



Innovation

**SUSTAINABLE
DEVELOPMENT
GOALS**

and Circular Economy

We live in a
complex,
dynamic world
where everything
is connected to
everything else



We need better approaches, to study,
understand and manage complexity

From pre to post Industrial Revolution



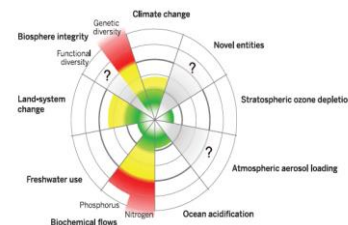
Abundance of goods and services from nature



- *Technological advances dependent on fossil fuels & other raw materials*
- *Massive production & consumption*
- *Take-make-waste models*
- *Economic & population growth*



Limits to Growth (1973)
Our Common Future (1987)
Planetary Boundaries (2009)



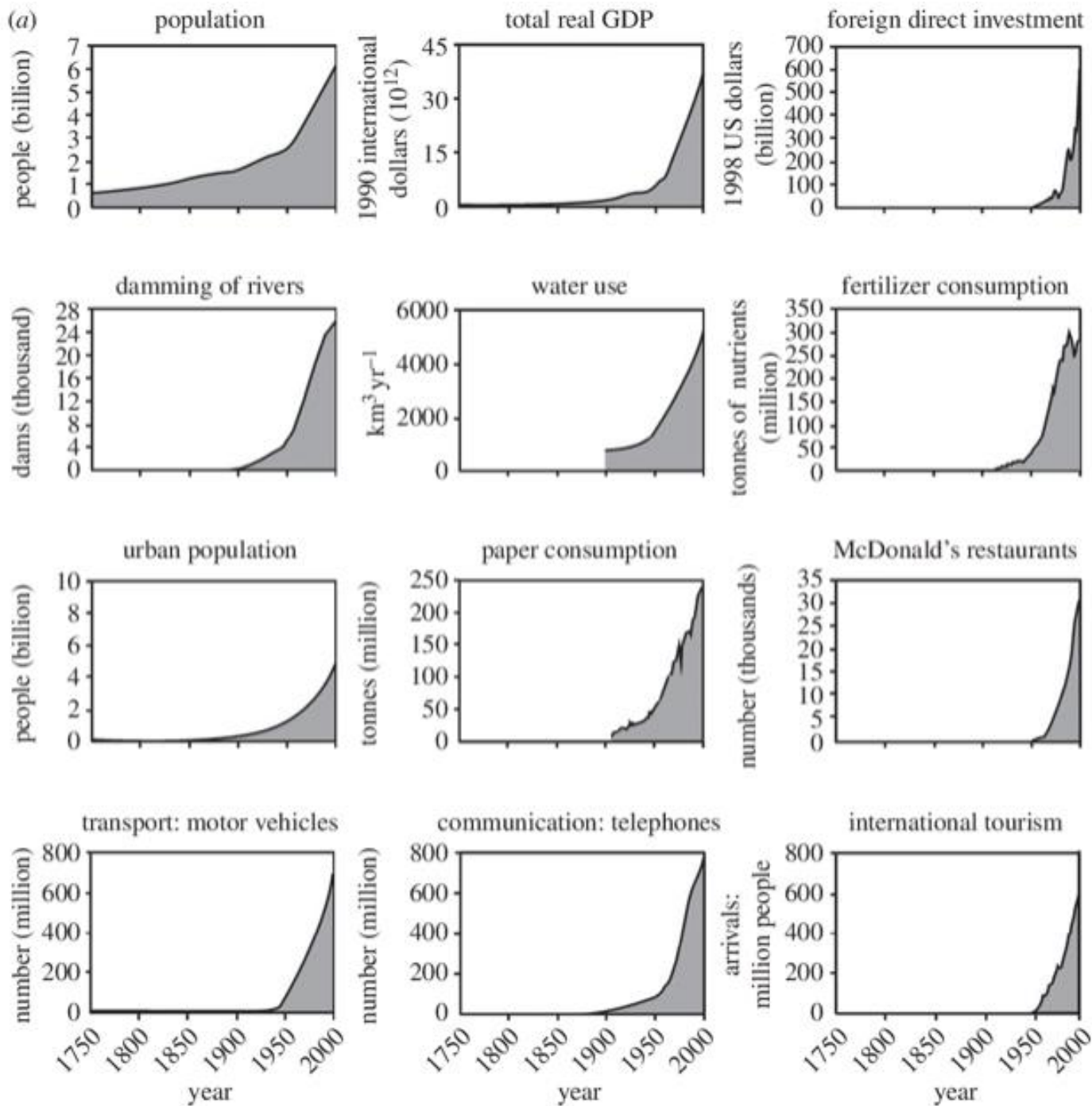


5 Variables

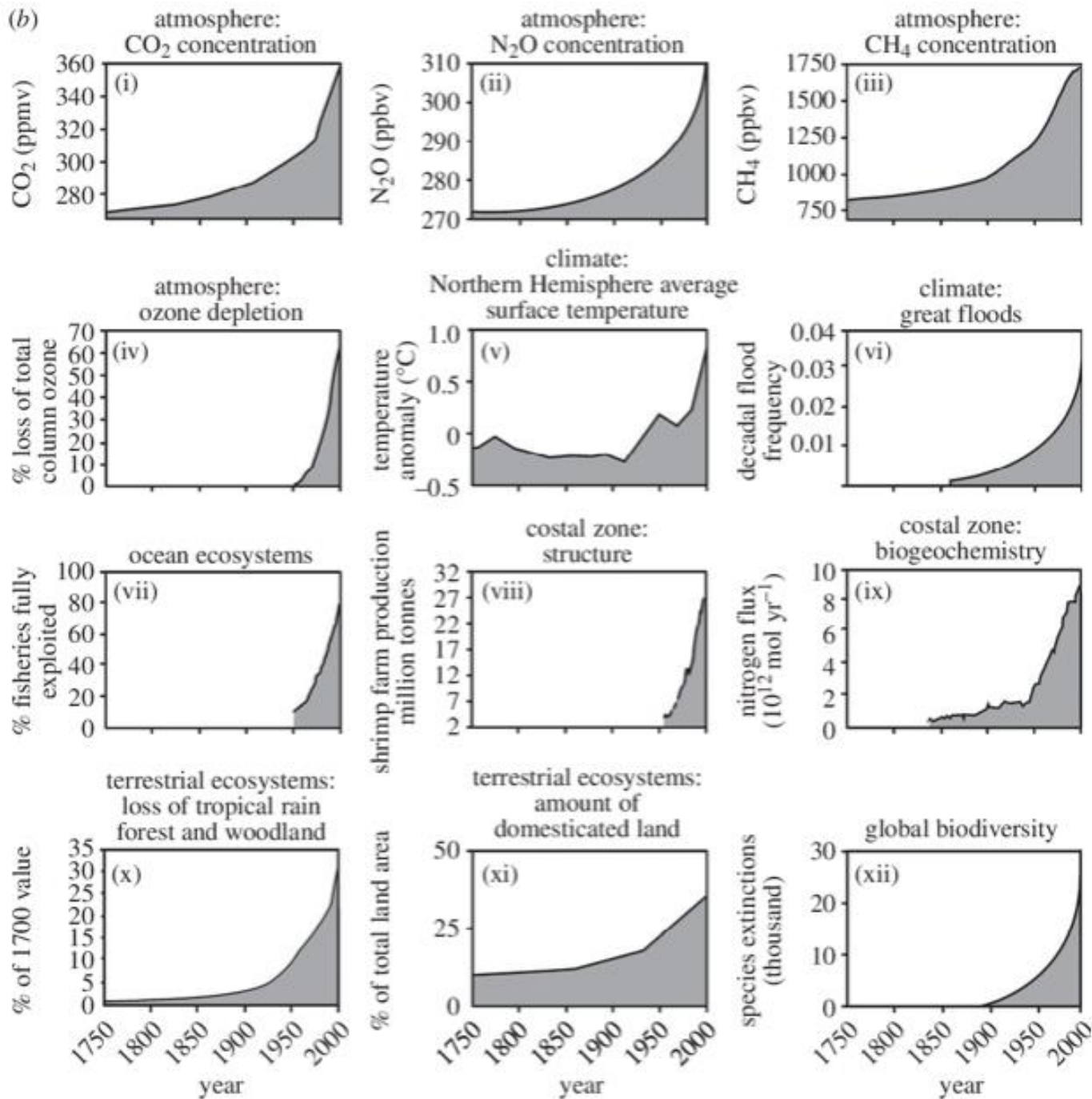
- Population increase
- Agricultural production
- Nonrenewable resource depletion
- Industrial output
- Pollution generation

Exponential Growth

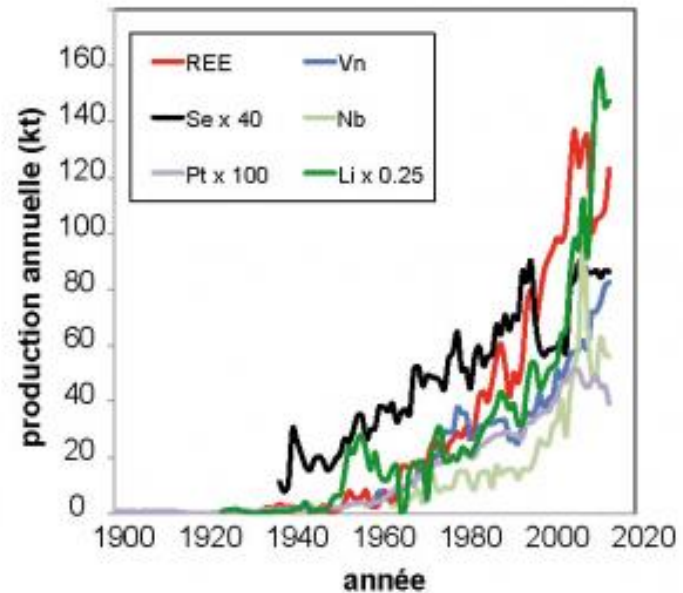
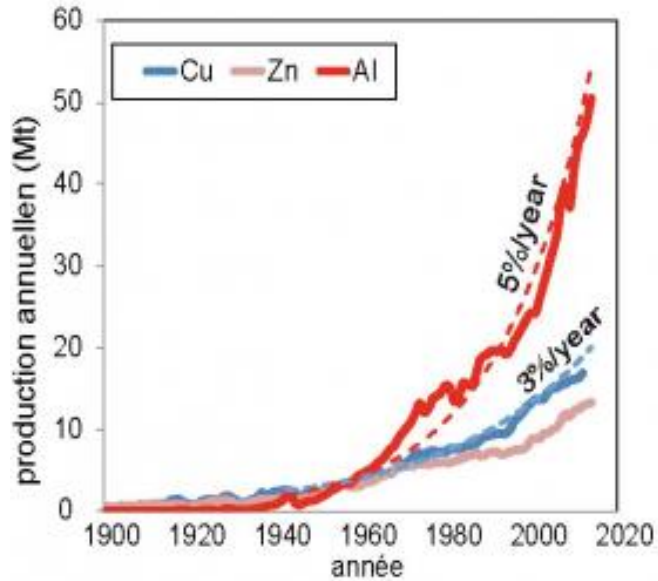
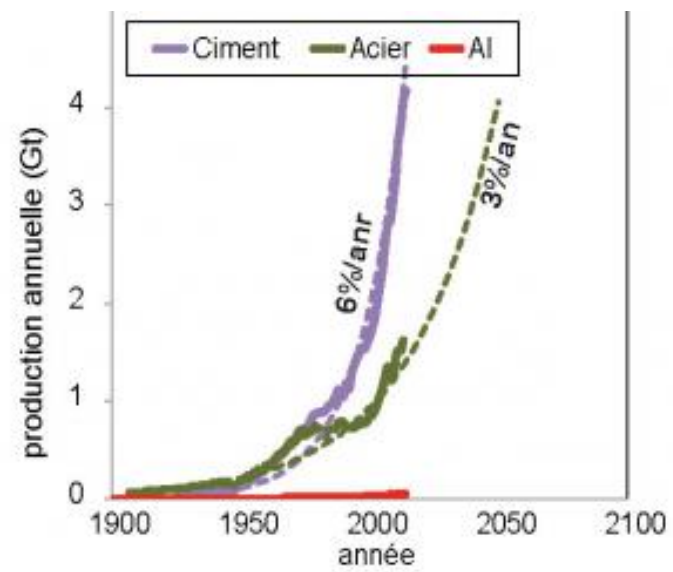
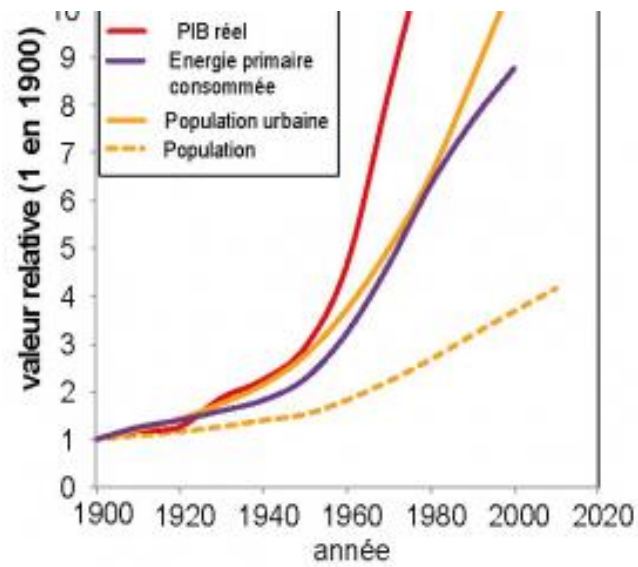
- A quantity exhibits exponential growth when it increases by a constant percentage of the whole in a constant time period
- Involves elements that change over time (systems dynamics)
- When many different quantities are growing simultaneously and when all quantities are interrelated in a complicated way, analysis of the causes of growth and the future behavior of the system becomes difficult



Source:
 Steffen, W., Grinevald, J.,
 Crutzen, P. Mitchell, J. &
 McNeil, J. (2011) *The Anthropocene: Conceptual and historical perspectives*
, Philosophical Transactions of the Royal Society A- Mathematical, Physical and Engineering Sciences



Source:
 Steffen, W., Grinevald, J.,
 Crutzen, P. Mitchell, J. &
 McNeil, J. (2011) *The Anthropocene: Conceptual and historical perspectives*
, Philosophical Transactions of the Royal Society A- Mathematical, Physical and Engineering Sciences



Evolution historique de différents indicateurs de prospérité et activité humaine d'après Vidal (2017)

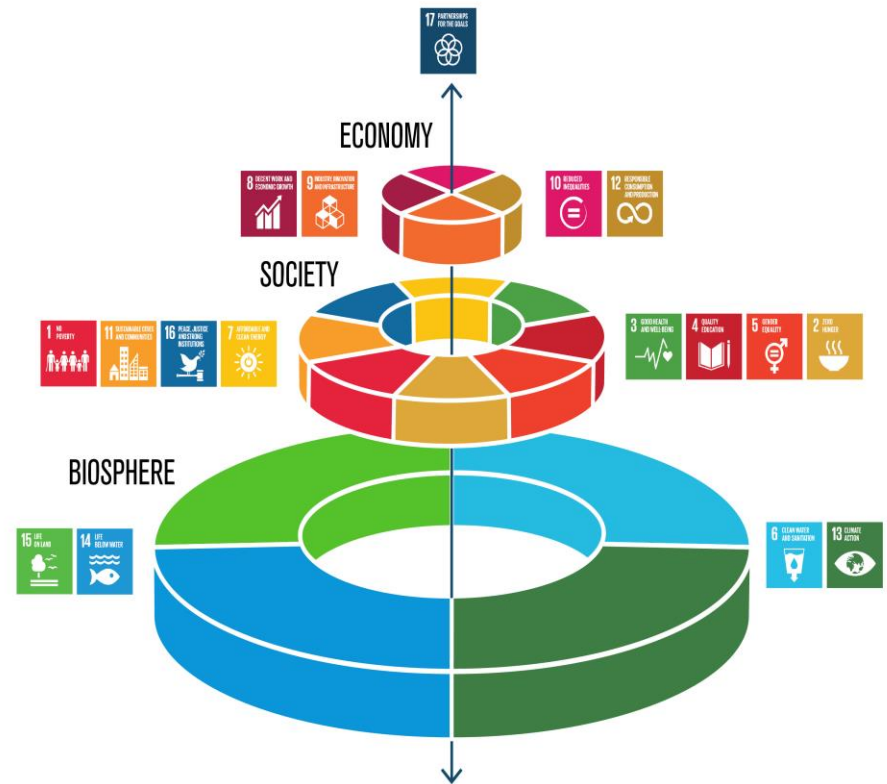
The United Nations Call to Action

2000 -> 2015



8 Millennium Goals

2015 -> 2030 Agenda



17 Universal and Systemic Goals

2030 Agenda offers the world a plan for saving the Earth. Although critical and urgent, the task is extremely complex

It means meeting four objectives at the same time.

- Social progress which recognizes the needs of everyone
- Effective protection of the environment
- Prudent use of natural resources and
- Development and maintenance of high and stable levels of economic growth and employment

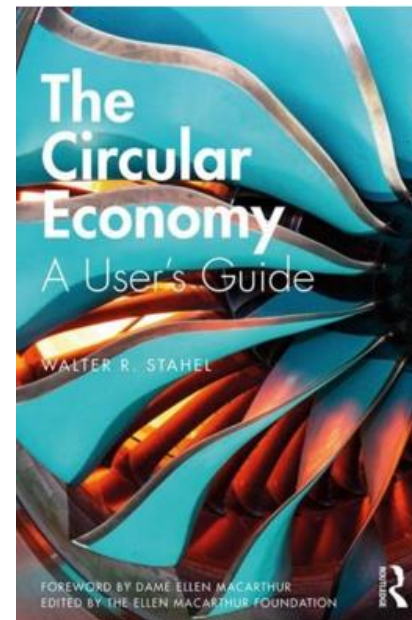


*Which economic model ?
What kind of innovation ?*

A new economic model – the circular economy

Walter R. Stahel

- Swiss architect (ETH Zurich)
- Founder-director of the Product-Life Institute, Geneva
- Member of the Club of Rome



What influences the circular economy and what is influenced by the circular economy

- The coming resources' price paradigm shift
- Last 100 years
 - prices for energy and materials have ***constantly decrease***
- In the 21st century
 - resources' prices ***will constantly increase***
- Resource ***security*** - a major political bone of contention

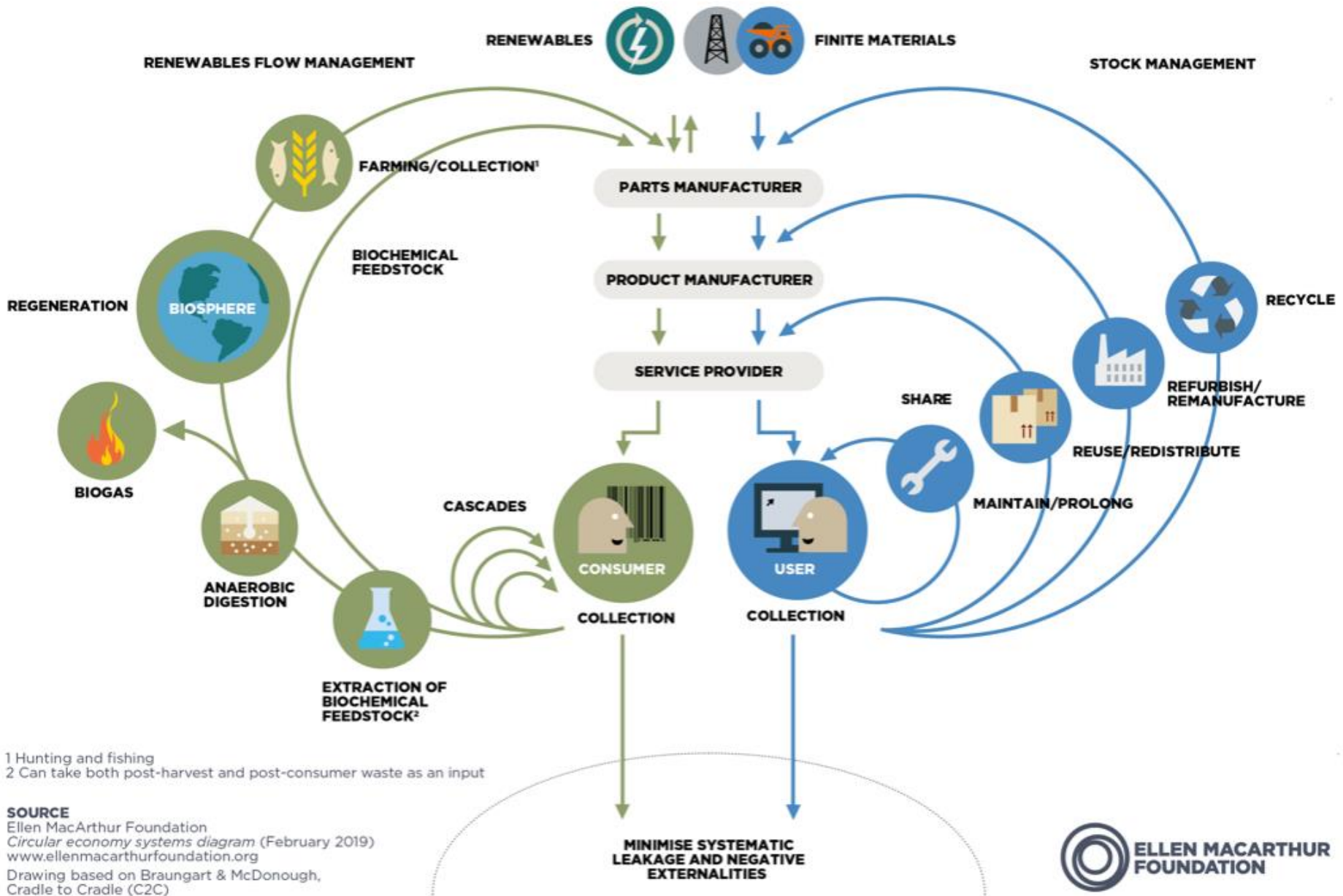
Circular Economy

A circular economy is a **systemic approach** to economic development designed to benefit business, society and the environment. In contrast to the “take-make-waste” linear model, a circular economy is **regenerative by design** and aims to gradually **decouple growth from** the **consumption** of finite resources.

3 Principles:

- Design out waste and pollution
- Keep products and material in use
- Regenerate natural systems





1 Hunting and fishing
 2 Can take both post-harvest and post-consumer waste as an input

SOURCE
 Ellen MacArthur Foundation
Circular economy systems diagram (February 2019)
www.ellenmacarthurfoundation.org
 Drawing based on Braungart & McDonough,
 Cradle to Cradle (C2C)

Strategies for Circular Design

1. Designing for inner loops

- Inner loops – Reuse, sharing, remanufacturing, and refurbishment
- Outer loop – Recycling
- The closer the loop to the center, the most valuable

2. Moving from products to services – Is ownership really necessary?

- Shift from ownership to access
- Rental, pay per use, subscription, sharing, leasing

3. Product life extension – design products that last

- Design product to be both physically and emotionally durable

4. Safe and circular material choices

- Some materials contain chemicals that are hazardous to humans or the environment

5. Dematerialisation - reduce the resource requirements of your designs

- Dematerialized packaging – employ durable, reusable containers rather than single-use packaging

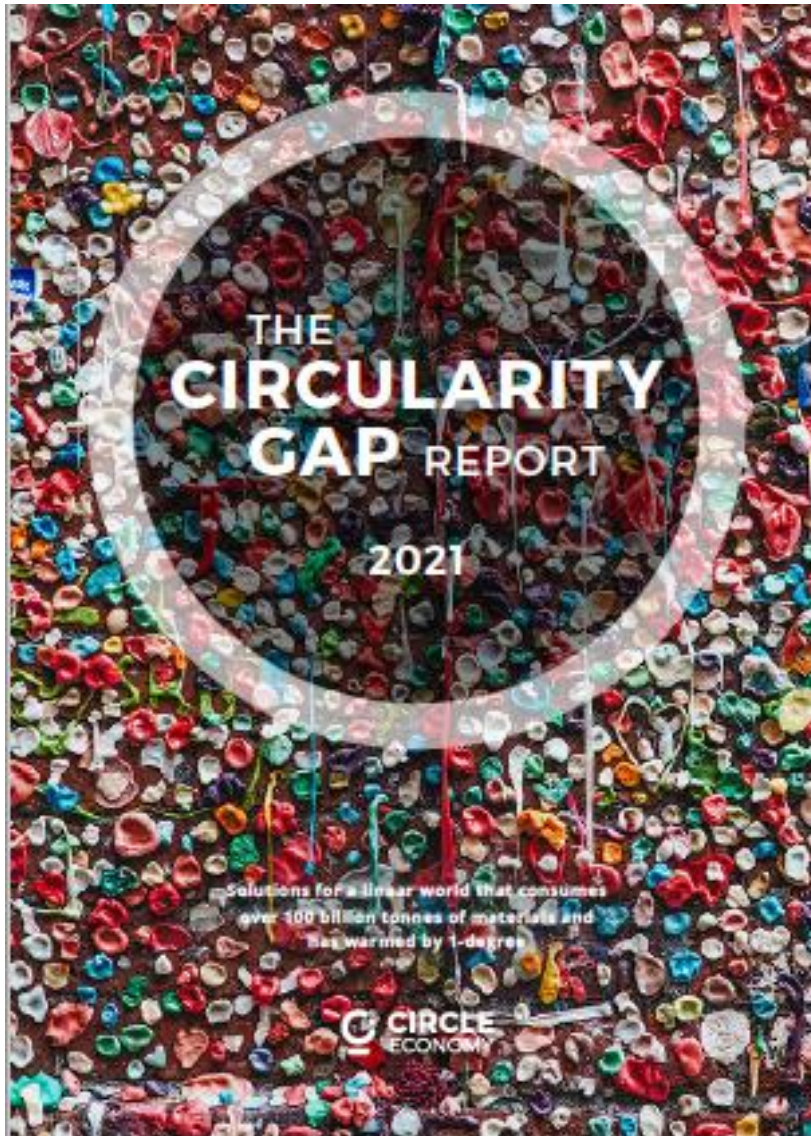
6. Modularity – design for upgradability and repair

Circular models - Challenges

- Need to maintain control over resources
- Products to be tracked and returned
- Manpower and skills (repair, refurbish, remanufacture)

Circular models - Opportunities

- New product-service system model to keep products in use
- Leasing, renting, pay per use, performance-based models



- In 2018
 - 9.1% circular economy
 - Of all the fossil fuels, minerals, metals and biomass that enter the economy each year, just 9.1% are cycled back
 - Doubling it to only 18% could close the emission gap
- In 2021 – Trending Down !
 - 8.6% of circularity
 - Due to unbridled economic growth