcycling" is possible for fiber-reinforced materials (for the end-of-life treatment of fiber-reinforced plastics, see e.g. Oliveux et al. 2015).*

Recover

The Recover strategy does not belong to the strategies of circular value creation in the narrower sense, as it does not lead to materials being recycled and thus occupies the last position in the prioritization list. In today's practice, it is often still applied in cases where recycling of raw materials is not (yet) economically or technically feasible. In such cases, useful energy is to be generated from the waste. Through adequate governmental framework conditions, product design and improved recycling technology, this non-circular strategy use can be largely avoided. *In waste incineration plants, for example, bicycle parts made of plastic are burned, thus generating energy from this waste.*



R9

In the context of the „Circular Economy" strategy of the European Commission (cf. European Commision (ed.) 2020) as well as in Cradle to Cradle® approaches (cf. e.g. Braungart and Mcdonough 2016), complementary strategies are considered necessary to make the value chain not only circular but also lowrisk, i.e. largely emission- and pollutant-free. These include the use of renewable energies and renewable raw materials (cf. Ellen MacArthur Foundation 2013, p. 7), which could be referred to as the R strategy „Renewable," as well as the use of materials that are harmless to health throughout the value chain and the production of pollutant-free products (cf. ibid), which could be referred to as the R strategy „Respect" (respect for people and the environment).

Own representation L2C
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