Sommario

GLOSSARY

Circular Economy

The **circular economy** is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended.

In practice, it implies reducing waste to a minimum. When a product reaches the end of its life, its materials are kept within the economy wherever possible. These can be productively used again and again, thereby creating further value.

https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits#:~:text=The%20circular%20economy%20is%20a,reducing%20waste%20to%20a%20minimum

Linear economy

A linear economy traditionally follows the "take-make-dispose" step-by-step plan. This means that raw materials are collected, and then transformed into products that are used until they are finally discarded as waste. Value is created in this economic system by producing and selling as many products as possible.
An economic model based on the sequence take (raw material), make (products), use (consume), dispose (of non-recyclable waste), which has demonstrated to be unsustainable for both its resources consumption and its environmental impact.

https://www.igi-global.com/dictionary/operationalization-of-circular economy/75076#:~:text=An%20economy%20based%20on%20'take,they%20are%20accumulated%20as%20waste.

Old Economy and New Economy

Old economy differs from new economy in that it relies on traditional methods of doing business rather than leveraging new cutting-edge technology. This traditional economic system dates back to the Industrial Revolution and revolves around producing goods as opposed to the exchange of information. Common goods are valued by measurable factors such as operating expenses and scarcity of the product.

https://www.investopedia.com/terms/o/oldeconomy.asp#:~:text=Old%20Economy%20vs.-,New%20Economy,to%20the%20exchange%20of%20information.

1) INTRODUCTION

1.1 CIRCULAR ECONOMY DEFINITION

In the past ten years, the traditional model of "buy, consume and dispose" started to gradually be replaced by more sustainable thinking, that imposes slowly the concept of circular economy. The Ellen McArthur Foundation describes the term of circular economy as "as system that is restorative or regenerative by intention and design that can be achieved by eliminating waste through the superior design of materials, products, systems and, within this, business models". The circular economy is thus a restructuring of whole economic and social systems, which imply a redesign of the products and services offered from their conceiving phase.

As shown in Figure 1 below, Weetman summarises the six necessary factors of the circular economy framework, which translate the four principles of this concept, namely:

a. Circular economy design meaning designing products from the beginning of the production to enable product reuse or recycling or cascading in the sense of becoming input for another product at the end of one life cycle;
b. New, innovative business models to facilitate the transition from the buy, consume, dispose principle to the sustainability principles mentioned at point 1;
c. Reverse cycles, meaning providing efficient, innovative systems for new materials and product cascades as well as return of used materials to soil or to production. This implies logistics, collections, sorting, treatment and segmentation;
d. Enablers and accelerators, namely market mechanisms can encourage reuse of materials and higher resource productivity, such as educational institutions, policymakers, financing in the field, etc. A circular economy shifts the focus to reusing, repairing, refurbishing and recycling existing materials and products.

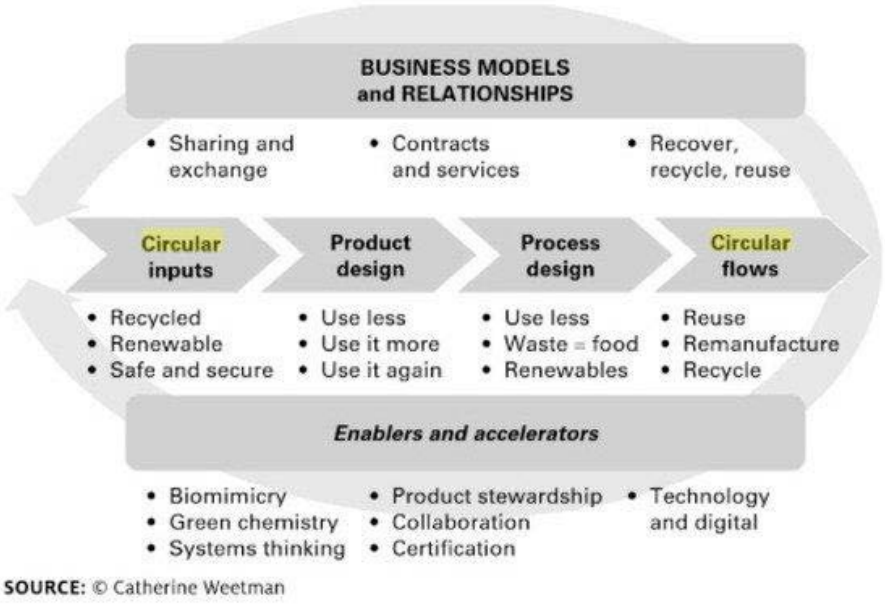


Figure 1. The circular economy framework. Source: Weetmann, 2016.

When referring to circular economic models, mention the following: product design, service and function-based models, reuse, repair and collaborative consumption, in the sense that products should be designed from the beginning with the scope of being reintegrated after the life cycle for reuse or repair in order not to become waste. Other authors have provided several other definitions for the concept of a circular economy, that mentioned a circular economy is "one, where the resources coming into the economy are not allowed to become waste or lose their value". These resources should therefore be recovered and used for as long as possible in production processes. As mentioned by several authors, the term of circular economy is strongly linked to the concept of waste management in the sense of diminishing or eliminating waste after the main cycle of consumption has been fulfilled. Within the meaning of the concept "waste management", Lemann includes the formation, treatment and disposal of waste materials and their resulting products, whether resulting from households or industry. Furthermore, many autors mention the nine elements of the circular economy:

- refuse or preventing the use of raw materials;
- reduce in the sense of reducing the use of raw materials;
- product reuse (second-hand, sharing of products);
- repair or maintenance and repair;
- refurbishing a product;
- remanufacture or creating new products from (parts of) old products;
- repurpose meaning product reuse for a different purpose;
- recycle or processing and reuse of materials;
- recover energy through incineration of residual flows.

Thus, this definition also emphasizes the need to minimize waste by reuse and repair referring ultimately to the concept of circular economy. Waste can have several meanings depending on the fields of activity, that cause it or debate on it. However, there are some main types of main waste, such as: household waste, namely the unwanted materials produced by families, homes or apartment complexes; commercial waste, originating from the business field or retail establishments; e-waste from electronics; hazardous waste, that is toxic, reactive, corrosive, ignitable; industrial waste from different industries, such as construction and mining; agricultural waste; and medical waste Vaughn.

More indicators are used to measure effectiveness of waste management measures in several fields, as the issue of waste diminishing has become a strategic issue. For example, Cifrian et al. mention treatment of municipal solid waste (MSW) (recycling, composting, incineration and landfill), the recycling rates of glass, paper and cardboard and packaging wastes (metals, plastics and wood) and the landfill of bio-waste as indicators for municipal solid waste management effectiveness.

One of the main indicators used to calculate the amount of waste generated per community is the recycling rate of municipal solid waste including residential (single or multi-family), commercial (office buildings, retail companies, restaurants), institutional (schools, hospitals, etc.), industrial (packaging, administrative) and municipal origins. Recycling as a concept includes material recycling, composting and anaerobic digestion and in certain cases incineration with energy recovery according to Williams.

The recycling rate of municipal waste is a main indicator of recycling efficiency, being calculated as a ratio between tonnage recycled from municipal waste divided by total municipal waste arising. In terms of municipal waste, this refers to the main waste generated by households, by small businesses and public institutions, which is collected by the municipality.

Regarding methods of reintegrating or diminishing waste, several processes can be considered such as: repairing, reuse of products or product components in other production processes, transformation of waste

into energy, recycling materials, and redesigning processes from the beginning in order to ensure recyclable products and/or reuse of product, materials or components. Furthermore, several institutions have already begun to offer instead of a one-time buy product, that is later disposed, subscriptions that ensure the maintenance of the products, repair and/or replacement after consumption while the old product is recycled by the company itself. This innovative approach of redesigning the classical economic system of "buy, consume, and dispose" to a sustainable system of continuous use and reintegration represents one of the main strategic issues of the current business sector today. Other authors, such as Lewandowski [11] also emphasise the recycled material used product value after a certain period of use as a key indicator for measuring the decreasing ecological footprint and the obtained direct financial value through recovery of materials and assets.

The relationship of municipal waste in terms of its generation and relationship to economic drivers, such as income and socioeconomic and policy factors, has been analysed through a panel regression by Mazzantti et al. [25] resulting in empirical evidence in this sense. Thus, this indicator in terms of its generation and recycling is one of the main factors used in the field of measuring progress in the field of circular economy.

Other authors inquired about different parts of sustainable development of the economy through variables, such as trade impact on GDP growth and employment level as in the case of Miron et al.

Currently, the internationalisation process finds itself in a dynamic rhythm and adds more pressure towards implementing practically the efforts for a sustainable economic development and restructuring of the business field in order to reduce waste generation. Practices, such as corporate social responsibility measures directed towards environmental friendly actions, as well as clearer legislations, clusters for cooperation of several institutions and partnerships between the academic field and the business environment are considered to be contributing to the efforts in the sense of a sustainable approach for the environment protection in the sense of diminishing waste from the beginning of the production process, as well as after consumption of the product. In order to reduce generation of waste or emissions, new approaches and methods are starting to be implemented in the business field, such as in the case of reducing or treatment of municipal waste or reducing the CO2 emissions from the iron and steel processes.

Although there are several indicators and management methods in the sense of waste diminishment, there is still progress needed in the sense of joint efforts from the side of institutions, populations and business in order to reduce the gaps to increased efficiency of these measures.

1.2 CIRCULAR VS LINEAR ECONOMY

A circular economy is fundamentally different from a linear economy. To put it simply, in a linear economy we mine raw materials that we process into a product that is thrown away after use. In a circular economy, we close the cycles of all these raw materials. Closing these cycles requires much more than just recycling. It changes the way in which value is created and preserved, how production is made more sustainable and which business models are used.

Linear Economy

The circular system and the linear system differ from each other in the way in which value is created or maintained. A linear economy traditionally follows the "take-make-dispose" step-by-step plan. This means that raw materials are collected, then transformed into products that are used until they are finally discarded as waste. Value is created in this economic system by producing and selling as many products as possible.

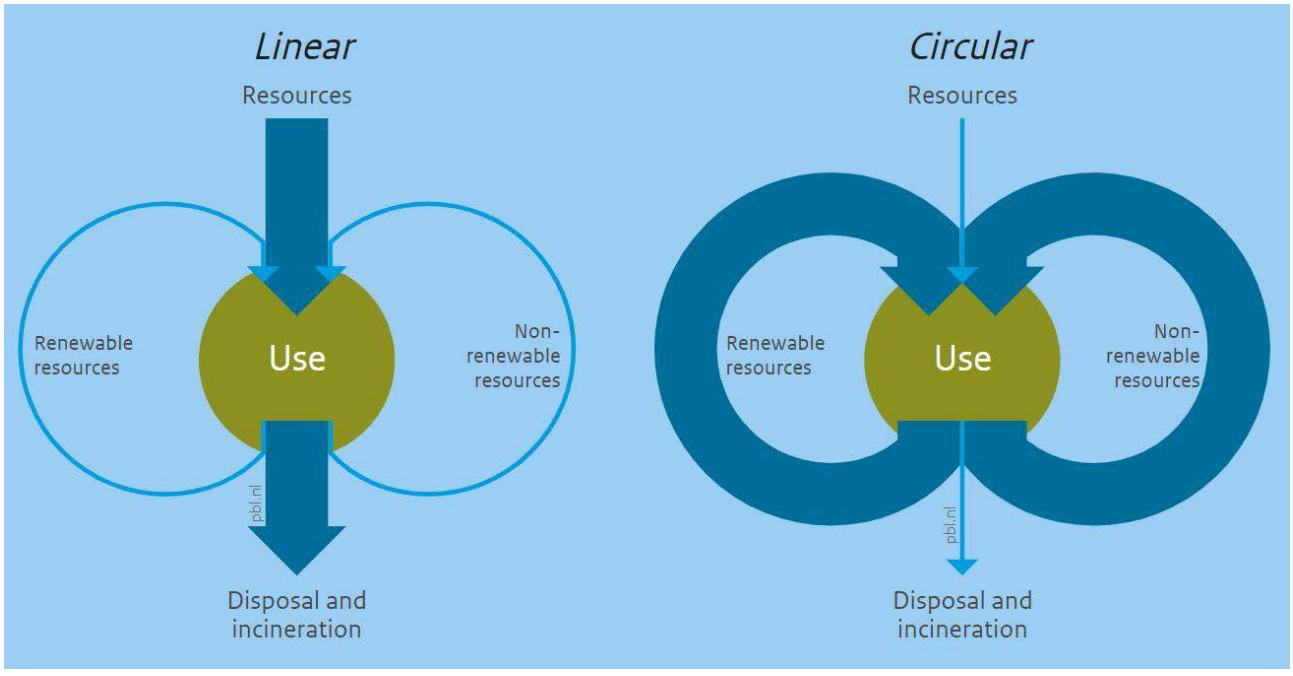
Circular economy

A circular economy follows the 3R approach: reduce, reuse and recycle. Resource use is minimised (reduce). Reuse of products and parts is maximized (reuse). And last but not least, raw materials are reused (recycled) to a high standard. This can be done by using goods with more people, such as shared cars. Products can also

be converted into services, such as Spotify sells listening licences instead of CDs. In this system, value is created by focusing on value preservation.

The difference between a linear and a circular economy

	Linear	**Circular**
Step plan	Take-make-dispose	Reduce-reuse-recycle
Focus	Eco-Efficiency	Eco-Effectivity
System boundaries	Short term, from purchase to sales	Long term, multiple life cycles
Reuse	Downcycling,	Upcycling, cascading and high-grade recycling.
Business model	Focuses on products	Focuses on services



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2) WHY CHOOSE CIRCULAR ECONOMY?

2.1 What are the disadvantages of the current linear economy?

The linear economy results from business practices that assume a constant supply of natural resources. This has resulted in the take-make-dispose mentality. This mentality is based on the extraction of resources, the production of goods and services and the disposal of post-consumer waste. However, this approach is coming under increasing pressure because of its environmental and economic disadvantages.

Ecological disadvantages

The ecological disadvantage of the linear economy is that the production of goods is at the expense of the productivity of our ecosystems. Excessive pressure on these ecosystems jeopardises the provision of essential ecosystem services, such as water, air and soil cleaning.

All three steps of the "take-make-dispose" mentality affect ecosystem services in different ways. The collection of raw materials leads to high energy and water consumption, emissions of toxic substances and disruption of natural capital such as forests and lakes. Product formation is also often accompanied by high energy and water consumption and toxic emissions. Eventually, when these products are discarded, space is taken up from natural areas and toxic substances are often also emitted (PBL, 2018b).

Economic disadvantages

In addition to the damage caused by the linear economy to the provision of ecosystem services, this economic model also jeopardises the supply of materials. This uncertainty is caused by fluctuating raw material prices, scarce materials, geopolitical dependence on different materials and increasing demand. These problems are solved in a circular economy. The risks are explained below.

Fluctuating raw material prices

Since 2006, the level and fluctuation of raw material prices have significantly increased. This not only creates problems for diggers and buyers of raw materials, it also creates greater risks in the market. This, in turn, discourages investments in the extraction and processing of materials, which can ensure that raw material prices continue to rise over time. In addition, these price fluctuations prevent companies from making price forecasts, which gives them a weaker competitive position than companies that are less material-dependent (Circle Economy, 2018a).

Critical materials

Another disadvantage of the current linear economic system is that much is produced with scarce materials. A number of industries make intensive use of critical materials for their production processes, such as indium and chromium. These materials are only available to a very limited extent. In particular, the metal industry, the computer and electronics industry, the electrical equipment industry, and the automotive and vehicle industries make use of these raw materials. In the Netherlands, these sectors make up a significant percentage of the economy (CBS, 2019).

Interdependence

As a result of the increase in trade, the geopolitical interconnectedness of products has become increasingly strong. For example: countries with water scarcity but a surplus of oil trade oil to buy grain. As a result, these raw materials are, as it were, linked to each other. In addition, the production process of many goods depends on water and fuels. As a result of this interdependence, the scarcity of one raw material will have a widespread effect on the prices and availability of many more goods (European Commission, 2020).

Increase in material demand

In addition to the limited supply of raw materials available anyway, a significant increase in demand for materials is also predicted. As a result of population and welfare growth, the number of middle-class consumers (with a higher demand for material consumption) will increase by three billion by 2030. In addition, the lifespan of products has decreased dramatically in recent years. This is one of the driving forces

behind the increasing consumption of materials in the Western world. Product lifespan is still decreasing, because there is a process of positive feedback: consumers want new products faster and therefore use their "old" products shorter. This in turn means that less quality is needed in a product's lifecycle, which in turn leads to consumers wanting new products even faster.

2.2 What are the environmental benefits of the circular economy?

The initial goal of the circular economy is to have a positive impact on the ecological systems, which will not deplete or overload them. This is reflected in the ecological benefits of the circular economy. For example, a circular economy emits less greenhouse gases, the soil, air and water remain vital and nature reserves are preserved.

Less greenhouse gases

By following the principles of the circular economy, greenhouse gas emissions are automatically reduced on a global scale. Climate change and the use of materials are closely linked. According to Circle Economy calculations, 62% of global greenhouse gas emissions (excluding those from land use and forestry) come from the extraction, processing and production of goods to meet society's needs; only 38% are emitted in the supply and use of products and services (Circle Economy, 2019). For example, emissions from industry in the European Union would fall by 56% in 2050 if the circular economy were to become a reality (SITRA, 2018). The reduction in emissions measured on a global scale will be even greater, because the European Union will no longer import primary raw materials from countries outside the Union, which will also reduce greenhouse gas emissions in those countries.

Vital soil, air, and water bodies

The application of circularity in the economy creates vital ecosystems such as soil, air and water bodies. These ecosystems provide services such as cleaning, products such as fertile farmland, pollination and clean drinking water. In a linear economy, these services are ultimately depleted by constant withdrawal of products or overburdened by the dumping of toxins. If these products are used in a cycle and the services are not burdened by toxic substances, the soil, air and water bodies remain resilient and productive (SYKE, 2018).

A good illustration of this is the agricultural system, which is highly dependent on ecosystem services such as water cleaning, nutrient recycling and pollination. In Europe, for example, a circular approach to our food systems can lead to an 80% reduction in the use of artificial fertilisers. This restores the natural balance in the soil (Ellen MacArthur Foundation, 2016). For this reason, the Ministry of Agriculture, Nature and Food Quality presented its Vision on Agriculture, Nature and Food: Valuable and Connected in 2018. The vision states that the future of our food supply can only be secured if we switch to recycled agriculture.

Conservation of nature reserves

The extraction of raw materials and the dumping of waste have a negative impact on nature reserves. These nature areas are important for the preservation of ecosystem services (as explained above), natural and cultural heritage. At the moment, many governments and organisations are mainly involved in protecting nature from extraction and the dumping of raw materials and waste. In order to systematically preserve nature, this extraction and dumping must stop in general. This is achieved within the circular economy (SYKE, 2018).

2.3 What are the economic benefits of the circular economy?

Circularity has several advantages for the economy. Globally, the economy would benefit around 2 trillion euros a year from more effective resource management. This is because the cost of raw materials will decrease substantially, while promoting employment and innovation.

Substantial resource savings

While the attention for the circular economy is increasing, the extraction and prices of primary raw materials are still increasing (see figure 1). According to Circle Economy calculations, 9% of all raw materials were fully recycled by 2019. In 2018, this percentage was slightly higher at 9.1% (Circle Economy, 2019). In theory, in the circular economy, 100% of all raw materials are fully recycled, and no new virgin raw materials are needed. It will take a very long time for this scenario to be achieved, because methods will have to be found to fully recycle materials that are currently used in products (Fellner, Lederer, Scharff, and Laner, 2017).

Economic growth

An important principle of circular economy is to decouple economic growth from the consumption of raw materials. As a result, the economy is not hampered by the shortage of raw materials to grow. It is assumed that a move towards the circular economy will promote economic growth. The United Nations Environmental Plan (UNEP) calculated that in 2050 the global economy would benefit from more effective resource use by $2 trillion a year (UNEP, 2017). In a circular economy, this gain would certainly be achieved. On the one hand through increased turnover from new circular activities and on the other hand through the creation of more functionality from the same number of materials and means of production. The development, production and maintenance of these circular products requires a specialised workforce, which will increase these jobs. On the other hand, there will be less demand for the extraction and processing of raw materials, which will reduce the number of less specialised jobs. This will increase the value of labour, which is good for employment and GNP (WE Forum, 2017).

Growth of employment

As explained above, in a circular economy, labour is valued more than raw materials. As a result, employment is growing. These jobs will expand for labour-intensive recycling and high-quality repairs; jobs in the logistics sector through local product take-back; new enterprises through innovation, service economy and new business models (WE Forum, 2017).

Innovation stimulus

Circular economics challenges innovative solutions based on a new way of thinking. That means thinking about circular rather than linear value chains and striving for optimizations for the entire system. This results in new insights, interdisciplinary cooperation between designers, producers and recyclers and therefore also in sustainable innovations (Kraaijenhagen, Van Oppen & Bocken, 2016).

Changing demand

A final important factor in the economic benefits of circular economy is the change in and better understanding of the demand side. How companies deal with their customers and the role they play throughout their lives ultimately leads to less use of raw materials, less waste generation and changing production (WE Forum, 2017).

Sources

https://pdfs.semanticscholar.org/daa9/51a6575f0bca2ae48dfa576a2e644d9e8489.pdf **)**

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