Preserving Value by Managing Stocks in the Circular Industrial Economy (final)

SINTEF Circular Economy Conference Mo I Rana, 10 May 17

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CIE - opportunities for industry - PE

In-house and client options for
The era of R (reman):

- **follow products into use**:
  - repair technologies,
  - service-life extension tech,
  - O&M solutions,
  - upgrading solutions,
- buy/take/bringback markets

The era of D (de-linking):

- **recycle atoms, molecules**:
  - de-alloy metals,
  - de-vulcanise rubber,
  - de-polymerise plastics,
  - deconstruct (public works)

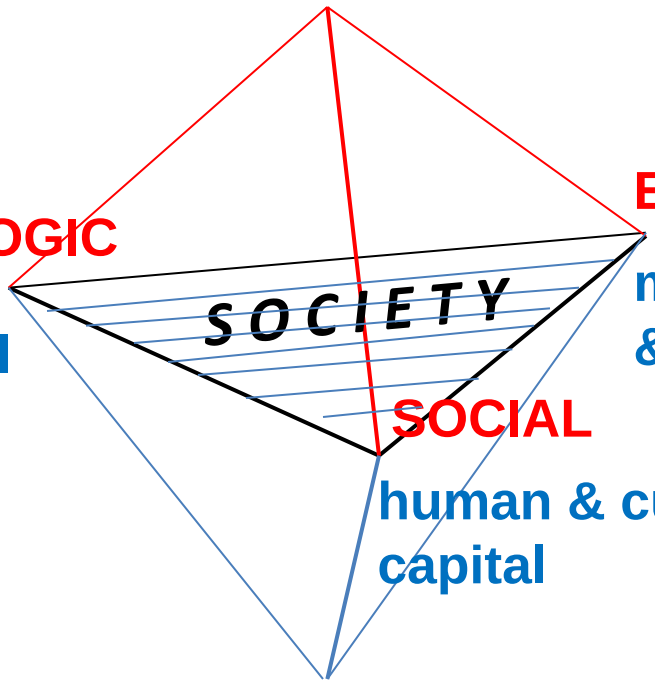
- buying and selling 'service'
  - performance,
  - molecules as service,
  - goods as service,
  - function guarantees,
  - life-long guarantees,
  - standardised parts,
  - multifunctional goods,
  - supply guarantees,
  - systems solutions,
  - sufficiency solutions.

The art of “making money from less”

- Preface:
  Sustainability, Christmas, the Linear Industrial Economy
- Circular Economy.
- Performance Economy.
- Sufficiency.
- Component standardisation,
- Systems design & thinking,

OBJECTIF: *HAPPINESS*

QUALITATIVE *WORLD*



OBJECTIF: *MANAGING CAPITALS*

PHYSICAL *WORLD*

SITUATING SOCIETY, SUSTAINABILITY AND A CIRCULAR INDUTRIAL ECONOMY

Example: ***Celebrating Christmas***

and building a circular economy:

- preventing waste *(all waste is man-made)*
- maintaining value
- managing resource stocks

- *Let us look at Christmas trees*

Waste management solution: incineration.

- economic value lost,
- resource stock lost,
- small labour input,
- some waste produced (ashes and heat)

If burnt in a co-gen heat and power plant, some energy may be recovered.

Value preservation solution: reuse of goods and materials

Christmas tree dismantled for ‘reuse’

- highest value preservation,
- labour intensive,
- zero waste, high resource security.

whose decision? whose investment?
whose liability? whose risk? whose profit?

Source: Wehrli, Ursus. Die Kunst aufzuräumen.

Sharing economy

rent-a-tree
serial
economy

Photo Rent-a-Christmas-tree San Francisco

Sharing society

sharing the

. event,

. trees,

. candles,

. people,

. emotions,

. music

Photo cvjm hochdorf.de

Who takes the decision?

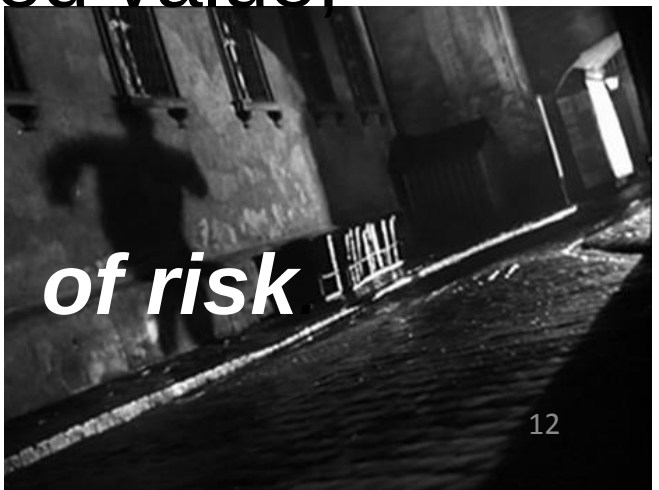
L.I.E.
the Linear Industrial Economy

e.g. mining, manufacturing, selling

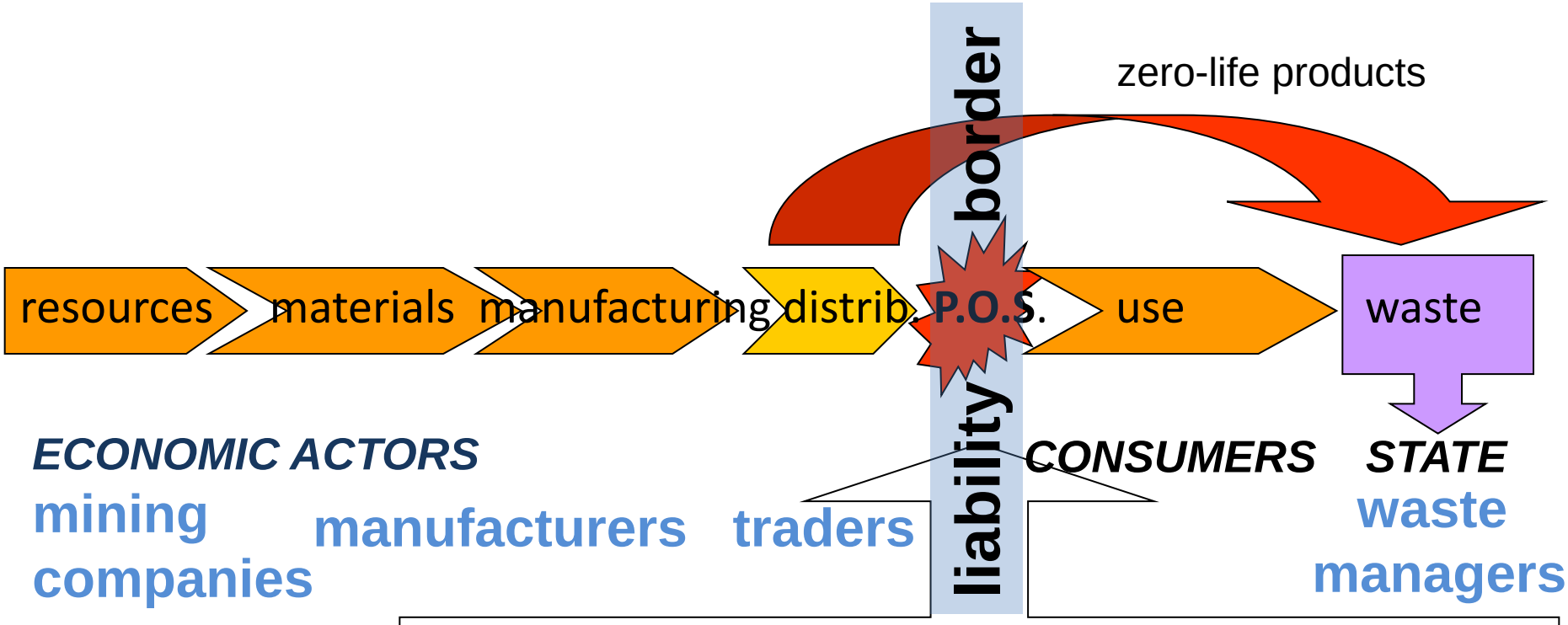
The Linear Industrial Economy is

- **focused on manufacturing,**
- efficient to overcome scarcities,
- **a continuous flow** / throughput process,
- a series of value added steps,
- driven by **economy of scale**, emotions, fashion, progress, depreciated value,
- measured as flow (GDP),

- *neglecting the* ***diseconomy*** *of risk*



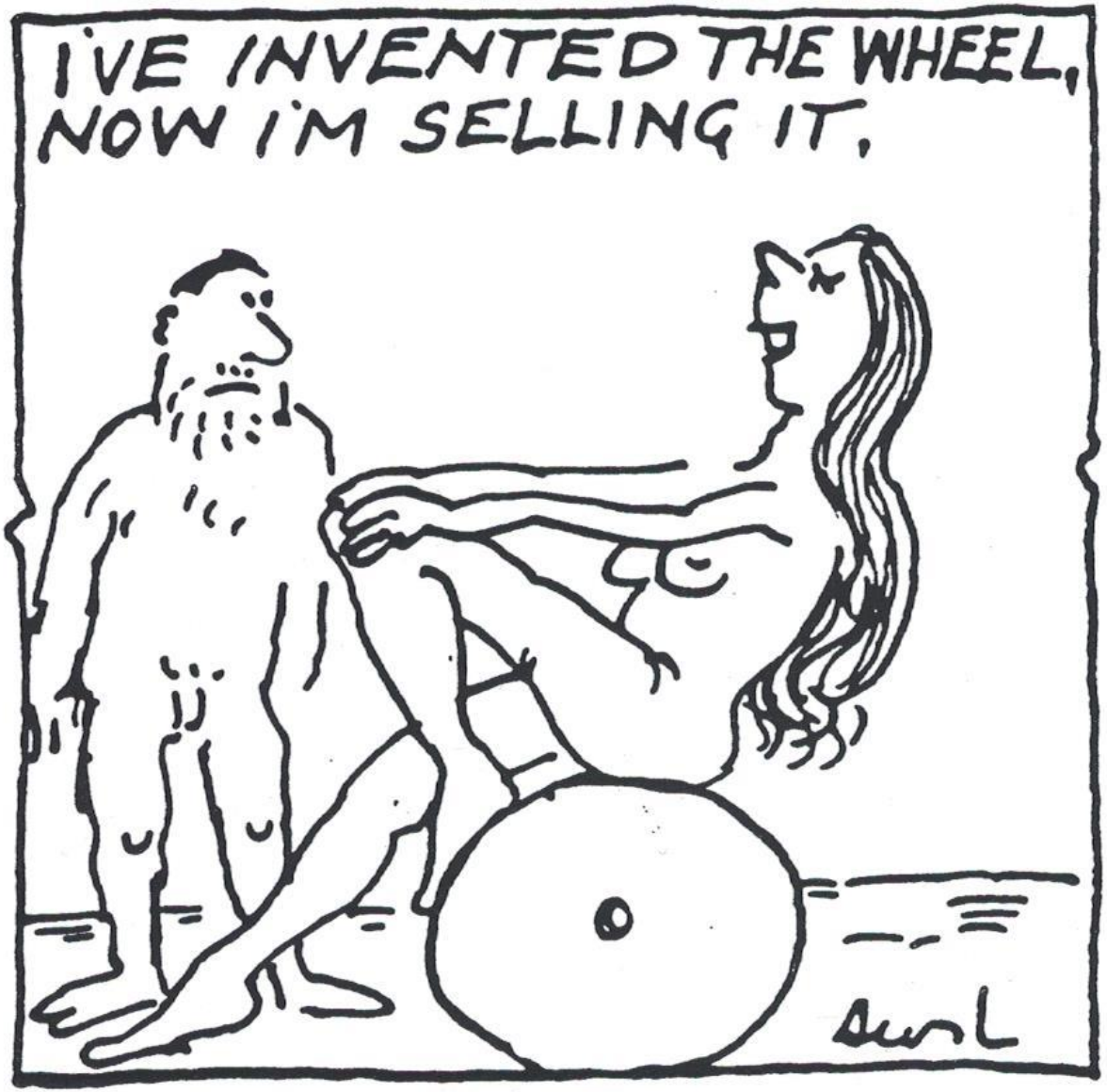
The **Linear Industrial Economy** (a river): *growth means more throughput*



Property and liability are transferred to the CONSUMER (risk) *and the State (waste).*

***The manufacturer's liability for industrial goods is limited to manufacturing quality*.**

The visible part of the Point of Sale



The other PoS parts: global supply chains global branding

Logistics- centres, shopping malls, exhibition halls

Container ports, ships, trains pipelines

packaging publicity

Warehouse on wheels trucks at the Brenner

Delivery drones **?**

The quality of new goods is guaranteed by the manufacturing quality

Volkswagen publicity 2016

Depreciated value – a pillar of the linear economy

Museum guard: *That is a 500 year old statue you have broken!*
Insurance agent: ***Thank God. I feared it was a new one***.

The hidden risk of the linear industrial economy

The art of “making money from less”

- Preface
- Circular Economy: **reuse** (eBay, long-life tools and goods, bring-back), **service-life extension** (repair, remanufacture, upgrade, **recycle** material) operation & maintenance, **social innovations** (repair cafés, caring).
  “substituting manpower for energy and materials”
- Performance Economy.
- Sufficiency.
- Component standardisation.
- Systems design & thinking.

The Circular Industrial Economy

- is about **economics** but is counter-intuitive, (local is beautiful, the smaller the loops the more profitable and resource efficient),
- **is focused on use & utilisation,**
- enables to re-industrialize regions,
- **maintains values and manages stocks,**
- is an intelligent decentralisation,
- is measured in quality & quantity of stocks.

The C.I.E. compliments the L.I.E, which produces quantum leap innovation to upgrade & renew the stocks.

research & innovation

The Circular Economy is local and ecologic

Logistics- and
Shopping **Centers**

Co rts, ships, trains

little packaging,

little global distribution logistics

little publicity

Warehouse on wheels, trucks at the Brenner

Delivery drohnes ?

Societal benefits of the Circular Economy

in comparison to the present economy (12 countries) Sweden
macro-economic I/O *Study* *by Skanberg-Wijkman 2016.*

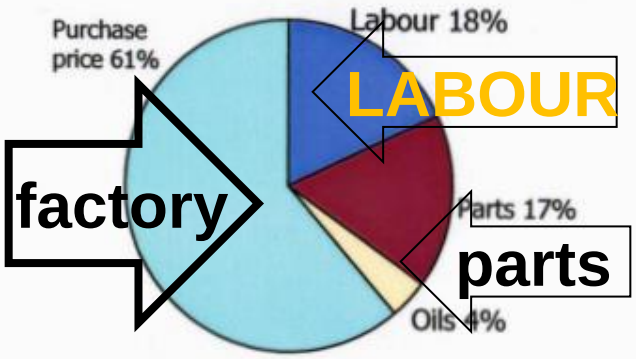
	circular scenario	energy efficiency	material efficiency	combined scenario
GHG	**— 50,1%**	**— 28%**	**— 5%**	**— 66%**
additional **jobs**	**+ 100’000**	**+ 200’000**	**+>300’000**	**+ 4% +>500’000**
trade balance	**+ 0.4%** of GDP	**+ 0.4%** of GDP	**+ 0,2%** of GDP	**+ 0,25%** of GDP

Source: http://www.clubofrome.org/

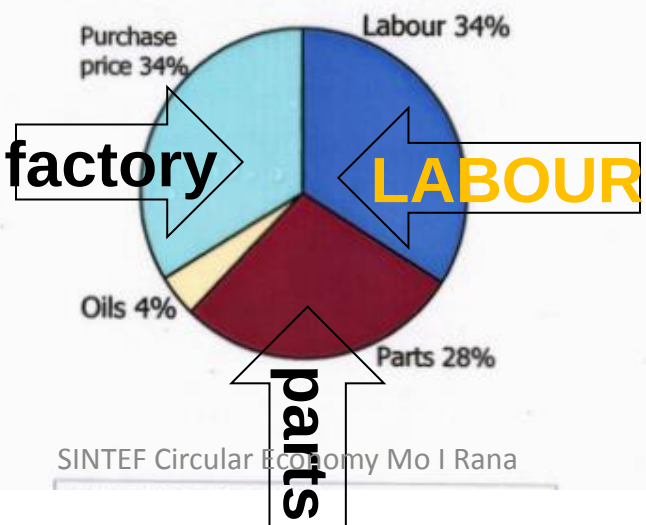
Societal benefits of the Circular Economy **micro-eco**: **product-life extension creates local jobs** and **prevents waste** **(substituting manpower for energy)**

Figure 3
Analysis of the running costs of a 30 year old automobile: Toyota Corona Mk II 1969

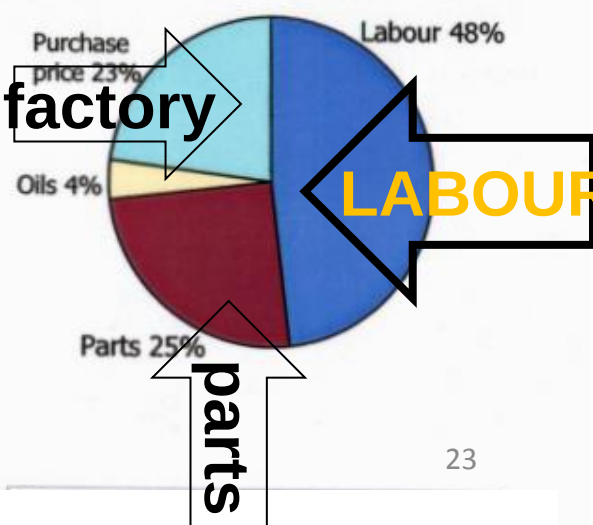
10 years



20 years



30 years



Source: Stahel, Walter 1982

The C.I.E. is **profitable** but unknown and under-researched

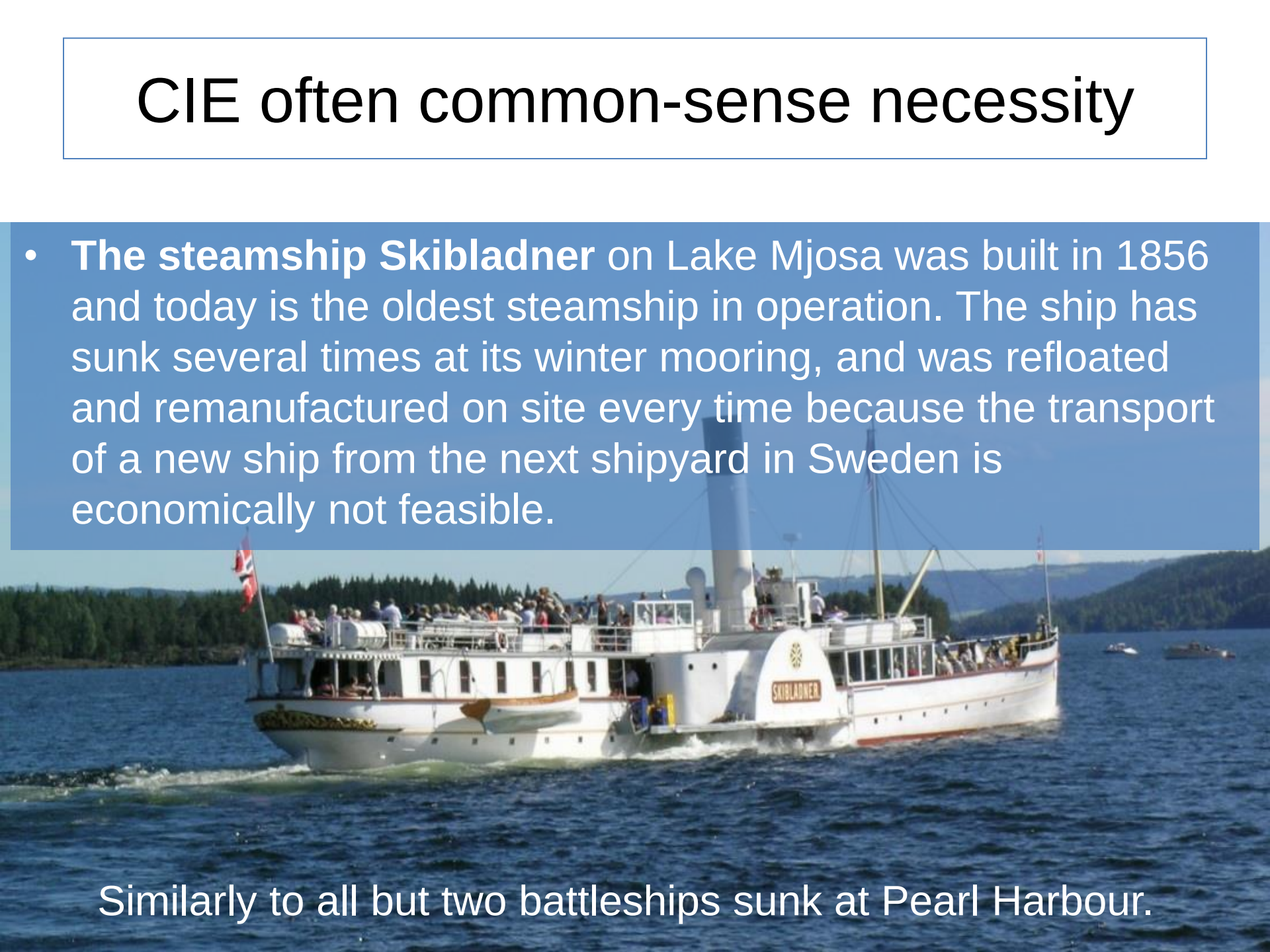
- The ROI of a re-manufacturing plant is **5** times the ROI of a manufacturing plant, for the same goods (diesel engines, Caterpillar and Renault).

Financial research needed

- Resource security:
  "The goods of today are the resources of tomorrow at yesterday's resource prices".

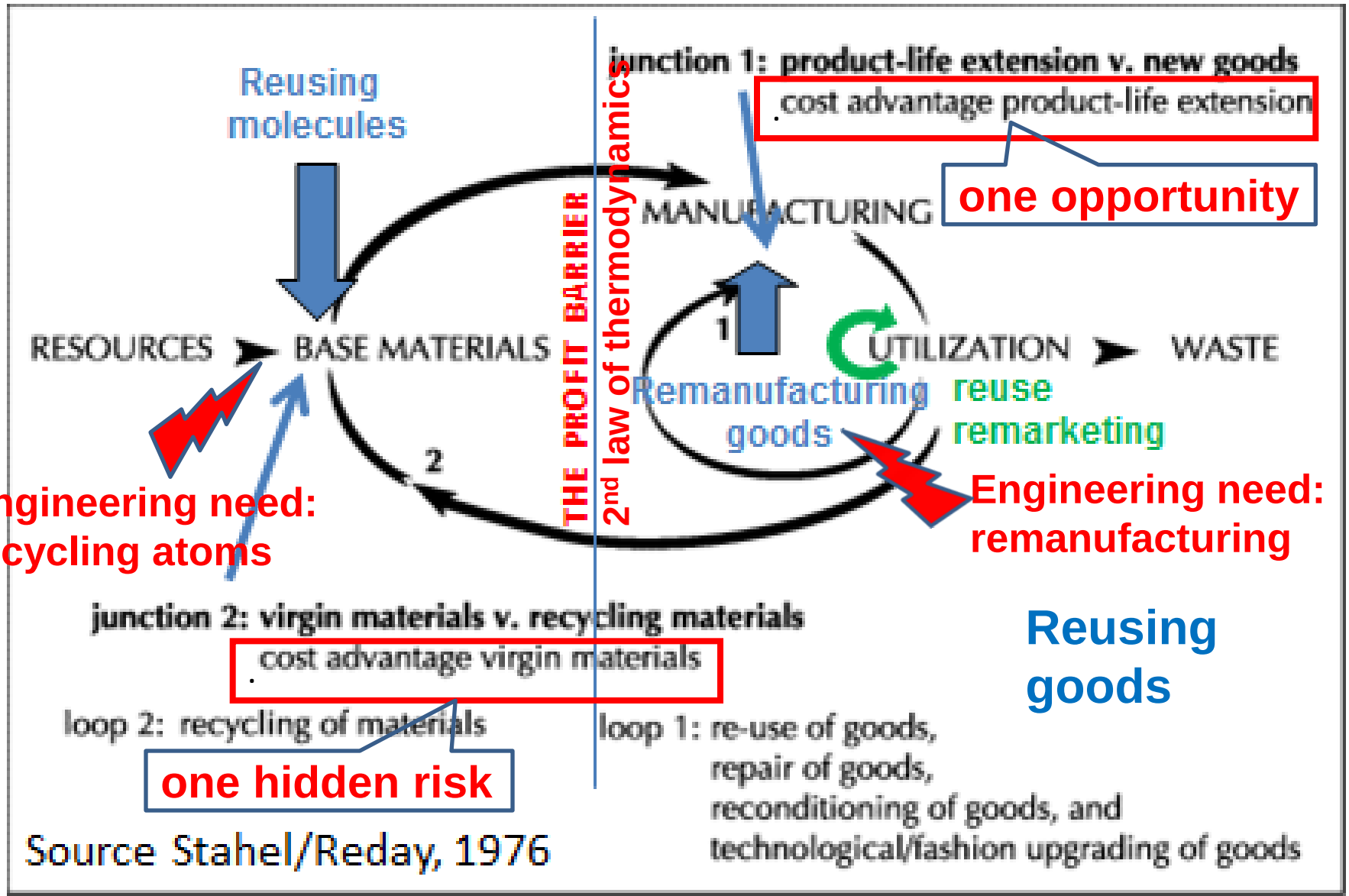
CIE often common-sense necessity

- **The steamship Skibladner** on Lake Mjosa was built in 1856 and today is the oldest steamship in operation. The ship has sunk several times at its winter mooring, and was refloated and remanufactured on site every time because the transport of a new ship from the next shipyard in Sweden is economically not feasible.



Similarly to all but two battleships sunk at Pearl Harbour.

The Circular Industrial Economy – is about **loops** to manage molecules and goods **over time**



The C.I.E. is about managing **manufactured stock** (physical capital) and its embodied resources (energy,material, water)
but also natural, human, cultural, financial capital.

Infrastructure, buildings, equipment, (durable) goods, catalytic goods (lub oils, solvents) through

- **Reuse and remarketing**
  e.g. 2nd hand markets, eBay, rent-a-wreck,
- **Repair, remanufacturing and re-refining**
  e.g. NASA's space shuttle, catalytic goods,
- **Technologic and fashion upgrading**
  e.g. reprogrammable microchips

commercial
engineering
innovation

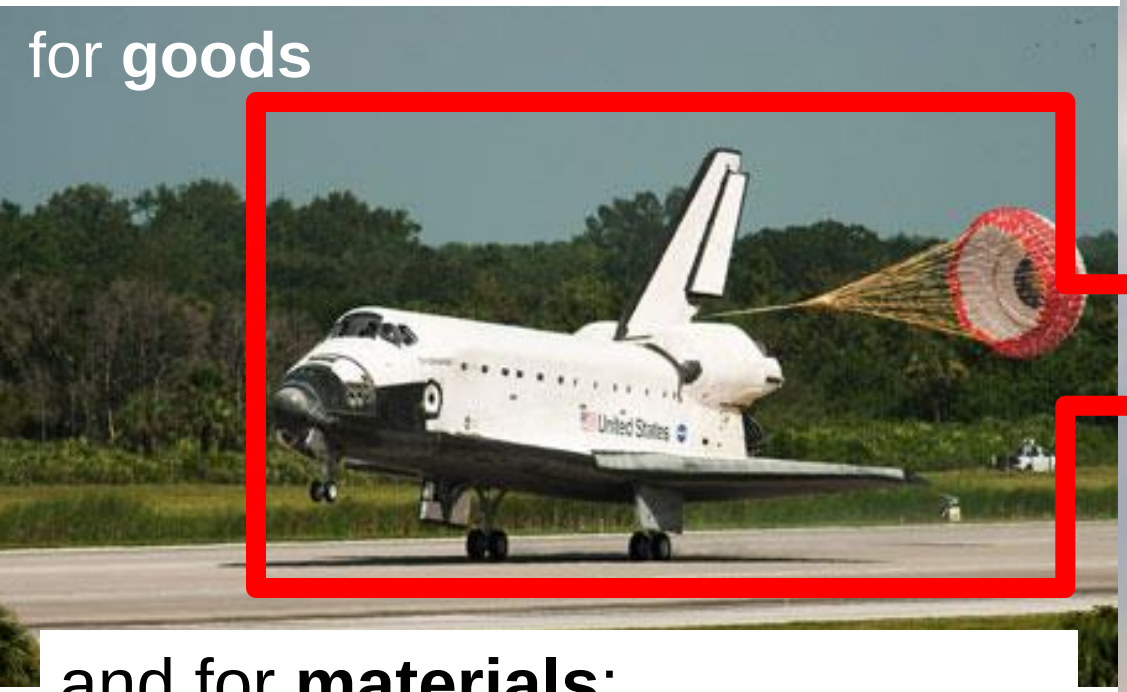
Service-life extension needs **innovation** in **local repair and maintenance services**

Scaffolding-less renovation

In situ cowbell maintenance

The Circular Economy is jeopardised by technology quantum leaps

for **goods**



Space X's reusable rocket Falcon

Falcon rocket **landing**

and for **materials**:
The Two-Teams-Project reduces water and energy use in paper making by 80% - questioning the ecology of paper recycling.

The basis of use, reuse, second-hand are **utilisation value and trust in function** by e.g. national banks or fleet managers

Quality of repair and maintenance
becomes key for commercial success

1964 DeHavilland Twinotter Seaplanes
Harbour Air, Vancouver

Reuse

of heat and acid resistant salad/cooking bowls

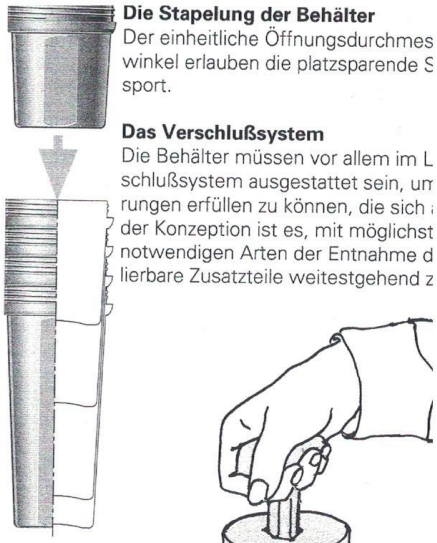
Waste is the result of our unwilling-ness or inability to design goods for easy use, to use them over long periods through self- replenishing loops, or to remarket them,

the secret of small loops:

‘*Gazosa*’, **local** Swiss mineral waters in zero-waste reusable packaging

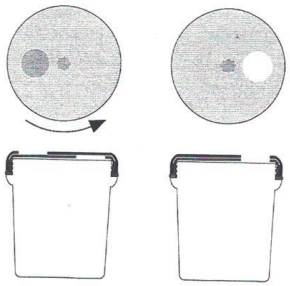
global versus local

von diesem repariert, instandgesetzt oder recycelt.



Die Stapelung der Behälter
Der einheitliche Öffnungsdurchmes
winkel erlauben die platzsparende S
sport.

Das Verschlußsystem
Die Behälter müssen vor allem im L
schlußsystem ausgestattet sein, un
rungen erfüllen zu können, die sich
der Konzeption ist es, mit möglichst
notwendigen Arten der Entnahme d
lierbare Zusatzteile weitestgehend z



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Reusable packaging: stainless steel cans, staple-able with unified double lid inventors Petra Mangold and Holger Jahn.

source: Proceedings of the International Design Forum Ulm 1992, published in:
IFG (ed.) (1993), Gemeinsam nutzen statt einzeln verbrauchen, eine neue Beziehung zu den Dingen. Anabas Verlag Giessen.

system
Behälter aus Edelstahl werden mit einem einheitlichen Öffnungs-
in jeweils vier verschiedenen Höhen gefertigt. Die Volumina betra-
750 ml, 500 ml und 250 ml.

Reuse cloth: *old staff uniforms turned into bags for Eurostar.* *Source: Worn Again*

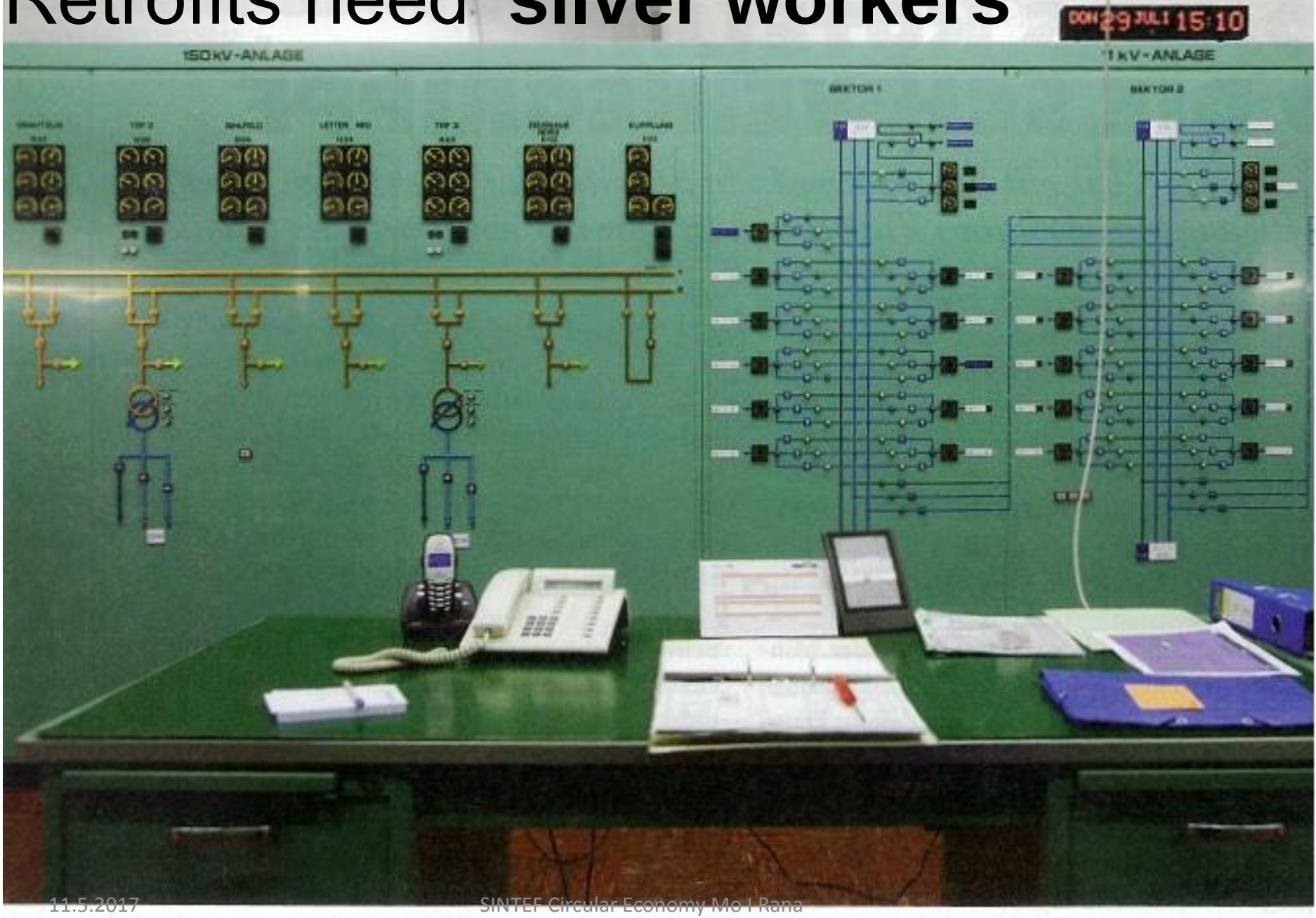
Cheap & green: ICE1 Redesign

In 1995, the 59 trains of German Rail had been in service for 15 years, covering 15 million km each.

- Redesign costs were **€ 3 million** per train, versus **€ 25 million** for a similar new train. **Savings 88%**
- Redesign **preserved 80% of resources** -- 16'500 tons of steel, 1180 tons of copper -- **prevented** 35'000 tons of CO_2 emissions & 500'000 tons of mining waste **per train**. **80%**

The Redesign included a technological upgrading of the rolling stock, and allowed to add more seats. **innovation**

Retrofits need '**silver workers**'



Bei der Modernisierung einer Schaltanlage wie jener im Unterwerk «Katz» ist die Kenntnis alter Geräte Gold wert.

reman by fleet managers in-house

Remanufacturing of a passenger jumbo to cargo

Savings 80%	B747-400F Existing Cargo	B747-400SF Remanufactured Cargo
Max, Takeoff load	394 t	394 t
Max, Payload	117 t	115 t
Max, Range	8241 km	7593 km
Costs of purchase/remanufacturing	$150 million	$30 million
Number of parts		42000

Source: Chosun Daily Newspaper, 2 May 2007

Reman: substantially reducing resource consumption, waste, emissions and costs

a 2004 sectoral study on restoring used automotive engines compared to a like-new condition showed, compared to manufacturing new engines, found:

- **Lower economic costs (30-53%),**
- **Lower raw material consumption (26-90%),**
- **Lower waste generation (65-88%),**
- **Lower energy consumption (68-83%),**
- **Lower emissions (50-88%)**
  - **73-78% less** carbon dioxide (CO_2),
  - **48-88% less** CO,
  - **72-85% less** NOx,
  - **71-84% less** SOx,
  - **50-61% less** non-methane hydrocarbons emissions.

green and cheap

Source: Smith, VM and Keolian, GA (2004) The value of remanufactured engines, lifecycle environmental and economic perspectives, Journal of Industrial Ecology, 8(1-2) 193-222

Two Resource Efficiency strategies

managing waste vs. preserving stocks

material recycling:

- looses most embodied resources,
- reduces waste volum
- has fixed-cost and purity disadvantages,
- is a flow process,
- is capital intensive,
- trend to globalisation & economy of scale.

Second law of thermodynamics and profit barrier

reusing goods:

- **maintains** most em-bodied resources,
- **prevents** waste,
- has **cost (quality) advantage** over new, manages stocks,
- is **labour** intensive,
- trend to regional and local, SMEs.

Rapid recycling = resources lost

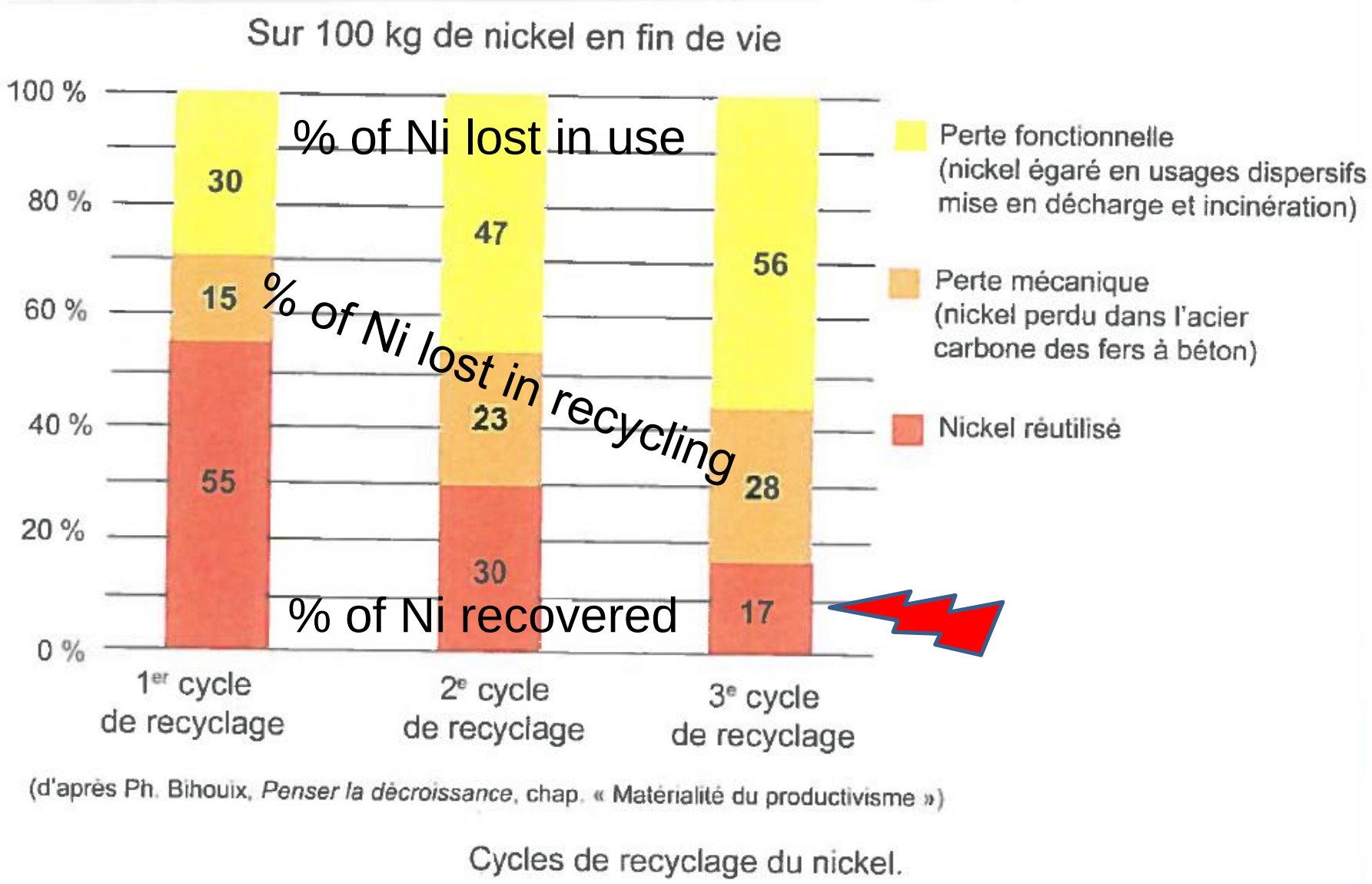
The cumulative loss of aluminium from the hard packaging cycle in Flanders, 2004 - 2014

Source: modelled by VITO, based on data from OVAM. Quoted in EEA report, p.25

Figure 3.2 The cumulative loss of aluminium from the hard packaging cycle in Flanders over time

Source: Modelled by VITO, based on data from OVAM (forthcoming).

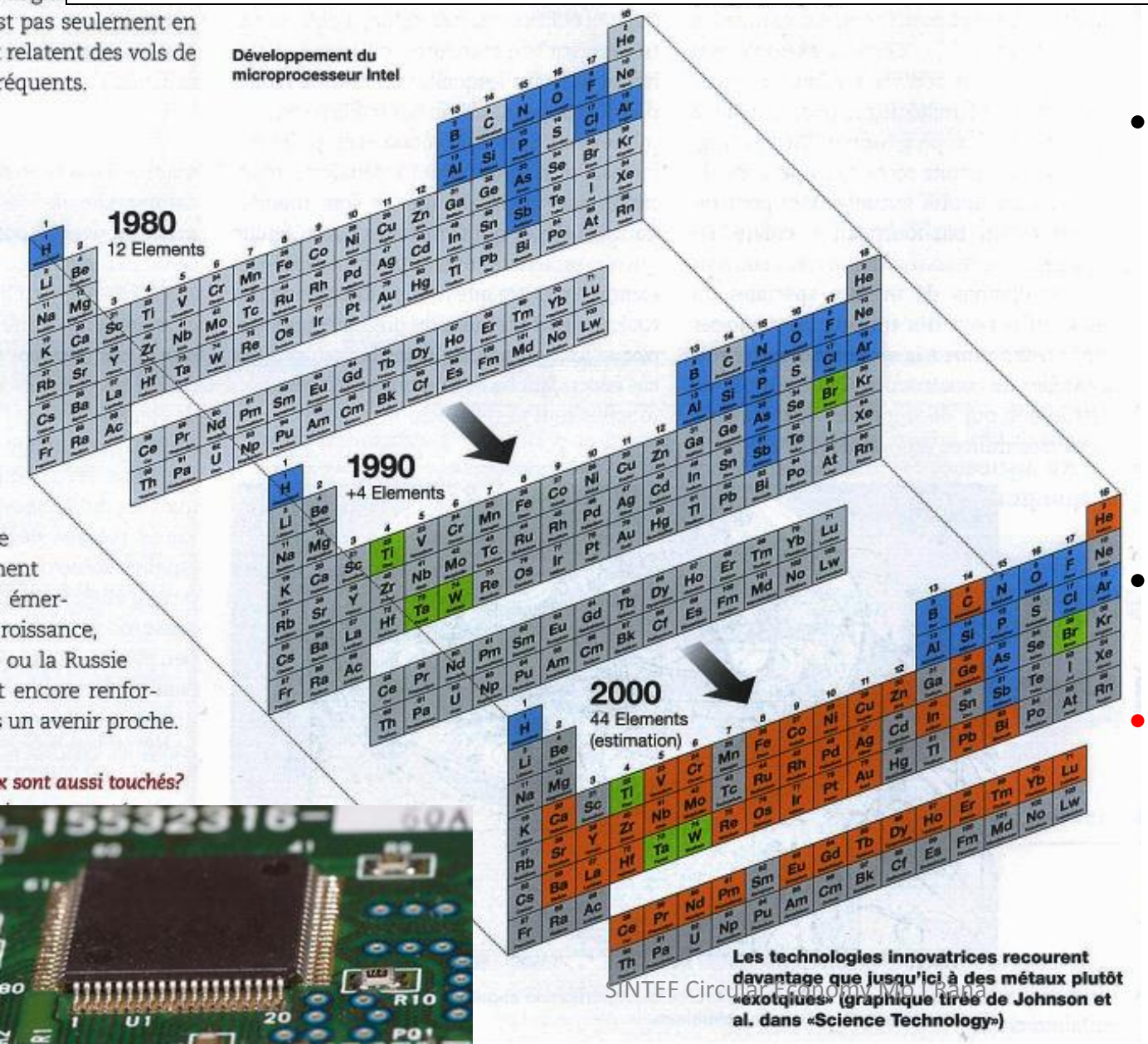
Resource losses in use and recycling



(d'après Ph. Bihouix, *Penser la décroissance*, chap. « Matérialité du productivisme »)

Cycles de recyclage du nickel.

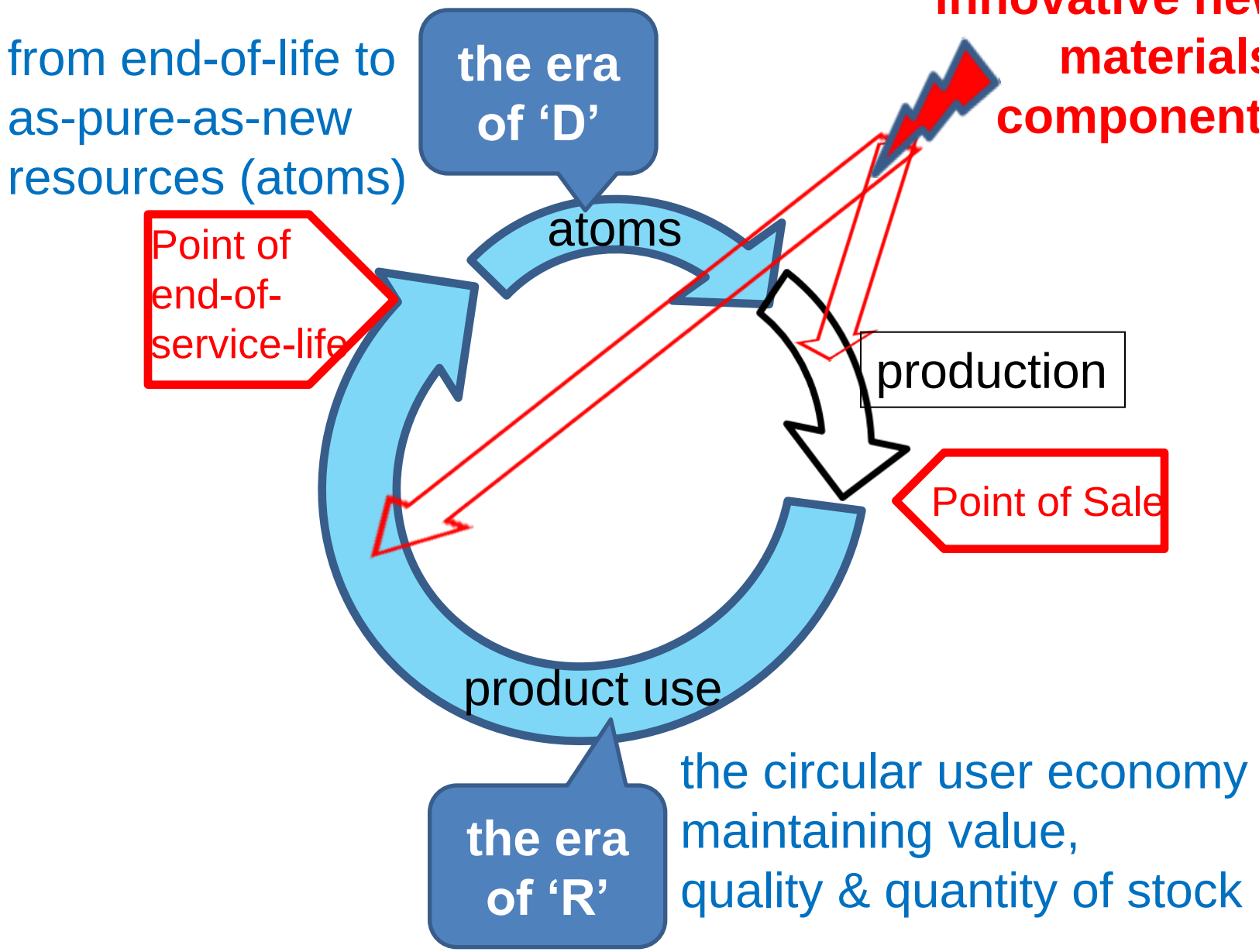
Re-use or loose? The curse of complexity



- the number of elements in an INTEL microchip has increased from 12 in 1980, to 16 in 1990, to 44 in 2000.
- **Resources are lost in recycling**
- *Reprogrammable microchips*

Engineering innovation

backcasting view from a mature CE



The challenges: innovation and spreading the knowledge

The era of 'R': techno-commercial strategies to reuse, repair, remarket, remanufacture, re-refine, recycle, reprogramme goods.

The era of 'D': technologies and policies to de-polymerize, de-alloy, de-laminate, de-vulcanize, de-coat materials, de-construct.

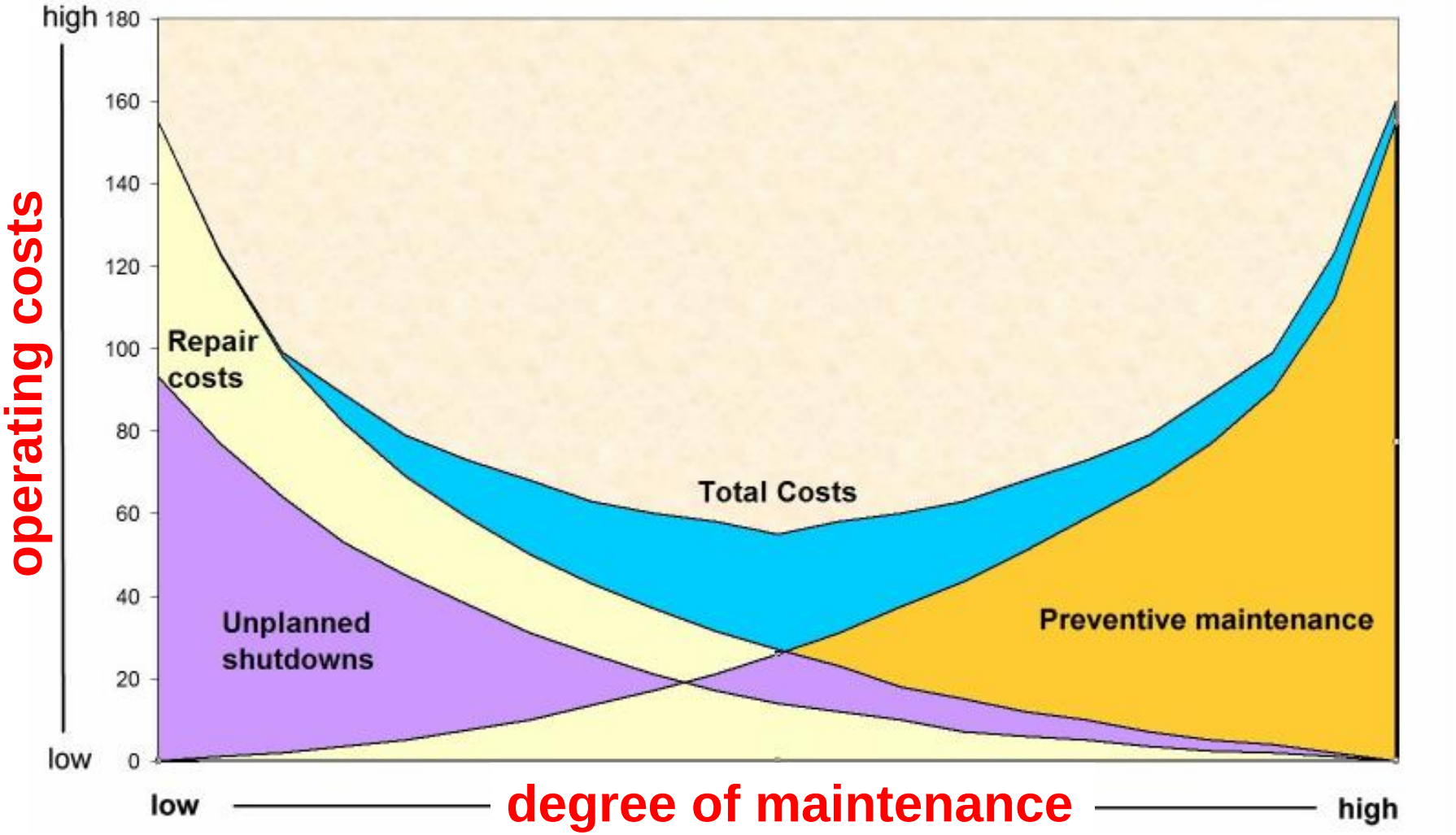
R&D challenges

Spreading the CE knowledge – technical and economic – to class- and boardrooms, to academia & technical training institutions to new professions (vehicle restorers)

education challenge

Spreading the knowledge of fleet managers

e.g. optimising the life-cycle costs of complex goods in use, function of desired availability



CIE - opportunities for industry

In-house and client options for
The era of R (reman):

- **follow products into use**:
  - repair technologies (underwater hull repair at quay)
  - service-life extension tech (trains, planes, aircraft)
  - O&M solutions,
  - upgrading solutions (**Speno rail grinding**),
- **buy/take/bring-back markets** (single use cameras)

The era of D:

- **recycle atoms, molecules**:
  - de-alloy metals, de-vulcanise rubber,
  - de-polymerise plastics, deconstruct public works.

Innovative corporate CIE strategy:
follow your products into use

Examples for shipyards and steel mills

- Underwater hull repairs while ships are loaded and unloaded.
- Speno rail grinding: in-situ remanufacturing of railheads to a ten times lesser tolerance, instead of replacing rails.

The art of “making money from less”

- Preface.
- Circular Economy.
- Performance Economy: Xerox, rent-a-molecule, ceramic slide-gate services for the steel and iron industry; long-life tools for rent; maintenance-free crude oil pump; Grundfoss pumps as a service; Interface’s 20 year green lease, power by the hour by Rolls-Royce; tyres by the mile by Michelin; concept 03 (Geely); autolib Paris.
- Sufficiency.
- Component standardisation.
- Systems design & thinking.

The Performance Economy

a C.I.E. where economic actors retain the ownership of goods and embodied resources, and internalise all costs and liabilities

e.g. hotels, ISO shipping containers, rent-a-tree, taxis, NASA's launch services programme

Public procurement : buying performance

NASA buys commercial (launch) services, not hardware, **only specifying mission unique requirements**

NASA Launch Services Program

U.S. Space Transportation Policy

Commercial Space Transportation: U.S. Government agencies shall "purchase commercially available U.S. space transportation products and services to the maximum extent possible . . . "

NASA Strategic Plan

". . . It is imperative that all reasonable measures be taken to assure launch success." NASA will encourage a more competitive market to lower launch costs and provide better ROI to taxpayers

Launch Services Program

NASA buys commercial launch services, not hardware. NASA specifies mission unique requirements

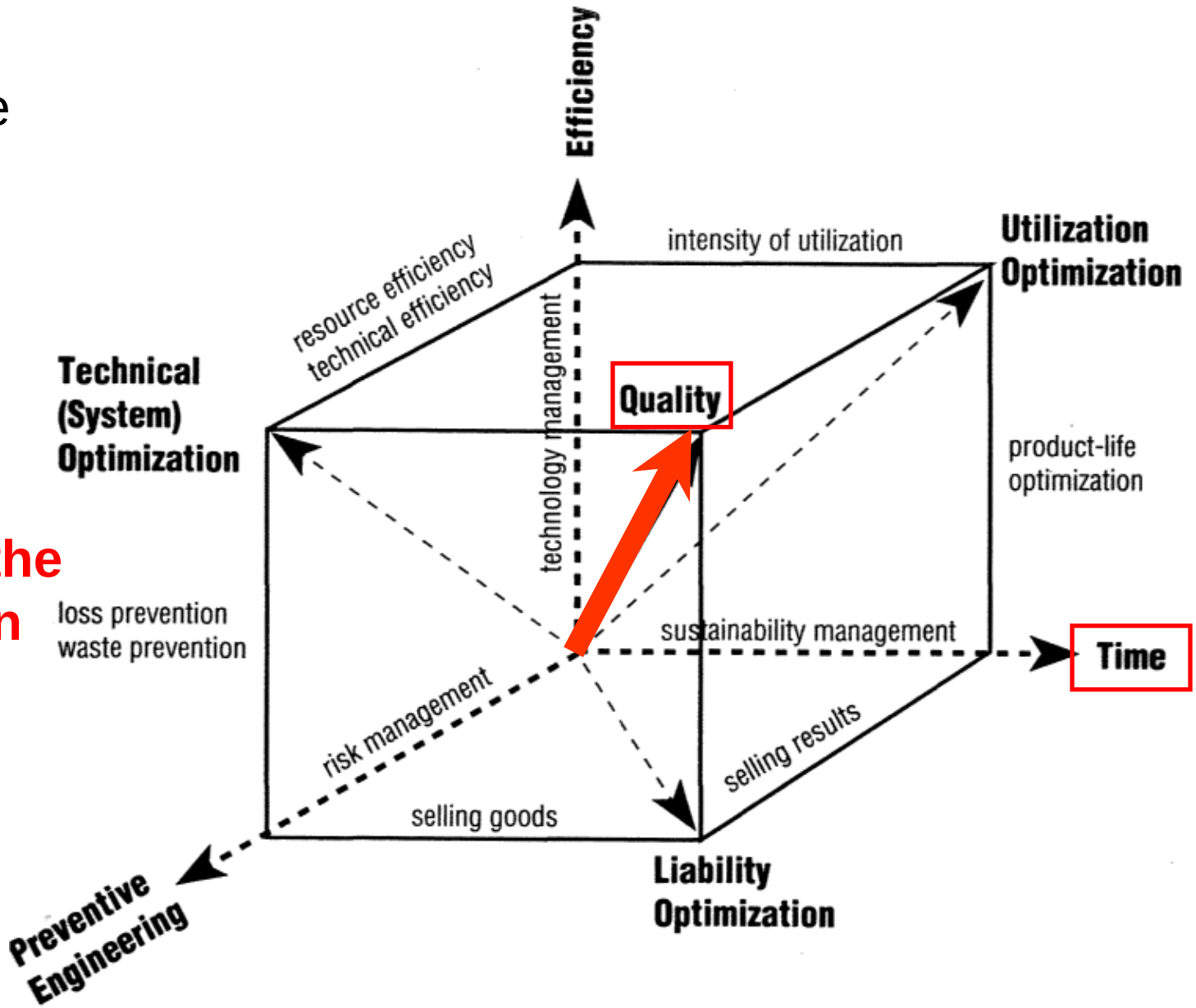
The Performance Economy
or Functional Service Economy

The ultimate systems solution challenge

- **is the most sustainable form of the CIE**,
- **defines quality as guaranteed results**,
- **thrives on systems and sufficiency solutions**,
- sells goods as services, **maintains ownership**,
- **internalises the costs of risk and of waste,**
- **is driven by a quest for competitiveness**,
- embraces pharmaceuticals, Internet of Things,
- is measured using absolute decoupling indicators.

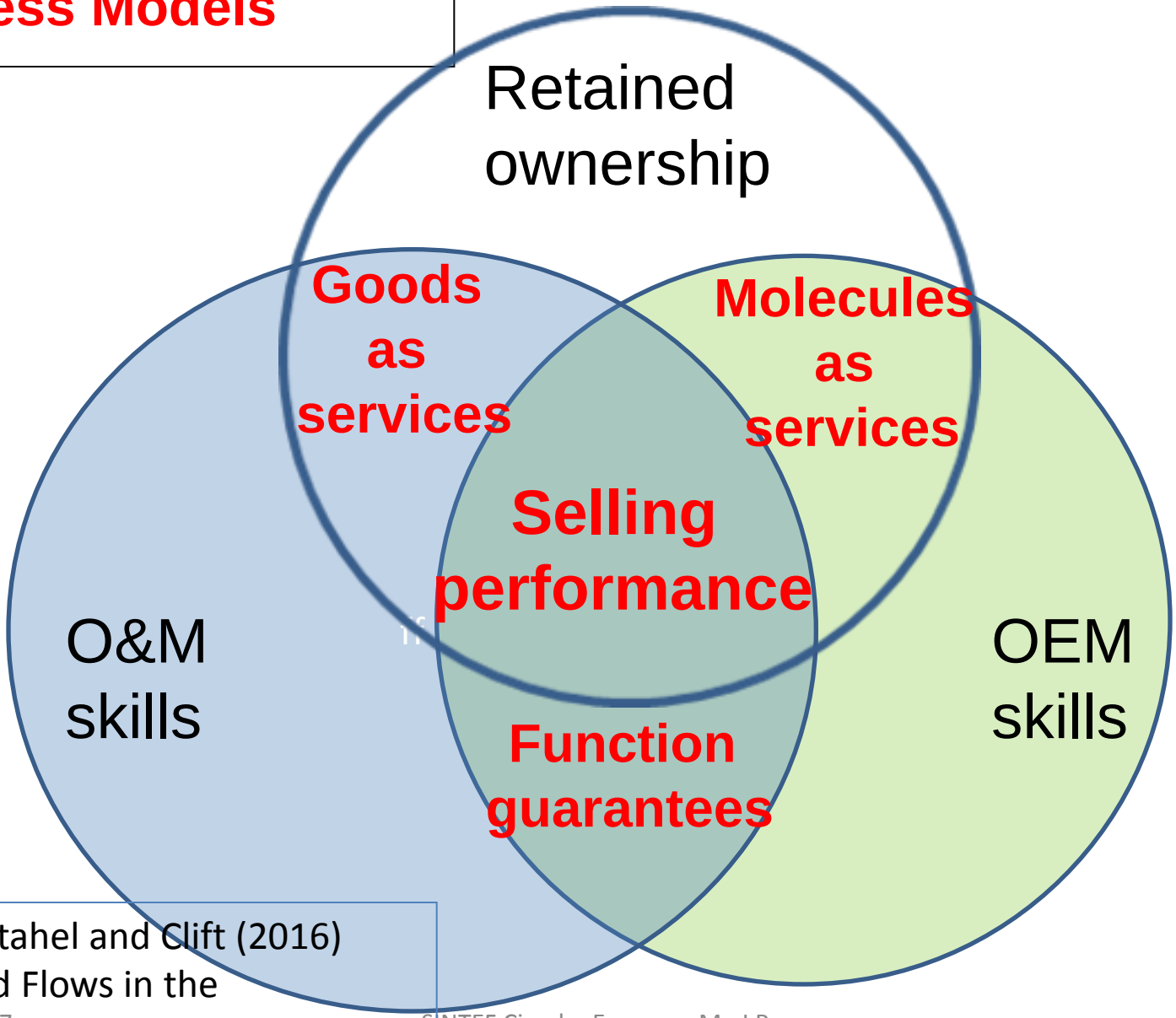
Performance Economy: **introducing time** in the economy

Quality defined as the optimisation of system functioning over long periods of time



Source: Giarini/Stahel (1993) The Limits to Certainty - facing risks in the New Servic Economy, Kluwer Academic Press.

Performance Economy Business Models

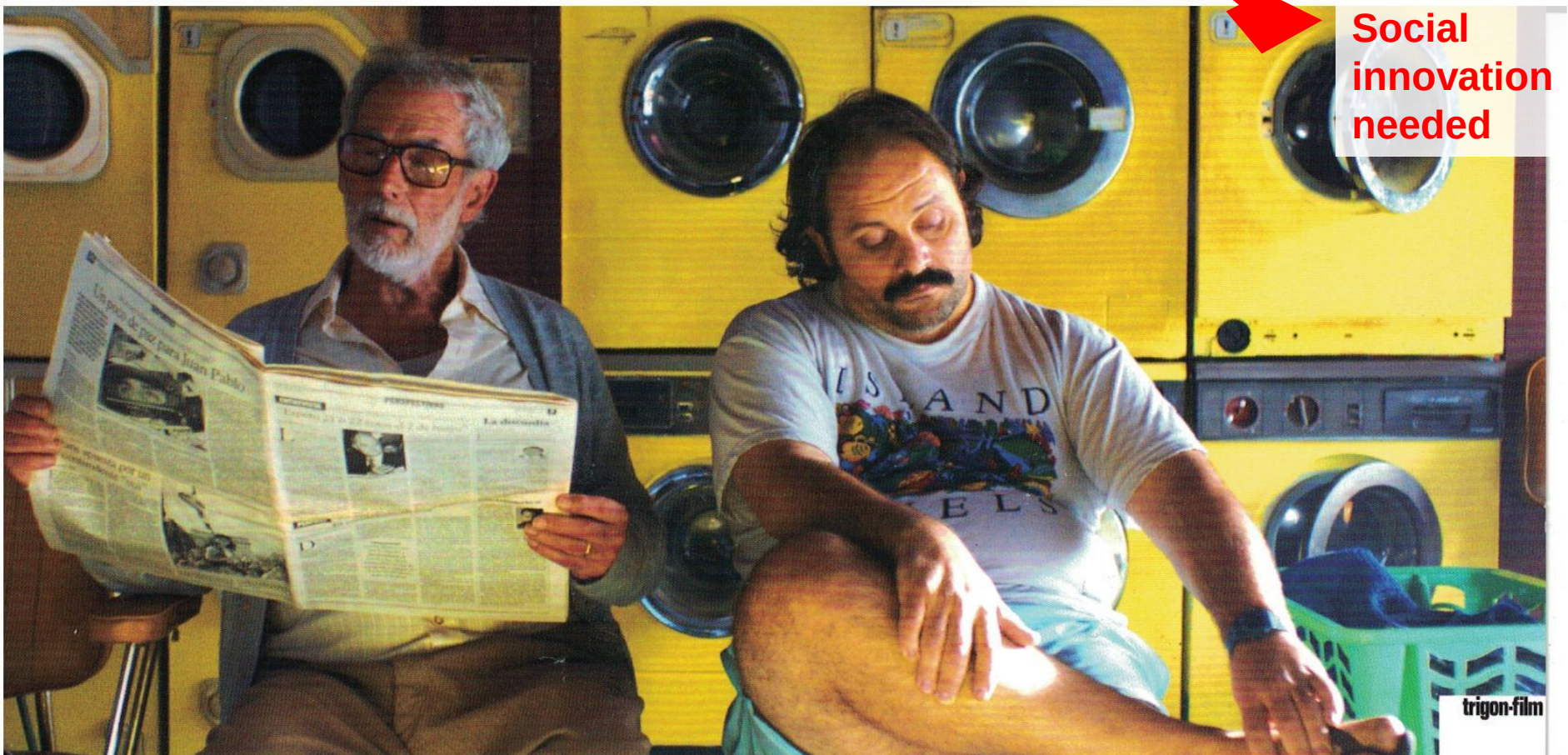


Source: Stahel and Clift (2016) Stocks and Flows in the Performance Economy, Springer


Queen Mary 2
UP/HAUT
SURVITEC ZODIAC
COMMERCIAL LIFERAFTS
ON HIRE FROM
survitecgroup
Certificate Valid Until 6/2018
expertise you can trust
serviceuk@survitecgroup.com
survitecgroup
GLOBAL HIRE LIFERAFT
PROPERTY OF SURVITEC GROUP
SOLAS
Hired mission-critical equipment, maintenance and tech updating are done in the factory on land

Sharing economy = boring economy?

Laundromats need to be combined with animation, dancings, internet cafés, to make them attractive for (single) clients.



Public procurement

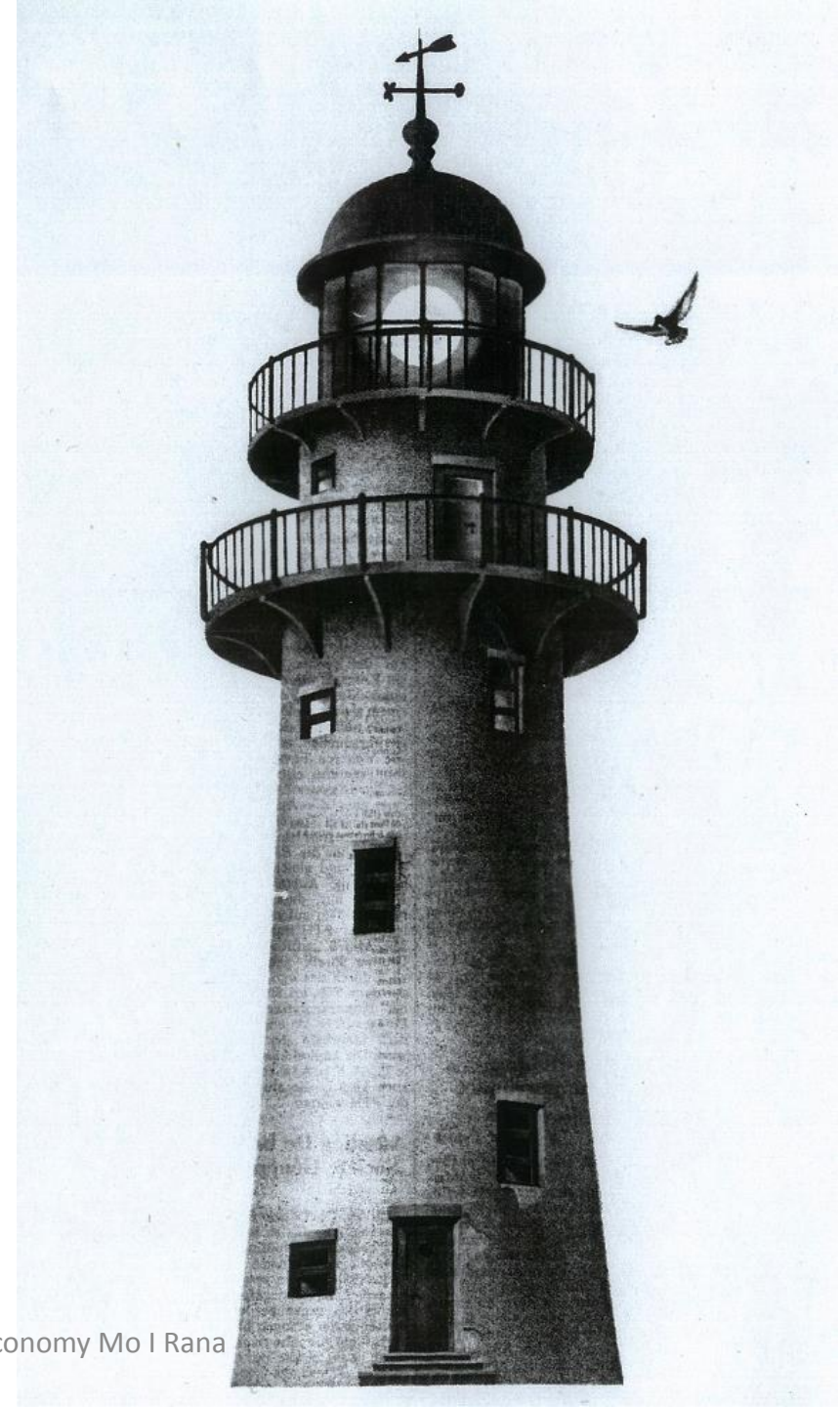
Example:
Private Finance Initiatives (PFI)
Le Viaduc de Millau,

a 2001 **78-year contract** to design, finance, build and operate the bridge till 2079, with a maintenance contract until 2121

Le pont de Millau, France

Systems solutions are also part of the Performance Economy

Lighthouses have done more for the safety of shipping than any improvement to ships.



The Performance Economy

Second Edition

Walter R. Stahel

Real wealth is based on use, not ownership

Aristotle

Palgrave Macmillan London, March 2006, 2010

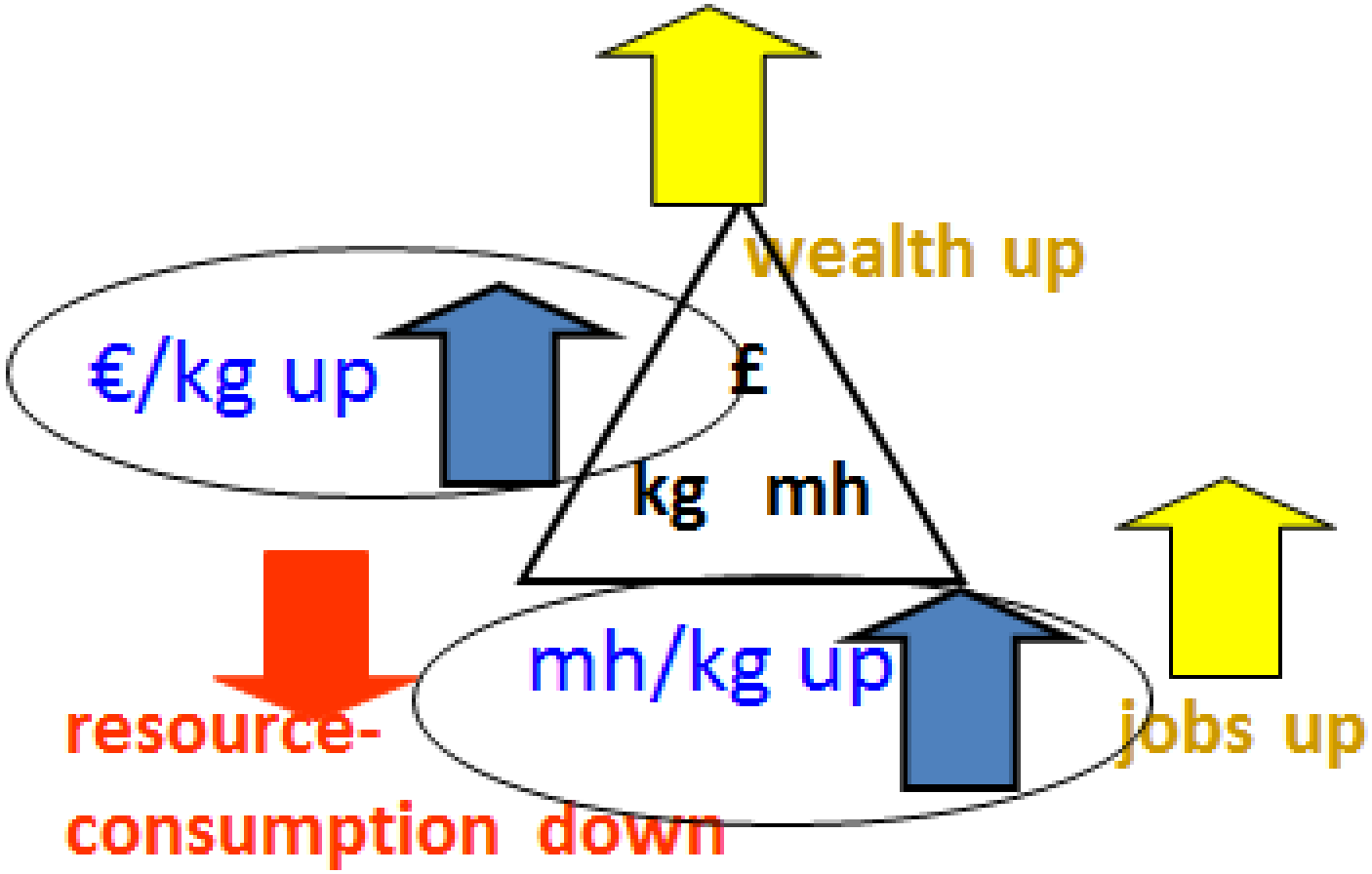
- Producing performance,
- Selling performance, and
- Maintaining performance over time.

NEW ?

CIE - opportunities for industry - PE

- buying and selling 'services' of:
  - performance,
  - molecules as service,
  - goods as service,
  - function guarantees,
  - life-long guarantees,
  - standardised parts,
  - multifunctional goods,
  - supply guarantees,
  - systems solutions,
  - sufficiency solutions.

The Performance Economy uses absolute decoupling indicators to monitor more wealth and jobs from less resource consumption



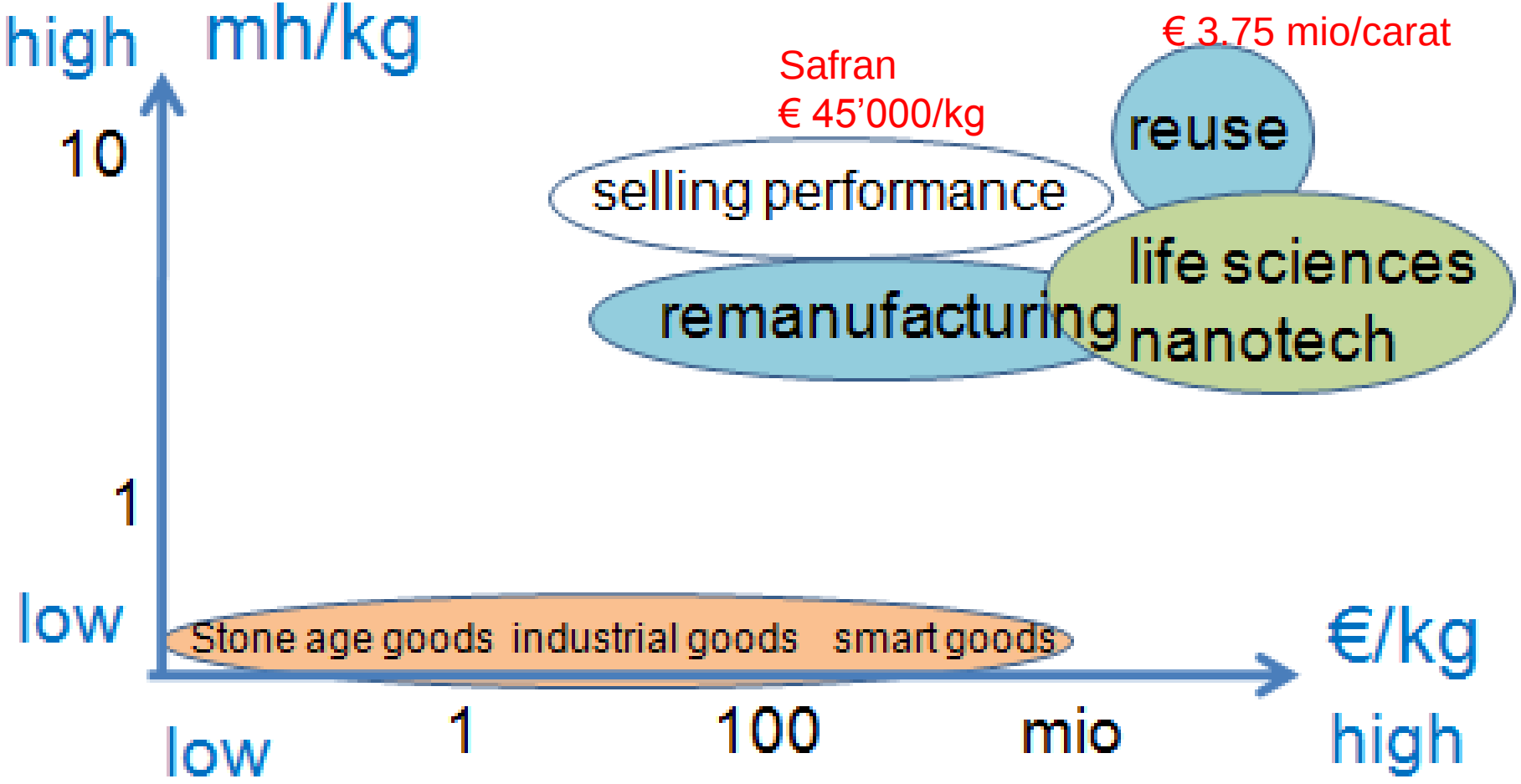
Stahel, The Performance Economy, 2006/2010

Zenith wristwatch repair
7500 mh/kg, 1,5 mio€/kg

Performance sustainability rating of sectors

using absolute decoupling indicators

Blue Moon diamond
€ 3.75 mio/carat



The mh/kg ratio of remanufacturing a car engine is 270 times that of manufacturing a new engine

Thank you for listening

Dr h.c. Walter R. Stahel, Visiting Professor, University of Surrey
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CIE - opportunities for industry - PE

In-house and client options for
The era of R (reman):

- **follow products into use**:
  - repair technologies,
  - service-life extension tech,
  - O&M solutions,
  - upgrading solutions,
- buy/take/bringback markets

The era of D:

- **recycle atoms, molecules**:
  - de-alloy metals,
  - de-vulcanise rubber,
  - de-polymerise plastics,
  - deconstruct public works

- buying and selling 'service'
  - performance,
  - molecules as service,
  - goods as service,
  - function guarantees,
  - life-long guarantees,
  - standardised parts,
  - multifunctional goods,
  - supply guarantees,
  - systems solutions,
  - sufficiency solutions.