

## R-strategies as guidelines for the Circular Economy

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The Circular Economy is a vision promoted by the European Union to implement sustainability across the board in the economic system (cf. European Commission (ed.) 2020). The current economic system is not or only insufficiently sustainable, as it is characterized, among other aspects, by the fact that value is created through the processing of raw materials and the raw materials ultimately leave the economic system in the form of waste (cf. Ayres 1994). The goal of the Circular Economy is to reduce the consumption of natural resources and improve the recycling of materials, which in turn results in less waste (cf. Potting et al. 2017, p. 4). The central element of the implementation of the CE is the change of the companies' business models, which they adapt through so-called R-strategies.

The R-strategies get their name from the prefix of the English-language designations of the individual strategies. The prefix "re" originally comes from Latin (meaning "again" or "back") and stands for "new" or "again".

In science, there is currently no agreement on the exact definition and number of R-strategies. In the following, the very

granular 9-R framework by Kirchherr et al. (2017, p. 224) based on Potting et al. (2017, p. 5) is presented and discussed. For a better understanding, each R-strategy is illustrated with an application example of the everyday object "bicycle".

### The R-strategies at a glance

The R0 to R2 strategies aim to avoid or reduce the raw material input in production. This is possible by making products redundant, as the functions associated with them are provided elsewhere. In addition, the raw material input is reduced through increased production efficiency or increased intensity of use. This way, the same overall benefit for customers can be provided with fewer raw materials. Strategies R3 to R7 aim to keep raw materials within the economic system.

Through the reuse or further use of products or product parts, their benefits can be provided without further raw material extraction. If R0 to R7 cannot be applied, it is possible to secure the raw materials of products or product parts that are no longer functional through the strategies R8 and R9.

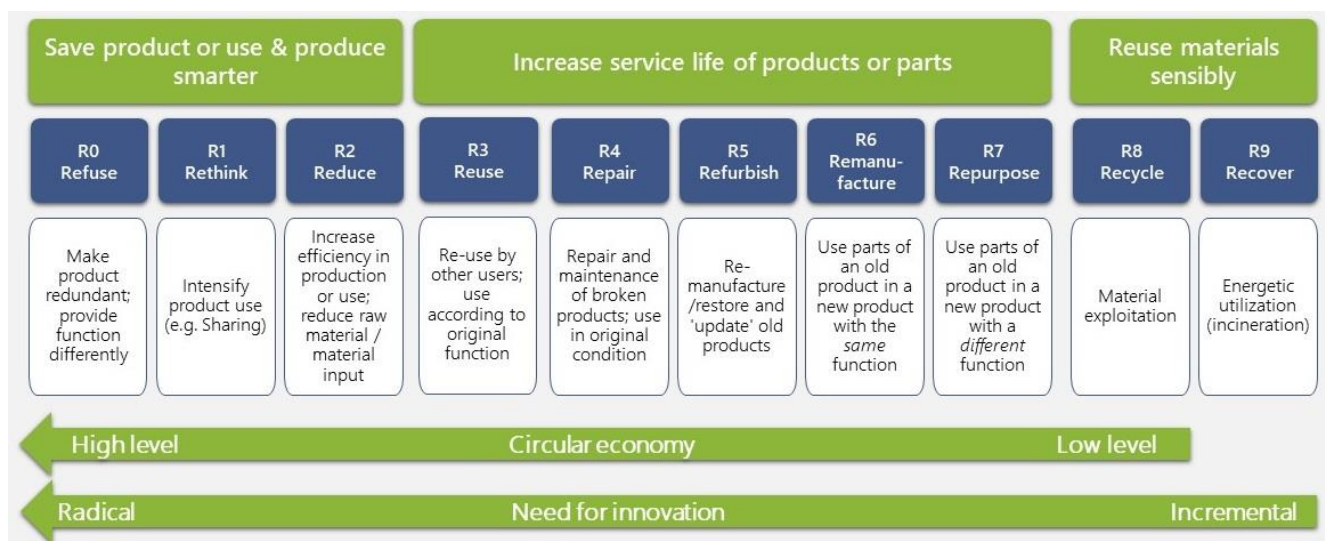


Figure 1: The 9R Framework, Source: own illustration; based on Kirchherr et al. (2017), p. 224, Potting et al. (2017), p. 5.



In this process, the products or components are destroyed. By recovering secondary raw materials, the need for primary raw materials can be reduced. In other words, fewer raw materials have to be newly extracted from the environment.

## R0 Refuse

The product benefit can also be fulfilled in another way, consumers can do without it.

*For example, a bicycle does not necessarily have to be used for short journeys; the distance can also be covered on foot.*

## R1 Rethink

The intensity of use of a product is increased by different customers using the product without purchasing it.

*An example of this that is gaining popularity is bike sharing in many cities.*

## R2 Reduce

Increasing efficiency can also lead to less material being used for the same outcome. On the one hand, it is possible to reduce the material requirements of the end product through design measures or by optimizing the requirements of the manufacturing processes through process optimization.

*For example, depending on the painting process, it is possible to save paint powder and energy.*

## R3 Reuse

In the application of the reuse strategy, an unchanged product is sold 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.*

## R4 Repair

The repair strategy can be used when a product is defective and is no longer able to perform its function. Through repair, the product is returned to its original state so that the function can be performed again and thus a benefit fulfillment is possible.

*Public bicycle repair shops offer the possibility of guided bicycle repair, such as patching the bicycle tube.*

## R5 Refurbish

Refurbishment describes the improvement of products. These are not only repaired, but also brought up to the current state of the art.

*An LED light bulb can be used to improve the light quality of a bicycle lamp.*

## R6 Remanufacture

In contrast to refurbishment, remanufacturing involves integrating product components that are still perfectly intact into new complete products.

*For example, it is quite common for cyclists to continue using their old saddle for a new bicycle.*

## R7 Repurpose

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

*Consumers often serve as a model for this. For example, do-it-yourselfers use bicycle handlebars as wall brackets (see Figure 2).*



Figure 2: Bicycle handlebars as wall brackets, source: glandis.com

## R8 Recycle

If products or components cannot be used any further, it makes sense to recover the raw materials used through recycling processes. The recycling possibilities are already largely determined by the product design. 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 input for the respective product.

If the materials can no longer be recycled in the same quality, this is referred to as downcycling. For maximum recycling of materials, the goal of a high recycled content in products is therefore also more important than the goal of a high recyclability at the end of the service life.

*By recycling the bicycle inner tube, butyl rubber can be recovered for the production of new bicycle inner tubes. While a bicycle frame made of aluminium can be recycled in such a way that the aluminium can be used again for the production of a new bicycle frame, only downcycling is possible for fibre-reinforced materials (for the end-of-life treatment of fibre-reinforced plastics, see e.g. Oliveux et al. 2015).*



## R9 Recover

The recover strategy does not belong to the strategies of circular value creation in the conventional sense, as it does not lead to materials being recycled. Therefore, it occupies the last position in the prioritization list. In today's practice, the recover strategy is often still applied in cases where recycling of raw materials is not (yet) economically or technically possible. 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 burnt, thus generating energy from this waste.*

The R-strategies serve companies as tools for identifying circular potentials. At the same time, according to their order, they represent a classification and list of recommendations for action, according to whose characteristics the most circular business models can and should be created. Nevertheless, it should be noted that the R-strategies do not represent universal approaches to solutions. It is still the task of companies to adapt a strategy suitable for achieving the company's goals, to work out an individual and custom-fit (further) development of the business idea from this approach and thus to create innovative circular business models.

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