



Co-funded by
the European Union



FAST.0150. course
Sustainable Agri-Food Production and Supply Chain Management

CIRCULAR ECONOMY & CIRCULAR MANUFACTURING & CIRCULAR FOOD SUPPLY CHAIN

This project is funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Project name: EU Sustainable Agri-Food Production Principles and Supply Chain Management: Innovative Approaches for Turkey's Integration (AGRIEU)

Call: ERASMUS-JMO-2021-HEI-TCH-RSCH

Topic: ERASMUS-JMO-2021-MODULE

CIRCULAR ECONOMY

- Circular economy (CE) is an industrial system that seeks to intercept waste by keeping it as its maximum utility, and with the aid of using cleaner, renewable and sustainable technologies, innovative business models, and policies that enable it.
- The fundamental aim of implementing CE activities is minimizing the use of new materials, eliminating waste and decoupling growth from material use.
- CE can be used as a strategy to address environmental challenges to foster the circularity of the resources for sustainable development.
- (<https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview>)



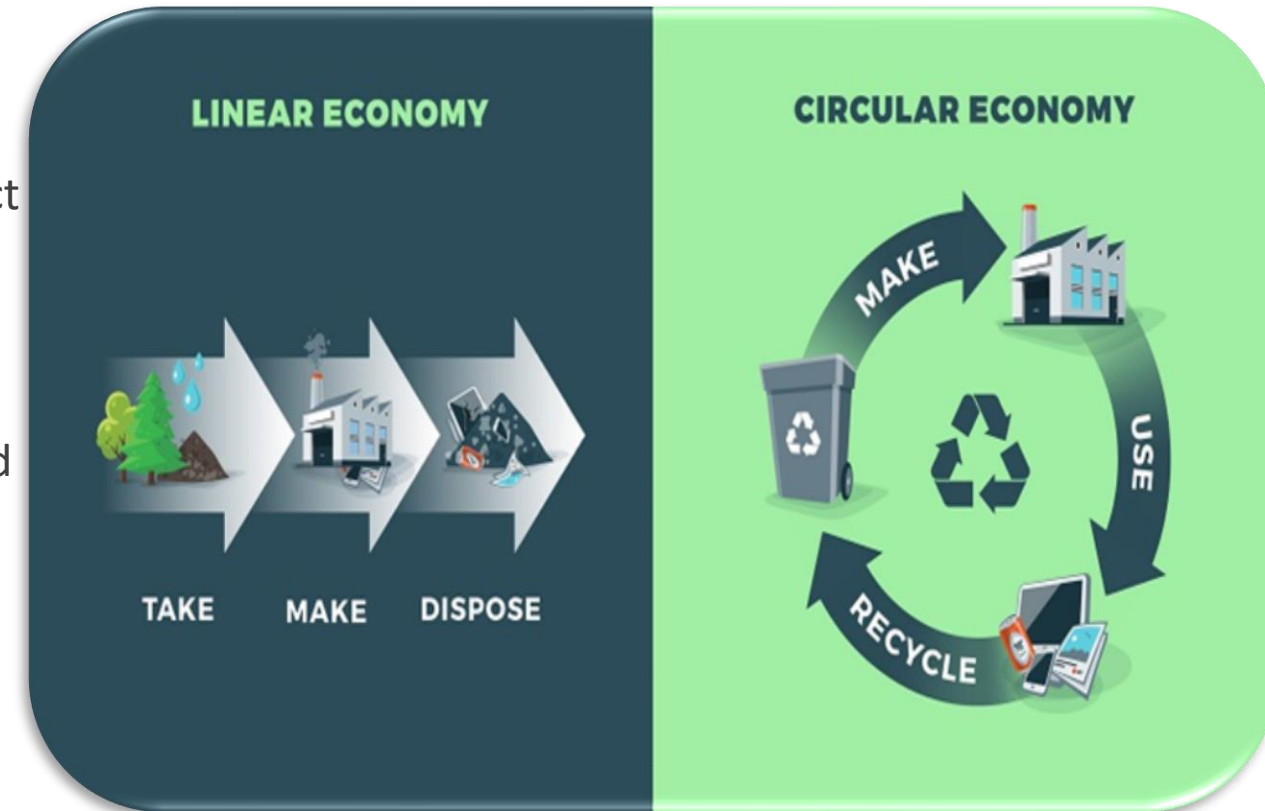
CIRCULAR ECONOMY

From cradle to grave

- Determining the Environmental Impact of the Product at All Stages (Life Cycle Assessment)

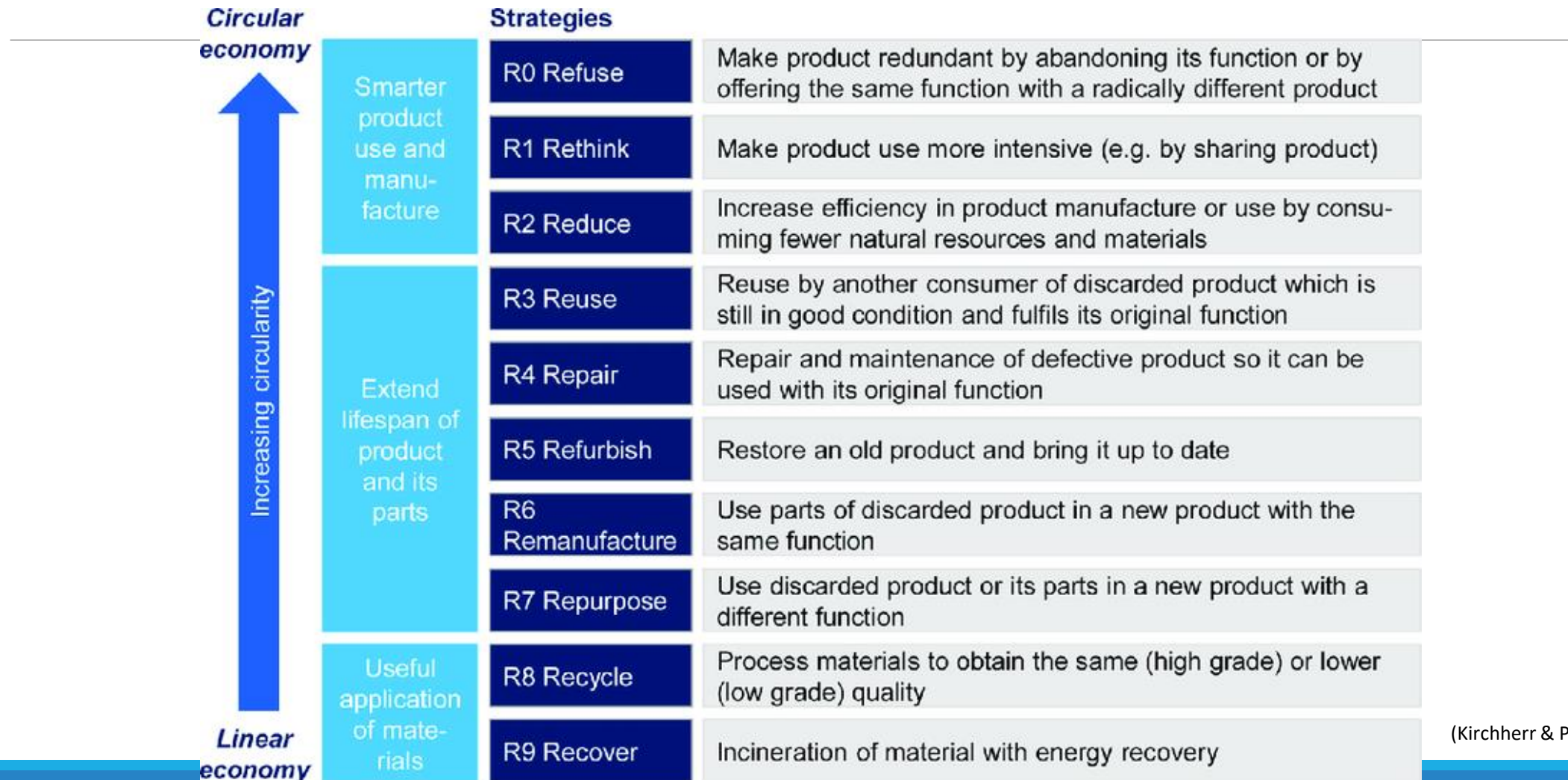
Cradle to Cradle

- The product is produced and used with completely environmentally friendly methods, it is converted and reused after its function is over.



(VitalBriefing, 2018)

9R OF CIRCULAR ECONOMY



(Kirchherr & Piscicelli, 2019)

CIRCULAR ECONOMY IN MANUFACTURING

- The manufacturing industry is a diverse sector in which machines, metal products, means of transport, electronics, plastics processing and textiles, among others, are manufactured.
- Linear economy vision is challenging manufacturers to rethink how they design, produce, and ship products away from the old way of the linear economy (take, make, waste) to a more regenerative process. Consumers want products that are produced using more sustainable practices.

Examples of impact manufacturing has on the environment

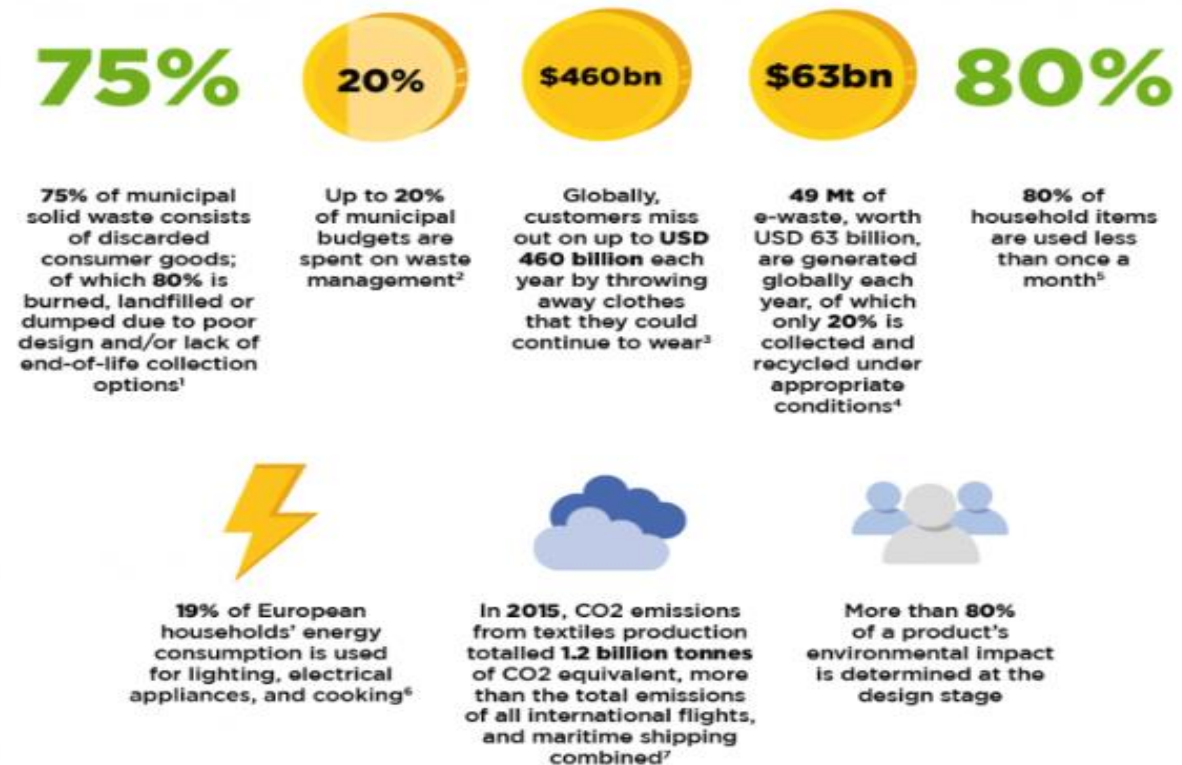
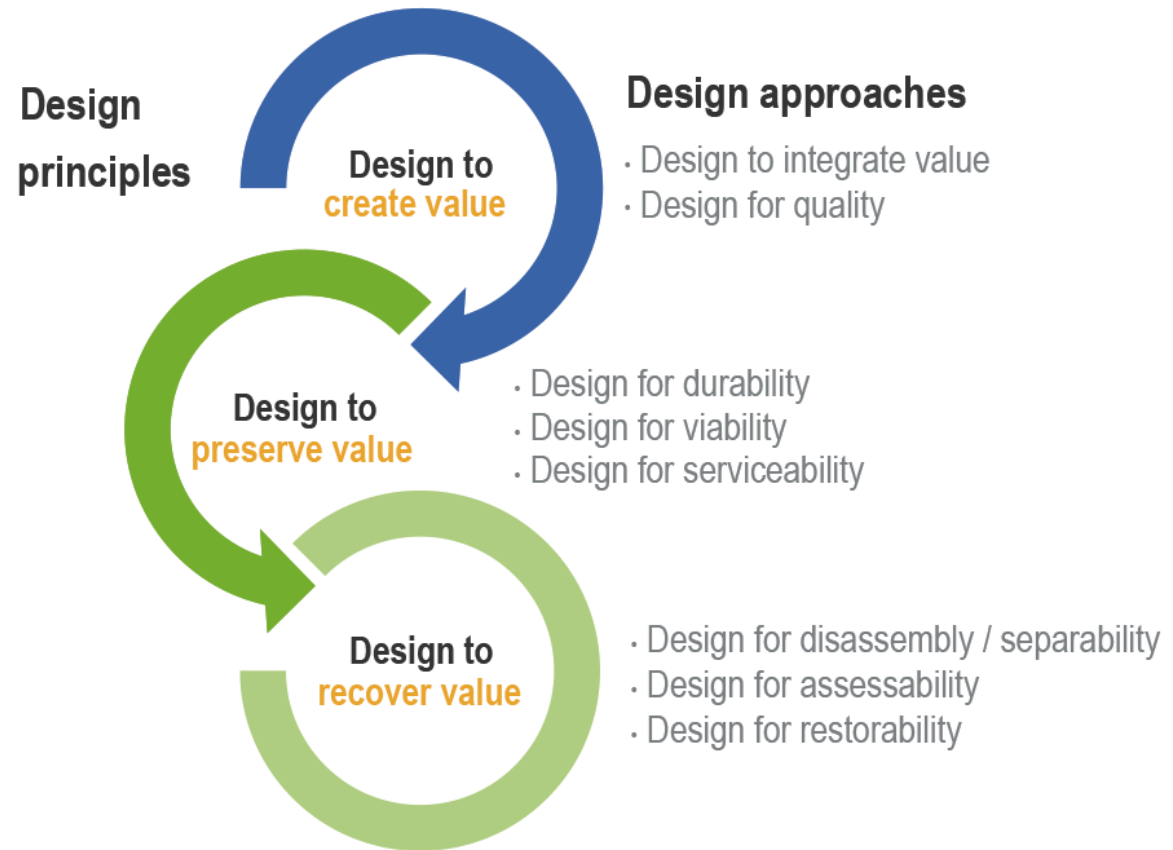


Figure 1. Examples of impact manufacturing has on the environment.

(Ellen Macarthur Foundation, 2019)

HOW CAN WE TRANSFORM OUR MANUFACTURING SECTOR INTO A CIRCULAR MANUFACTURING SECTOR?

- *Circular design models*
- *Use and life extension models*
- *Value recovery models*
- *Circular support models*





REMANUFACTURING



WHAT IS REMANUFACTURING?

- Within the Circular Economy value regeneration cycles, products can be REpaired, RENovated REconditioned, REmanufactured or REcycled.
- The Circular Economy model applied to these technical loops aims to reuse end-of-life products and components as input resources through more or less structured and rigorous activities to restore their performance.
- Remanufacturing is a well-defined industrial process, the most rigorous and structured of all value regeneration processes.
- The industrial process consists of restoring a worn-out component or product (broken, at end-of-life, obsolete or waste), to a product with equal -or even higher- performances to its original state.



The technical loops of the Circular Economy which make it possible to extend the lifespan of...

materials



Recycling

Extracting the individual materials from a product and reprocessing them, to be used as raw materials for the same (type of) product, or any other product, or used as a source of energy.

products



Reuse

Simply reusing the product without any modification, basic cleaning for example.



Repair

Fixing a mechanical or electronic failure for example, but without guaranteeing the performances and proper functioning on the entire product.



Renovate

Fixing a failure, cleaning the product to look like new, and replacing some semi-worn-out parts for example.



Recondition

Fixing failures, preventing future failures, cleaning the product to look like new product, changing aesthetical parts, and functional upgrades, although without guaranteeing the initial performances.



Remanufacturing

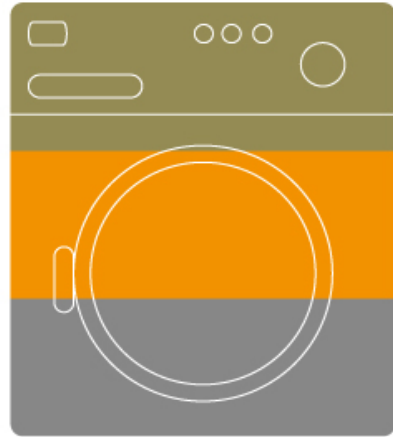
An industrial process that **regenerates the intrinsic value of components** (formed & machined materials, energy and knowledge) **from end-of-life products**; these components are then used **to make products with equal or higher performances** as they were originally.

REMANUFACTURING PROCESS



<http://www.remanufacturing.fr/en/pages/basics-remanufacturing.html>

● A new product requires :



Transformed
Materials

Materials from mines – and sometimes from recycled materials – that have been processed to be used for specific industrial applications

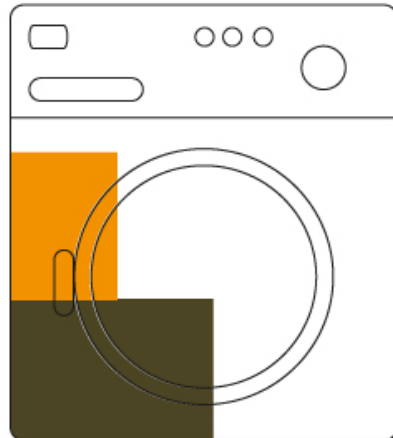
Energy

Energy, mainly from fossil fuels and labour, used during the design & development, industrial, and logistical and distribution process.

Knowledge

Knowledge and experience for the complete process of getting the product on the market; from research to manufacture, through to innovation, design, marketing, and finance.

● Savings through recycling :



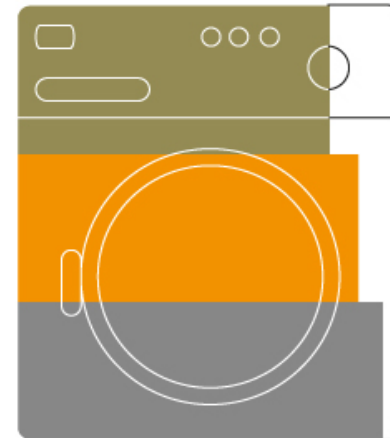
Energy

20%

Downgraded
Materials

50%

● Savings through Remanufacturing :



Transformed
Materials

70%

Energy

80%

Knowledge

90%

ADVANTAGES OF REMANUFACTURING

- The consumer can purchase a product that is of the same quality as new at a discounted price, for example older cars needing a replacement engine.
 - The supplier reduces material and energy costs by having most of the material already in a state suitable for the product. Meaning less machining operations required and reduced direct labour charges.
 - Remanufacturing should be considered both a preventative measure and current solution to the global problem of steadily depleting natural resources. There is no need to extract more raw material when previously extracted material is available to be re-used.
 - It typically requires 50-80% less energy to generate a product in comparison to manufacturing the product from scratch.
 - Less energy consumption per product and less waste being fed into landfill sites results in a significantly more environmentally friendly approach to manufacturing products.
- <https://www.nibusinessinfo.co.uk/content/advantages-and-disadvantages-remanufacturing#:~:text=market%20new%20product%20service%20offerings,and%20enhance%20after%2Dsales%20activities>

DISADVANTAGES OF REMANUFACTURING

- **COST** - cheaper to buy new products than to recondition old ones using conventional purchasing models.
 - **IMAGE** - the perception by consumers of remanufactured goods as 'second class' can limit sales growth
 - **ADAPTABILITY** - remanufacturing is not always the most sustainable strategy for reusing products - for example, where costly reverse engineering of original products is needed, there is a skills shortage or where environmental benefits are higher through the process of recycling or design for recycling.
-
- <https://www.nibusinessinfo.co.uk/content/advantages-and-disadvantages-remanufacturing#:~:text=market%20new%20product%20service%20offerings,and%20enhance%20after%20sales%20activities>

Manufacturing

Remanufacturing

The Life of a Product



Metal Processing



Manufacturer



New Product



End of Life Cycle



Land Fill



The Rebirth of a Product

Remanufacturer

WHY REMANUFACTURING ENVIRONMENTALLY SUSTAINABLE?

- **Reduces energy costs and environmental impact of:**
 - Raw materials and natural resources
 - Manufacturing products
 - Shipping components and final products



CIRCULAR ECONOMY & FOOD SUPPLY CHAIN

Changing our food system is one of the most impactful things we can do to address climate change, create healthy cities, and rebuild biodiversity.

The current food system has fuelled urbanisation, economic development, and supported a fast-growing population. However, this has come at an enormous cost to society and the environment.

TRANSITIONING FROM A LINEAR ECONOMY...



1.2bn tonnes
of food is lost on farms annually¹



931m tonnes
of food is wasted at the consumption level (retail, food services and households) annually²

...TO A CIRCULAR ECONOMY

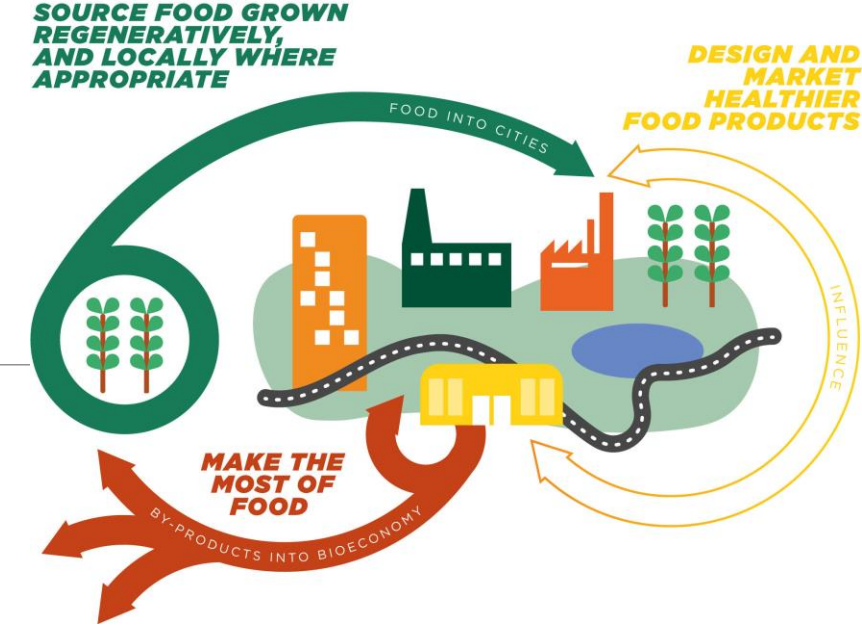
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Transitioning to a circular economy contributes to the achievement of the UN SDGs, including **SDG 12.**



SOURCES: ¹ European Commission, 2016; ² WWF, 2021; ³ UNEP, 2021

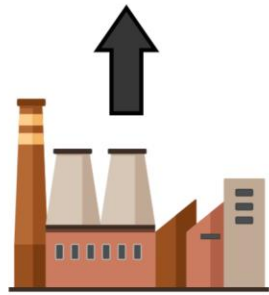
Circular Food Supply Chain Management



- ❖ Most food products end up as waste without recycling. Recently, the *circular economy* has become extremely important in *food supply chains* due to the need for organizations to become more sustainable.
- ❖ The main aim of circular food supply chains; keeping food products in use as long as possible, extracting maximum value from them during use, then recovering and renewing products and materials at the end of product life.

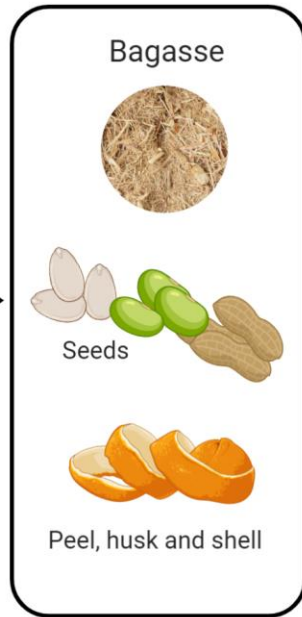
Example

<https://www.youtube.com/watch?v=irThrRZdT5o&t=104s>



Food production
(Fruits, vegetables, cereals,
legumes and roots)

Circular Economy
(Food loss and waste recovery)



Enzymes



Vitamins



Essential oils



Pigments



Lignocellulosic
compounds



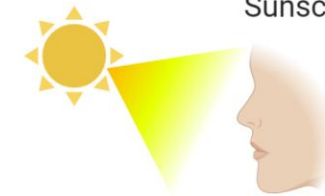
Antioxidants

Food industry



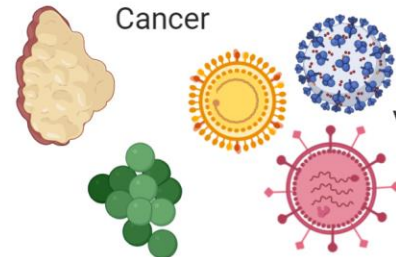
Pastry, bakery,
confectionery
and pasta

Cosmetic industry



Sunscreen

Pharmaceutical industry



Cancer

Virus

Respiratory
pathogens

Example

<https://youtu.be/eQiR0GKWeTA>

Circular Food Supply Chains

- ❖ Food supply chains (FSCs) need to be more resilient among other supply chains (SCs) against SC disruptions because their vulnerable structure such as having perishable products (Kazancoglu et al., 2021).

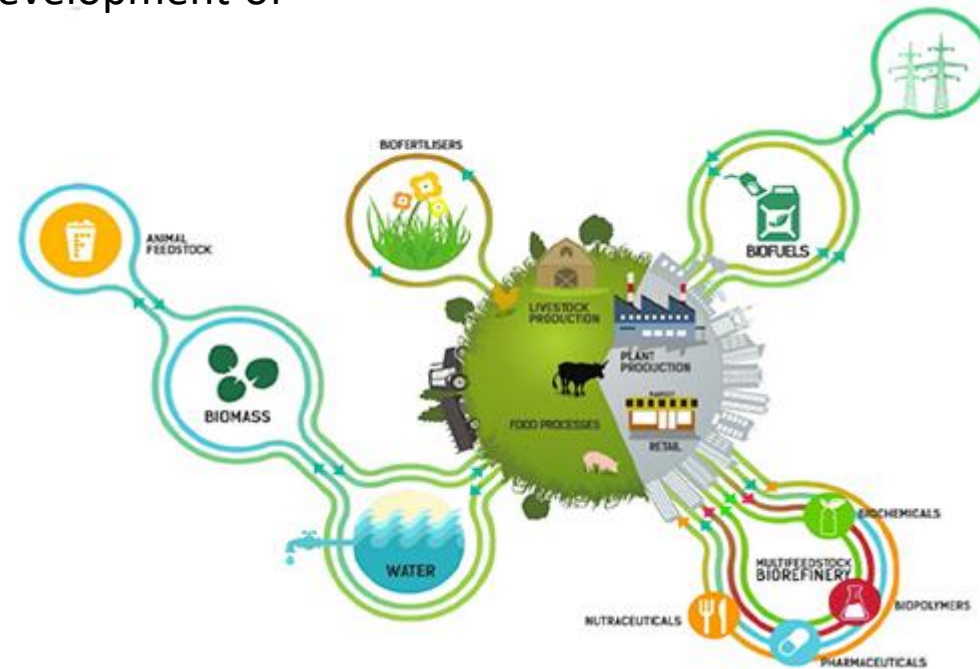
Circular Food Supply Chains

- ❖ Adopting circular economy dimensions enables the food industry to redefine its processes in the new World.
- ❖ The COVID-19 outbreak indicates the weaknesses and vulnerability of the FSCs and how quickly it can be disrupted and revealed a need for improving the SC resilience research and practices.
- ❖ In addition, crises such as the COVID-19 pandemic and others tend to affect technical and system changes that encourage innovation and ideally create resistance against future shocks on an ongoing basis.
- ❖ For this purpose, circular economy dimensions can be used to improve efficiency and resilience of FSC.

(Kazancoglu et al., 2021)

CIRCULAR ECONOMY IN AGRICULTURE

- Circular agriculture is a revolution of traditional agriculture; it is also an important part of the circular economy.
- Policy and regulation can help guide and push the development of circular agriculture.



CIRCULAR ECONOMY IN AGRICULTURE

Circular agriculture focuses on using minimal amounts of external inputs, closing nutrients loops, regenerating soils, and minimizing the impact on the environment

If practiced on a wide scale, circular agriculture can reduce resource requirements and the ecological footprint of agriculture.

It can also help ensure a reduction in land-use, chemical fertilizers and waste, which makes it possible to reduce global CO2 emissions.

https://www.youtube.com/watch?v=CzR_ArBQXi0

CARBON FOOTPRINT

What's Part of Your Carbon Footprint?



A carbon footprint is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions. The average carbon footprint for a person in the United States is 16 tons, one of the highest rates in the world. Globally, the average carbon footprint is closer to 4 tons.

GAMIFICATION: CALCULATION OF CARBON FOOT PRINT

<https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/>

<https://yesilbiradim.com/bireysel-bilgiler>

THANK YOU
