

Sustainable Development: Definition, Principles, Challenges

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Sustainable Development Reporting,
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13, November 2017 American University of Armenia

The Institute of Environmental Engineering (APINI)

Kaunas University of Technology



The Institute of Environmental Engineering (APINI)

was established in 1991 as an independent interdisciplinary research institute affiliated with Kaunas University of Technology.



The APINI has 25 employees and its activities fall into the following main research and service areas:

- **Sustainable consumption and production**
- **Cleaner production, Cleaner production financing and EMA**
- **Corporate social responsibility**
- **Integrated waste management**
- **Eco-design. Life-cycle assessment**
- **Environmental impact assessment**
- **Chemical risk assessment and management**
- **Energy and resource management**

The Institute of Environmental Engineering (APINI)

Kaunas University of Technology

APINI staff :

- actively takes part in international and national conferences
- has published more than 300 publications, including 12 monographs and books and defended 15 Ph.D. theses
- is running MSc and PhD programs

In 1995 APINI together with other Lithuanian universities initiated scientific quarterly journal

“Environmental Research, Engineering and Management”

In 2003 the spin – off „Centre for sustainable industrial development” has been established

Sustainable production capacity building activities in Lithuania

- ❑ Lithuania was one of the first countries that achieved basic capacity level in cleaner production in Central and Eastern Europe
 - ❑ APINI served as cleaner production centre since 1994
 - ❑ More than 150 demonstration projects implemented
 - ❑ More than 20 long-term training programmes organised
 - ❑ More than 30 books and 250 scientific articles published
 - ❑ M.Sc. Programme in Environmental Management and Cleaner Production established
-

SD History (I)

- ❑ Cranberry-free Thanksgiving in US, 1959;
- ❑ Rachel Carson's book "Silent Spring", 1962 Monsanto: "hysterical woman". Result; US EPA, 1970;
- ❑ UN Conference on the Human Environment, Stockholm, 1972, chaired by Canadian Maurice Strong, establisher of Business Council for Sustainable Development (WBCSD);
- ❑ "The limits of Growth" (commissioned by the Club of Rome, produced by MIT experts. Yale economist Henry C. Wallich: "irresponsible nonsense". Scenario, based on system modelling, includes economic and social collapse in the middle of 21st century;
- ❑ From 1972 on – Greenpeace was founded along with many other environmental organizations.
- ❑ Accidents: Union Carbide(1984, Bhopal, India,1986, Chernobyl, Alaska,Exxon Valdez, 1989

SD History (II)

- ❑ World Conservation Strategy, 1980 by International Union for the Conservation of Nature;
- ❑ Our Common Future, 1987 by Brundtland Commission;
- ❑ Agenda 21, 1992 Rio de Janeiro, by UN Conference on Environment and Development;
- ❑ UN Millenium Declaration (WEHAD), SCP, 2002 Johannesburg by World Summit on SD;
- ❑ Rio +20, 2012
- ❑ SDG, 2015 September 25 by UN General Assembly;
- ❑ ISG, 2016 July by UN High Level Political Forum

Brundtland report (1987)

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

Vague but clearly captured two fundamental issue:

***Problem of environmental degradation;
Economic growth to alleviate poverty.***

Sustainable development



Human beings are at the
centre of concerns for
sustainable development

They are entitled to a
healthy and productive
life in a harmony with
nature

**(The first principle of Rio
Declaration, 1992)**

Formalization of Brundtland's report

$$W=f(C_i, I, K)$$

W- human wellbeing;

C_i- "Capital assets" (from which services flow);

C_m- manufactured capital (factories, homes, roads);

C_h- human capital (population, health, education);

C_n- natural capital (ecosystems and their services);

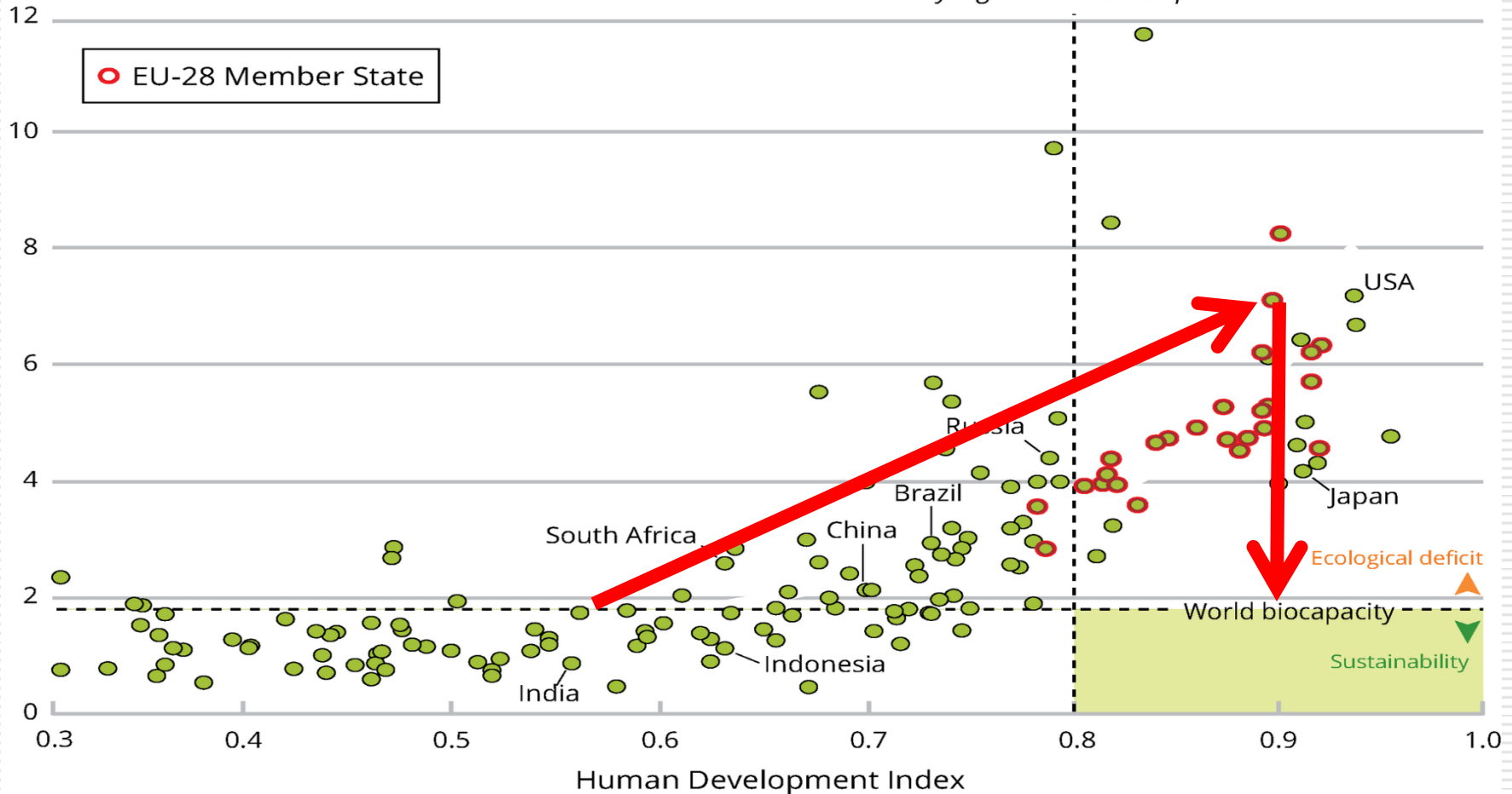
I – „Institutions“(laws, rules, norms, expectations);

K – Knowledge (scientific, practical, innovations)

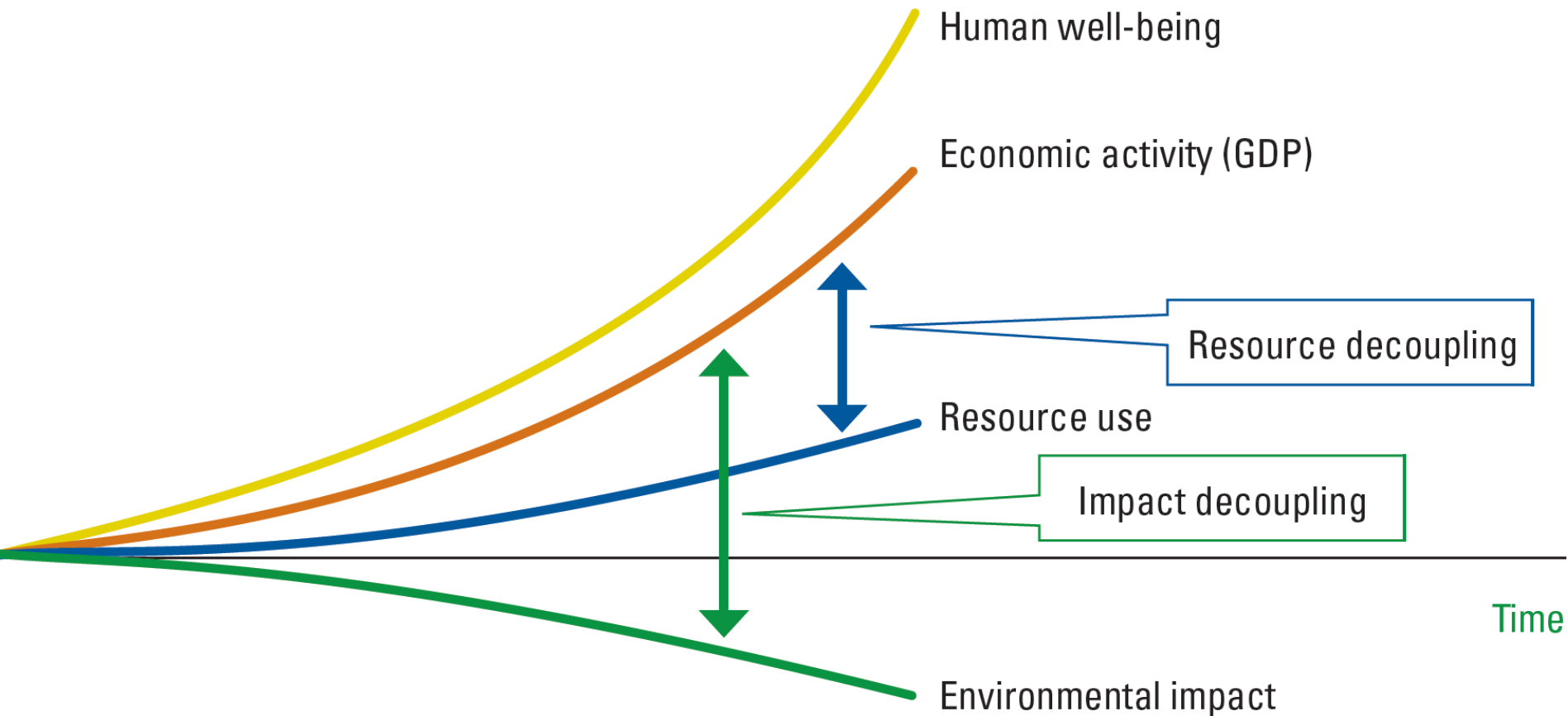
However, in practise, development decisions by governments, bussinesses and other actors do allow trade-offs and put greatest emphasis on the economy above other dimensions of sustainability. *The three pillars cannot be treated as if equivalent.*

The main problem

Ecological footprint
(hectares per person per year)



Scenarios for sustainable economical development



1

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows

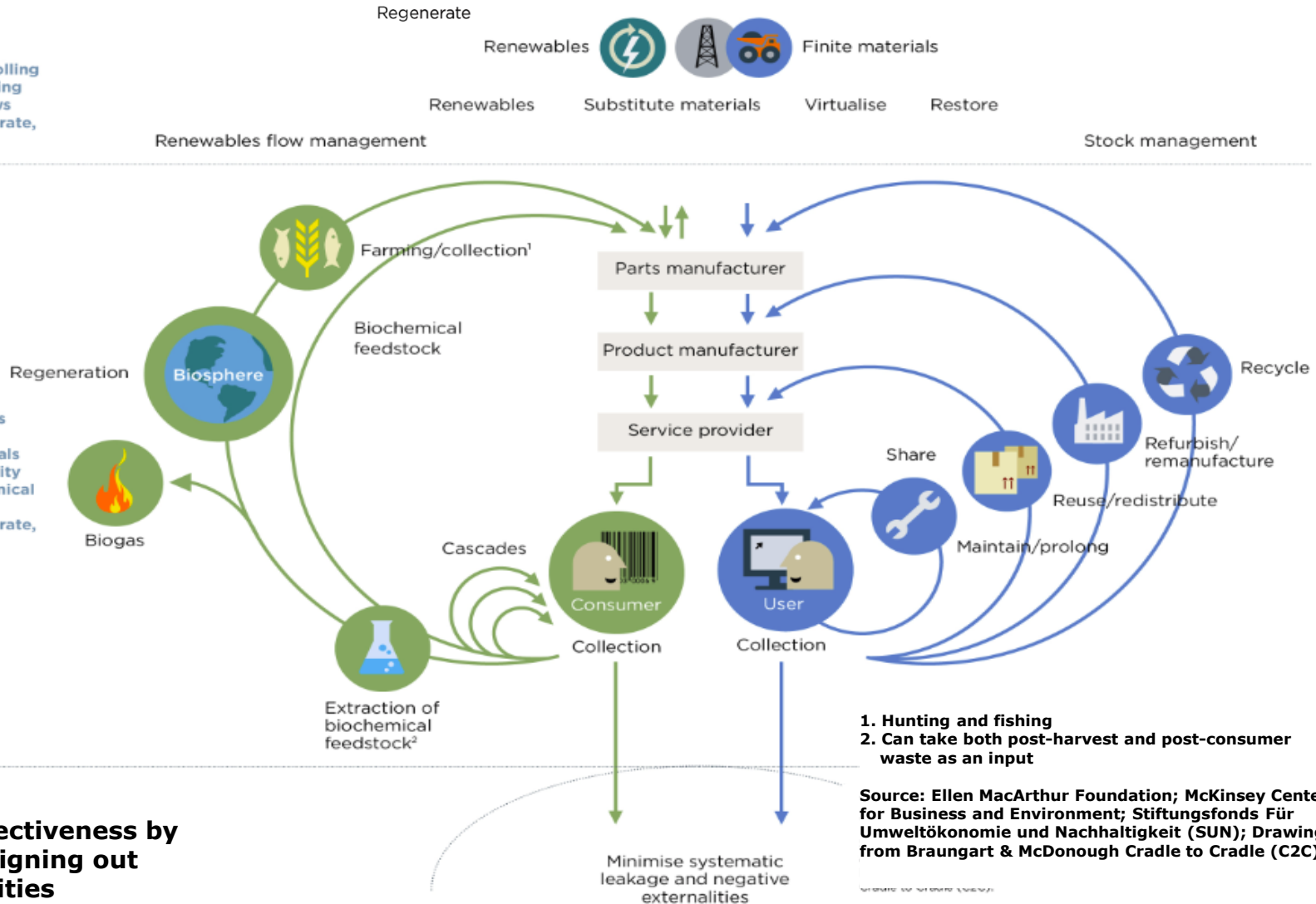
Circular economy

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
 ReSOLVE levers: regenerate, **change**

PRINCIPLE

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



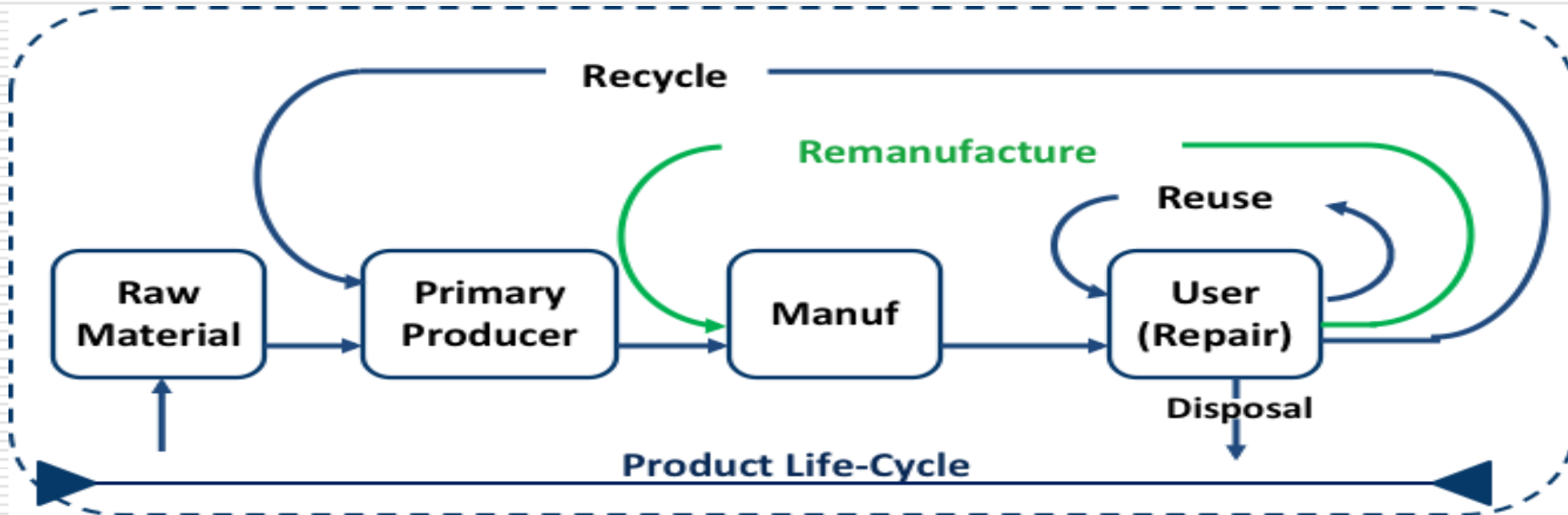
PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities

Design out negative externalities
 All ReSOLVE levers

Circular production



“Closing the loop” of product lifecycles through greater recycling and re-use, and **bring benefits for both the environment and the economy**

Problems

1. All production processes lead to downgrading materials and to create value we always need energy. Complete recycling is therefore a thermodynamic impossibility
2. The assumption that natural nutrients can be fed into the ecosphere without any problems, regardless of their quantity, cannot be guaranteed
3. Scientific information about more or less harmful effects of substance flows on the environment is growing continuously leading to necessitate treatment and disposal of unexpected waste
4. Optimizing production systems to completely close material loops requires a rigid coupling of diverse processes of material conversion, not only within one company, but also between processes in different companies and countries. This is difficult to establish and manage in market economy

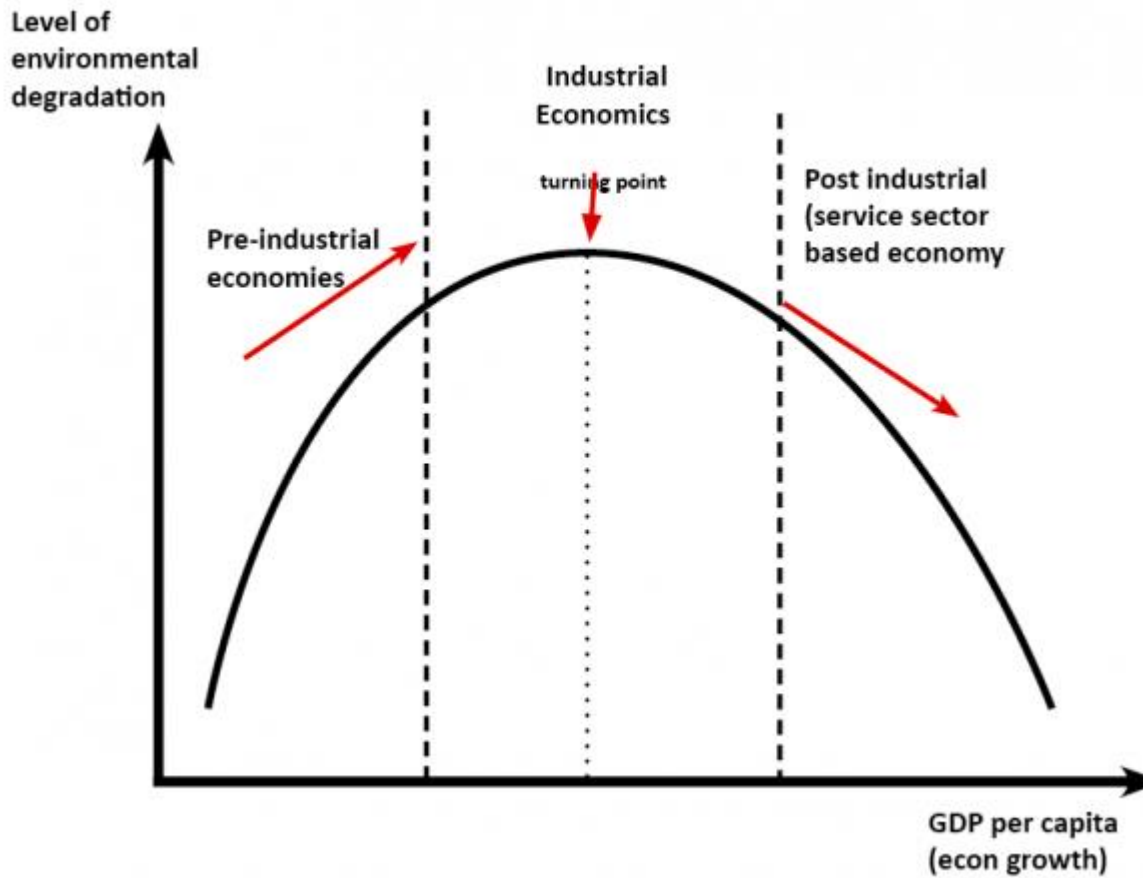
The main obstacle to sustainability

- ❑ One large obstacle to transformation towards sustainability began with a bargain made long ago with the giant companies that promised to make our lives affluent, convenient, easy and fun.
- ❑ But they also made our world fragile, polluted, violent, undemocratic, insecure, and unsustainable. Moreover, they corrupted our very thoughts and words (David W. Orr)

Tim Jackson

- “I don’t at all deny that material gain exists in the human psyche. My point is that it doesn’t exhaust what it means to be human. It never did. And it never will. And we would never have evolved as a successful species if it had. The error of the consumer society is to believe that it does, to construct all our financial and economic institutions around this belief...
- The task is to **rebuild an economics** fit for purpose in which stability no longer depends relentlessly priming people’s materialistic appetites to the point of excess. And to create – or perhaps **recreate – a social language** to supplement the damaging, and ultimately unsatisfactory language of goods”.

S. Kuznets curve



What is GDP?

(Simon Kuznets, 1934)

$$\text{GDP} = C + I + G + X$$

C- consumer spending

I- Investment spending

G- government spending

X- Net export

Simon Kuznets in 1962 stated on GDP:

“Distinction must be kept in mind between quantity and quality of growth, between costs and returns, and between the short and long run. Goals for more growth should specify more growth of what and for what”

HDI- human development index

ISEW- Index of sustainable economic welfare

Empowered Life Years (ELY)

- Desire for longer life weighted with empowerment indicators (literacy, health, being out of poverty, wellbeing/happiness)
- ELY (*health, cognitive, emotional, and material dimensions*):
 - healthy life expectancy;
 - literate life expectancy;
 - happy life expectancy;
 - poverty free life expectancy.

Capitalism

- „Virtually every bad social trend from crime to obesity is strongly linked to the unequal distribution of income and opportunity, risk and reward. The fact is that the global capitalist economy is trending toward greater concentration of wealth and is therefore increasingly prone to lurch from crisis to crisis and to foster a growingly public disaffection“
(Richard Wilkinson, Kate Pickett „*The Spirit level: why equality is better for everyone*“, 2010)

Communism and Capitalism

- Communism and capitalism have many similarities, including their dependence on economic growth and industrial paradigm rooted in a rationalistic philosophy that regards the world as so much dead material waiting to be transformed in ways suitable for human use and then discarded without consequence. Both ideologies worship at the same altar, even if they argue who owns the church". (*Thomas Piketty „Capitalism in the Twenty-first century“, 2014), Joseph Stiglitz „The Great Divide“, 2015, Anthony Atkinson Inequality: What Can be Done? Harvard university Press, 2015*)



Davos man

- They speak confidently about investments and new technologies and how they will make the journey profitable for a few and far easier for everyone else: solar power cheap to meter, miracle materials lighter than feathers and stronger than steel, a new circular economy, an internet of things, robot to do our work, and much more. Theirs is a world of technological progress, economic growth, and opportunity; no cloud darkens their skies.

Klaus Schwab

“Progress trap” (I)

- The heart of our predicament is that technology is addictive. Material progress creates problems that are – or seem to be – soluble only by further progress. It is an old story. Many of great ruins that grace the deserts and jungles of the earth are monuments to progress traps, the headstones of civilizations which fell victim to their own success. The problem is the inherent human inability to foresee long-range consequences.

(Ronald Wright, historian)

“Progress trap” (II)

A still more fundamental progress trap is inherent in the dynamism of a continually growing, energy- and resource- intensive, consumption-oriented market economy. There are good reasons to believe that the economy has already exceeded the carrying capacity of Earth. But the possibility that there are limits to growth or fundamental differences between quantitative and qualitative growth is still incomprehensible to most economists, corporate chiefs, bankers, financiers, managers of the economy, media talking heads and all of the nabobs who gather to preen and be seen at their annual séance at Davos.

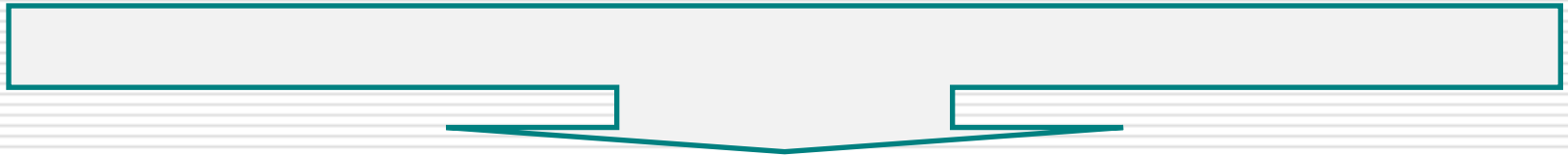
1960

“Many people assume, wrongly, that a company exists simply to make money. While this is an important result of a company’s existence, we have to go deeper and find the real reasons for our being... People get together and exist as... a company so that they are able to accomplish something collectively that they could not accomplish separately – they make a contribution to society.”

Dave Packard

1970

Three thousand people show up to GM'S annual meeting as stockholders endorsed resolutions to establish a committee on corporate responsibility.



Milton Friedman wrote "The Social Responsibility of Business Is to Increase Its Profits."

How to Fix Capitalism

In these tough times, it's easy to forget that during the past century, the world has gotten better. But billions have not been able to benefit from capitalism's miracle.

Bill Gates, TIME, 08 11 2008

Creative capitalism isn't some big new economic theory. And it isn't a knock on capitalism itself. It is a way to answer a vital question: How can we most effectively spread the benefits of capitalism and the huge improvements in quality of life it can provide to people who have been left out?

Education (I)

We , EDUCATORS, have equipped our graduates with the tools and technology necessary to enlarge the human empire, but not the wisdom to understand the consequences of doing so;

We have taught the how to manipulate, make, conjure, communicate worldwide, and sell everything under the sun but not how to think about the effects on themselves and others of doing such things;

Education (II)

We have trained armies of lawyers and lobbyists with the skills to defend their right to plunder, but taught them nothing about enlarging the empire of justice across generational and species line;

We have taught the future leaders of mighty corporations how to grow their companies beyond imagination, but given them no guidance regarding the physical, ecological, and moral limits to the scale of human estate or the concepts of enough and sufficiency.

They were taught to be technicians, not thinkers, in a culture that is long on know-how and short on know-why.

What we have today(I)

- ❑ Distance learning, online courses, and vendors including some colleges and universities are already redefining the content, process, economics, and meaning of education. What they mostly offer are cheaply acquired skills and quick credentials fitted for a turbulent job market in a devil-take-the-hindmost economy: mental junk food, not quality nutrition

What we have today (II)

The fast educators have neither the time nor the inclination to facilitate deep consideration of education or enable their students to think about the act of thinking or offer useful guidance on the larger issues of our time.

THEIR model of education is the business plan, their metric is cash flow, their students are just customers, their teachers are increasingly underpaid and overexploited adjuncts, and their pedagogy is that of the assembly line.

Sustainability science (SC)

- ❑ SC focuses on the interactions between nature and society, i.e. how social change shapes the environment and how environmental change shapes society;
- ❑ It is problem-driven with a goal of creating and applying knowledge in support of decision making for SD;
- ❑ SC is not yet an autonomous field or discipline, but rather a vibrant arena that is bringing together scholarship and practice, global and local perspectives from North and South, and disciplines across the natural and social sciences, engineering, and medicine;
- ❑ What determines the vulnerability or resilience of the nature-society systems in particular kinds of places and for particular types of ecosystems and human livelihoods

W.C. Clark and N.M. Dickson "Sustainability Science: The emerging research program. Harvard Univ.

SC definition (Harvard university, 2008)

- Sustainability science is problem-driven, interdisciplinary scholarship that seeks to facilitate the design, implementation, and evaluation of effective interventions that foster shared prosperity and reduced poverty while protecting the environment. It is defined by the problems it addresses rather than the disciplines it employs. It thus draws as need from multiple disciplines of the natural, social, medical and engineering sciences, from the professions, and from the knowledge of practice.

Drawbacks of SC definition

- ❑ SC definition should take a much broader view, emphasizing the root causes of fundamental unsustainability of the prevailing economic system, such as the emphasis on growth as key to solving political and social problems and advancing society's well-being;
- ❑ For instance, Halina Brown(2012) argues that SC must include social aspects of material consumption and the structure of consumerist society, the role of technology in aggravating the unsustainable social practices, as well as in solving the problems they create, the macroeconomic theories that presuppose economic growth as a necessary condition for advancing societal well-being, and others.

The Science and Technology Alliance for Global Sustainability

The gravity and urgency of today's changing global realities put human well-being and the security of societies all over the world at serious risk, but simultaneously offer unprecedented chances. This calls for the sciences – natural, social, human and engineering – to take new, bold steps to deliver solutions – oriented knowledge for sustainability. This in turn requires the kind of global efforts and fundamental changes in the practice of science that the Alliance works to facilitate and support.

Alliance members and activities

- ❑ Bellmont Forum (USA);
- ❑ International Council for Science (ICSU);
- ❑ International Social Science Council (ISSC);
- ❑ UNEP, UNESCO, UNU;
- ❑ World Meteorological Organisation (MWO)
(*observer*)

Alliance first flagship initiative is FUTURE EARTH, an international programme of integrated, solutions-oriented research for global sustainability (www.futureearth.info)

Next steps for SC

- ❑ Wide discussion within the scientific community- North and South – regarding key questions, appropriate methodologies, and institutional needs;
- ❑ Science must be connected to the political agenda for sustainable development, using in particular SDGs.
- ❑ Most important – research itself must be focused on the character of nature – society interactions, on our ability to guide those interactions along sustainable trajectories, and on ways of promoting social learning that will be necessary to navigate the transformations towards sustainability. It is along this pathway – in the field, in the simulation lab., in the stakeholder's meeting, and in the quiet study.

Science-Policy Interface for Global Sustainability

Criteria, that science must fulfil if it is to be integral to policy making, whether at national, regional or global levels:

- Scientific quality and credibility (truly scientific exercise, independence, ;
- Policy relevance and coherence (participation of civil society and private sector, respond quickly to new challenges;
- Legitimacy in a political context (process open, inclusive and geographically balanced.

Rio declaration, Principle 15:

"In order to protect environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation"

Research topics for SC

There is an urgent need for more fundamental transformations in the way societies interact with each other and with the natural environment as the basis of sustainability:

- Governance of societal transformations towards sustainability;
- Economy and finance of societal transformations to sustainability;
- Well-being, quality of life, identity, and social and cultural values in relation to societal transformations to sustainability (Bellman Forum, 2017)

Thank you !

