



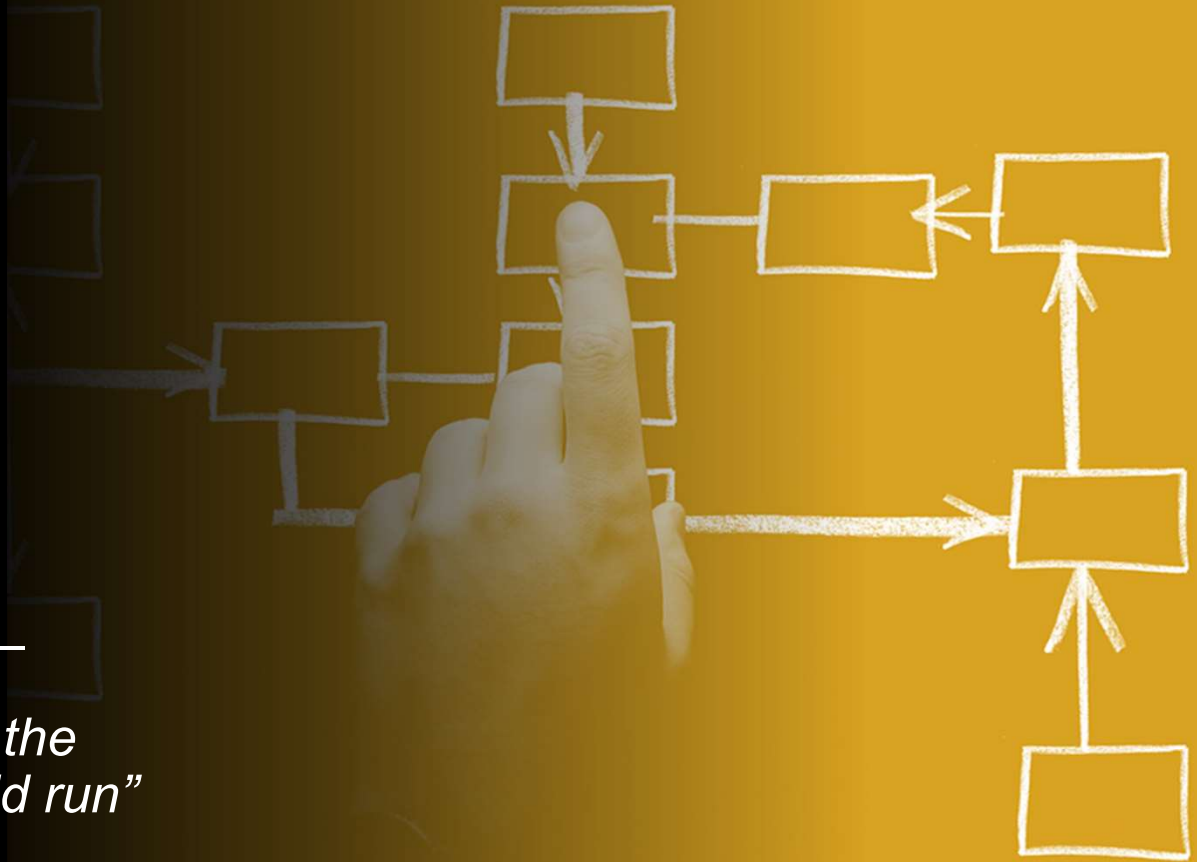
# Operations Management MLI21C617

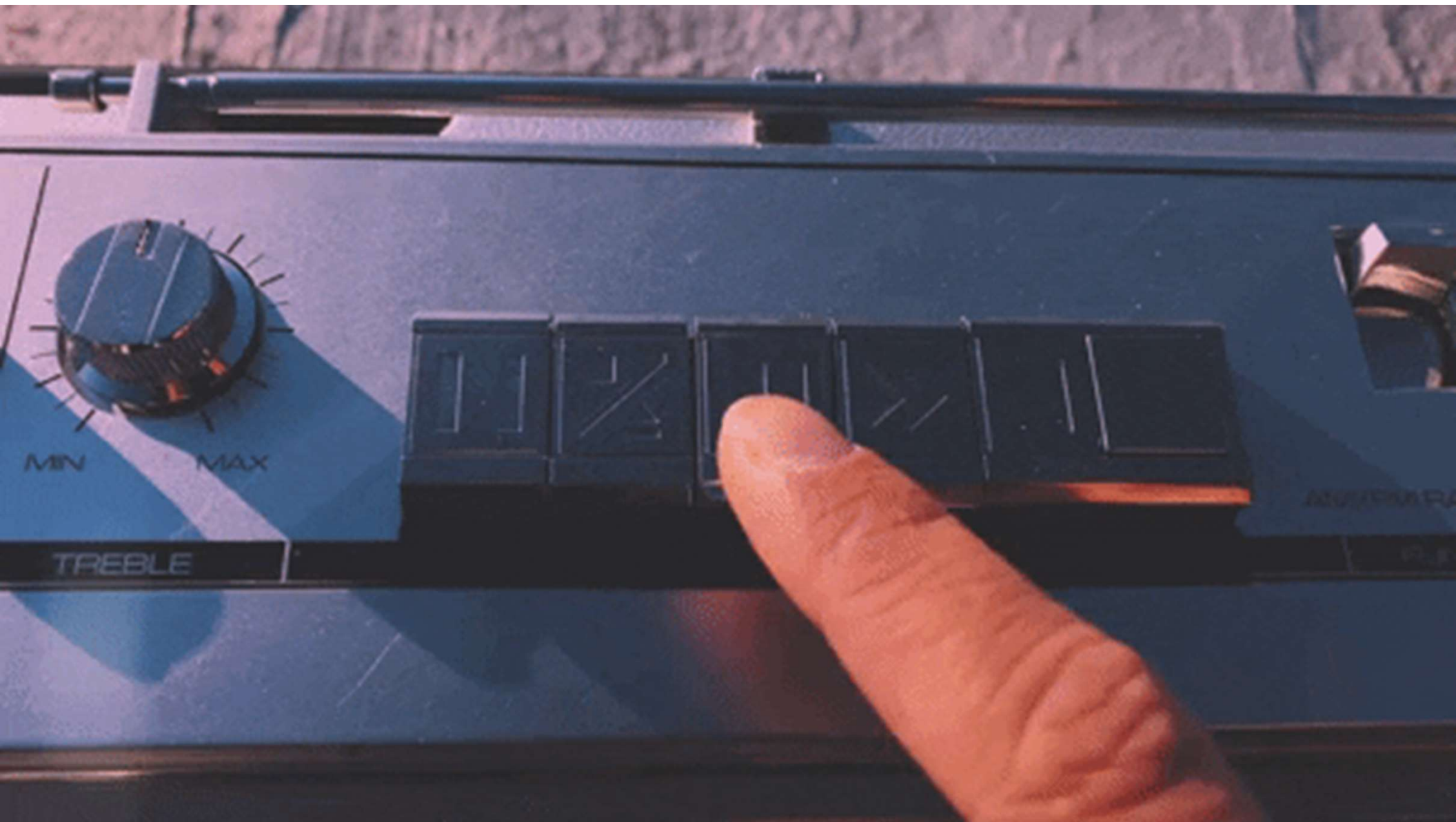
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*“Operations may not run the world, but it makes the world run”*

Lecturer: Misa Bakajic

Spring 2024





# Recap

1. The supply network is a system of interdependent actors
2. Transparency reduces variation in the supply chain
3. Government policy plays a key role in shaping company actions

**A!**

# LECTURE 12 Sustainable Supply Chains

**A!**

—

# The sustainability paradigm

# What is sustainability?



“Sustainability focuses on meeting the needs of the present without compromising the ability of future generations to meet their needs.”

- derived from Latin word *sustinere*, (to hold; keep; comprehend; represent; support)
- modern usage emerged in 1970s
- can be interpret as sustaining the current processes
- misused by industry during “green washing” campaigns

Source: <https://www.un.org/en/academic-impact/sustainability>

# UN SDG - Exercise

- Search the “UN SDG” website and review all 17 SDGs
- Select one area that is important to you personally. Decide if reaching the goal will be possible in your lifetime
- Imagine you are the CEO of Stora Enso the Finnish forest company
- Decide 3 SDG goals that would be important to the company and would have the largest impact on its operations and products



# Wise words?

“When discussing sustainability we should not be concerned so much about which product or brand to follow, rather which supply chain we wish to support. “ (Bakajic, 2024)

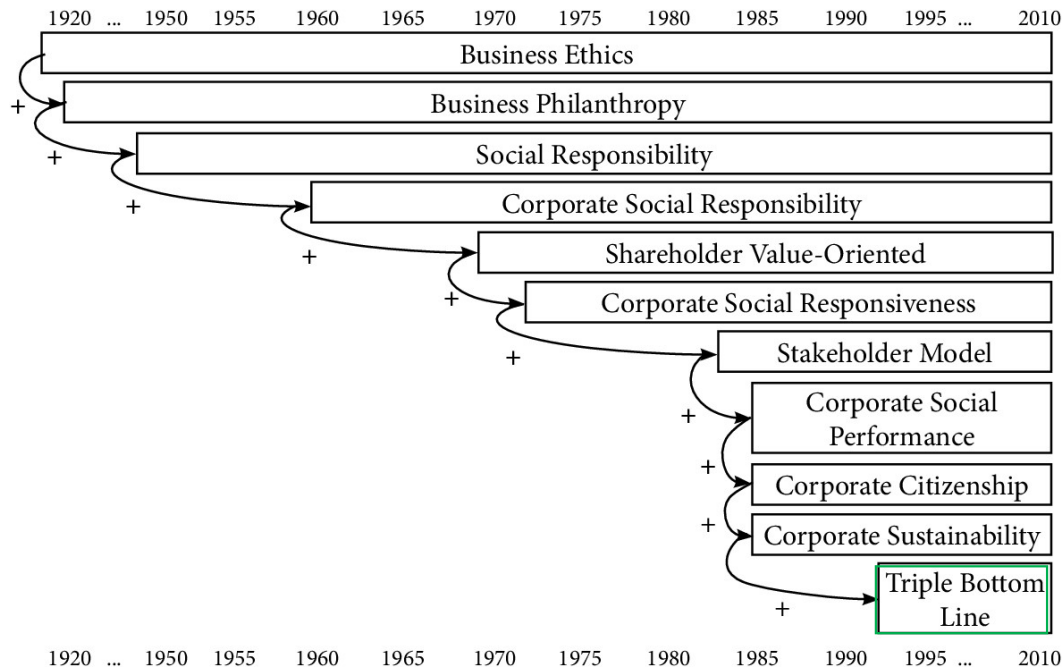




# Problems with being sustainable

- Easier to demonstrate something is not sustainable than prove that it is
- It is better to compare sustainability **within** a product, family, industry
- Biggest polluters also tend to talk about sustainability the most.
- Sustainability is often vaguely defined in both society and legislation.
- Showing sustainability only through CO<sub>2</sub> emissions is costly or inaccurate.

# The sustainability paradigm\*



\*In science a **paradigm** is a distinct set of concepts or thought patterns, including theories, research methods, postulates, and standards for what constitutes legitimate contributions to a field.

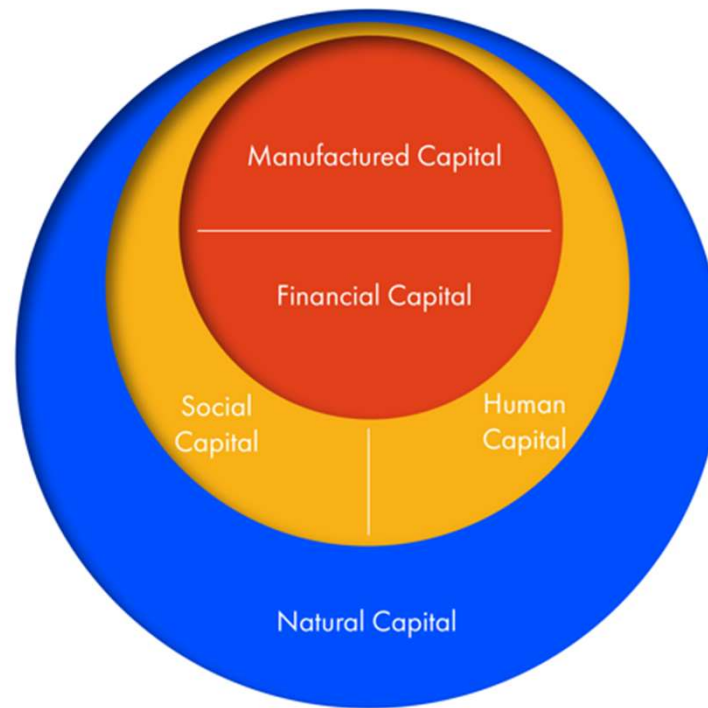
Yevdokimova, M., Zamlynskiy, V., Minakova, S., Biriuk, O. and Ilina, O., 2019. Evolution of corporate social responsibility applied to the concept of sustainable development. *Journal of Security & Sustainability Issues*, 8(3).

# The triple bottom line (TBL)

- Phrase coined in 1994 by John Elkington, from the British consultancy, SustainAbility.
- His argued that firms should be preparing 3 different (and quite separate) bottom lines.
- Bottom line = traditional measure of profit—the “bottom line” of the profit/loss account
- Elkington proposed the following three bottom line measures:
  1. Corporate profit generated
  2. Societal impact of firm activity
  3. Environmental impact of operations
- The TBL concept is commonly referred to as the 3 Ps: profit, people and planet
- The central idea is the that a company that takes into account all three bottom lines considers the “**true cost**” of doing business.

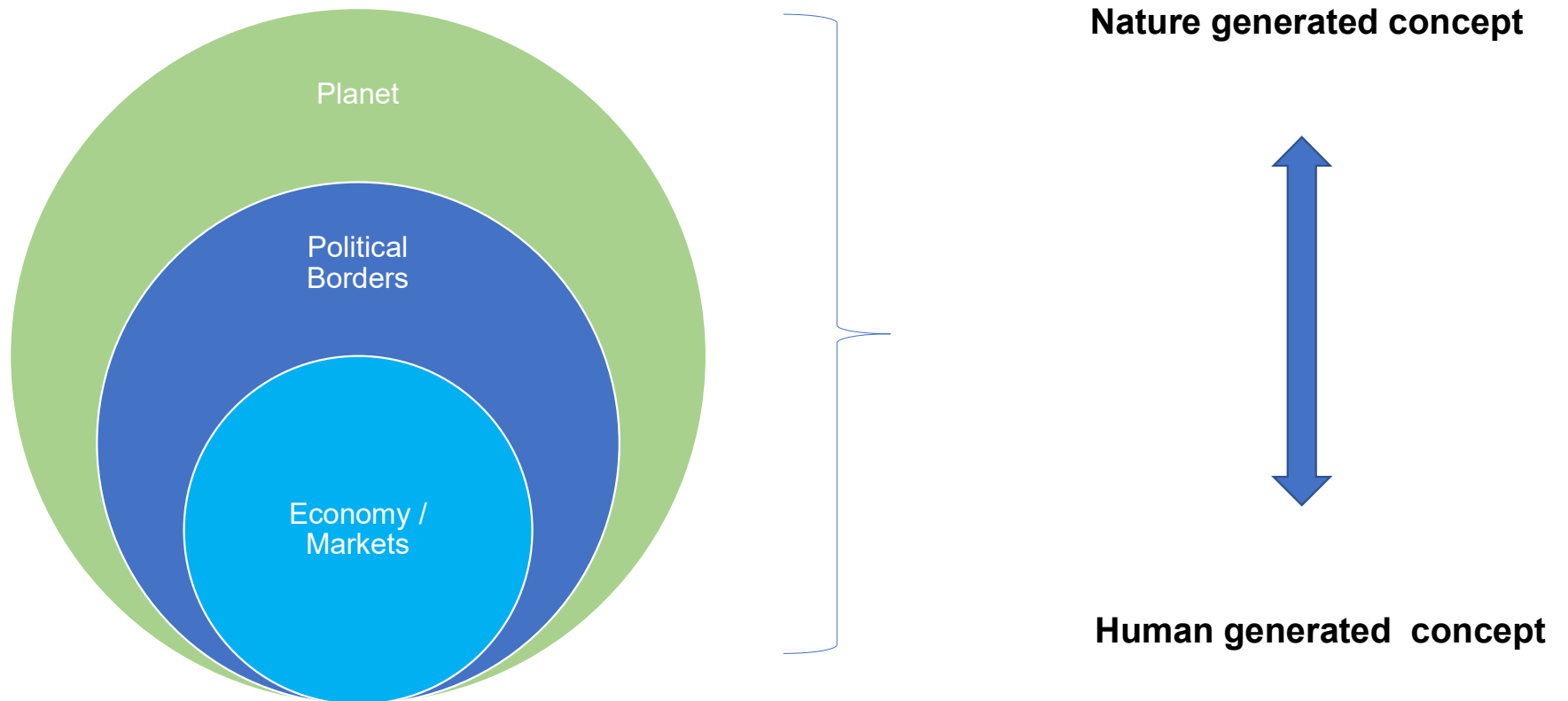
Particulars	Amounts \$
Total Revenue	20000
Cost of goods sold	8000
<b>Gross profit</b>	<b>12000</b>
Operating Expenses	
- Salaries	2000
- Rent	2000
- Other Expenses	1000
- Depreciation	1000
- Interest Expense	1000
Taxes	1000
<b>Bottom Line/ Net Income</b>	<b>4000</b>

# Expanding the concept of capital



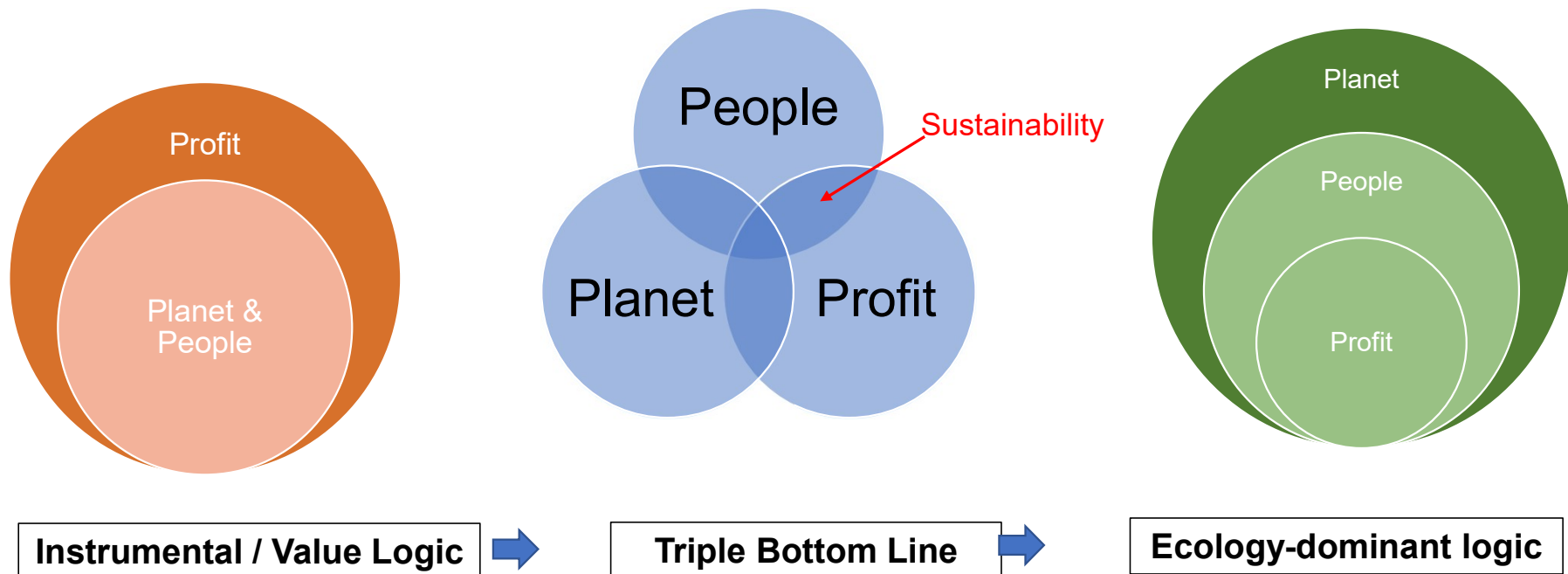
**Source:** Porritt, J., 2012. *Capitalism as if the World Matters*. Routledge.

# Planetary limits VS market boundaries

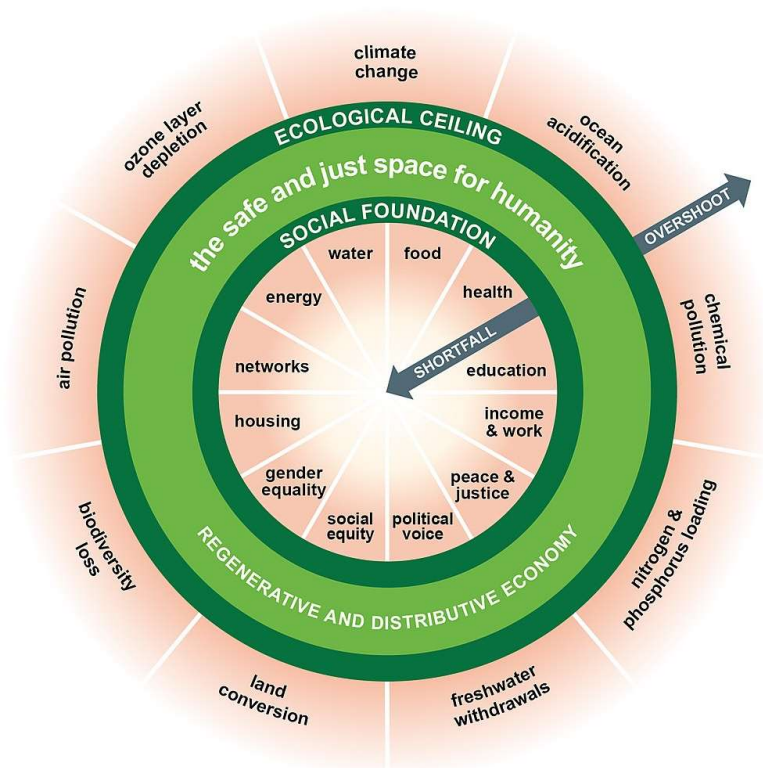


**Q** Which of these boundaries are changeable?

# Evolving business logic



# Doughnut economics



Raworth, K. 2017. Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist. Random House.

- Developed in 2012
- Oxford economist Kate Raworth
- Linking economic growth and planetary boundaries
- **Social Foundation** – Inspired by [UN SDGs](#)
- **Ecological ceilings** – Proposed a group of well-known climate scientists.
- Global economy is considered prosperous when all 12 social foundations are met without overshooting any of the 9 ecological ceilings.

# The paradox of environmental ethics

Q: Consider a mining company which has performed open pit mining in some previously unspoiled area. The area is far from human settlements. Does the company have a moral obligation to restore the landform and surface ecology? Should the company invest resources to return the land to its original state?





# Environmental Ethics – Overview

## Anthropocentric view (human centric)

- Since only human beings have moral value, we only have responsibilities to other humans

## Extension of Anthropocentric view

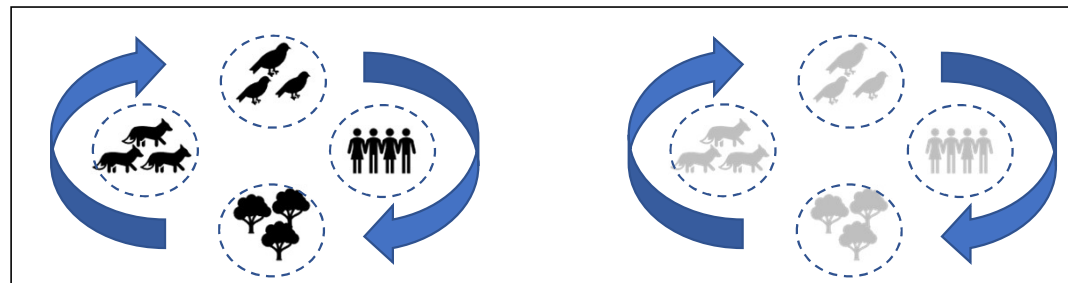
- We have a moral responsibility to both to present human society and future generations

## Non-Anthropocentric view

- In addition to our responsibilities to humans we have responsibilities to natural objects (core issues relate to plant and animal extinction)

## Extension of Non-Anthropocentric view (ecological wholes)

- Shifting focus from individual things to species, populations, ecosystems.



# Corporate personhood

*“In the eyes of U.S. law, a corporation is also regarded as a person”* (Ha-Brookshire, 2017)



- Firms are governed by regulation just like individuals
- Firms can enter into contracts with others
- Firms can be sued
- Firms pay corporate taxes
- Firms can have possessions
- Firms have power and influence

**Q:** Does a company have the capacity to possess ethics?

Elias L. Khalil, Is the firm an individual?, *Cambridge Journal of Economics*, Volume 21, Issue 4, July 1997, Pages 519–544, <https://doi.org/10.1093/oxfordjournals.cje.a013684>

French, P.A., 1979. The corporation as a moral person. *American Philosophical Quarterly*, 16(3), pp.207-215.

Ha-Brookshire, J., 2017. Toward moral responsibility theories of corporate sustainability and sustainable supply chain. *Journal of Business Ethics*, 145(2), pp.227-237.

# Corporate Social Responsibility

- *“voluntary integration...of social and environmental concerns in [companies’] commercial operations and in their relationships with interested parties”*
- CSR is an approach to business that helps the company to be socially accountable to itself, its stakeholders, and the public
- Engaging in CSR means a company operates in ways that enhance society and the environment instead of contributing negatively to them

Q: Is it reasonable to expect companies to be socially responsible?

# Companies as mechanisms for change

**Q:** Who gets to decide which outcomes are positive or negative?

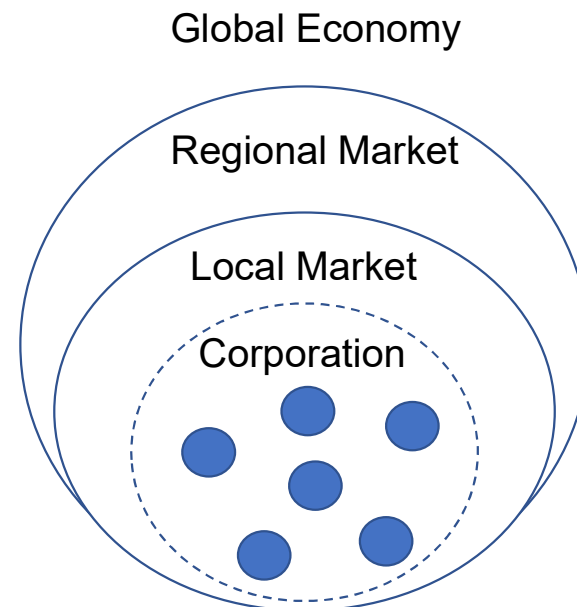
## INPUT

Land  
Labour  
Capital  
Entrepreneurship

Materials

Information

Knowledge



## OUTPUTS

**Positive Outcomes “Externalities”**  
(e.g. Jobs, economic progress, CSR activity)

**Negative Outcomes / “Externalities”**  
(e.g. Pollution, traffic, )

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**Levers of sustainable operations**  
LCA and Carbon emissions tracking

# **Levers of sustainable operations**

## **1. Life cycle analysis (LCA)**

Methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.

## **2. Carbon emissions monitoring**

Using methods to track the CO<sub>2</sub> emissions from operations, assets, companies and industries.

# Life Cycle Assessment (LCA)

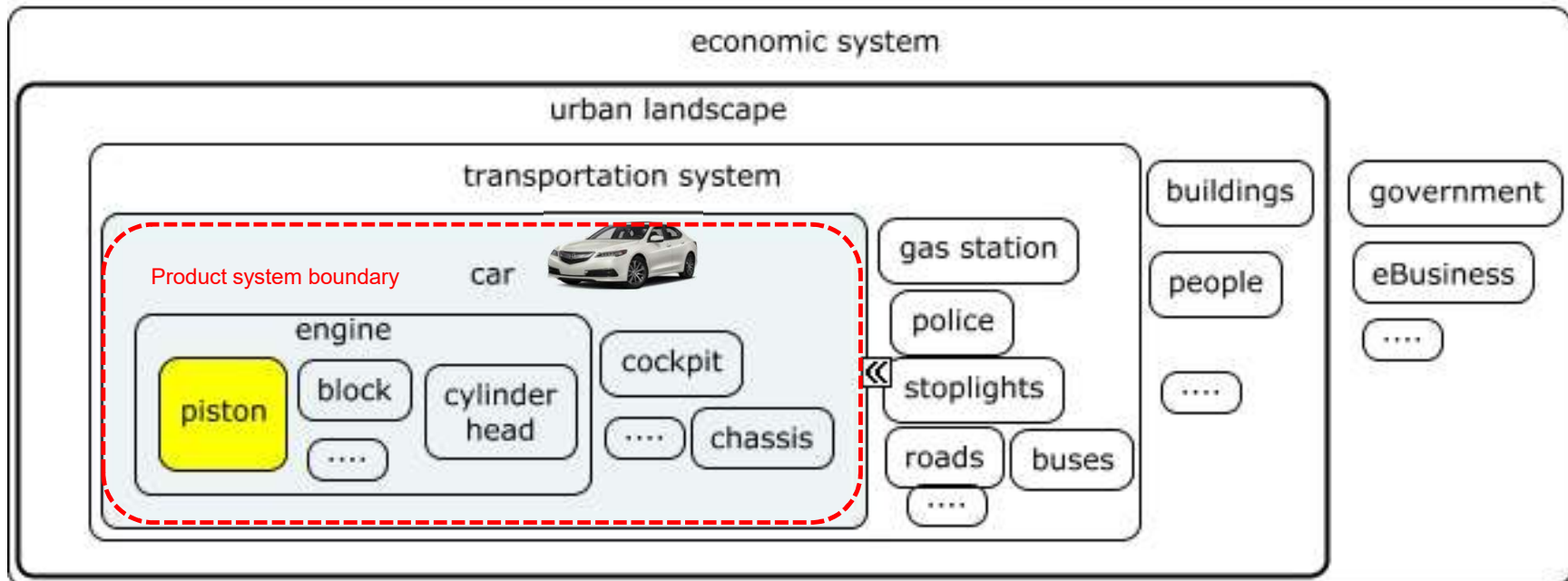
Three key terms that are related to LCA are:

1. **functional unit** (*quantified description of what a product or system does*)
2. **product systems** (*encompasses all interconnected processes that bring a product to life*)
3. **cradle-to-grave** (*describes entire lifespan of a product or system*)

# Product system

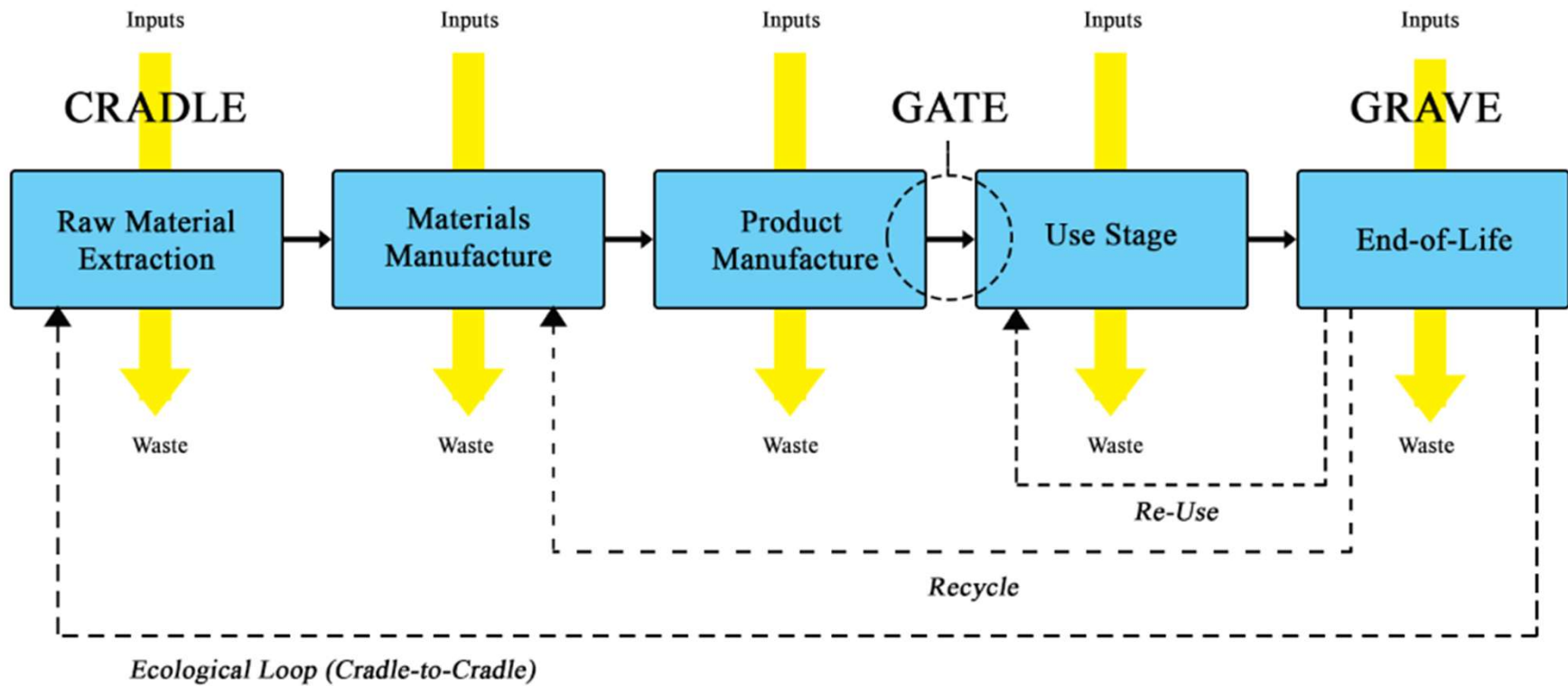
**Everything is part of a larger system**

So everything is connected to everything else. It just depends on how and how much.





# Cradle-to-grave



# The impact receipt by Asket



A S K  
E T

## The Impact Receipt

ORDER: 001

### THE T-SHIRT

RAW MATERIALS	
Impact (CO <sub>2</sub> )	0,29 kg
Water	33,27 m <sup>3</sup>
Energy	12,41 mJ
MILLING	
Impact (CO <sub>2</sub> )	1,12 kg
Water	0,50 m <sup>3</sup>
Energy	20,00 mJ
MANUFACTURING	
Impact (CO <sub>2</sub> )	0,24 kg
Water	1,30 m <sup>3</sup>
Energy	5,40 mJ
TRIMS	
Impact (CO <sub>2</sub> )	0,13 kg
Water	0,03 m <sup>3</sup>
Energy	5,14 mJ
TRANSPORT	
Impact (CO <sub>2</sub> )	0,11 kg
Water	0,00 m <sup>3</sup>
Energy	1,20 mJ
TRUE COST	
Impact (CO <sub>2</sub> )	1,89 kg
Water	35,10 m <sup>3</sup>
Energy	44,1 mJ

### 180 WEARS

MIN. EXPECTED LIFETIME

<b>0,19 EUR</b>	<b>0,01KG</b>
COST PER WEAR	CO <sub>2</sub> PER USE
<b>0,20 m<sup>3</sup></b>	<b>0,25 mJ</b>
WATER PER WEAR	ENERGY PER USE

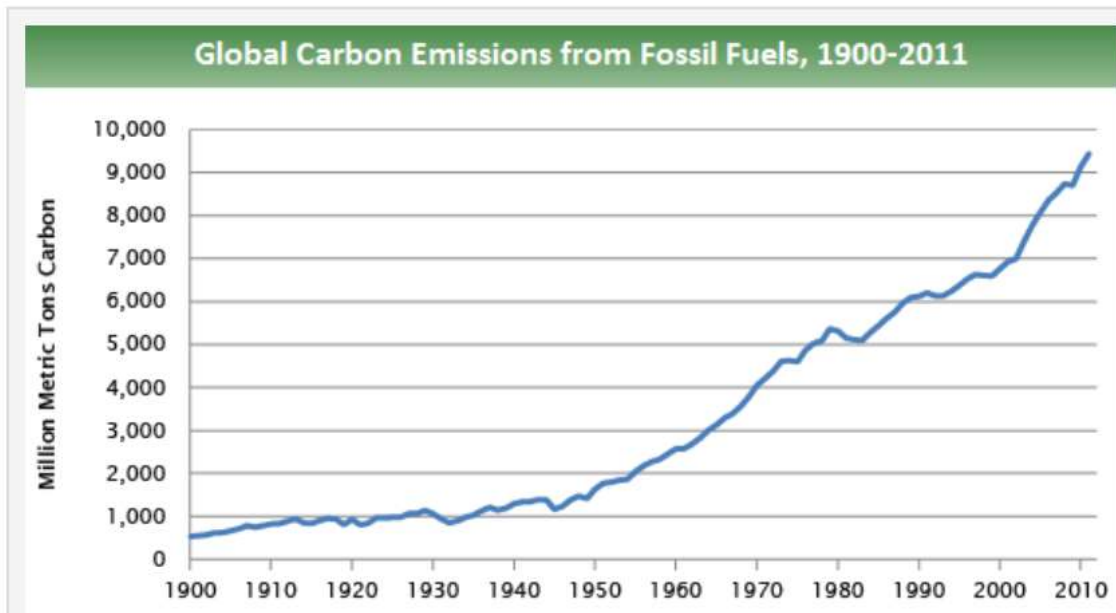
KNOW YOUR IMPACT, BUY LESS,  
KEEP IT LONGER

I'VE READ AND UNDERSTOOD THE  
IMPACT OF MY CHOICE:

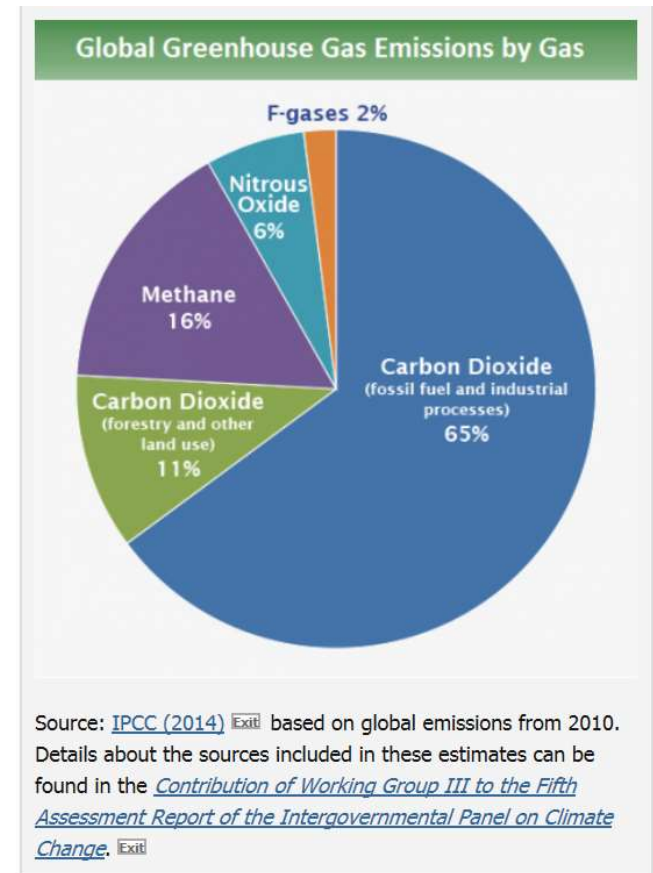
ASKET.COM

# Greenhouse gas (GHG) emissions

## Trends in Global Emissions



Source: Boden, T.A., Marland, G., and Andres R.J. (2015). [Global, Regional, and National Fossil-Fuel CO<sub>2</sub> Emissions](#). Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, doi 10.3334/CDIAC/00001\_V2015.

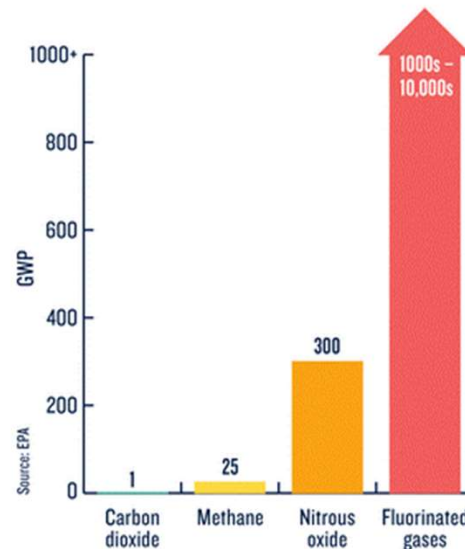


Source: [IPCC \(2014\)](#) <sup>Exit</sup> based on global emissions from 2010. Details about the sources included in these estimates can be found in the [Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change](#). <sup>Exit</sup>

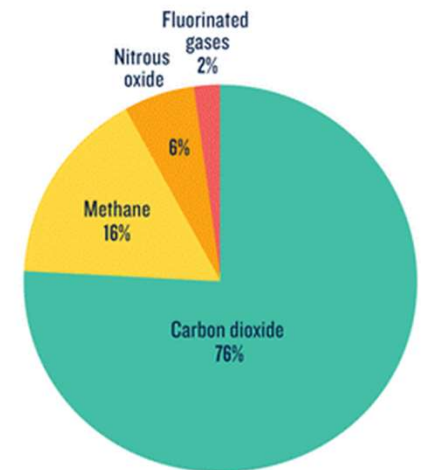
# Global Warming Potential (GWP)

- GWP was developed to compare global warming impacts of different gases.
- Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, **relative to the emissions of 1 ton of carbon dioxide (CO<sub>2</sub>)**

## HOW GREENHOUSE GASES WARM OUR PLANET



The global warming potential (GWP) of human-generated greenhouse gases is a measure of how much heat each gas traps in the atmosphere, relative to carbon dioxide.



How much each human-caused greenhouse gas contributes to total emissions around the globe.

# CO<sub>2</sub> equivalent (CO<sub>2</sub>e)

A **carbon dioxide equivalent** abbreviated as **CO<sub>2</sub>-eq** or **CO<sub>2</sub>e** is a metric measure used to compare emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.



# Carbon Tax VS Cap and Trade Systems

The two be compared to the “carrot and stick” approach to the government approach to policy.

## **CAP AND TRADE**

- Government regulatory program designed to limit, (or cap), the total level of emissions of certain chemicals, particularly carbon dioxide, as a result of industrial activity.

## **CARBON TAX**

- A carbon tax is a tax levied on the carbon emissions required to produce goods and services.

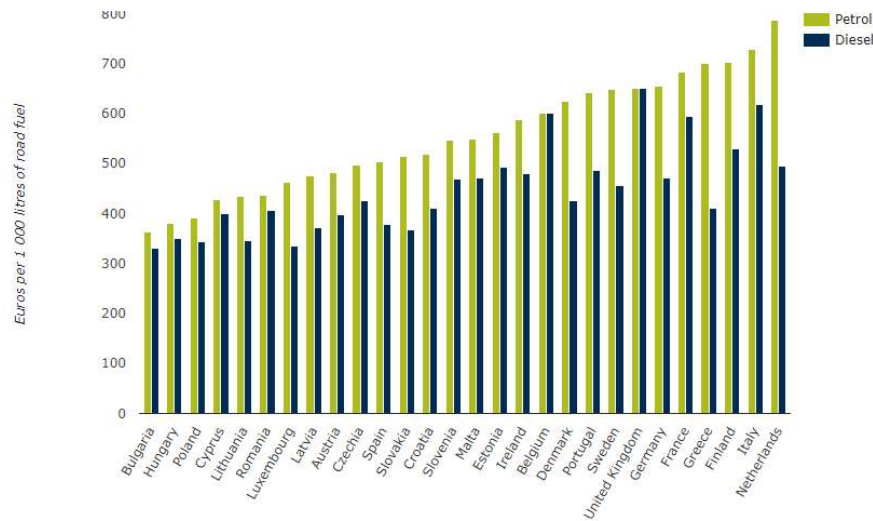


Source: <https://www.investopedia.com/terms/c/cap-and-trade.asp>

# Carbon Tax

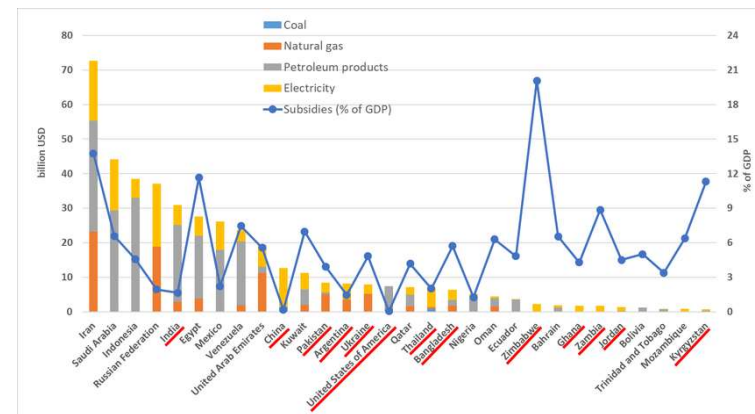
- Under a carbon tax, the government sets a price that emitters must pay for each ton of greenhouse gas emissions they emit. Businesses and consumers will take steps, such as reducing consumption, switching fuels or adopting new technologies, to avoid paying the tax.

Road fuel excise duties



E.C.2022. Fuel Prices and taxes <https://www.eea.europa.eu/data-and-maps/indicators/fuel-prices-and-taxes/assessment-4>

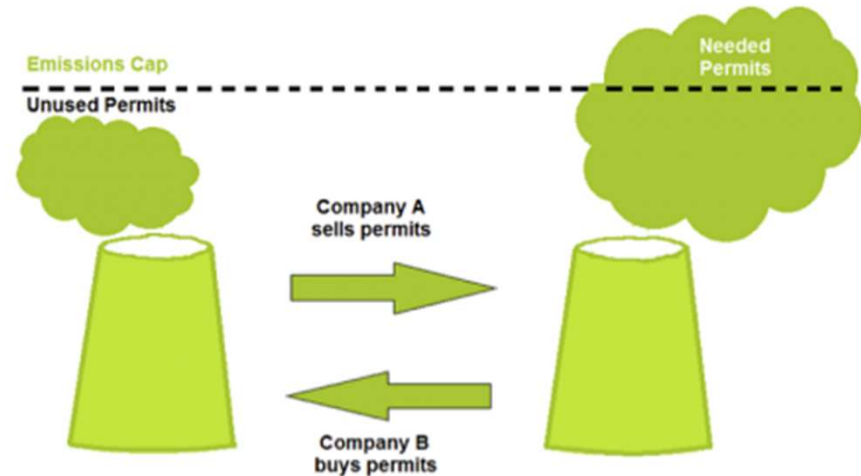
Fuel Subsidy



Chepeliev, M. and van der Mensbrugge, D., 2020. Global fossil-fuel subsidy reform and Paris Agreement. *Energy Economics*, 85, p.104598.

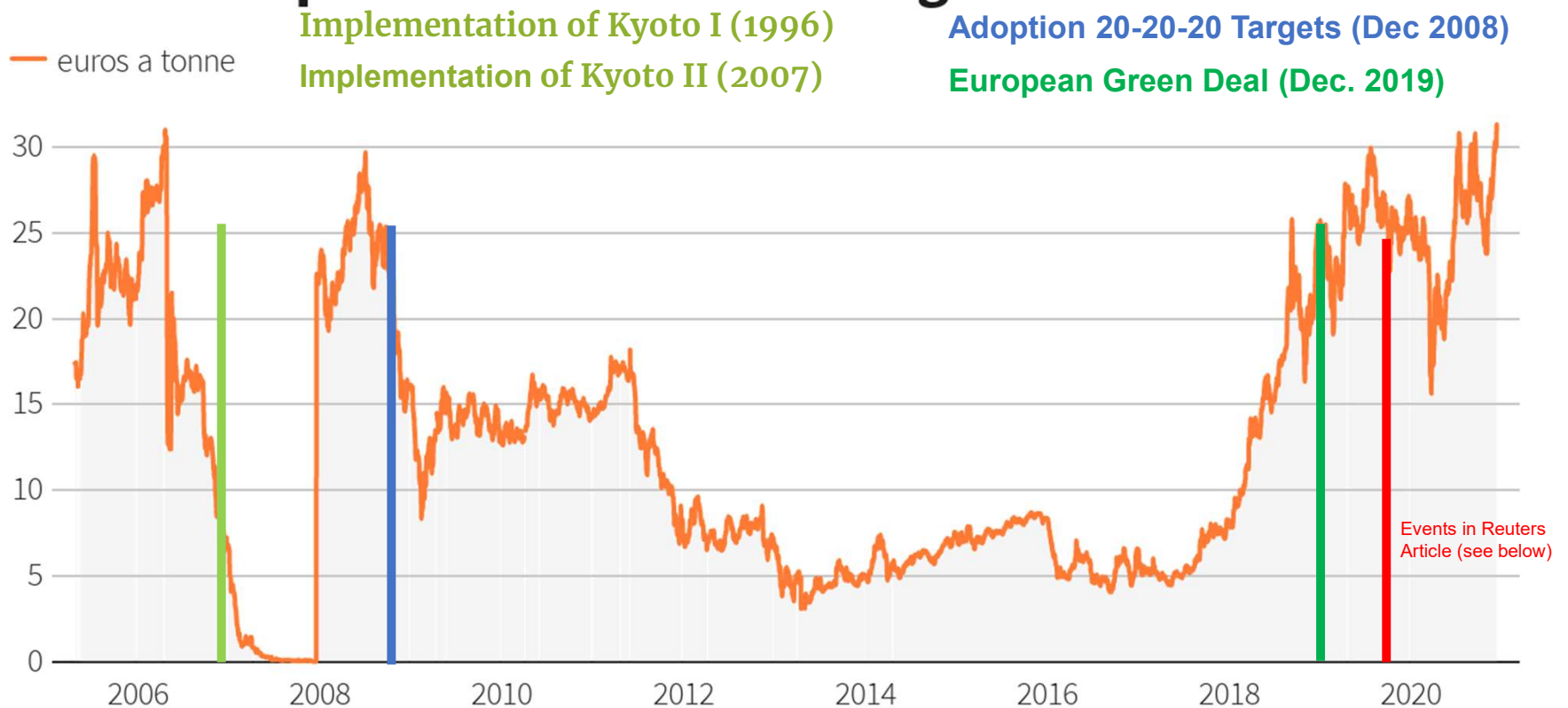
# Cap and Trade System in the EU

- EU Emissions Trading Scheme is a key pillar of European climate policy.
- EU Emissions Trading Scheme (EU ETS) is the world's first and largest installation-level 'cap-and-trade' system for cutting greenhouse gas (GHG) emissions.
- The main features of the EU ETS are:
  1. the emission cap (a ceiling on the maximum amount)
  2. the trading of EU emission allowances (EUAs)





# EU carbon price rises to all-time high



Note:

Source: Refinitiv

Reuters.(2020). EU carbon price rises to all-time high after EU climate deal. [online]Accessed at: < <https://www.reuters.com/article/us-eu-carbon-idUSKBN28L0SO> >

# Polluter pays principle



- Polluter Pays Principle (PPP) is one of the key principles underlying the EU environmental policy.
- It means that polluters bear the costs of their pollution including the cost of measures taken to prevent, control and remedy pollution and the costs it imposes on society.
- Polluters are incentivised to avoid environmental damage and are held responsible for the pollution that they cause.
- The polluter, not the taxpayer, who covers cost of remediation.

# Polluter pays principle



## Command and control law

- **Licensing procedures**
- **Bans**
- **Emission limit values**
- **Administrative orders & sanctions**

aims to cut pollution at source by setting environmental standards, mandating pollution control and monitoring systems to reduce risks, prohibiting certain activities and capping the emissions of certain pollutants. The PPP is applied because the polluter is required to bear the compliance costs.



## Market-based instruments

- **Subsidies/feed-in tariffs**
- **Taxes, charges, fees**
- **Tradable permits and quotas**
- **Liability rules**

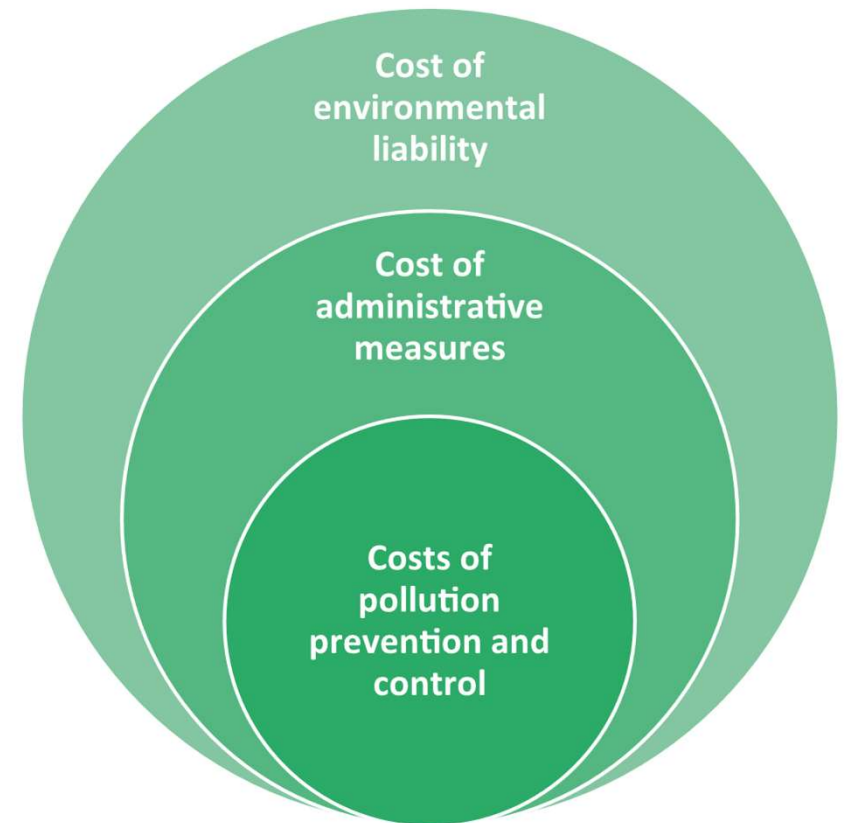
are intended to achieve environmental objectives in a flexible manner. Financial incentives or disincentives are used to influence polluters' behaviour by incorporating environmental costs and benefits into the budgets of households and enterprises. Not all market-based instruments can be adopted at EU level. In particular, taxation is primarily a Member State competence.



## Voluntary approaches

- **Voluntary agreements**
- **Environmental management systems (e.g. ISO 14001)**
- **Labelling (e.g. eco-label, energy label)**

can encourage less polluting products or companies. For example, consumers may favour products bearing the "Ecolabel", which gives producers the incentive to manufacture less polluting products.



# The European Green Deal



Set of policy initiative by the European Commission (EC)

Key objective is to make the EU climate neutral by 2050

Goals extend to different sectors such as: construction, energy, transport, food, etc.

Plan includes potential carbon tariffs for member states that do not meet targets.

# What is sustainability reporting?

Sustainability information may be included in a company's annual report or a separate report.

Helps investors, civil society organizations, consumers, policy makers and other **stakeholders to evaluate the non-financial performance** of large companies.

It encourages companies to develop a responsible approach to business.



# What is sustainability reporting?



**EU law requires** certain large companies to disclose information on the way they operate and manage social and environmental challenges.

Rules non-financial reporting currently apply to large public-interest companies with more than 500 employees. It includes about 11 700 large companies and groups across the EU, including

- listed companies
- banks
- insurance companies
- other companies designated by national authorities as public-interest entities

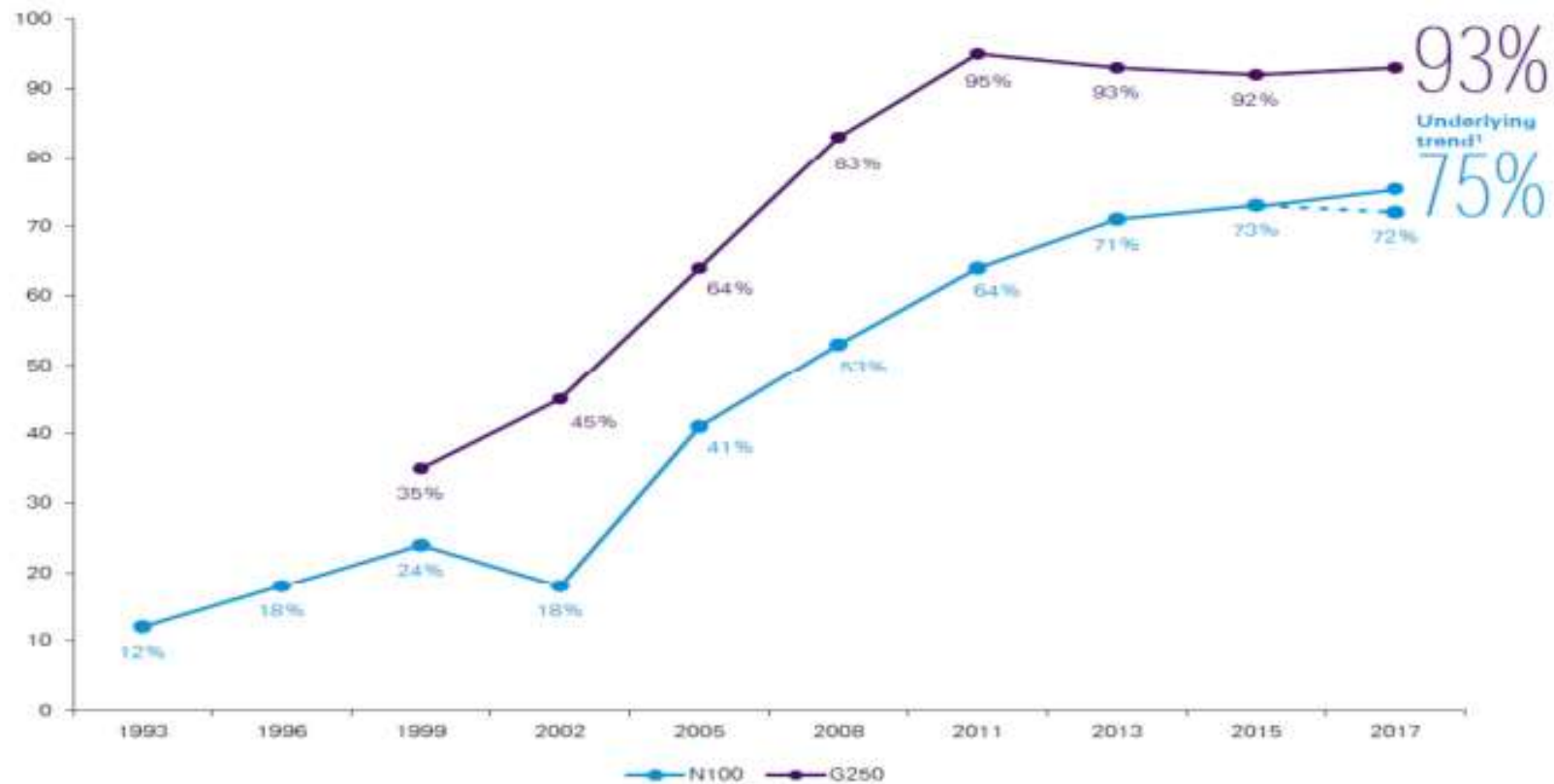
# How is sustainability reported?

“an organization’s practice of reporting publicly on its economic, environmental, and/or social impacts, and hence its contributions – positive or negative –towards the goal of sustainable development.”(GRI)

“The information made available through sustainability reporting allows internal and external stakeholders to form opinions and to make informed decisions about an organization’s contribution to the goal of sustainable development.

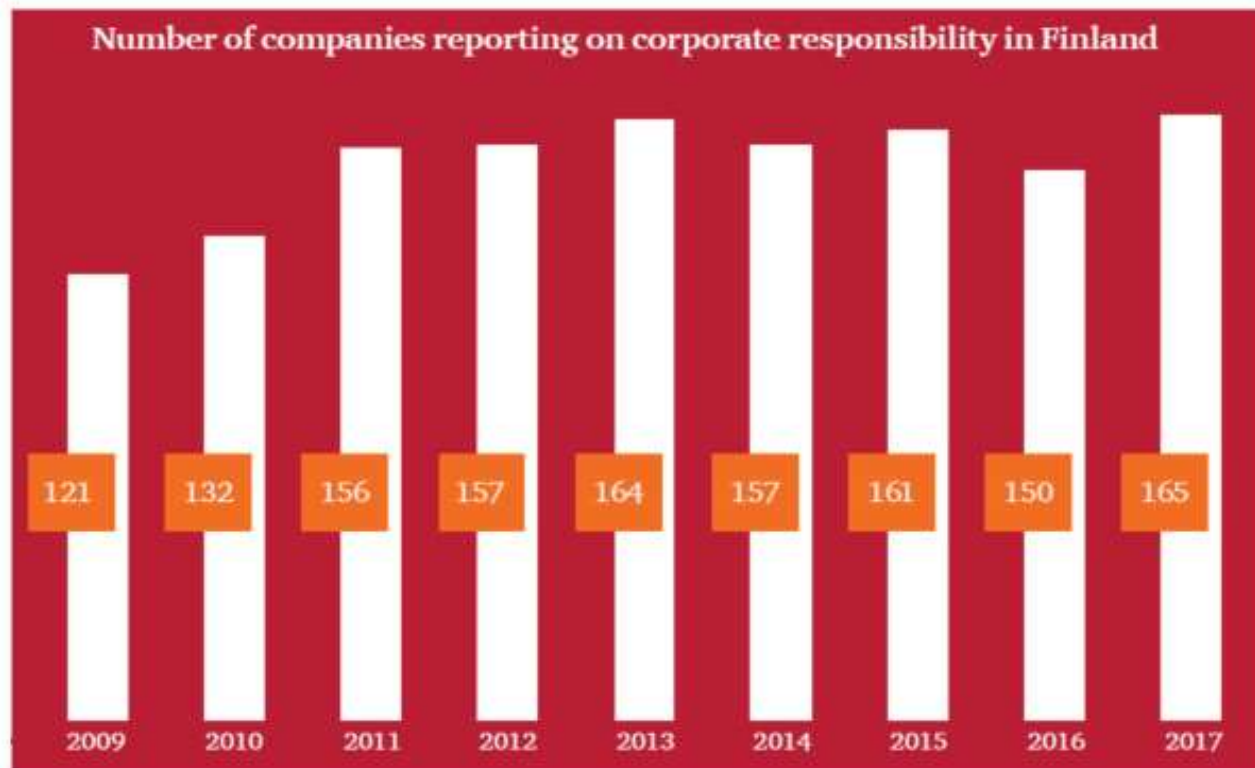
# Growth in Sustainability Reporting

Growth in global CR reporting rates since 1993





# PwC's Corporate Responsibility Barometer 2018



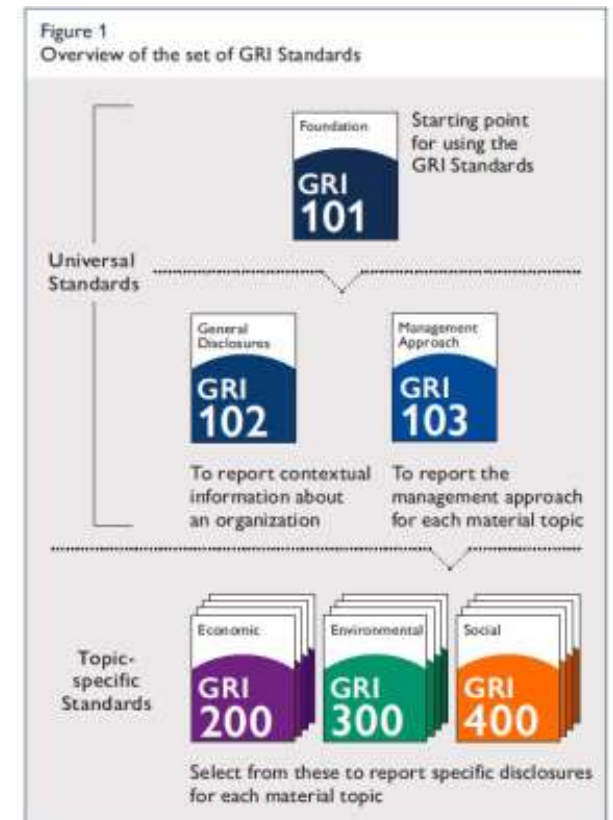
Source: <https://www.pwc.fi/en/publications/corporate-responsibility-barometer-2018.html>

# Sustainability reporting landscape

- **Global Reporting Initiative - GRI**
- Non-financial information statement – NFI (EU related)
- Integrated Reporting - IR
- Sustainable Development Goals - SDG
- UN Global Compact – UN GC
- Task Force on Climate-related Financial Disclosures - TCFD
- Sustainability Accounting Standards Board – SASB
- Etc.

# Global Reporting Initiative - GRI

- Founded 1997 in Boston, US
- Independent international organization
- Established non-financial reporting standard
- GRI helps organizations to measure, understand, communicate performance.
- GRI helps firms set future goals.



# Materiality in sustainability reporting

- **Definition:** information that is likely to influence the assessment process and decisions of stakeholders.
- Concept taken from financial accounting
  - Where information is deemed material if its omission or misstatement could influence the economic decisions of users taken on the basis of the financial statements (IASB Framework).
- What is considered material in one industry may not be important in another industry?
- **Q:** Is fair to compare the sustainability impact of the oil industry with that of the manufacturing sector?



# Group Assignment – Materiality

Visit the SASB Materiality Finder and compare materiality from Stora Enso Pulp & Paper Products with that of the Forestry Management sector.

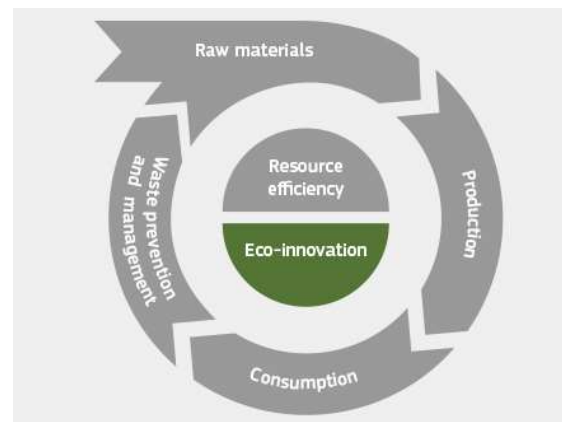
1. Which topics are material for both sectors?
2. From the common topics select one topic you feel is especially critical to the both sectors.
3. Look up both of your companies and compare the topics

• **Time:** 5 minutes

Link: <https://www.sasb.org/standards/materiality-finder/find/>

# Eco-Innovation

- ‘...innovation...through **reducing impacts on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources.**
- Eco-innovation may be technological or non-technological.



# EU Eco-innovation index

Performance of EU Member States on environmental innovations is measured by the summary Eco-innovation index using 16 indicators. (e.g., investments, patents, eco-product exports, etc.)

Select year:

2012 2013 2014 2015 2016 2017 2018 2019 2020 2021



E.C. 2022. Eco-innovation Index. [online] Available at: < [https://ec.europa.eu/environment/ecoap/indicators/index\\_en](https://ec.europa.eu/environment/ecoap/indicators/index_en) >

# Quantifying the eco-innovation opportunity

- eco-innovation is creating new business, jobs and growth in
- today estimated annual turnover of €227 billion (2.2% of EU's GDP) outperforming the aerospace or pharmaceutical industries.
- directly employs 3.4 million people
- large portions of funding is allocated towards eco-innovations



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# Measuring supply chain sustainability

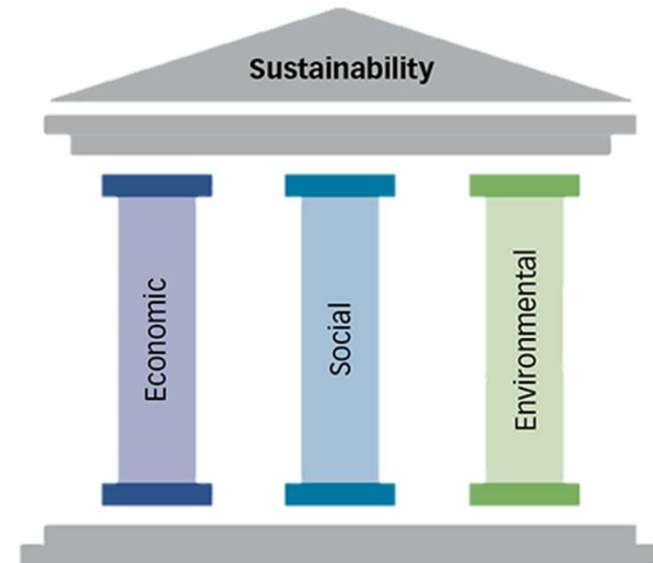
# Measuring supply chain sustainability

## Reporting supply chain sustainability: a myriad of metrics

There are more than 2,500 different metrics used to measure sustainability in supply chains, bringing both challenges and opportunities for business



## THE TRIPLE BOTTOM LINE (TBL)



# 1. Measuring environmental sustainability

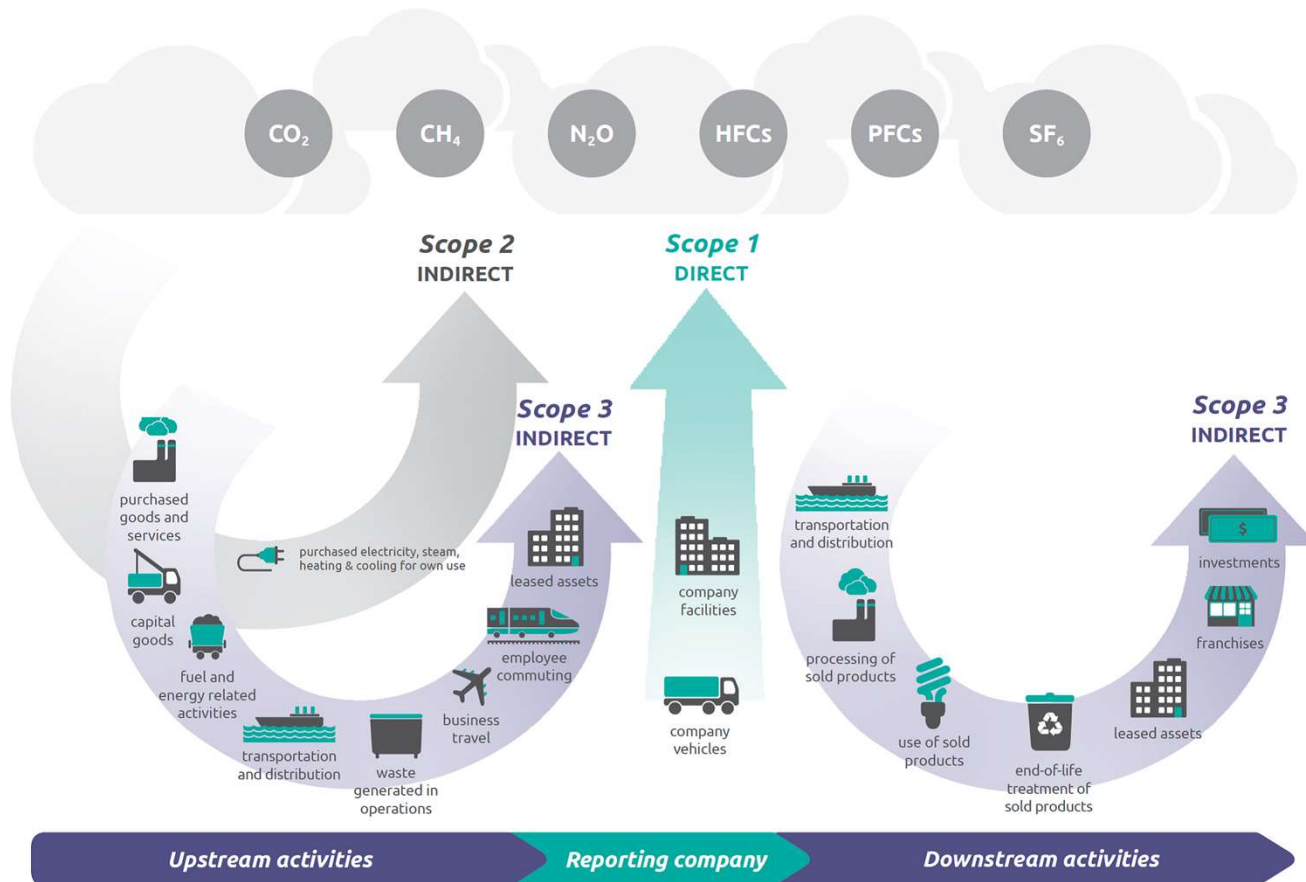


## Some popular metrics

- GHG emissions
- Hazardous substance usage and waste
- Net water consumption and waste
- Total usage of energy and key virgin resources
- Total supplier waste to landfills
- Total supplier energy consumption per unit of corporate output
- Recycling rates
- Recycled material % in product
- Environmental investments & training

**Q:** What does per unit of corporate output mean?

# Scope 1, 2 and 3 emissions



## 2. Measuring social sustainability



### Some popular metrics

- Labor productivity (Corporate output /FTE)
- Employee satisfaction survey
- Turnover rate
- Health and safety aspects
- Supporting community Projects,
- Number of community complaints
- Charitable contributions
- Net income, (ratio of lowest wage to provincial minimum)
- Social investments and training

Q: What does FTE mean?

### 3. Measuring supply chain performance (economic dimension)

- The SCOR framework offers 250 SCOR metrics, categorized against five performance attributes:

1. Reliability
2. Responsiveness
3. Flexibility
4. Costs
5. Asset management



Q: Which of these could be used to measure risk?

# Environmental certification (Ecolabels)

- Can be voluntary or mandatory
- Ranging in monitoring activity
- Impacts all stages of supply chain (from raw materials to recycling)
- Often costs money to maintain the label validity
- Labels vary in effectiveness (some are only marketing AKA “greenwash”)



# Rainforest Alliance VS Fairtrade



**Vision/ Mission** *“creating a more sustainable world by using social and market forces to protect nature and improve the lives of farmers and forest communities.*



**Vision/ Mission** *“to connect disadvantaged producers and consumers, promote fairer trading conditions and empower producers to combat poverty, strengthen their position and take more control over their lives.”*



# Solving supply chain uncertainty

- Sharing information
- System integration
- Use of contracts
- **Performance monitoring**
- Partner development / training
- Coordination
- Third party certification



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# Circular supply chains

# Sustainable supply chain archetypes

- **Forward Logistics** 

Standard flow of goods and materials from raw material extraction to customer. Information and money flows travel in the opposite direction.

- **Reverse logistics** 

Activity of collecting and sorting product waste materials from the end customer. Objectives include, customer returns, warranty and maintenance services, and recycling.

- **Closed Loop Logistics or Supply Chain Management (CLSCM)** 

Refers to all forward Logistics in the chain (like procurement of materials, production and distribution) as well as the Reverse Logistics

- **Green Logistics or Green Supply Chain Management (GSCM)** 

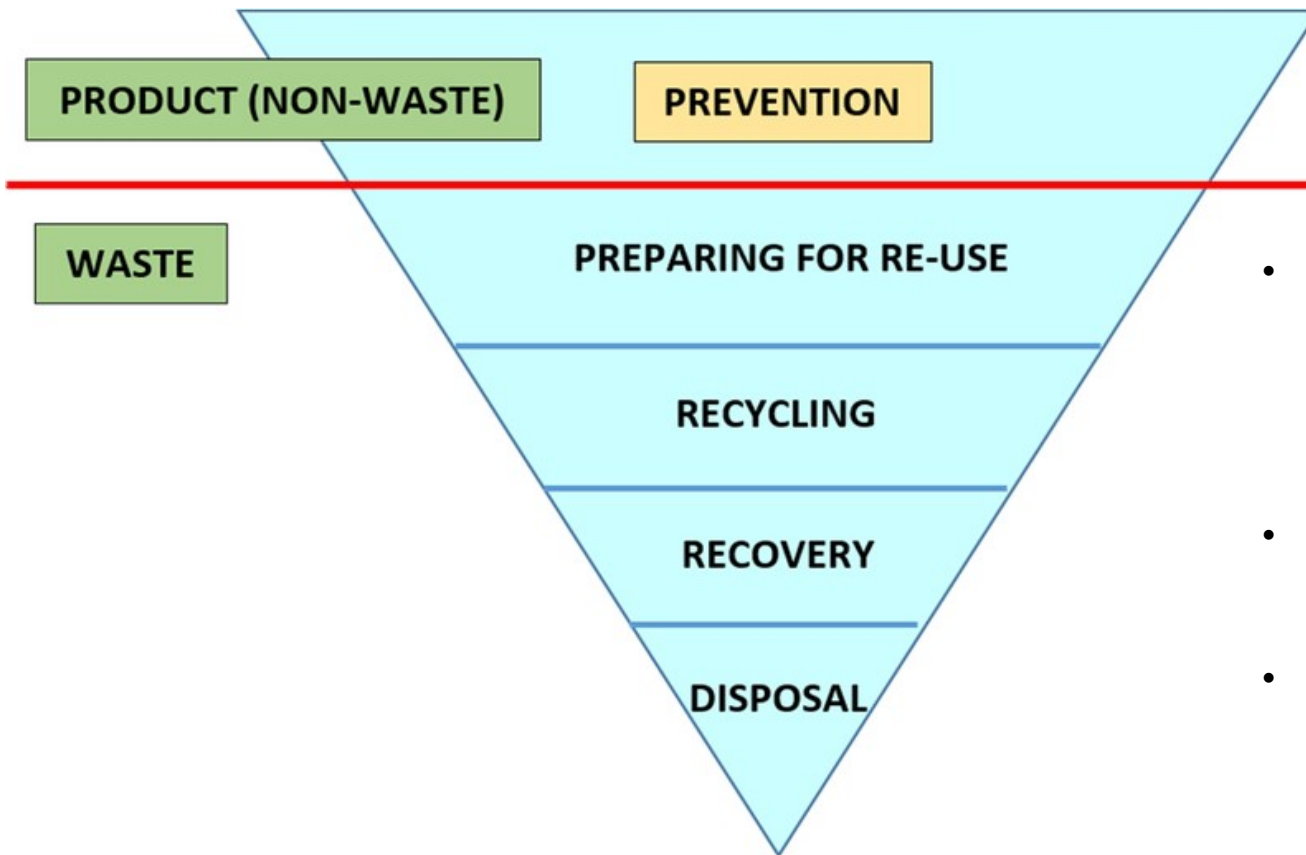
Describes activities and methods that reduce the ecological impact of transport, processing and storage of goods.

- **Sustainable supply chain management (SSCM)** 

Holistic approach that involves integrating environmental, economic [often social] objectives into the management of the operation strategy of the supply chain.

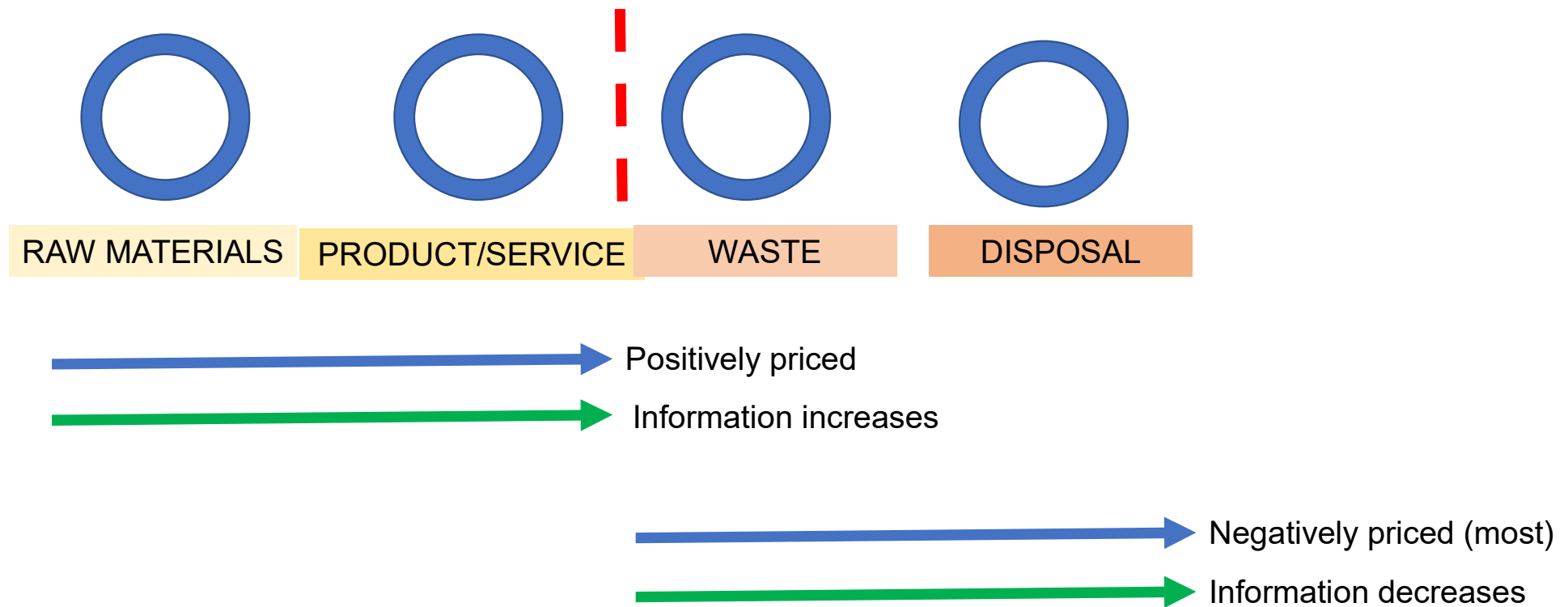
- Herrmann, F.F., Barbosa-Povoa, A.P.; Butturi, M.A., Marinelli, S.; Sellitto, M.A. 2021 Green Supply Chain Management: Conceptual Framework and Models for Analysis. Sustainability, 13, 8127. <https://doi.org/10.3390/s13088127>
- Batista, L., Bourlakis, M., Smart, P. and Maull, R., 2018. In search of a circular supply chain archetype—a content-analysis-based literature review. *Production Planning & Control*, 29(6), pp.438-451.

# EU WASTE HIERARCHY



- EU categorises waste according to environmental harm:
  - I. hazardous waste
  - II. non-hazardous waste
  - III. inert waste
- Waste hierarchy expands categorization of waste
- prioritises and guides waste related legislation in the EU

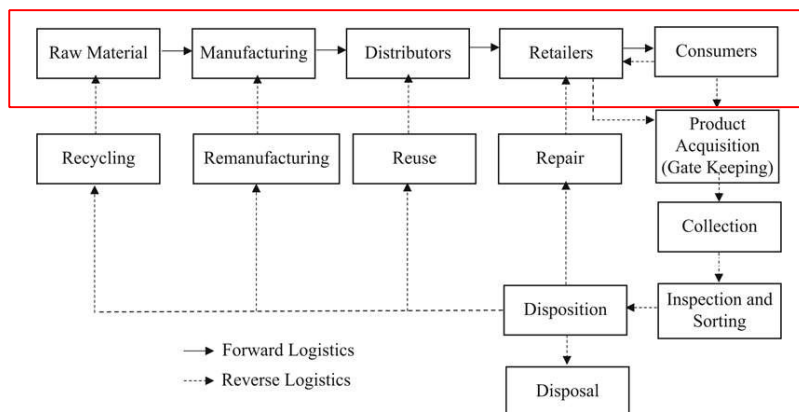
# Information in the waste value chain



**Increasing material information has potential to increase the value of waste**

# Reverse Logistics

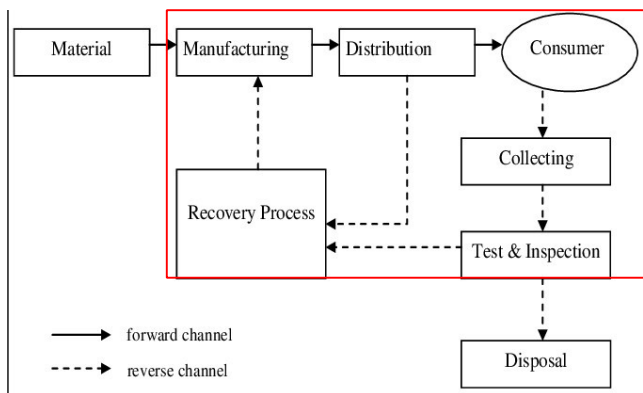
- Activity of collecting and sorting product waste materials from the end customer. Objectives include, customer returns, warranty and maintenance services, and recycling.



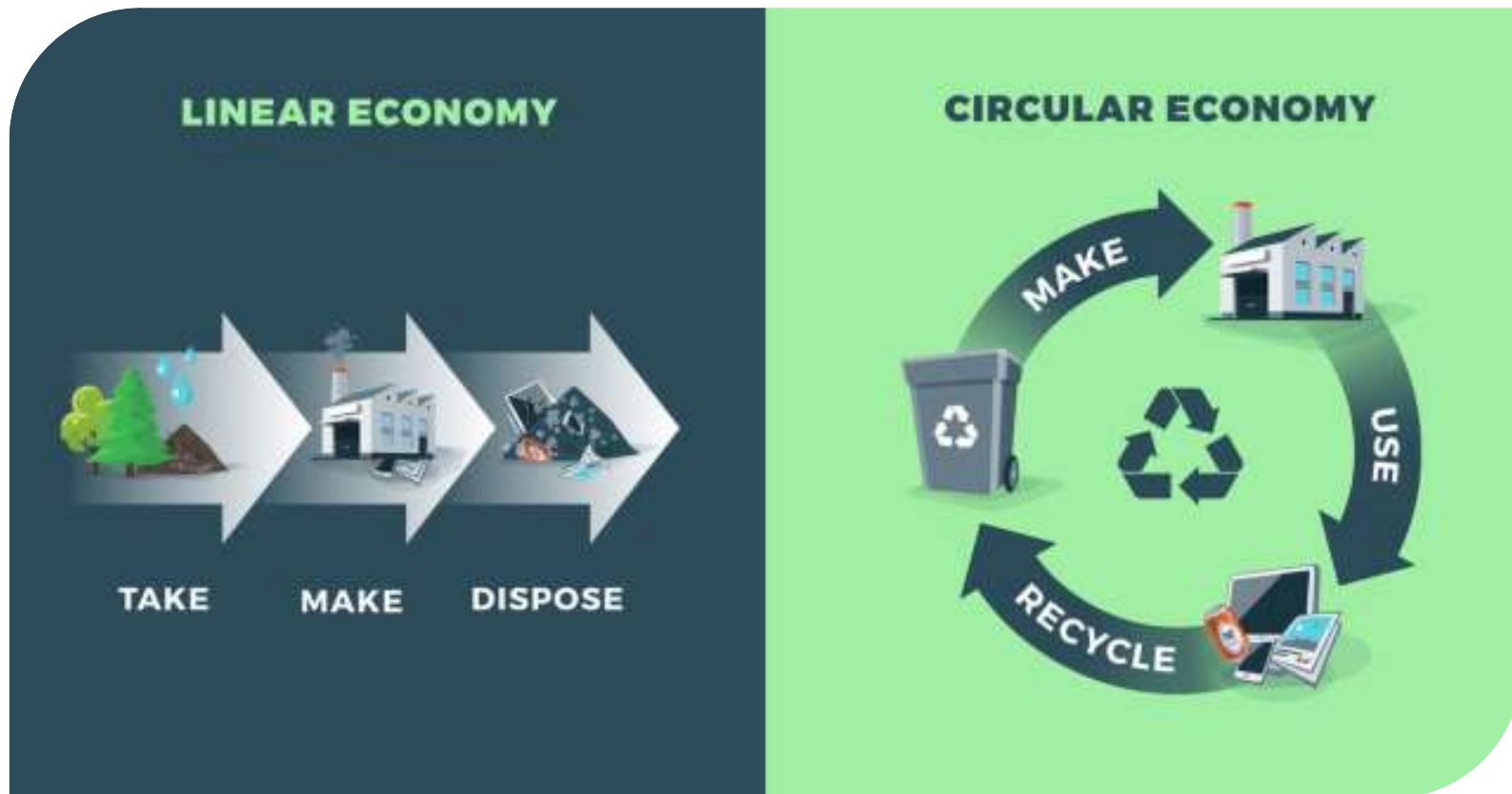
Source: Adapted from Agrawal *et al.* (2015, p. 78)

# Closed - Loop Logistics

- All forward logistics activities in the supply chain as well as the Reverse Logistics activities done together with the intent to increase material efficiency or reduce environmental impact.



# CORE IDEA OF CIRCULARITY







# WASTE COLLECTION IS NOW COMPULSORY

YOUR household waste is part of the country's war material. It must help to win the war. From now on, under the Defence Regulations, your Local Council is required to collect (1) Paper and Cardboard; (2) Household bones (excluding fish); (3) Scrap metal.

## BUT IT DEPENDS ON YOU

The local Council will arrange for the collection of all this valuable waste material. But it depends on YOU—on how carefully YOU save it and keep it for collection—how far every bit of material can be used again to full advantage.

## SALVAGE OF WASTE IS VITAL

Britain is menaced. We are cut off for a time from certain countries which used to send us important materials. We can no longer afford to bring from overseas one single ounce of anything that can be produced—or saved—at home. Every year we have filled our dustbins with hundreds of thousands of tons of waste paper, cardboard, bones, metal, rags—all essential raw materials for vital war equipment. To continue this waste in wartime would be a crime. With YOUR help the waste will stop.

*This tells you what to do and why*

SEE INSIDE

*Turn this*

**RAW MATERIAL**

**INTO WAR MATERIAL!**

FURTHER INFORMATION CAN BE OBTAINED FROM :-  
**THE DIRECTOR OF PUBLIC CLEANSING,  
 CITY OF WESTMINSTER**  
 31 CHARING CROSS ROAD, W. C. 2.  
 Tele. TEMPLE BAR 0111. Extension 44

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 回收利用，经过加工，可以生产出数量巨大的几十种有机磷、  
 这种化肥经过中国科学院植物研究所试验证明，对  
 土壤肥力，土壤不板结，增加地力，能延长果树寿命，  
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**Kiitos  
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