

# The Limits to Growth: Sustainability and the Circular Economy

## Lecture 7: Circular Economy

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- Updated versions of these slides will be available in our [Github repository](#).

# **NEWS/UPDATES**



## Course Evaluation

- Link: [Click Me](#)



# **EXERCISES E04 - E05**

## Exercise E04

### National Sustainability Discourse

- You chose articles and reported how sustainability is discussed in the following countries:
  - India
  - Ukraine
  - Russia
  - Saudi Arabia
  - Brazil
  - Germany

## Exercise E04

### National Sustainability Discourse

Country	Your Assessemnt	CCPI 2023
India	<ul style="list-style-type: none"><li>“Indian government considers sustainability to be an important national issue”</li><li>“India has been giving importance to maintaining a sustainable environment”</li></ul>	Rank: 8 High Rating
Ukraine	<ul style="list-style-type: none"><li>“sustainability is a political priority of Ukraine since 2015”</li></ul>	Not ranked due to the war (2022: Rank: 20)
Russia	<ul style="list-style-type: none"><li>“I don't feel that sustainability is an important topic in society or in government”</li><li>“Speaking about Russia in general, sustainability is not a major political priority for now”</li></ul>	Rank 59 Very Low
Saudi Arabia	<ul style="list-style-type: none"><li>“Sustainability was not a political priority in Saudi Arabia, although in more recent times it has been aiming to be better involved in it, and has been trying to rebrand itself as a greener country”</li></ul>	Rank: 62 Very Low
Brazil	<ul style="list-style-type: none"><li>“Sustainability is a political priority to varying degrees”</li></ul>	Rank: 38 Low

## Exercise E05

### Your Suggestions for Policy Actions

- Industrialization:
  - “The most important thing for this scenario is probably to deliberately slow down the growth of industrialization. It is this sector that has the greatest impact on the amount of pollution and the amount of use of natural resources.”
- Resources and Energy Sources:
  - “resort to more sustainable sources of resources, like renewable energy”
  - “We could invest heavily in research for new technologies to reduce pollution and use our resources more efficiently.”
  - “Better distribution of resources across the world”
  - “100 percent renewable energy without fossil or atomic energy”
- Food Stability/ Poverty:
  - “We focus on the Food sector and trying to beat poverty and starvation”
  - “We could prohibit the consumption of meat.”

# **INTRODUCTION**

# Introduction

## Sustainability - Definition

*„Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.“*

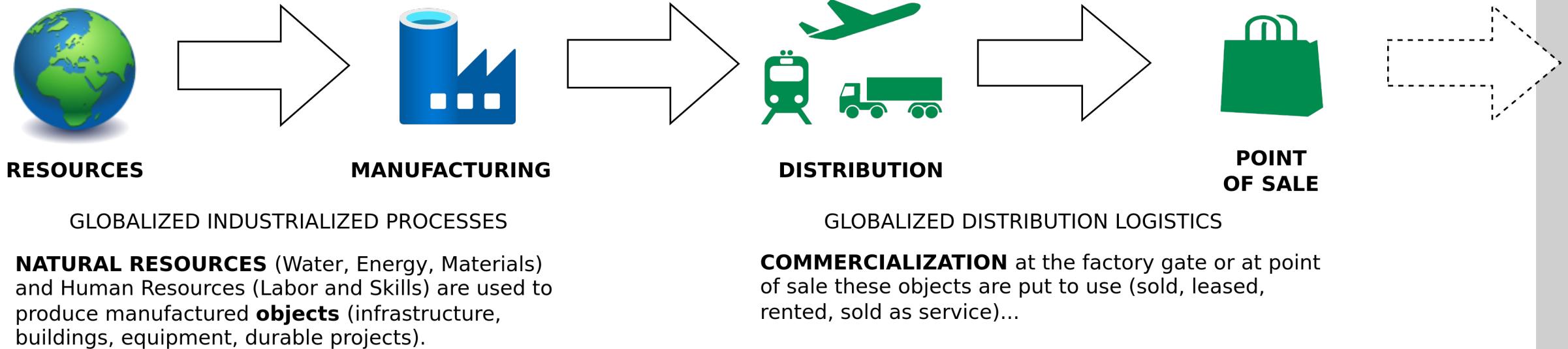
# Introduction

## Sustainability - Implications

**Sustainability → Consume less**

# Introduction

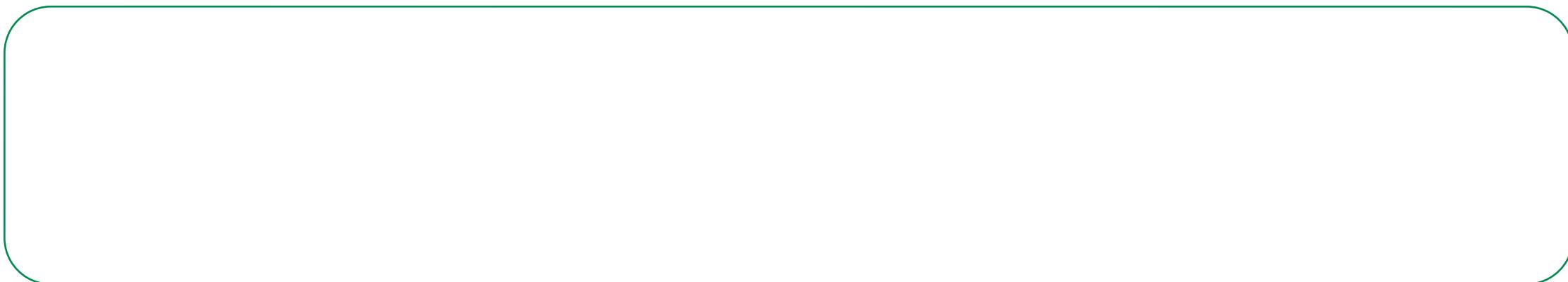
## Linear (Industrial) Economy





# Introduction

## Linear Economy



# Introduction

## Linear Economy

“Take – Make – Dispose”

## Introduction

### Linear (Industrial) Economy – Definition

“Its objectives are to **maintain value** (not to create value added), to **optimise stock** management (not flows) and to **increase the efficiency of using goods** (not of producing goods)”

# Introduction

## Linear (Industrial) Economy - Waste Management as last Step

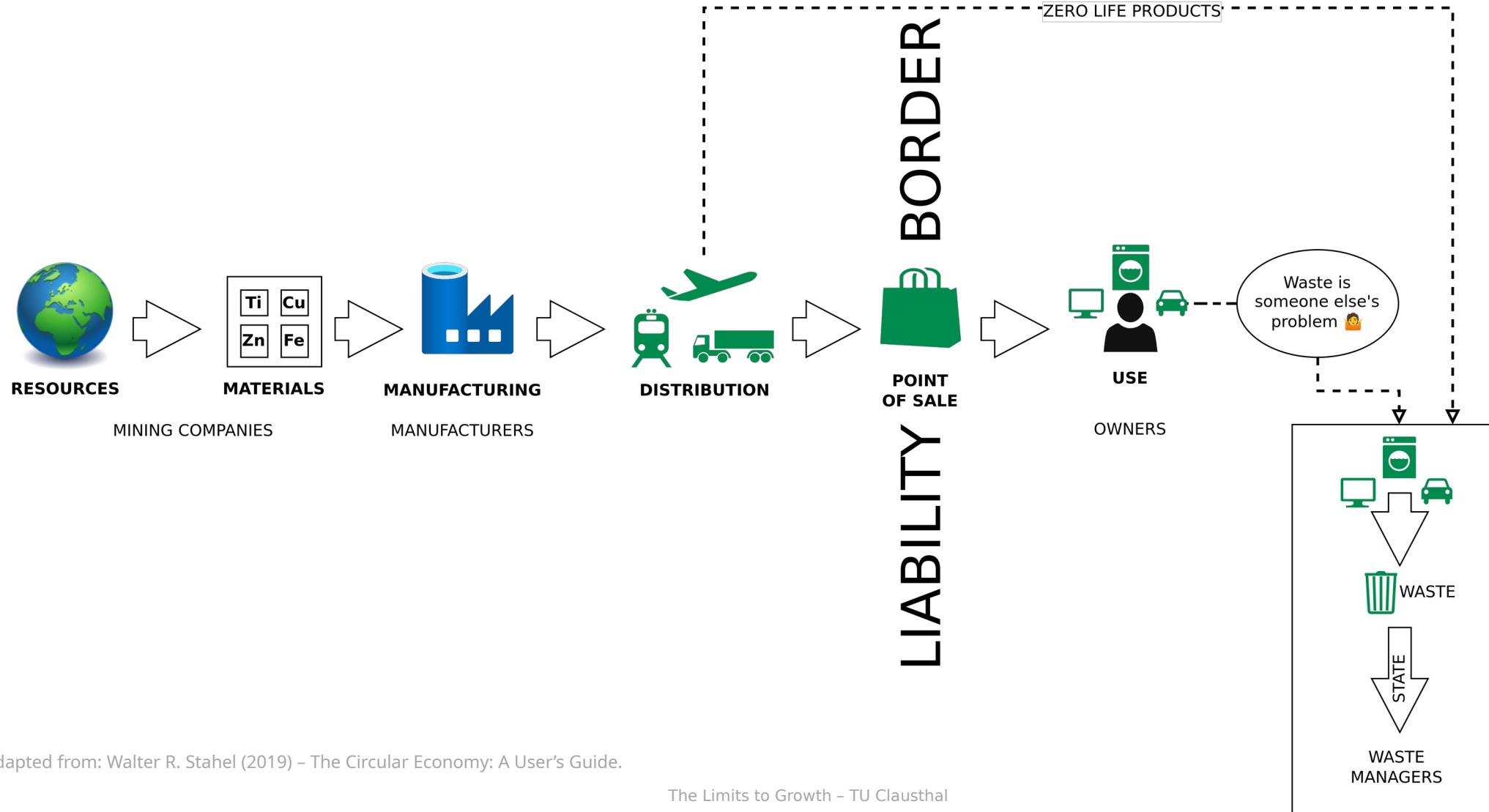


Image adapted from: Walter R. Stahel (2019) – The Circular Economy: A User's Guide.

# Introduction

## Horrible Waste Management



1. "Landfill at Upernivik" by ulalume - <https://www.flickr.com/photos/96649248@N00/43867280734> - [CC BY-NC-ND 2.0](#).

2. Christian Hüpfer - <https://flic.kr/p/aKXw2F> - [CC BY-SA 2.0](#).

# Introduction

## Horrible Waste Management - Nuclear Waste



## Introduction

### Horrible Waste Management - Nuclear Waste

- 2 generations profited from cheap nuclear energy
- 40,000 generation will have to live with the waste

# Introduction

## Horrible Waste Management - Plastic



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# Introduction

## The Limits to Recycling

- Recycling often requires a lot of energy
- Some materials cannot be recycled at all (yet)
- Impurities are challenging
- Often requires a lot of manual labor
- Recycled material often with lower quality than input material
- False sense of safety!

**I am not saying you should stop recycling!**

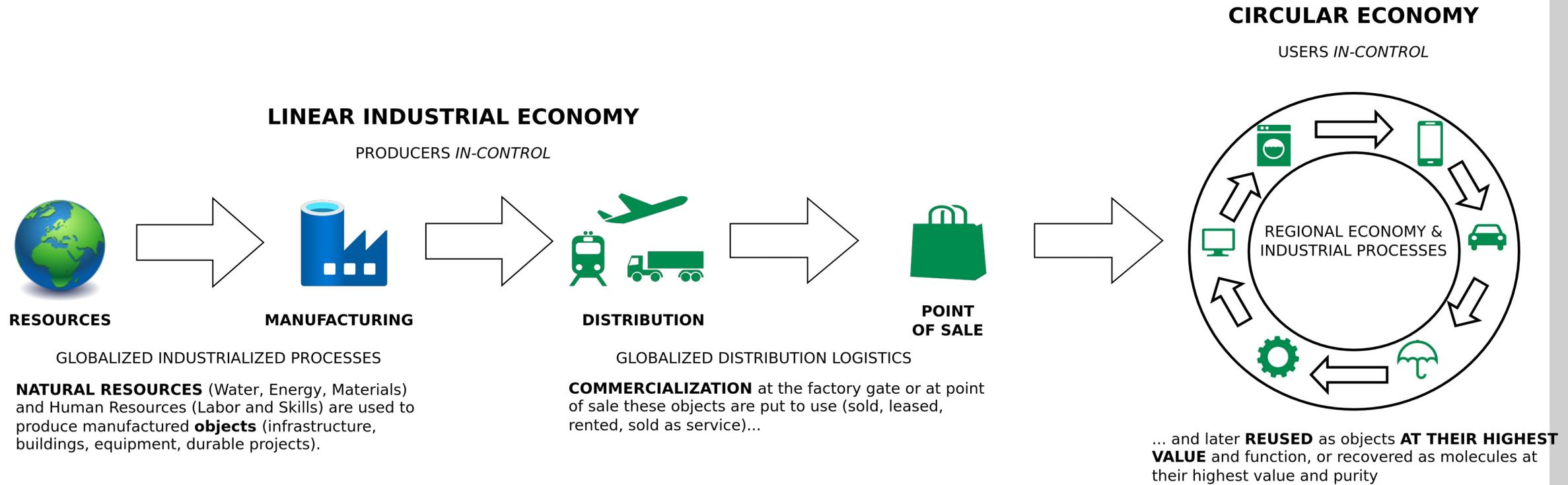
→ Recycling is great but it is better to make sure that we do not have to recycle anything.  
→ Buying less (e.g., only the essentials) is way more effective.

*"We buy things we don't need, to impress people we don't like." -  
Tyler Durden / Chuck Palahniuk*

**Waste = Inefficiency**

# Introduction

## From Linear to Circular



# Introduction

## Linear Economy - Main Challenges

- Environmental pollution / waste
- Waste of resources
  - → Just recycling is not gonna do it

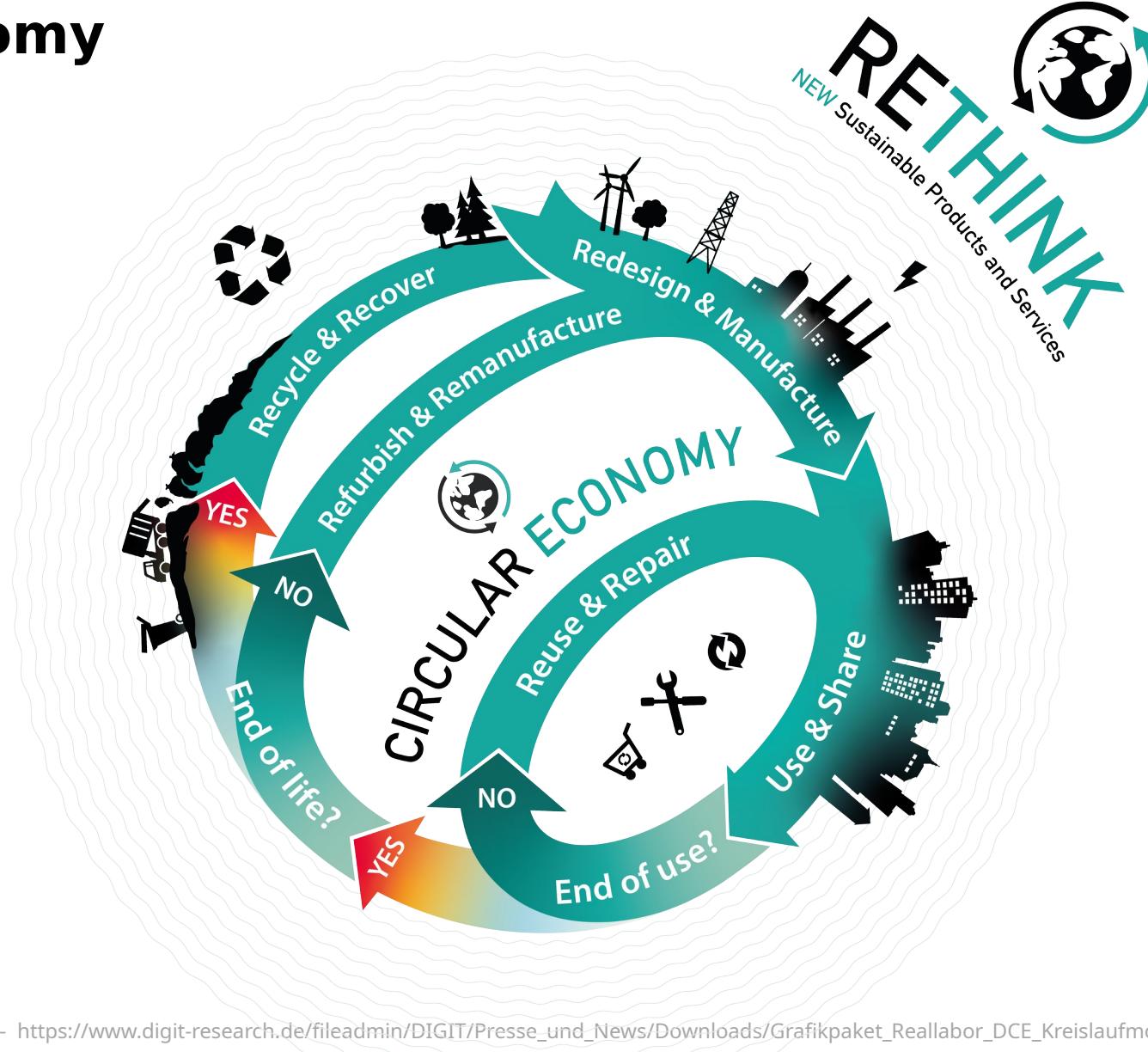
# Introduction

## Linear Economy - Main Challenges

- Environmental pollution / waste
- Waste of resources
  - → Just recycling is not gonna do it
- Therefore:
  - Consume less
  - Make stuff last longer
  - Maximize resource utilization

# **THE CIRCULAR ECONOMY**

# Circular Economy



# Circular Economy

## Definition

**“Conceptualizing the circular economy: An analysis of 114 definitions.”**

Kirchherr, Julian, Denise Reike and Marko P. Hekkert. Resources Conservation and Recycling 127 (2017): 221-232.

<https://doi.org/10.1016/J.RESCONREC.2017.09.005>

# Circular Economy

## Definition

“A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the ‘end-of-life’ concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models.”

– Ellen MacArthur Foundation

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– Ellen MacArthur Foundation

“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.”

– European Parliament

# Circular (Industrial) Economy

## Definition

“The circular industrial economy **manages stocks** of manufactured assets, such as infrastructure, buildings, vehicles, equipment and consumer goods, to **maintain their value and utility as high as possible for as long as possible**; and stocks of **resources at their highest purity and value.**”

# Circular Economy

## Sustainability - Definition

„Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.“

# Circular Economy

## Characteristics

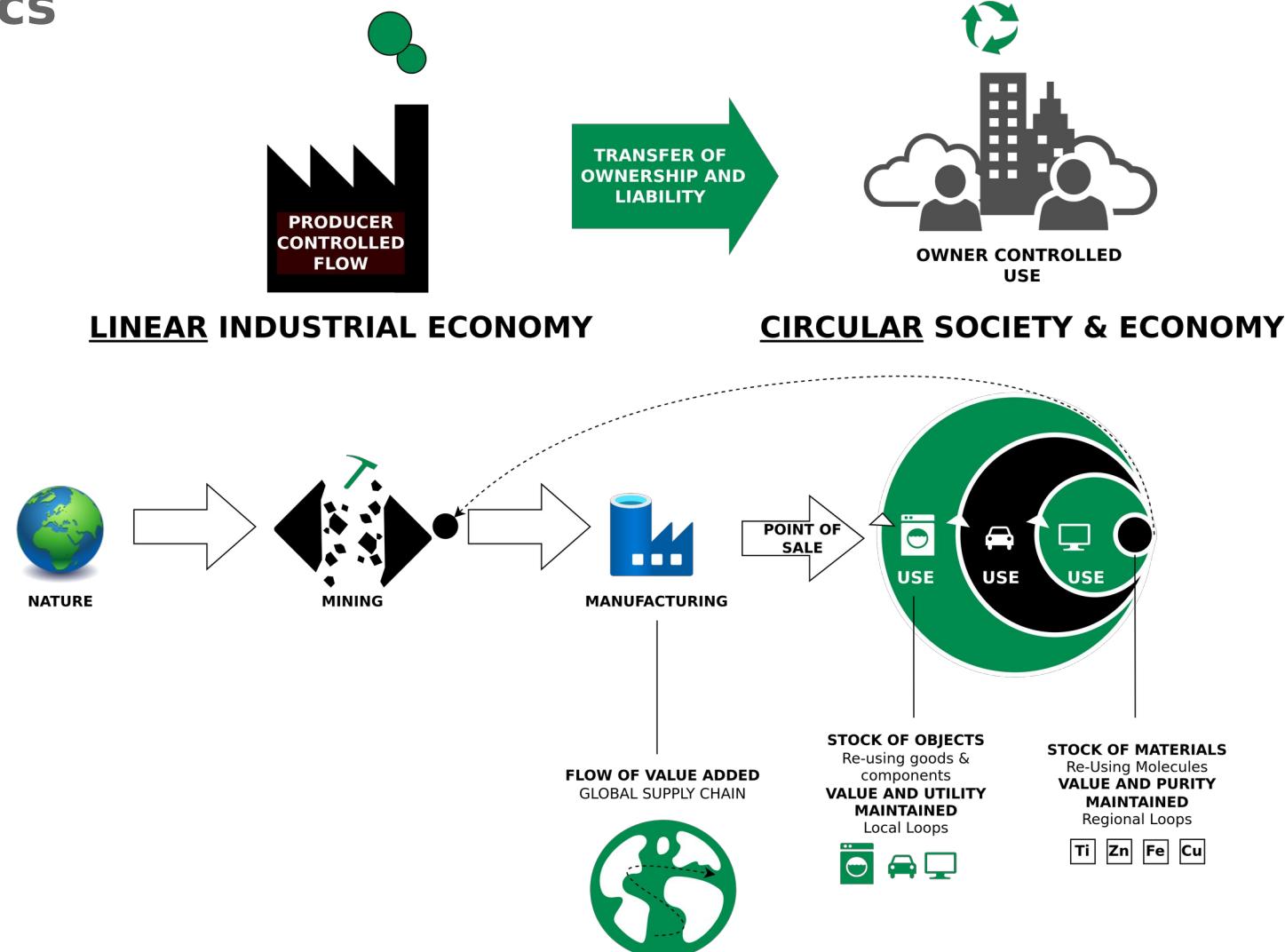


Image adapted from: Walter R. Stahel (2019) – The Circular Economy: A User's Guide.

# Circular Economy

## The Era of R

Techno-commercial strategies to keep goods and components at highest value level through:

- **Reuse**
- **Repair**
- **Remarket**
- **Remanufacture**
- **Re-refine**
- **Reprogramme goods**

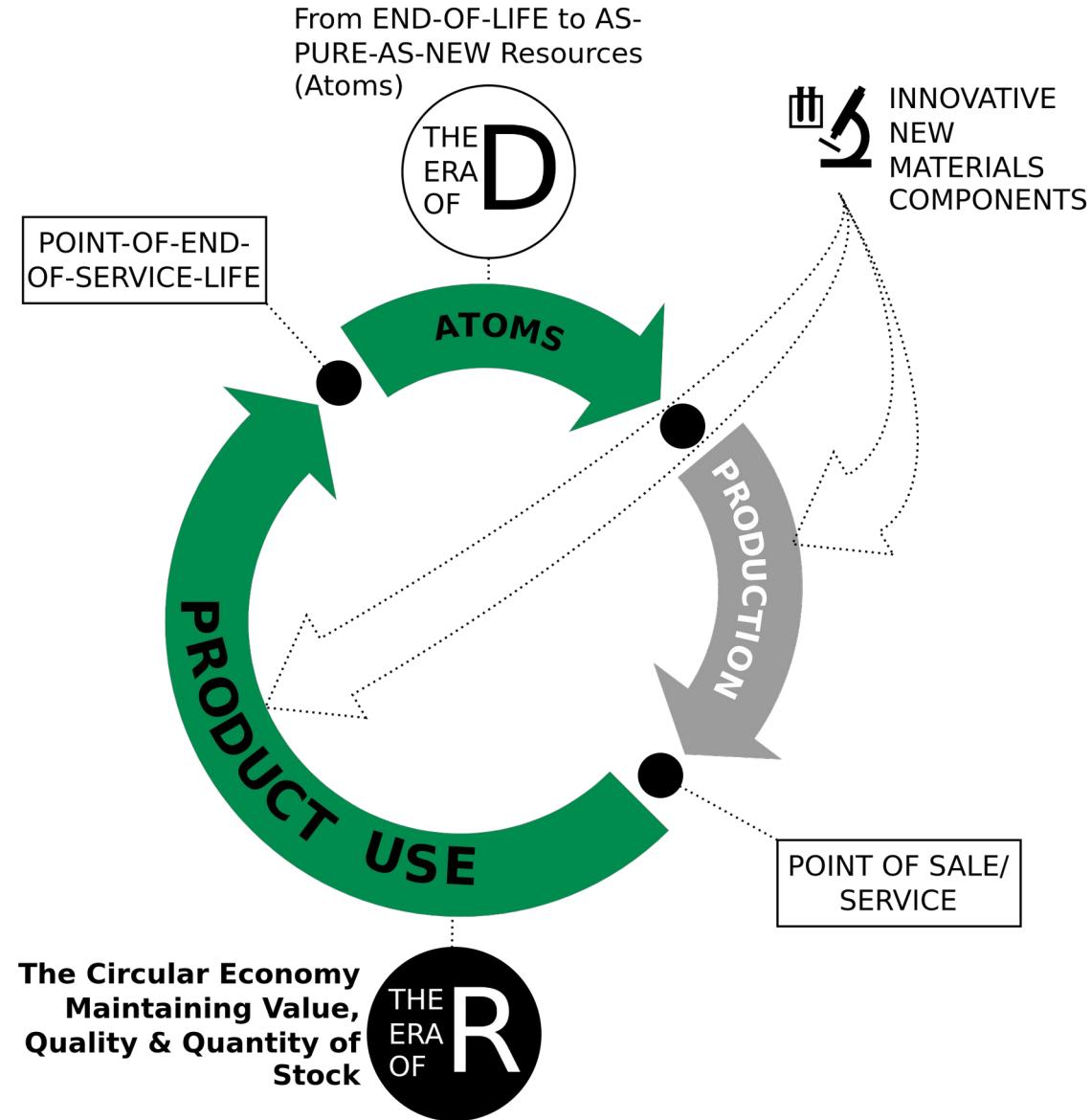


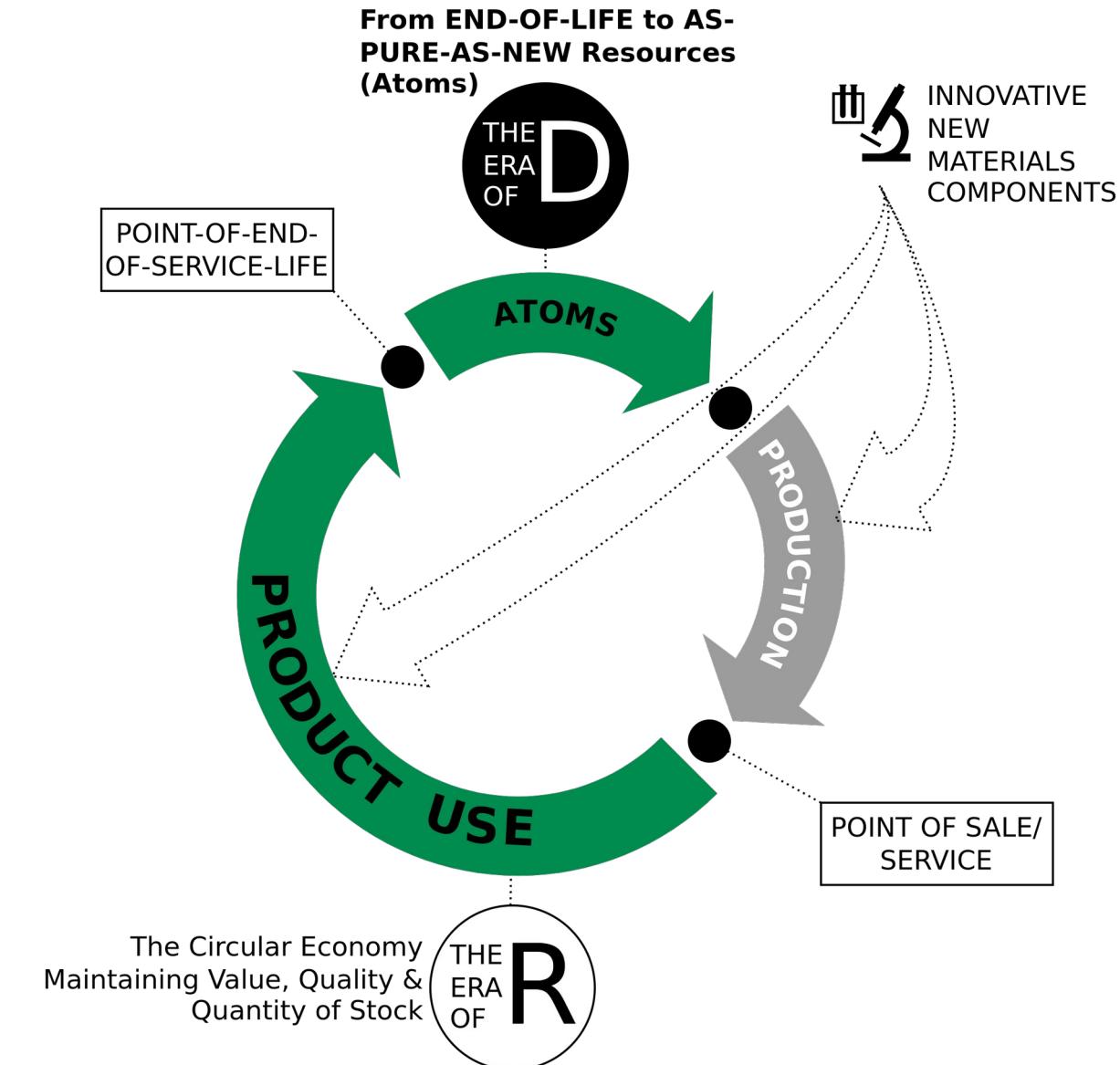
Image adapted from Walter R. Stahel (2019) – The Circular Economy: A User's Guide.

# Circular Economy

## The Era of D

Technologies and actions to recover atoms and molecules at highest quality (purity and value) level as pure as virgin:

- **D**e-polymerise
- **D**e-alloy
- **D**e-laminate
- **D**e-vulcanise
- **D**e-coat materials
- **D**e-construct high-rise buildings and major infrastructure



# Circular Economy

## End-of-Life - Reuse or Recycle?

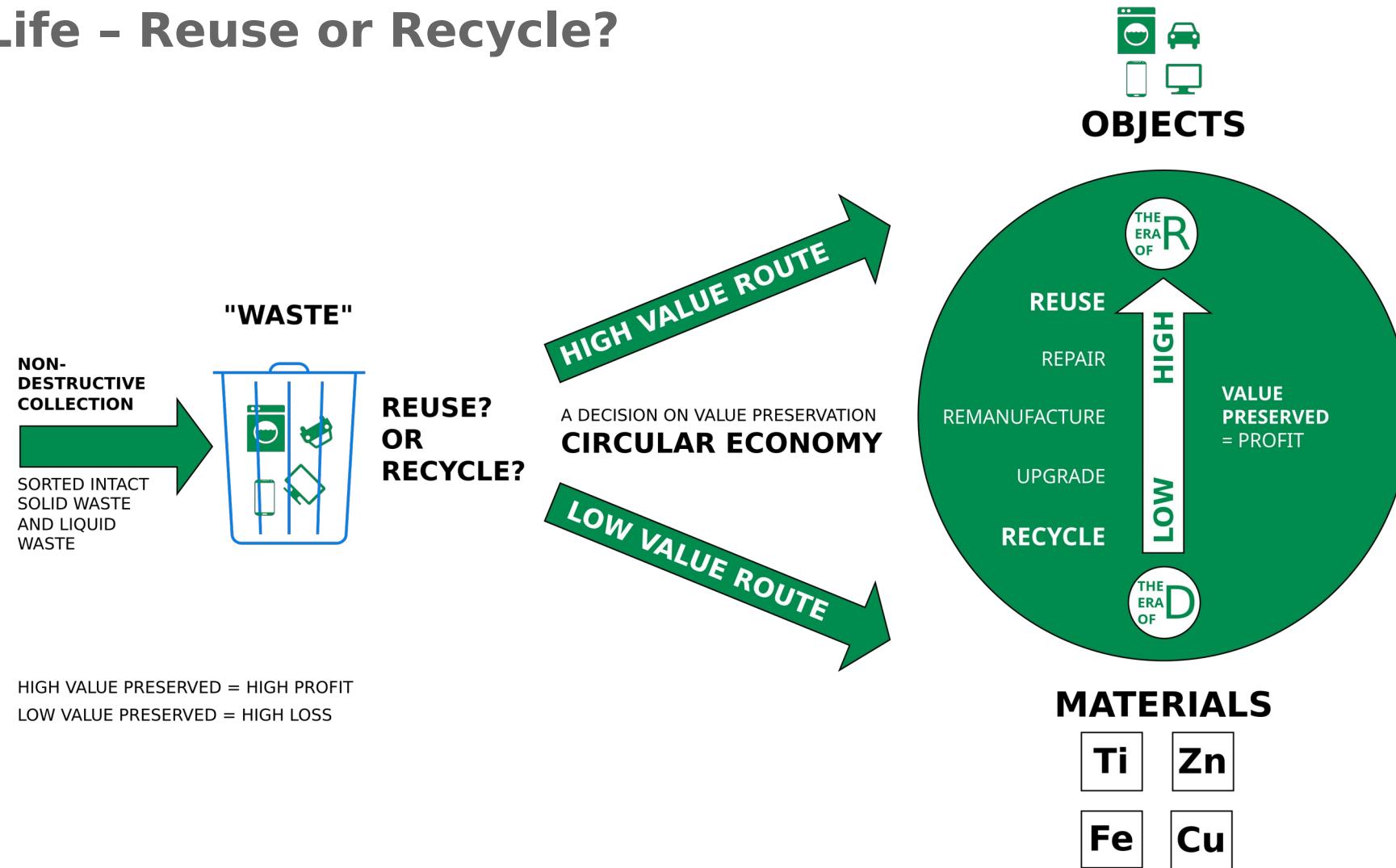


Image adapted from Walter R. Stahel (2019) – The Circular Economy: A User's Guide.

# Circular Economy

## More Wealth/Jobs From Less Resource Consumption

- **Linear Economy:** Low hr/kg (labor input per weight) ratios, coherent with mass production in highly mechanized processes, and low to medium €/kg (value per weight) ratios, in a range from basic materials like cement to smart goods like USB memory sticks

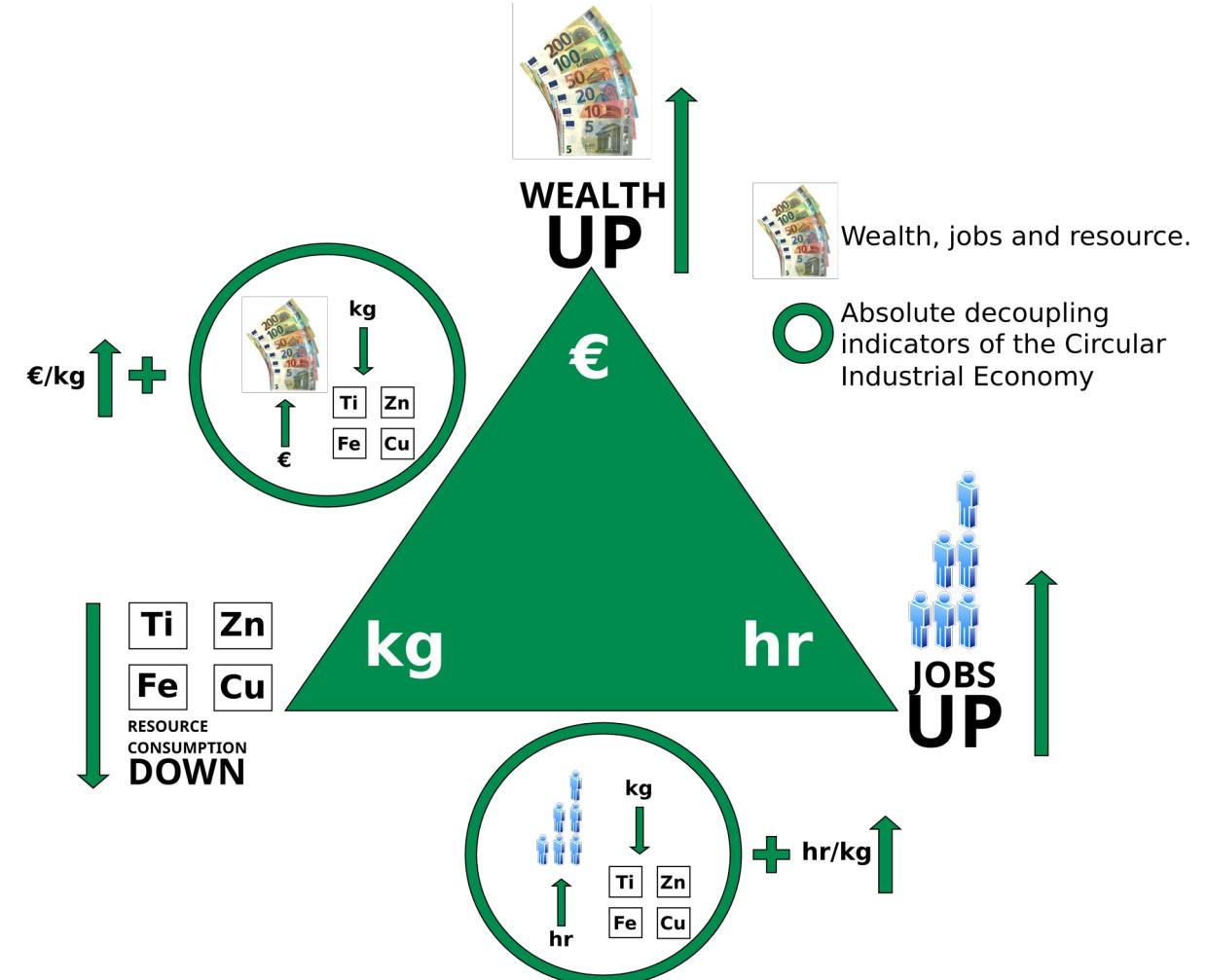


Image adapted from Walter R. Stahel (2019) – The Circular Economy: A User's Guide.

# Circular Economy

## New Engine vs. Remanufacturing A Car Engine

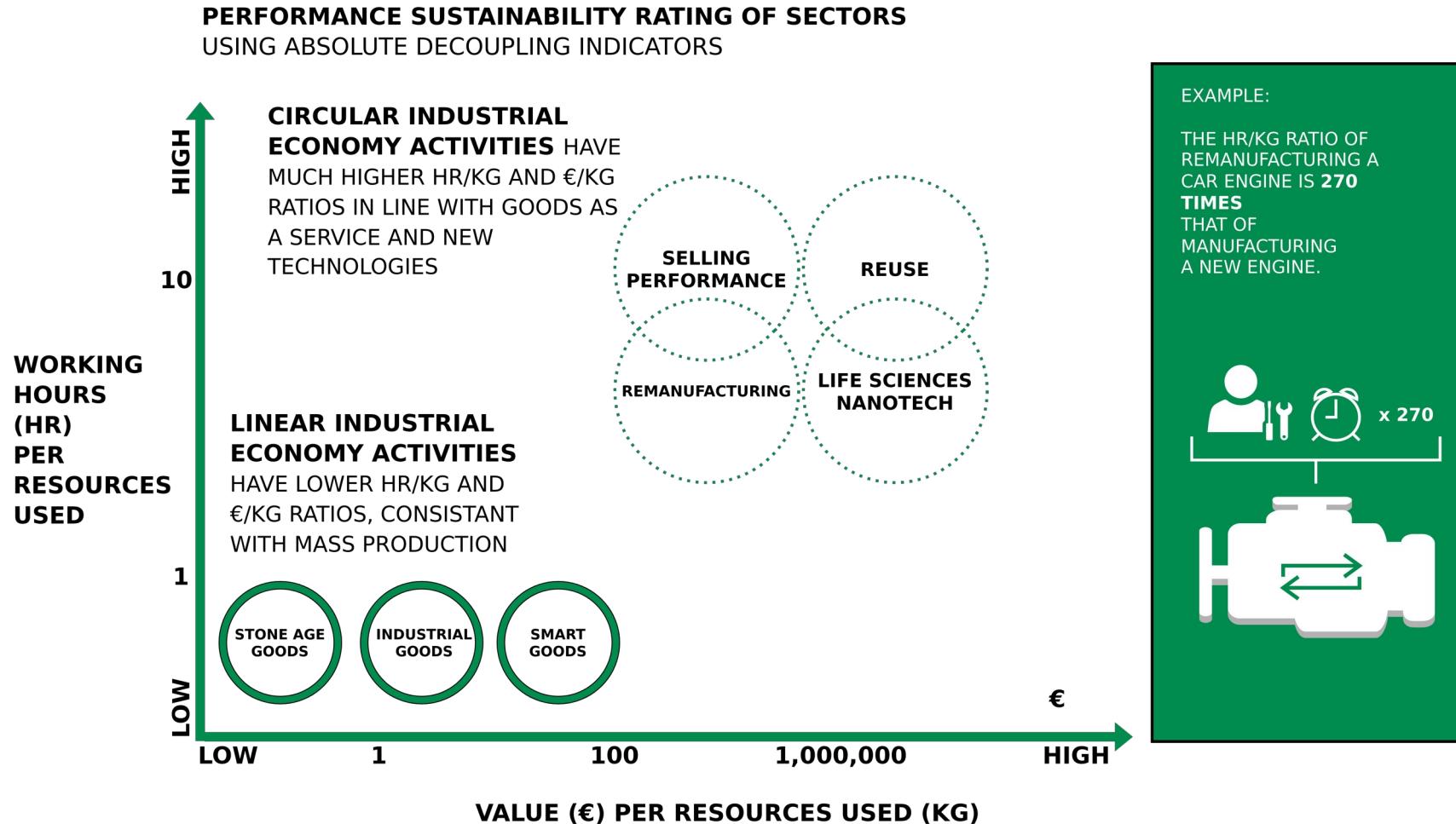
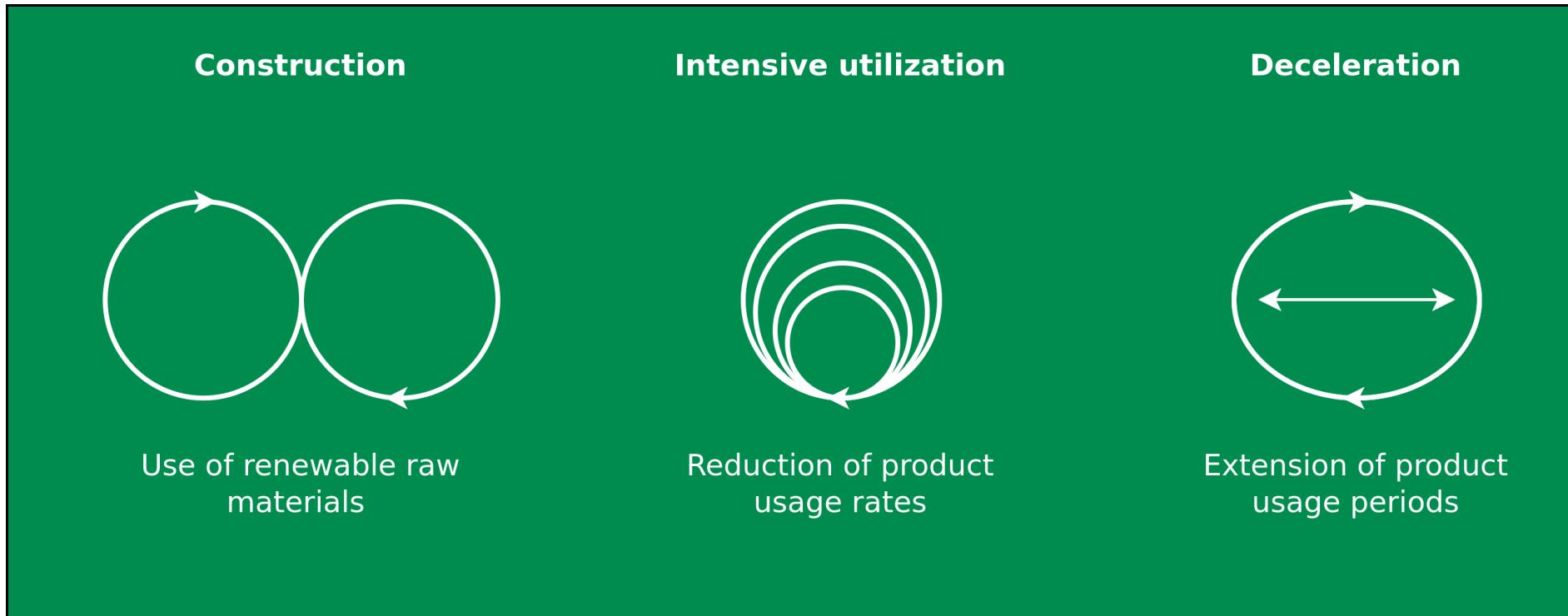


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# Circular Economy

## Business Model Characteristics



# Circular Economy

BUSINESS MODEL TOPOLOGY OF THE CIRCULAR ECONOMY

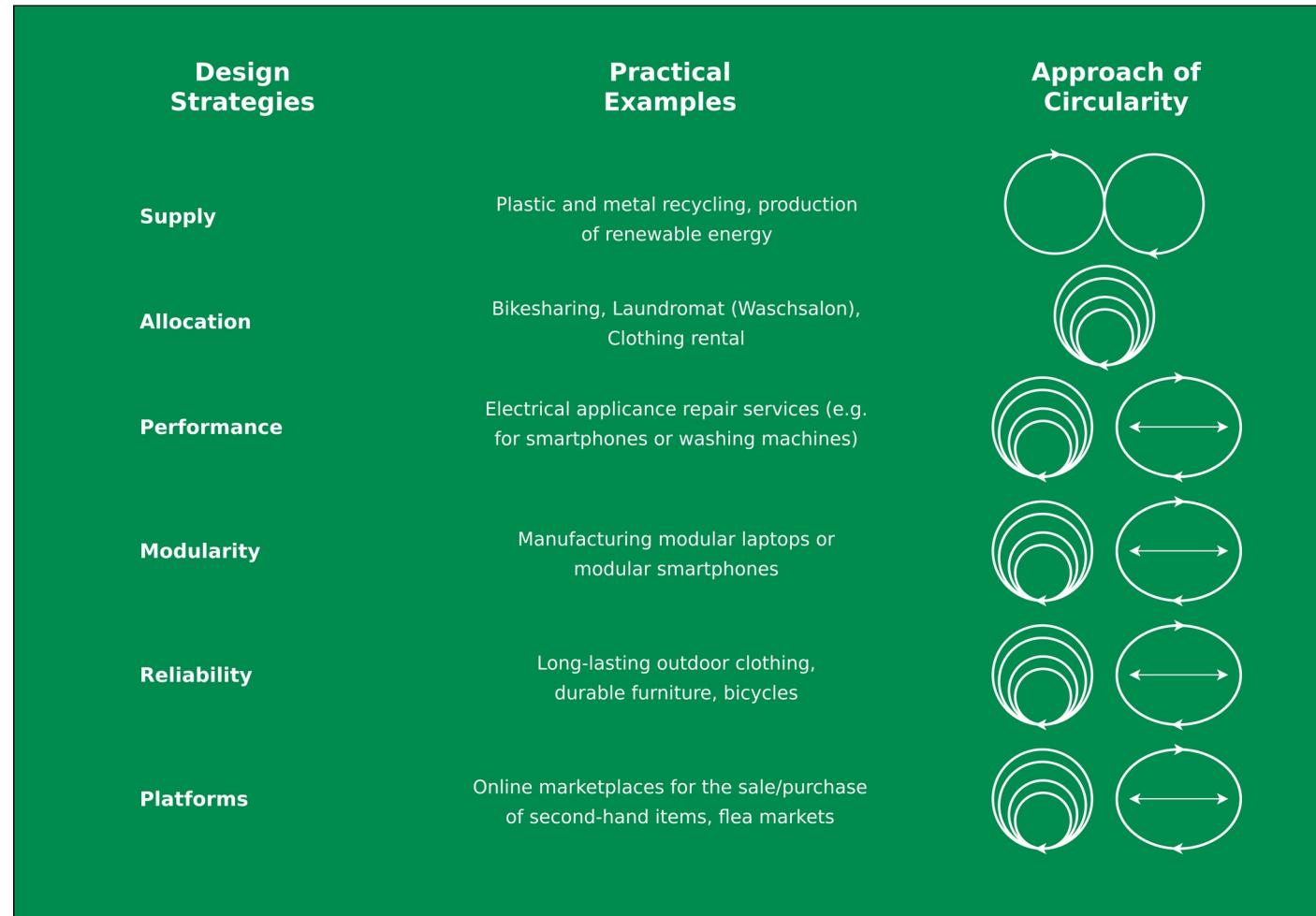


Image adapted from: M. Jaeger-Erben, F. Hofmann (2019) – Kreislaufwirtschaft - Ein Ausweg aus der sozial-ökologischen Krise? – [Link](#).

# **PERFORMANCE ECONOMY**

# Performance Economy

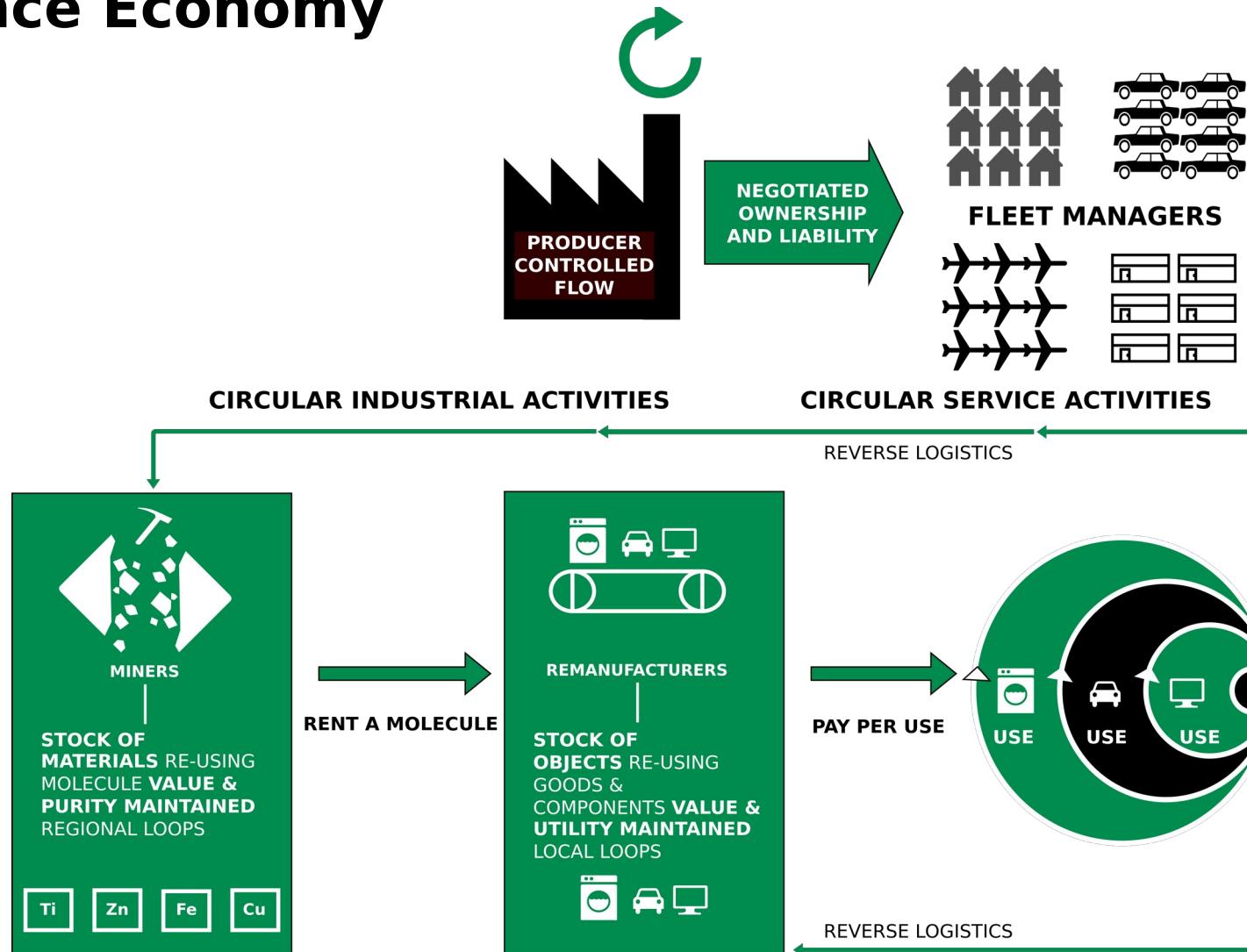


Image adapted from Walter R. Stahel (2019) – The Circular Economy: A User's Guide.

## Performance Economy - Definition

„**The Performance Economy sells results instead of objects.** Its economic actors may be manufacturers of durable objects or fleet managers operating them. In both cases, they sell the use of these objects as a service over the longest possible period of time and maximize their profits by exploiting both efficiency and sufficiency solutions. “

## Performance Economy - Most sustainable CE business model?

- Stahel argues:
  - “The Performance Economy of selling goods and molecules as a service, function guarantees or results and performance, is the most sustainable business model of the circular industrial economy because by internalising the costs of product liability, of risk and waste, it offers manufacturers a strong financial incentive to prevent losses and waste.”

## Performance Economy - Most sustainable CE business model?

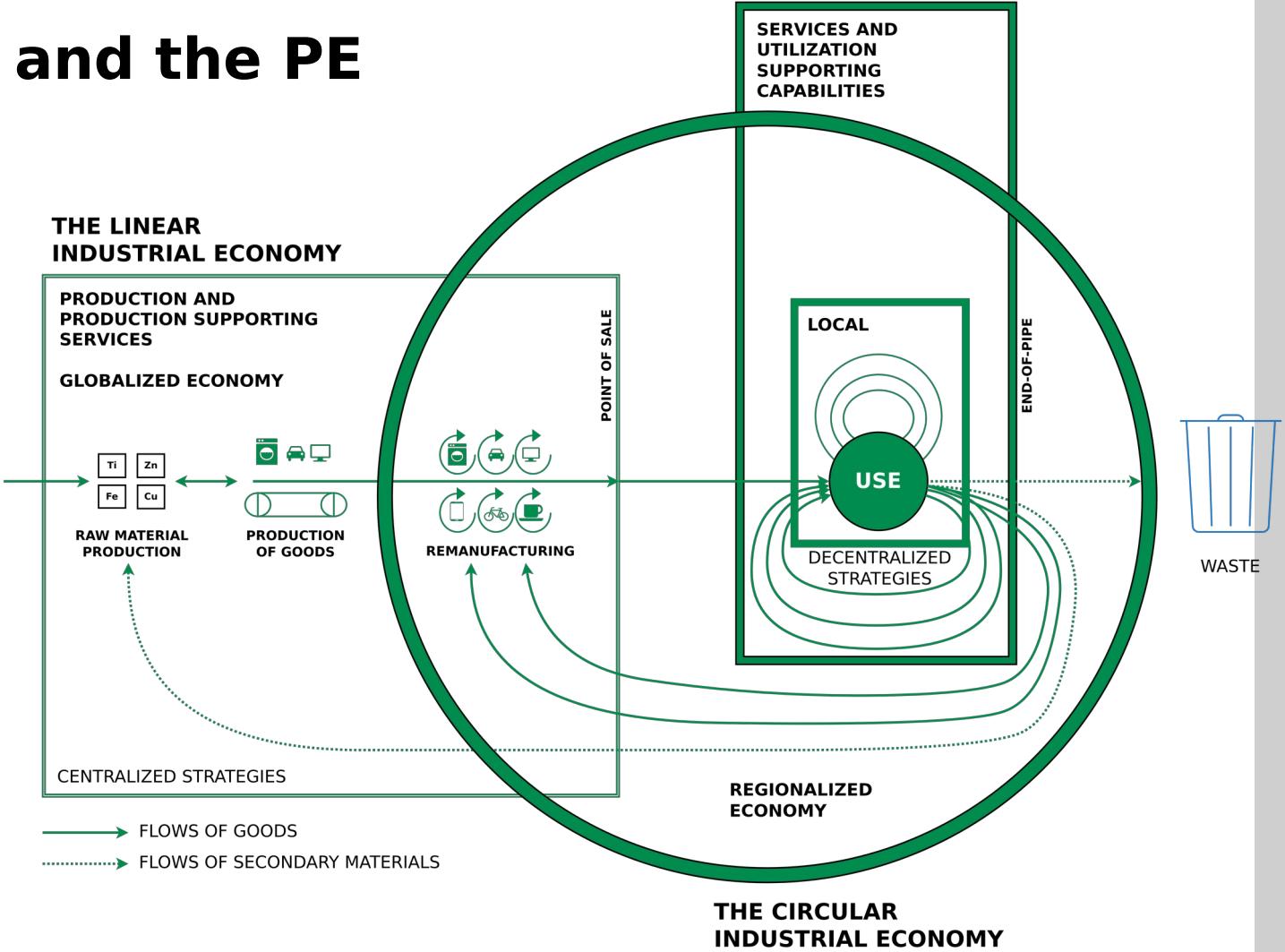
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  - “It maximises the profit potential by exploiting sufficiency, efficiency and systems solutions.”

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  - “It maximises the profit potential by exploiting sufficiency, efficiency and systems solutions.”
  - “In addition, by maintaining the ownership of objects and embodied resources, it creates long-term corporate and national resource security at low cost.”

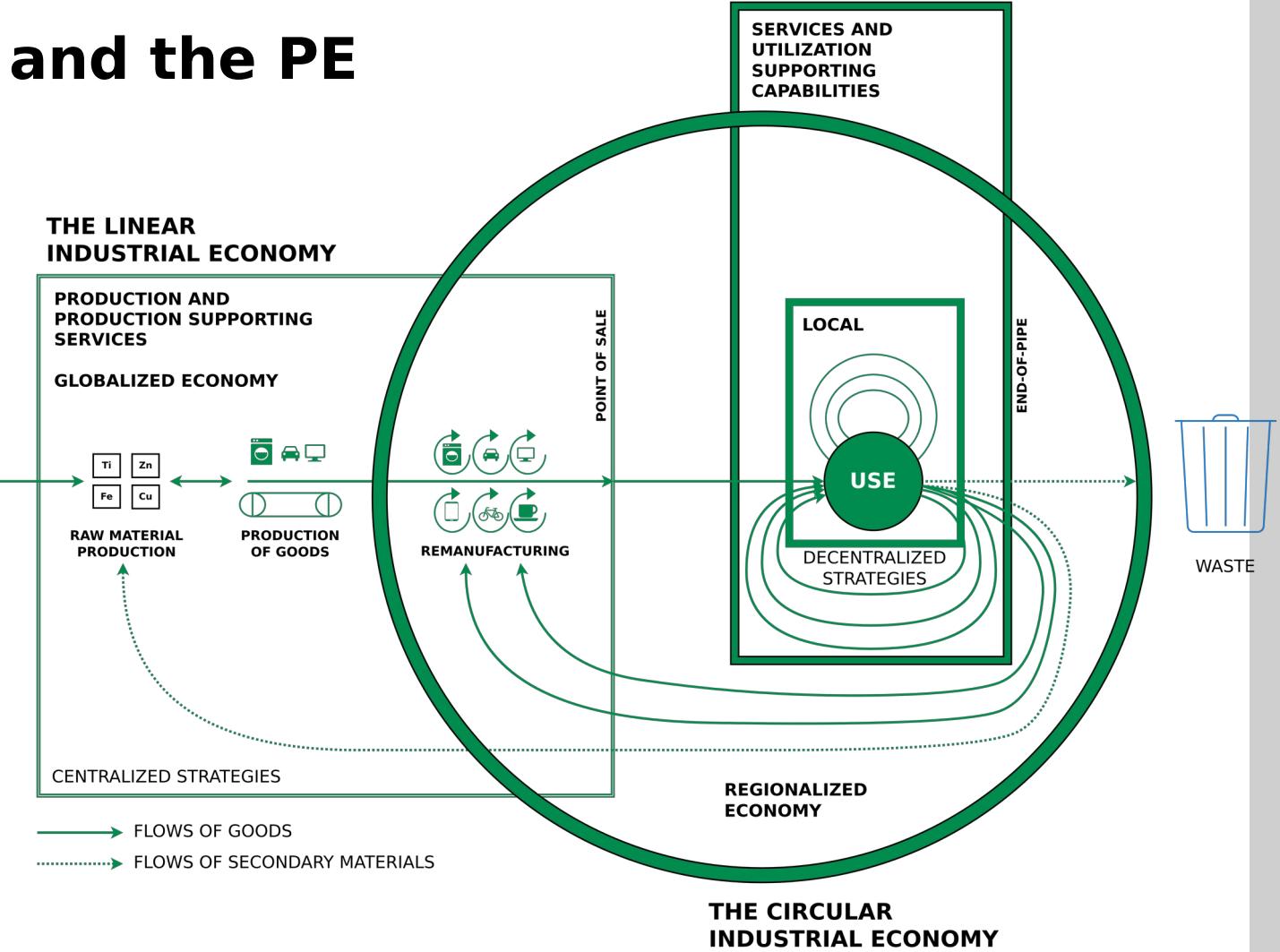
# Situating the LIE, the CIE and the PE

- **Circle:** Managing the utilisation or use phase of stocks of manufactured objects and their components, by maintaining the value and quality of infrastructure, buildings, investment goods, equipment and durable consumer goods in a local or regional economy



# Situating the LIE, the CIE and the PE

- **Circle:** Managing the utilisation or use phase of stocks of manufactured objects and their components, by maintaining the value and quality of infrastructure, buildings, investment goods, equipment and durable consumer goods in a local or regional economy
- **Small square:** Local use-focused PE



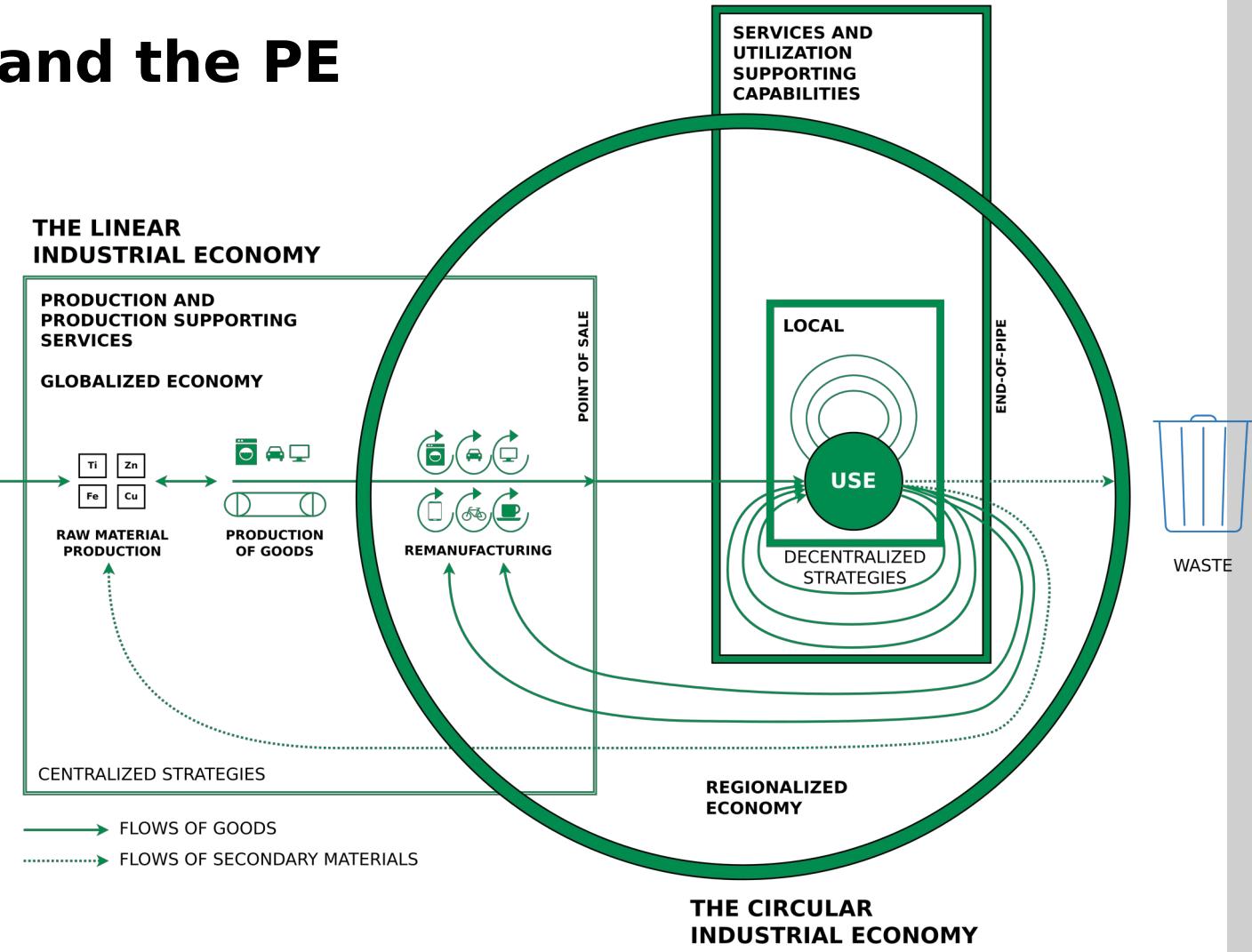
## Situating the LIE, the CIE and the PE

- **Circle:** Managing the utilisation or use phase of stocks of manufactured objects and their components, by maintaining the value and quality of infrastructure, buildings, investment goods, equipment and durable consumer goods in a local or regional economy



RESOURCES

- **Small square:** Local use-focused PE
- **Big square:** Flows of used materials returning to the raw material producer to recover molecules and atoms in a globalised economy



# **CONCLUSION**

## Conclusion

- Linear Economy (LE) → “Take – make – dispose”
- Circular Economy (CE) → Maintain value and utility as high as possible for as long as possible
- Performance Economy → Sell results instead of objects

# **EXERCISE E07**

# Exercise E07

## Evaluating the MOOC Content

As we have explained in the beginning of the lecture, we are currently working on developing asynchronous and interactive learning content for the “Limits to Growth” lecture.

### Sustainable Everyday Practices

#### The Limits to Growth – Sustainability and Circular Society

In a world faced with pressing environmental challenges, it has become increasingly important for individuals to adopt sustainable habits and make a positive impact in their daily lives. As part of the lecture "The Limits to Growth - Sustainability and Circular Society" at TU Clausthal, in this module you will learn what can be understood as sustainable everyday practices, what distinguishes individual practices from corporate action and we will give you an in-depth example of how foodsharing as way to minimize food waste and live more sustainably works and how easy it is to partake in foodsharing activities.

*In order to complete this module, work through both chapters, read all the pages and watch videos included in the lessons and complete the exercises within the material.*



Sustainable Everyday Practices

Throughout this module, we will delve into examples of sustainable everyday practices, discuss why it is crucial to embrace sustainable practices in your everyday life and explore the differences between individual and



Food Waste and Foodsharing

In the following section, you will learn more about one specific sustainable practice: foodsharing. What exactly is foodsharing, how does it work and how can you share food with others or get food that others are

## Exercise E07

### Evaluating the MOOC Content

As we have explained in the beginning of the lecture, we are currently working on developing asynchronous and interactive learning content for the “Limits to Growth” lecture.

1. Work through the whole lesson on “Sustainable Everyday Practices and Foodsharing”
  - Go to the website ([Link](#)).
  - Read all the texts, watch the videos and answers the assessment questions.
2. After you completed the online lesson, please answer the following questions:
  - What did you like about the MOOC content?
  - Which parts of the MOOC content did you not like?
  - Give up to three ways this online learning material could been improved.

## Additional Resources

- Walter R. Stahel (2019) – The Circular Economy: A User's Guide
- Website of the Ellen MacArthur Foundation – [Link](#)

# Questions?