Introduction, Techology and Sustainablility

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and

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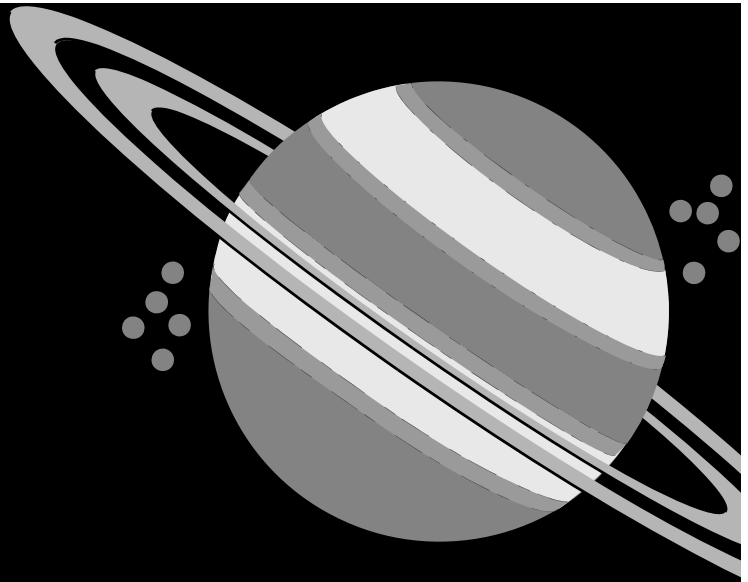
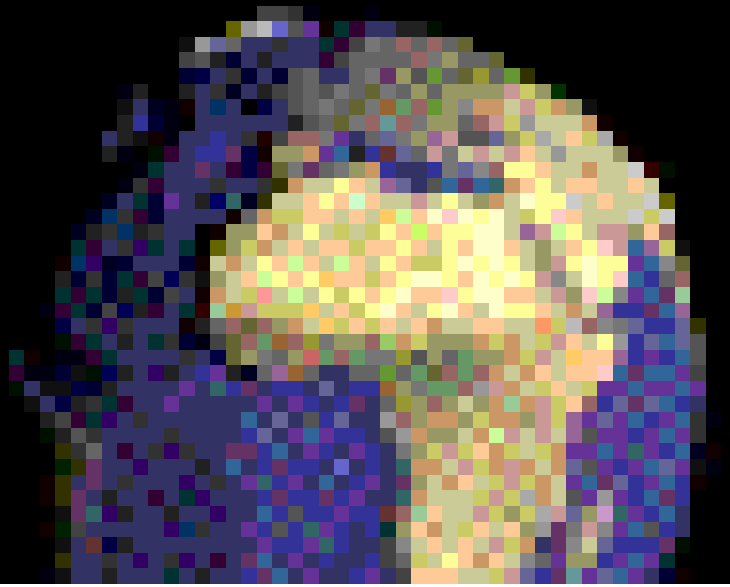
A planet meets an other one and says:



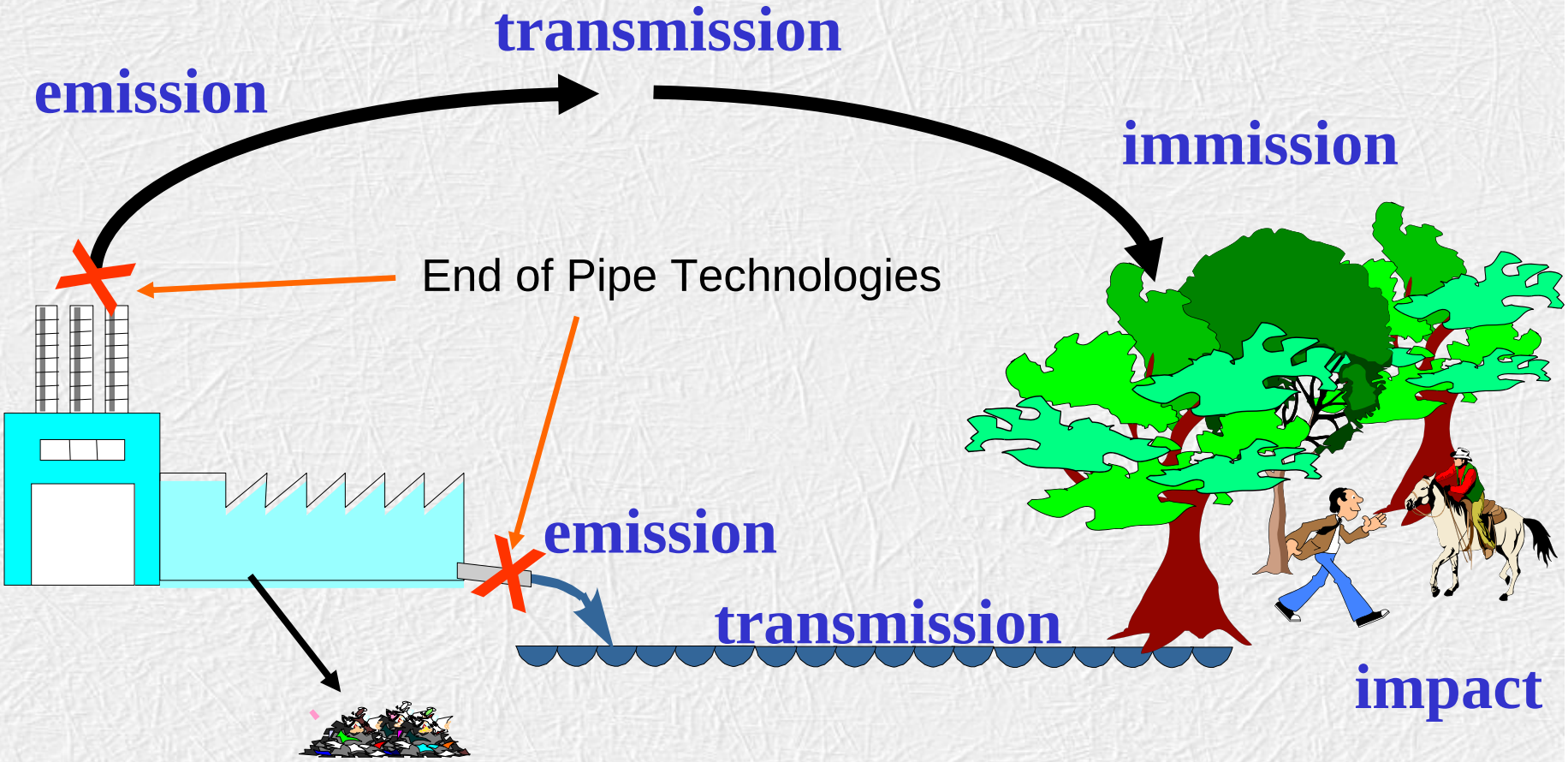
You are looking ill!

”Yes, I’ve got Homo Sapiens"



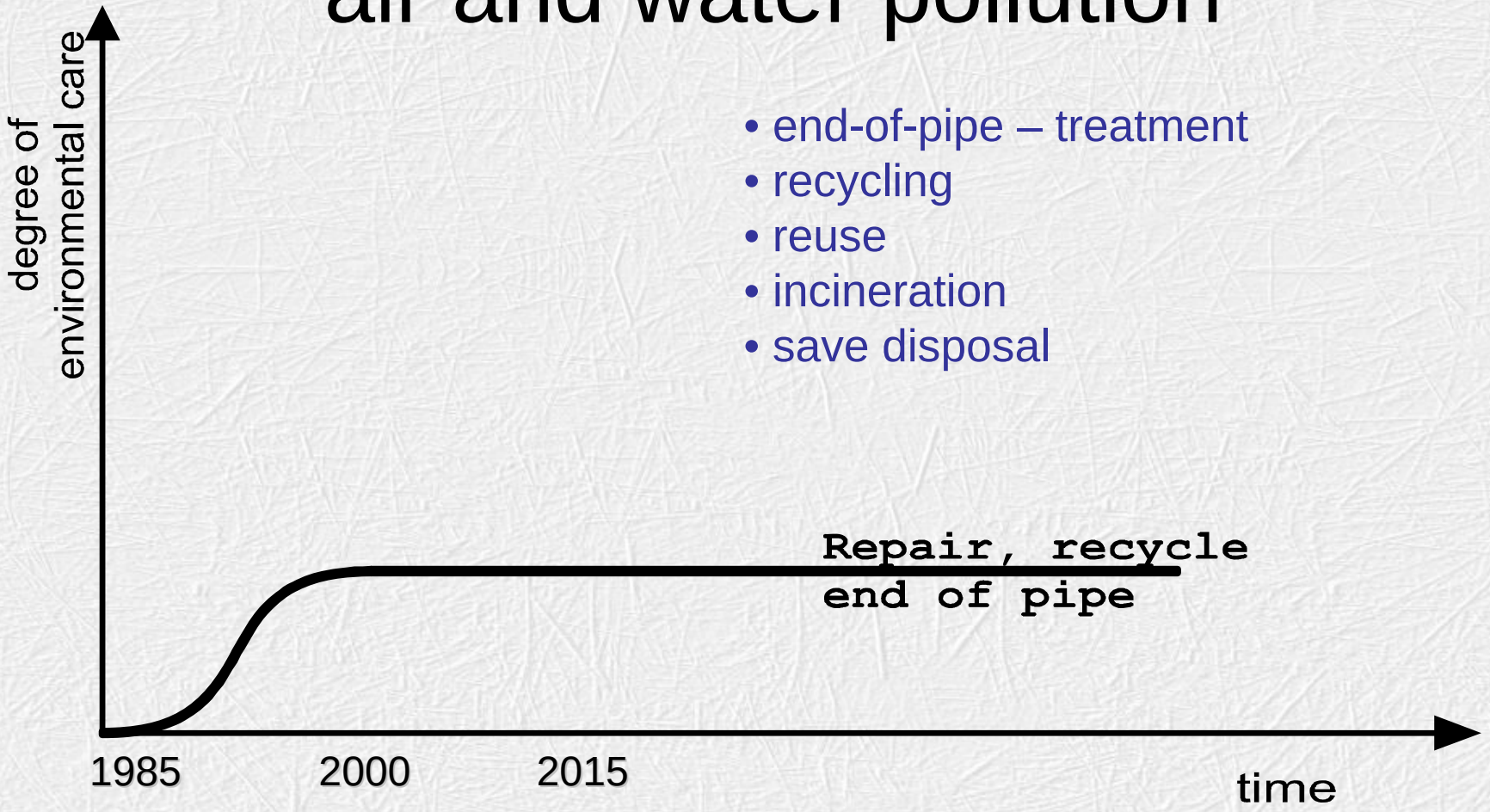
“Don‘t care, it does not last for long”

Industry and the environment



Environmental protection reduced air and water pollution

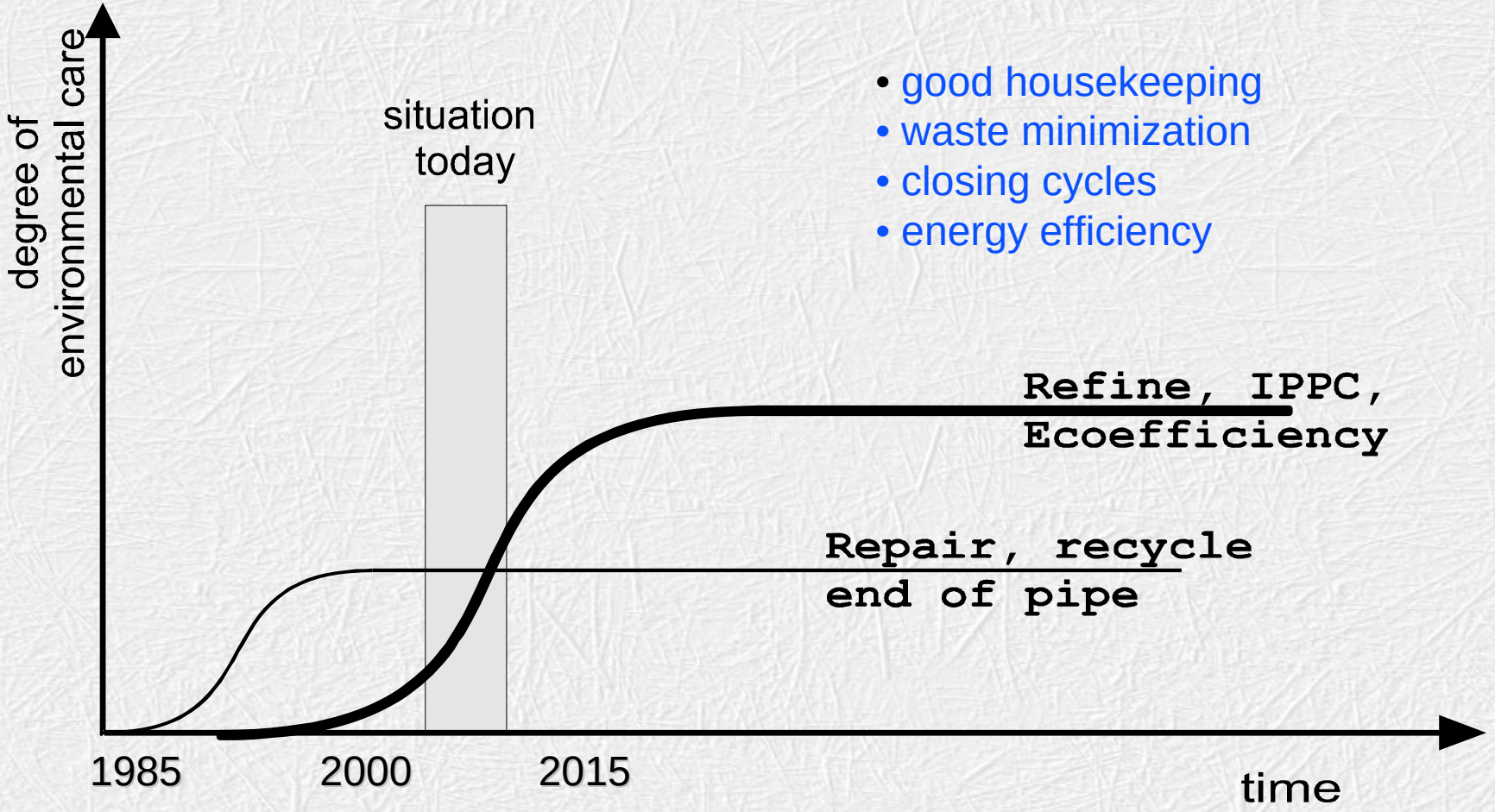
- end-of-pipe – treatment
- recycling
- reuse
- incineration
- save disposal



What we have learned

- Pro:
  - Environmental technologies lead to a significant reduction of emissions (at least per product)
- But:
  - Environmental technologies are expensive and need further input of materials, energy and manpower
  - no economic incentives for industry – in general higher production costs
  - regulatory approach, industry looks for countries with less strict regulations

Eco-efficiency, IPPC



3M invents 3P

Pollution Prevention Pays

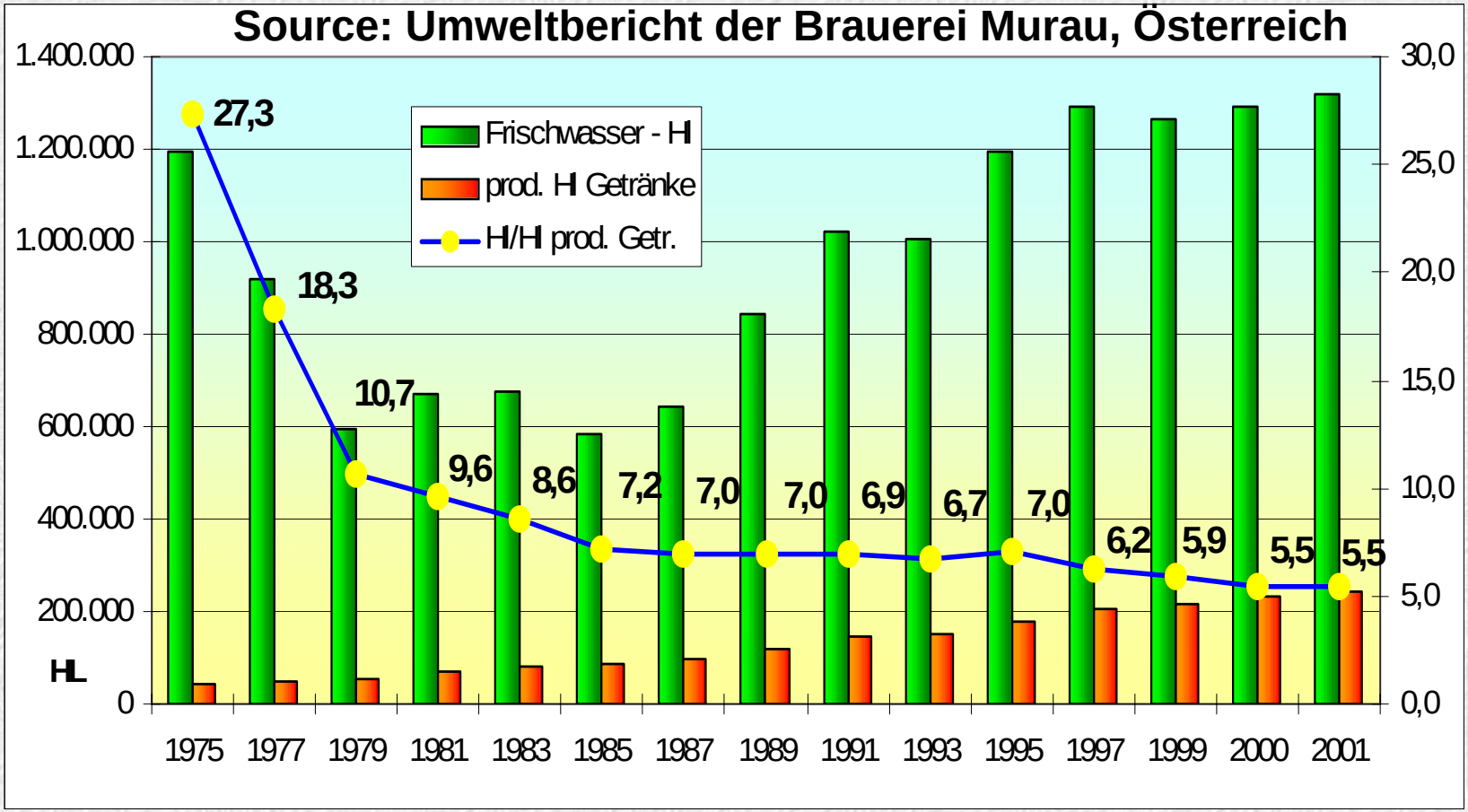
Managing for a better environment

Cleaner Production

Eco-efficiency

- Is reached by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts throughout the life cycle, to a level at least in line with the earth‘s carrying capacity.

Continuous improvements are limited



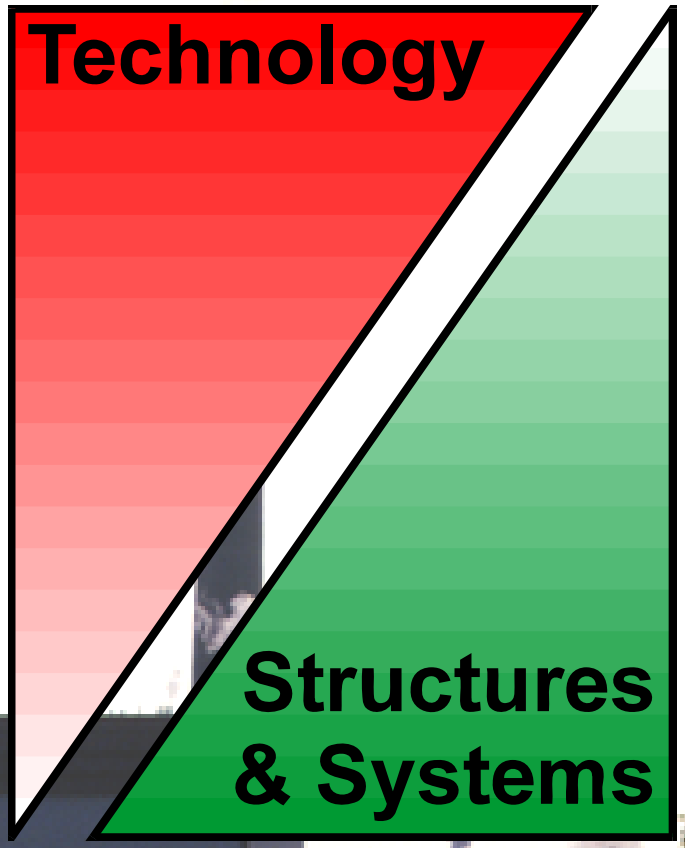
What we have learned

- Pro:
  - eco-efficient technologies and Eco-Design of products can increase the resource efficiency by the factor 4
  - a first step towards sustainability since there is an effect on the input-side of the process (les input per service)
  - win-win situations can be found
  - activities go beyond legislation
- But:
  - very often the total amount of emissions increased due to increased production
  - in order to reach a factor of 10 (or more) companies have to change attitudes: Sustainable Technologies have to go beyond efficiency
  - no in-company research done and therefore no competitive advantage on the world market

Is it progress, if a cannibal starts eating with a fork and a knife?

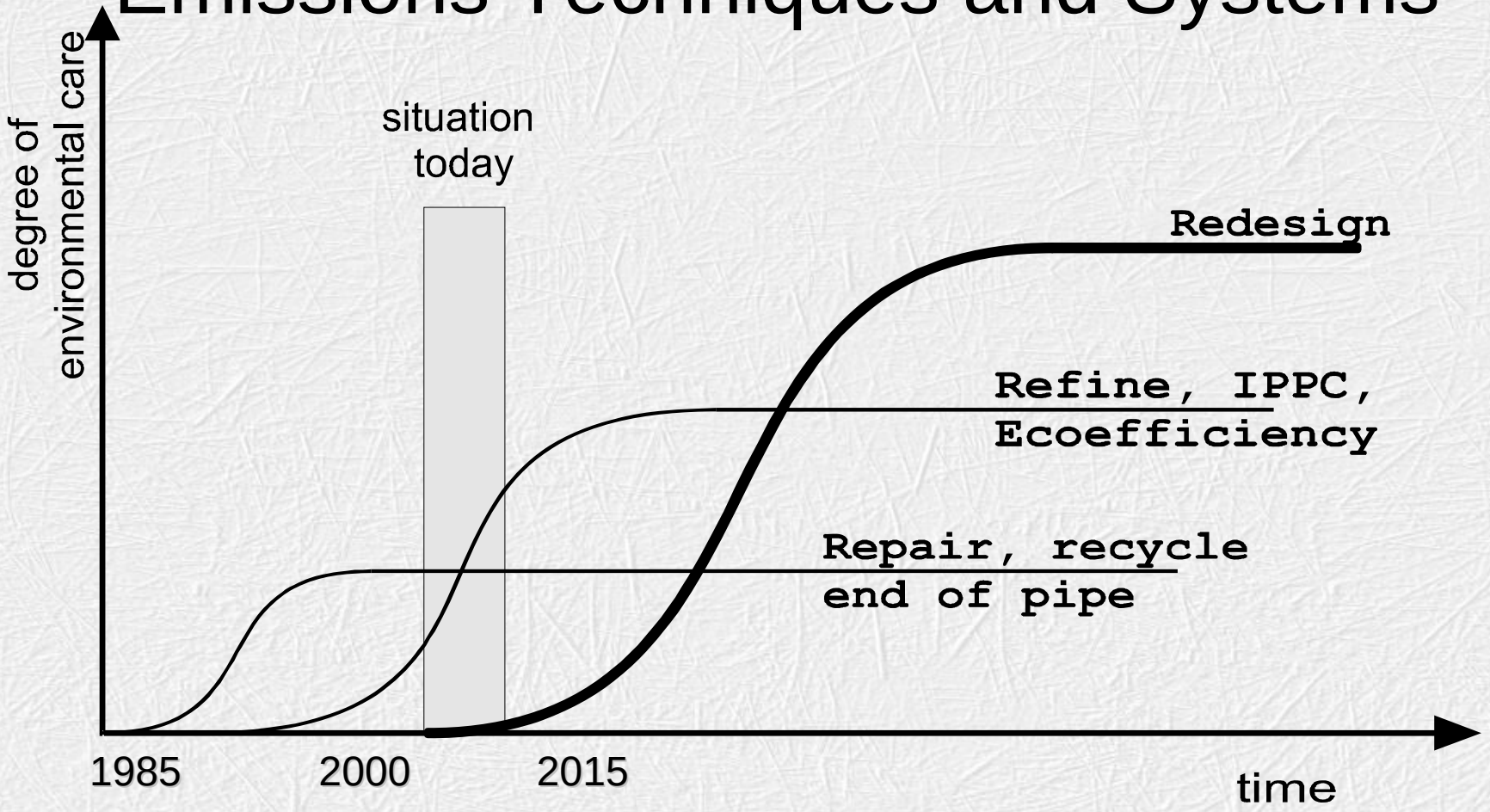
Cannibals with forks: the triple bottom line of 21st century business,"
by John Elkington, New Society Publishers, 1998

What is the nature of our problems today ?



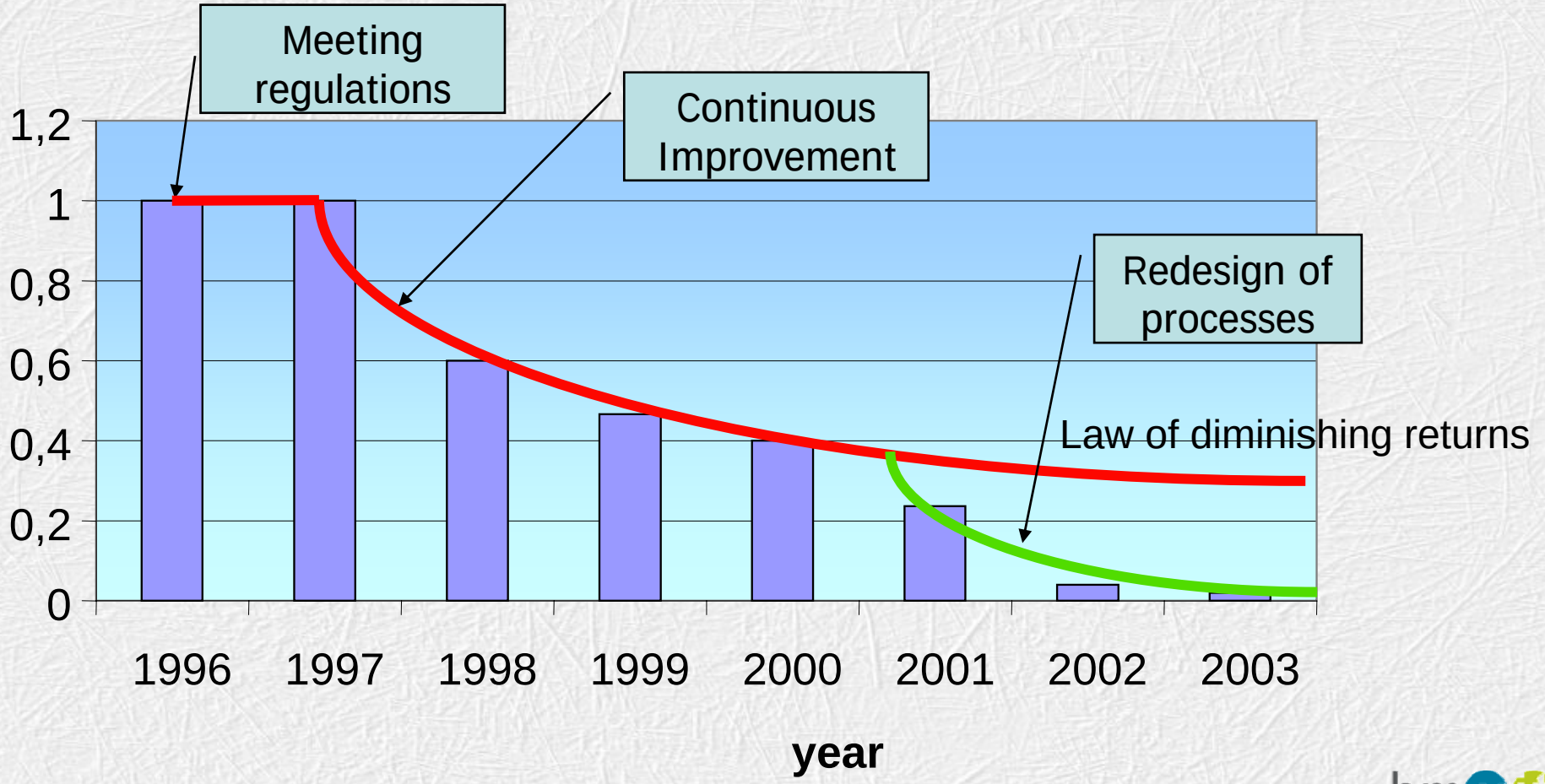
- Damages from air pollution
- Ground water quality
- Ozone hole
- Global warming

From continuous improvements to Zero Emissions Techniques and Systems



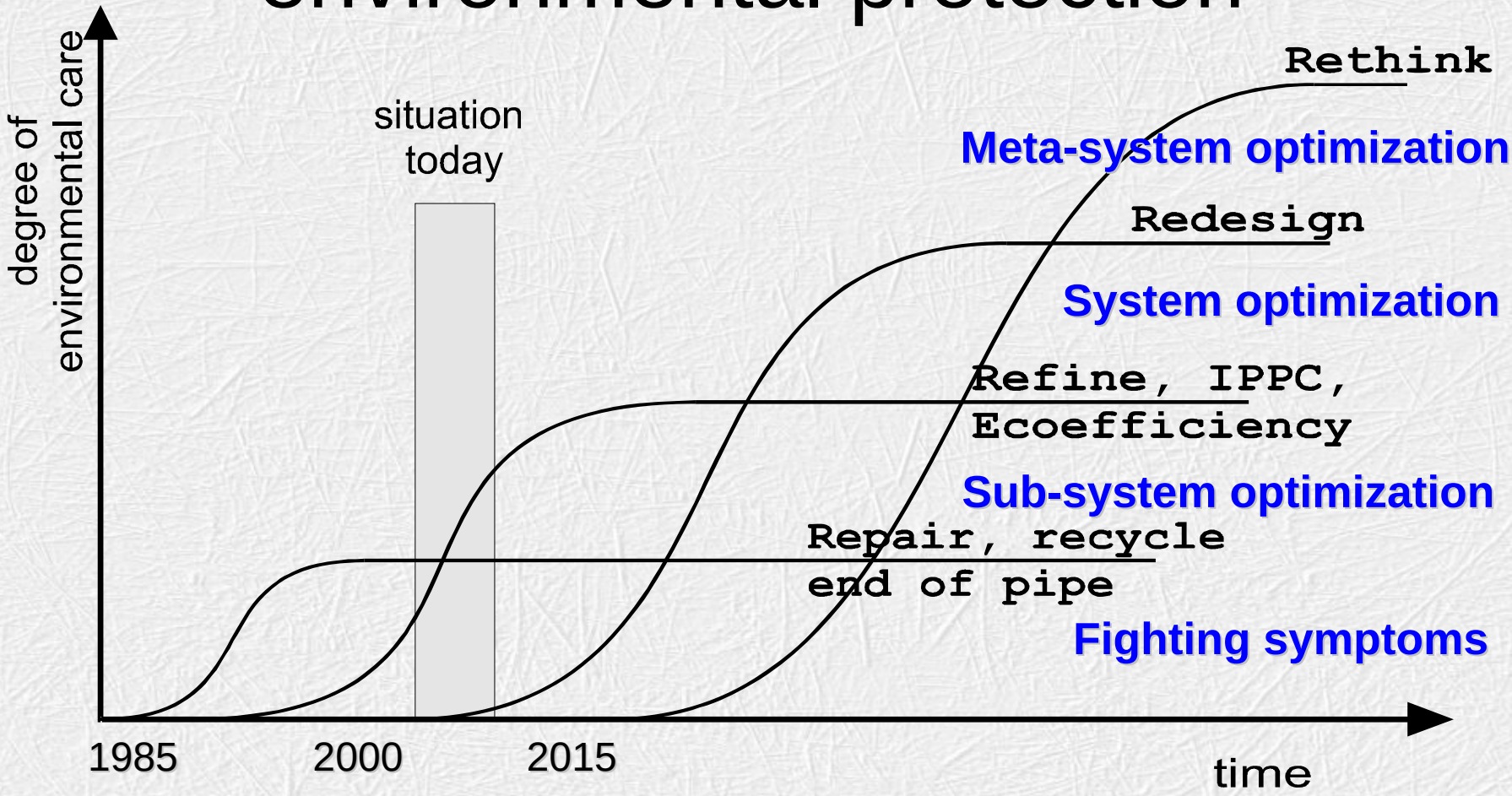
Specific water consumption in an eloxal plant

Heuberger eloxal



Source: STENUM, 2004

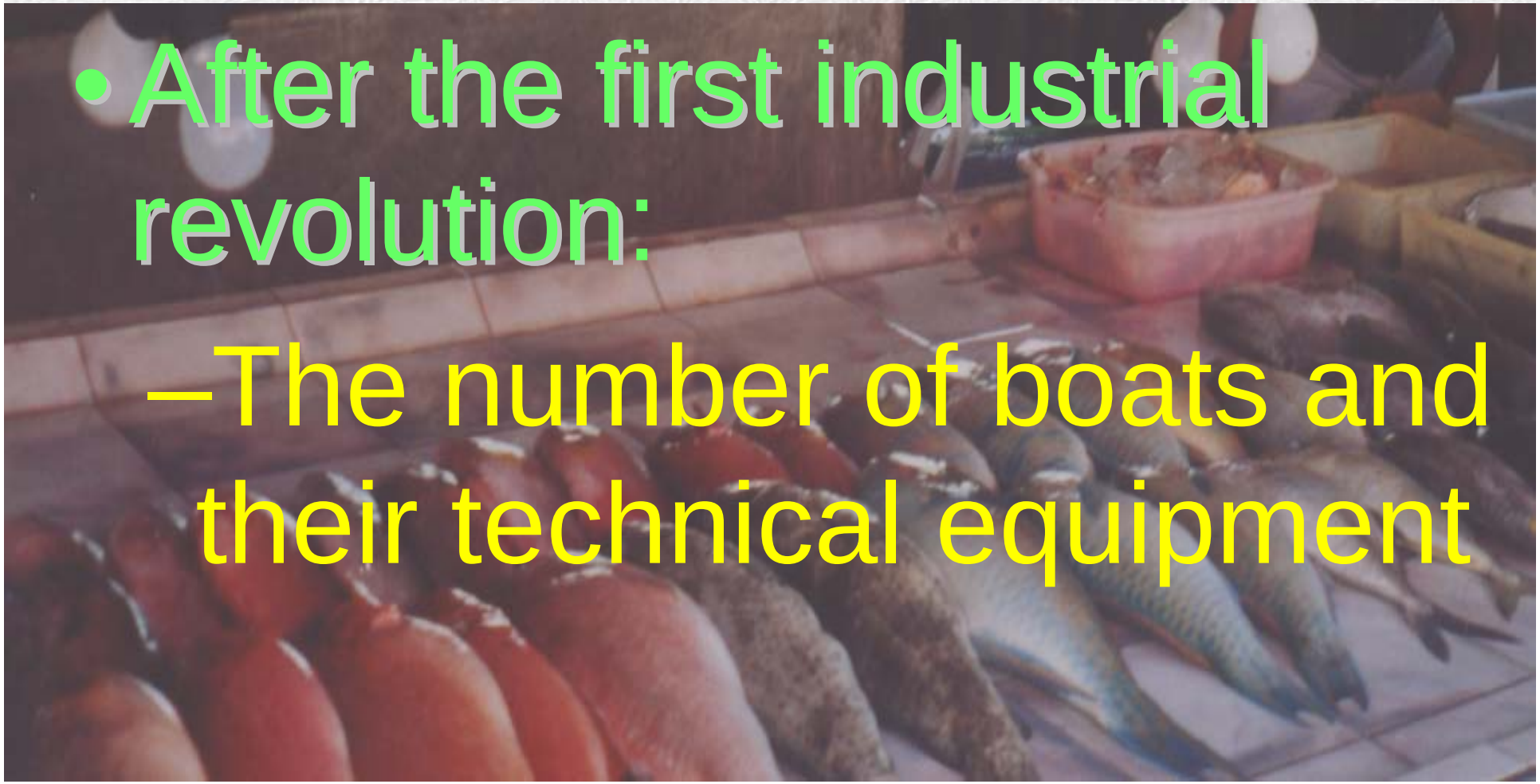
The paradigm shift in environmental protection



What determines how much fish there is on the market?

- Before the first industrial revolution:
  - The number of fisherman

What determines how much fish there is on the market?



- After the first industrial revolution:
  - The number of boats and their technical equipment

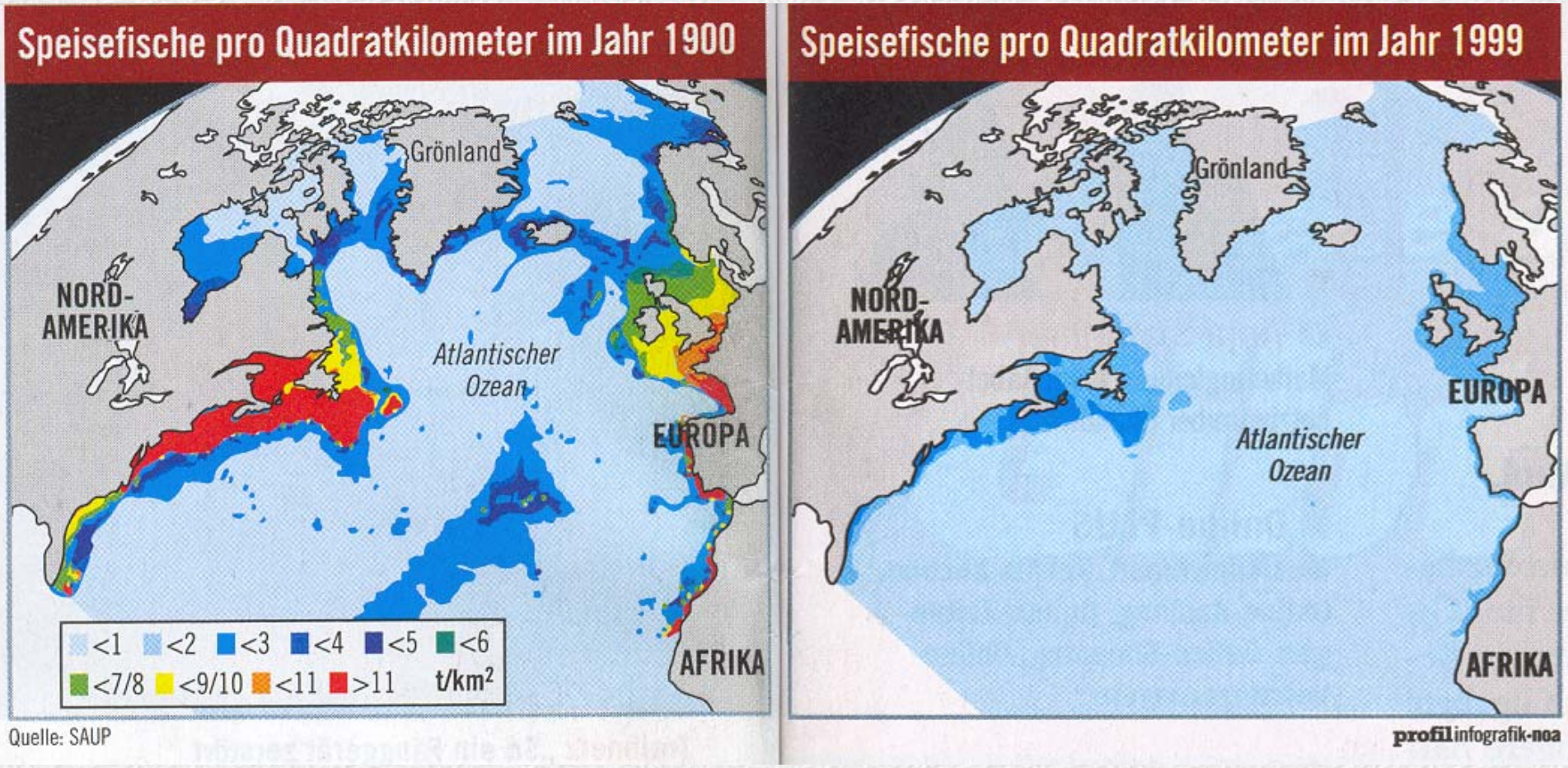
What determines how much fish there is on the market?

- After the second industrial revolution:
  - The knowledge about the place where the fishes are

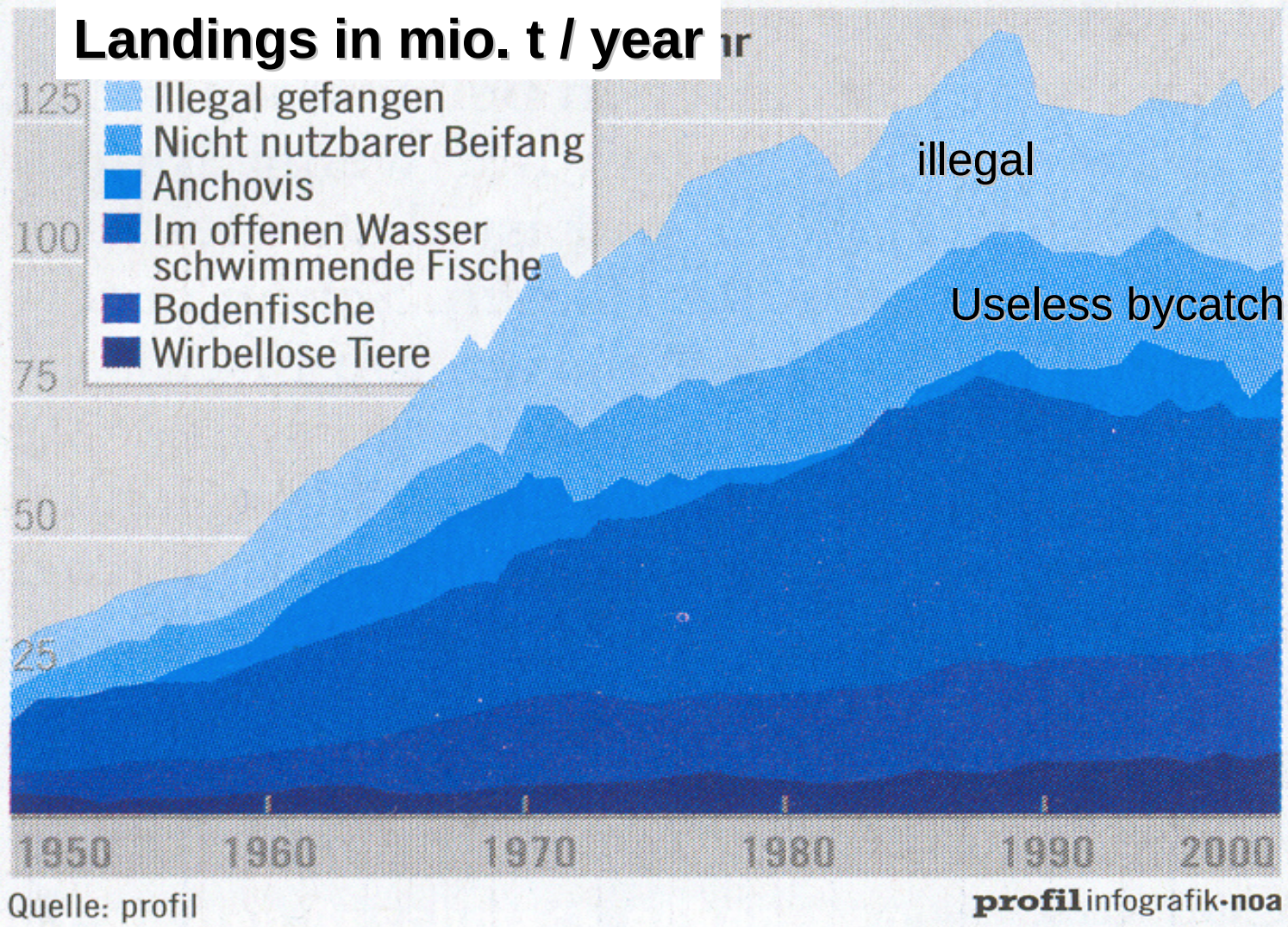
What determines how much fish there is on the market?

- After the next industrial revolution:
  - The number of fishes

The resource controlled economy



The resource controlled economy

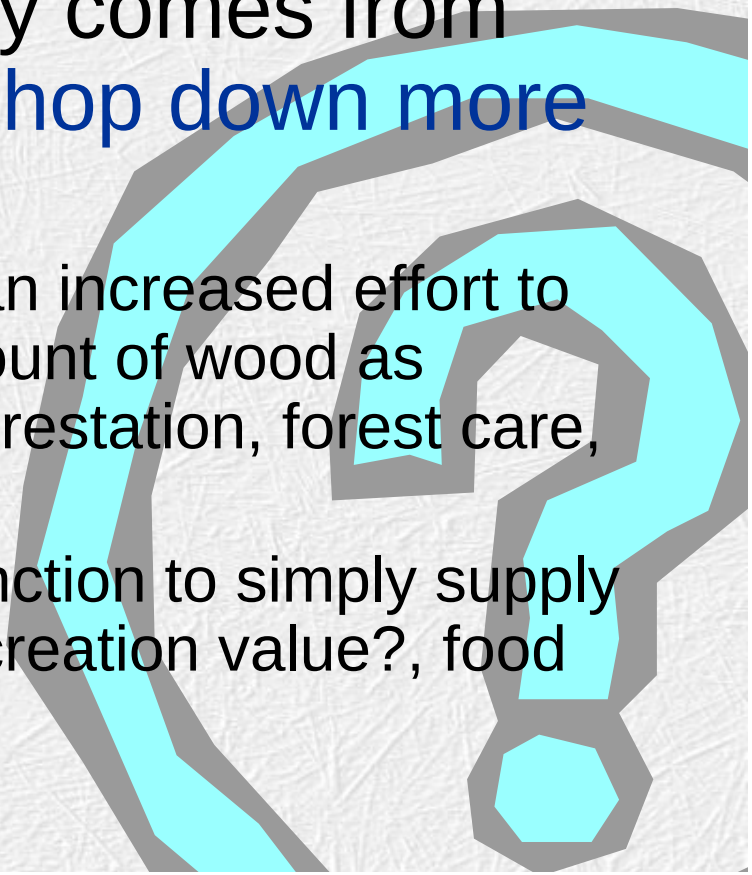


SUSTAINABLE DEVELOPMENT

meets the needs of the present without compromising the ability of future generations to meet their own needs

Control question: Is wood a renewable raw material?

- The terms of sustainability comes from forestry: you should not chop down more wood as will grow back
  - Therefore there should be an increased effort to ensure that as large an amount of wood as possible grows back by reforestation, forest care, ...
  - Reduction of the forest‘s function to simply supply wood: (water reservoir?, recreation value?, food source,? ecosystem?, ...)



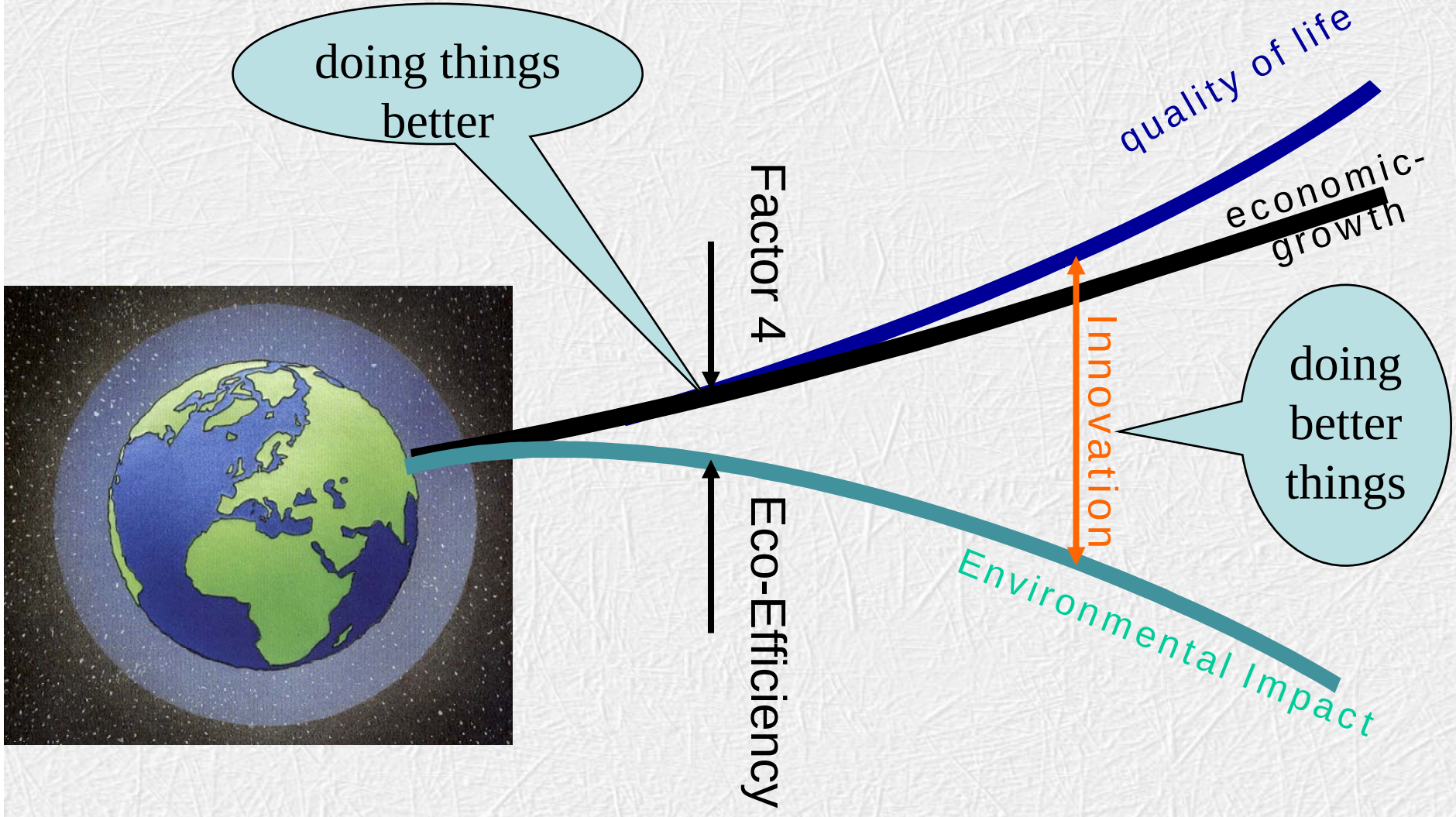
Is wood a renewable resource?

- wood is only renewable, if it is managed in that way
- Sustainability is more than long-time economics
- Sustainability also covers other service-functions like:
  - storage of water, protection against avalanches
  - air cleaning, production of oxygen
  - recreation area
  - biodiversity
  - ...
- The problem: we pay only for the wood

Basic Questions

- How can economic growth and environmental impact be de-coupled?
- How can production and consumption be de-linked from resource throughput?
- Where in the life cycle of a product lie the most troubling environmental effects

Sustainability requires innovation



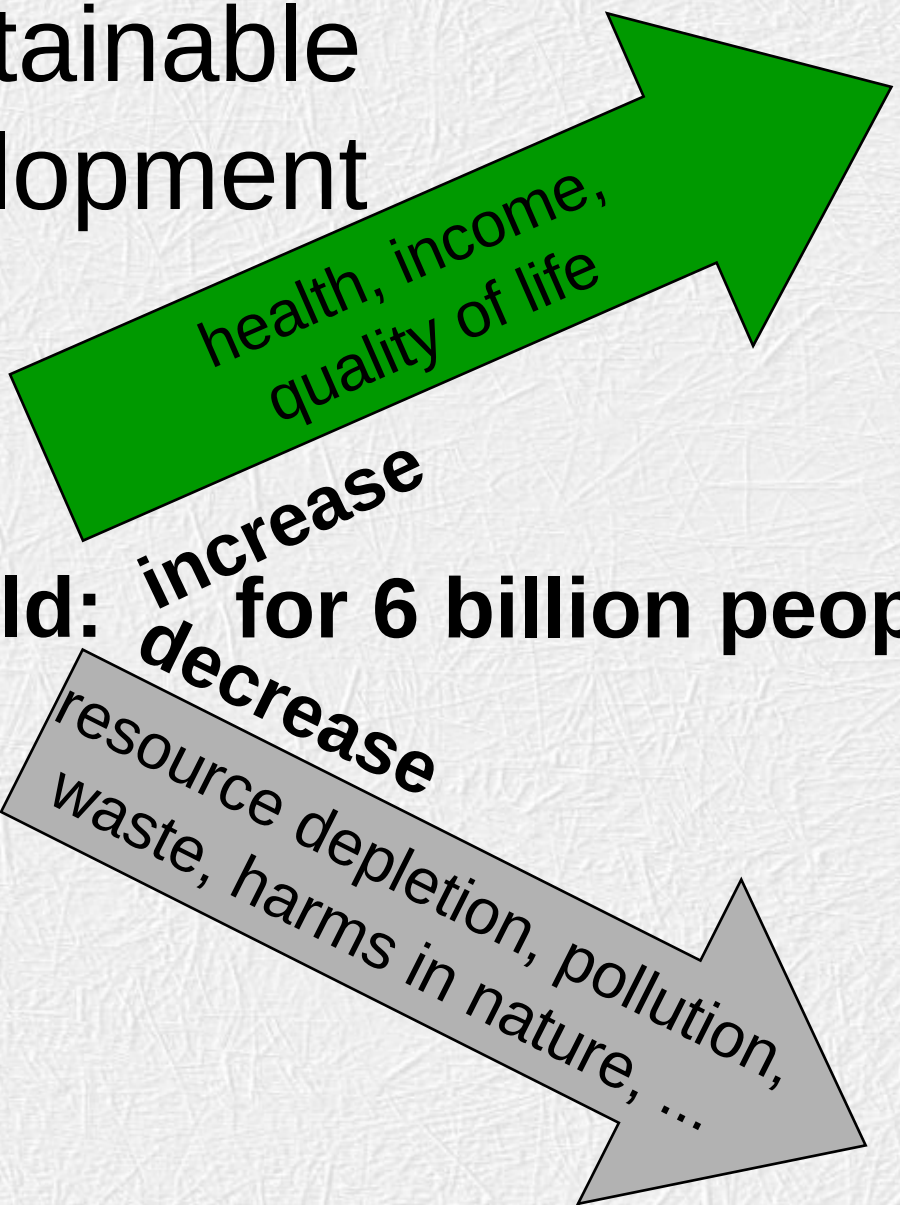
INNOVATION

The continuous improvement of existing technologies and systems will not be sufficient to obtain an economy that generates and secures welfare and income for a growing number of people on the basis of available resources, not to speak of initializing sustainable development

Change is indeed needed – but its not easy

- Innovation is not a natural process in our culture — imitation and adaptation are
- Risk-taking and change-making are not praised values in our societies – stability is
- Open competition and entrepreneurship are not (yet) assets in our economies – protectionism and well-establishment (still) are

Goals of a sustainable industrial development



industrial development

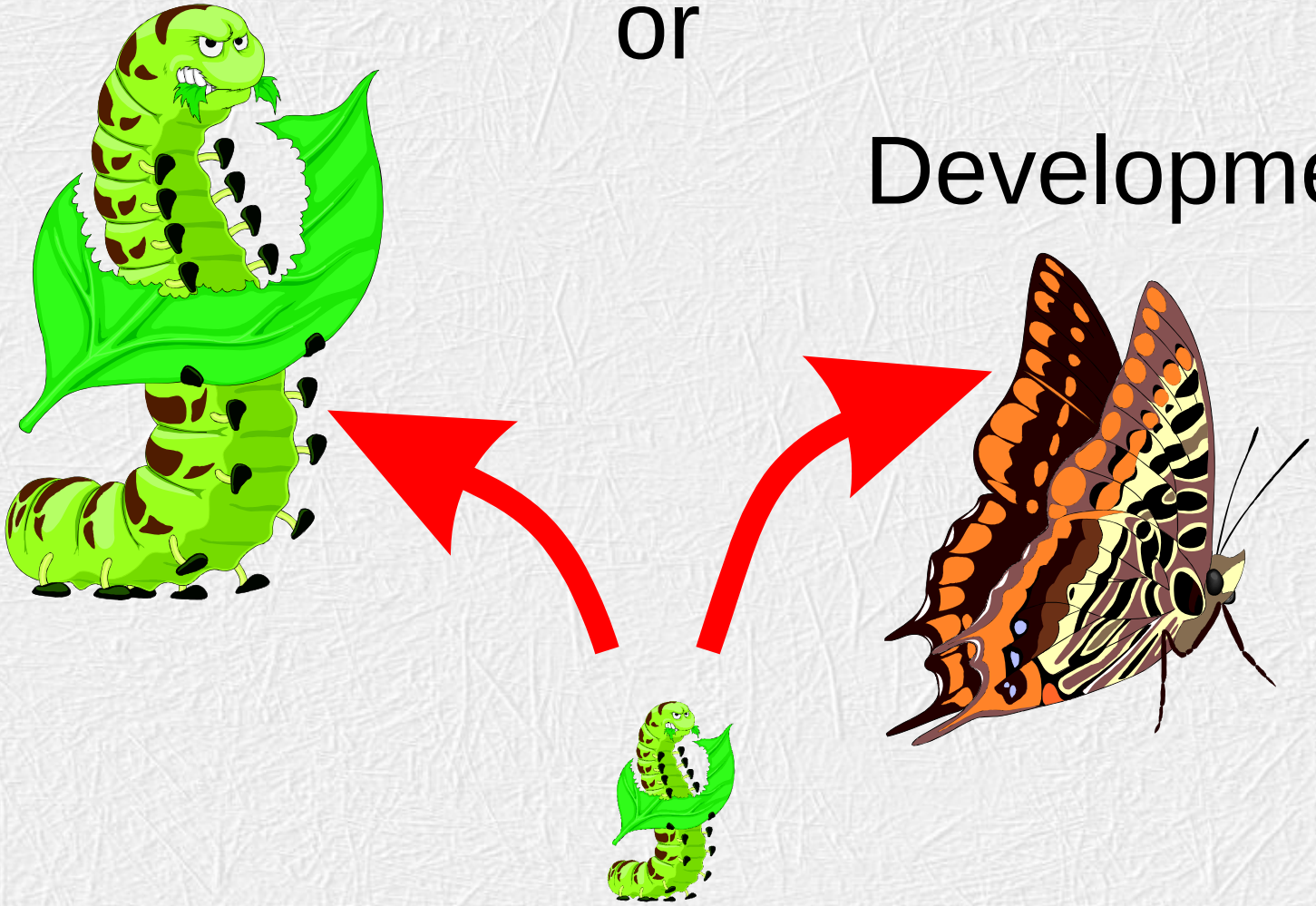
should: increase for 6 billion people

decrease

Growth

or

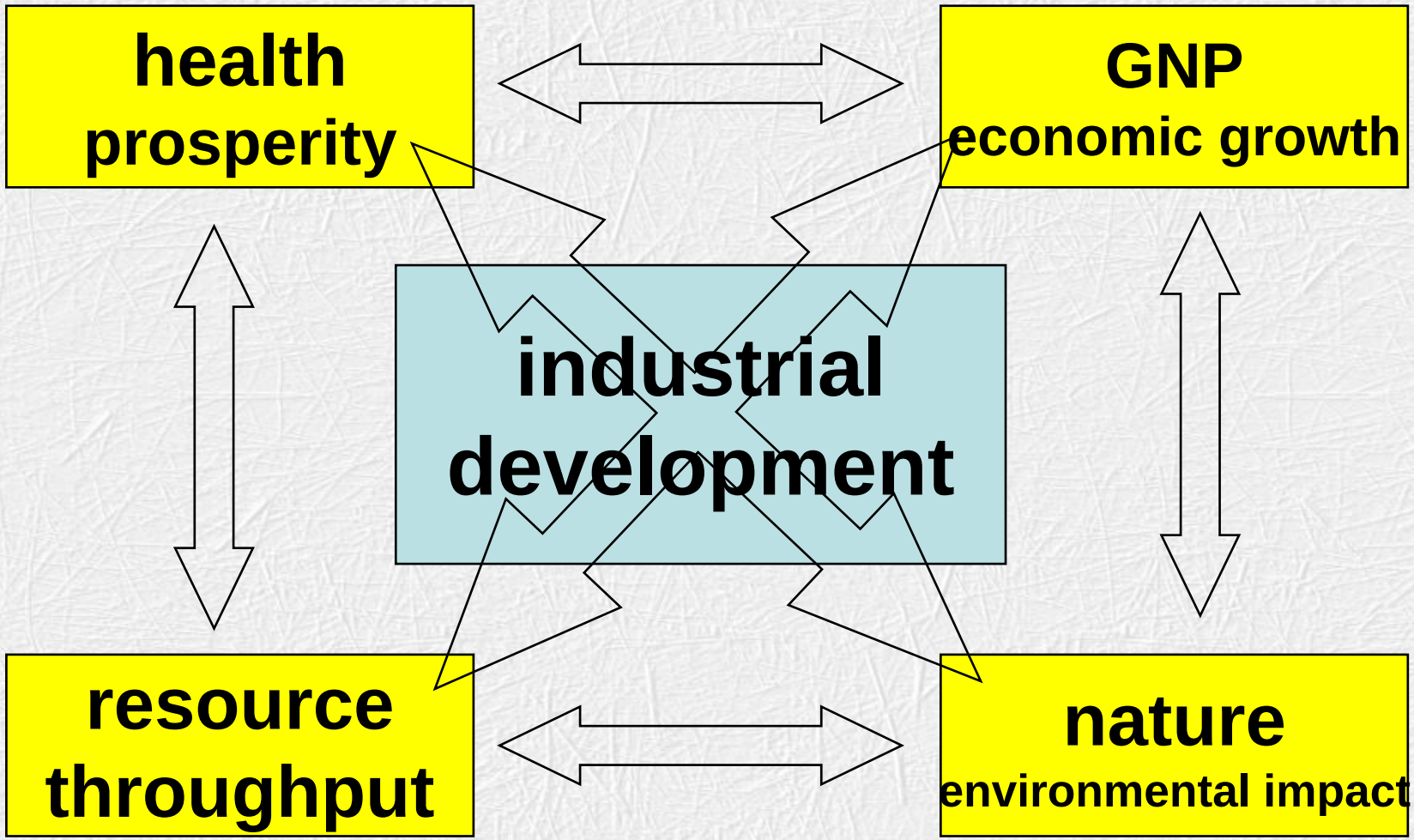
Development?



Cornerstone Issues

- The European system of production is not sustainable and has not begun to address in a substantive way how competitiveness can be achieved within the framework of sustainability and the same time maintain an acceptable quality of life
- Current trends in the modernization of production have the potential to improve competitiveness and to reduce environmental impacts but are unlikely to bring production, and the use of products, within the framework of sustainability
- Present EU policies and actions for RD&I might improve environmental performance but will not foster the transformation in production that are required to achieve competitiveness within the framework of sustainability

Source: European Commission. Sustainable Production - challenges & objectives, DG Research


health
prosperity
GNP
economic growth
industrial
development
resource
throughput
nature
environmental impact

Why is the European economic system not transferable to the world's scale?

- Europe is largely depending on non-renewable resources for materials and energy
- Europe is largely depending on imported resources for materials and energy
- Europe has dramatically changed its ecosystems and overexploited its nature
- Europe succeeded in the reduction of the "classical" environmental pollution but is facing new problems (climate change, particulates,…)

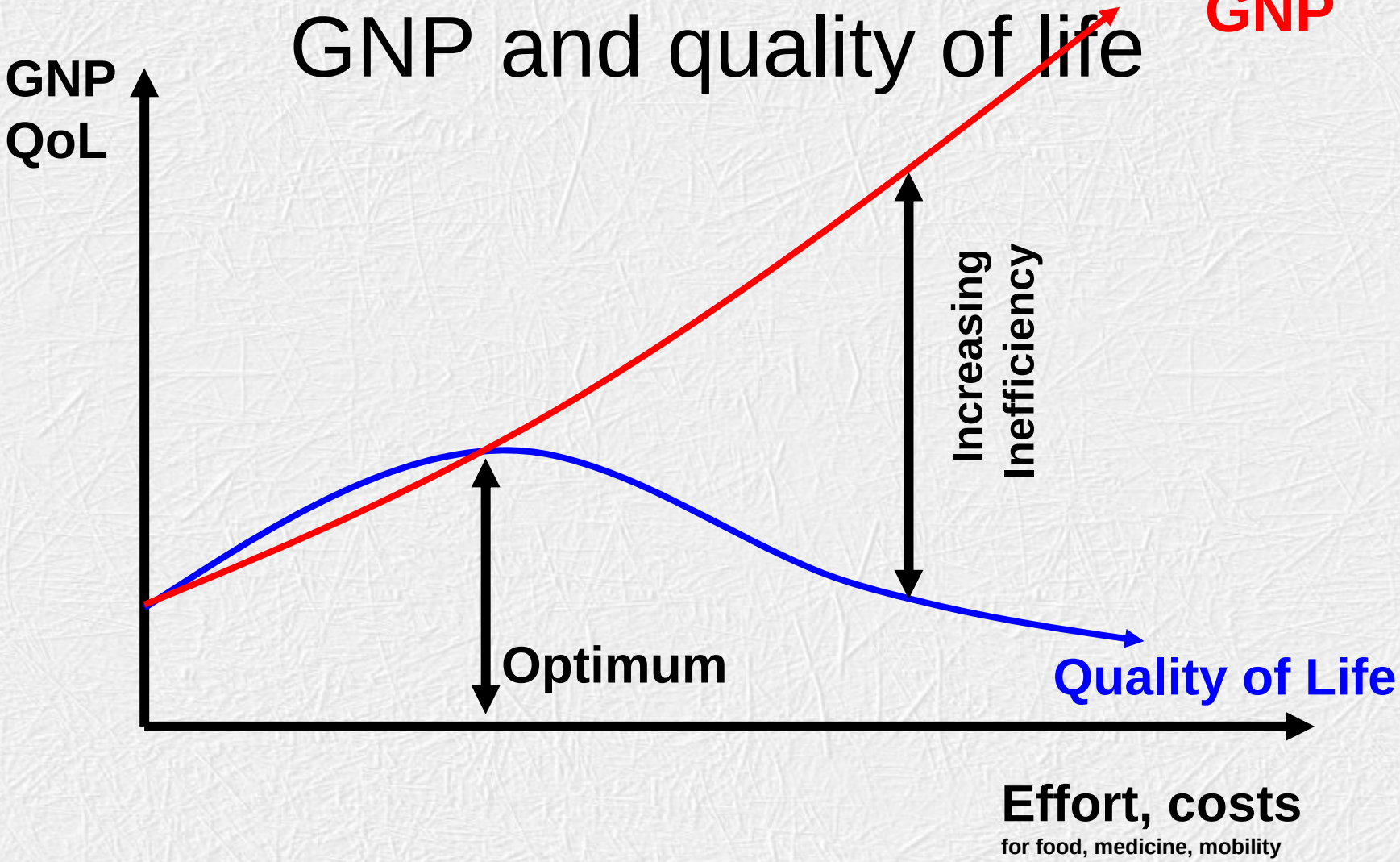
can we conclude?

- Europe does not have the technologies that can help developing economies on a way to a sustainable future
- Europe does not have consumption patterns that can be adapted by 6 billion people
- Europe has a “footprint” much larger than Europe – this cannot be scaled up the world
- The “quality of life” – as felt by the (Western) Europeans is not growing since 20 years

Where European approaches fail to serve 6 billion people

- traffic: individual ice-car for everybody?
- energy: mainly based on fossil resources (reserves, internal dependency, CO_2-emissions,…)
- waste water: large, expensive systems that require maintenance and energy
- solid waste: incineration and landfills with little material recycling
- agriculture: depending on fossil energy
- leisure, tourism: interconnected with traffic, destruction of nature and health hazards

GNP and quality of life



There is a need for actions

"An important challenge facing European industry is the

transition from a traditional to a sustainable system of industrial production.

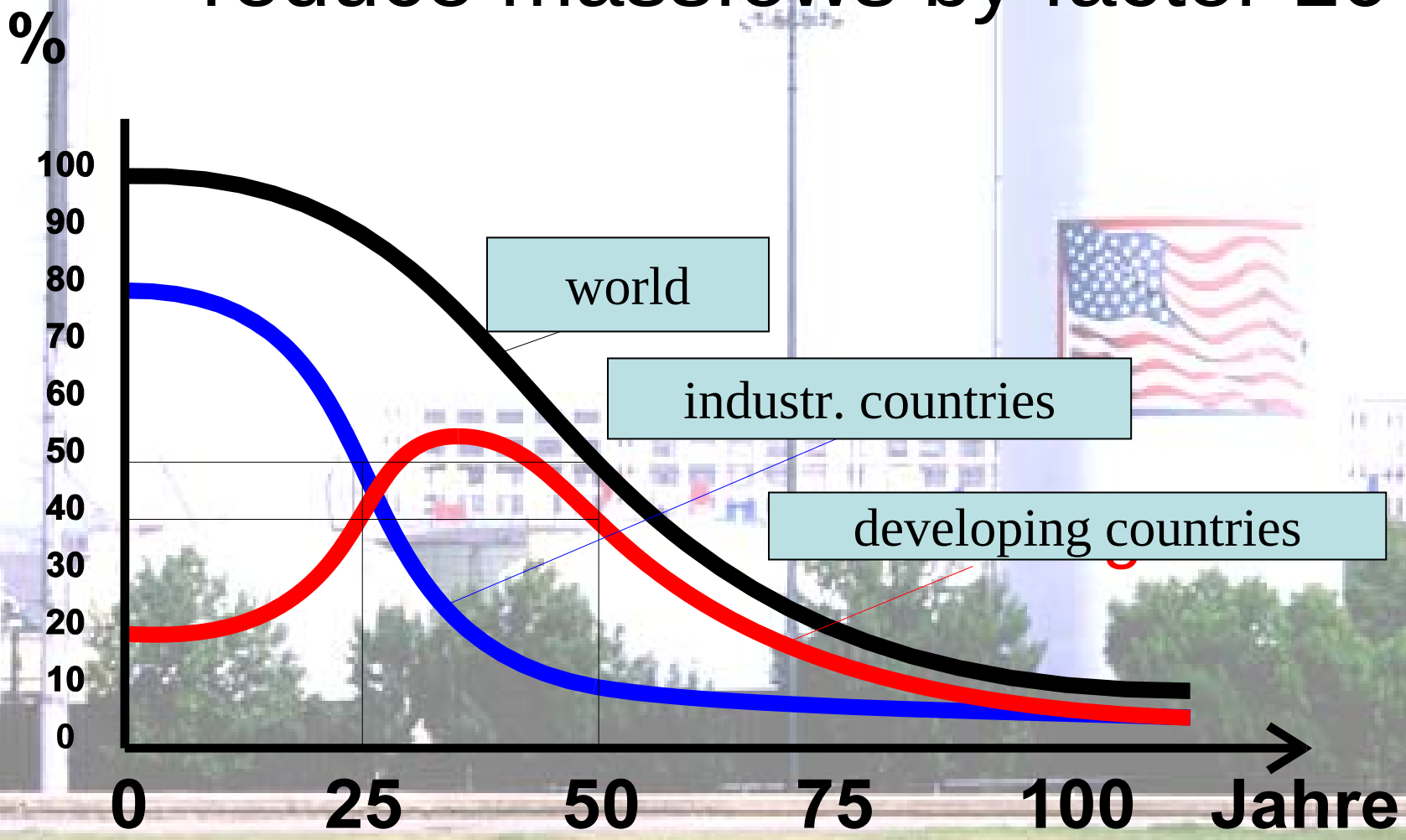
Regarding this, research and innovation strategies that

combine competitiveness with the objective of sustainability

should be supported."

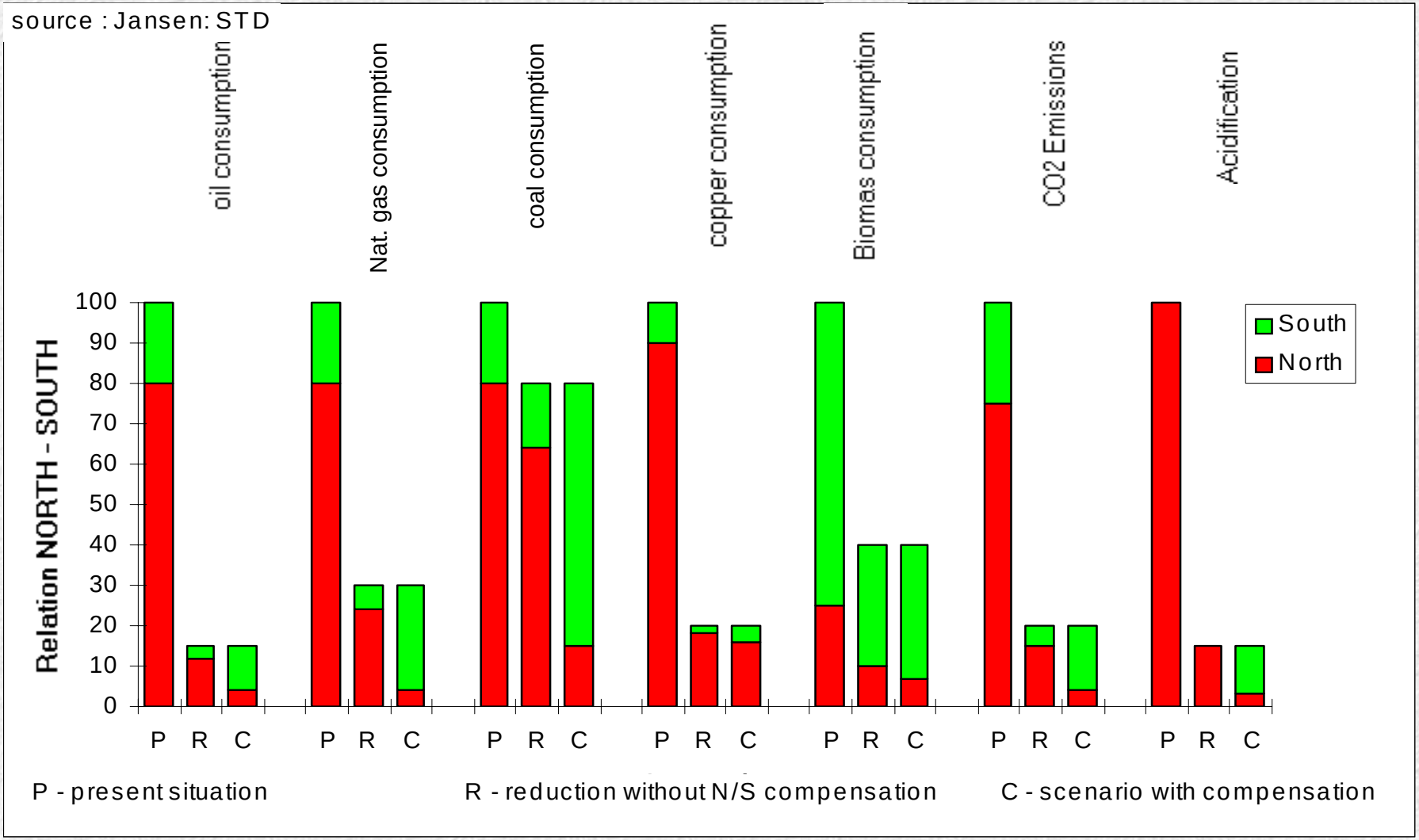
(Statement of the commission "Innovation in the Economy", 2000)

SD-Postulate #1
reduce massfows by factor 10



nach Schmidt-Bleek

Reduction needed in different fields



Factor 4 and Factor 10 are System-Efficiencies

- A life-cycle consists of 6 stages at least
- the conversion takes 50 years
- the conversion takes 50 years at 6 steps

$$(1.26)^6 = 4{,}0$$

$$(1{,}05)^{50} > 10$$

$$[(1{,}01)^6]^{50} = 20$$

Ways to boost resource-efficiency

EFFICIENCY

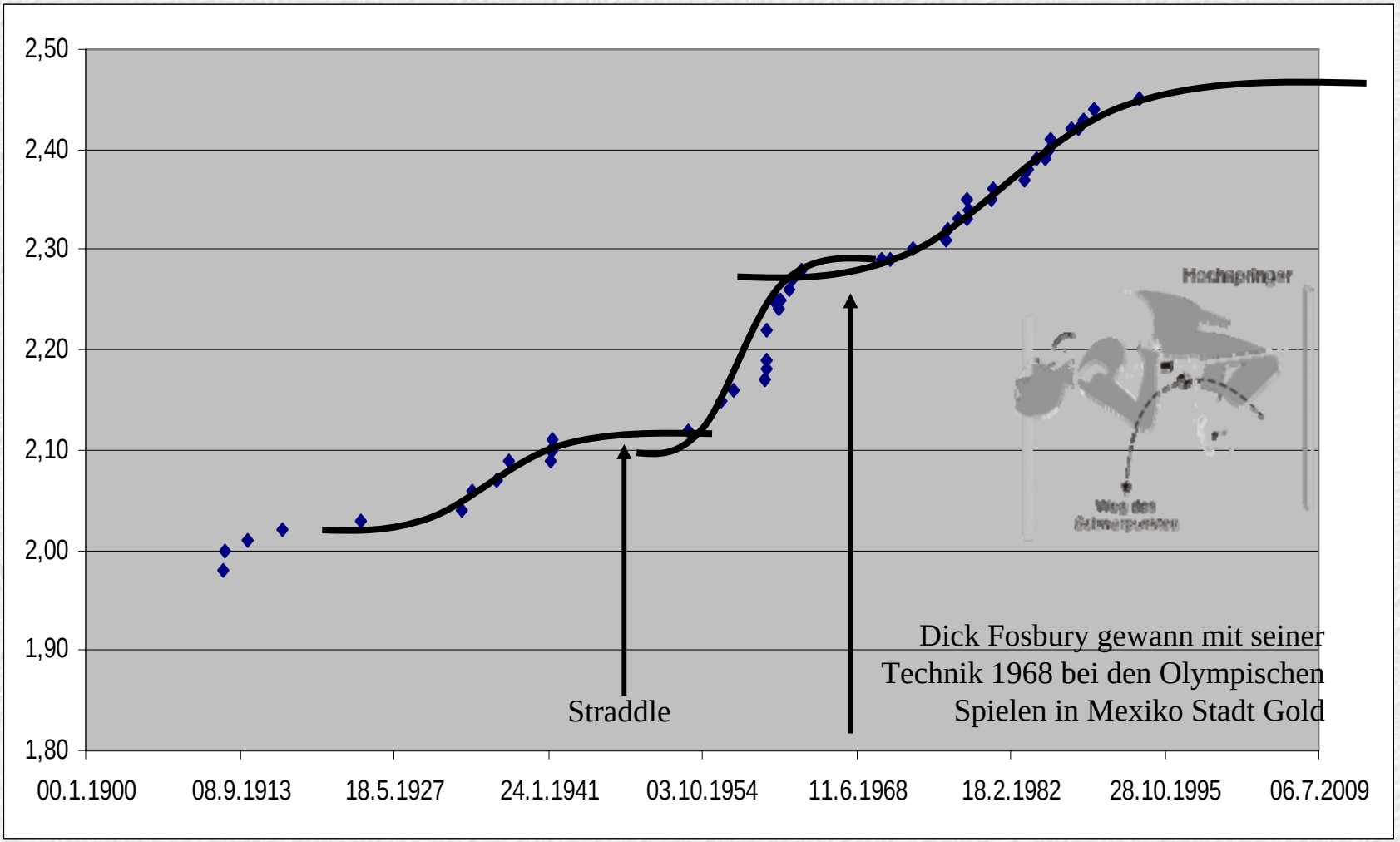
- Technical (Sub-system): optimise processes, products and systems
- Organisational (system): Service instead of products, logistics, distribution; concern service aspect

SUFFICIENCY

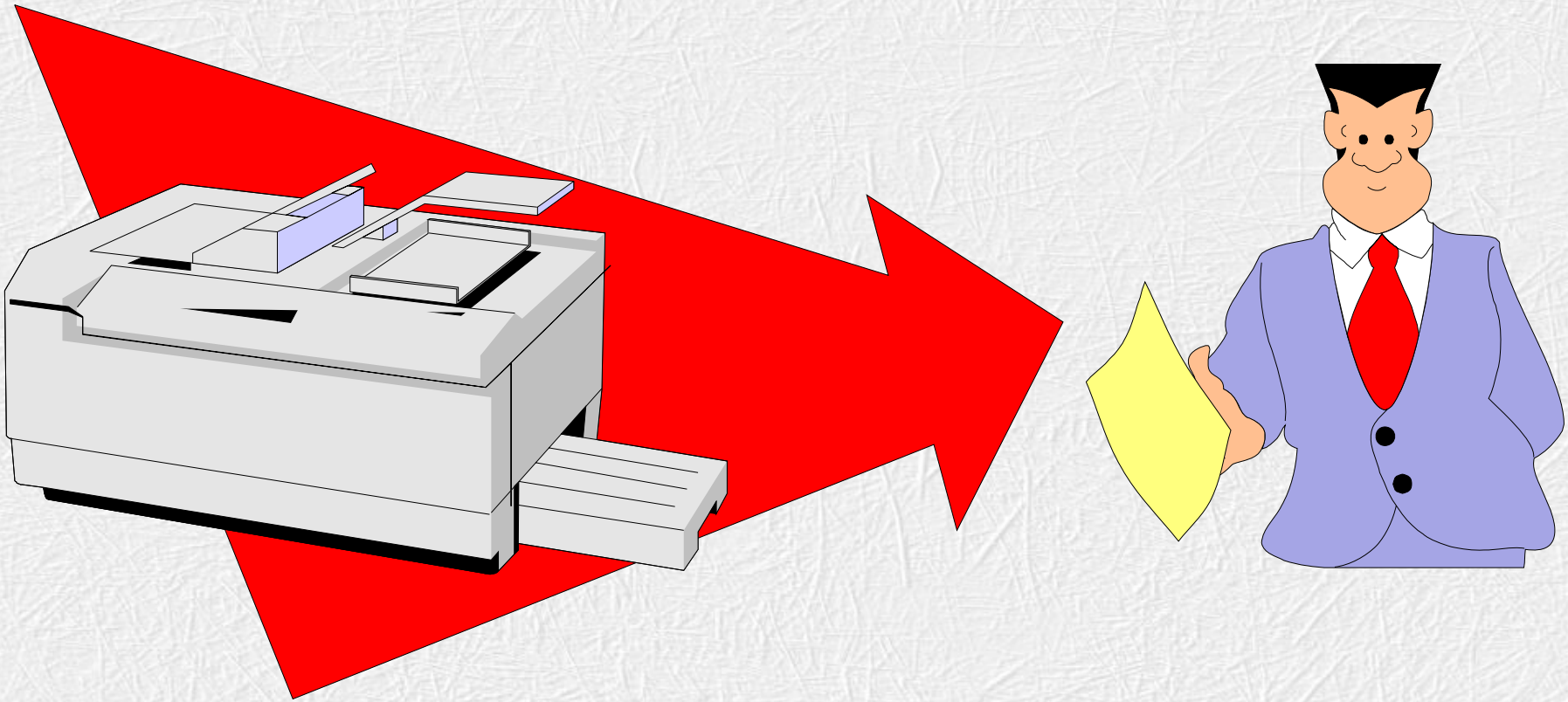
- Societal (meta-system): Revision of utilisation, what is welfare?

nach: Schmidt-Bleek; WIFI 270

Improvements are discontinuous



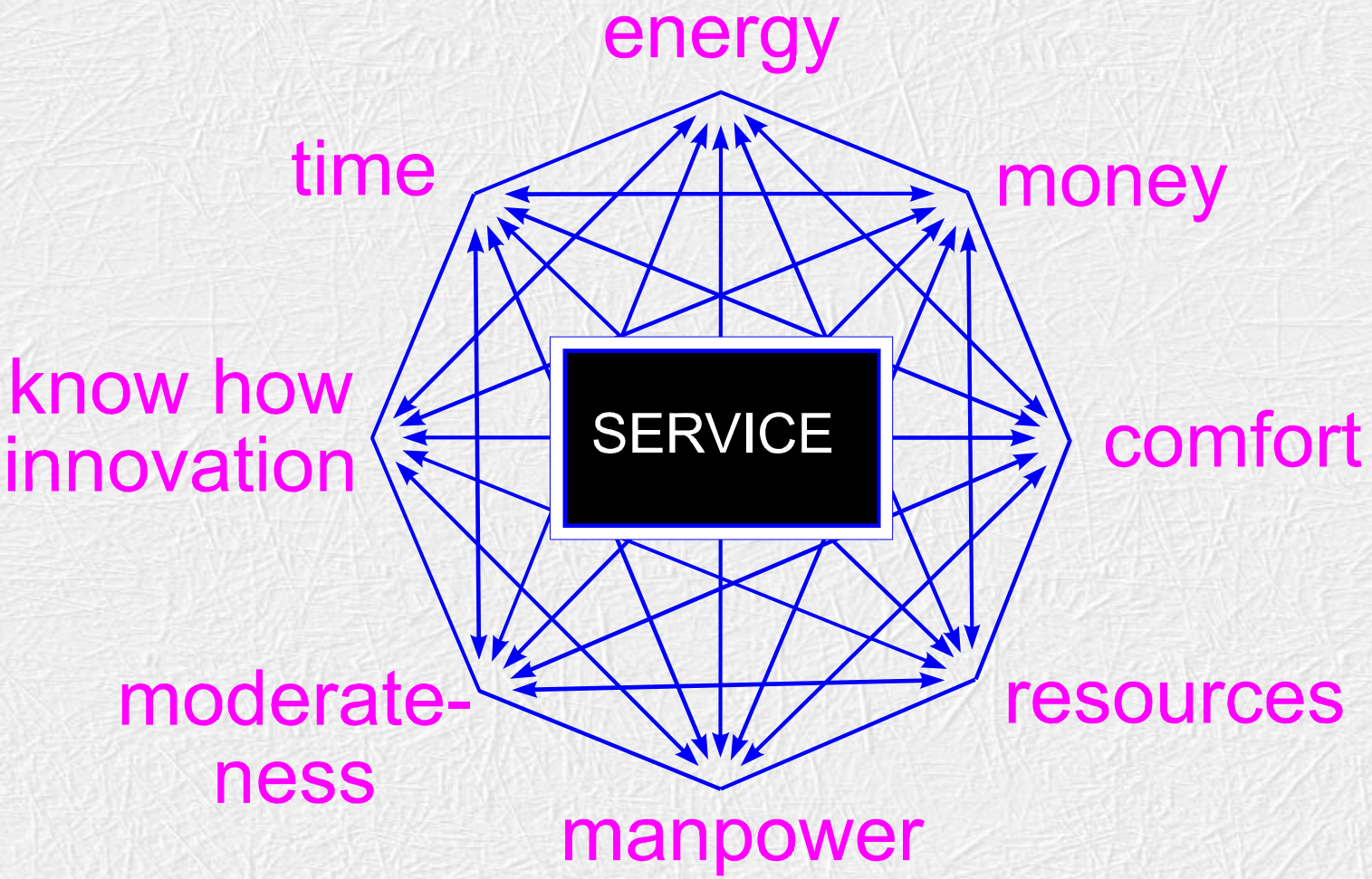
Change from products to services



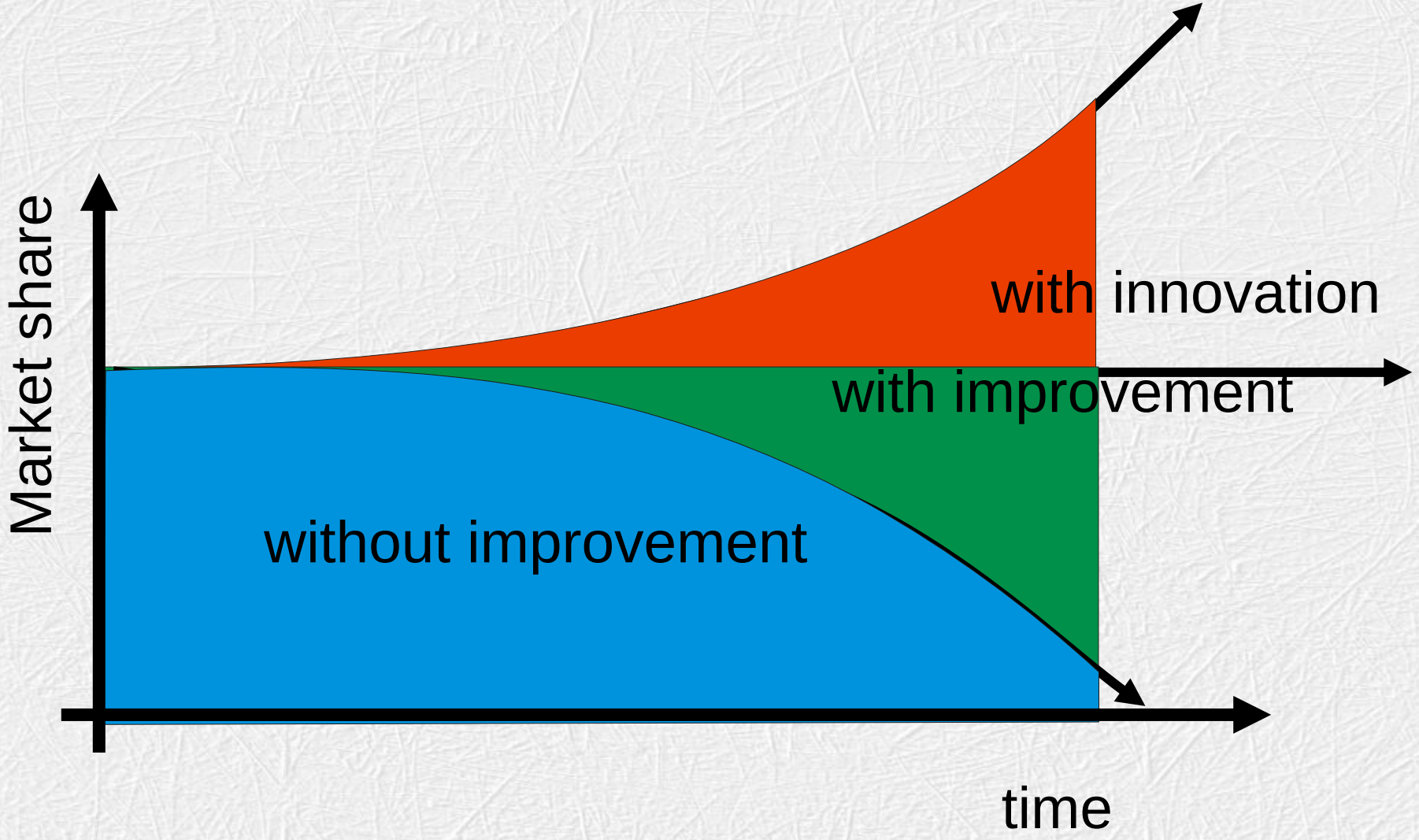
Beyond eco-efficiency and continuous improvement

- Progress towards zero wastes & emissions: rather than seeking to reduce waste, companies will come as close as possible to eliminating it altogether
- Whole systems thinking: addressing problems at the level of the entire system, rather than the parts.
- Looking beyond internal operational sustainability and making the world‘s problems the company‘s problems
- Moving beyond the focus on the environmental issues to a focus on Sustainable Development

How to substitute resources

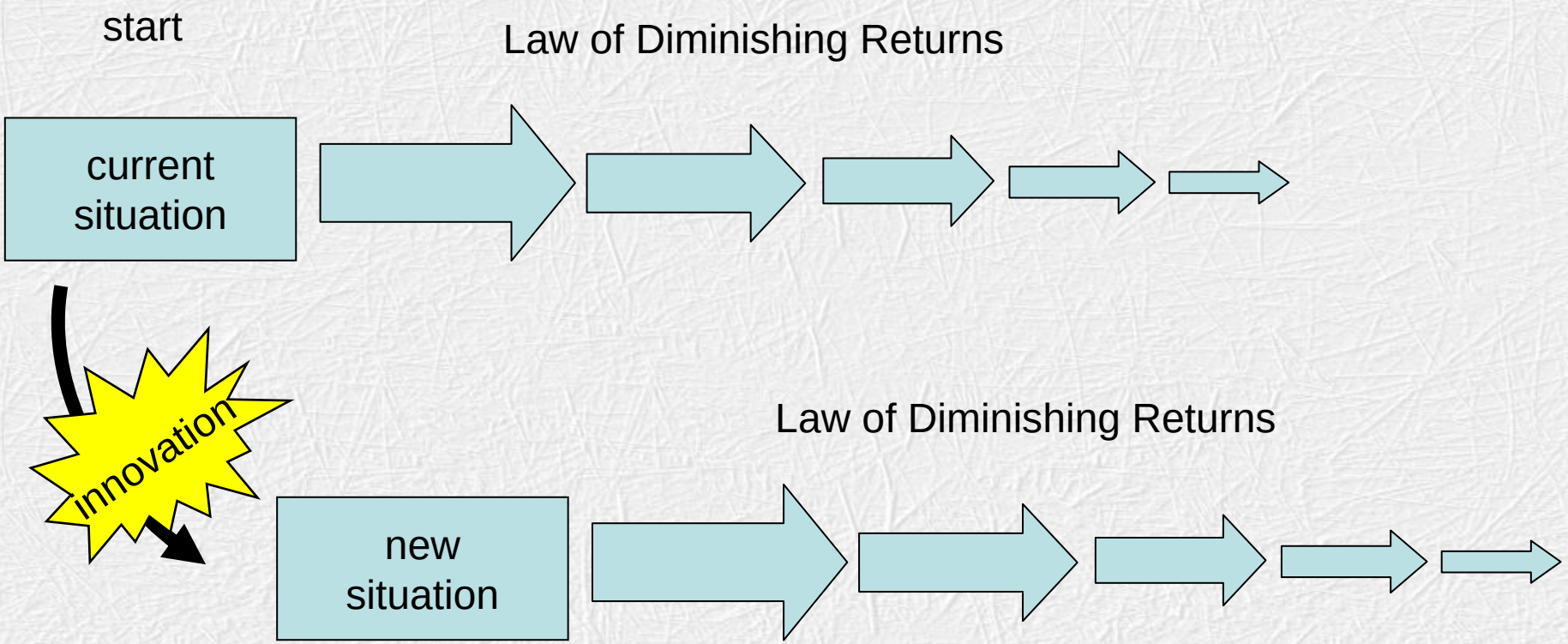


Innovation and Market Share



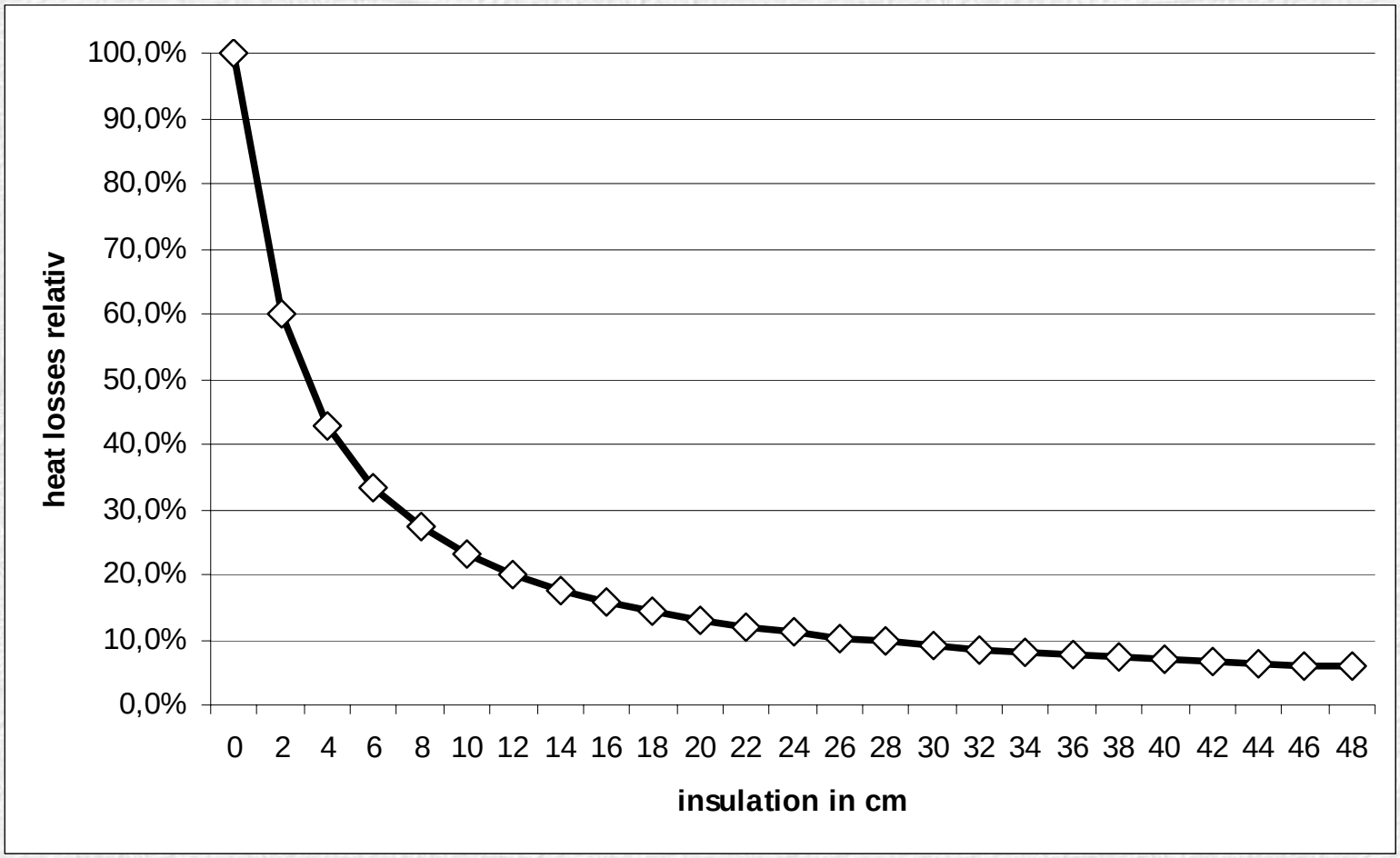
Technology – discontinuity at Fontana di Trevi in Rome

Continuous improvement

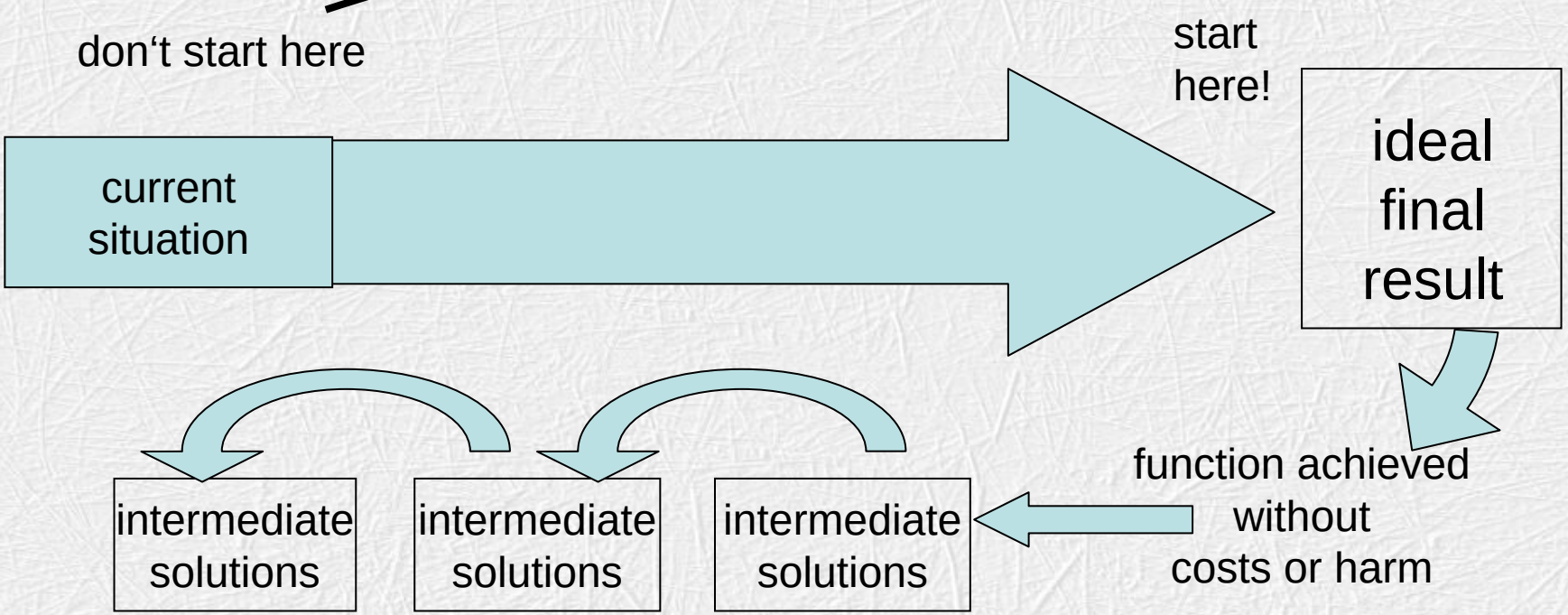


Source: D. Mann, Hands on Systematic Innovation, CREAX Press 2002

Diminishing returns of 2cm thermal insulation on a brick wall



ZEE: Starting innovation with the ideal final product



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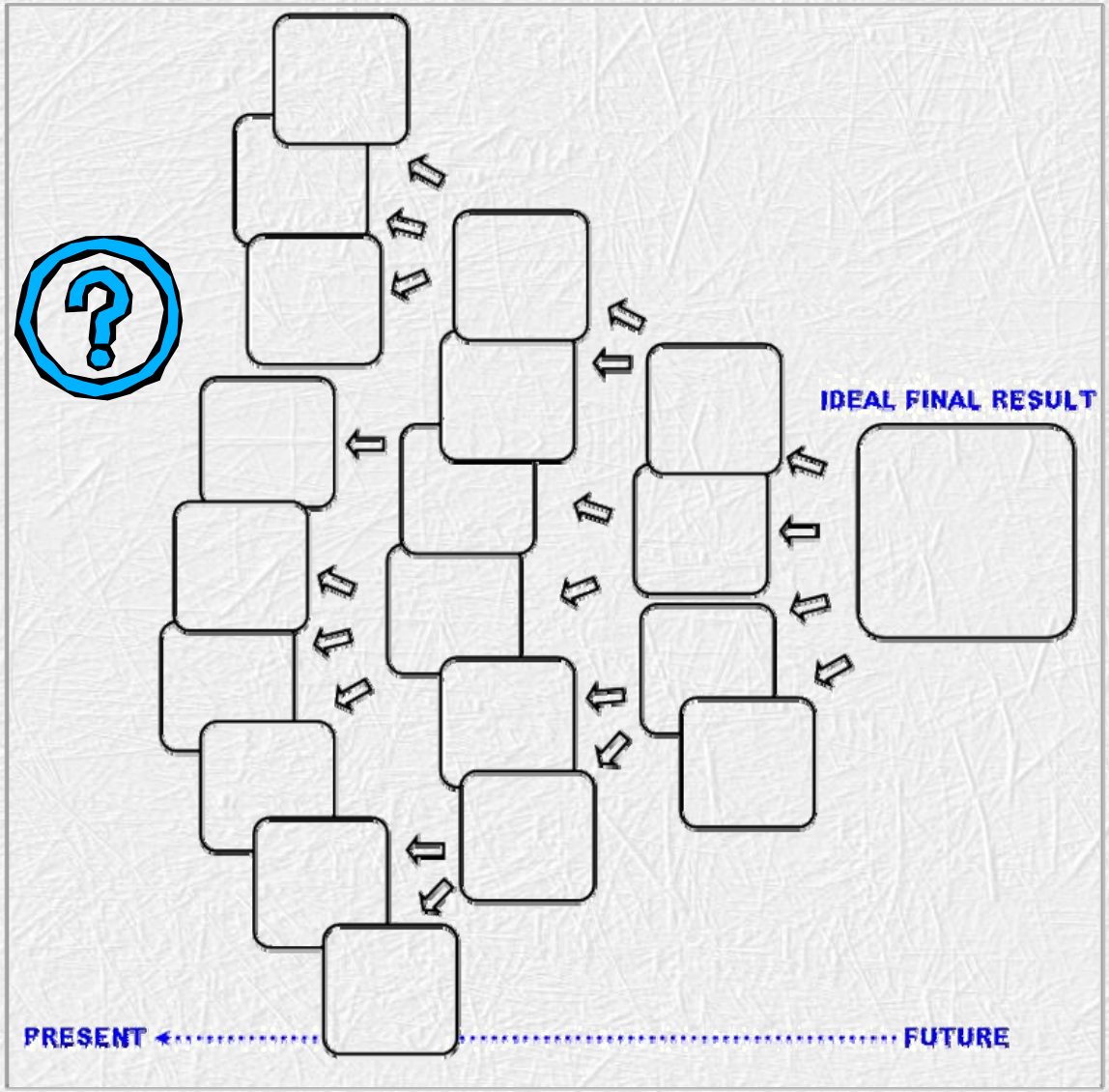
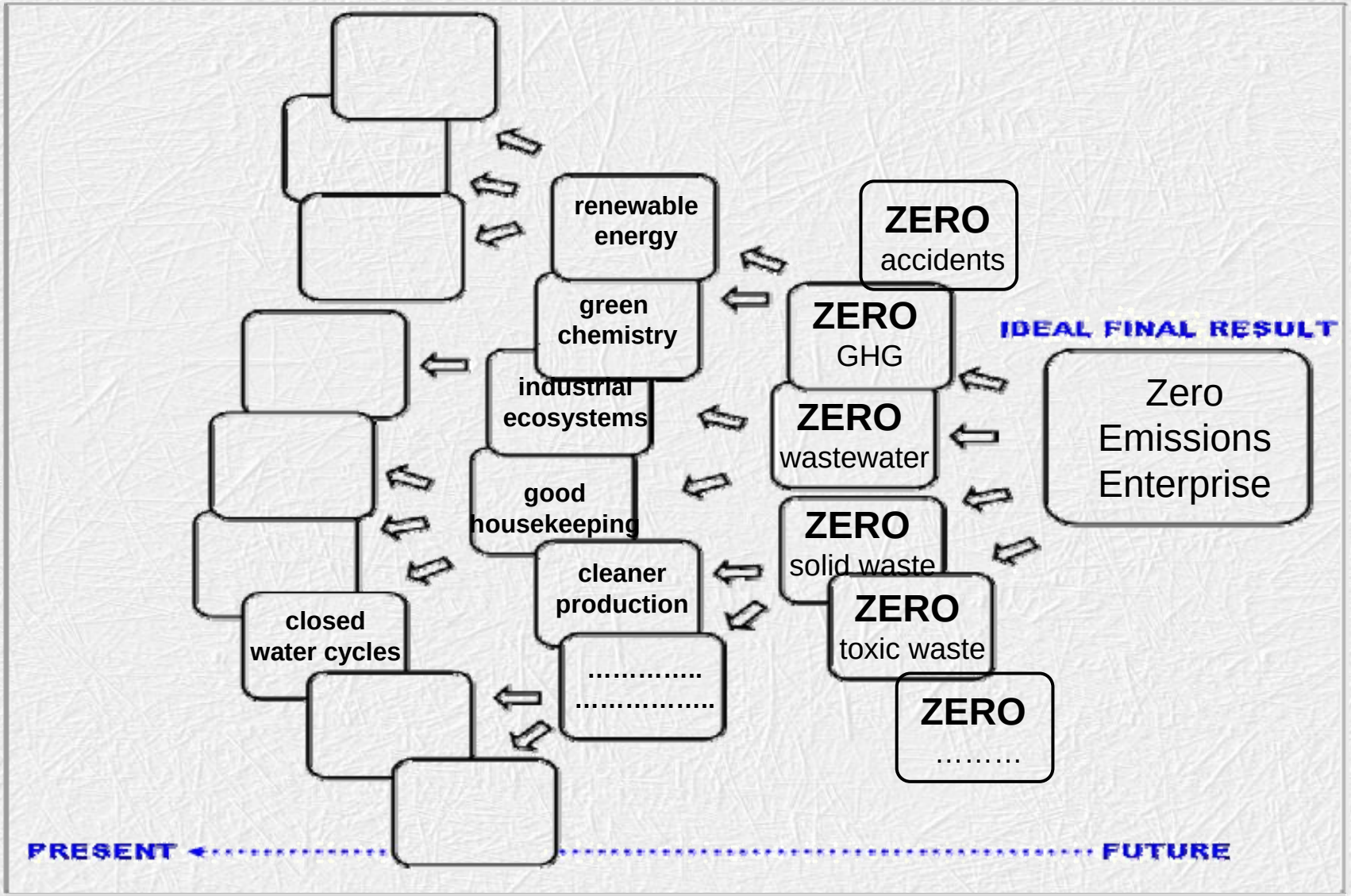


Back casting will often bring up several lines of enquiry.

A map of back-casted statements is likely to look like the expanding fan.

Each line of enquiry will create multiple options as we work towards ideas for today's solutions.


renewable energy
green chemistry
industrial ecosystems
good housekeeping
cleaner production
.....
.....
closed water cycles
ZERO accidents
ZERO GHG
ZERO wastewater
ZERO solid waste
ZERO toxic waste
ZERO .....
IDEAL FINAL RESULT
Zero Emissions Enterprise
PRESENT
FUTURE

The ideal detergent

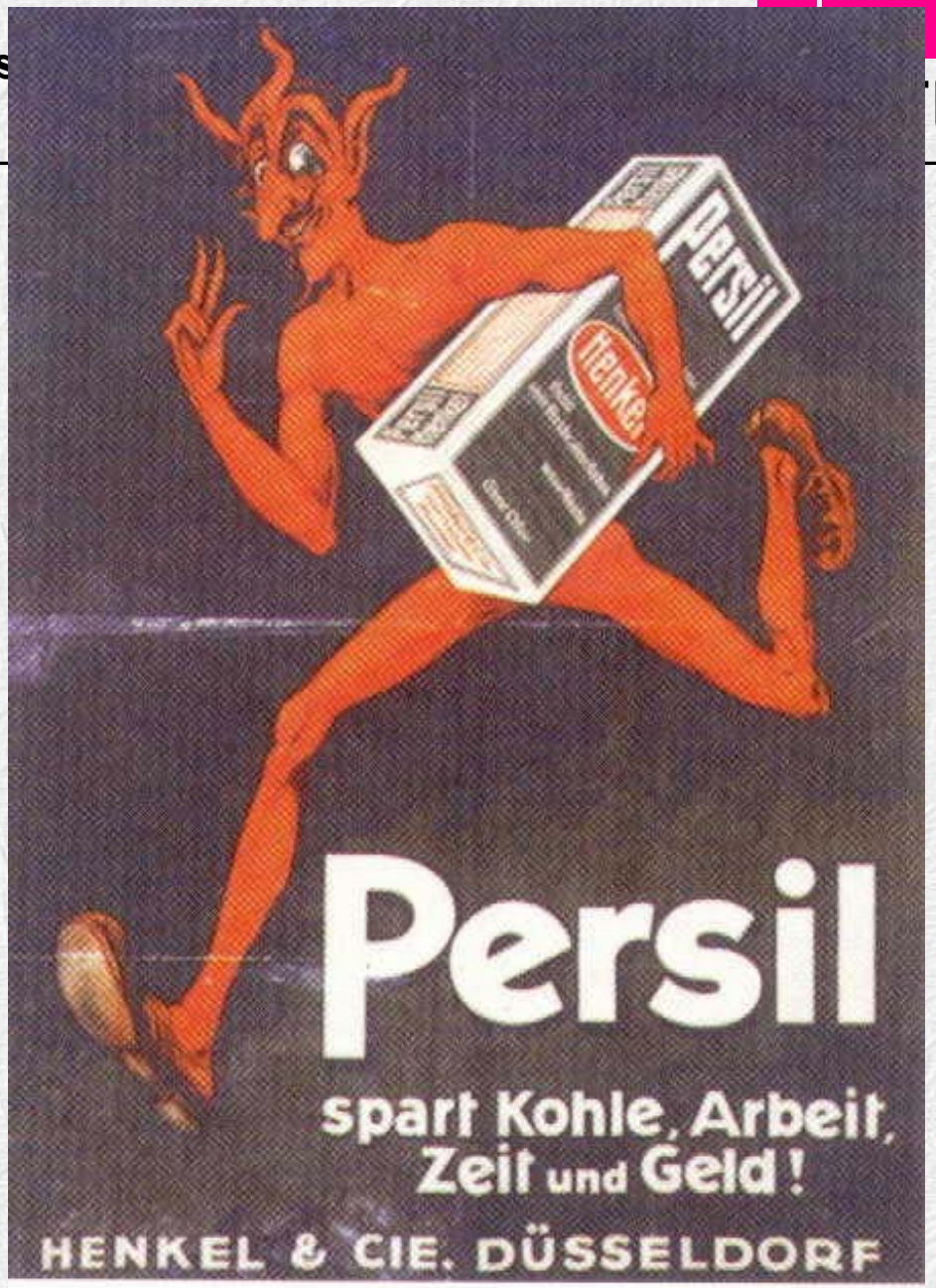
PERSIL
helps to save:

- coal
- workload
- time

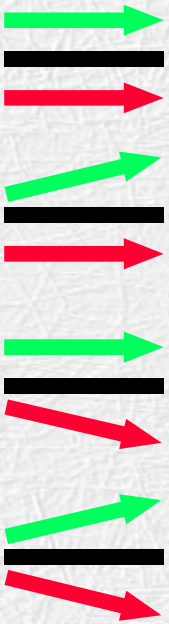
and

- money!

advertisement 1920



Technical Evolution strives towards Ideality



Experience has shown that:

- "Technical evolution is developing towards ideality."

Vision: "Ideal Final Result"

- Delivers all of the benefits without any unwanted side-effects and extra costs.
- Doesn't require any space, has no weight, requires no extra work or maintenance.
- Fulfills the functions without being present.

Characteristics of an "Ideal Final Result" in reality:

- Eliminates disadvantages and keeps advantages
- Makes the system easier
- Uses available resources
- Transition to a higher system level

$$\text{ideality} = \frac{\text{benefits}}{\text{costs and harm}}$$

Maximise benefits
Minimise cost and harm

The ideal washing powder

The ideal washing powder

- high washing power ➔ lasts for ever
- uses available resources ➔ produces detergents out of available material (soap from fat)
- no pollution to water ➔ stays in machine or functions without water
- no need for energy ➔ functions in cold water
- no need for rinsing ➔ does not stick to surface
- no allergies, non toxic, baby-proof, ... ➔ containing no chemicals,…
- easy handling/dosing ➔ self-regulating
- easy to carry home ➔ no weight

Re-Usable Washing Ball

150 washes
0.05 Euro per wash

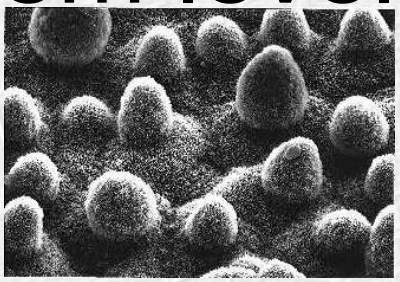
SANYO has now succeeded in implementing its Electrolyzed Water technology cultivated in SANYO's Water purifying bacteria-removing device into the Fully-Automatic "Wash with Ultrasonic Waves and Electrolysis" washing machine. By combining Electrolyzed Water's dirt dissolving and bacteria-removing properties with the cleansing power of Ultrasonic Wave technology SANYO has brought to realization the World's first "Zero-Detergent course" washing machine.

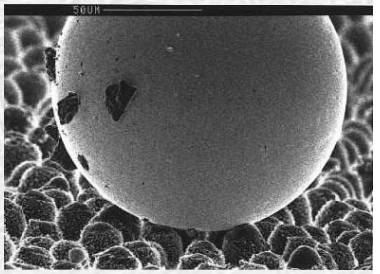
SANYO Introduces the Worlds First Zero-Detergent Electrolyzed Water Cleaning Powered Washing Machine

Allows the option of "Detergent Course" or "Non-Detergent Course" according to the extent and type of dirt

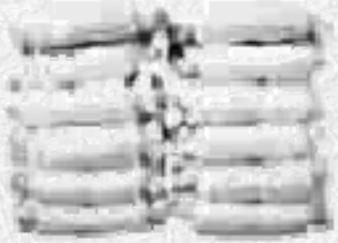
going to the system level:

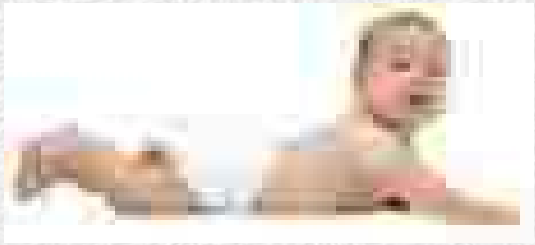
- self-cleaning fabric
  - self cleaning shoes ?!?!
- disposable tissues
  - disposable nappies
  - paper tissues
  - paper towels





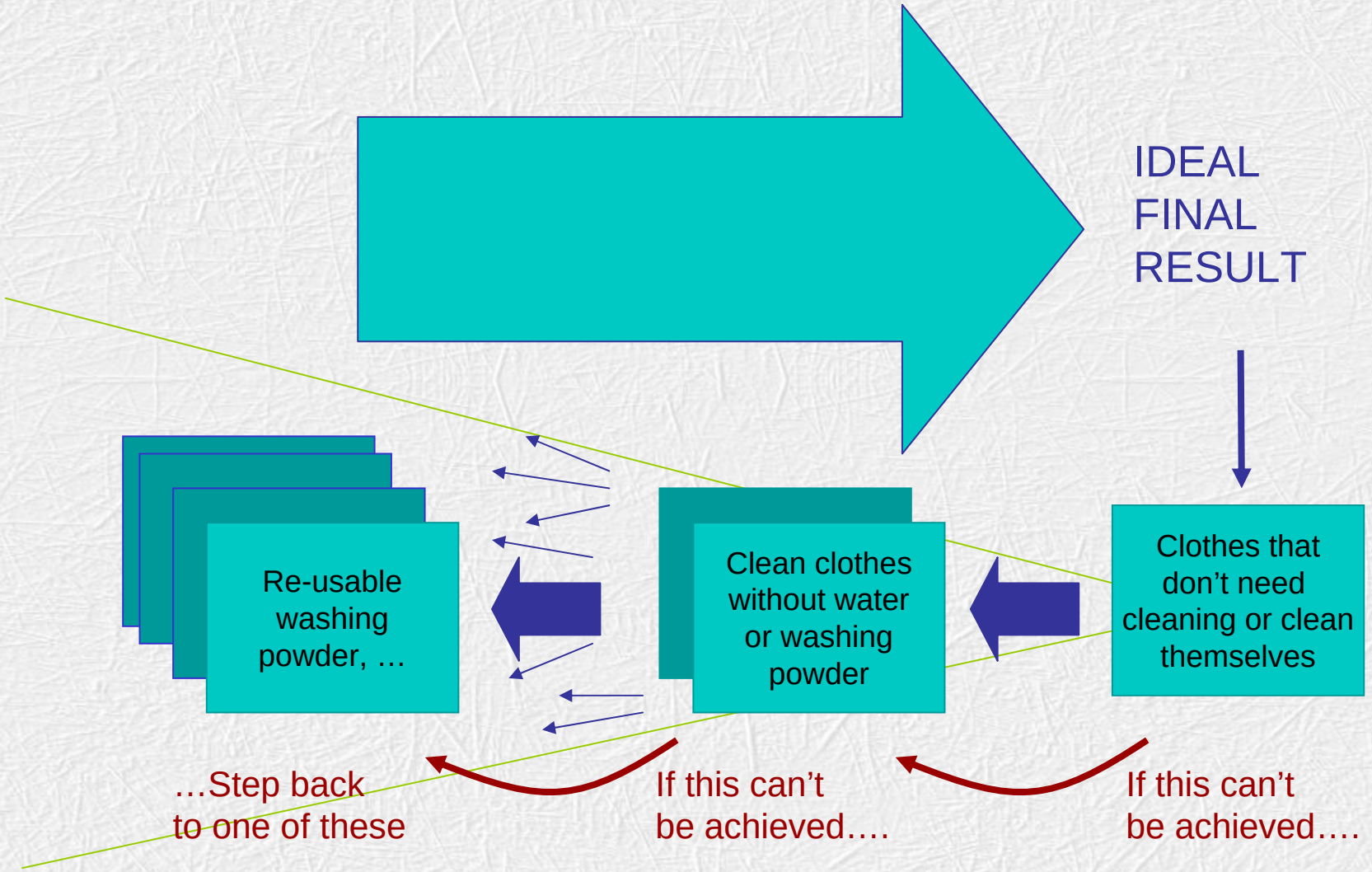
Lotus leaf - micro-structure
Lotus leaf - water droplet repulsion





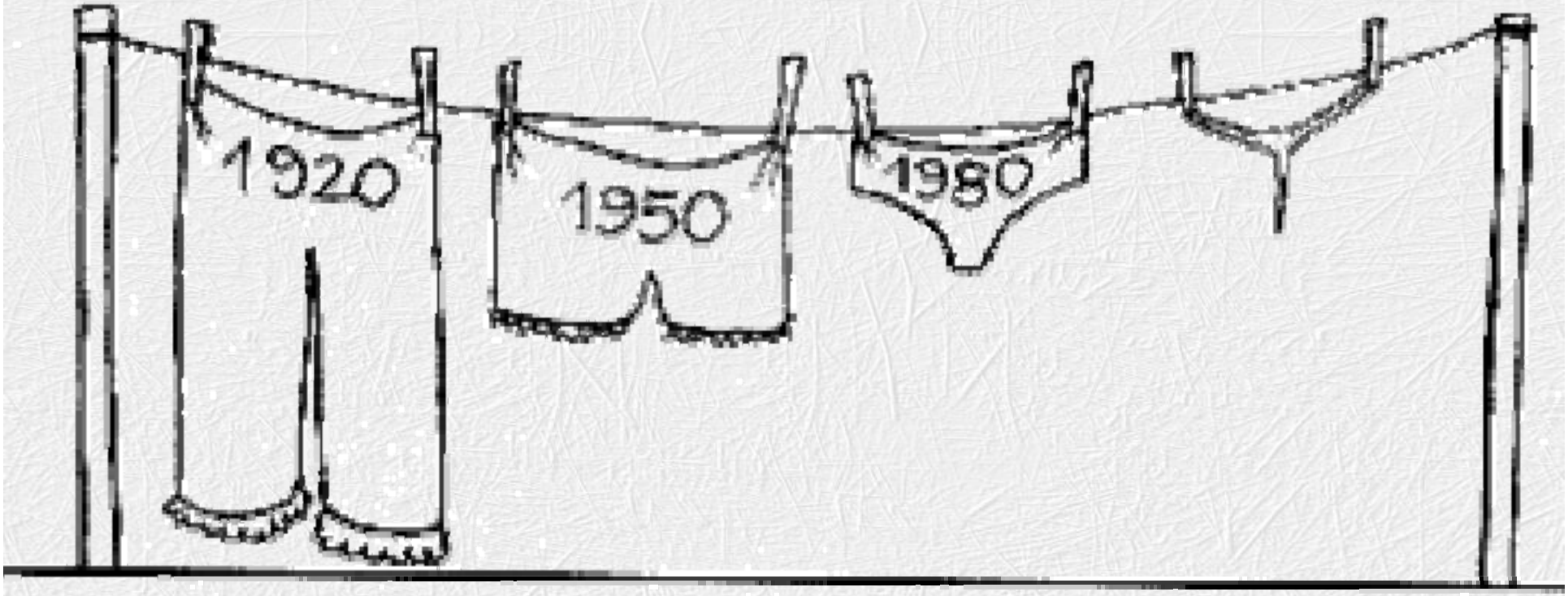
How about disposable cloths?

- paper shirts
- disposable underwear ??
- throw-away socks ??


IDEAL
FINAL
RESULT
Clothes that don't need cleaning or clean themselves
Clean clothes without water or washing powder
Re-usable washing powder, …
…Step back to one of these
If this can't be achieved….
If this can't be achieved….

Dematerialization

- just an other way to avoid water pollution from washing machines



The ZETS approach

- Define the ideality:
  - The ideal production process delivers all of the benefits without any side effects or extra costs:
    - it has no wastes and emissions
    - it has no need for additional equipment
    - requires no work or maintenance
  - makes the system easier
  - uses available resources
  - initiates the transition to a higher system level
- Locate contradictions and barriers
- Find the solution on the systems level

Operationalizing Sustainable Development on company‘s level

The rules relate to:

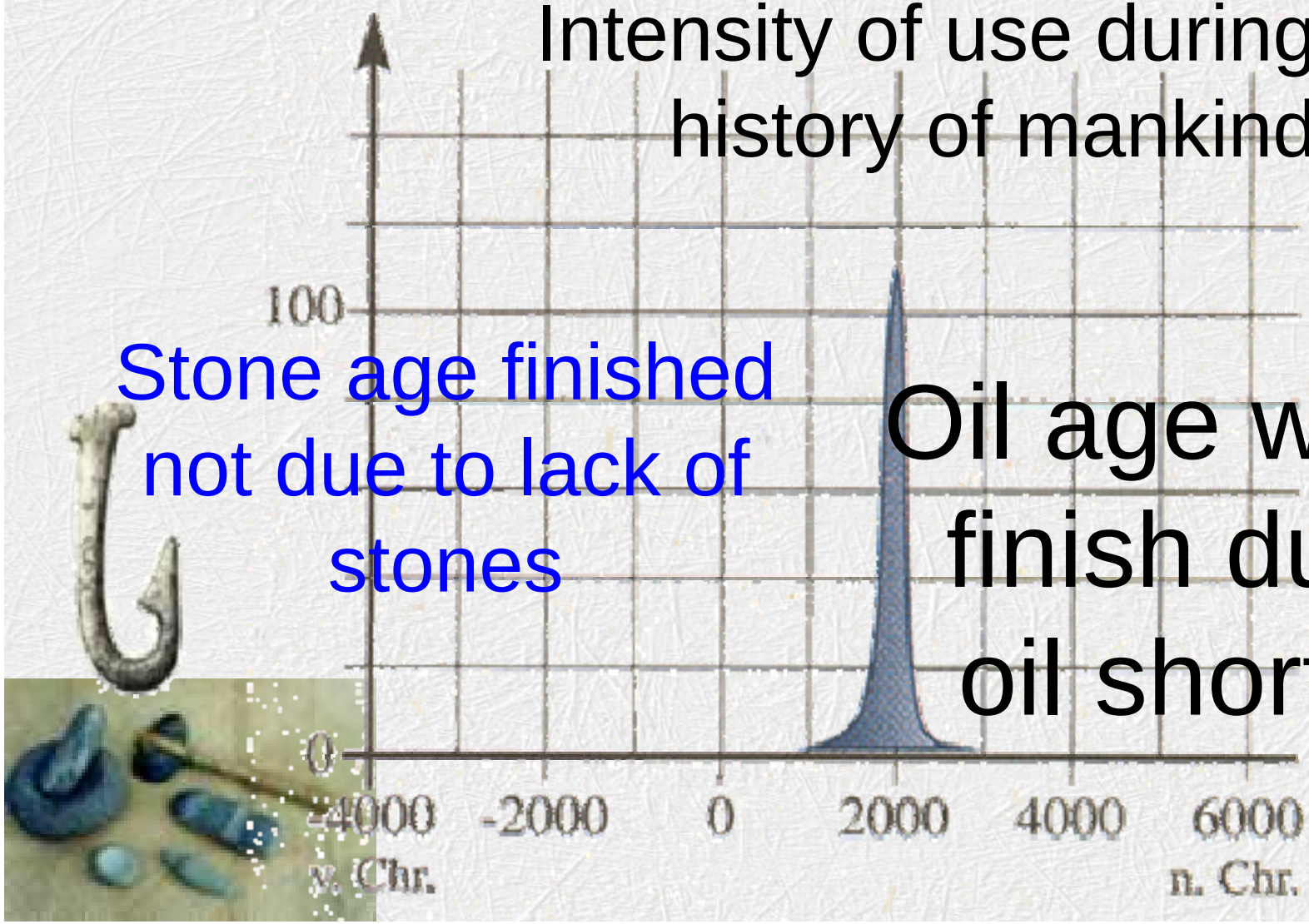
- Resources
- Technologies
- Products and Services
- Ecosystem Integration of wastes and emissions
- Integration into the Socio-Economic System
- Transport and Mobility

Technologies in a Sustainable Company

- Sustainable technologies aim at utilising resources at 100%
- Workplaces are save (regarding accidents and the exposure to chemicals, noise…) in a way that the quality of life of the worker is not influenced in a negative way
- workplaces take care of social equity in a country and between countries

Fossil Energy

Intensity of use during history of mankind



Stone age finished not due to lack of stones

Oil age won‘t finish due to oil shortage

Quelle: Ökoenergie 49, 2002

Wrong technologies are always inefficient

Viagra protects Rhinos !

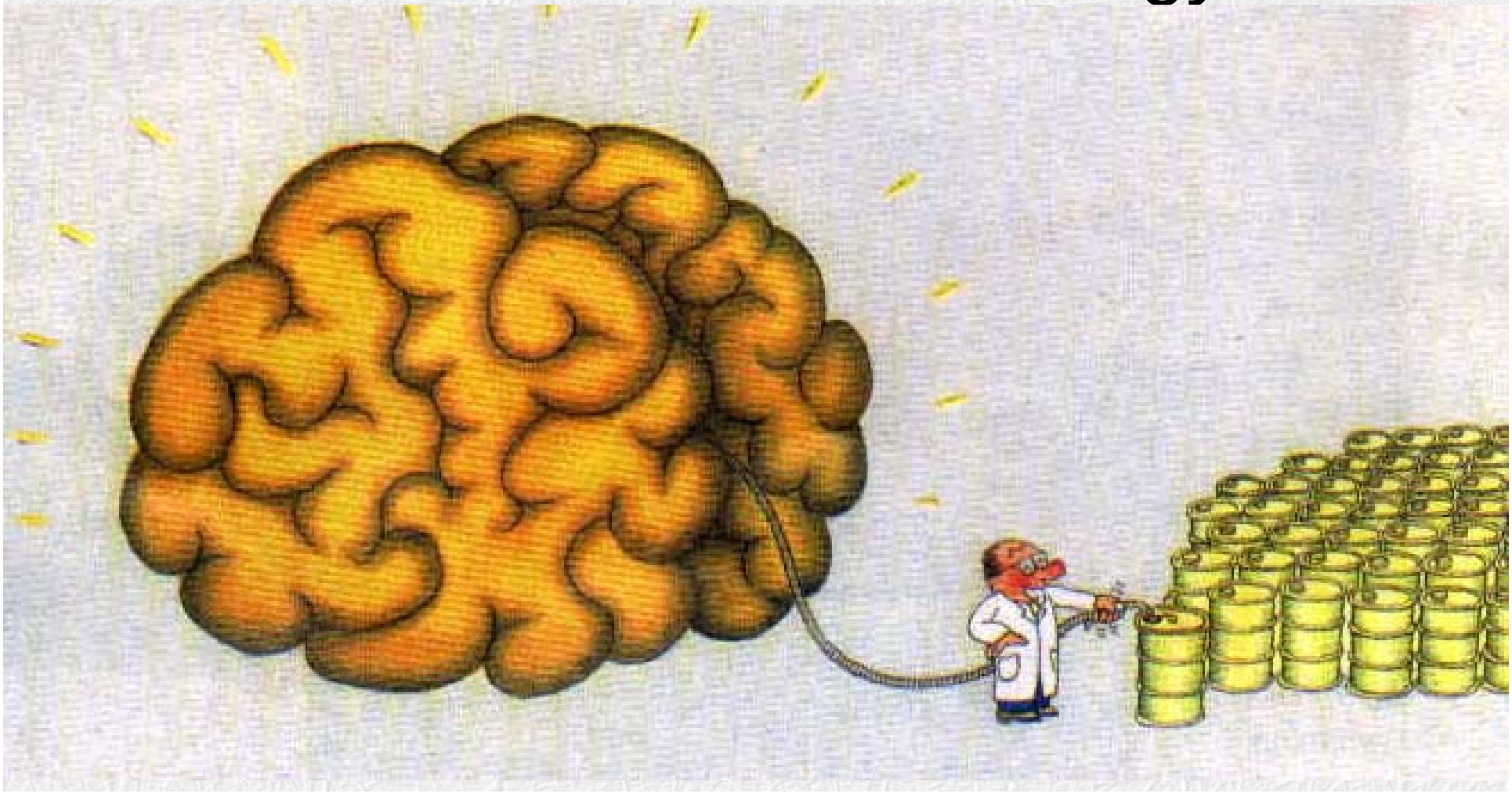
The World of Yesterday

LANDFILL

CIRCA 1999

A hole in the ground where valuable resources were needlessly buried. This practice was ended in the early 2000's with the introduction of ZERO WASTE.

Brain power is the only form of eternal renewable energy



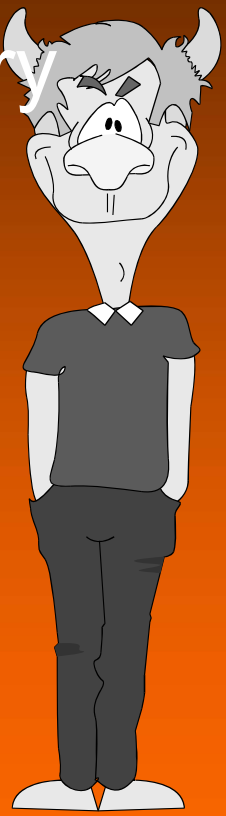
The gross national product in heaven

- Everything is available in abundance - therefore prices are low
- the main occupation is singing hallelujah - without being paid
- *The GNP is therefore very low*

The gross national product in hell

- Everything is scarce – luxury is practically unattainable.

- The heating is not properly tuned and – because it is ineffective – uses too much energy.



- *The GNP is very high.*

Limits to Sustainable Development

- The size of earth
- The solar constant
- Our creativity


Parting thought:
We are doing so much to prepare our children for their future
But are we doing enough to prepare the future for our children?
Larry Chalfan