KEREN HAYESOD קרן היסוד
UNITED ISRAEL APPEAL

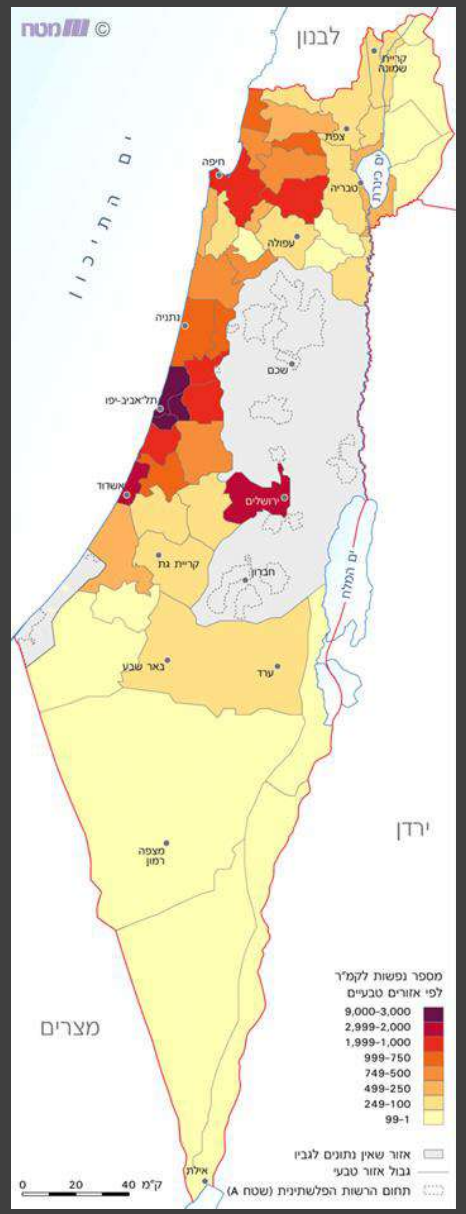
# ntroduction
# Waste Management in Israel

Tamir Arviv

# Today

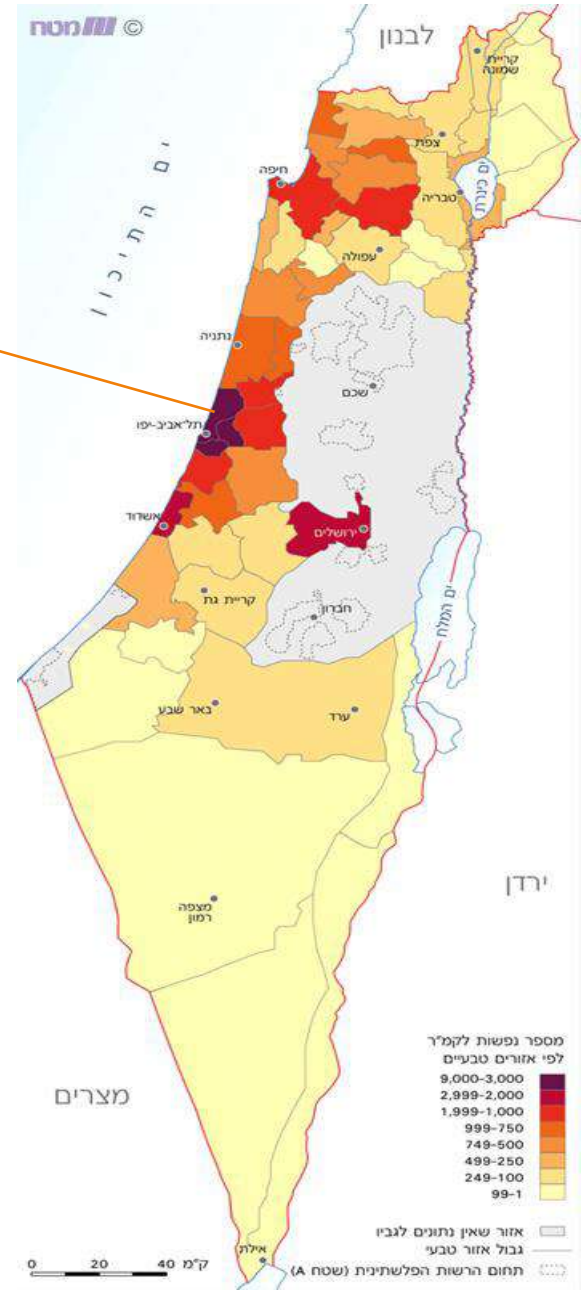
- Introduction
- Israel – geography and demography (briefly)
- Generation, disposal and treatment of Solid Waste in Israel
- Israel's Waste Management Strategic Plan
  - 'Circular Economy'
  - Material efficiency opportunities

# ISRAEL




# Israel’s population: 8.79 million (2021)

92% are living in urban area




347 people per km$^2$

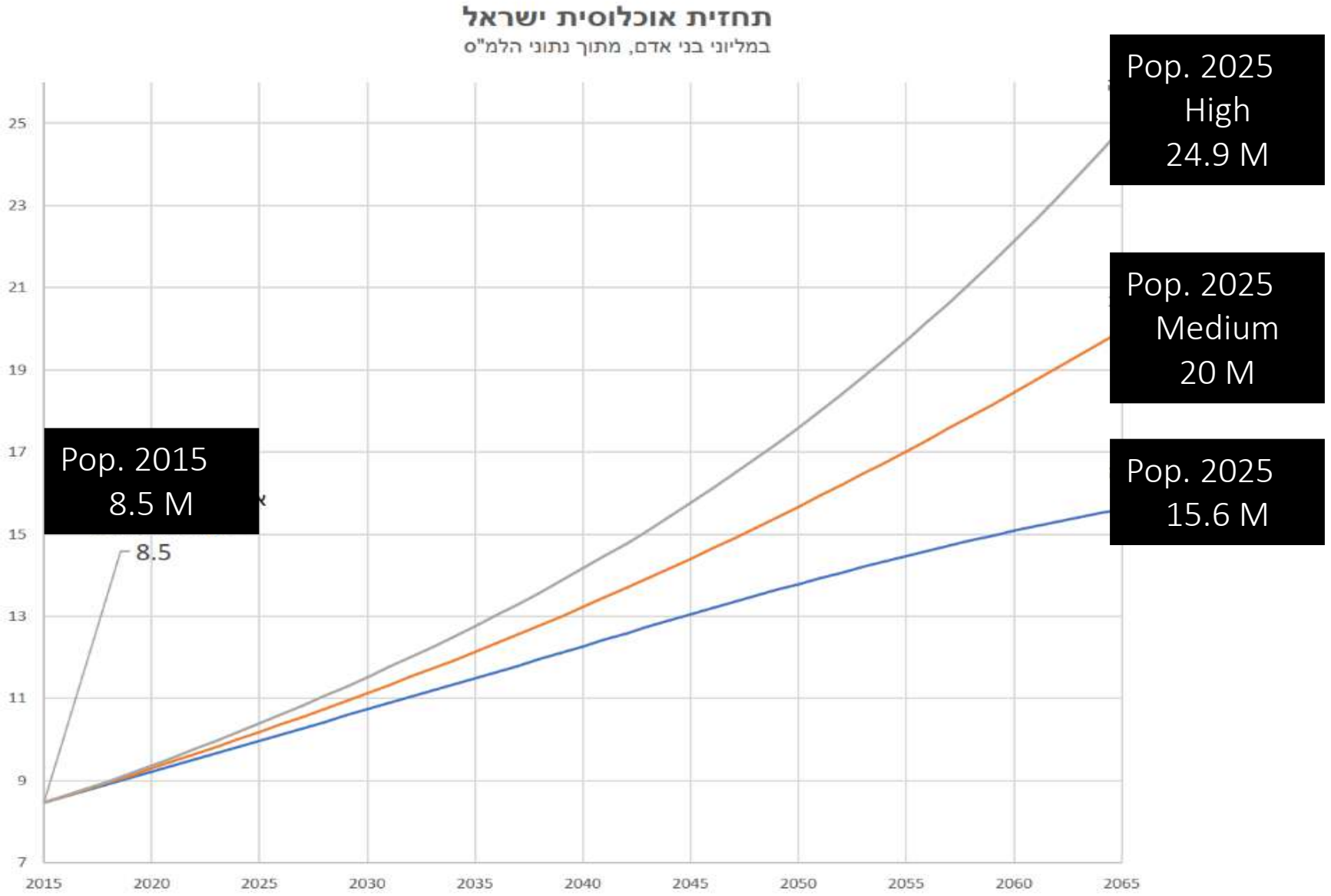
10 times denser than the average of the OECD countries .

Southern areas (2008): 45.2 people per km$^2$.

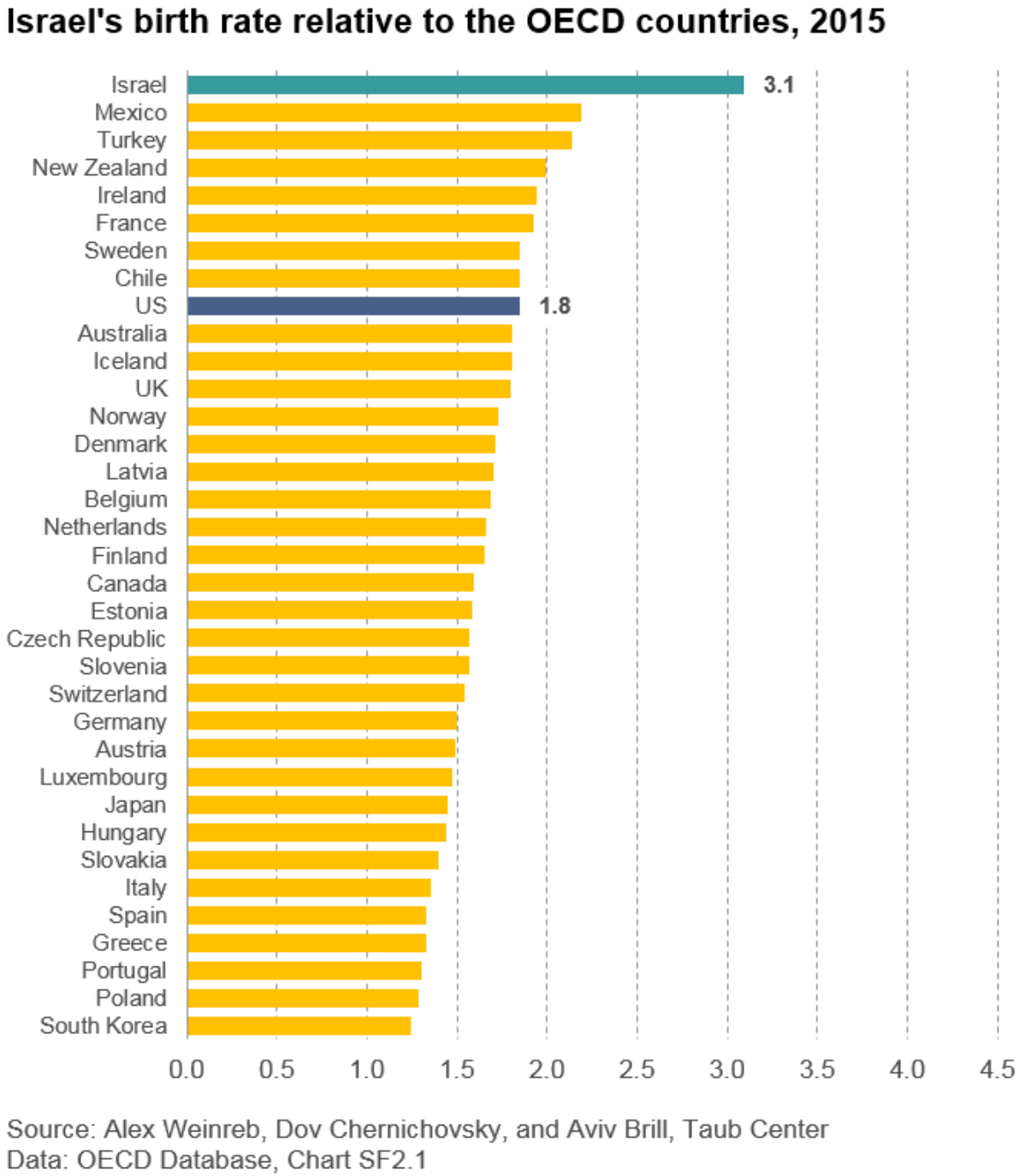
Central and northern areas (2008): 710 people per km$^2$

**Tel Aviv area (2011): 7,522 people per km$^2$**

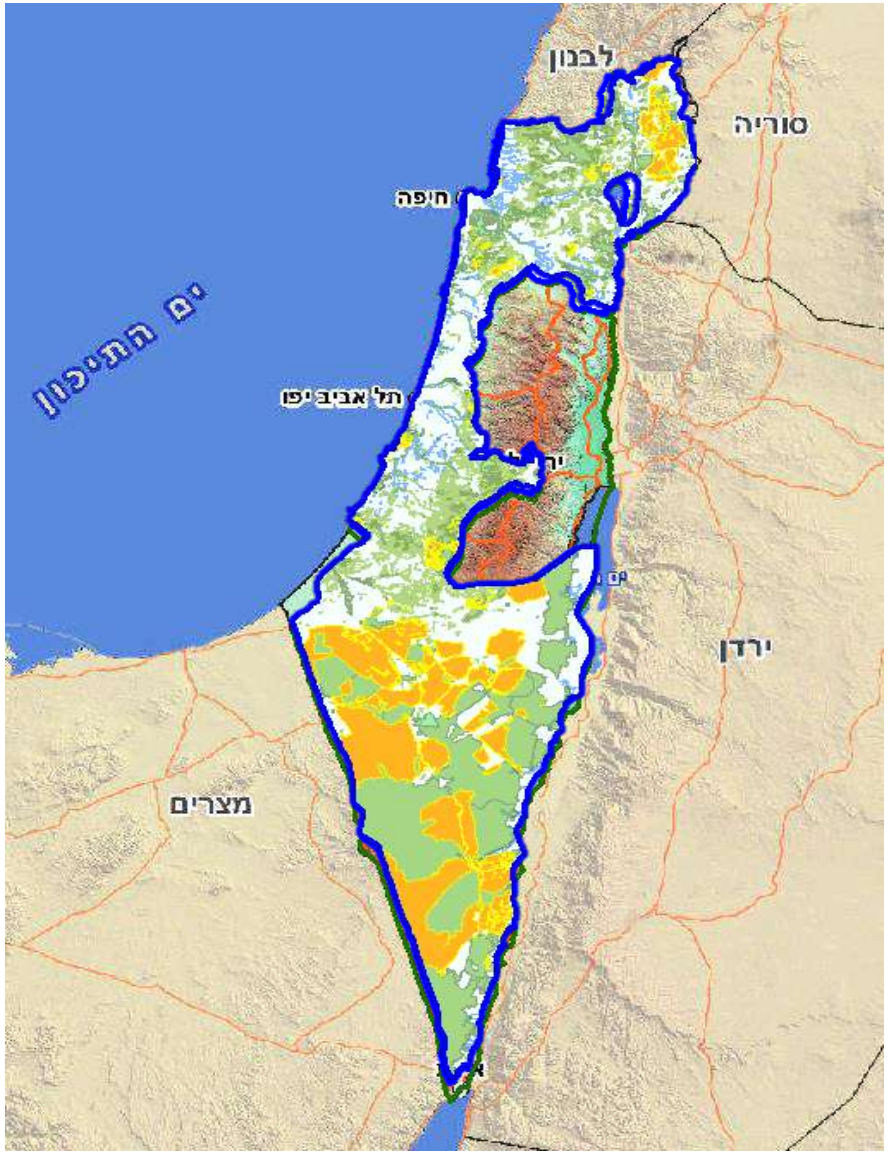
# Israel's population will number 15-25 million by the year 2050, making it the most crowded country in the OECD



- **High natural growth rates**
  - Total fertility rate: 3.1 children family (1.6 western countries)
- Commitment to the continuing absorption of immigrants.



# Land available for planning and development




- Israel's total land area: 22,145 $km^2$
- Protected open space: 7,281 $km^2$
- Built-up areas: 1,241 $km^2$
- Beaches, infrastructure, etc.: 7,381 $km^2$
- Military firing zones: 4,693 $km^2$

**Land available: 1,550 $km^2$**

About 7% of Israel's total land area

# Land-cover conversion

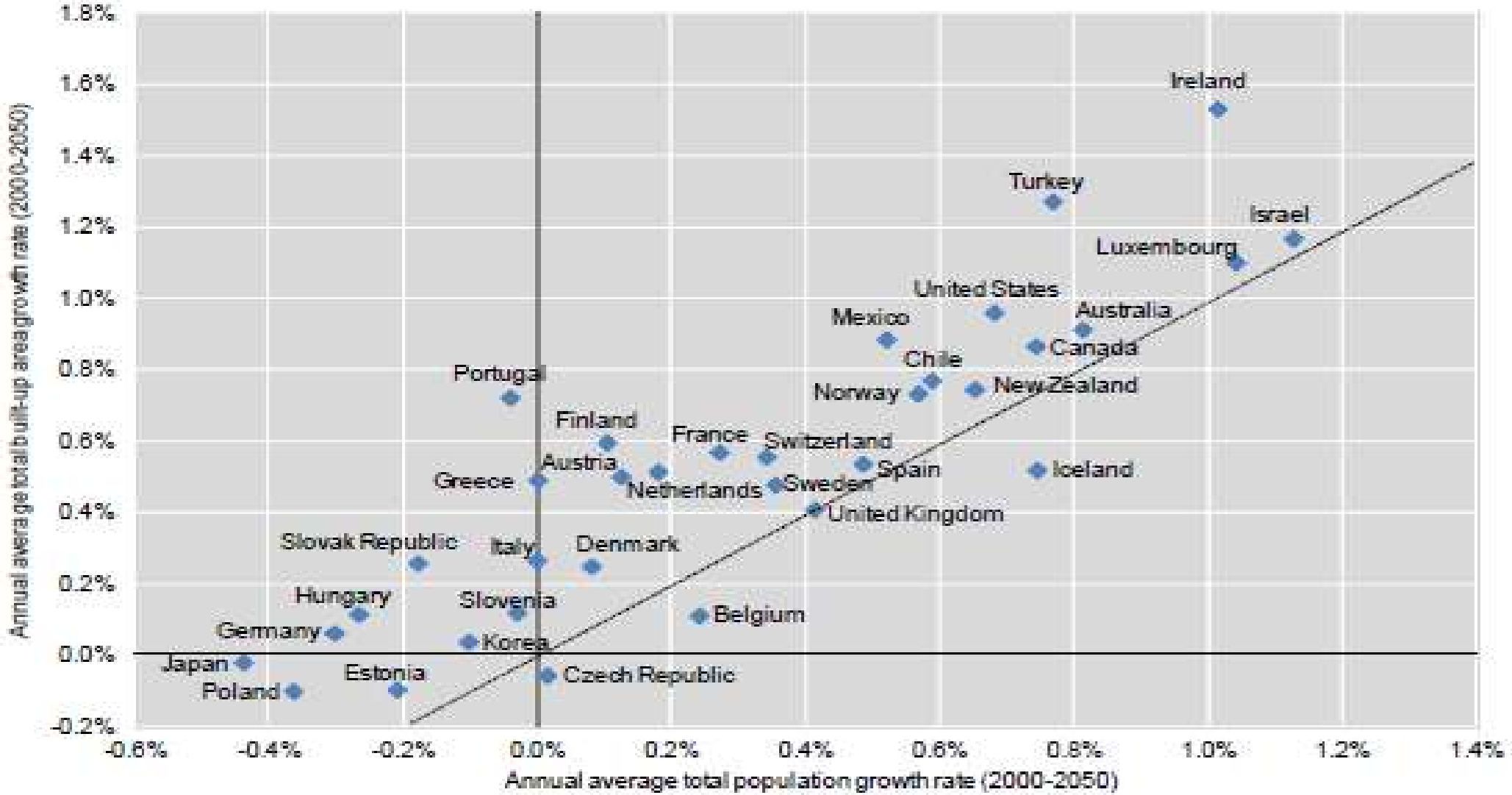
- **The rate of land-cover conversion between 2014-2017 was the highest in the last 20 years!**
  - 55 $km^2$ were converted from open landscape into built-up areas.
  - 53k $km^2$ were converted from natural landscapes and planted forests into Agricultural lands.

מוזיאון הטבע שטיינהרדט

המארג הערכת מצב הטבע

**דו"ח מצב הטבע ישראל 2018**

## Figure 1.6. **Population and built-up area growth rate in OECD countries, 2000-2050**



# WASTE MANAGEMENT

## How many planets we'd need if everyone lived like a resident of the following:

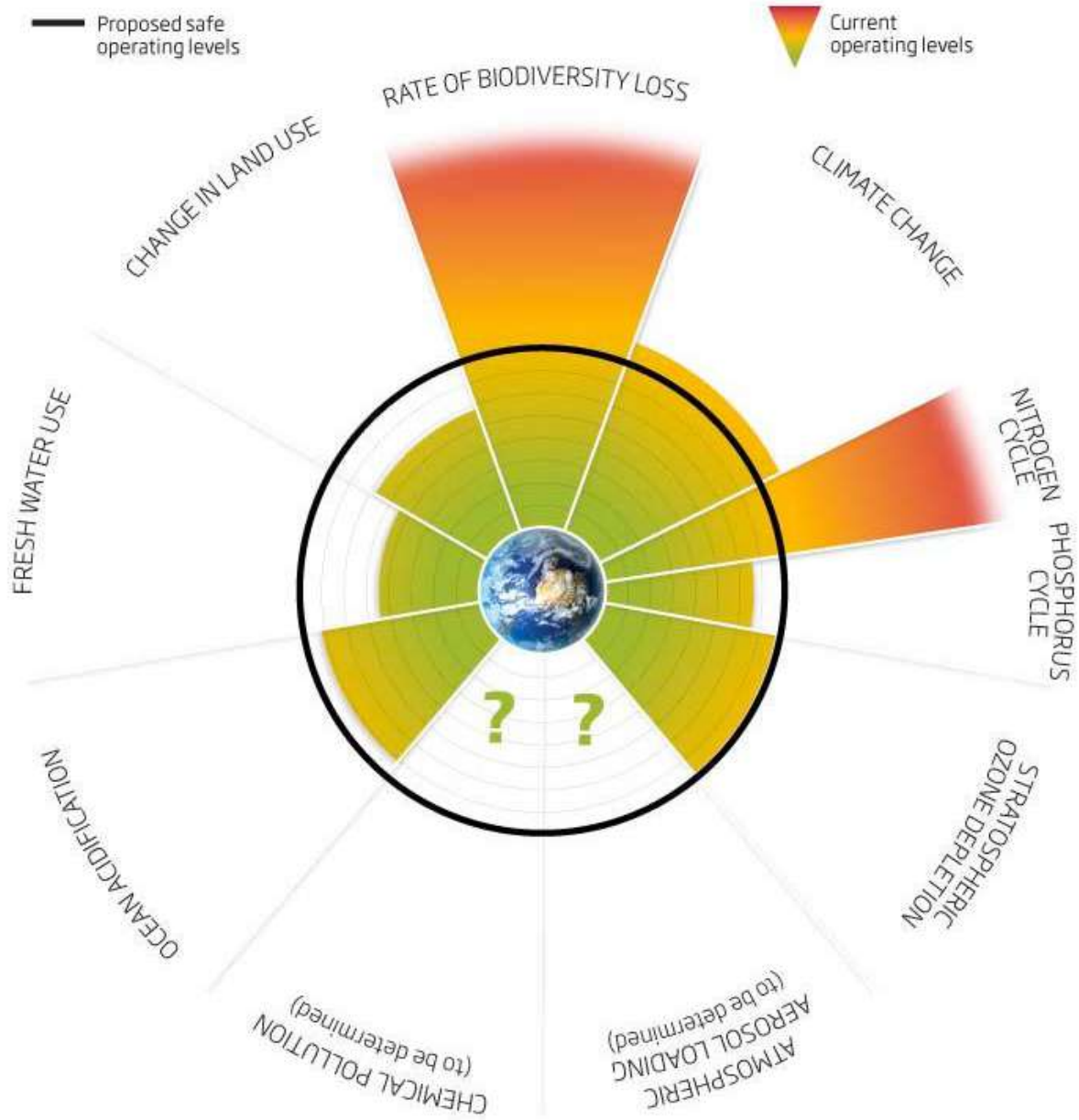
| Balanced Budget | | Global Deficit |
|---|---|---|
| **USA** 5 Planets |  |  |
| **UK** 3.4 |  |  |
| **Argentina** 1.7 |  |  |
| **South Africa** 1.5 |  |  |
| **China** 1.0 |  | |
| **India** 0.4 |  | |
| **World Average** 1.4 |  |  |

Credit InfoGrafik.com

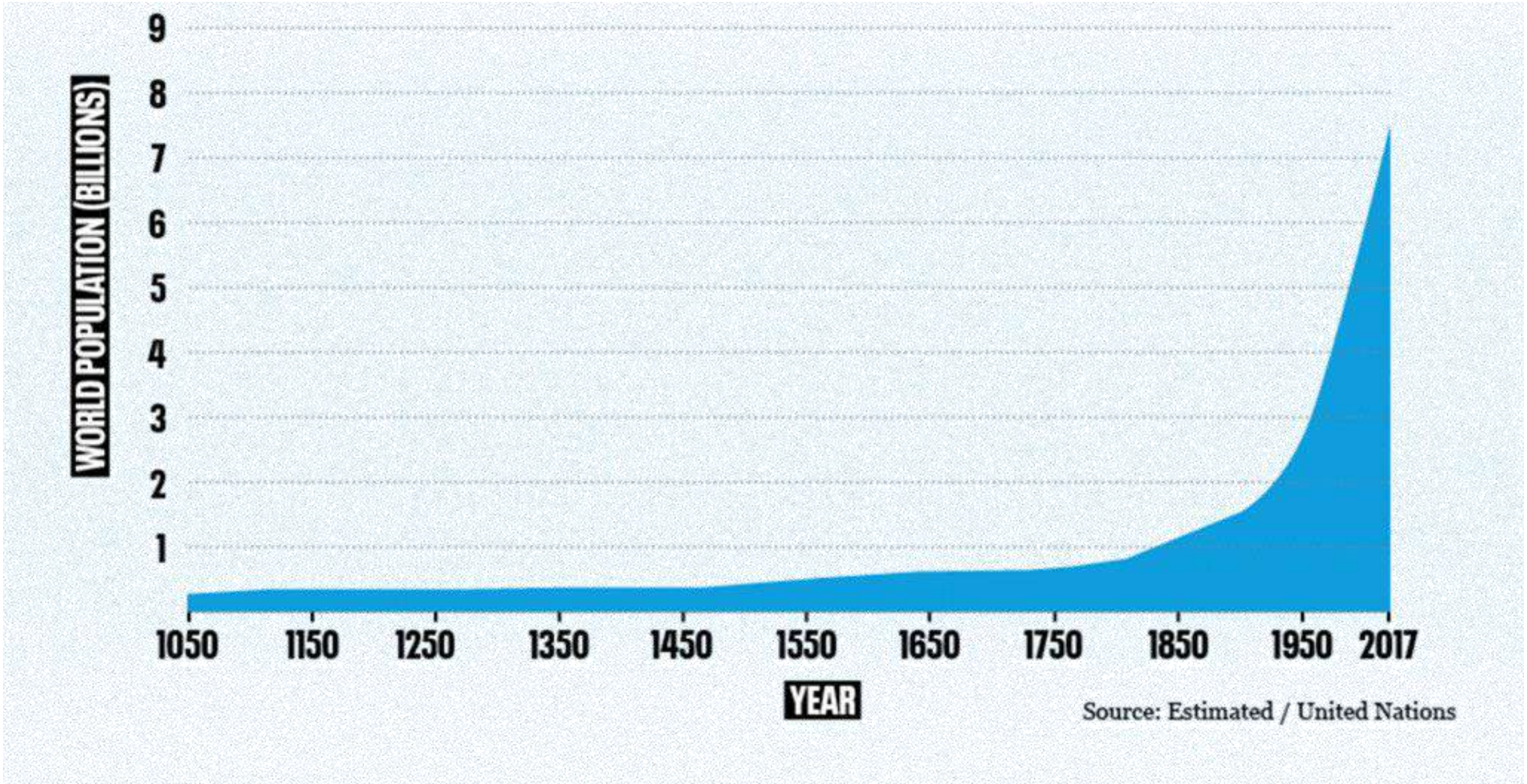
## Beyond the boundaries



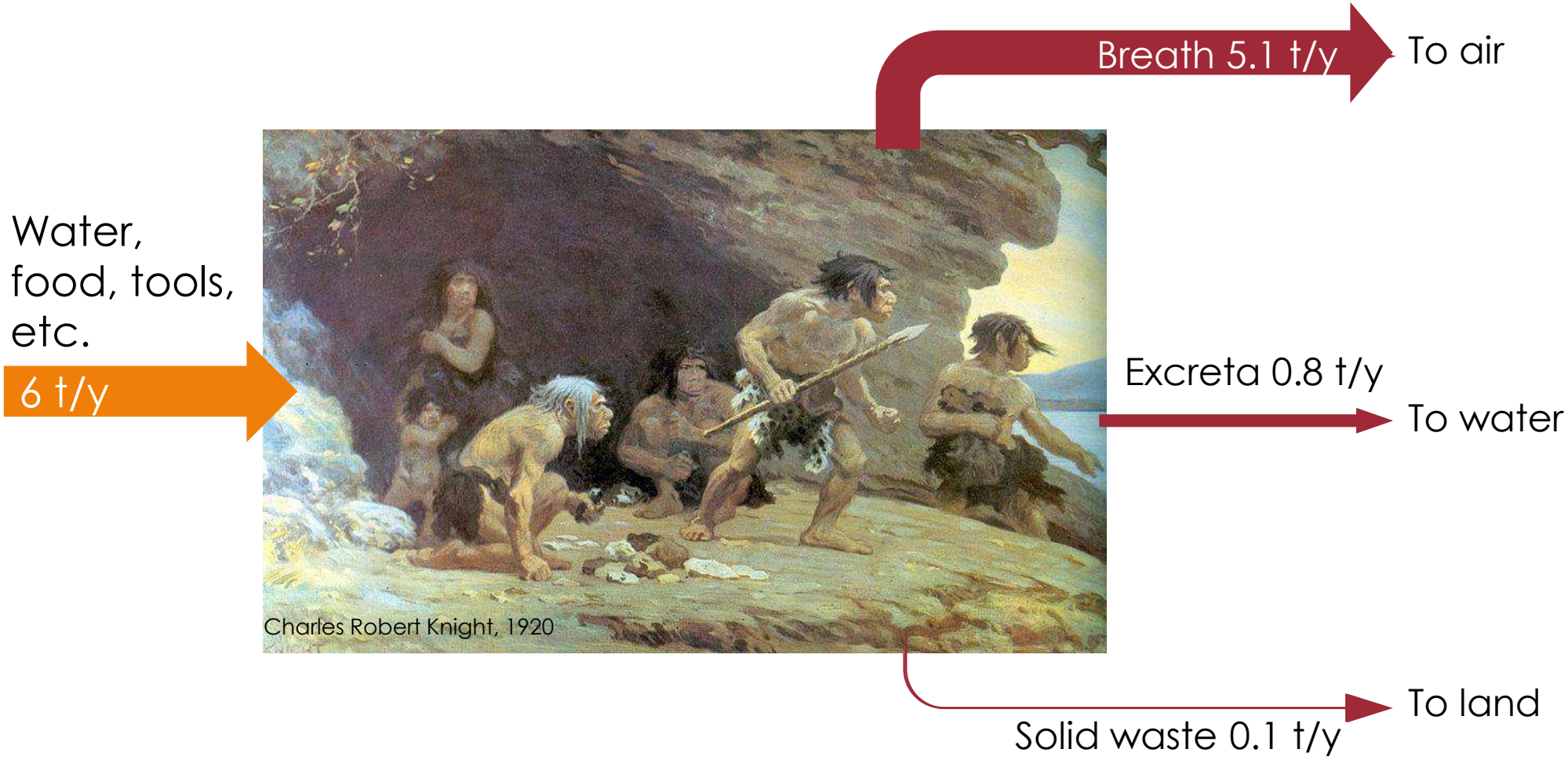
We have already overstepped three of nine planetary boundaries and are at grave risk of transgressing several others



# How did we reach this?

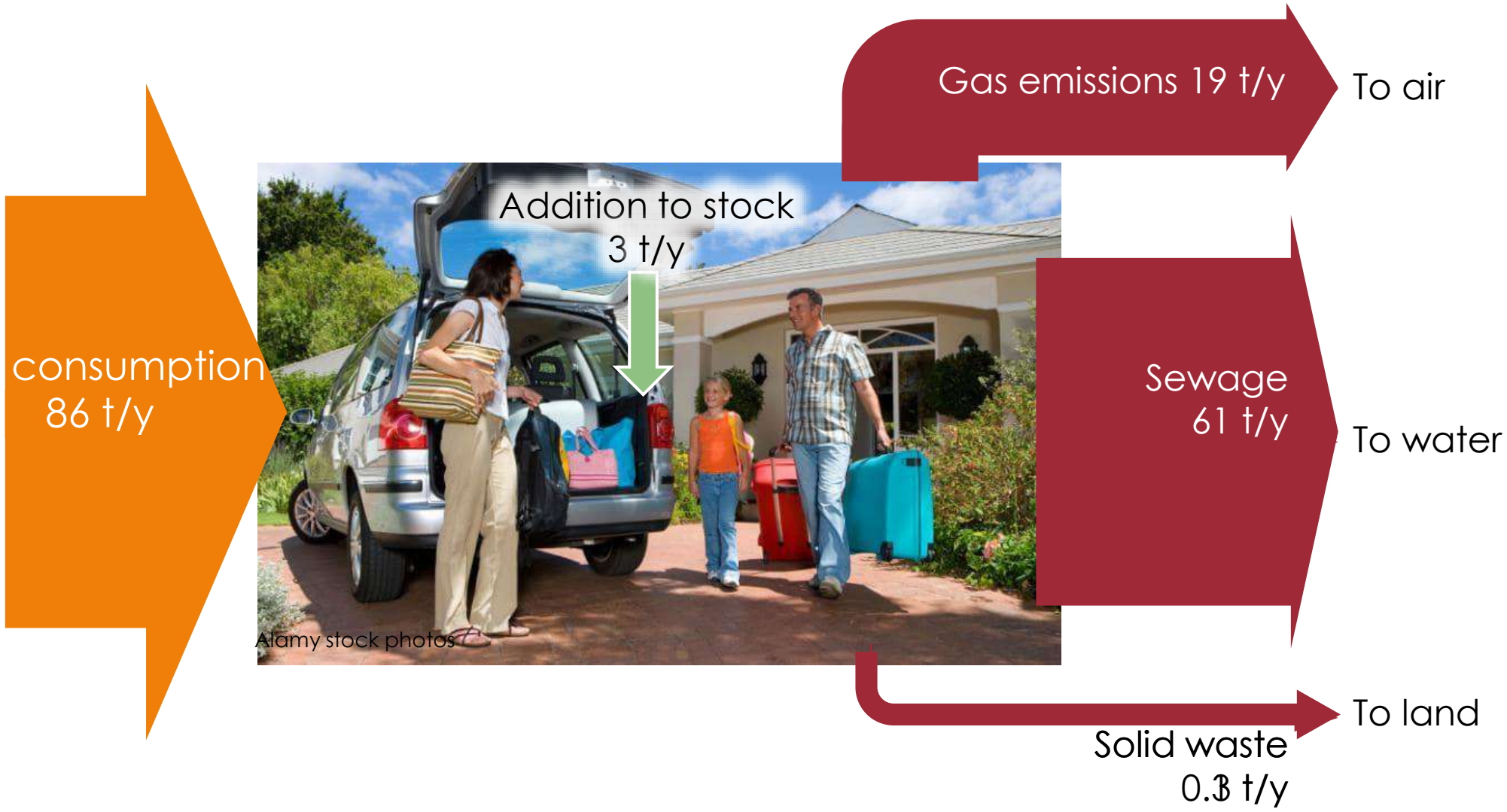

WORLD POPULATION (BILLIONS)
9
8
7
6
5
4
3
2
1
1050
1150
1250
1350
1450
1550
1650
1750
1850
1950
2017
YEAR
Source: Estimated / United Nations

# Prehistoric times




Brunner, P.H., Rechberger, H., 2004. Practical handbook of material flow analysis

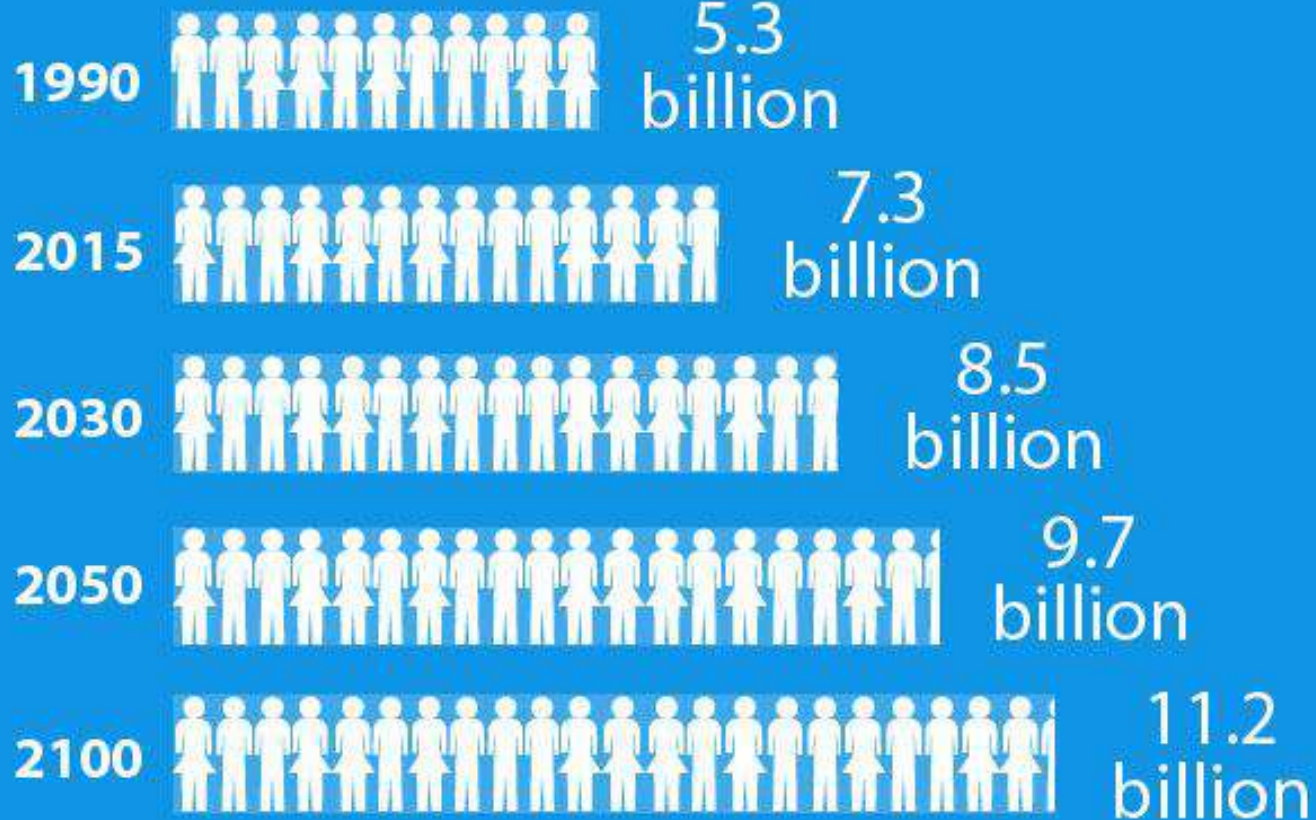
# Modern times




Brunner, P.H., Rechberger, H., 2004. Practical handbook of material flow analysis

# World Population

*Projected world population until 2100*




Source: United Nations Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision*
Produced by: United Nations Department of Public Information

2015 TIME FOR GLOBAL ACTION

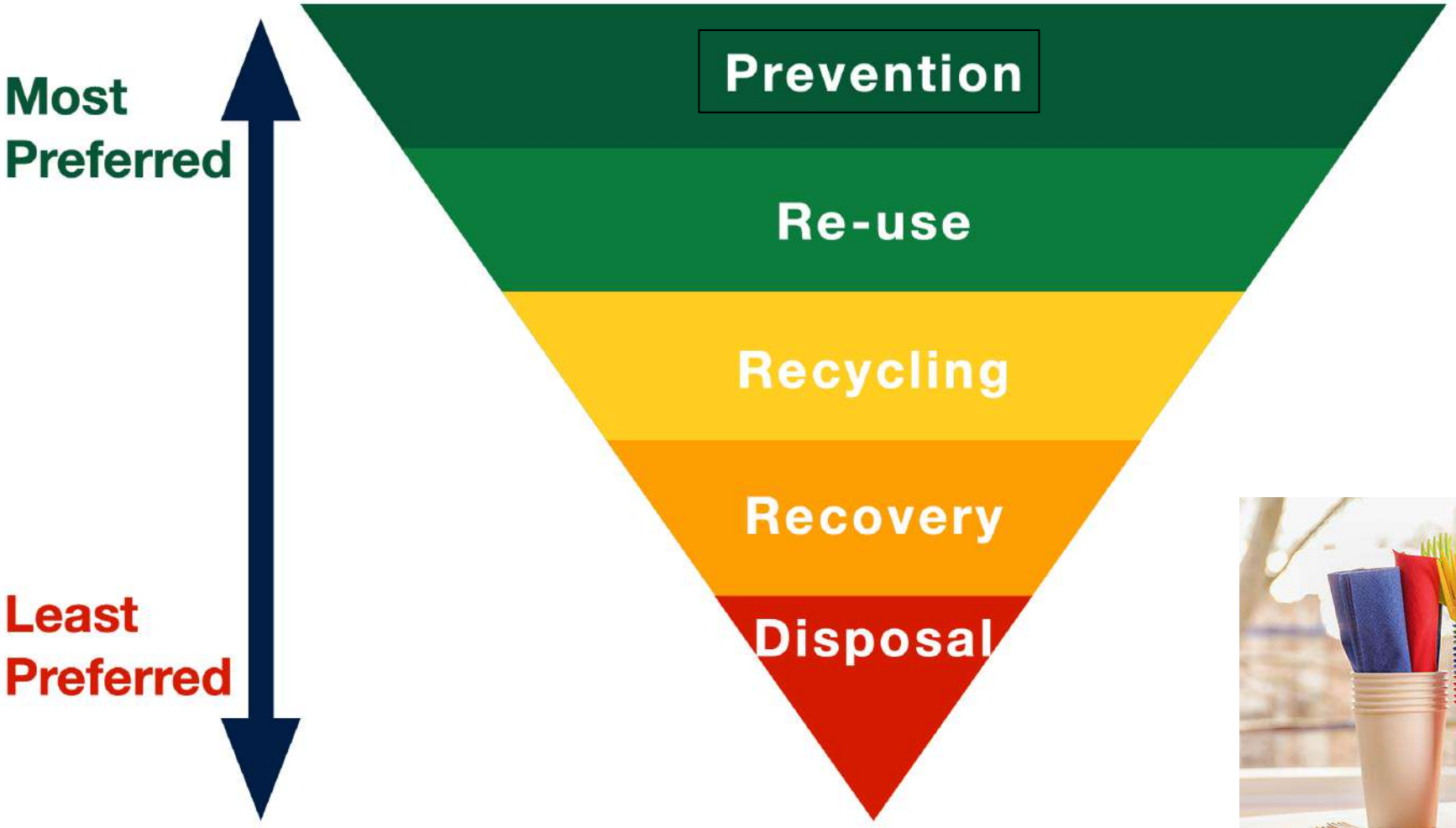

SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS


- 9.2 Promote inclusive and sustainable industrialization
- 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies.
- 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries


- 12.2 By 2030, achieve the sustainable management and efficient use of natural resources
- **12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse**
- 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
- 12.7 Promote public procurement practices that are sustainable
- 12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature
- 12.a Support developing countries to strengthen their scientific and technological capacity

https://sustainabledevelopment.un.org/

# The Waste Hierarchy





# The Waste Hierarchy


Most Preferred

Least Preferred

Prevention

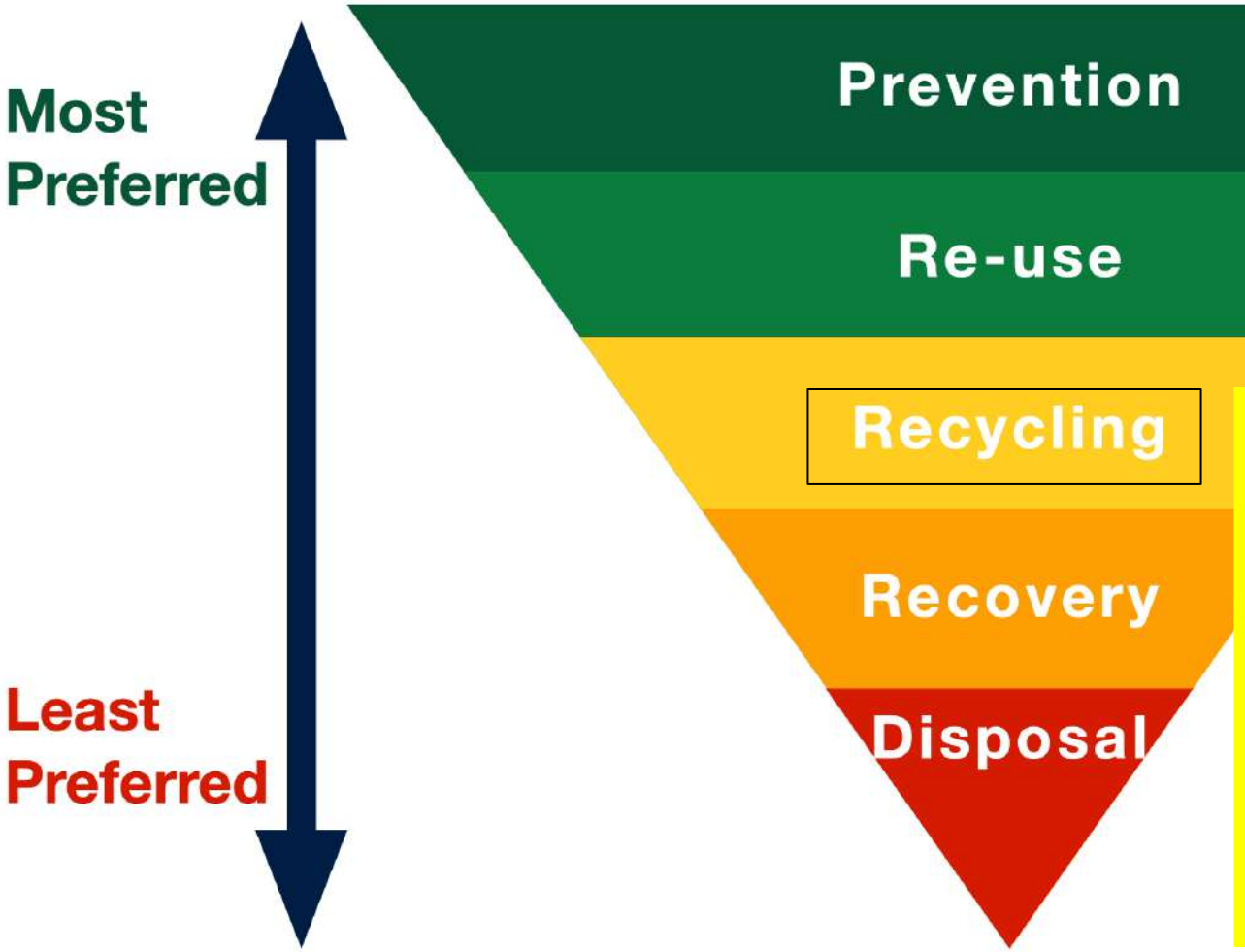
Re-use

Recycling

Recovery

Disposal

# The Waste Hierarchy





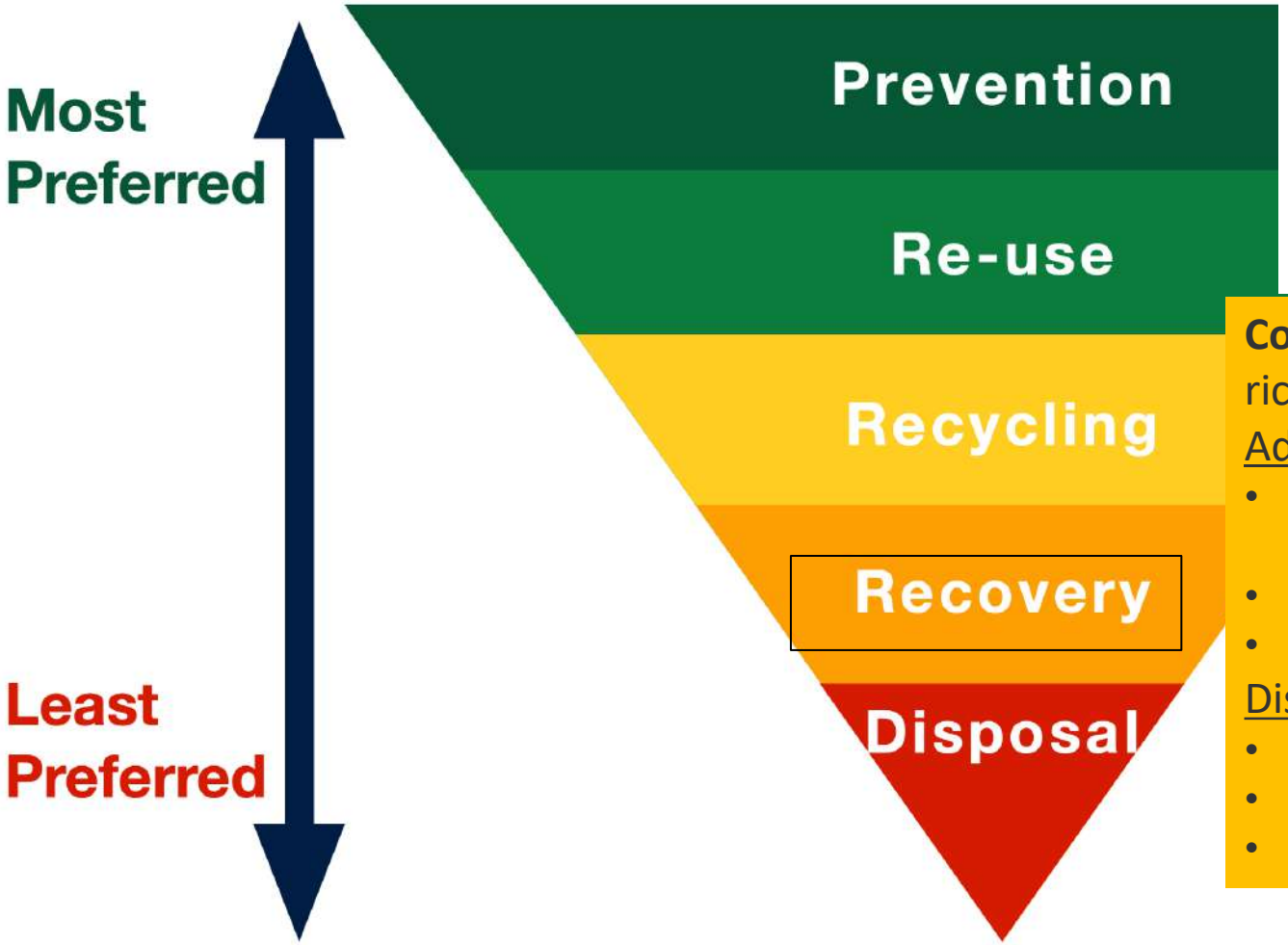
Advantages:

- Conservation of resources
- Supply of raw materials to industry
- Reduction of waste disposal to incineration & landfill

Disadvantages:

- Emissions from recycling process
- Recycling sites are unhygienic, unsafe and unsightly (odours, noise, vermin nuisance)

# The Waste Hierarchy





**Composting** (turning organic wastes into nutrient-rich food for plants).

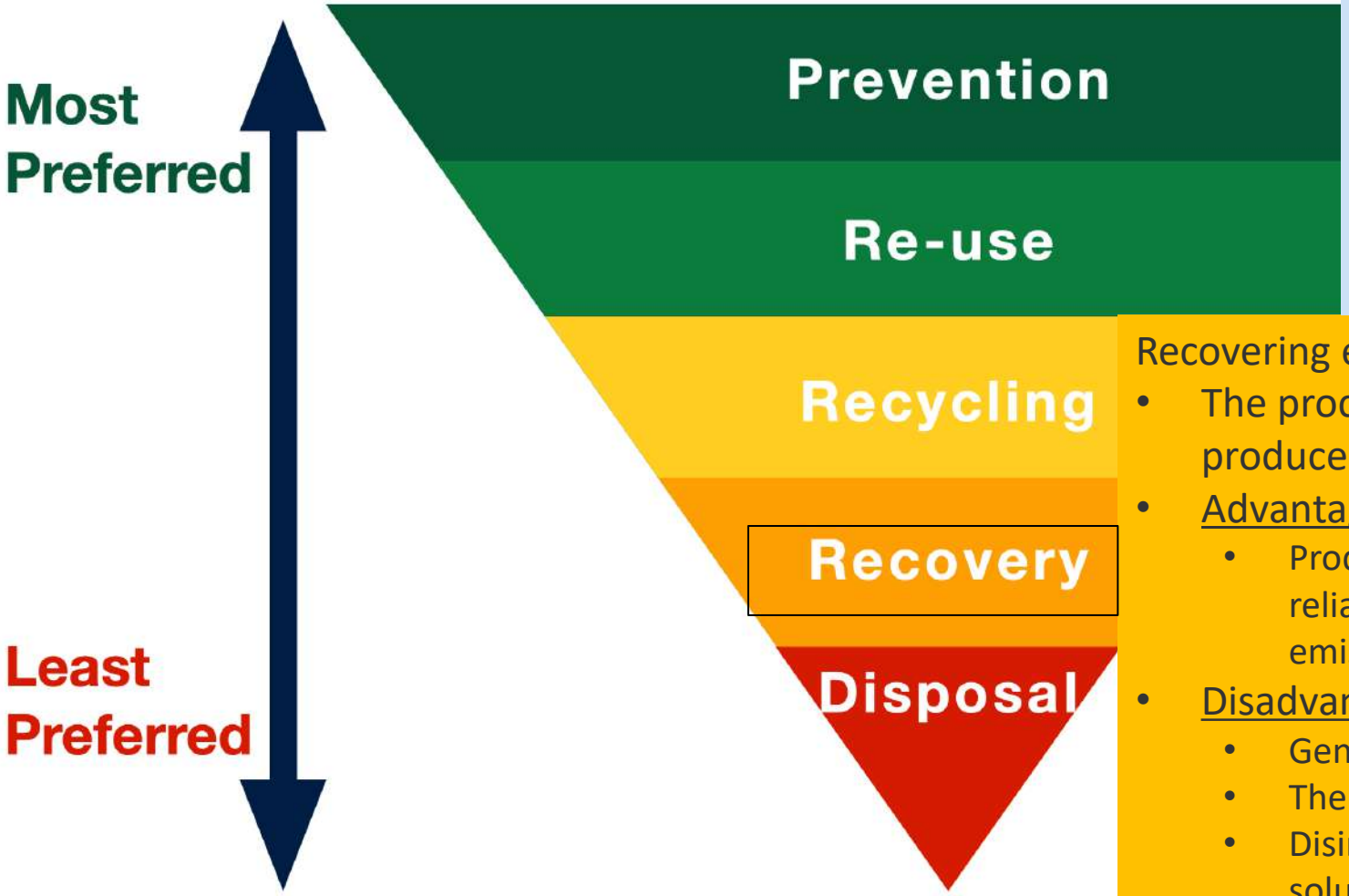
Advantages:

- Recovery of useful organic matter for use as soil amendment
- Employment opportunities
- Reduction of waste disposal to incineration & landfill

Disadvantages/challenges:

- Unpleasant smell (neighbours may complain)
- May attract rats, snakes and bugs.
- Involves plenty of work and needs some monitoring.

# The Waste Hierarchy





Recovering energy ("**waste to energy"/WtE)**

- The process of incinerating non-recyclable waste to produce electricity.
- Advantages:
  - Produces energy for electricity generation (reduces reliance on fossil fuels and decreases carbon emissions).
- Disadvantages:
  - Generates pollution and particulates.
  - The destruction of useful materials.
  - Disincentivizes more sustainable waste management solutions and renewable energy sources.

# Amager Bakke (Copenhill)

https://www.youtube.com/watch?v=pOqocj2h6EM

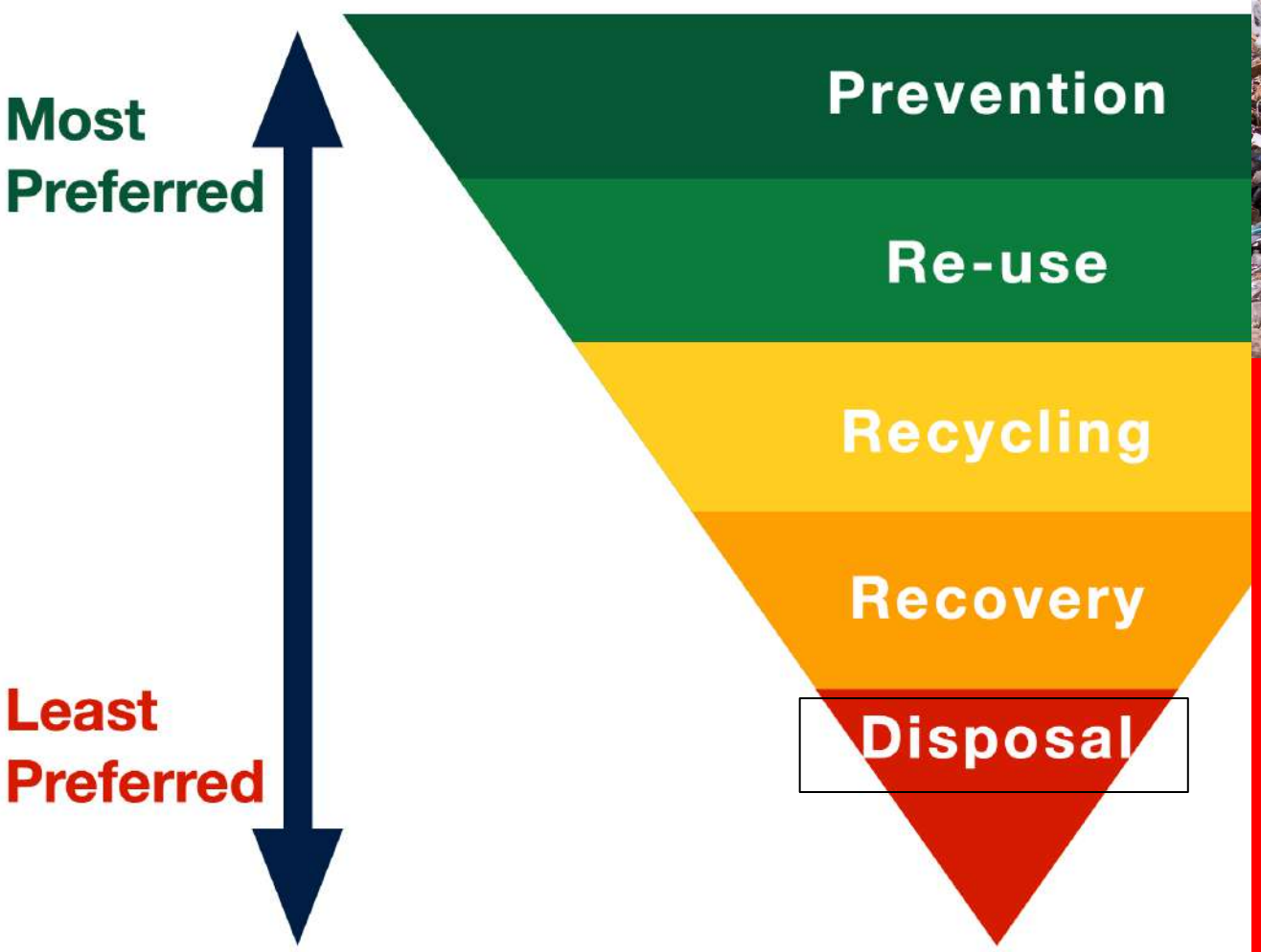
# Energy production 2020

**599,000**
tons of waste

Electricity sales
**244 GWh = 80,000 households**
(Annual consumption: 3,000 KWh per household)

District heating
**1,363 GWh = 90,000 apartments**
(Annual consumption: 15 MWh in an appartment of 75 m2)

# The Waste Hierarchy

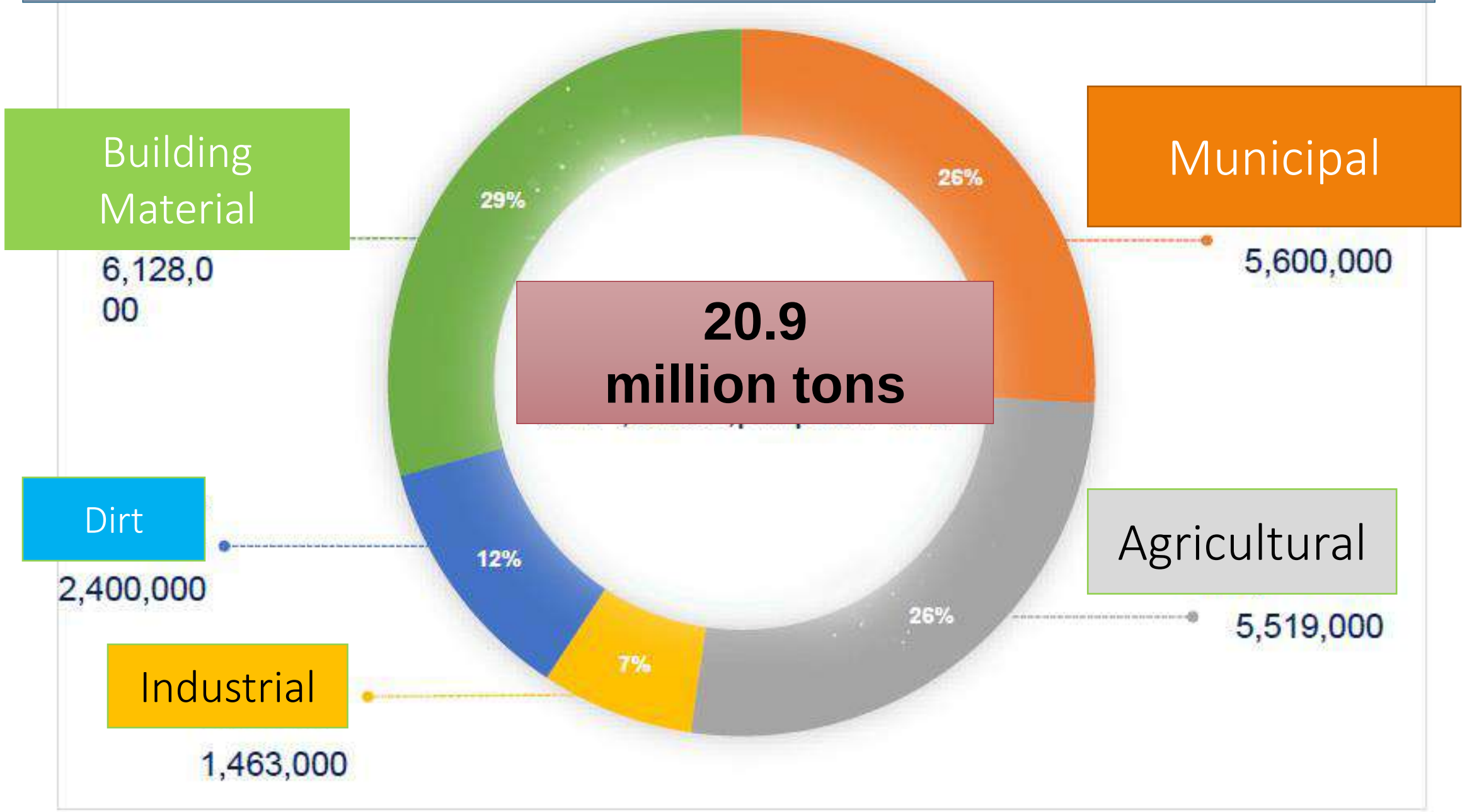



Advantages: Cheap + Support Jobs

Disadvantages:

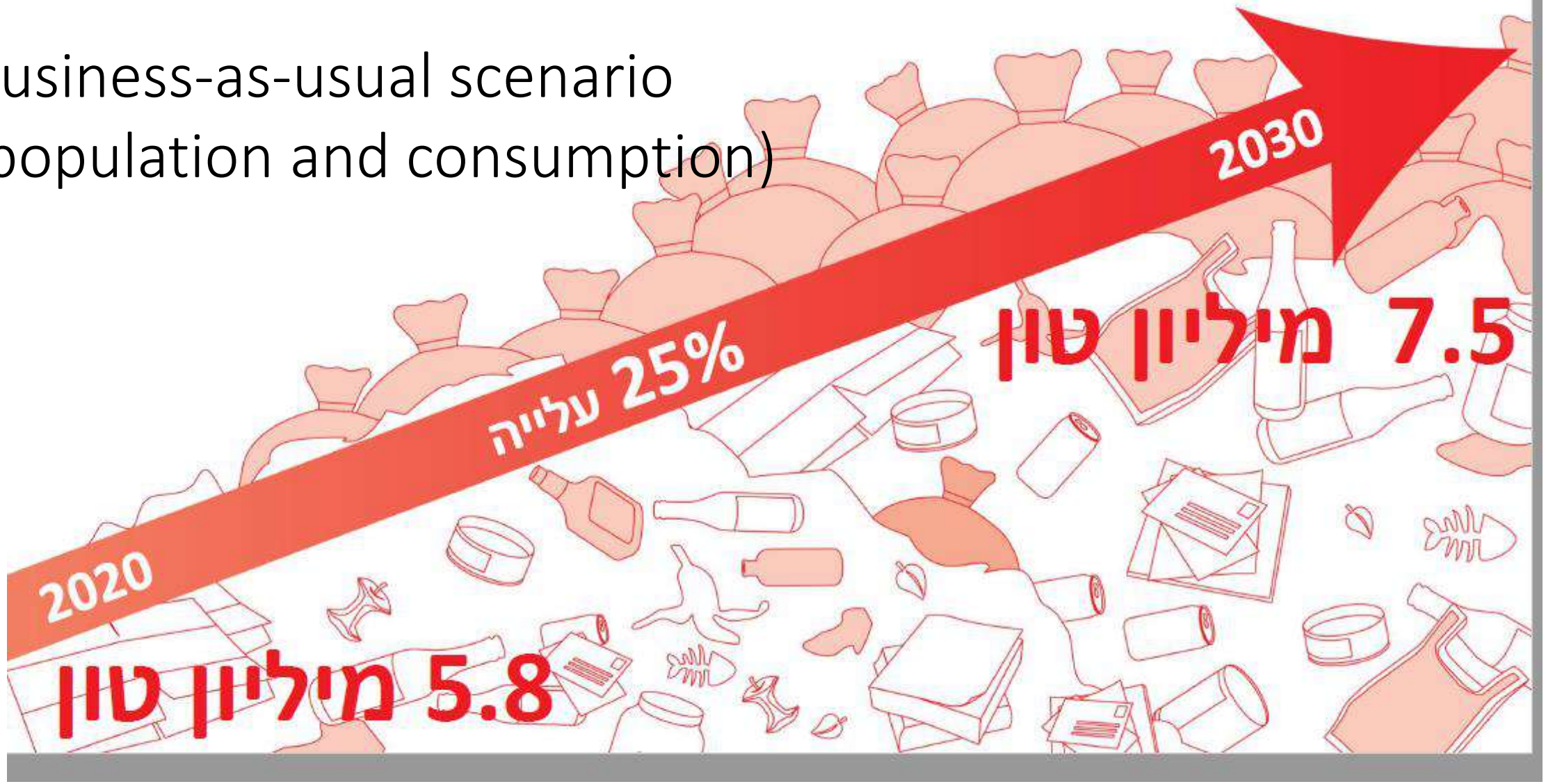
- Contribution to global warming: landfill gas contains methane and carbon dioxide.
- Methane is a highly inflammable gas
- Soil and water pollution: hazardous chemicals, gases, and toxins seep from landfills, get mixed with soil and groundwater.
- Affect Wildlife: certain birds and animals feed on landfill sites and ingest plastic, aluminum, drywall, and other materials.

# Solid Waste in Israel (2017)

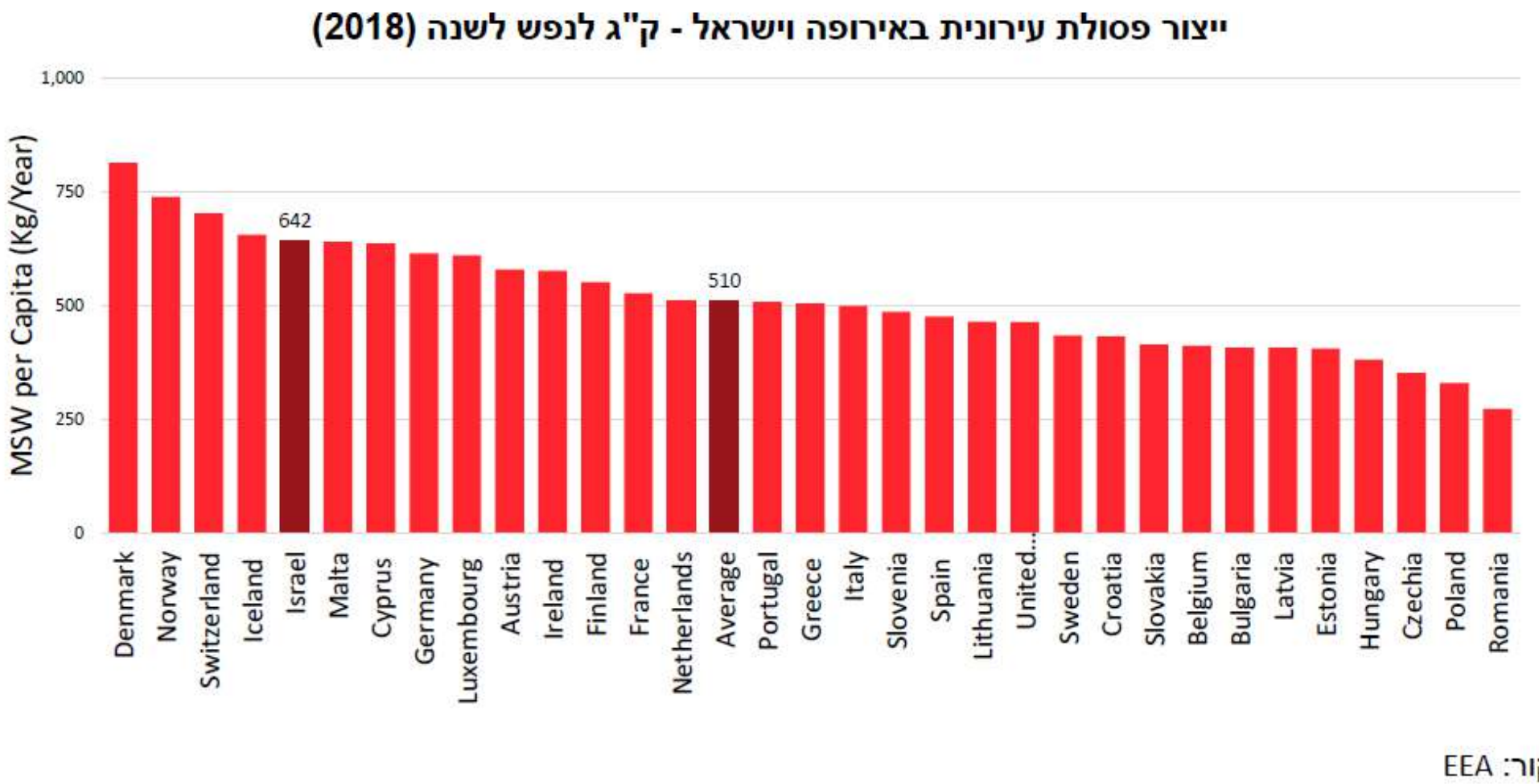


# Growth in **Municipal** Solid Waste (2030, ton per year)

Business-as-usual scenario
(population and consumption)



# Municipal Solid Waste per Capita



# Genertaion of  Solid Waste per capita (Israel vs. Europe)

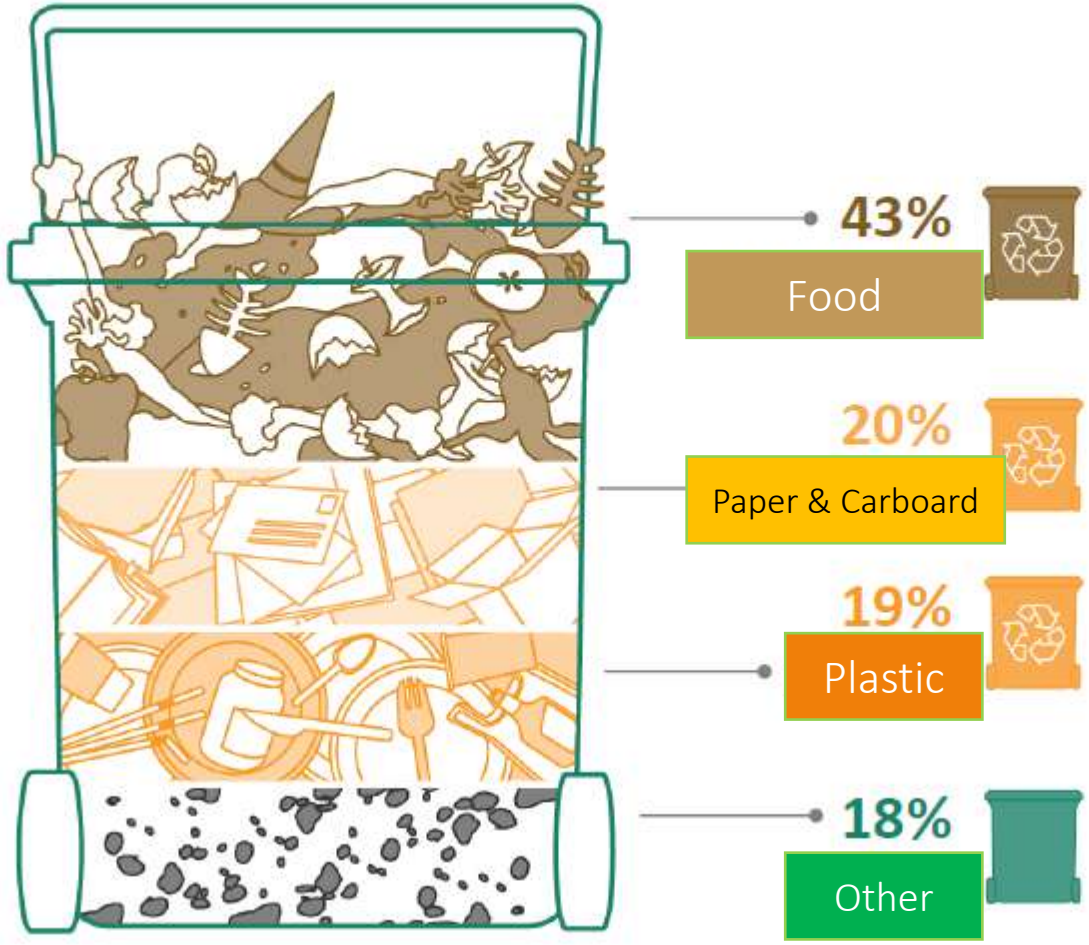
Europe **1.4%**

מגמת הירידה בכמות הפסולת השנתית **באירופה**


Israel **2.6%**

מגמת גידול הפסולת השנתית **בישראל**

# Municipal Solid Waste Composition



# Treatment of Municipal Solid Waste In OECD Countries


OECD 2019

https://stats.oecd.org/Index.aspx?DataSetCode=MUNW#

# Disposal of waste materials in Landfills

1996-2005: Closing 400 not regulated landfills

2006-2015: Landfill tax

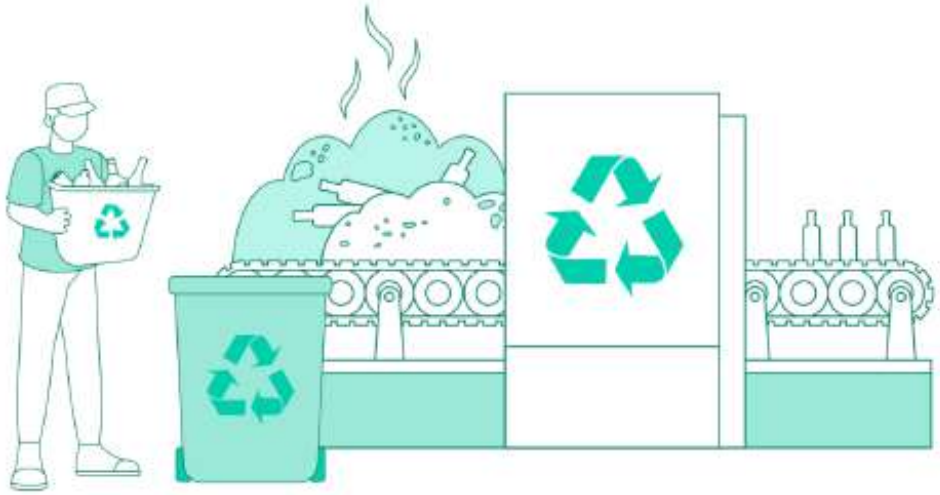
- 2007: 10 NIS (3€ )
- 2015: 108 NIS (31€ )

- 2006 onwards: 80%

# Recycling – Israel vs. Europe

Europe **46%**

**אירופה** - ממוצע העברה למחזור



Israel **14%**

**ישראל** - העברה למחזור

Including organic waste - 20%
(since 2006)

6% נוספים מסך הפסולת הם פסולת אורגנית ממוינת שמועברת לתהליך ייצוב ביולוגי (מוכר בלמ"ס כהעברה למחזור, לא מוכר כמיחזור לפי החקיקה האירופית)

# Recycling – Israel vs. Europe

Europe

**46%**

**אירופה** - ממוצע העברה למחזור

Israel

**14%**

**ישראל** - העברה למחזור

Including organic waste - 20% (since 2006)

Barriers:

- Lack of coordination
  - central and local governments
  - other stakeholders
- Regulatory instability
- Lack of planning, measurement and monitoring

# Israel's Solid Waste Management Strategic Plans

# Israel's Solid Waste Management Strategic Plan 2030 - Goals

Resource Efficiency (Circular Economy)

Reduce Environmental Impacts in Waste Treatment Chain Efficiency

Reduce Manufactured Waste


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

# The concepts of Circular Economy

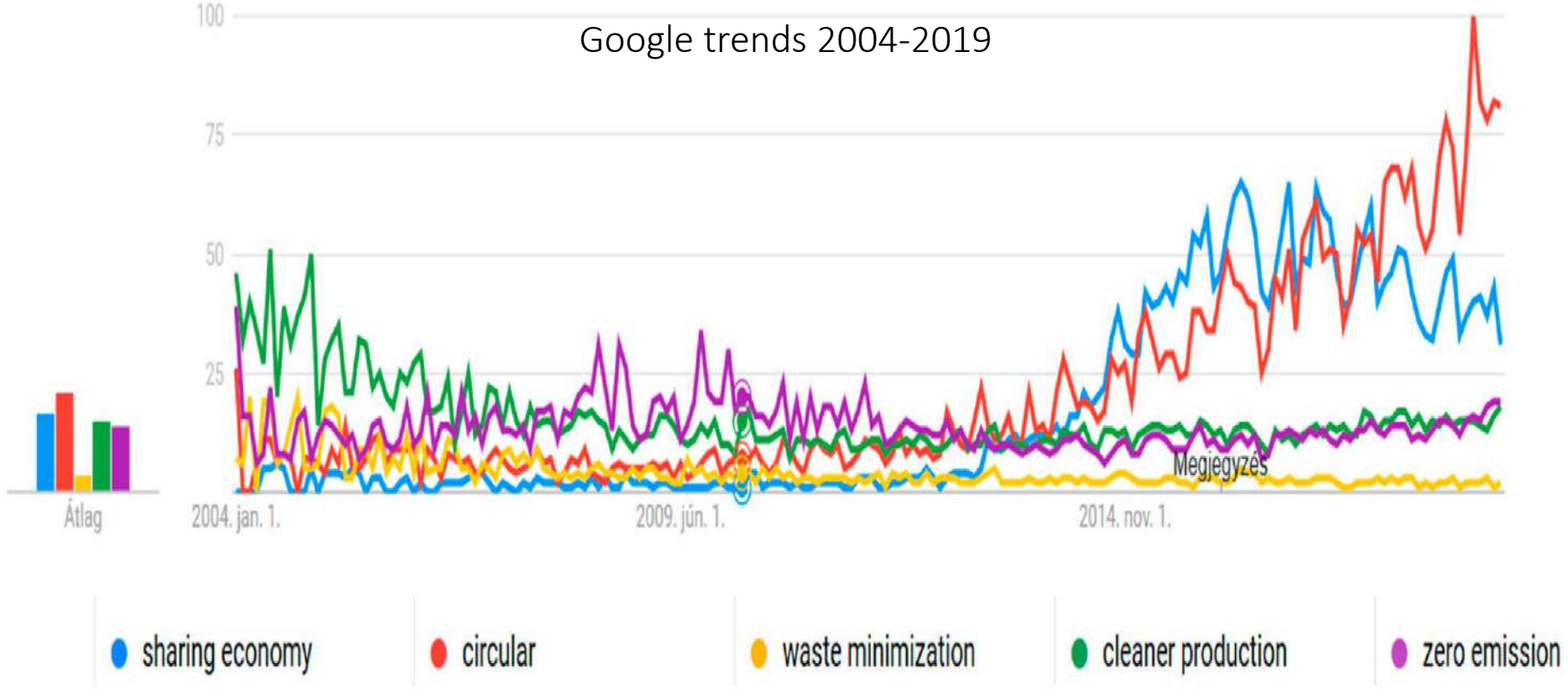
- Holistic approach: not just recycling or “zero waste” or “lower demand” – also redesign, reuse…..

- Recent surge in interest in no small part thanks to the activities of the Ellen MacArthur Foundation


https://ellenmacarthurfoundation.org/about-us/what-we-do

# The concepts of Circular Economy

- Lots of interest among consumers, producers, planners, and decision makers around the world.

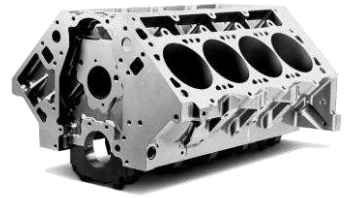



Tóth 2019, https://www.mdpi.com/2079-9276/8/4/159/htm

# From materials to products –life cycles

Fabrication

Manufacturing



Processing

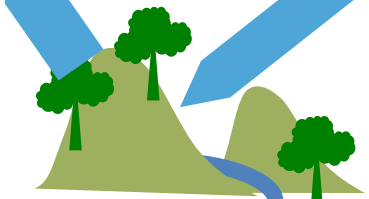
Scrap

Use

Stock

Extraction

Waste



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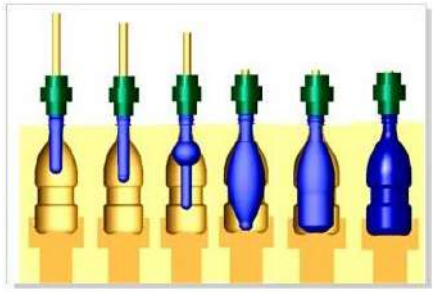
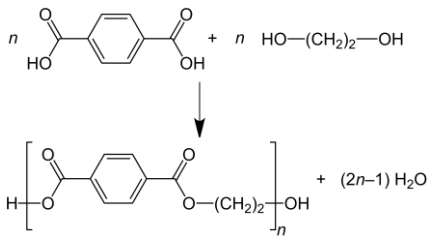
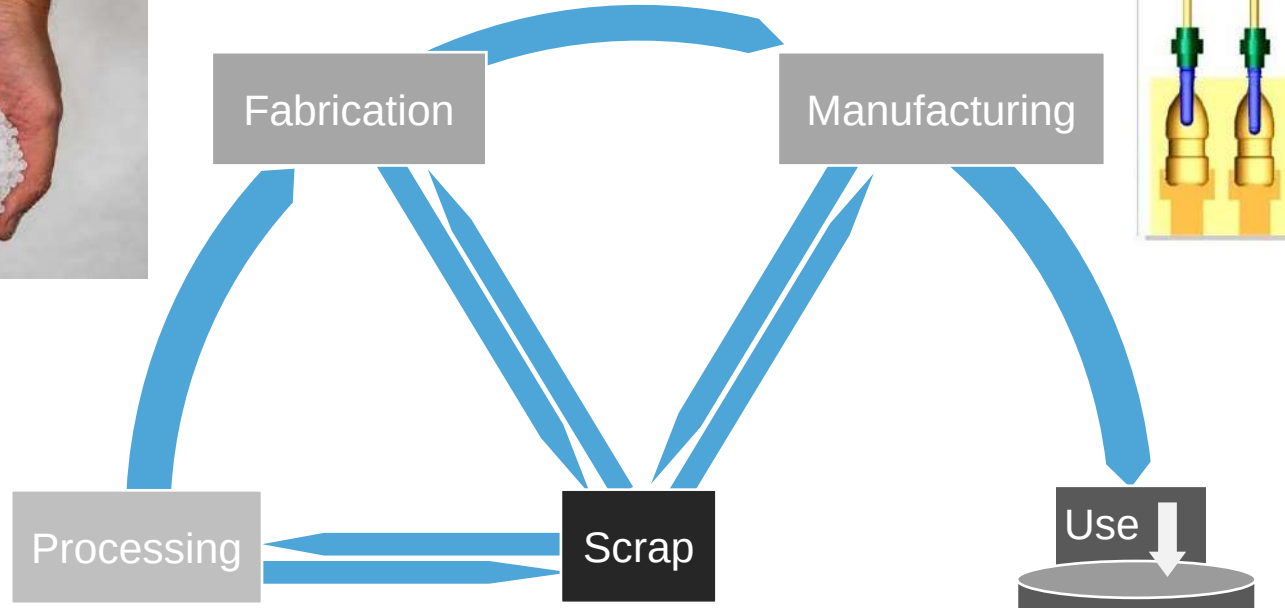
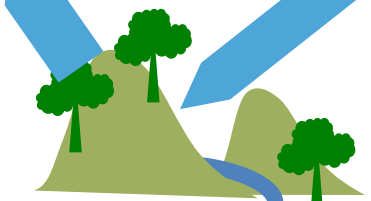


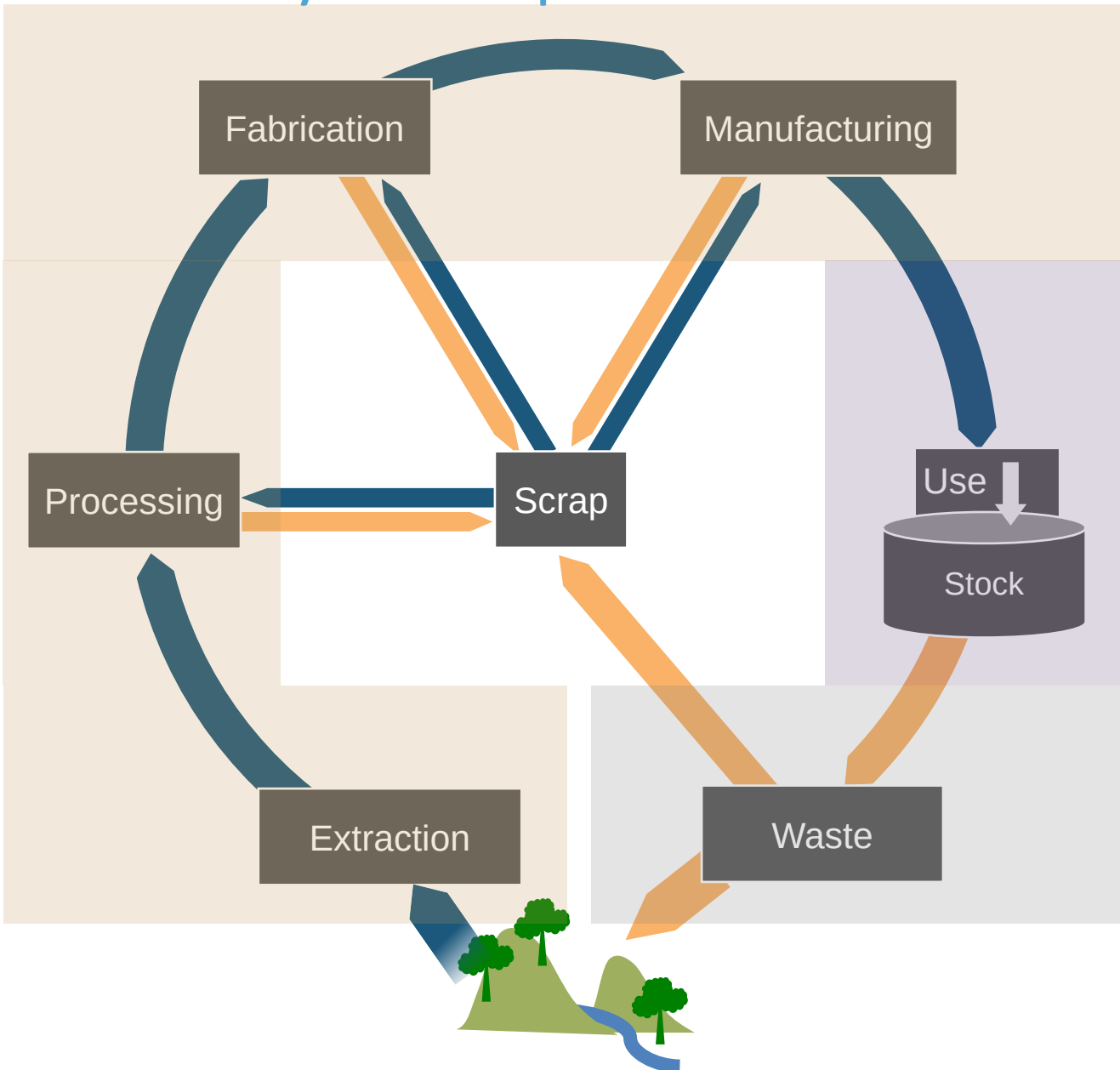


# Materials' life cycles: phases

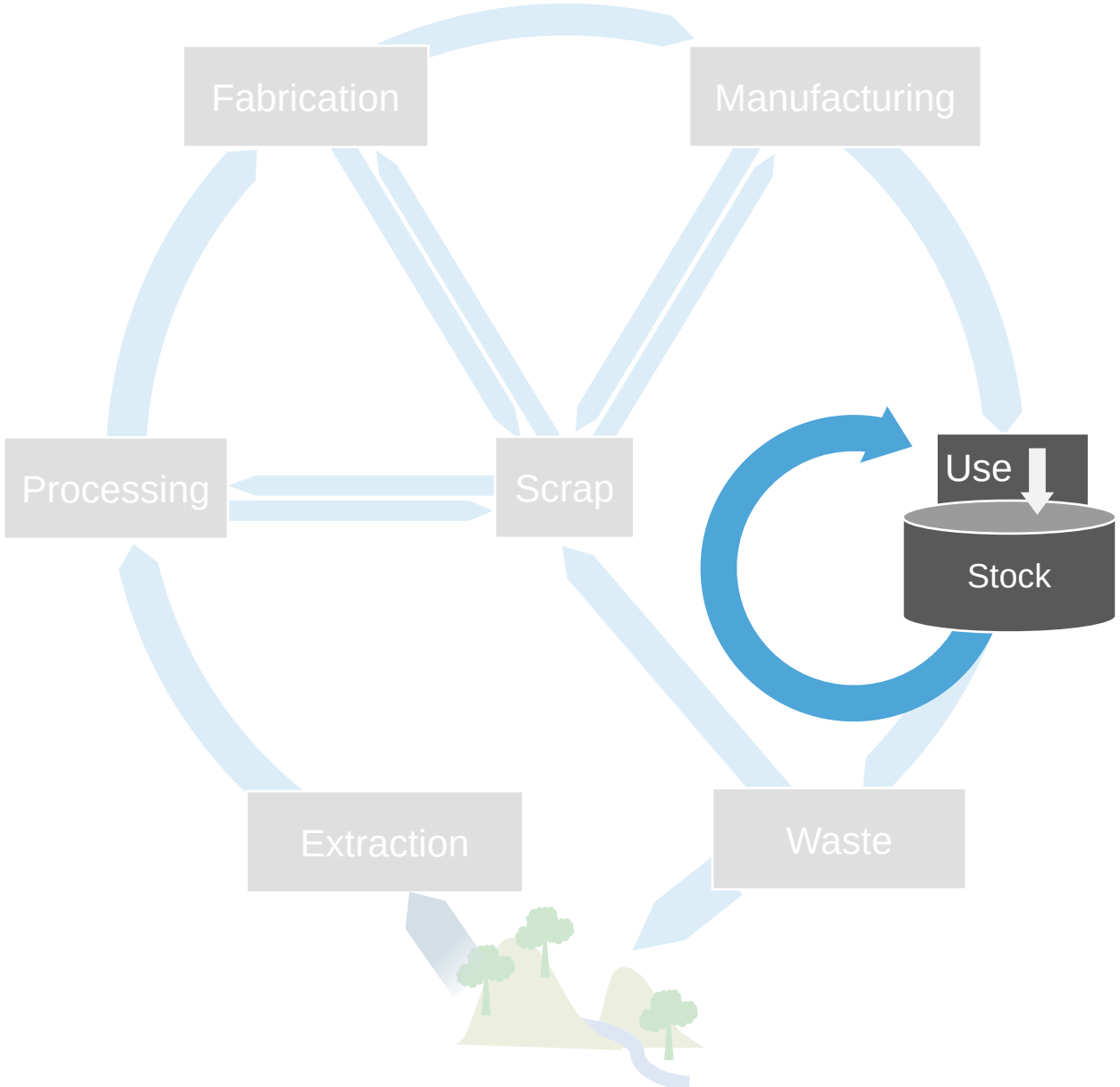
Production phase




Use phase

End-of-life phase

# Closing the circle: reuse, repair, refurbish, recycle, second life…



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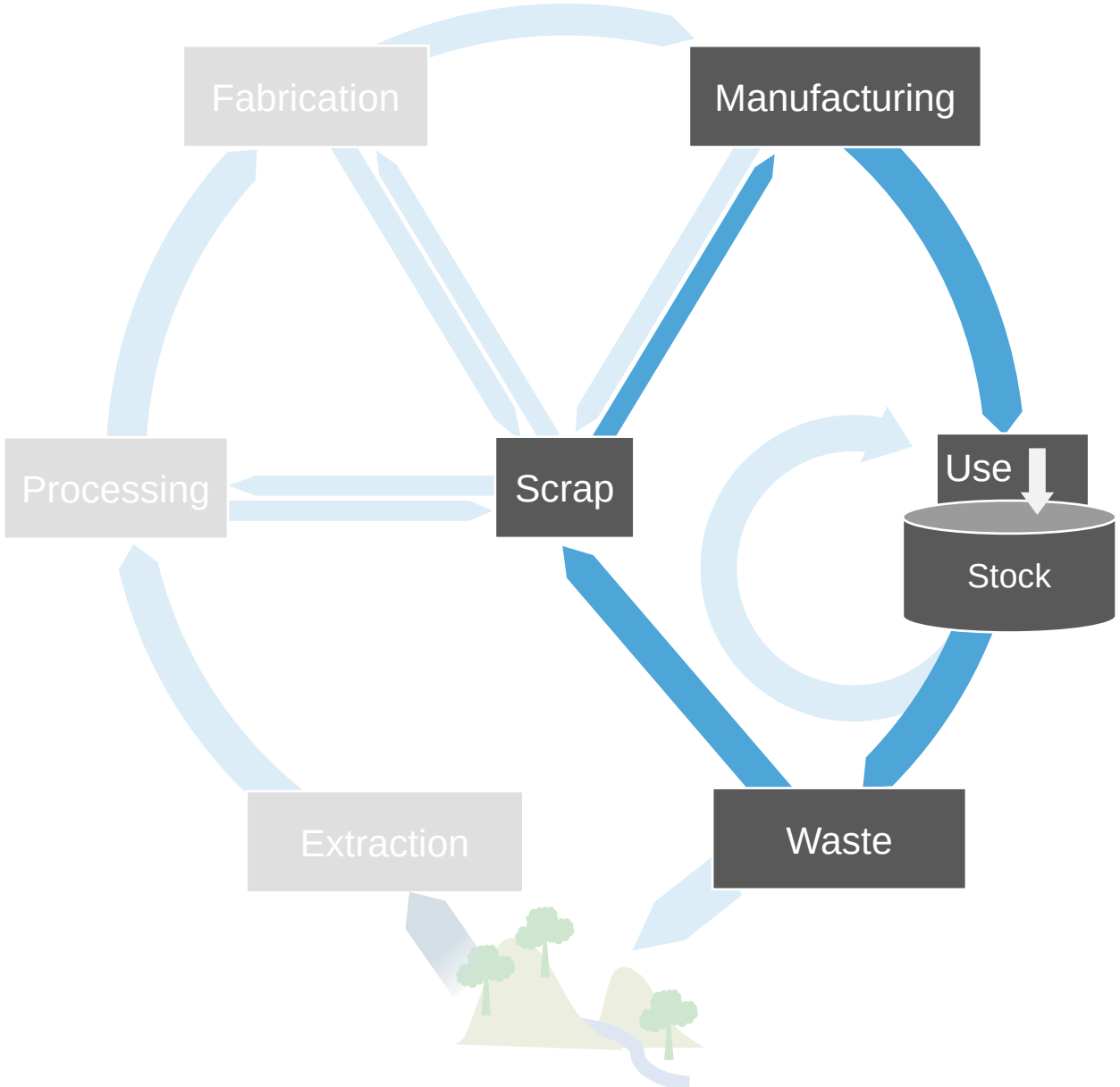

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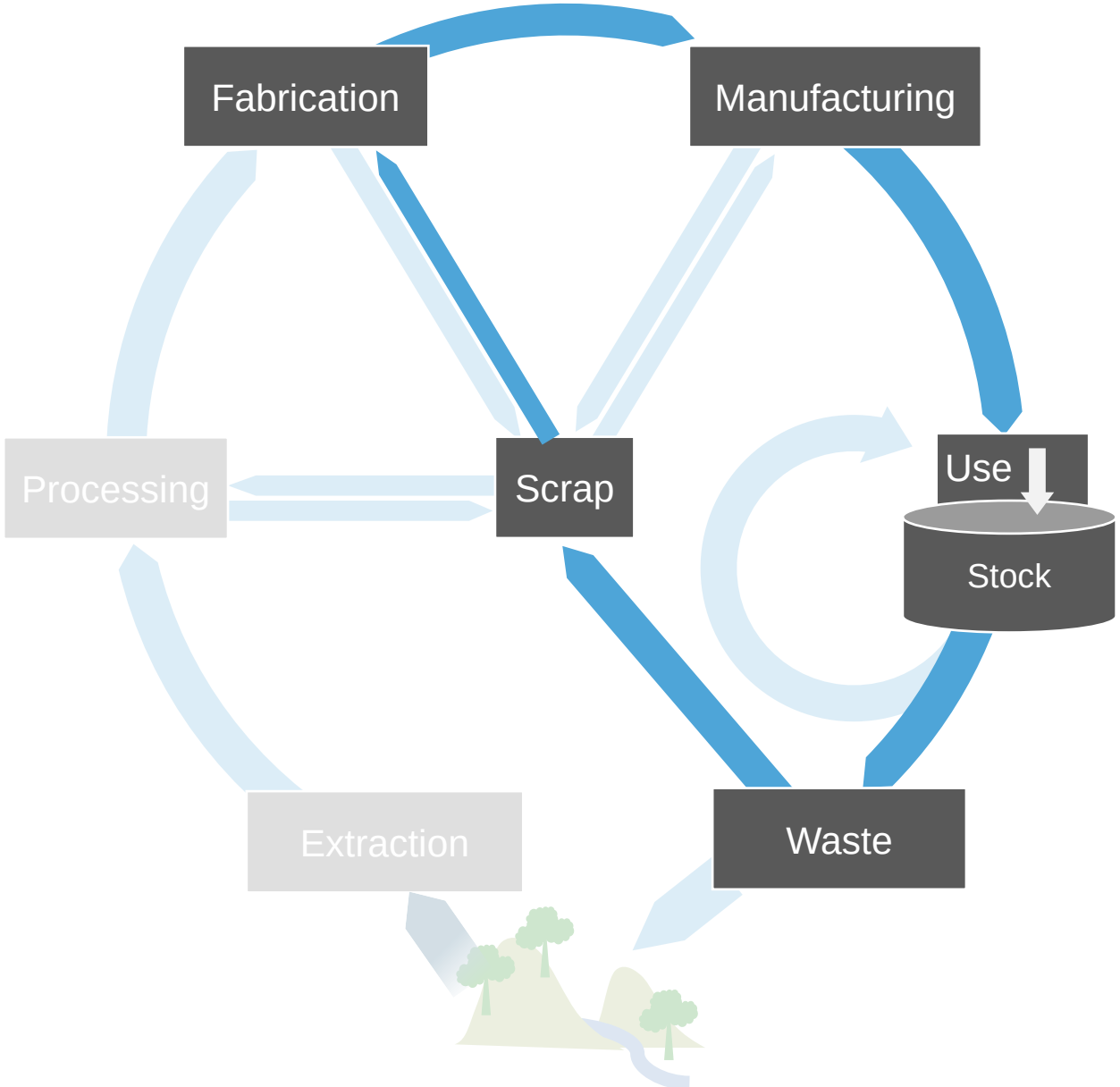

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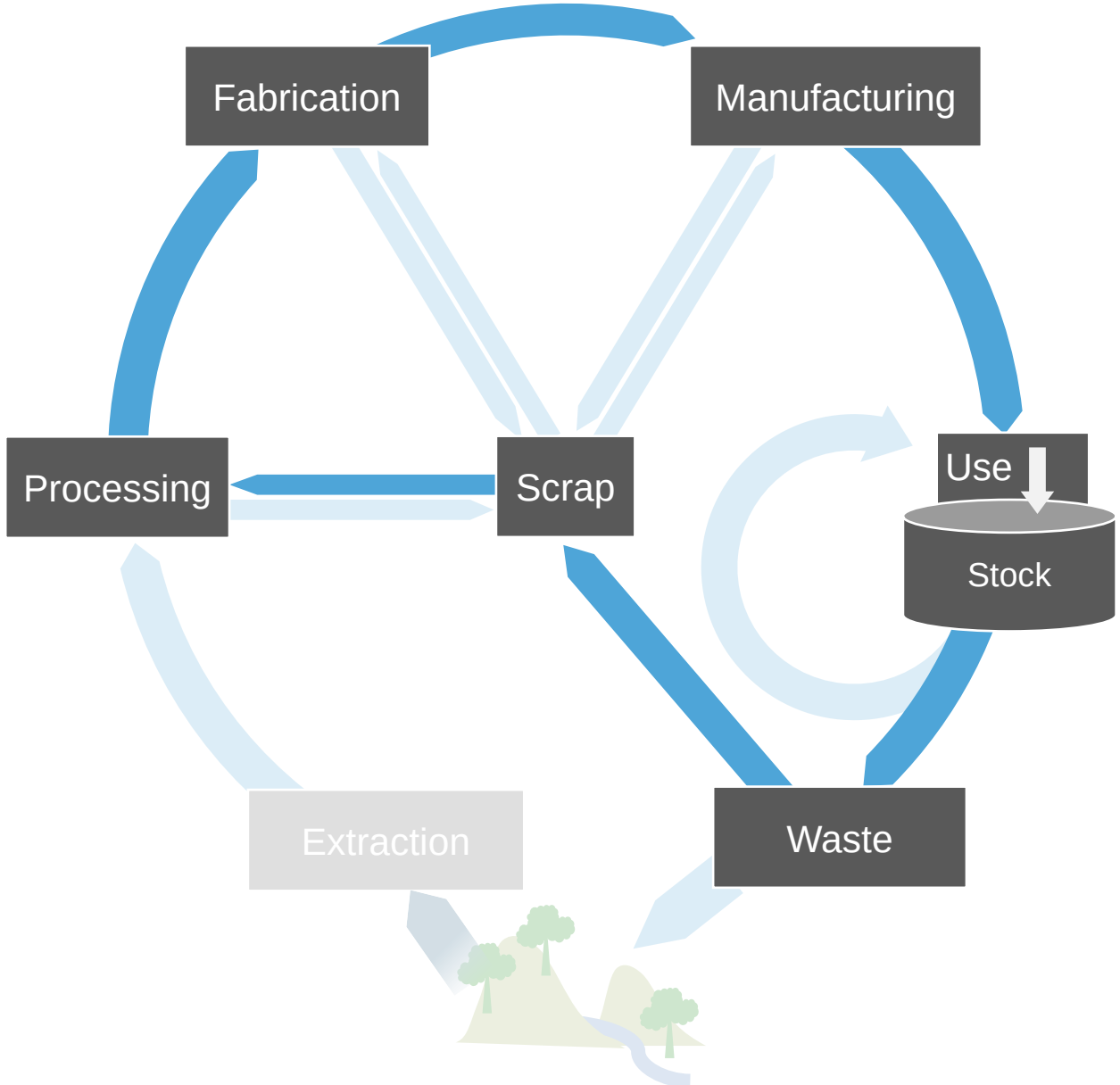


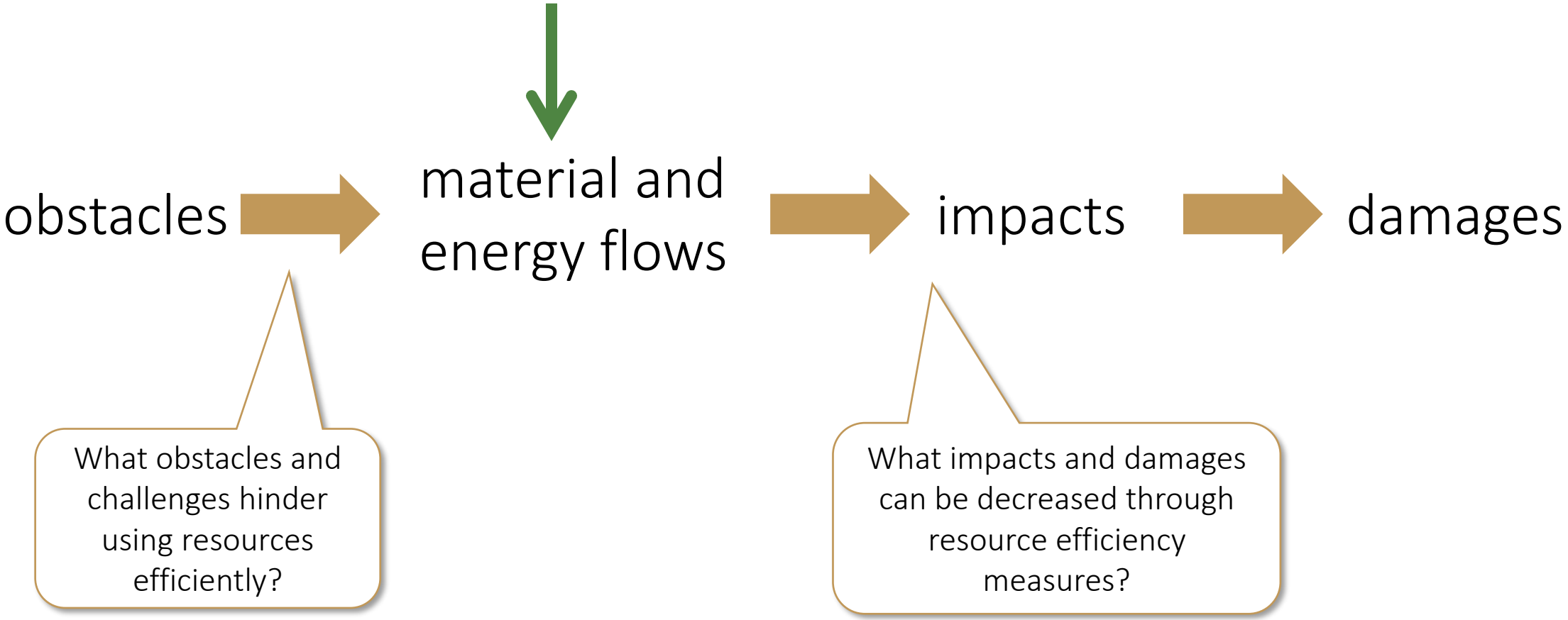
# Interim summary

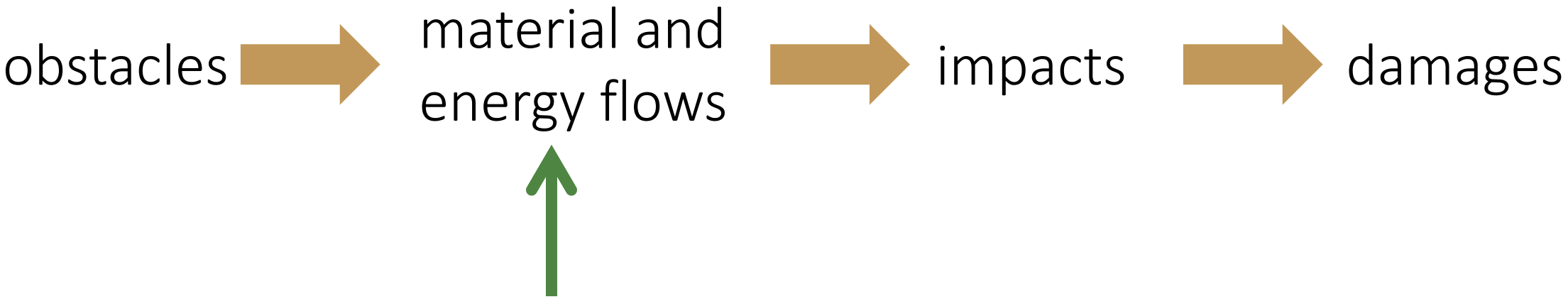
- Products have life cycles with a fairly standard pattern, which is quite linear: extraction, production, use, end of life.

- There is some circularity, but meager and incidental.

- What's the alternative?.....next week

# Material efficiency opportunities






# Material efficiency opportunities

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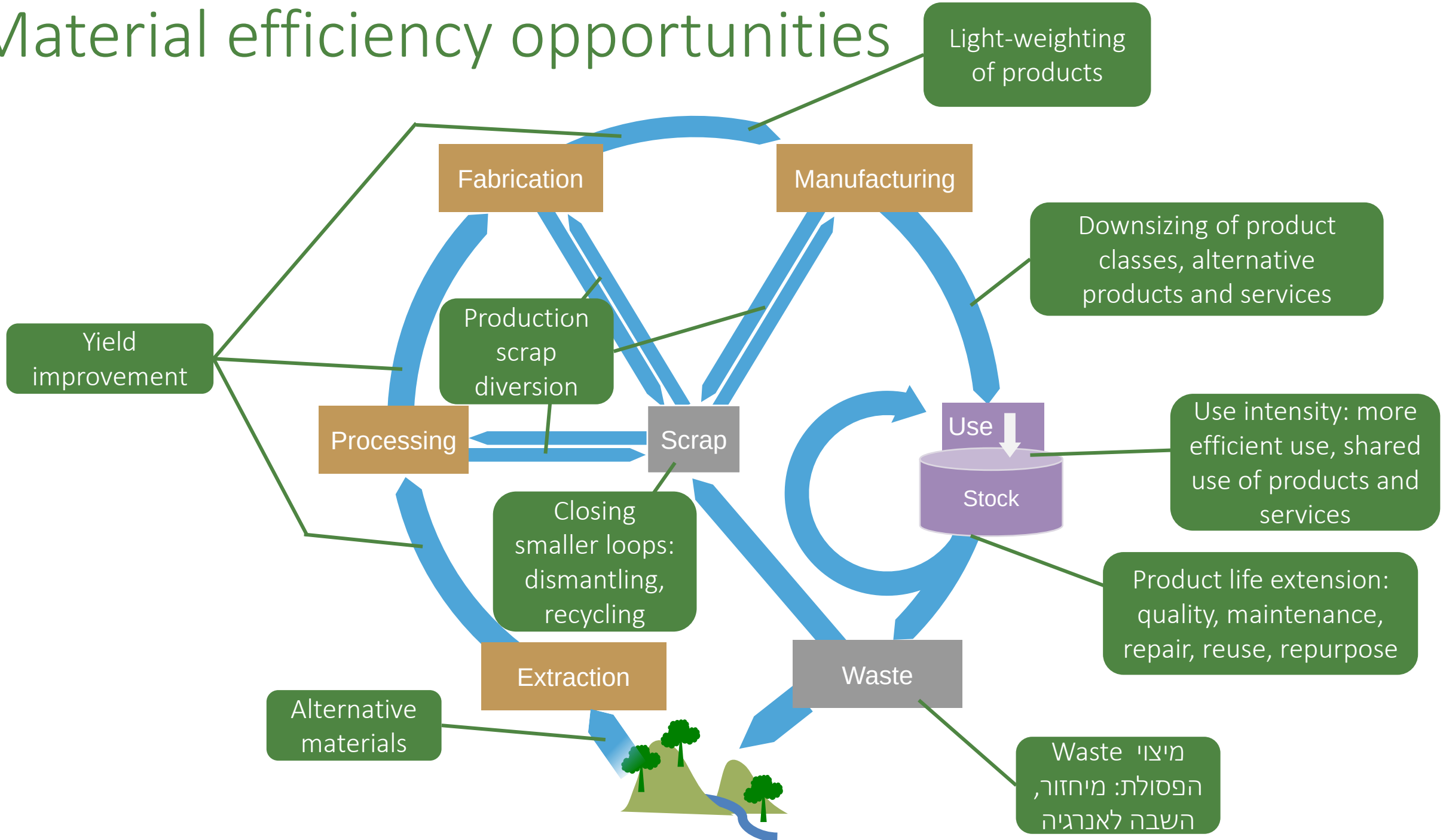

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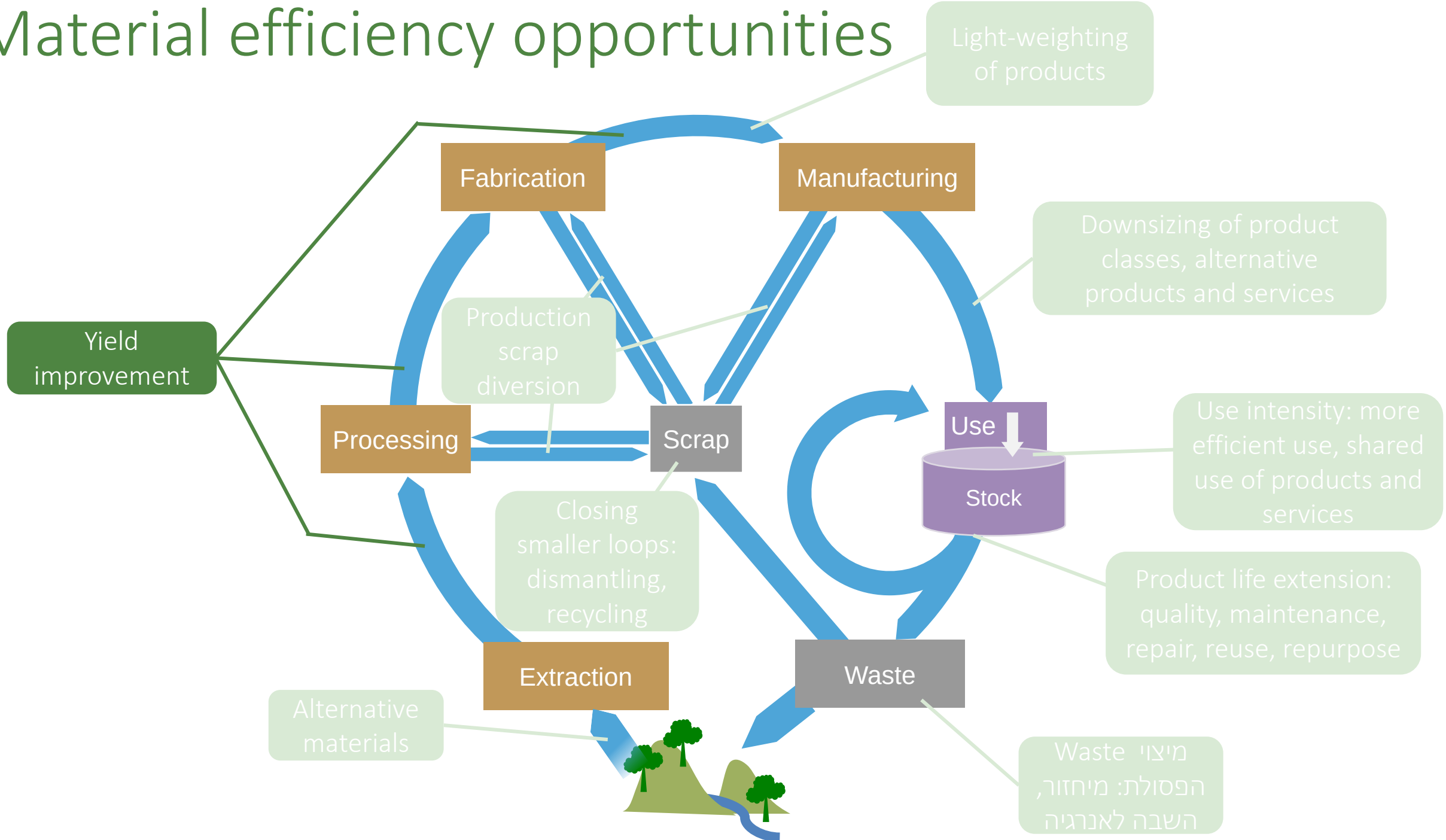


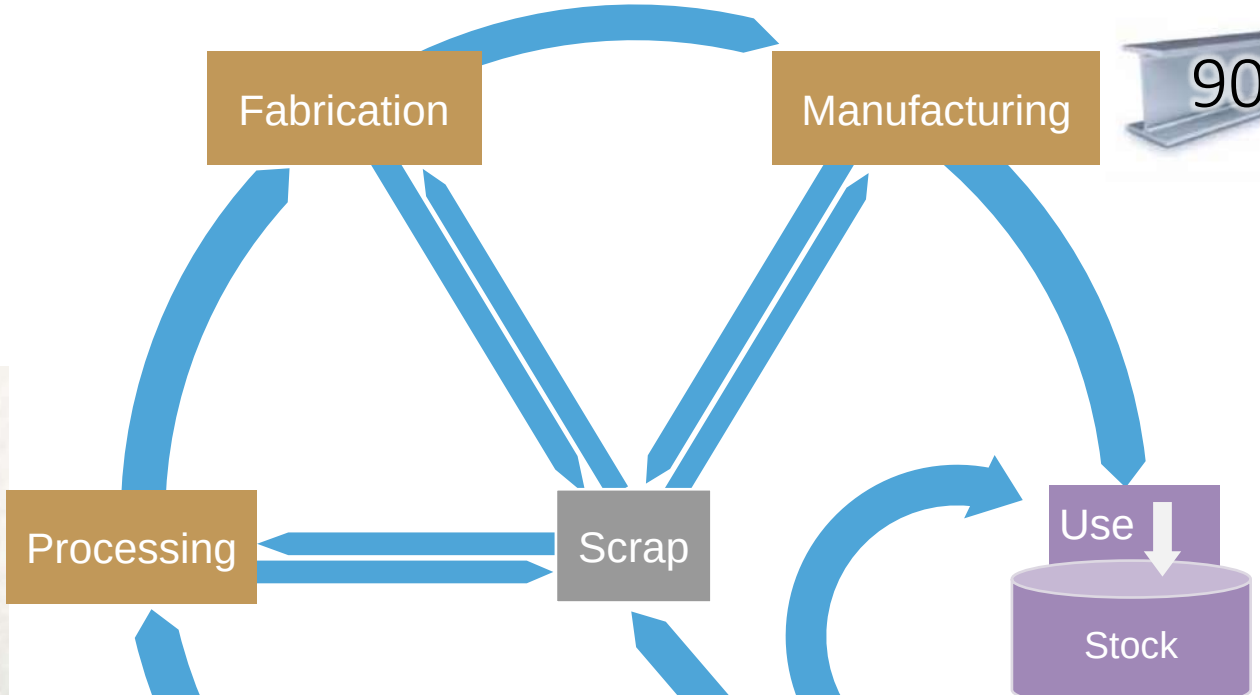
# How much of the raw material remains in the (intermediate) product component?


A car door panel


A drinks can


A steel I-beam


An aircraft wing



# Various causes

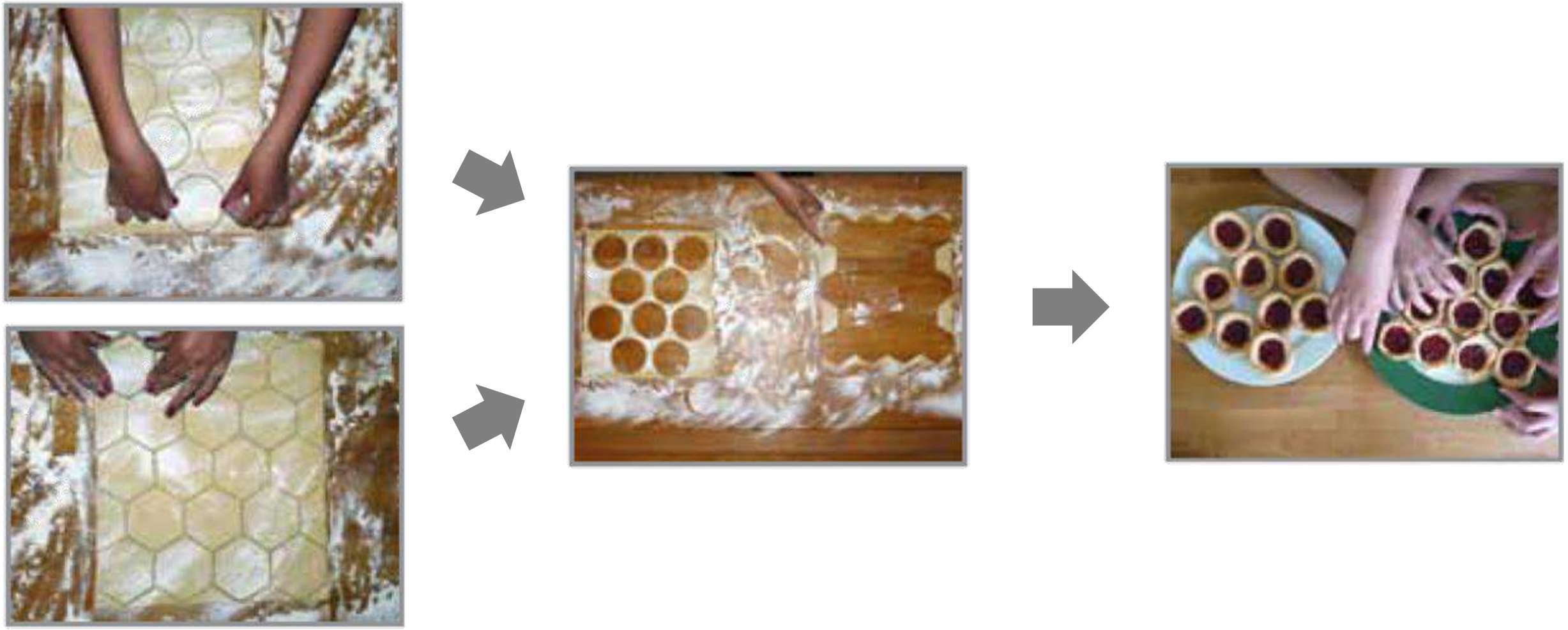
Scrap, milling chips, etc.


Maraqa et al. 2020

Components and products that don’t pass quality assurance

Over-ordered materials

# Resource efficiency through yield loss reduction: design solutions



Allwood, J. M.; Cullen, J. M.; Carruth, M. A.; Cooper, D. R.; McBrien, M.; Milford, R. L.; Moynihan, M. C.; Patel, A. C. *Sustainable Materials: With Both Eyes Open*; UIT Cambridge Limited, 2012.

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# Yield loss reduction: Technological solutions

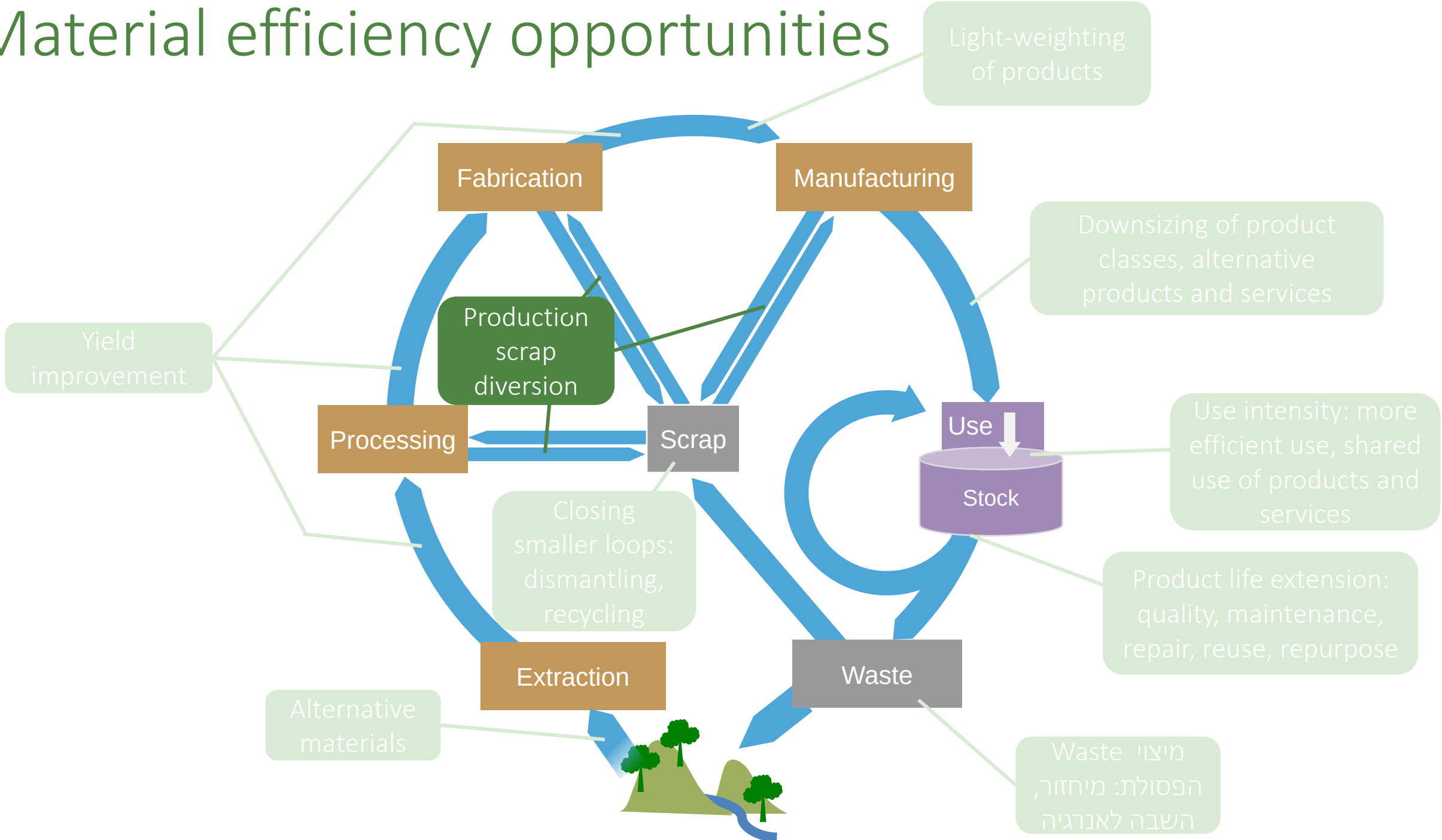
# yield loss reduction: planning and management solutions

Many management and quality methods can be applied to sustainability questions:

- Lean manufacturing
- 5S
- Just-in-time
- And many others

 industrial engineering

# Material efficiency opportunities



# Production scrap diversion

- Recycling within the manufacturing facility
- Reuse within the manufacturing facility
- Diversion to new products

# Outside the facility: industrial symbiosis

# Kalundborg (Denmark): the most famous case of industrial symbiosis

https://www.youtube.com/watch?v=1yCYGOxnpSY

http://www.symbiosis.dk/en/

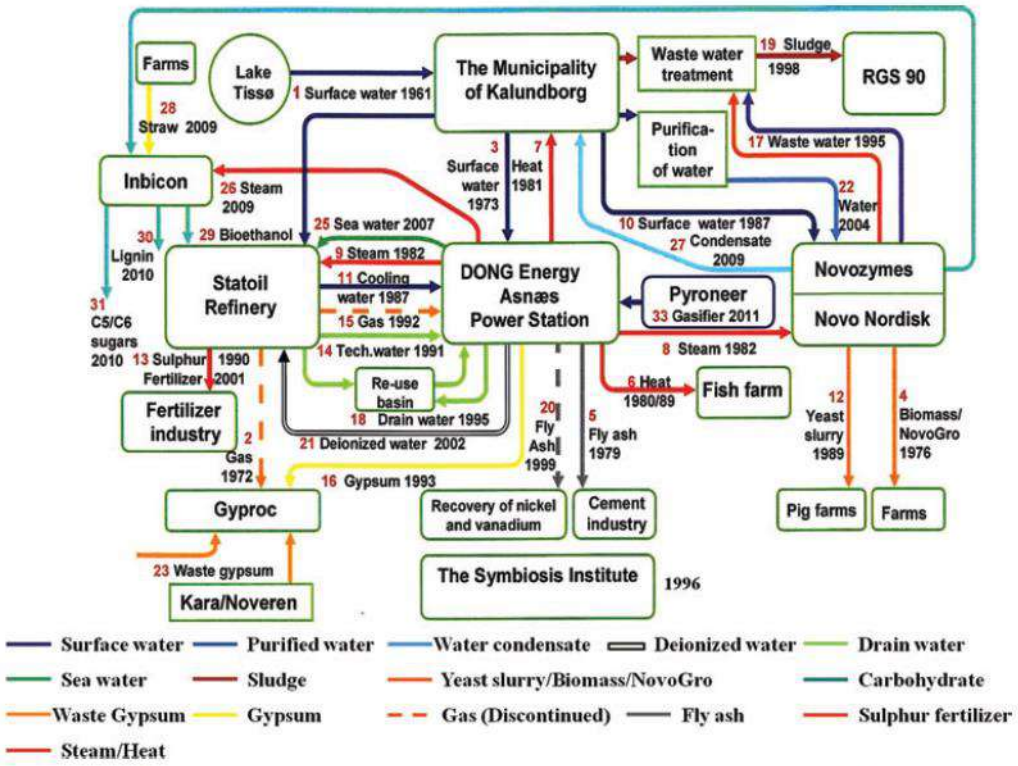
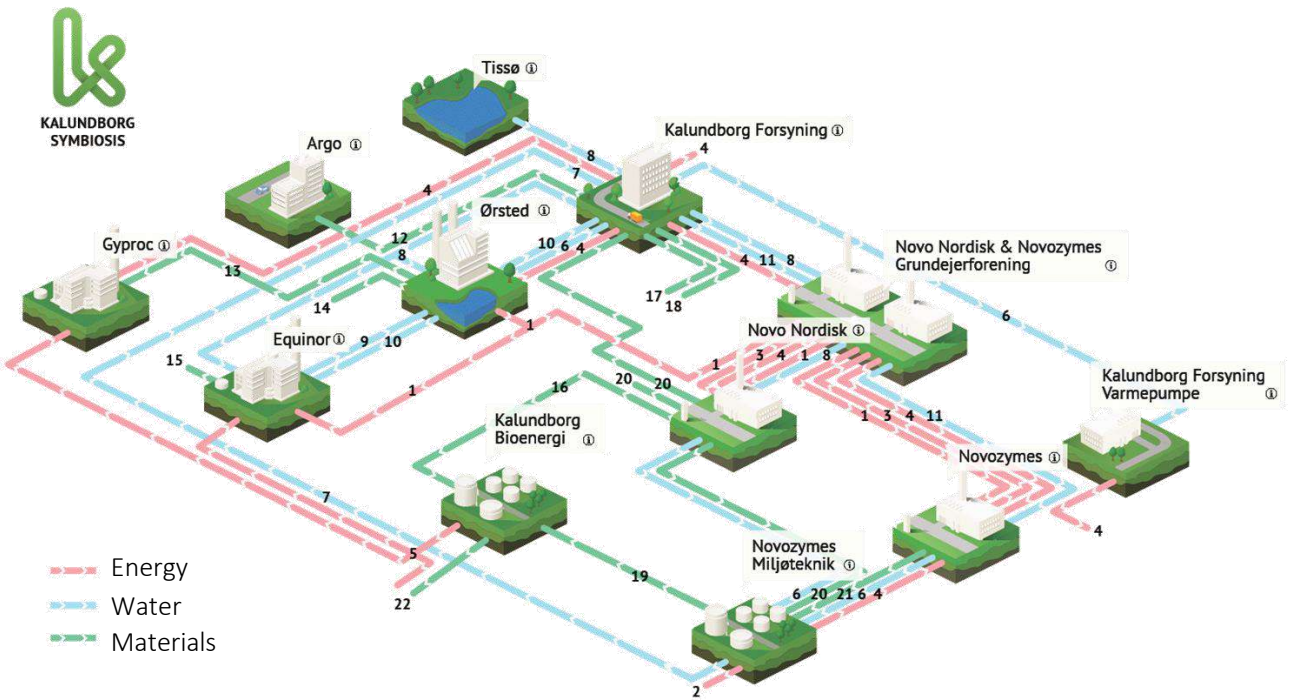



**Figure 2** The Kalundborg industrial symbiosis. Actors and exchanges of materials and energy. Exchanges are numbered from 1 to 33 and the years shown indicate when an exchange began. Discontinued links are shown as dotted lines. Modified from http://www.symbiosis.dk/en/system.




Source: Chertow and Ehrenfeld, J Ind Ecol., 16(1), (2012)

# IZ NÖ-Süd, Austria

Source: World Bank. 2017. *An international framework for eco-industrial parks (English)*. Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/429091513840815462/An-international-framework-for-eco-industrial-parks

*"IZ NÖ-Süd was established in 1962 and is located in the Lower Austria Province, Austria. The park covers 280 hectares and comprises 370 companies. The companies located in the industrial park are mostly comprised of SMEs and international companies that mostly rent the facilities for office, storage and production space purposes. Examples of active sectors include the following: food and beverage; aluminium and steel converting; production of energy and technical components; environmental services and technologies; and logistics."*

# Ulsan Mipo and Onsan, S. Korea

Source: World Bank. 2017. *An international framework for eco-industrial parks (English)*. Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/429091513840815462/An-international-framework-for-eco-industrial-parks

*”The Ulsan Mipo and Onsan industrial park is spread over an area of 6,540 hectares, at which 1,000 companies operate. The park includes a variety of industries, such as vehicle manufacturing, shipbuilding, oil refineries, machineries, non-ferrous metals, fertilizer and chemical industries. Collectively, they employ more than 100,000 people. The main objective of the Ulsan EIP initiative was to transform the Mipo-Onsan conventional national industrial complexes into sustainable eco-industrial parks (EIPs) based on the national eco-industrial park development master plan.”*

# In Israel:

- Variation on the theme: not a preplanned “eco-industrial park”
- Pilot project headed by the Ministry of Economy and Industry since 2019.
- Three companies were awarded franchises to map and connect products, by-products, and resource demands of industries across Israel

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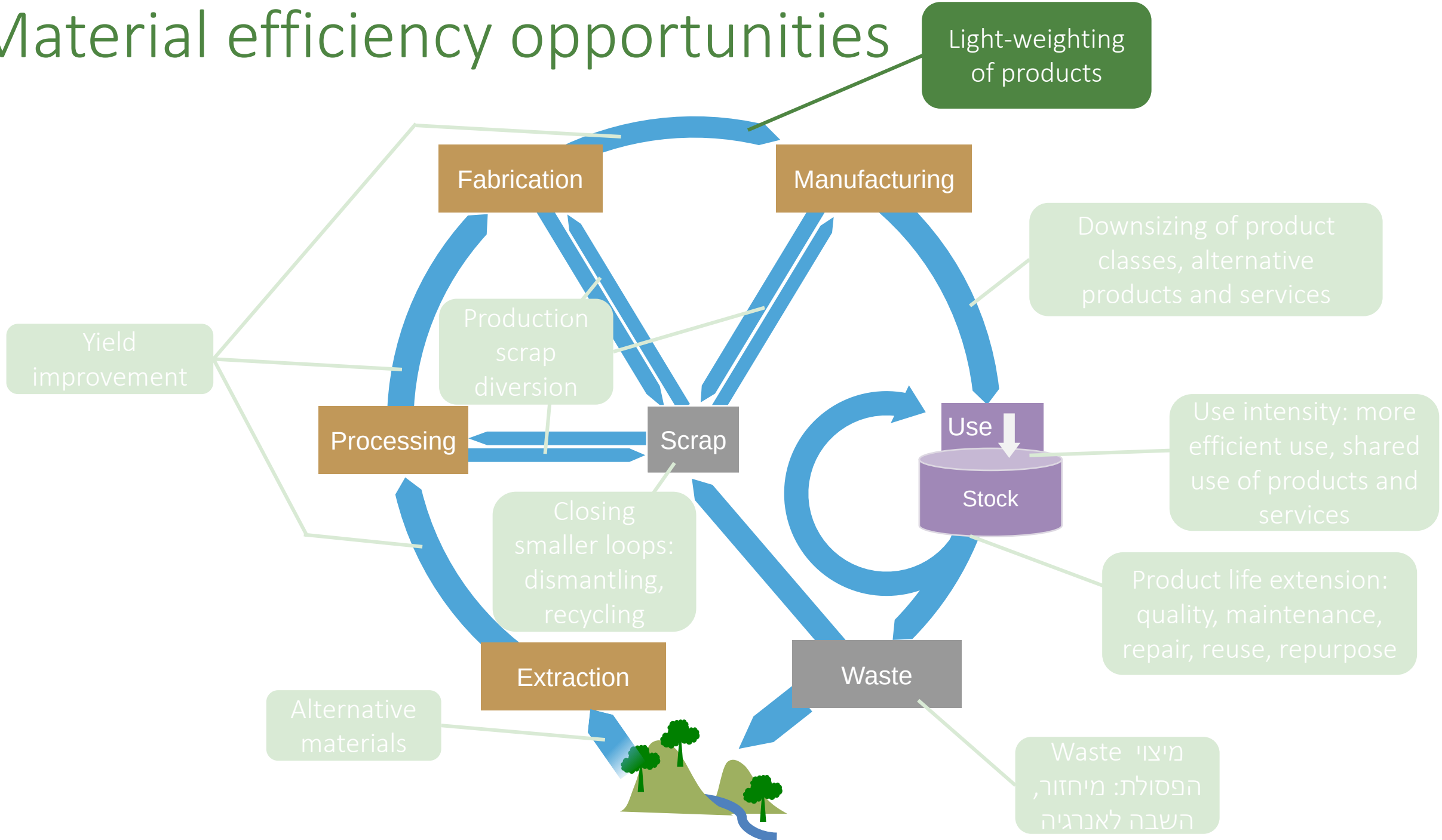
israel materials marketplace
https://www.israelmm.org.il/

אביב ייעוץ
סמביוזה תעשייתית
https://sim.aviv-ebc.co.il/

- As of September 2019. over 250 companies registered and 15 cross-industry deals were signed.

# Private initiatives, e.g.
# “The national commercial space for construction surplus materials”

# Material efficiency opportunities



# Lightweighting and less material by design

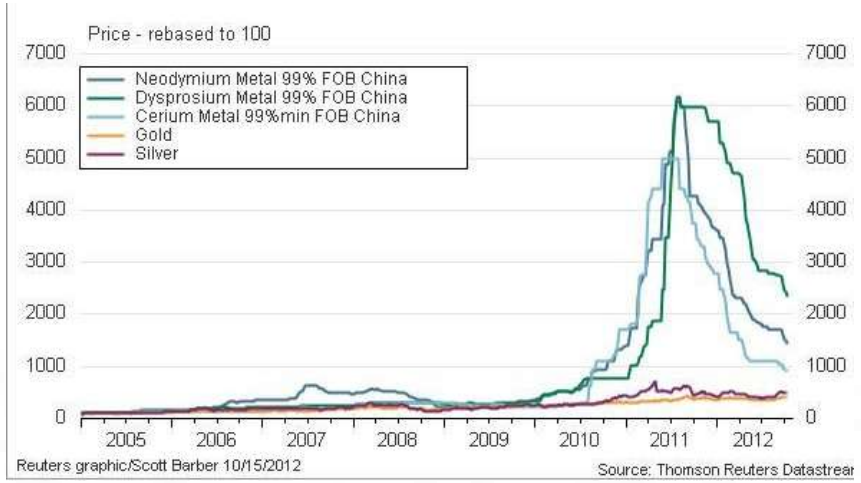
Providing the same function or service with less materials

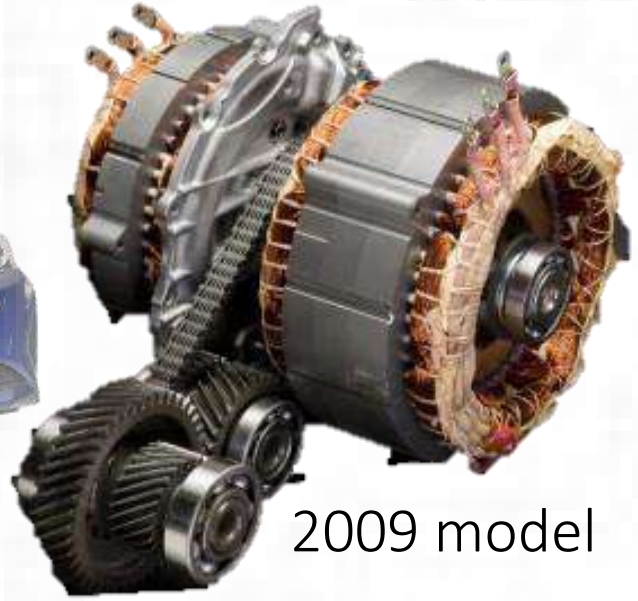

Lightweighting can sometimes also decrease energy consumption in the use phase…

… and sometimes increase energy consumption in the use phase.

# Factors promoting lightweighting

- Technology
- Costs



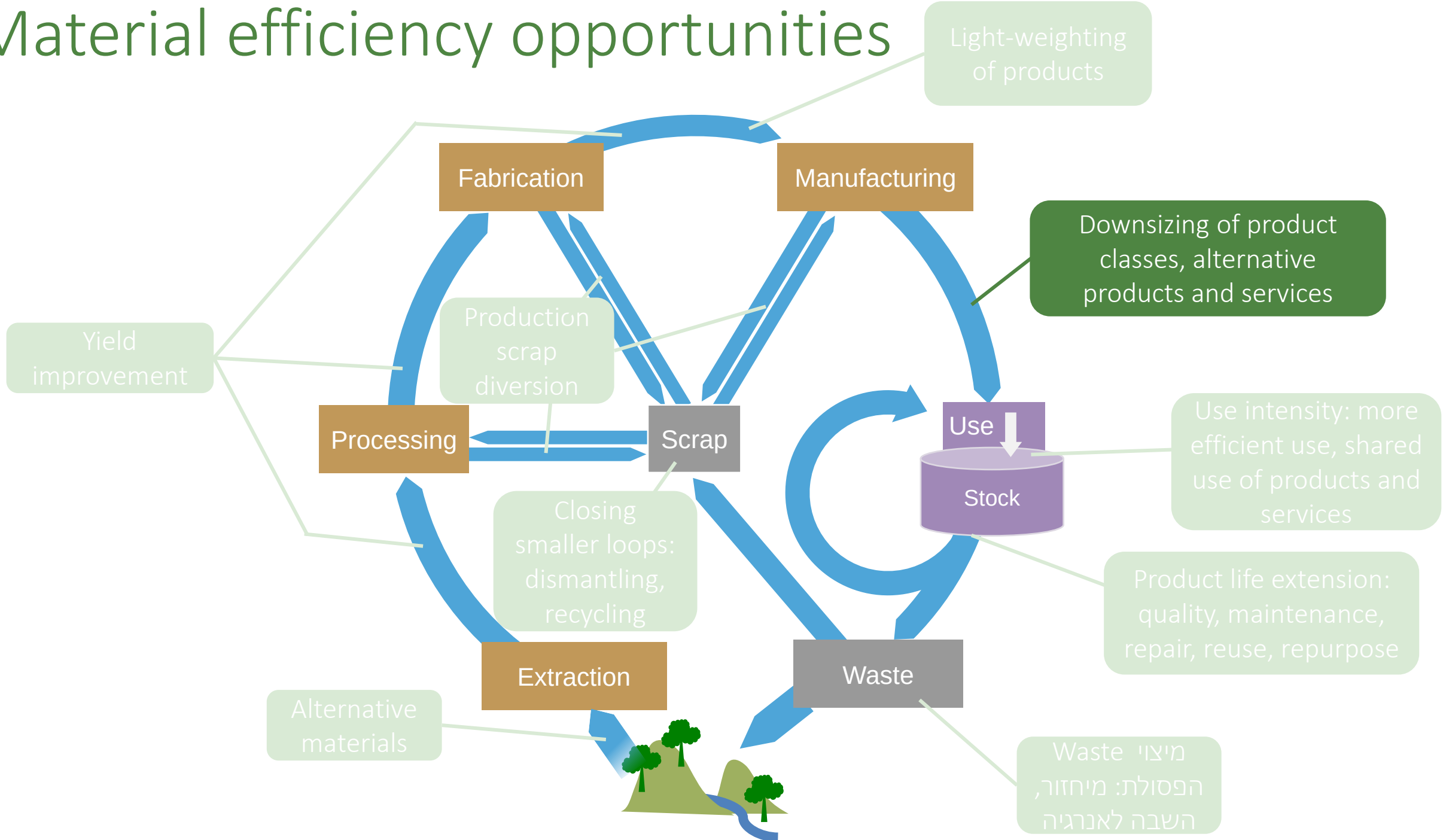
2009 model

2010 model

# Factors delaying lightweighting


- Over-standardization of components (heavy and not customized to their job)
- Research & development sexpenses
- Design for general use
- Poor planning

# Material efficiency opportunities



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# Downsizing

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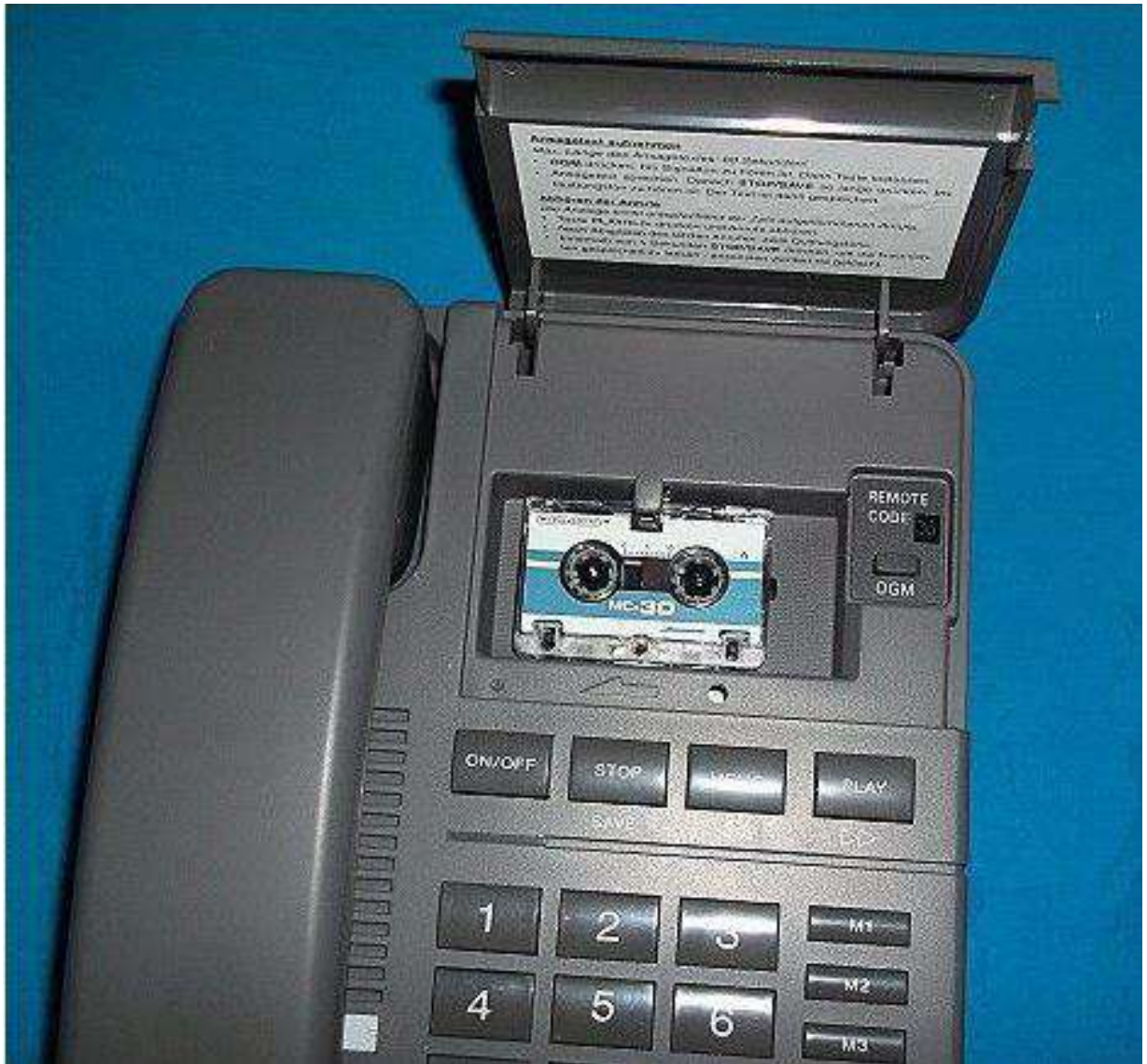
# Downsizing

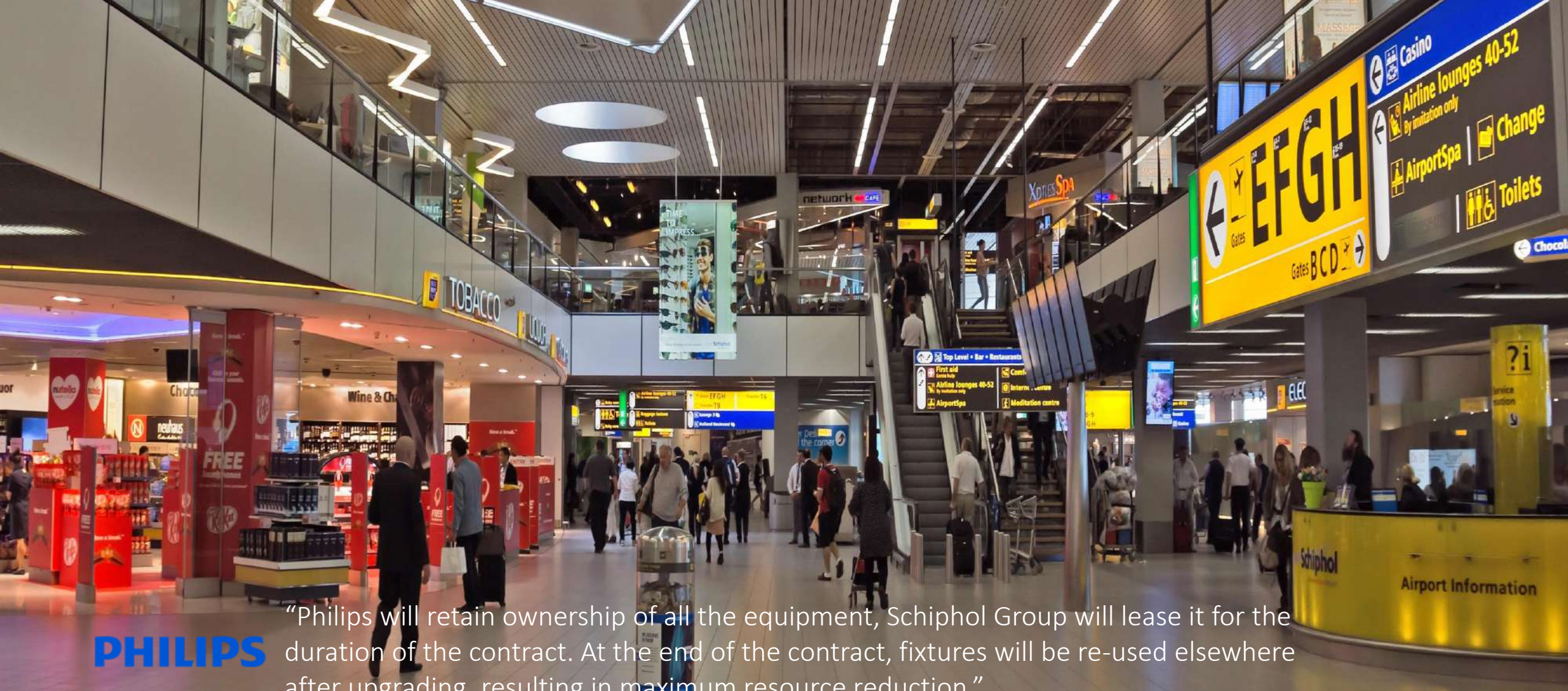
# Alternative products and services

# Alternative products and services


# Alternative products and services

# Product as service / pay for performance






PHILIPS

"Philips will retain ownership of all the equipment, Schiphol Group will lease it for the duration of the contract. At the end of the contract, fixtures will be re-used elsewhere after upgrading, resulting in maximum resource reduction."
https://www.philips.com/a-w/about/news/archive/standard/news/press/2015/20150416-Philips-provides-Light-as-a-Service-to-Schiphol-Airport.html

# Product as service / pay for performance

# Power by the hour

Our TotalCare ® circular business model helps us to reduce waste and optimise resource efficiency, whilst enabling our customers to maximise the flying potential of their engines.


https://www.rolls-royce.com/media/our-stories/discover/2017/totalcare.aspx



## A circular business model

Our long-term service agreements retain product stewardship. This provides a means to close the loop on material usage – reducing waste, increasing efficiency, and enhancing the robustness of our supply chain.

# Farmers Do Not Want To Buy Pesticides They Want To Buy A Pest-Free Crop

https://simapro.com/2016/five-ways-to-circular-economy-and-lca-product-as-a-service/

# Improving Access to Education with Xerox® Intelligent Workplace Services

The University of the District of Columbia (UDC) needed to find a way to reduce operational costs across nine locations to reallocate more resources to enhancing the student experience. Read the case study to see how **Xerox® Intelligent Workplace Services** helped them do just that.

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**Intelligent Workplace Services**

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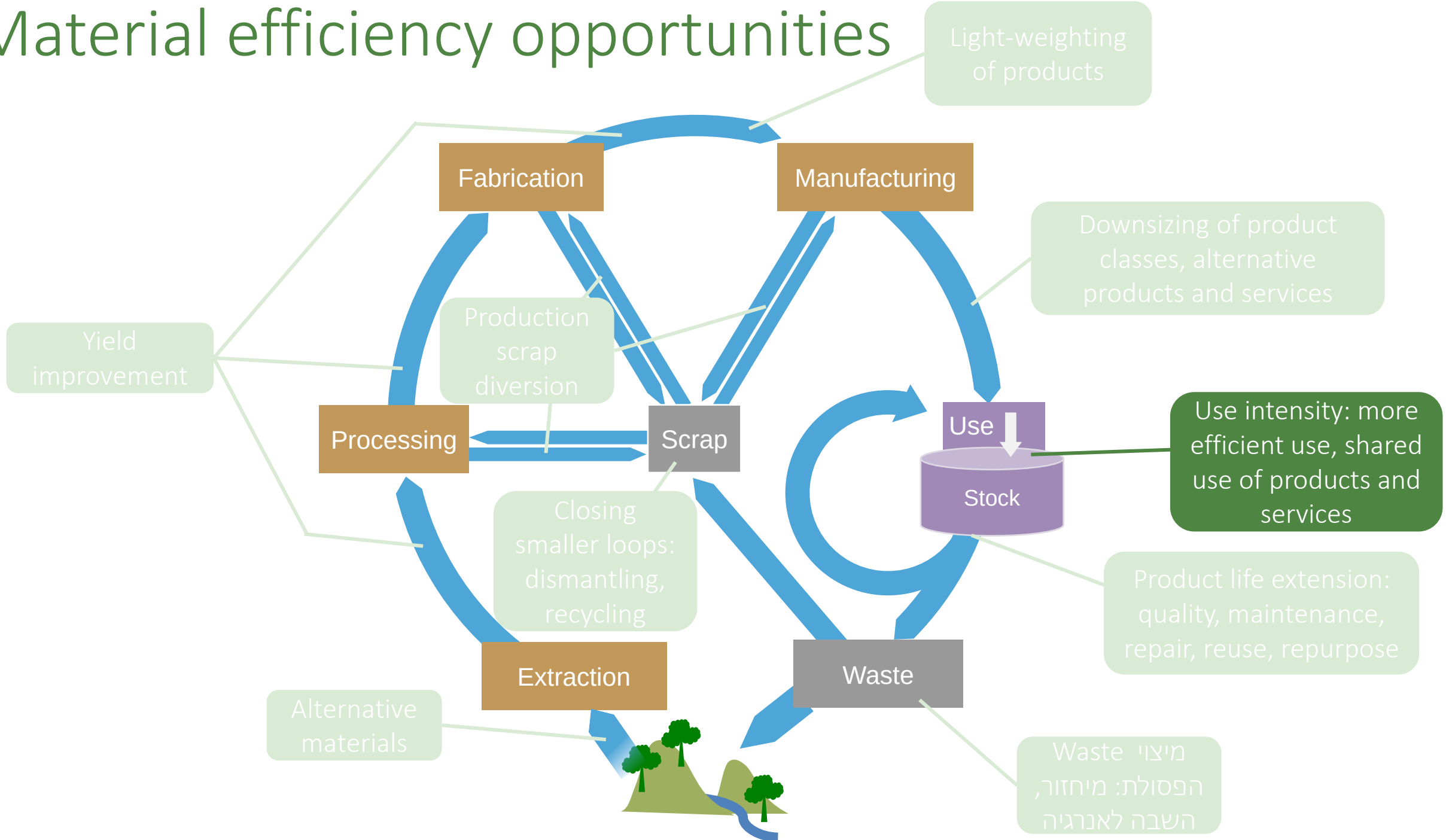
# Material efficiency opportunities



# More intensive use

"The car is dead capital. On average 1.2 passengers use it for 50 minutes a day only. It's uneconomic."

"המכונית היא הון מת. נוסעים בה בממוצע 1.2 אנשים 50 דקות ביום בלבד. היא לא כלכלית"

**סדרת כתבות ב"גלובס" - תקועים בפקק:** איך אפשר להוריד את מספר המכוניות בכבישי ישראל, מדינה שרכישות המכוניות הפרטיות בה שוברות שיאים? ■ כתבה ראשונה בסדרה: כמה עולה לנו כל הרכב הזה, ולמה לממשלה צריך להיות אינטרס לקדם חלופות?
https://www.globes.co.il/news/article.aspx?did=1001108287

**הדי כהן** 06.03.2016

# More intensive use: two types of sharing economy

More intensive use of the **service**

such as ride sharing


More intensive use of the **product**

such as car sharing

# One year later: Auto-Tel's cars are parked 95% of the time

כלכליסט
24/7 באזז השוק נדלניסט טכנולוגי משפט
ספורט פנאי מוסף CTECH Dun's 100
בלעדי לכלכליסט

# שנה למיזם: המכוניות של אוטותל חונות 95% מהזמן

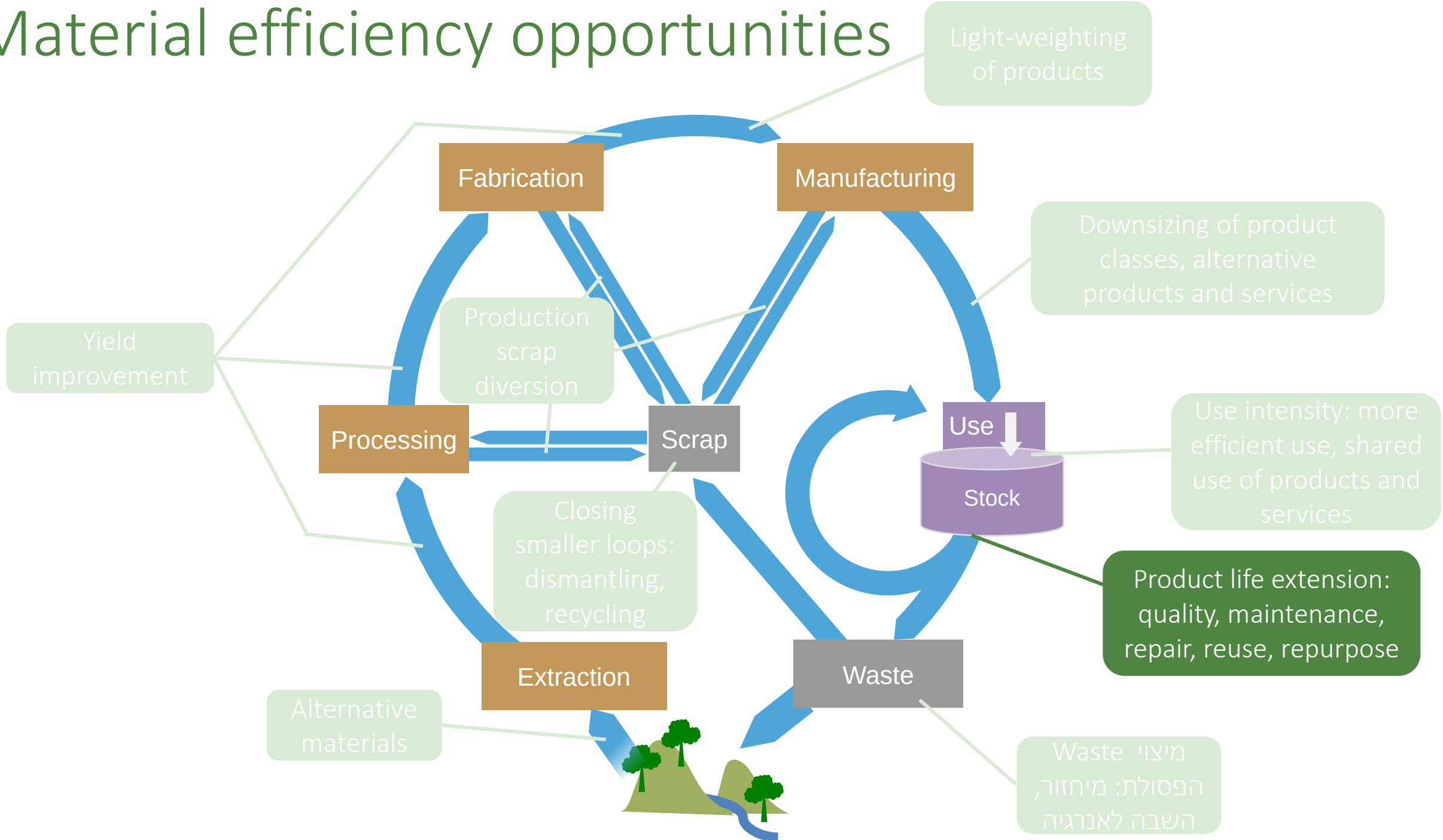
בכל אחד מ־260 הרכבים של מיזם הרכב השיתופי של עיריית תל אביב מתבצעות בממוצע חמש נסיעות בכל יום שאורכן הממוצע הוא 17 דקות

תומר הדר 25.10.18 06:54

**תגיות:** אוטותל Car2Go שיתוף רכבים תל אביב

הנתונים של אוטותל, מיזם שיתוף רכבים לנסיעות קצרות בתל אביב, נחשפים לראשונה. מנתונים שאספה עיריית תל אביב ושהגיעו לידי "כלכליסט", עולה כי המיזם, שמציין שנה להפעלתו בתשלום, ענה על הציפיות בצורה חלקית.

# Material efficiency opportunities



https://www.health.harvard.edu/staying-healthy/drug-expiration-dates-do-they-mean-anything

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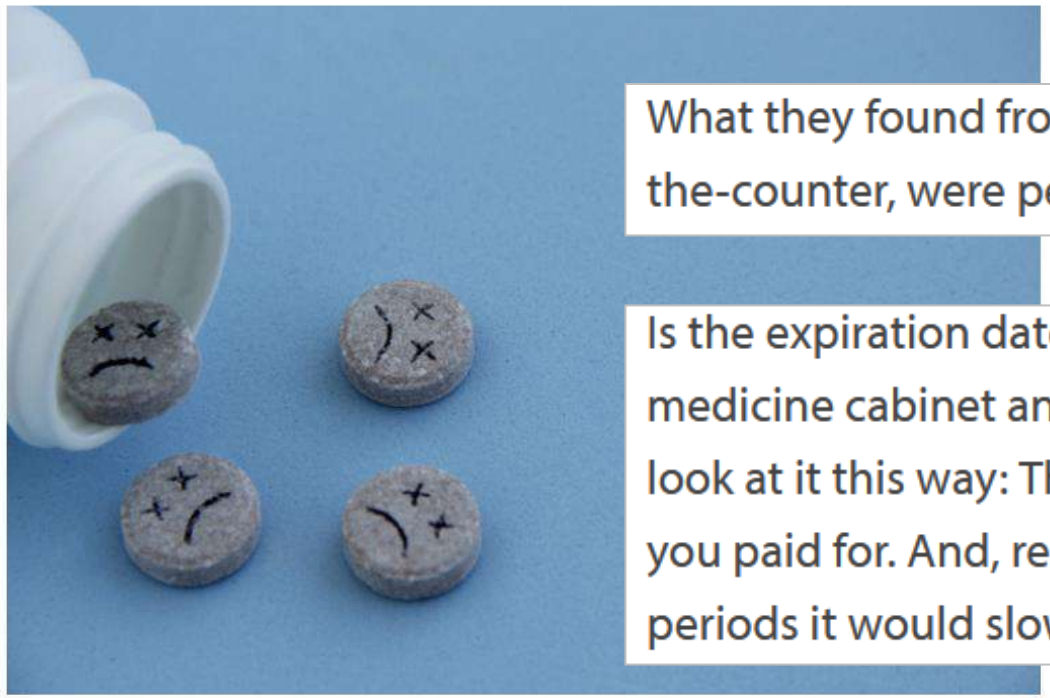
# Drug Expiration Dates — Do They Mean Anything?

## FDA study gets to the heart of expired medicine and safety



What they found from the study is 90% of more than 100 drugs, both prescription and over-the-counter, were perfectly good to use even 15 years after the expiration date.

Is the expiration date a marketing ploy by drug manufacturers, to keep you restocking your medicine cabinet and their pockets regularly? You can look at it that way. Or you can also look at it this way: The expiration dates are very conservative to ensure you get everything you paid for. And, really, if a drug manufacturer had to do expiration-date testing for longer periods it would slow their ability to bring you new and improved formulations.

**Updated: August 29, 2020** **Published: November, 2003**

# Life extension pros and cons

1953 Buick Skylark

Pros:

- Demand reduction
- Waste reduction

1963 Susita

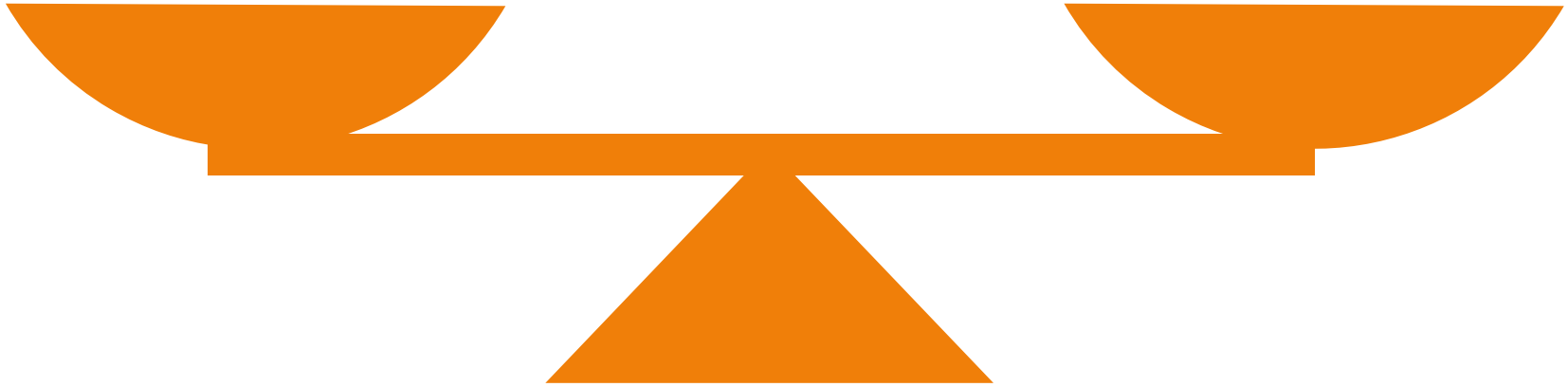
Cons:

- Lower efficiency
- May pollute more during use
- Higher maintenance and usage requirements
- Does it still provide the service?

# Tradeoff between life extension and more intensive use

Old products tend to be used less

Intensive use reduces product lifetime



# Repair as a resource efficiency strategy

COMMENTARY

## Americans Toss 151 Million Phones A Year. What If We Could Repair Them Instead?

https://www.wbur.org/cognoscenti/2018/12/11/right-to-repair-nathan-proctor

December 11, 2018 By Nathan Proctor

repair.org

https://www.repair.org/aboutus


**It's simple.** You bought it, you should own it. Period.

You should have the right to use it, modify it, and repair it whenever, wherever, and however you want. It's our mission to make sure you can. We fight for your right to fix.

Simple.

Our goal is to advocate for repair-friendly policies, regulations, statutes, and standards at the national, state, and local levels.

Members of The Repair Association enjoy the backing of some of the world's most powerful activists. We travel the globe on your behalf, testifying in front of statehouses, standards committees, and media outlets to make sure your business continues to thrive.

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Health

Business | Market Data | New Economy | New Tech Economy | Companies
Technology of Business | Global Education | Economy | Global Car Indust

# 'Right to repair' law to come in this summer

By Roger Harrabin
BBC environment analyst

10 March | Comments

Climate change

https://www.bbc.com/news/business-56340077


**Appliances such as fridges, washing machines and TVs should last longer and be cheaper to run under new rules.**

PC #Amplify #WorkFromHome Reviews Best Products How-To News Newsletters Find products, advice, te

PCMag editors select and review products independently. If you buy through affiliate links, we may earn commissions, which help support our testing. Learn more.

Home > How-To > Mobile Phones

# 11 Uses for Your Old Smartphone

Don't let that old smartphone gather dust in a drawer or kill the environment in a landfill. In just a few steps, you can re-purpose it as a security camera, alarm clock, science experiment, and more.

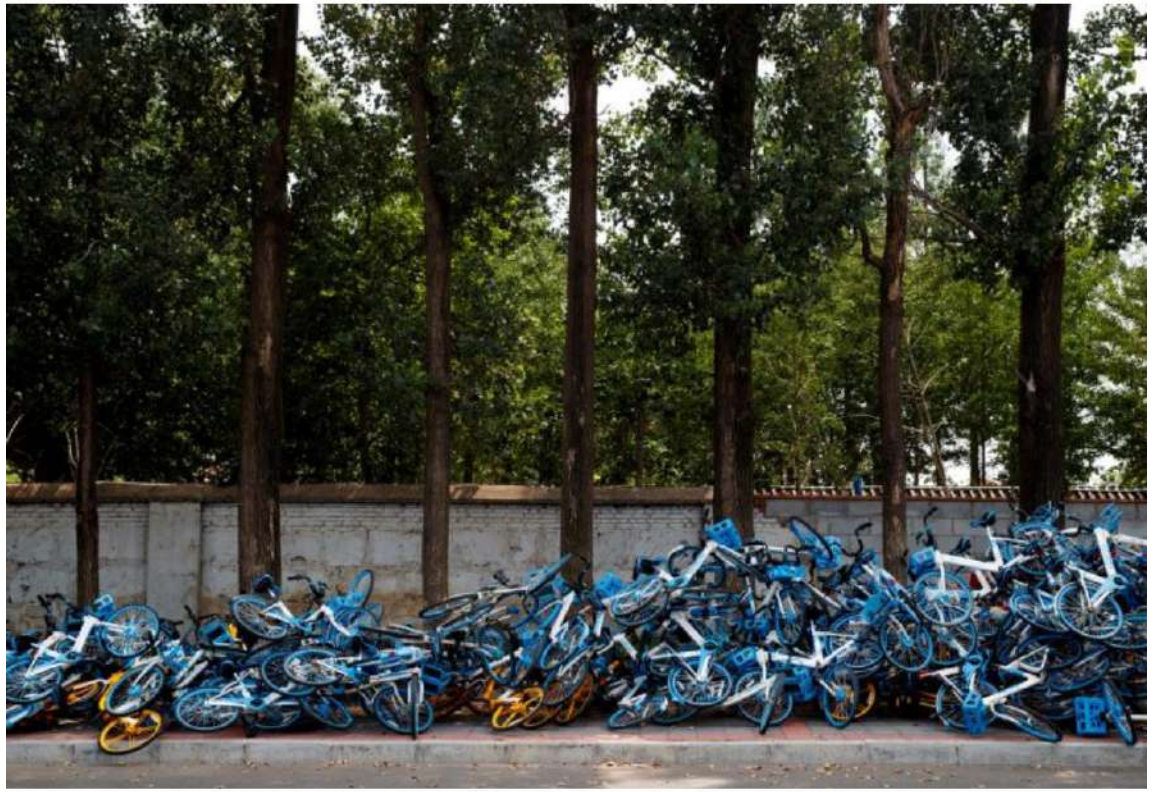
By Jason Cohen Updated April 22, 2021

https://www.pcmag.com/how-to/uses-for-your-old-smartphone

- Security camera
- Gaming system
- Video chat device
- Wireless webcam
- Alarm clock
- TV remote
- E-Book reader
- Media player
- Contribute your phone to science
- Emergency phone

THE STRAITS TIMES

# Whatever happened to China's giant piles of abandoned bicycles?



One government unit estimates there were as many as 20 million shared bikes in use in 2017. PHOTO: REUTERS

https://www.straitstimes.com/business/economy/whatever-happened-to-chinas-giant-piles-of-abandoned-bicycles

PUBLISHED SEP 17, 2020, 7:45 AM SGT

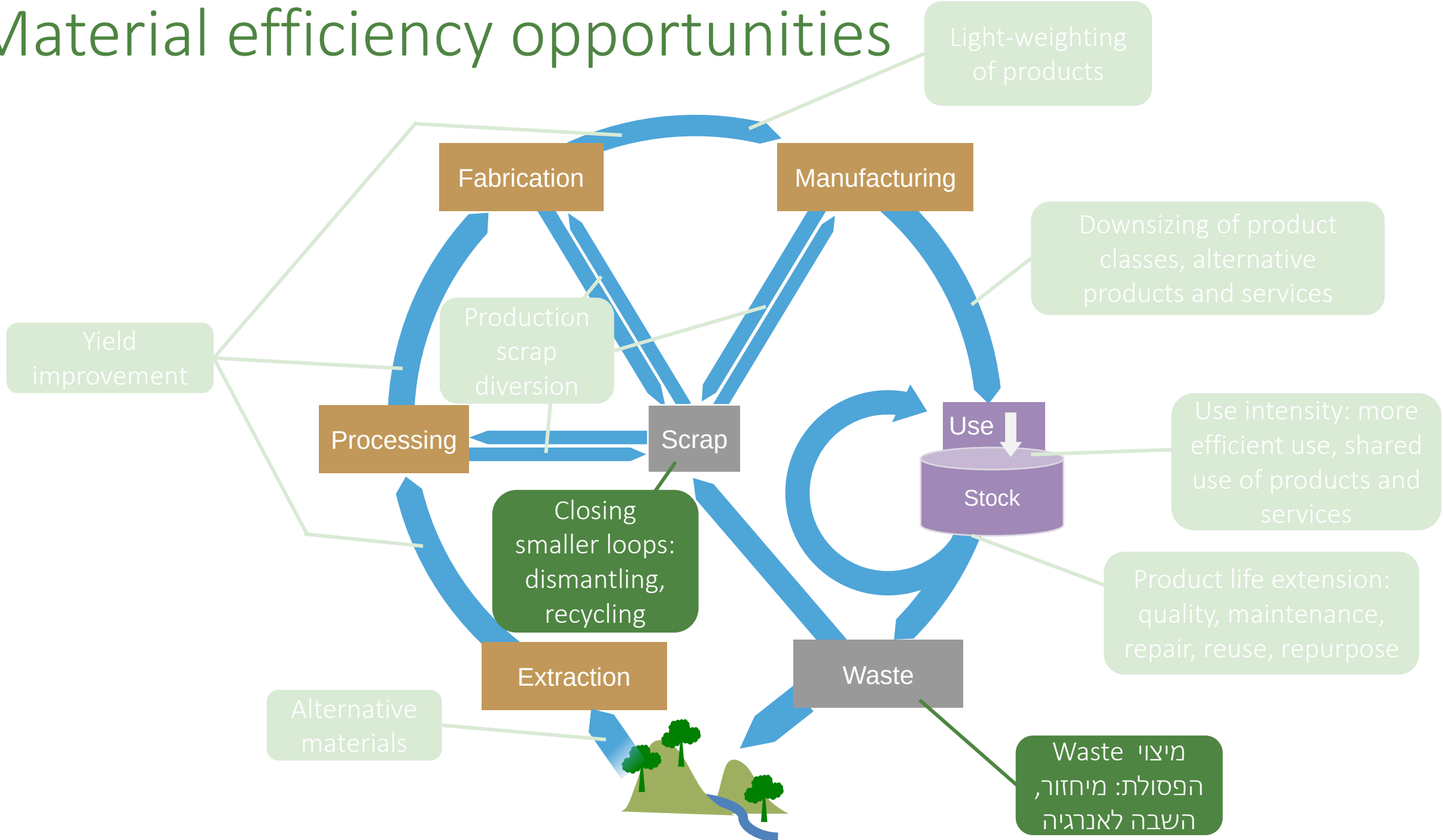
BEIJING (BLOOMBERG) - Remember those colorful mountains of metal in China after its bike-sharing boom went bust in 2017? Ever wondered what happened to them? Here's how you recycle bicycles.

THE STRAITS TIMES

# Graveyard of the bikes: Aerial photos of China's failed share-cycle scheme show mountains of damaged bikes

https://www.straitstimes.com/asia/east-asia/graveyard-of-the-bikes-chinas-failed-share-cycle-scheme-from-above

# Material efficiency opportunities



# THE CITY AS A RAW MATERIAL SUPPLIER

0 Comments / in Environment, Innovation

> In the city of Vienna, there are about 4,500 kg of iron, 340 kg of aluminum, 200 kg of copper, 40 kg of zinc and 210 kg of lead are hidden per capita,

# Material efficiency opportunities