UN environment

International Resource Panel

INDUSTRIAL SYMBIOSIS AND CIRCULAR ECONOMY

BRUSSELS, 21st February 2018

JANEZ POTOČNIK

Co-chair UNEP International Resource Panel (IRP)

Partner SYSTEMIQ

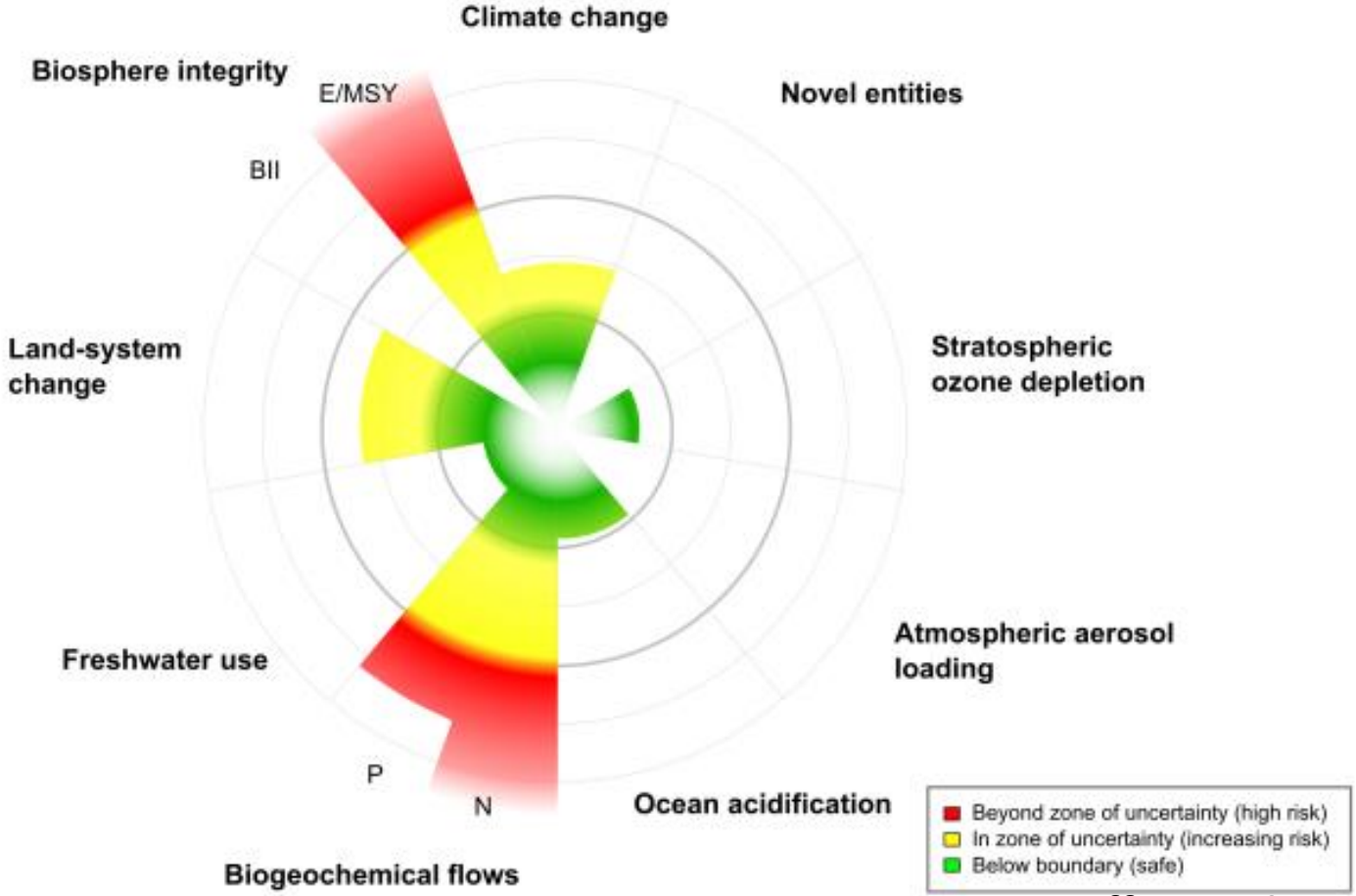
STRUCTURE

- *THE WORLD WE LIVE IN AND CHALLENGES WE ARE FACING*
- *SDGs – AND THE ROLE OF SCP*
- *ECONOMIC MODEL DRIVING OUR LIVES*
- *RESOURCE MANAGEMENT – IRP APPROACH*
- *THE ROLE OF THE CIRCULAR ECONOMY*
- *CIRCULAR ECONOMY AND INDUSTRIAL SYMBIOSIS*
- *TO CONCLUDE …*

THE WORLD WE LIVE IN

AND CHALLENGES WE ARE FACING

"PLANETARY BOUNDARIES"



Source: Steffen et al. 2015

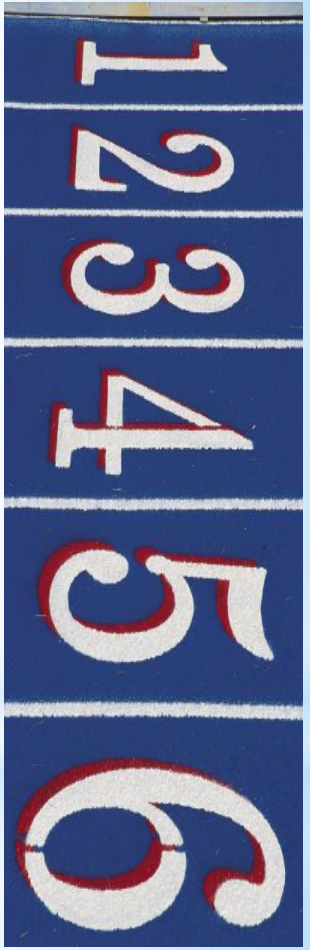
World Scientists‘ Warning to Humanity: a Second Notice

Signed by over 15000 scientists from 184 Countries on 13.November 2017

- *„Humanity has failed to make sufficient progress in generally solving these foreseen environmental challenges, and alarmingly, most of them are getting worse.“*
- *„Especially troubling is the current trajectory of potentially catastrophic climate change due to rising GHGs from burning fossil fuels, and agricultural production – particularly from farming ruminants from meat consumption.“*
- *From 1992 humanity has: „unleashed a mass extinction event, the sixth in roughly 540 million year, wherein many current life forms could be annihilated or at least committed to extinction by the end of this century.“*

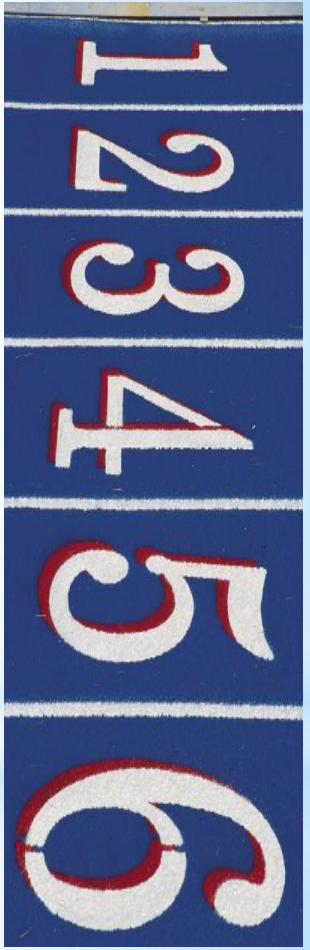
THE TASTE OF 21ST CENTURY
POPULATION

- *Population growth (2050 – 9.7 billion)*
- *Per capita consumption growth (up to 3 billion consumers moving from low to middle class consumption till 2030)*



THE TASTE OF 21ST CENTURY
POWERTY AND SOCIAL INEQUALITY

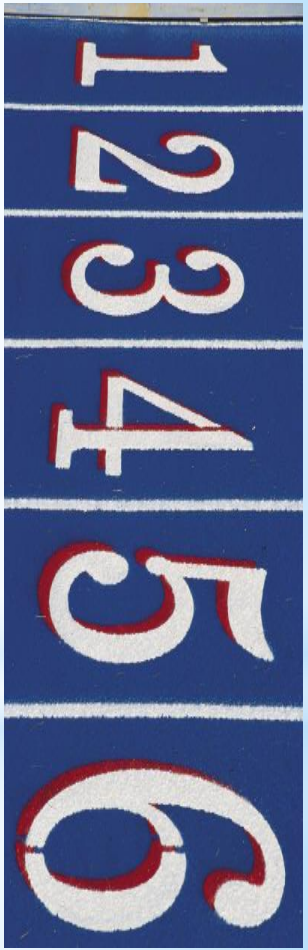
- *Oxfam Report: 8 people own the same as the poorest half of the world and the richest 1% is more wealthy than the rest of the world)*
- *Nearly 800 million people are hungry, over 2 billion suffer from micronutrient deficiencies … while over 2 billion people are obese*
- *We throw away one third of the food we produce*



THE TASTE OF 21ST CENTURY

ENVIRONMENT I

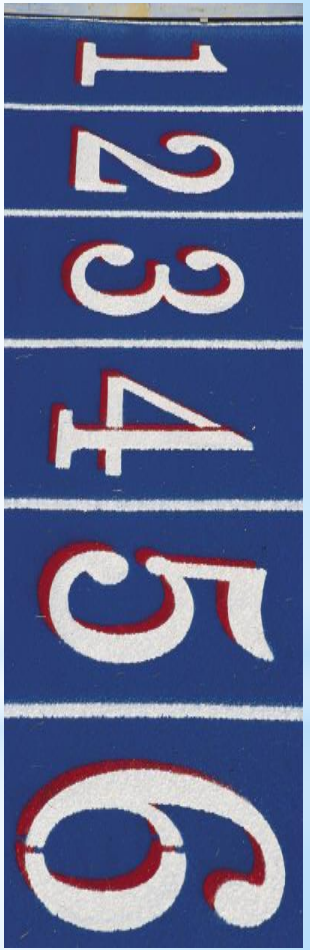
- There is increasing evidence of the climate change threat
- 60% of ecosystems already degraded or used unsustainably
- Disappearing biodiversity - the rate of number of species that become extinct is 1000 to 10000 times higher due to the presence of humans
- More than 85 % of the world's fisheries are at, or beyond, their biological limits



THE TASTE OF 21ST CENTURY

ENVIRONMENT II

- 33% of soils is moderately to highly degraded due to erosion, nutrient depletion, acidification, salinization, compaction and chemical pollution
- 467 000 premature deaths yearly in EU due to air pollution (7 millions globally)
- A million of plastic bottles are bought every minute. In 2015 9% of plastic was recycled, 12% incinerated, 79% accumulated in landfills or the environment



International Resource Panel

UN environment

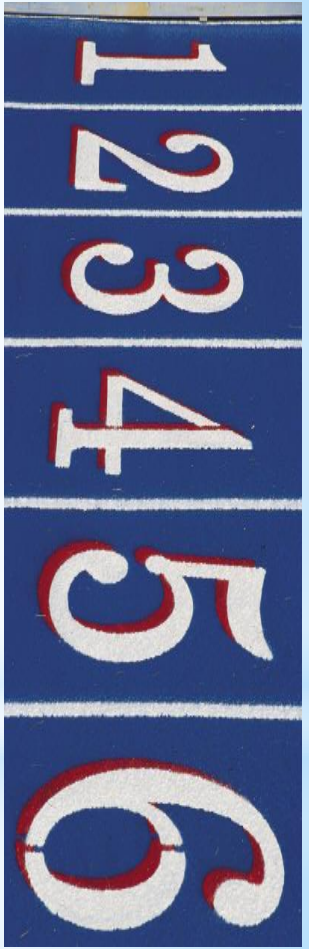
THE TASTE OF 21ST CENTURY

URBANISATION

- Globally, an area of the size of the UK has been converted to buildings since 1990 (OECD GG Indicators 2017)
- More than 50% of urban fabric expected to exist by 2050 still needs to be constructed
- In the three years period (2011-2013), China has used more cement than the USA during the entire 20th century

THE TASTE OF 21ST CENTURY
GLOBALISATION

- *For the first time in a human history we face the emergence of a single, tightly coupled human social-ecological system of planetary scope. We are more interconnected and interdependent than ever.*
- *Our individual and collective responsibility has enormously increased.*



SYNCHRONOUS FAILURE:

THE EMERGING CAUSAL ARCHITECTURE OF GLOBAL CRISIS

Ecology and Society 28/08/2015

Thomas Homer-Dixon, Brian Walker, Reinette Biggs, Anne-Sophie Crépin, Carl Folke, Eric F. Lambin, Garry D. Peterson, Johan Rockström, Marten Scheffer, Will Steffen, Max Troell

In a world where external reserves of resources are limited and second chances are thus increasingly rare, humankind must develop the ability to proactively navigate away from this new kind of crisis - globally extensive and inter-systemic - that could otherwise irreversibly degrade the biophysical and economic basis for human prosperity.

SUSTAINABLE DEVELOPMENT GOALS

AND

THE ROLE OF SCP

THE GLOBAL GOALS

For Sustainable Development

International Resource Panel

UN environment

Trade-offs among various SDGs are unavoidable. Sustainable Consumption and Production is the most efficient strategy to avoid trade-offs and create synergies to resolve the development and environmental challenges articulated in the SDGs.

International Resource Panel

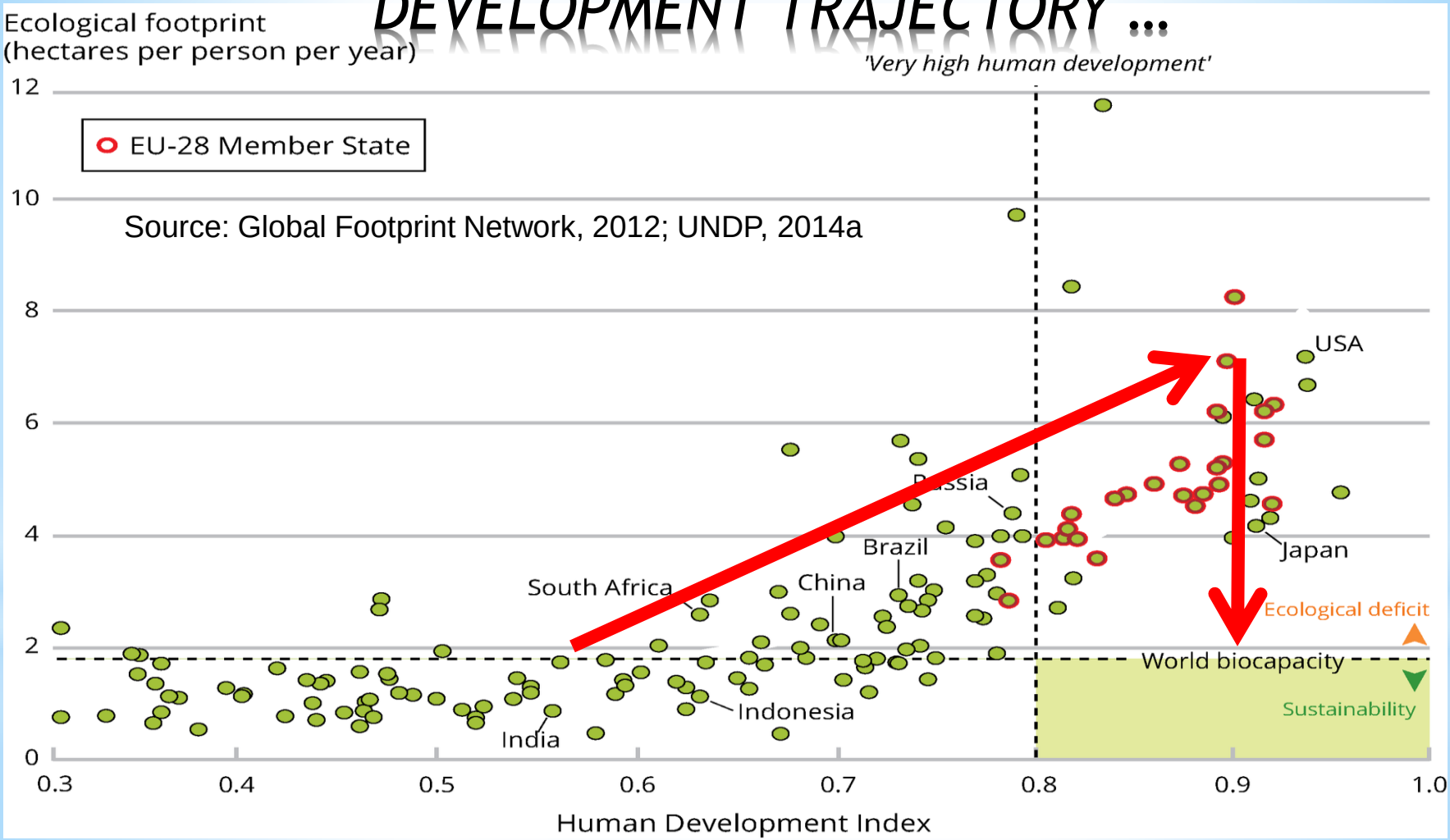
SDGs DIRECTLY DEPENDENT ON NATURAL RESOURCES

UN environment

ECONOMIC MODEL

DRIVING OUR LIVES

DEVELOPMENT TRAJECTORY …

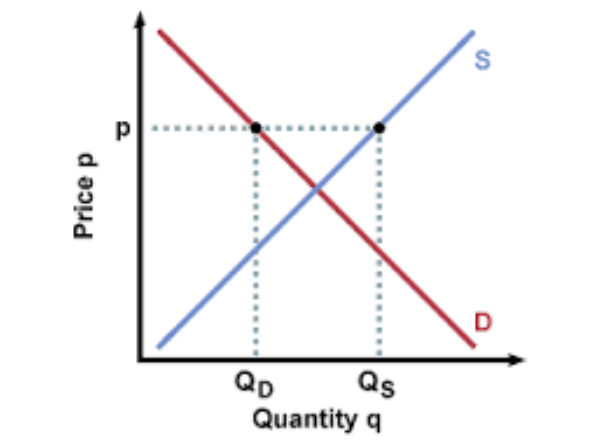


Price Signals:

Financial Capital Overvalued

Human Capital Undervalued

Natural Capital not Valued



Market

Producers/Consumers

Rational Behaviour

Economic model

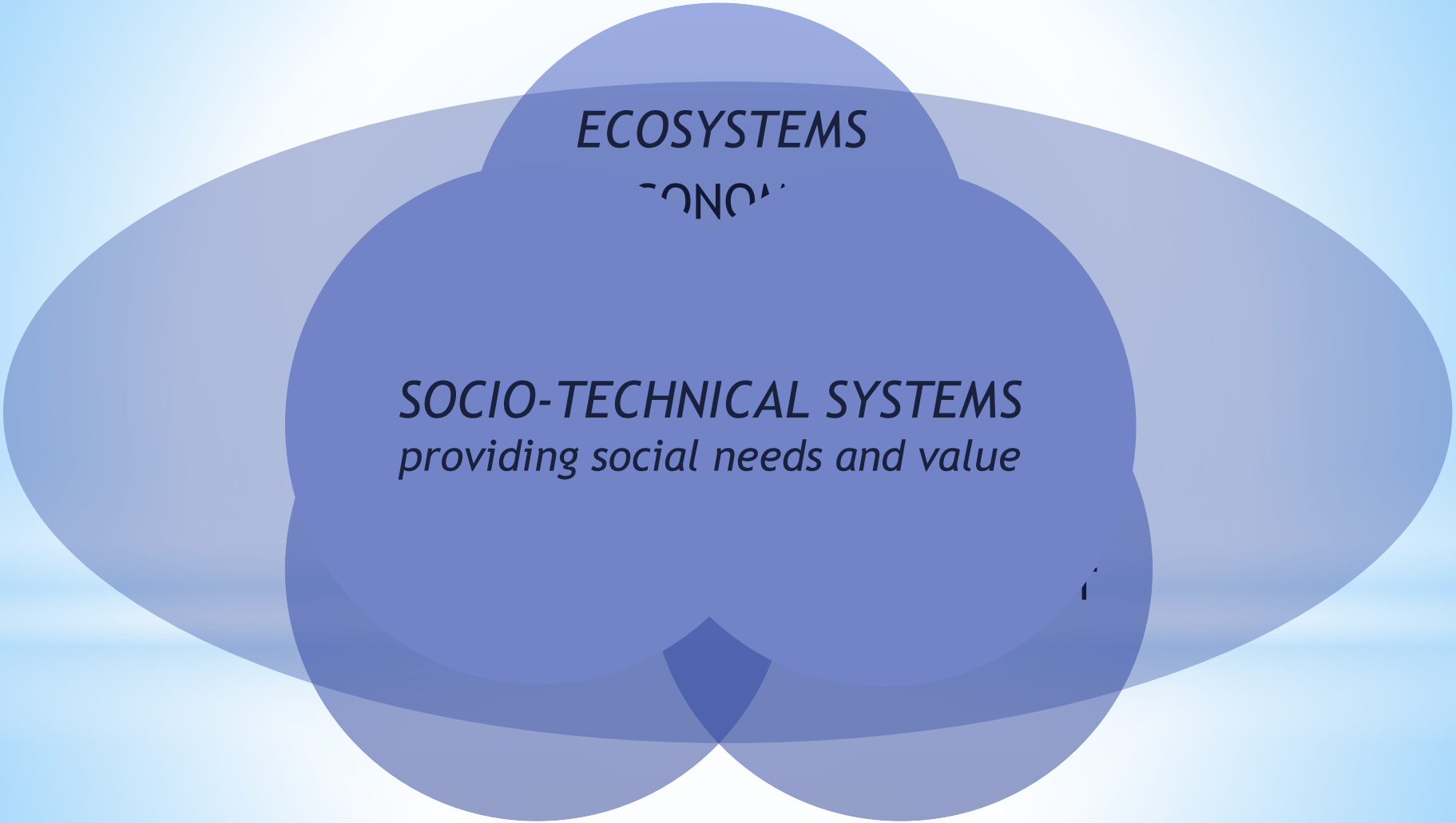
Inbuilt Economic, Social, Environmental Inbalances

International Resource Panel

UN environment

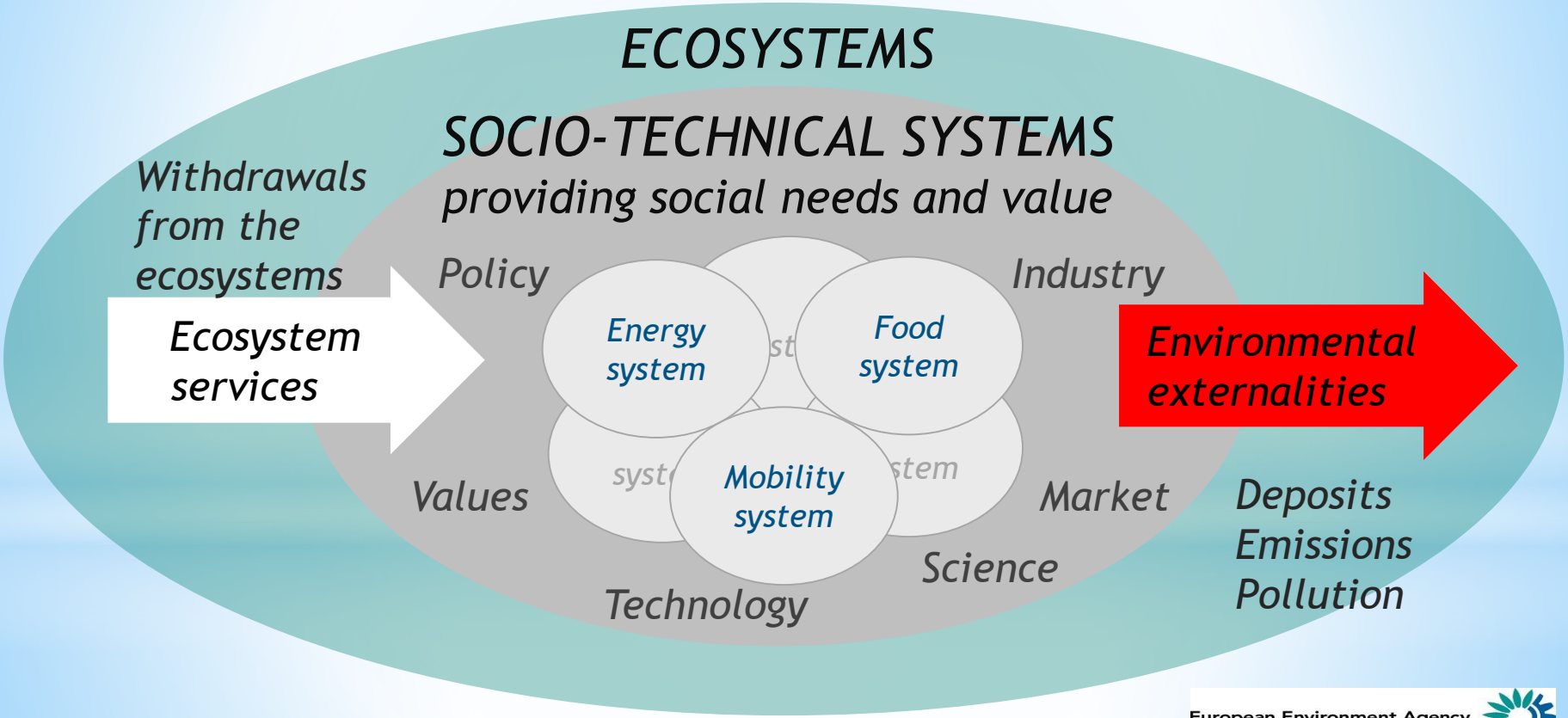
In the mid-term, except in specific cases, resource shortage will not be the core limiting factor of our (economic) development …

… but the environmental and health consequences caused by this excessive and irresponsible use of resources will be!


ECOSYSTEMS
SOCIO-TECHNICAL SYSTEMS
providing social needs and value

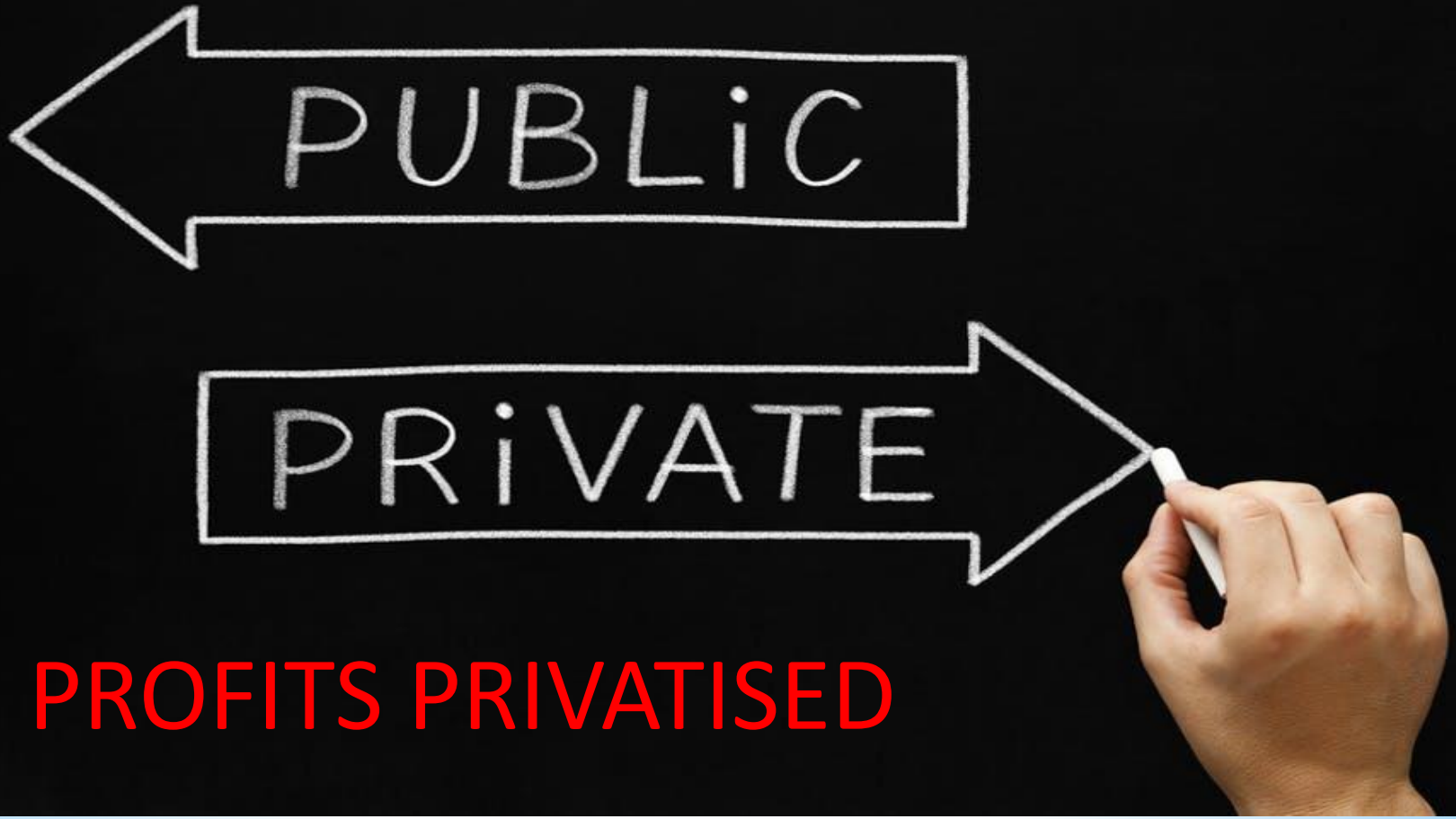
LIVING WELL WITHIN ECOLOGICAL LIMITS

ECONOMIC SYSTEM FUNCTION OF ECOSYSTEM



European Environment Agency

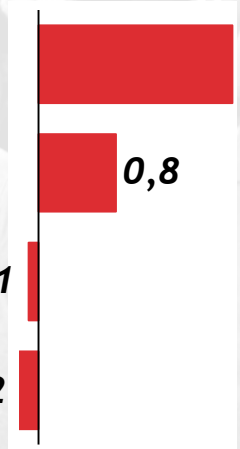
COSTS SOCIALISED



PROFITS PRIVATISED

MEASURES OF SOCIETAL DEVELOPMENT THAT INCLUDE NATURAL CAPITAL DEPLETION GROW MUCH SLOWER THAN GDP

Progress per capita[3], globally, 1990-2010, real terms



	Considerations: Capital		
	Economic	Social	Natural
Gross Domestic Product	✓		
Human Development Index	✓	✓	
Genuine Progress Indicator[1]	✓	✓	✓
Inclusive Wealth Index[2]	✓	✓	✓

1 1990-2005, as later data not available globally,
2 IWI exists in two versions, one unadjusted, and one where adjustments are made for environmental damage, oil capital gains, and total factor productivity. The adjusted version is shown here,
3 Global population growth was 1.6 percent per year during the period
SOURCE: UNEP (2014a), Kubiszewski et al. (2013)

SYSTEMIQ

- *"Good" growth -"Bad" growth - How much of the "growth" in the past actually qualifies for growth?*
- *GDP growth rates – GDP levels*
- *Flows, stocks and increased debt*
- *Remember: 10% growth – doubling of everything in 7 years!*

It is not helping if you are walking faster,

if you are walking in the wrong direction!

RESPONSIBILITIES OF THE BUSINESS SECTOR

Milton Friedman (New York Times 1970):

„What does it mean to say that „business“ has responsibilities? Only people can have responsibilities.“

L.D. Fink – BlackRock Founder and Chief executive (New York Times 2018):

„Society is demanding that companies, both public and private, serve a social purpose. To prosper over time, every company must not only deliver financial performance, but also show how it makes positive contribution to society.“

RESPONSIBILITIES OF THE BUSINESS SECTOR

Aligned with the SDGs

From being a pure product or service providers managing the risks of the company through profit maximisation

To socially responsible companies managing also the risks of the society

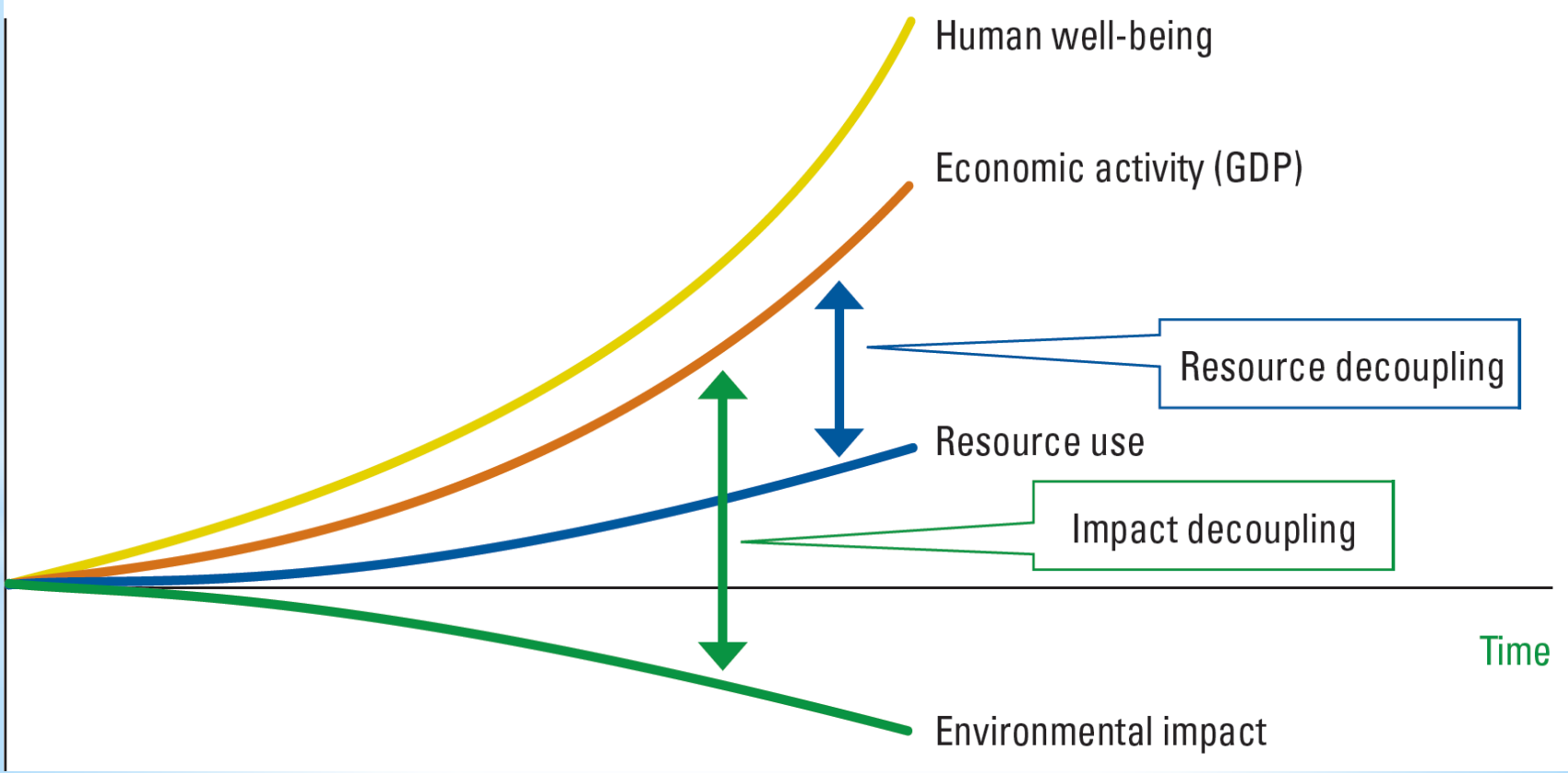
RESOURCE MANAGEMENT

IRP APPROACH

International Resource Panel

DECOUPLING IS THE IMPERATIVE OF MODERN ENVIRONMENTAL AND ECONOMIC POLICY

UN environment

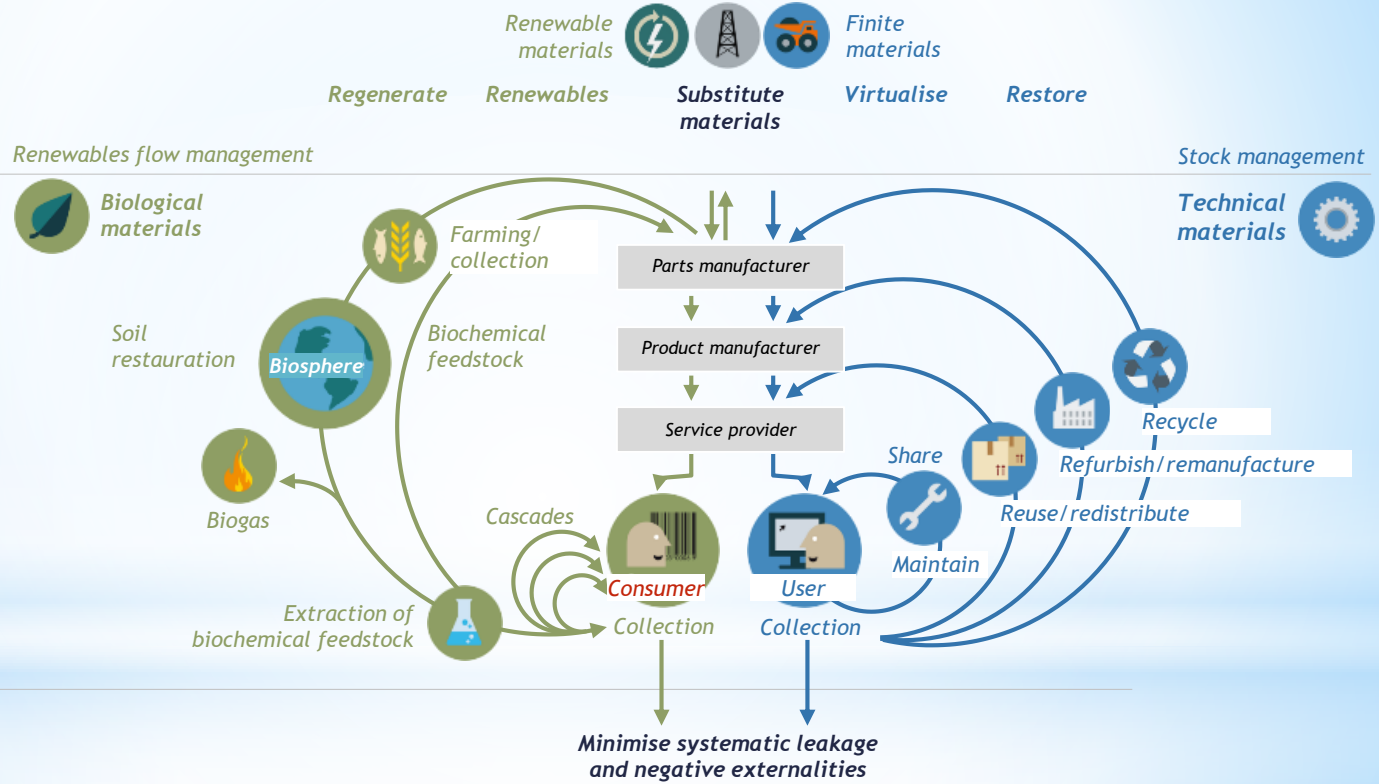


THE ROLE OF THE CIRCULAR ECONOMY

OUTLINE OF A CIRCULAR ECONOMY SYSTEM

Principles

1. *Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows*
2. *Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles*
3. *Foster system effectiveness by revealing and designing out negative externalities*

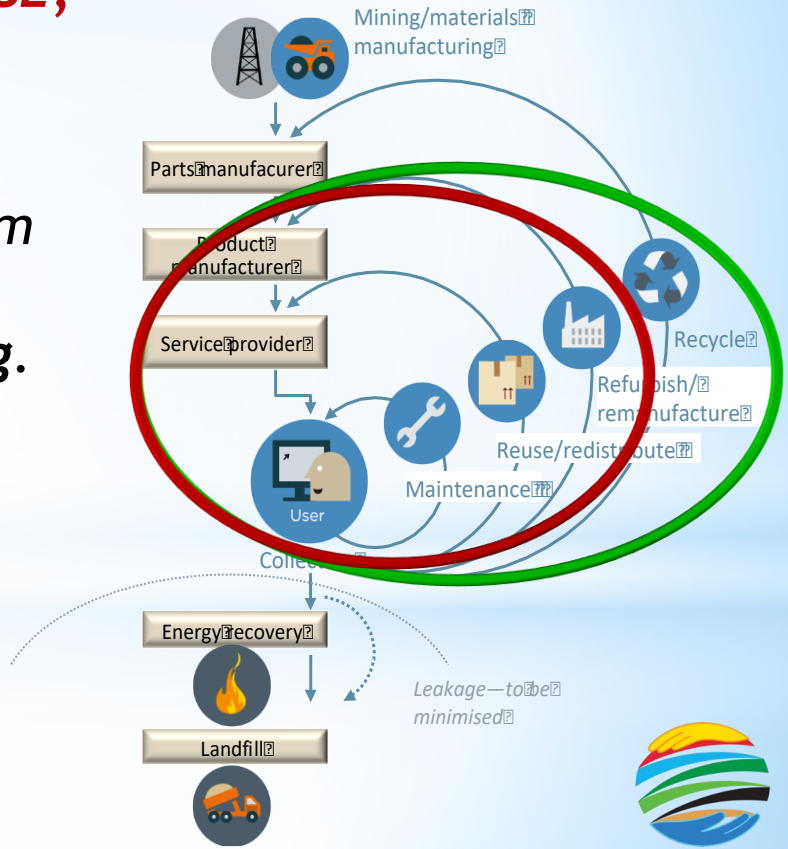


Source: Ellen MacArthur Foundation; McKinsey Center for Business and EnvironmenStiftungsfonds für Umweltökonomie und Nachhaltigkeit;

ASSESSMENT OF RESOURCE EFFICIENCY AND INNOVATION IN CIRCULAR ECONOMY THROUGH REMANUFACTURING, REUSE, REPAIR, AND REFURBISHMENT

Focus on production processes that retain value within the circular system through: ***direct reuse***, ***repair***, ***refurbishment***, *and* ***remanufacturing***.

- *Product Perspective*
- *Production Perspective*
- *Barriers Perspective*
- *Design Perspective*
- *Policy Perspective*



OVERVIEW OF CASE STUDY SECTORS, PRODUCTS AND SAMPLE ECONOMIES ASSESSED

Case Study Sectors	Case Study Products	Sample Economies
• *Industrial Digital Printers*	• *Digital Production Printer* • *Digital Printing Press #1* • *Digital Printing Press #2*	• *Brazil* • *China* • *Germany* • *USA*
• *Vehicle Parts*	• *Vehicle Engine* • *Vehicle Alternator* • *Vehicle Starter*	
• *Heavy-Duty and Off-Road (HDOR) Equipment Parts*	• *HDOR Engine* • *HDOR Alternator* • *HDOR Turbocharger*	

International Resource Panel

UN environment

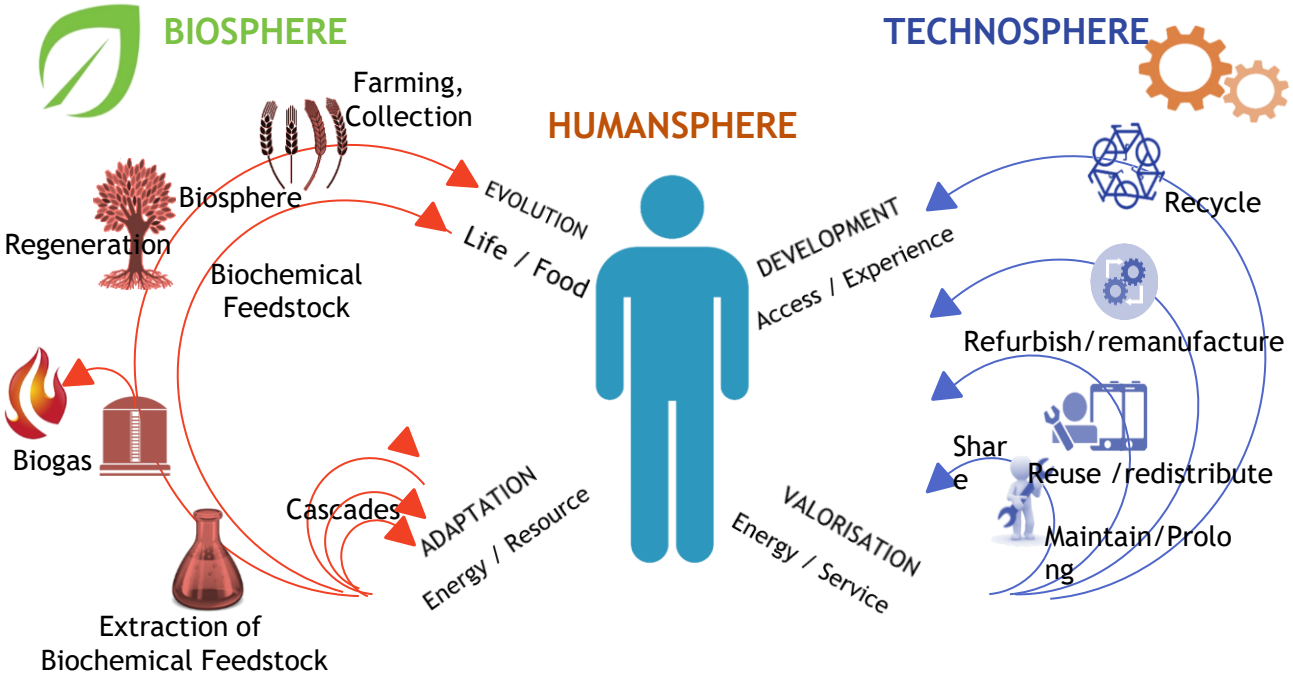
International Resource Panel

Assessment of Resource Efficiency and Innovation in Circular Economy through Remanufacturing, Reuse, Repair, and Refurbishment

UN environment

There is no evidence that economic status determines a country's ability to successfully engage in Value Retention Processes (VPRs) as a strategy for more sustainable production; rather, it is the presence and nature of systemic barriers that affect the speed at which VRPs can be integrated and adopted, and the resulting economic and environmental benefits realized.

ADAPTED "BUTTERFLY DIAGRAM"
INTEGRATING HUMAN FLOWS

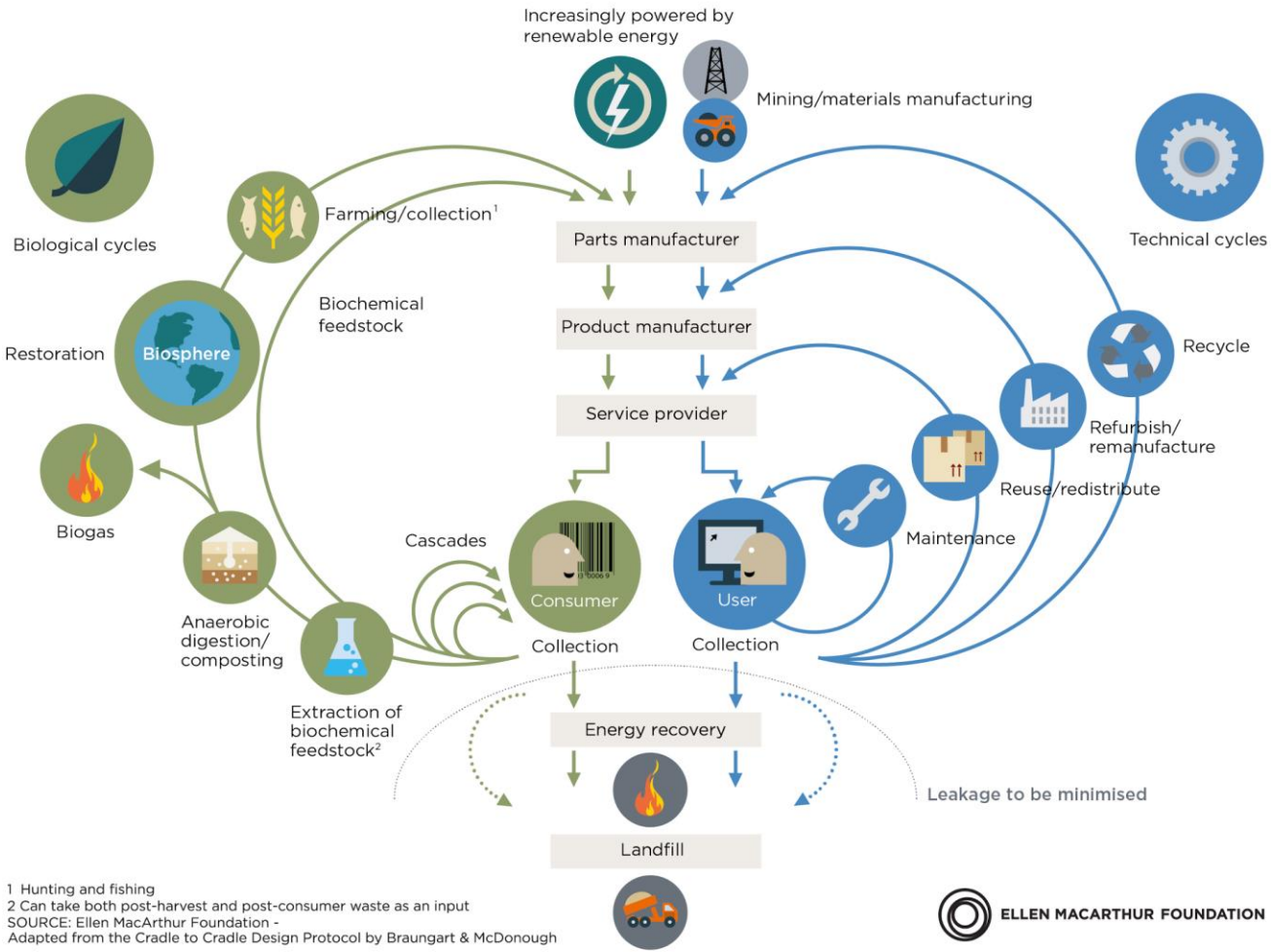


The Golden Rule of priorities:

Natural Capital → Human Capital → Remanufactured Capital

Source: A. Lemille, adapted from the "Butterfly Diagram" of the Ellen MacArthur Foundation

SOCIAL ASPECTS OF CIRCULAR ECONOMY



CIRCULAR ECONOMY AND CLIMATE CHANGE

CLIMATE

CARBON MANAGEMENT

LAND | WATER | GHG | MATE RIALS

DECOUPLING

RESOURCES

CIRCULAR ECONOMY - *an industrial system that is restorative by design*

creasingly powered by renewable energy

Mining/materials

Biological cycles

Technical cycles

ng/collection[1]

Parts manufacturer

Product manufacturer

Service provider

Restoration

Biosphere

Recycle

Refurbish/ remanufacture

Reuse/redistribute

Maintenance

Biogas

Cascades

Consumer

User

Anaerobic digestion/ composting

Collection

Collection

Extraction of biochemical feedstock[2]

Energy recovery

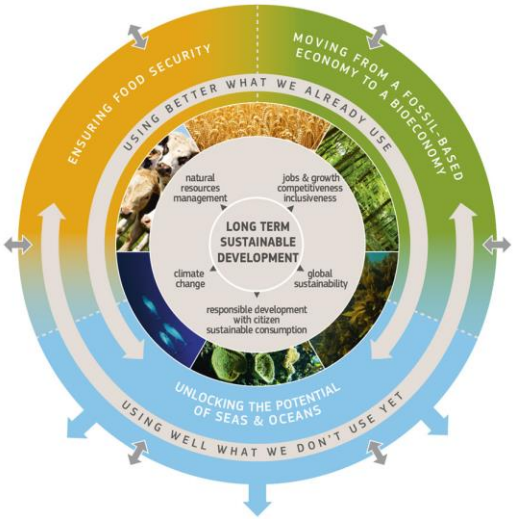
Leakage to be minimised

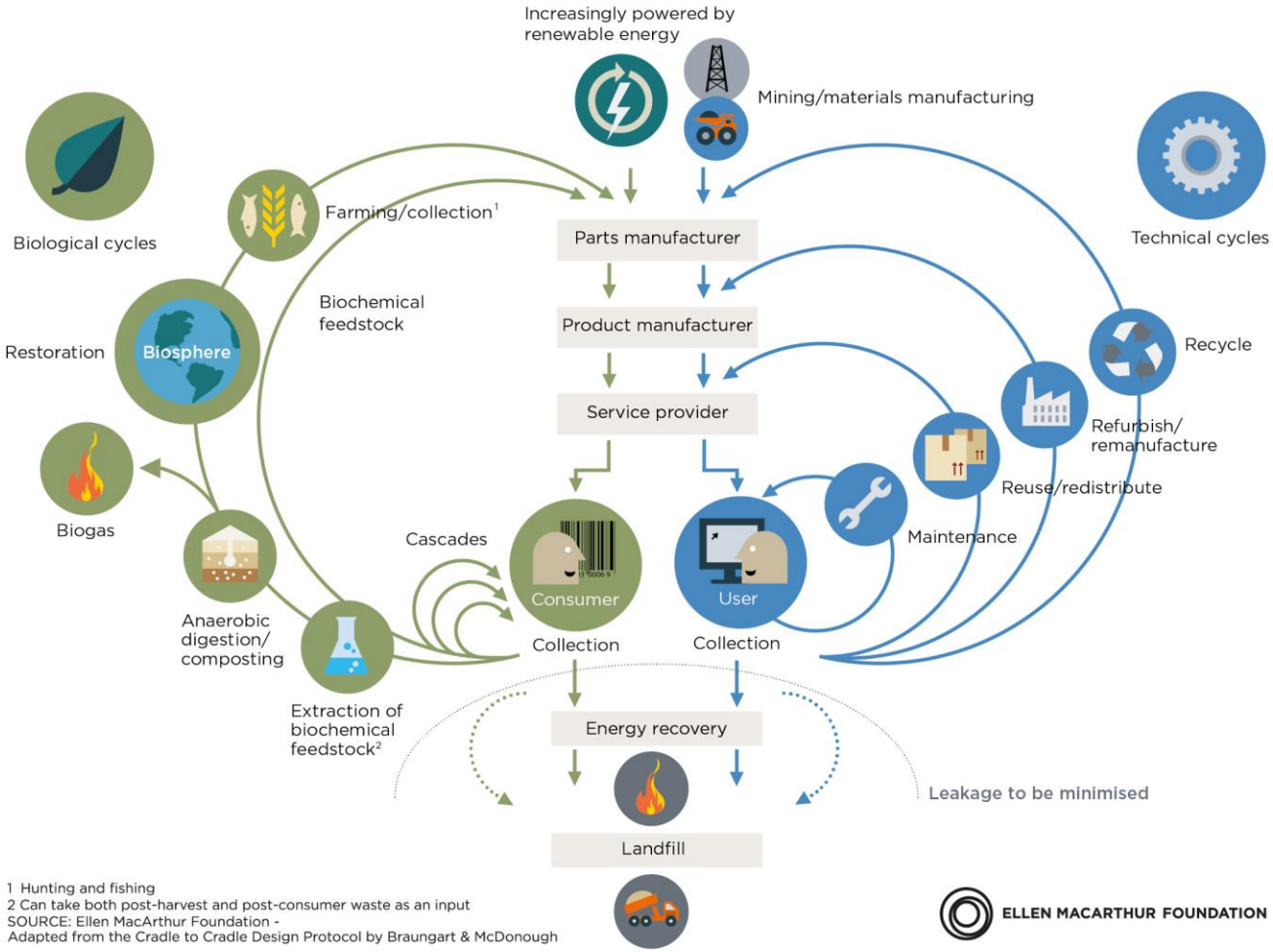
Landfill

1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input
SOURCE: Ellen MacArthur Foundation -
Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough

ELLEN MACARTHUR FOUNDATION

BIOECONOMY AND CIRCULAR ECONOMY



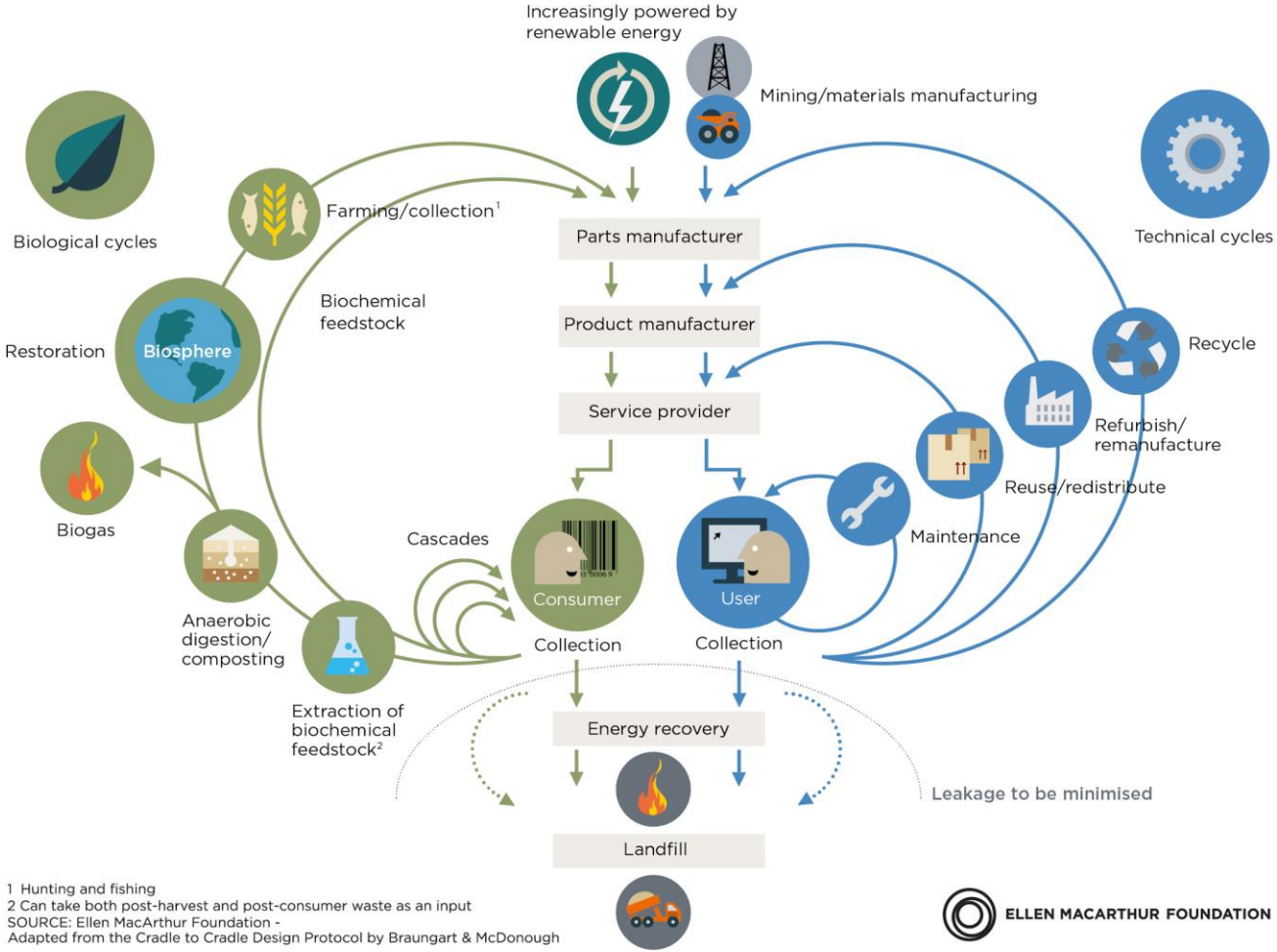


CITIES AND CIRCULAR ECONOMY

- SHARING MODELS
- MOBILITY SYSTEMS
- WASTE RECYCLING
- SUSTAINABLE BUILDINGS
- ENERGY EFFICIENCY

...

CIRCULAR ECONOMY - *an industrial system that is restorative by design*



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input
SOURCE: Ellen MacArthur Foundation -
Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough

ELLEN MACARTHUR FOUNDATION

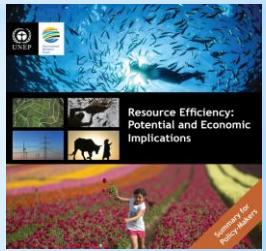
RETAINING VALUE IN CIRCULAR ECONOMY

International Resource Panel

UN environment

DISCONNECT BETWEEN RESOURCE EFFICIENCY AND ECONOMIC EFFICIENCY

There is a need to rebalance the cost of labour, and the costs of resources and pollution by pricing externalities, using taxation and other incentives for actors to favour paying for labour to save materials, rather than for materials to save labour



RETAINING VALUE IN THE SWEDISH MATERIALS SYSTEMS

- *Economic and industrial opportunities of improved materials handling do not depend on volumes, but on economic value of materials*
- *Four major materials analysed: Plastics, Steel, Aluminium, Other materials*

Source: Material Economics

RETAINING VALUE IN THE SWEDISH MATERIALS SYSTEMS

- *The downgrading of metals can create larger value losses, and preventing this is an important opportunity.*
- *Market failures and a 'linear' approach to product design explain much of today's loss of value.*
- *For all these reasons, policy will have a central role in achieving improved handling of materials.*
- *Companies can also act – even minor changes in how products are designed, produced and handled can make major contributions to preserving material value.*
- *The Swedish economy is still much more 'linear' than the impression given by public statistics.*

Source: Material Economics

RETAINING VALUE IN THE SWEDISH MATERIALS SYSTEMS
The Case of Plastics

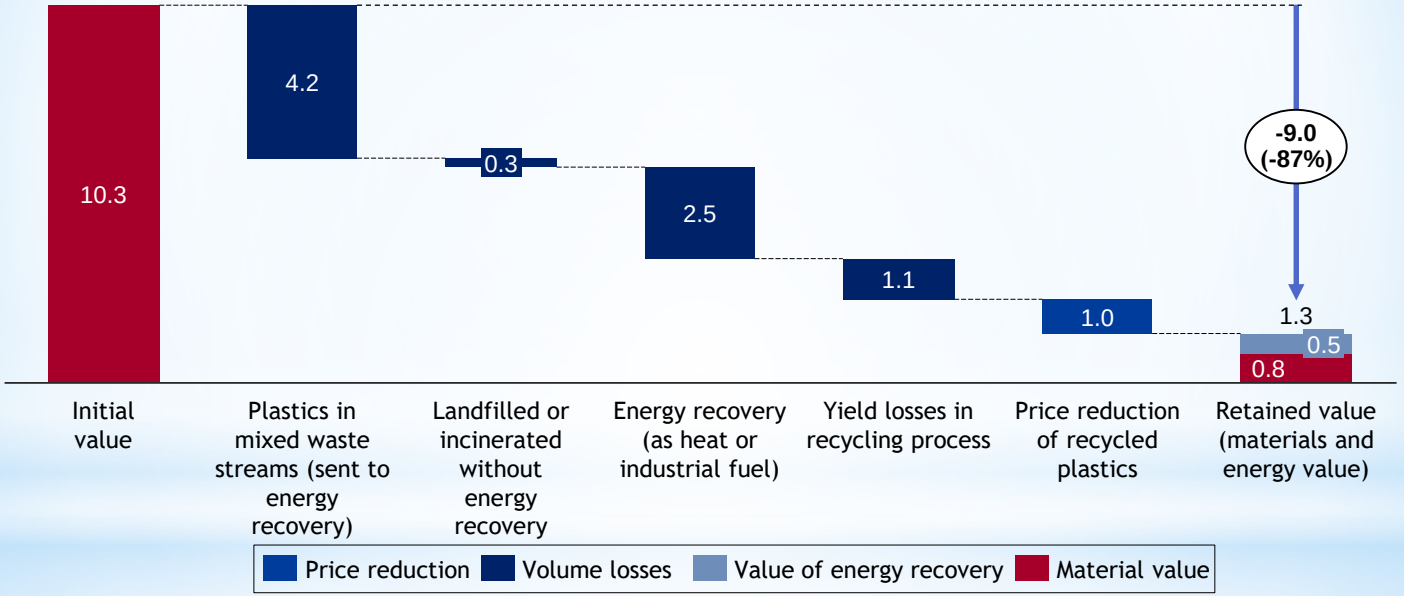
- *Offical statistics on plastic waste recycling* **53%**

- *Value end of use plastic each year* 10 bil SEK
  - *80% incinerated – energy value* 0.4 bil SEK
  - *16% new plastics* 0.9 bil SEK
  - *4% landfield* 0.0 bil SEK
- *All value retained* 1.3 bil SEK
- *Value retained/Value end of use* **13%**

Source: Material Economics

END-OF-USE PLASTICS LOSE 9 BN SEK ANNUALLY, OR 87% IN EVERY USE CYCLE

Initial value and value lost in one use cycle of plastics
Billion SEK per year, Sweden



Note: Energy value from energy recovery is calculated as the cost for alternative fuel to generate the same effect
Source: Plasticportal; SMED, Kartläggning av plastavfallsströmmar i Sverige (2012); Naturvårdsverket, Sveriges återvinning av förpackningar och tidningar 2015; Swerec 2017; Energimyndigheten; Skatteverket; Ellen MacArthur Foundation, New Plastics Economy; Norden (2014), Plastic value chains, Case: WEEE; IVL (2013), Återvinning av plastavfall i byggsektorn

RETAINING VALUE IN THE SWEDISH MATERIALS SYSTEMS
Summary

- *Plastics: S only maintain~15% of the original value. Mainly due to the fact that the majority of the plastic is incinerated for energy recovery, and the recycled plastic is of significantly lower quality and value than newly manufactured plastic.*
- *Steel: S only maintain ~40% of the original value, due to volume losses during collection and production, as well as the downgrading of the quality of steel.*
- *Aluminium: S looses over 60% of its value during one cycle of use, mainly due to downgrading, but also due to the fact that 30% of aluminium is not recycled.*

Source: Material Economics

RETAINING VALUE IN THE SWEDISH MATERIALS SYSTEMS

There are strong links between maintaining material value and contributing to environmental objectives. One connection is the role materials have in both Swedish and international climate targets.

Source: Material Economics

RETAINING VALUE IN THE SWEDISH MATERIALS SYSTEMS
Summary

- *The Swedish economy is still significantly more linear than implied by public statistics. Official numbers suggest recycling of 75-95% of steel, 50% of plastic, 50% of demolition waste.*
- *The retained material value after one use cycle is only 24%*
- *A more circular material system is also central to achieving climate goals. Without change today's use of steel, aluminium and plastics will give rise to 13 Mt CO_2 per year, which is more than 20% of Sweden's total emissions in 2015. In our circular scenario, this is reduced to 9 Mt.*

Source: Material Economics

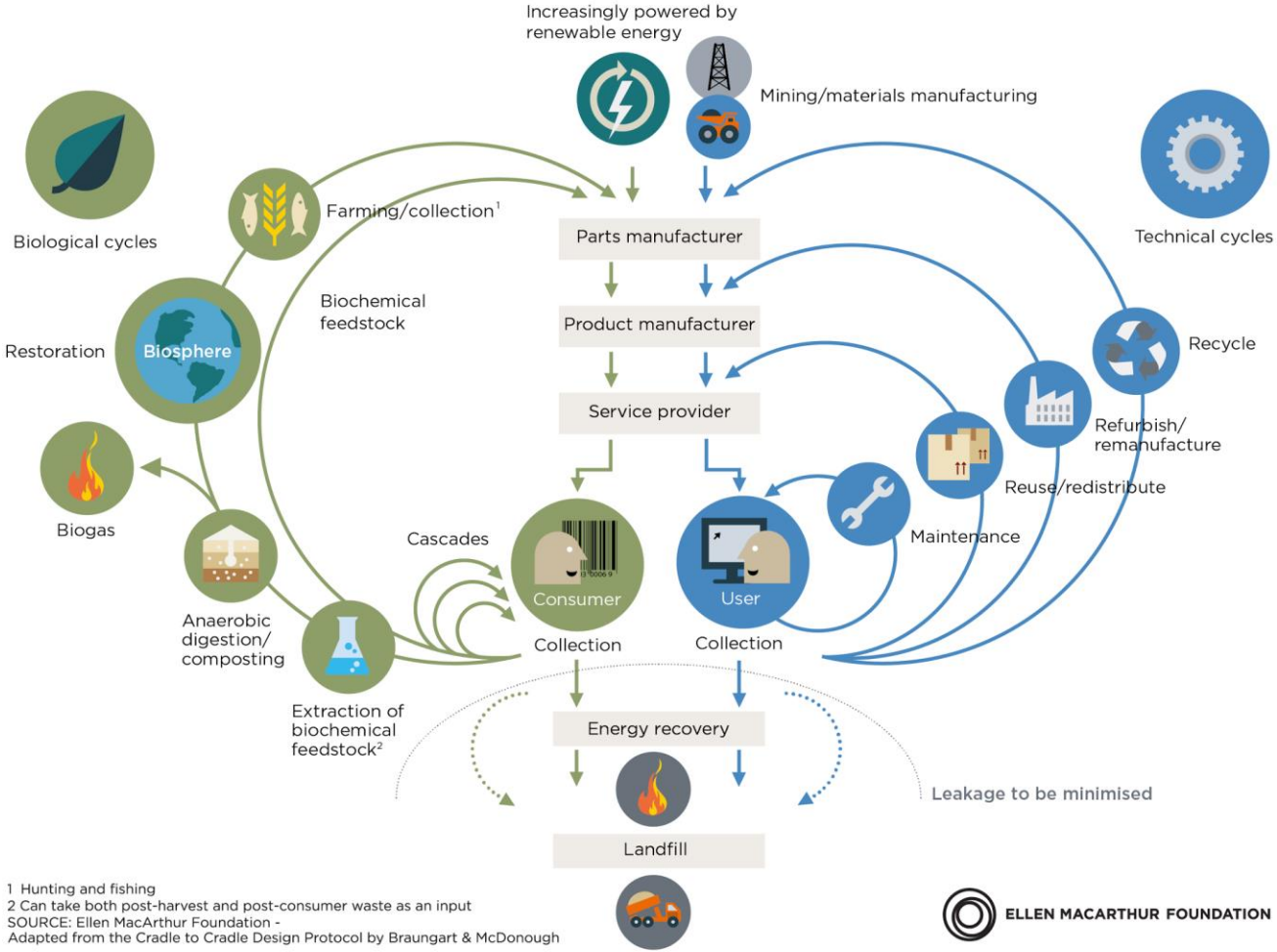
CIRCULAR ECONOMY AND INDUSTRIAL SYMBIOSIS

PRINCIPLES OF INDUSTRIAL SYMBIOSIS ARE FULLY CONSISTENT WITH CE APPROACH

- *Organising the business world to operate in the same way as the natural eco-system, where everything has a place and function, and nothing goes to waste.*
- *Instead of being thrown away or destroyed, surplus resources generated by an industrial process are captured and redirected for use as a „new“ input into another process by one or more other companies, providing a mutual benefit or symbiosis.*

Source: International Synergies

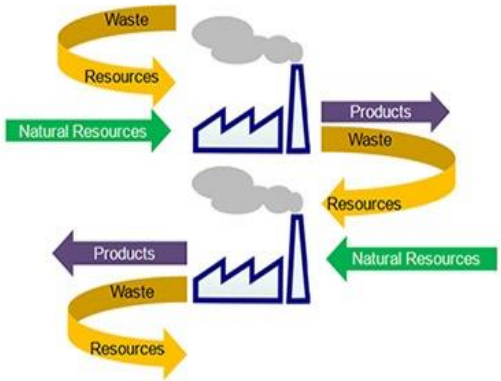
CIRCULAR ECONOMY - *an industrial system that is restorative by design*



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input
SOURCE: Ellen MacArthur Foundation -
Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough

ELLEN MACARTHUR FOUNDATION

INDUSTRIAL SYMBIOSIS PLAYS AN IMPORTANT PART IN REALISING CIRCULAR ECONOMY POTENTIAL



POLICY OPTIONS FOR CE AND INDUSTRIAL SYMBIOSIS

(GLOBAL, EUROPEAN, NATIONAL, LOCAL/REGIONAL)

- *REGULATION*

(providing direction)

- *Waste directives*
- *REACH*
- *Standardisation*
- *EPR*
- *Eco-Design*

- *MARKET MEASURES*

(fixing cost/prices)

- *Taxes*
- *Subsidies*
- *Public Procurement*
- *Market barriers,*
- *Trade barriers*
- *…*

- *OTHERS*

(supportive initiatives)

- *Cooperation platforms*
- *Facilitation activities*
- *Eco-industrial parks*
- *Secondary markets*
- *New business models*
- *Knowledge sharing, guidelines, coaching*
- *…*

TO CONCLUDE …

WE HAVE TO FIX A BROKEN COMPASS

(PAVAN SUKHDEV)

NEW ECONOMIC MODEL BASED ON SCP INTEGRATING ALL PILLARS OF SUSTAINABILITY IS

NECESSARY

AND UNAVOIDABLE

MAIN POINTS TO REMEMBER

- *For the first time in a human history we face emergence of a single, tightly coupled human social-ecological system of planetary scope.*
- *It is about system change. Without leadership and improved global governance SDGs are only a wishful thinking.*
- *Transition to a new economic model integrating all pillars of sustainability should be in the centre of our attention. Trade-offs among various SDGs are unavoidable. SCP is the most efficient strategy to avoid them and create synergies. Circular economy and industrial symbiosis are very good concepts to operationalise it in practice.*

MAIN POINTS TO REMEMBER

- *Implementing SDGs should be priority of any government defined in the strategic documents, supported by indicators, monitoring, reporting, linked to the core economic policy decisions.*
- *All (economic) policies should be systematically adjusted. Synergies among various policy approches and tools, including industrial symbiosis, should be exploited.*
- *All levels (global, European, national, local) and all stakeholders (public & private actors, financial sector, civil society, academia…) should actively participate in the system change. Active dialogue with potential losers is necessary to make transition fair and possible.*

MAIN POINTS TO REMEMBER

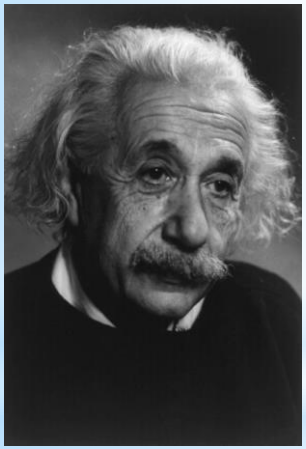
- *We should focus our efforts not only on state and impact (air polution, climate change, biodiversity loss …), but also on the pressures and drivers leading to them (economic, social, environmental … imbalances).*
- *Change will not appear by waiting for the leadership of others, be the leaders on your level of governance and authority … in politics, in business, in making your investment decisions …*
- *If we are to avoid globally extensive and inter-systemic crisis and frequent conflicts than let's get serious about implementing what we have agreed in SDGs. Changes are unavoidable and humans are supposed to be intelligent. It is high time to prove it.*

Any global transition is a major new opportunity for the innovation, new development opportunities, new jobs

And alternative ...
I would rather not think and talk about it!

Will it be easy …

ALBERT EINSTEIN



When asked why it is that mankind has stretched so far as to discover the structure of the atom, but we have not been able to devise the political means to keep the atom from destroying us he replied:

"That is simple, my friend. It is because politics is more difficult than physics"

International Resource Panel

UN environment

THANK YOU

For more information

Contact IRP Secretariat at resourcepanel@un.org

Visit our website at http://resourcepanel.org/