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Summer School

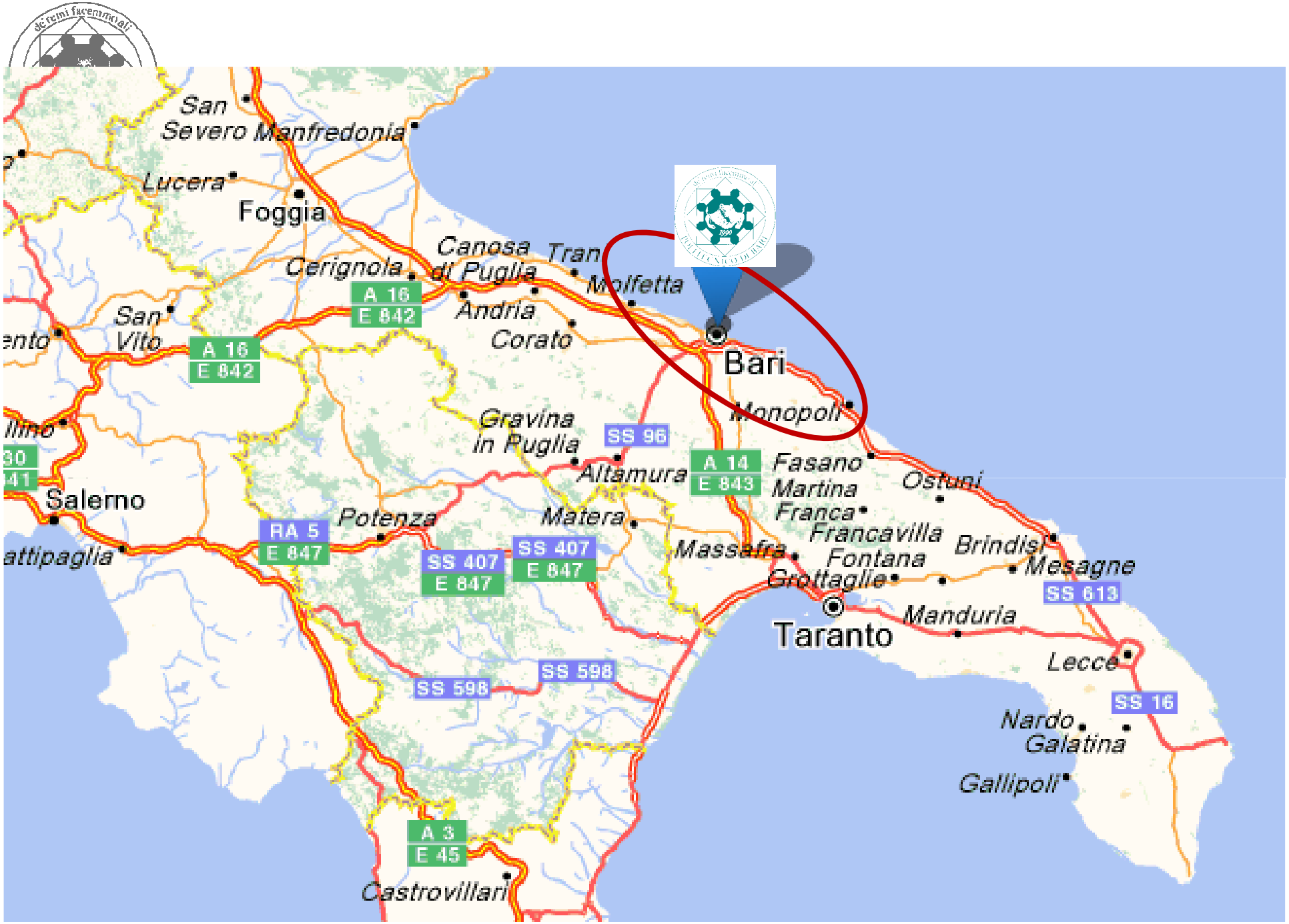
Sustainability: a new field related to RES

(Efforts of research and didactics in Apulia region)

Prof. Ing. Michele Dassisti

July 2, 2013

T.E.I. of Patras


San
Severo Manfredonia
Lucera
Foggia
Cerignola
Canosa
di Puglia
Tran
Molfetta
A 16
E 842
Andria
Corato
San
Vito
A 16
E 842
Bari
Monopoli
Gravina
in Puglia
SS 96
Altamura
A 14
E 843
Fasano
Martina
Franca
Ostuni
Salerno
Potenza
Matera
RA 5
E 847
SS 407
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SS 407
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Massafra
Francavilla
Fontana
Brindisi
Mesagne
Grottaglie
SS 613
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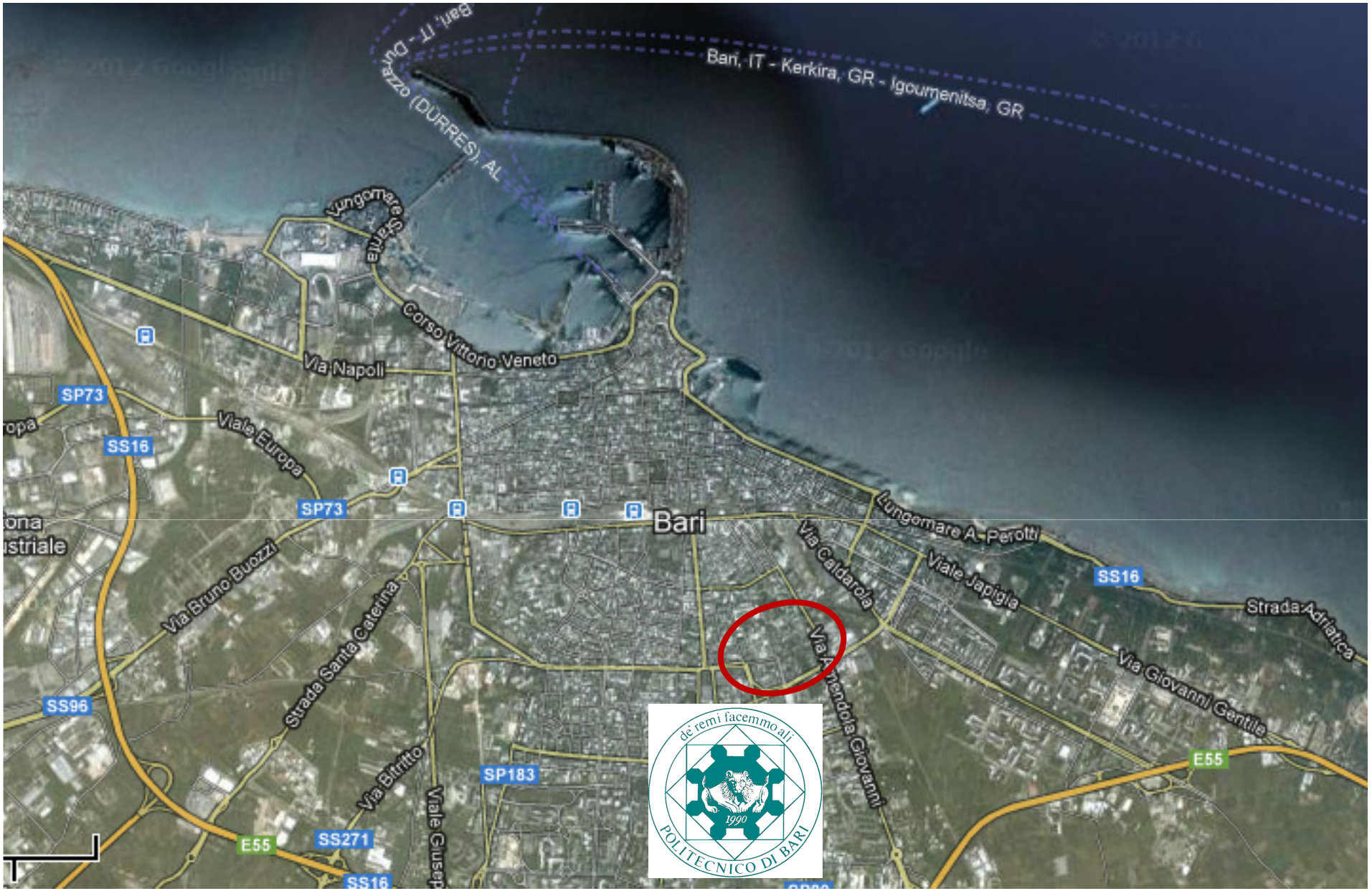
Castrovillari


Bari, IT - Kerkira, GR - Igoumenitsa, GR
Bari, IT - Durazzo (DURRES), AL
Lungomare Starita
Corso Vittorio Veneto
Via Napoli
SP73
SS16
Viale Europa
SP73
Bari
Lungomare A. Perotti
Via Caldarola
Viale Japigia
SS16
Strada Adriatica
Via Giovanni Gentile
Via Bruno Buozzi
Strada Santa Caterina
SS96
Via Bitritto
SP183
Viale Giuseppe
Via Amendola Giovanni
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SS271
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de remi facemmo ali
1990
POLITECNICO DI BARI

5 Departments,
- 3 for Engineering fields
- one for Architecture
- one Physics

32 Courses (3 and 5 ys)
several Masters and PhD.

Around 12.500 undergraduate and postgraduate students
132 researchers
84 professors
304 members as administrative services.

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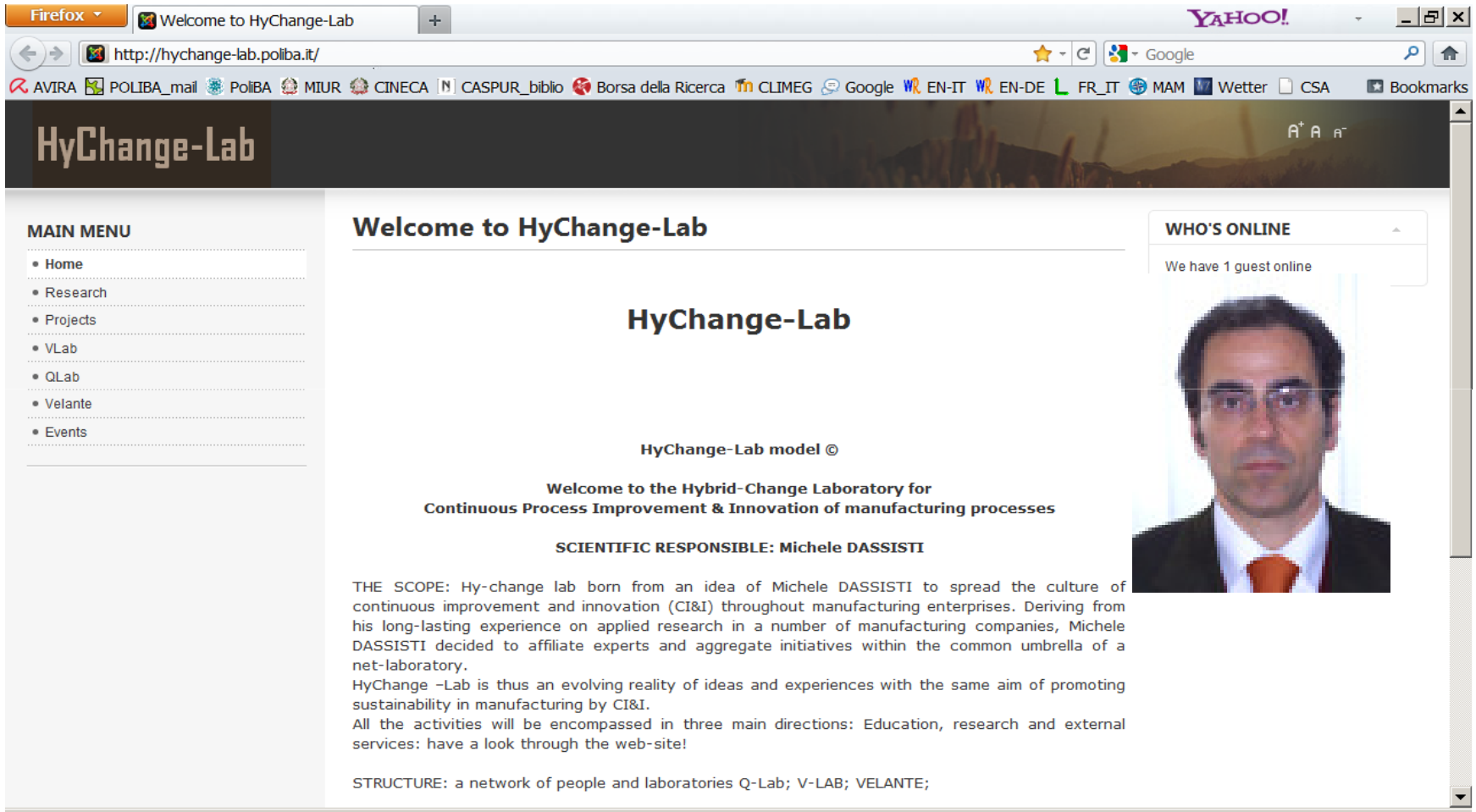

Rationale

I. **WHAT**
II. **WHY**
III. **WHO**
IV. **WHERE**
V. **HOW (1- 10)**
VI. **WHEN**
VII. **CONCLUSION**

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WHAT

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The problem….

http://www.clubofrome.org/eng/home/

<<If the actual line of development continues unchanged …, humanity is destined to reach the natural limits of development within the next 100 years.-The application of technological solutions can extend the period of industrial development/growth and of demographic increase, but cannot eliminate the fundamental limits of development.>> Club of Rome, 1972

Sustainability struggle:tangible signs

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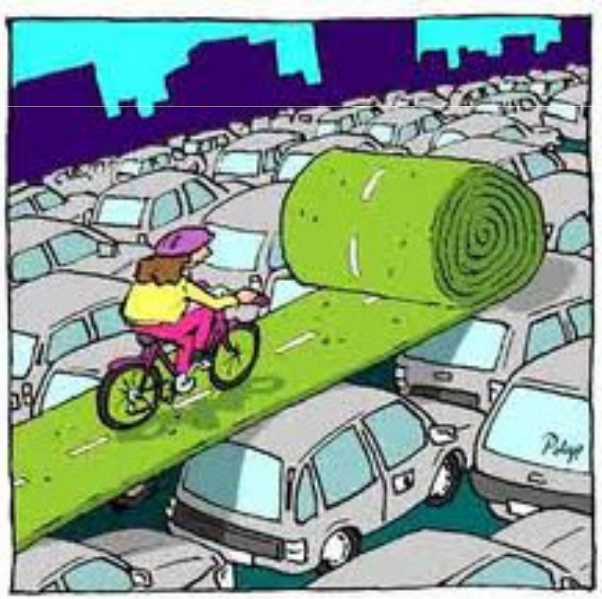
- Climate changes



- Crysis of complex systems

SUSTAINABILITY: too general level

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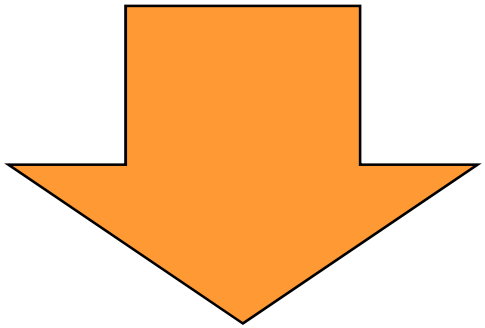
- <<Development that meets the needs of the present without compromising the ability of future generations to meet their own needs>>
  [the Brundtland Commission, 1987]

It is just a matter or RESOURCES??

Sustainability



SUSTAINABILITY WAS ADOPTED BY UNEP IN RIO DE JANEIRO (1992) AS THE MAIN POLITICAL GOAL FOR THE FUTURE DEVELOPMENT OF HUMANKIND.

IT SHOULD ALSO BE THE ULTIMATE AIM OF PRODUCT DEVELOPMENT.

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"The beauty in our inability to define it means that we cannot prescribe it." *[Fricker,1998]*

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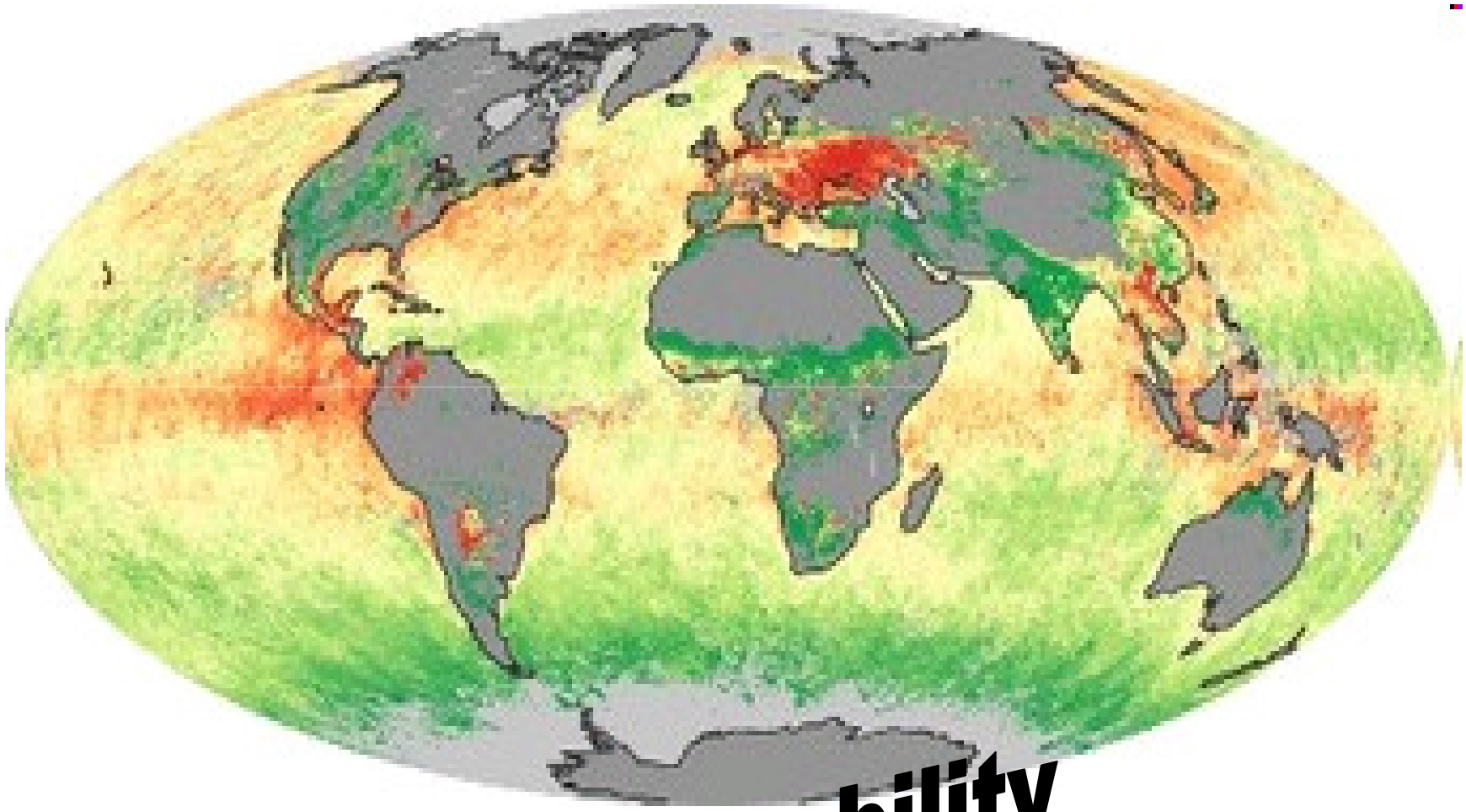
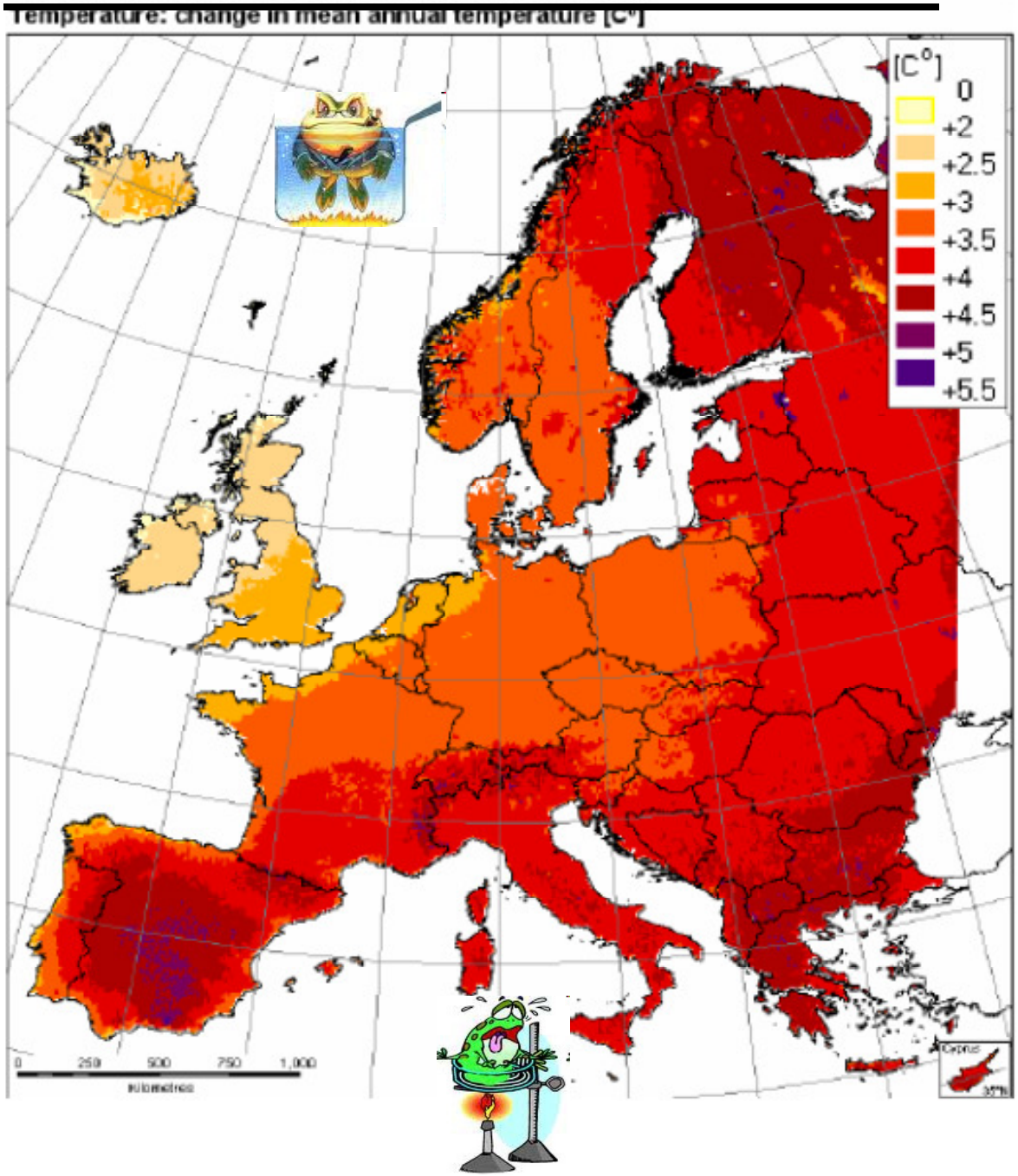


Sustainability

THE SWIMMING FROG…….

Tiniest Vertebrate On Earth *Paedophryne amauensis* is the smallest vertebrate, discovered in a village in Papua New Guinea. Adults are just 7.0 to 8.0 millimeters. Click here to embiggen the photo. Rittmeyer EN, Allison A, Grundler MC, Thompson DK, Austin CC/PLoS ONE



The three pillars of sustainability

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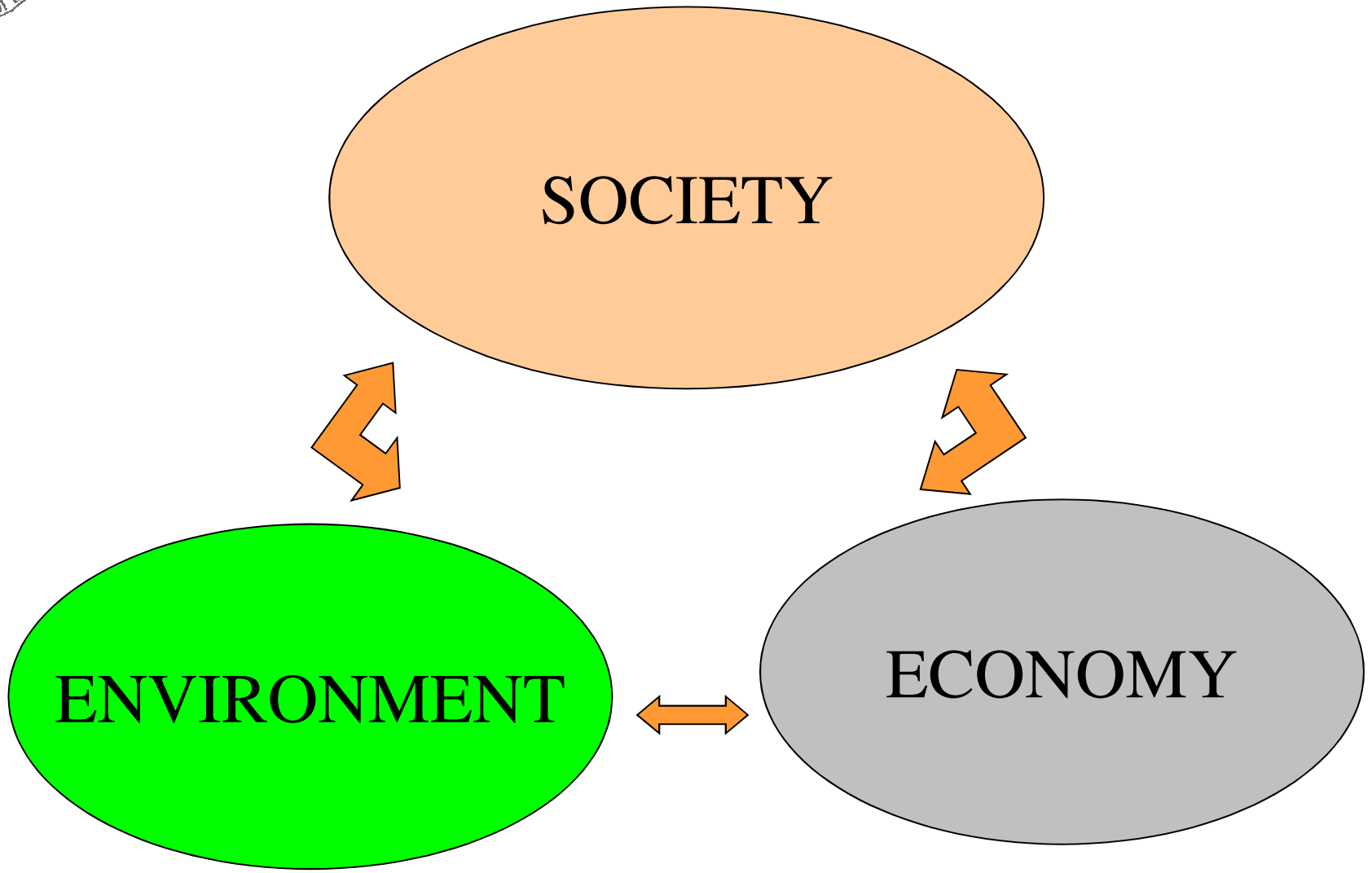

"The triple bottom line"

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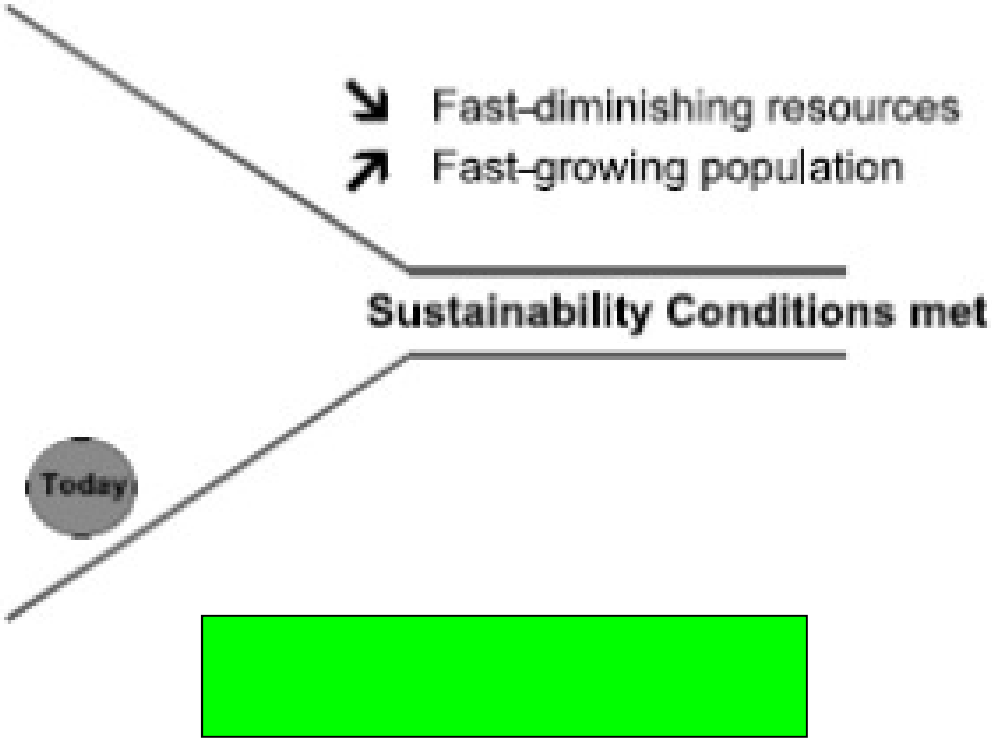
WHY

Finitedness of resources



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Some digit…

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1900

POPULATION:
c.a. 1500 Million

- ENERGY: 6 barrels/day
- METALS: 20Mton
- PAPER: 4 Mton
- PLASTICS: ----
- CHEMICALS El.: 20

2000

POPULATION:
c.a. 6600 Million

- ENERGY:80.000.000 barrels/day
- METALS: 1200Mton
- PAPER: 160 Mton
- PLASTICS: 160 Mton
- CHEMICAL: all (92)

Finitedness of resources

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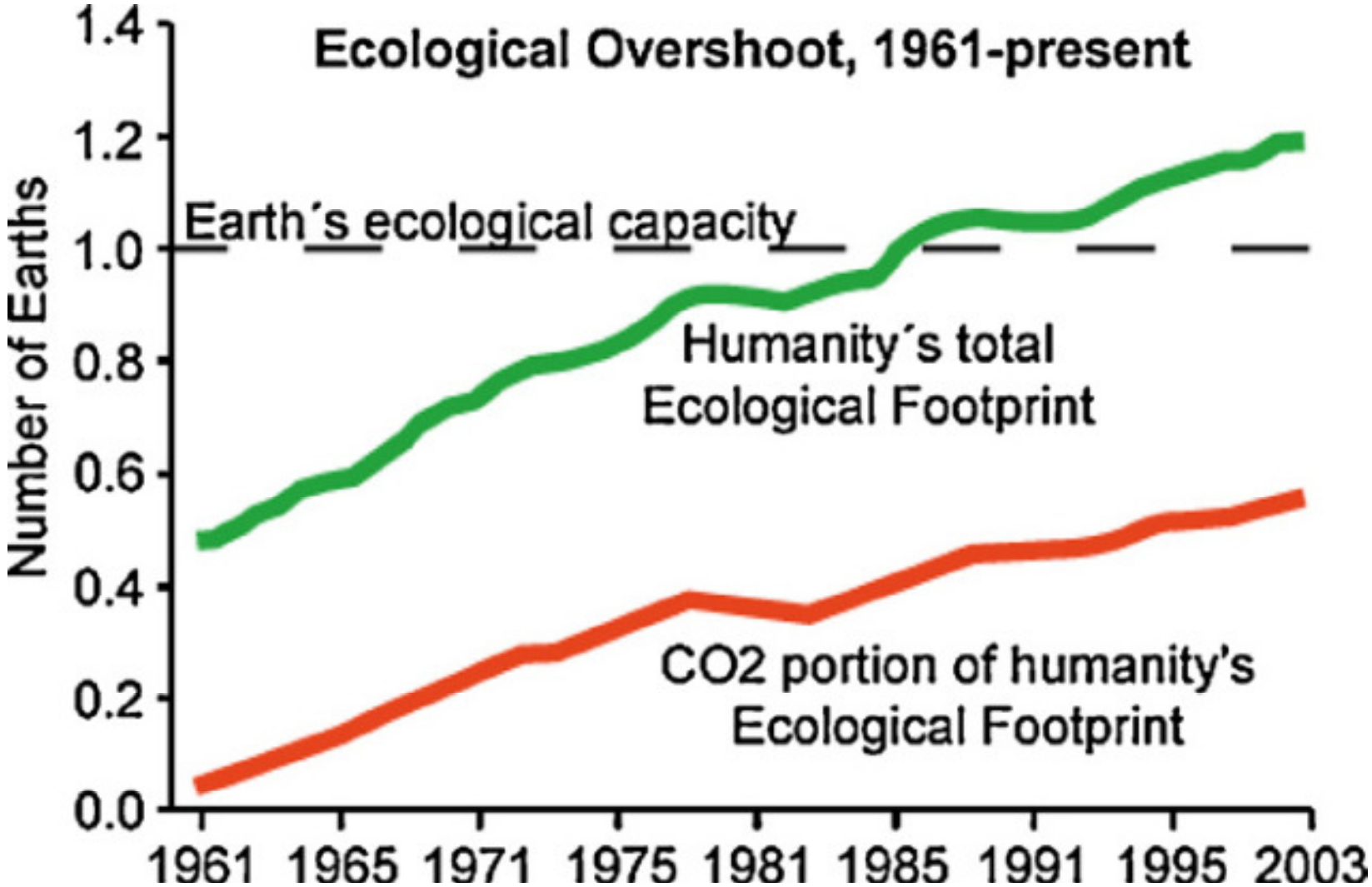

Jovane,2008

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Earth's digit…

Date	End of element	End of element	
2012	End of terbium	2040	End of uranium
2018	End of hafnium	2048	End of nickel
2021	End of silver	2050	End of oil
2022	End of antimony	2064	End of platinium
2023	End of palladium	2072	End of natural gas
2025	End of gold	2087	End of iron
2028	End of tin	2120	End of cobalt
2030	End of lead	2139	End of aluminium
2038	End of tantalum	2158	End of coal
2039	End of copper		

It is threatened of disappearance.

As copper !

As zinc and other metals.

Panta rei….

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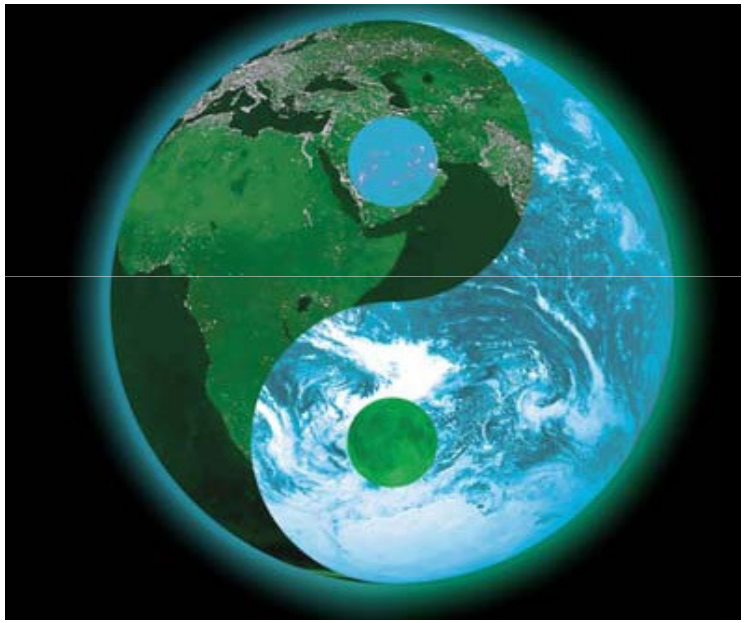

"World changes while we walk in it.
Man experiments big upsetting of his life"

(R. Oppenheimer)

WE ARE THE INTERESTED OBSERVER OF THE EVOLUTION OF OUR EARTH

A philosophical matter: equilibrium……

- The concept of "sustain-ability" implies the concept of "ability to sustain" a status of a system: let's call it a (status of) equilibrium thus means to have a reference point of observation, an interested observer with respect to whom all concepts will hold

- *<<United Nations Brundtland Commission called for sustainable development, 'that which meets all the needs of the present ...>> Appleton, 2006*

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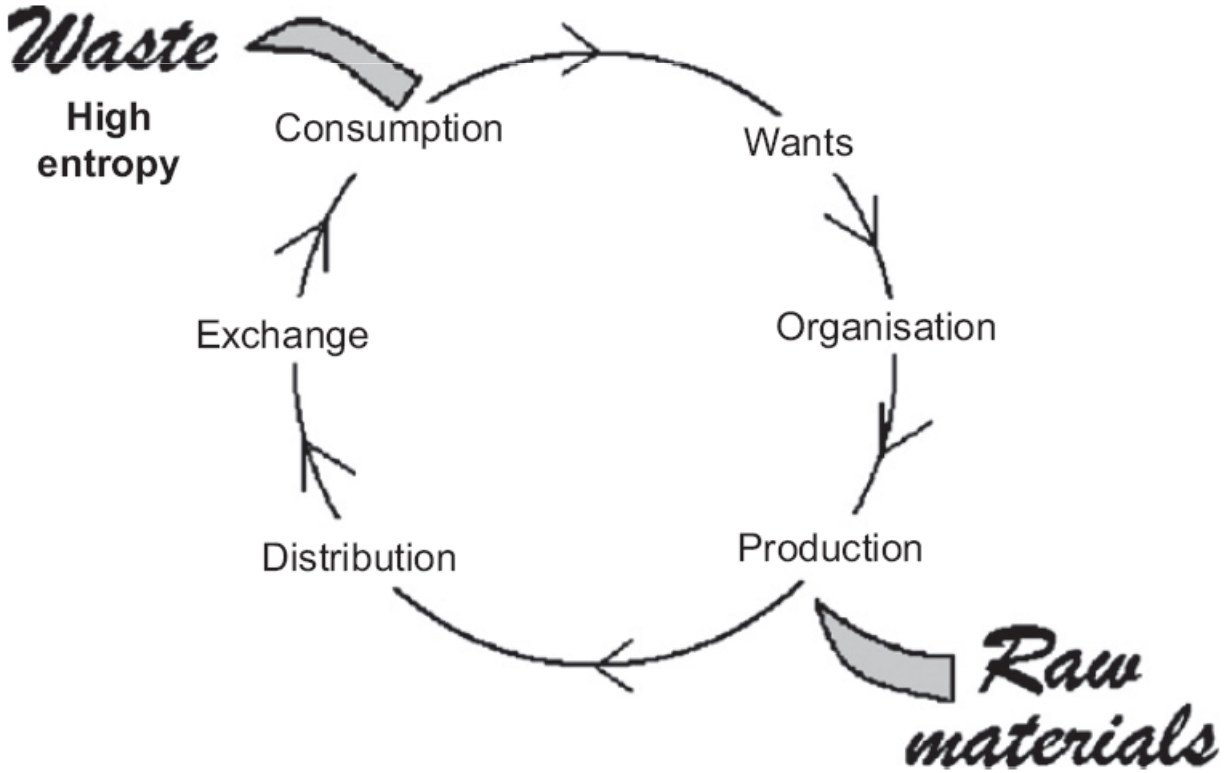
Sustainability vs Growth?!

- *<<The concept of environmental sustainability presents a major challenge to the ‘‘growth paradigm’’ of contemporary industrial culture. It is a concept fundamentally rooted in ethics and philosophy, but one which has strong technological ramifications* >>[Pacham,2009]



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WHO

The three challenges for enteprises

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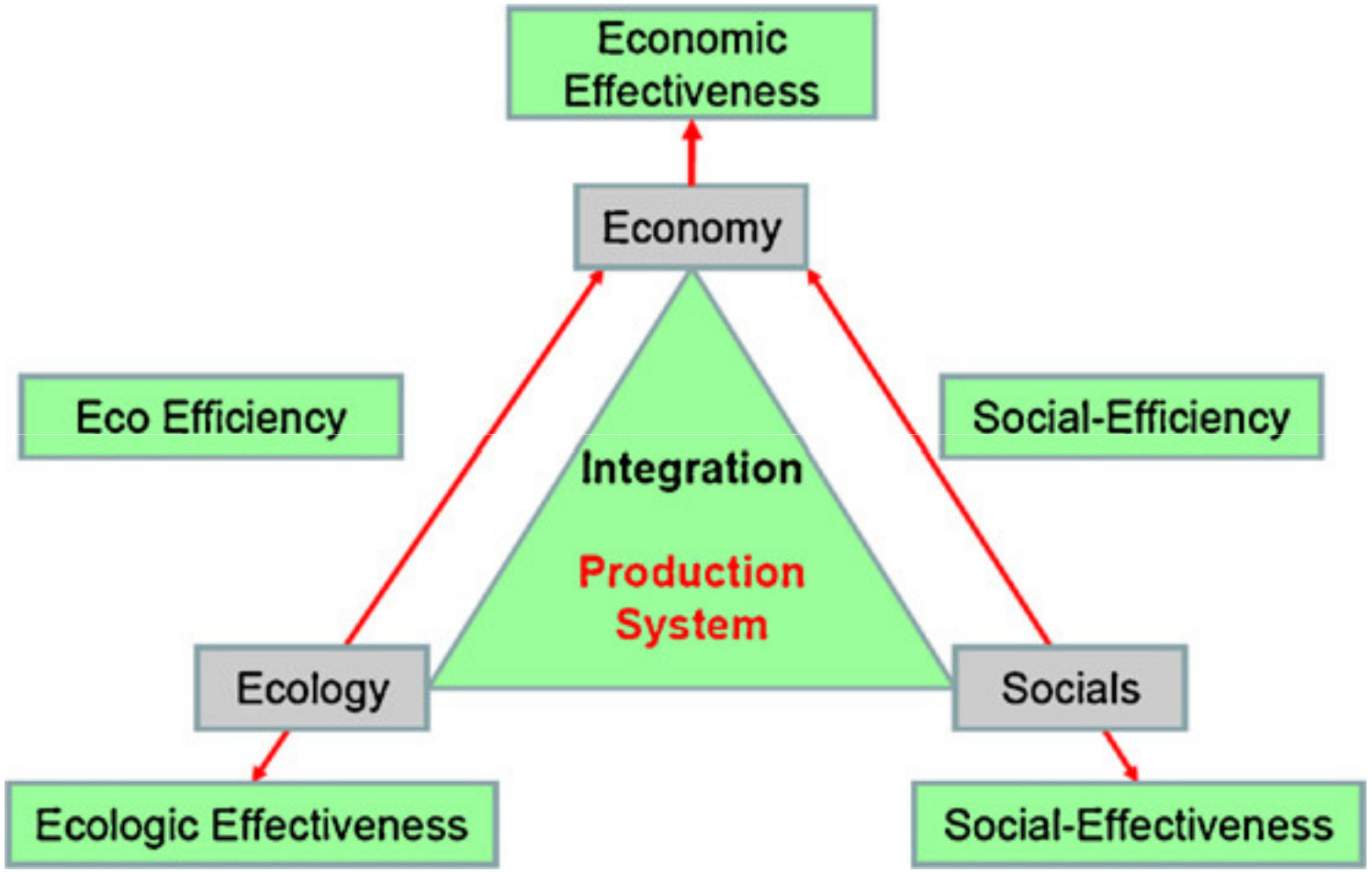

Jovane,2008

TOWARD WHAT?

- Paradox: how can we (mankind) define the right direction if we are the same actor in the system we are trying to measure?
- What means "the right direction" for influencing the future equilibrium state?
  - PRESERVATION SEEMS TO BE

THE ONLY REASONABLE ANSWER UP TO NOW

- *<< Now the phrase 'the environment' evokes in the mind of any reasonably informed person a panoply of images and adjective references such as the environmental movement, environmental issues, the environmental crisis, etc. And in hearing it, that same person will recognize that these terms are evoking something that intrinsically affects the shape of his or her life...>>* *Appleton, 2006*

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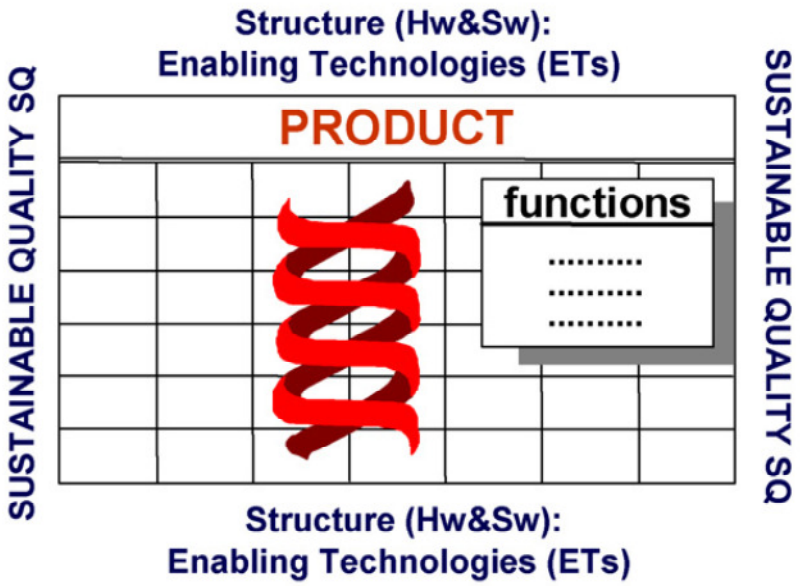
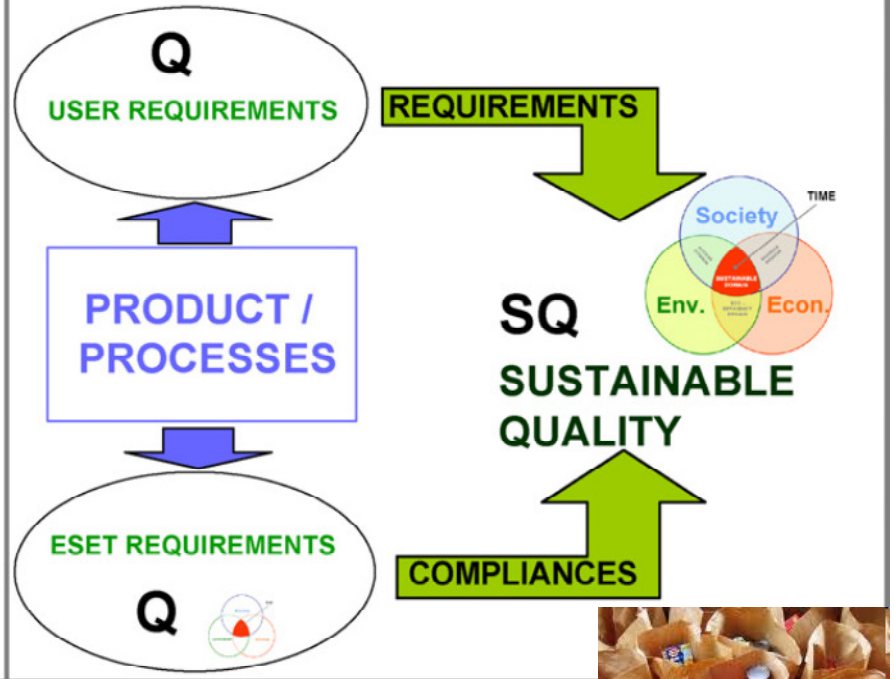
Stakeholder's responsibility

Are all the needs necessary?





FUNCTION:

the capability to satisfy needs

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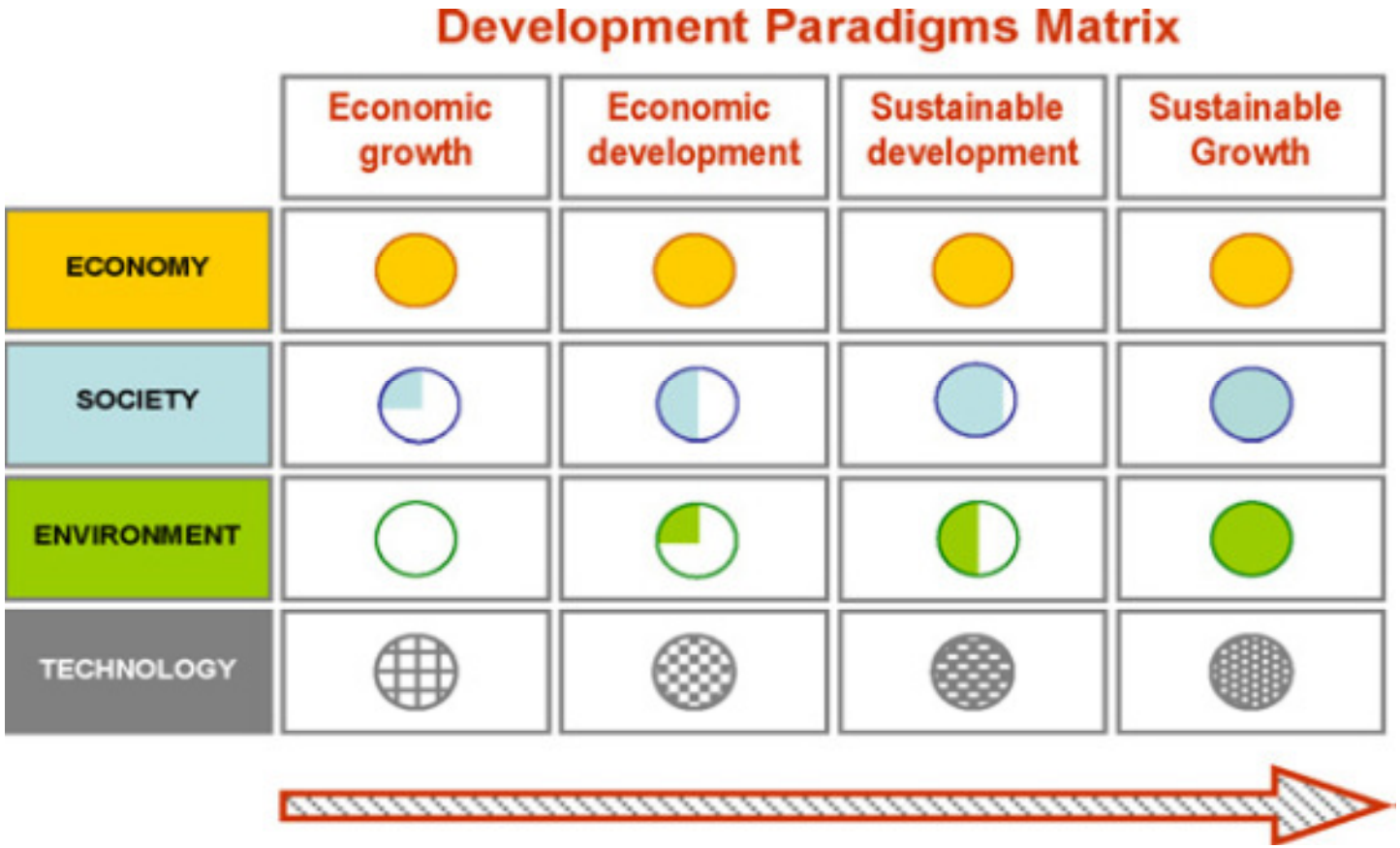
Sustainability and growth….



"sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional chang are made consistent with the future as well as present needs".

Open mind to a different view…

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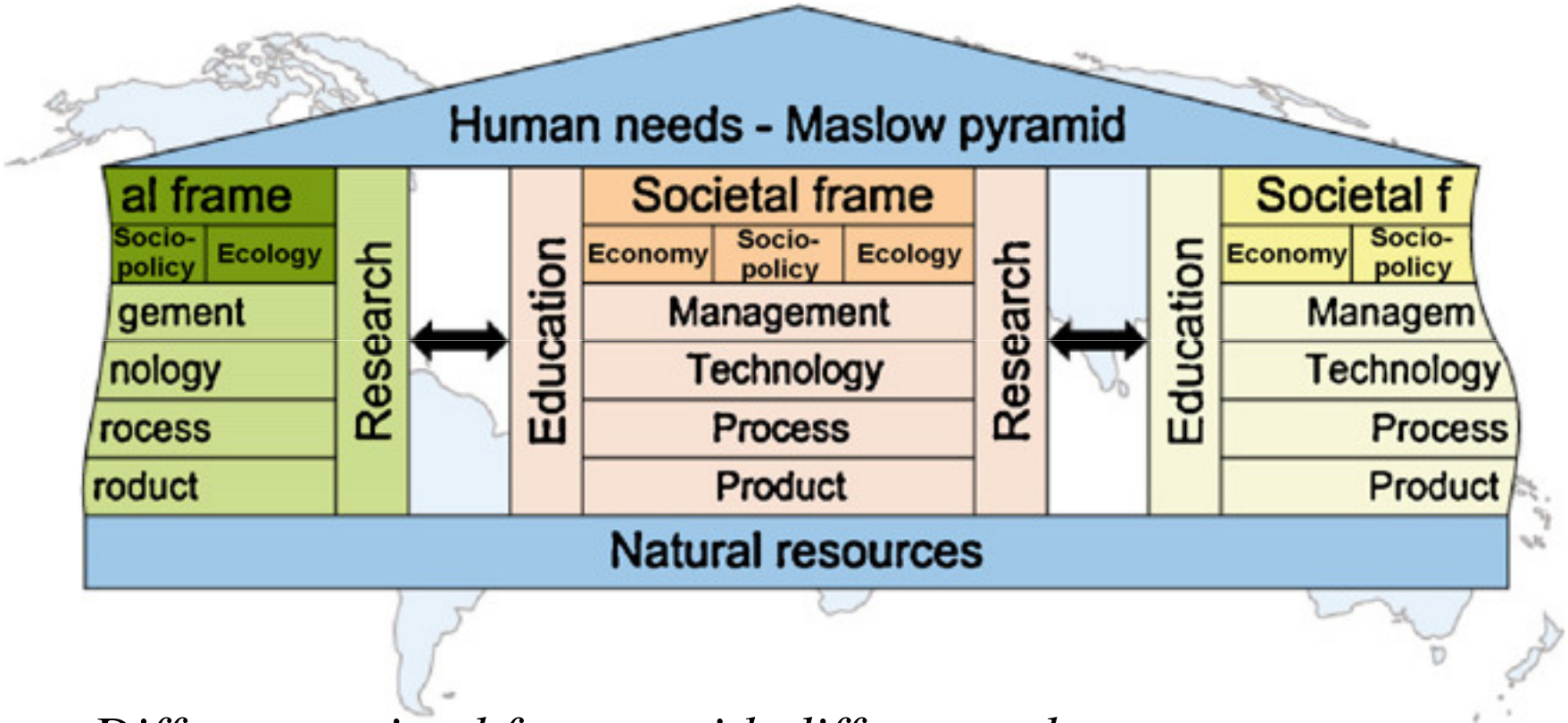
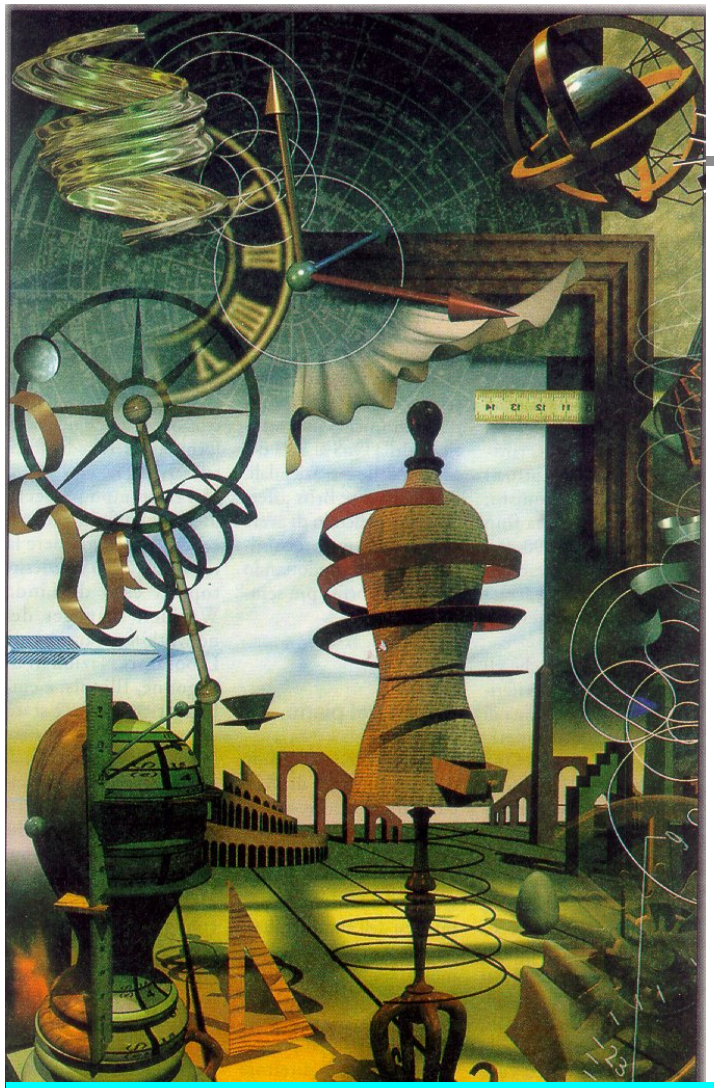


Different societal frames with different value systems – considering economic, ecological and sociopolitical issues in different regions of the globe – have to be taken into account

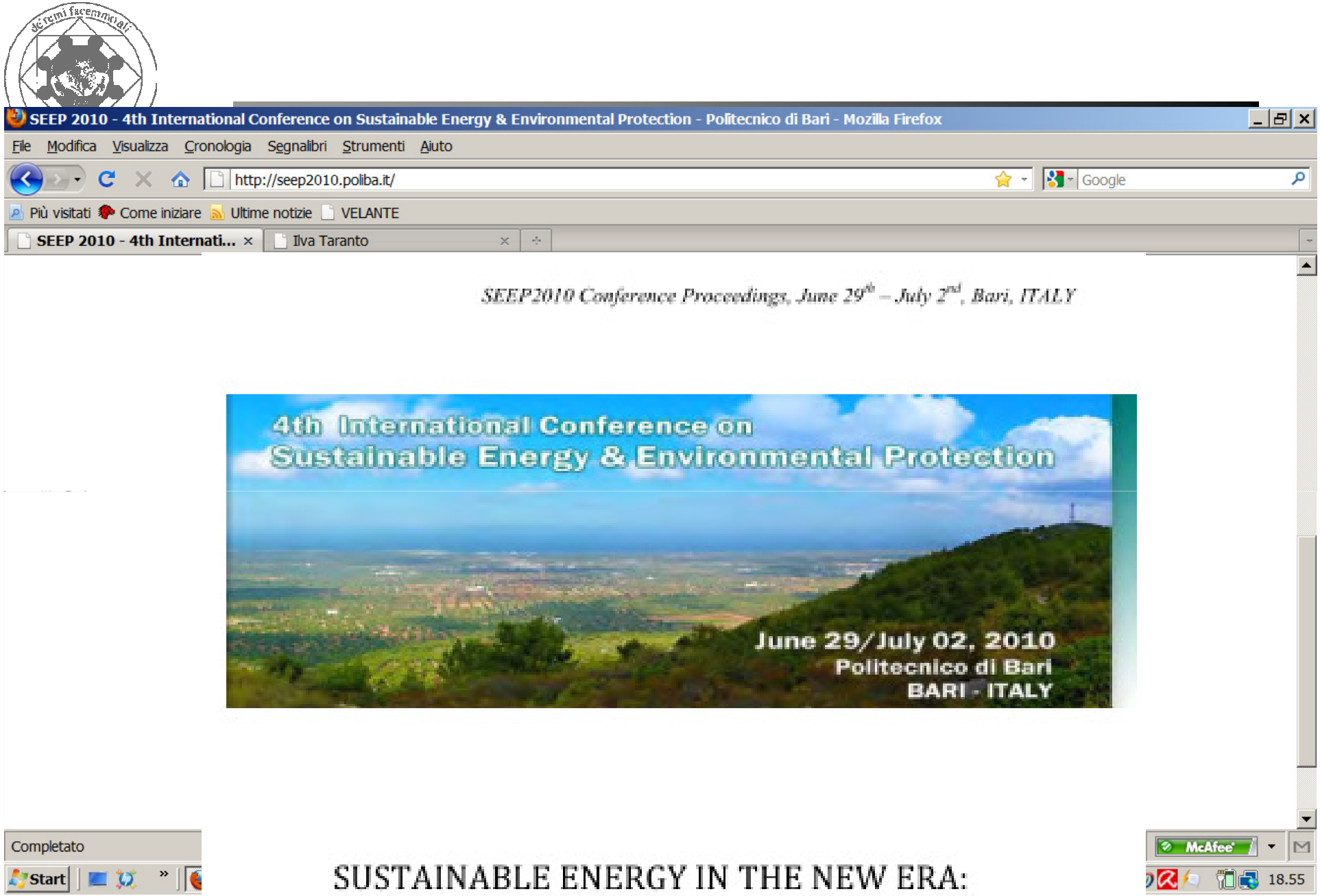


STAKEHOLDER's RENSPONSIBILITY

There is a time when we must firmly chose the course we will follow

or relentless drift of events will make decision for us

- *<< If environmental accounting works with the grain of business and business continues to encourage desecration of the planet (albeit at a reduced rate) then, ceteris paribus, we need to conclude that our environmental accounting may, perhaps, be doing more harm than good. . . .>>* *Young, 2006*



SUSTAINABLE ENERGY IN THE NEW ERA:

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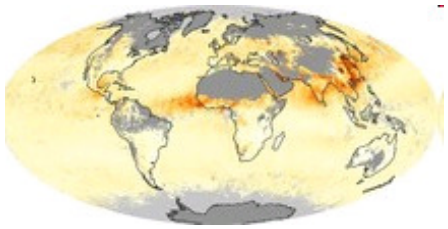
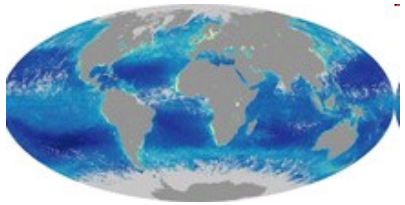
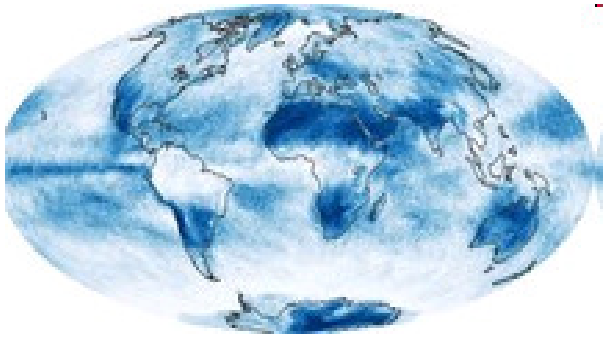
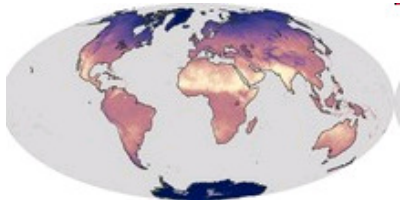
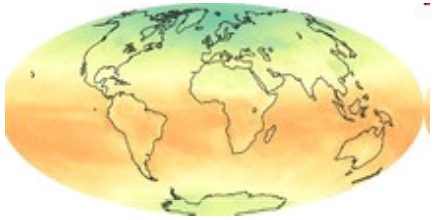
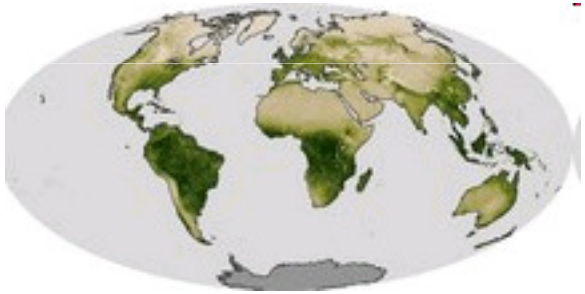
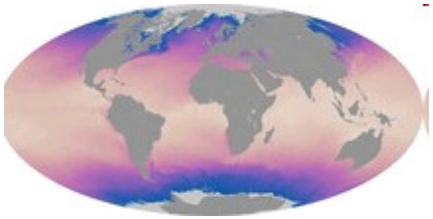
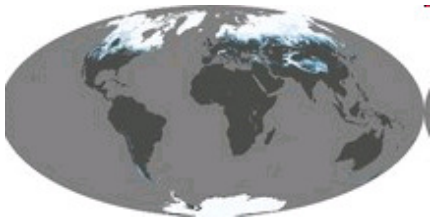
WHERE

Systemic thinking ….

http://earthobservatory.nasa.gov/GlobalMaps/

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Industrial ecology

Robert White, the former president of the US National Academy of Engineering (1994):

'the study of the flows of materials and energy in industrial and consumer activities, of the effects of these flows on the environment, and of the influences of economic, political, regulatory, and social factors on the flow, use, and transformation of resources'

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Industrial ecology

It is ecological in at least two senses :

- Industrial ecology looks to **non-human 'natural' ecosystems as models** for industrial activity.(ex. *The Industrial Symbiosis at Kalundborg:* http://indigodev.com/Kal.html)
- Industrial ecology places human technological activity in the context of the larger ecosystems that support it. This sense of 'ecological' links to questions of **carrying capacity** and **ecological resilience**, asking whether, how and to what degree technological society is perturbing or undermining the ecosystems that provide critical services to humanity.

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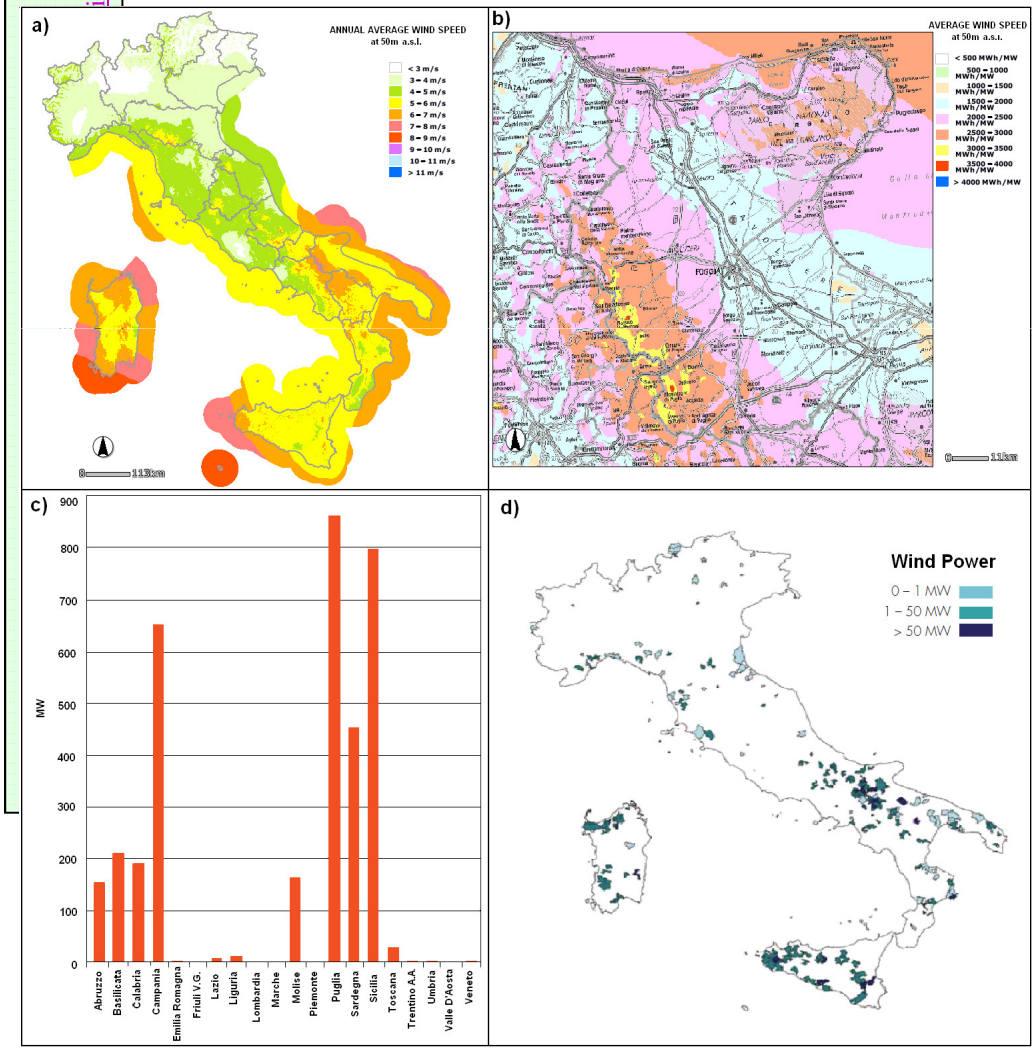
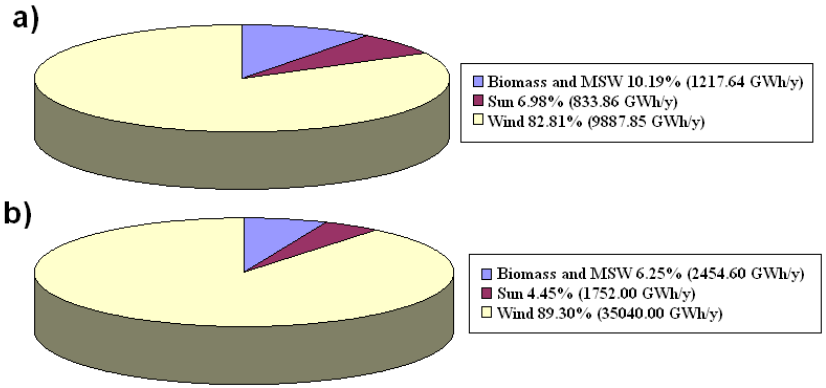


PEAR (2007), Energetic Environmental regional Plan, Italy, AFORIS



Resilience.

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The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks—in other words, stay in the same basin of attraction.

Aspects critical :

- **Latitude**: the maximum amount the system can be changed before losing its ability to recover
- **Precariousness**: the current trajectory of the system, and how close it currently is to a limit or "threshold" which, if breached, makes recovery difficult or impossible
- **Panarchy:** how the above three attributes are influenced by the states and dynamics of the (sub)systems at scales above and below the scale of interest

Networks of small enterprises

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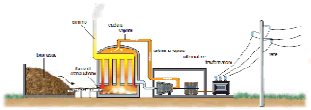
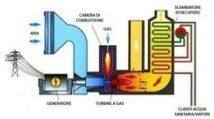
- Research
- Engineering
- Products development
- Realization
- Service
- IT e Multimedia

Photovoltaic Plants

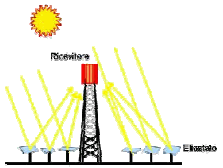
Wind Farms



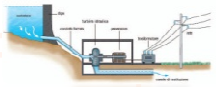
Biomass and Biogas Plants



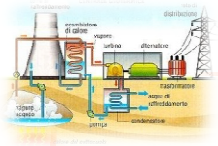
Cogeneration and Trigeneration Plants



Solar Thermal and Solar Cooling Plants



Micro-hydraulic Plants



Geothermal Plants

Hybrid Plants

KAD3 GROUP

Networks of small enterprises

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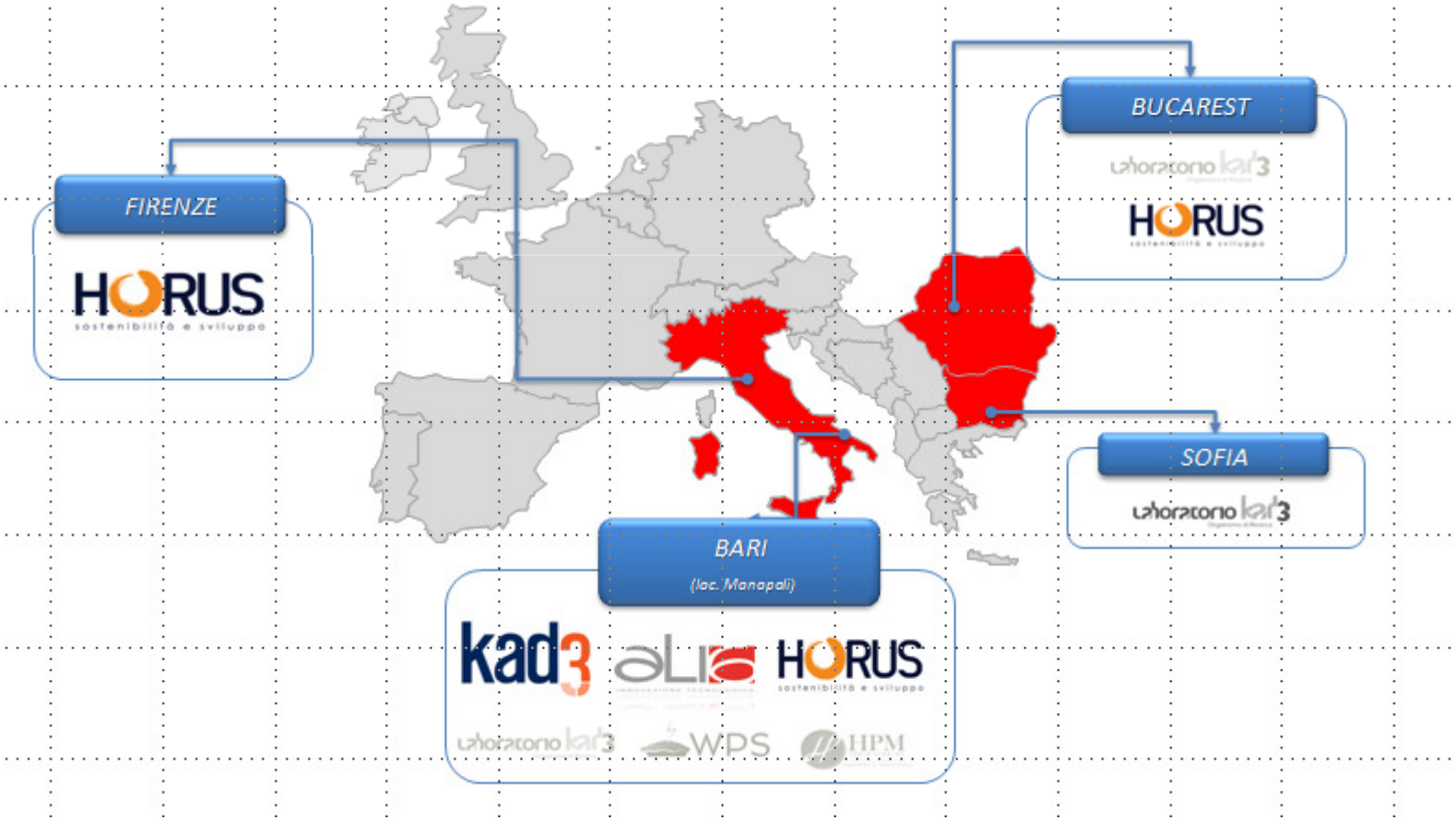

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HOW's

Number of different approaches.....

- Analyse (ORGANISATIONAL; ENVIRONMENTAL PERFORMANCE)
- Reduce (WATER; LUBRICATION; POLLUTION; WASTE; ENERGY CONSUMPTION; WASTE)
- Reuse (WASTE)
- Recycle (SYSTEMIC APPROACH)
- ReDesign (DECISION SUPPORT; GREENING PROCESS)
- Remanufacturing
- Eco-efficiency (OPTIMISE)
- Improve (MATERIALS)

- *=56/250 contribution*

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NO UNIQUE SOLUTION ⇔ NO SOLUTION?

- Can be so many solution a sign of no solutions?
- Is this a paradox?

The difficulty in finding a common roots in the frame of eco-approaches developed so far reflects the huge number of unknown potential influencing factors

- *<<In the last decade significant progress has been made in recognising and understanding the issues in sustainability. Much remains to be done because the science that underlies sustainability is still far from exact...>> Butterham, 2005*

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Green chemistry: 12 principles

- mass and energy in and outputs should be as inherently non-hazardous as possible
- prevention of waste is better than clean up
- minimize energy in separation/purification processes
- maximize mass, energy, volume and time efficiency in product/process
- output-pulled is preferred to input-pushed
- energy is main criterion for choice between recycle, reuse or disposal

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Green chemistry: 12 principles/2

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- durability must be targeted (no eternal life)
- avoid one-size-fits-all, minimize excess
- minimize material diversity in multicomponent products
- integration & interconnectivity are a way to industrial ecology
- design for performance in a commercial ‘‘after-life’’
- favour mass and energy inputs from renewable sources

REGULATION

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1

Regulations on M.S.

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Sustainability is inherently normative!

- There should be an overall goal and vision toward which policy and management programs and designs are directed.

Those environmental public goods that are defined through science and participatory decision-making processes as valuable enough to limit individual freedom of choice for sake of the common good can be influenced

EUROPE 20%

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GAS
-20%
Vs 1990

RENOVATE:
+20%

ClimateAction
Energia per un mondo che cambia

REDUCE:
-20%

After 38 years·····
-20% revolution.....
On 2020!!!!!!!!!!

http://ec.europa.eu/climateaction

U. S. A. 25%

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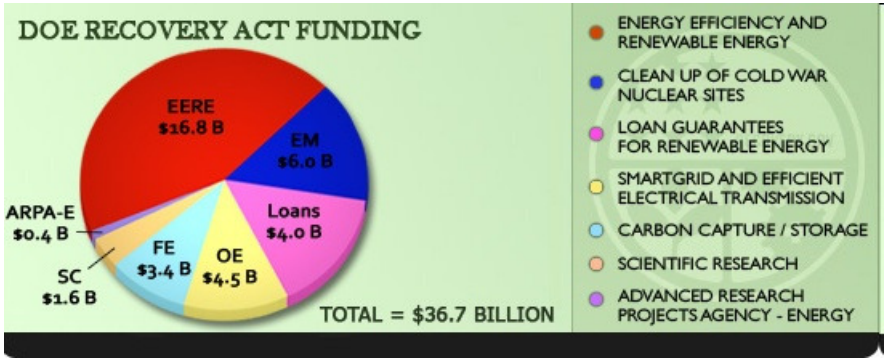

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AMERICA'S ENERGY FUTURE

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To beat EUrope for 2025!!!!!!!!!!

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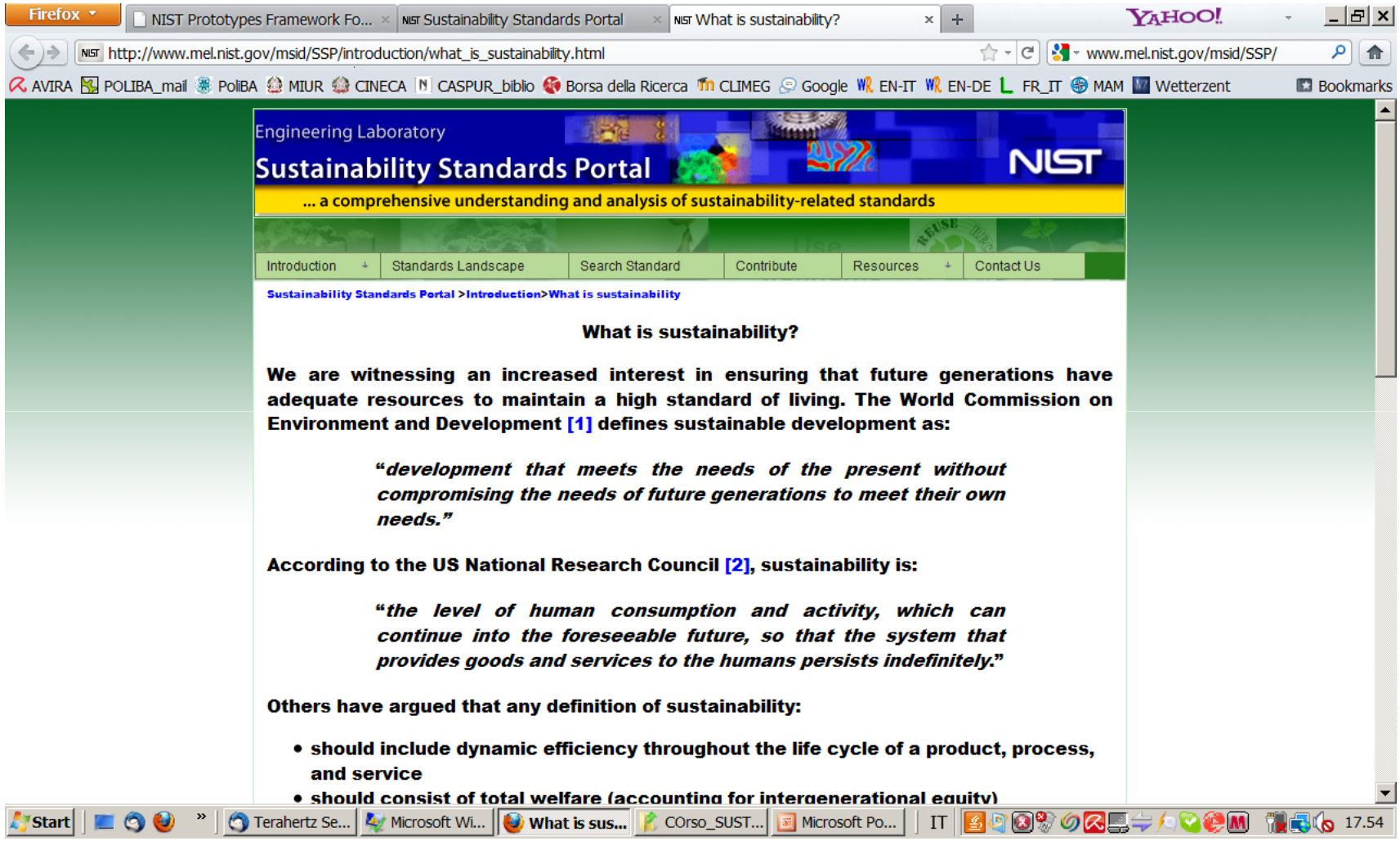
New initiatives



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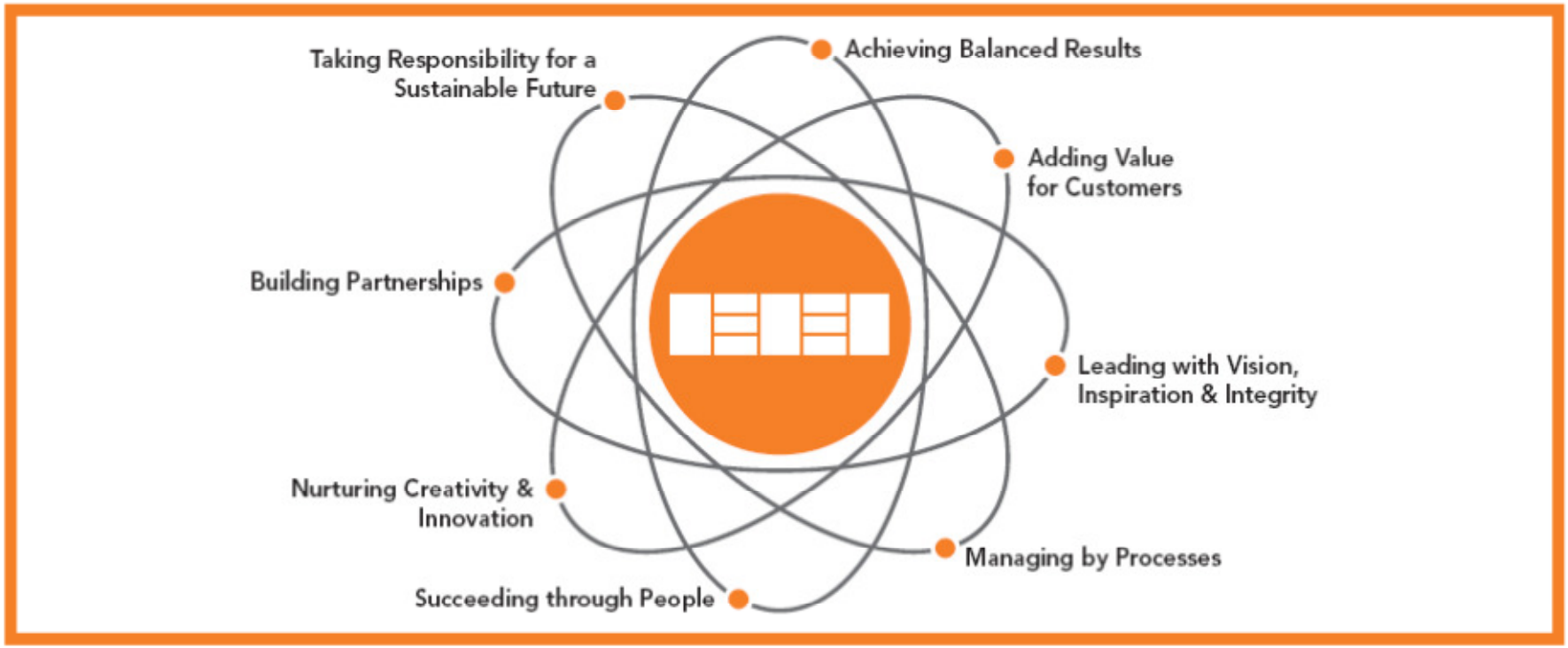

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CONCEPT	START UP	ON THE WAY	MATURE
Succeeding through People	Approaches are in place to involve people and their talents are recognised	The full potential of people is increasingly enabled, to the benefit of the people and the organisation	A culture of trust and empowerment exists and the full potential of people is released
Nurturing Creativity and Innovation	Although new ideas and innovations are sometimes encouraged, the approach to acting on them is ad hoc	Innovation is seen as essential to creating distinctive value and is increasingly evident in some aspects of the organisation	There is a systematic approach to innovation, throughout the organisation, creating distinctive value for stakeholders
Building Partnerships	A process exists for selecting and working with partners	The relationships with partners are based on shared goals and more effective ways of working	The organisation and its key partners are interdependent. A trusting relationship exists. Plans and policies are co-developed on the basis of shared knowledge
Taking Responsibility for a Sustainable Future	Legal and regulatory requirements are understood and met	The organisation's approaches positively support the aims of economic, social and ecological sustainability	Sustainable corporate behaviour is an integral part of the organisation's purpose. Societal expectations are measured and actioned

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	1					2				3					4					5					6		7		8		9	
Criterion	Leadership					Strategy				People					Partnerships & Resources					Processes, Products and Services					Customer Results		People Results		Society Results		Key Results	
Sub-Criterion	A	B	C	D	E	A	B	C	D	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	A	B	A	B	A	B
Achieving Balanced Results		X	X			X		X	X							X	x		X						X	X	X	X	X	X	X	X
Adding Value for Customers			X				X														X	X	X	X	X	X		x				
Leading with Vision, Inspiration and Integrity	X			X	X			X					X														X		X			X
Managing by Process		X					x		X			X				X	x	x	X	X		x				X		x		x		X
Succeeding through People	X			X						X	X	X	x	X													X	X	x			
Nurturing Creativity & Innovation			X				x		X			X						X	X	X	X					X		x	X	x	X	x	X
Building Partnerships			X			x	x								X							x				x	X	x	X	x	X	x	X
Taking Responsibility for a Sustainable Future	X	X	X		X	x	x	X					X	X			X				x		X	x			x		X	X	x	

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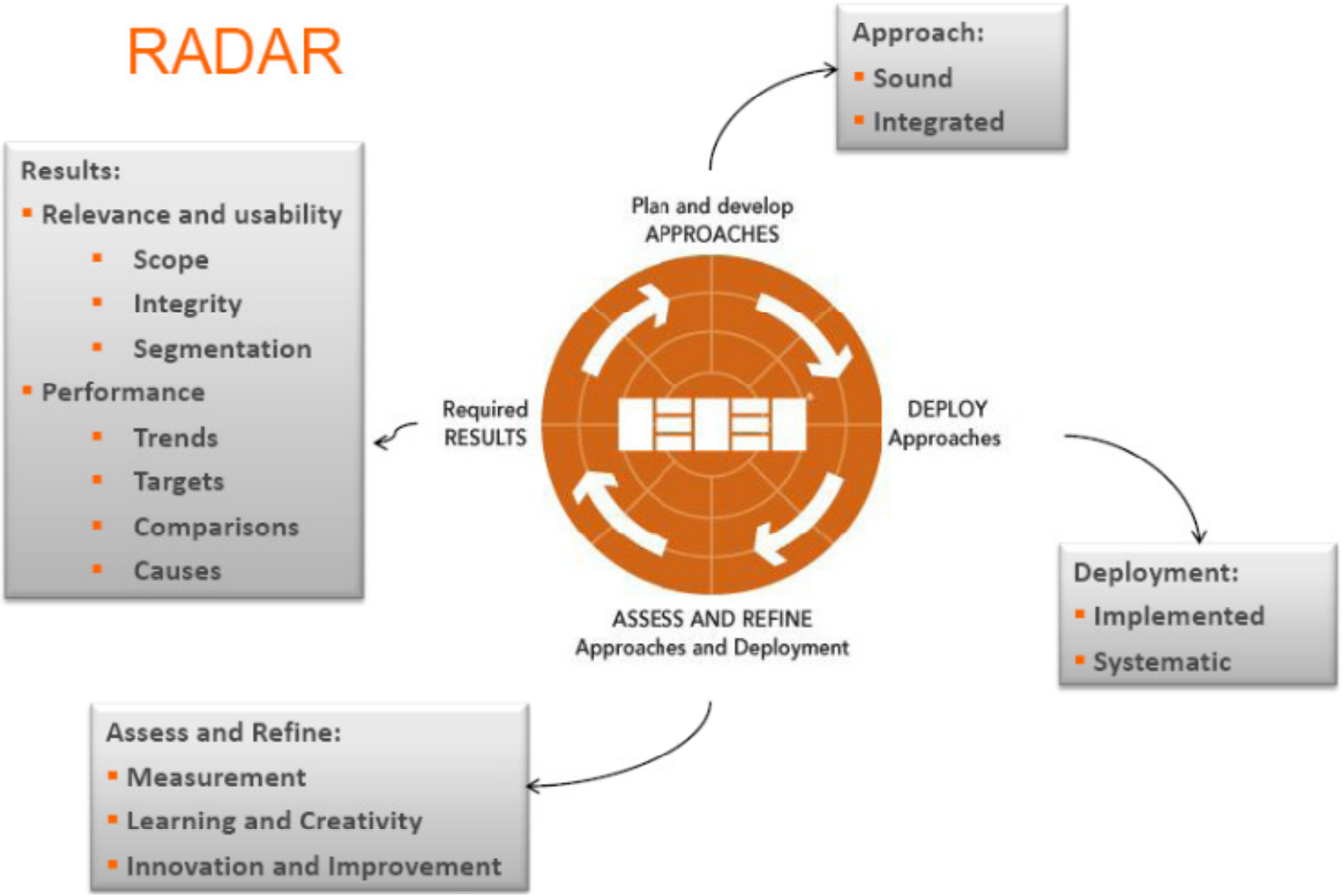
RADAR



Total Quality & Environmental Mgmt

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Total Quality Management (TQM) is widely recognized as an effective strategy for improving corporate performance. The basic elements of TQM are as follows:

- Primacy of the customer
- Measurement systems that provide continuous feedback
- More extensive use of external information (benchmarking)
- * A focus on processes rather than departments or events
- Strong emphasis on training
- Extensive use of teams
- Suggestions systems designed to promote continuous improvement
- A robust program of recognition and reward
- CEO commitment and involvement

Total Quality & Environmental Mgmt

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Environmental issues are increasingly seen as an integral component of continuous improvement in both the corporate and environmental fields.

This has lead to a movement called Total Quality Environmental Management (TQEM).

TQEM extends traditional quality tenets to the management of corporate environmental matters as well as those of process efficiency and product performance.

TQEM: Performance Measures: Environmental Metrics

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The progress of design projects should be clearly assessed with appropriate measures to help members of the design team achieve environmental goals. Consistent measures of impact reduction in all phases of design provide valuable information for design analysis and decision making.

It **is** important to establish measures that cover resource efficiency, waste generation in all media, ecosystem sustainability, and human health.

Life cycle design is likely to be more successful when environmental aspects are part of a firm's incentive and reward system.

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Human principles

2

The Natural step: a framework

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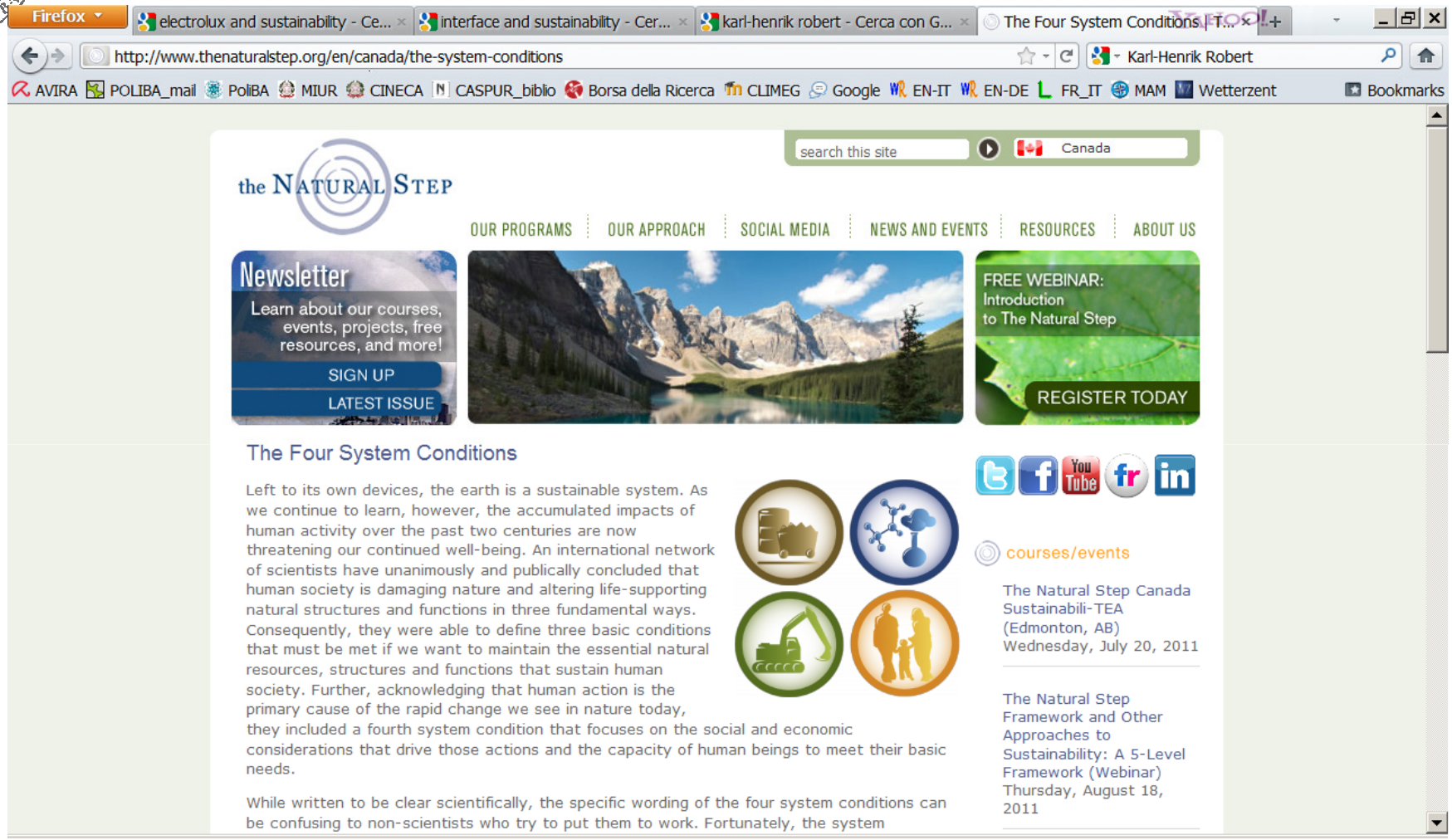

Karl-Henrik Robèrt, M.D., Ph.D. (born 1947), is one of Sweden's leading cancer scientists and an important figure in the worldwide sustainability movement.

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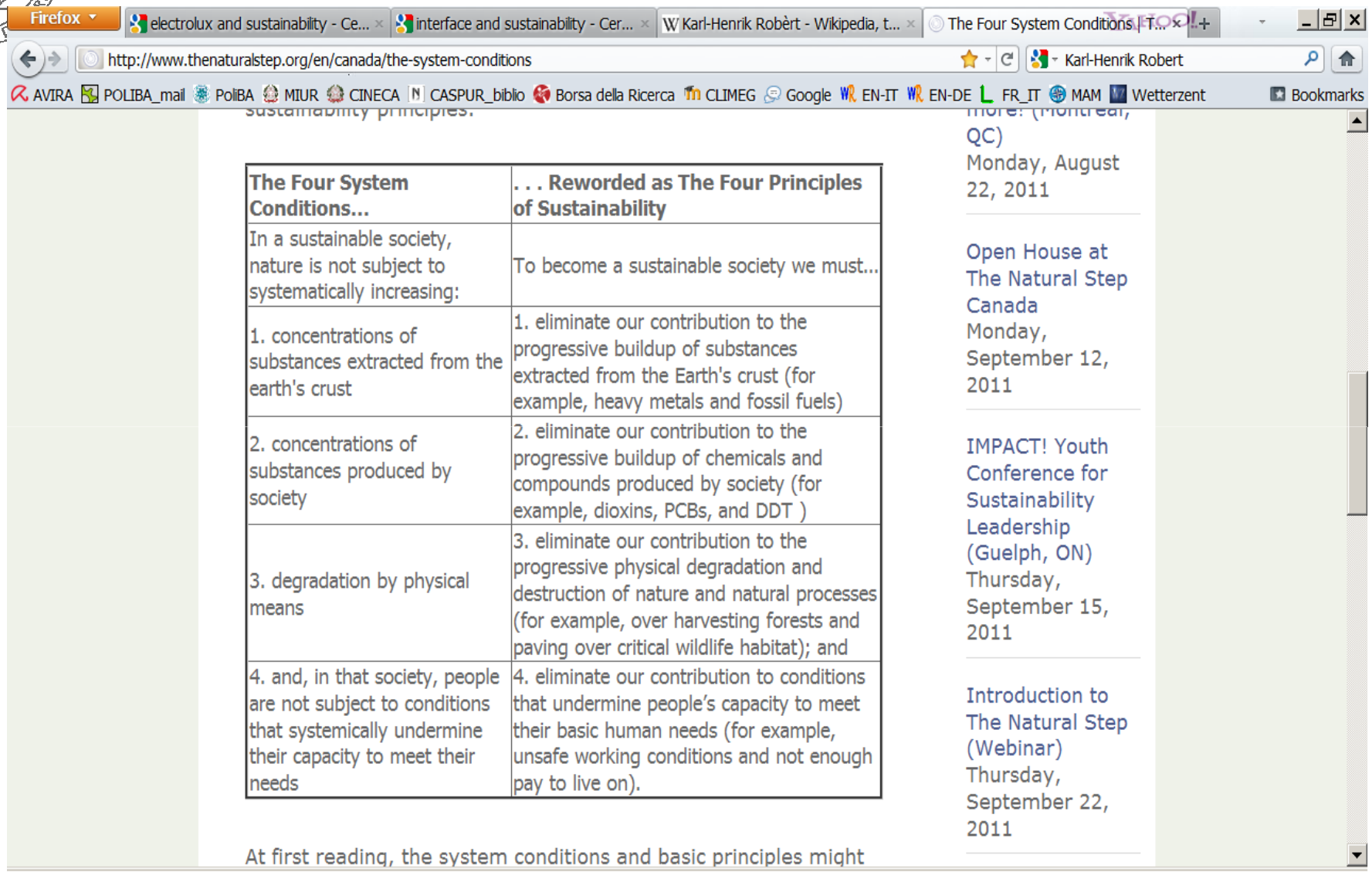
The Natural step framework



sustainability principles.

The Four System Conditions...	. . . Reworded as The Four Principles of Sustainability
In a sustainable society, nature is not subject to systematically increasing:	To become a sustainable society we must...
1. concentrations of substances extracted from the earth's crust	1. eliminate our contribution to the progressive buildup of substances extracted from the Earth's crust (for example, heavy metals and fossil fuels)
2. concentrations of substances produced by society	2. eliminate our contribution to the progressive buildup of chemicals and compounds produced by society (for example, dioxins, PCBs, and DDT)
3. degradation by physical means	3. eliminate our contribution to the progressive physical degradation and destruction of nature and natural processes (for example, over harvesting forests and paving over critical wildlife habitat); and
4. and, in that society, people are not subject to conditions that systemically undermine their capacity to meet their needs	4. eliminate our contribution to conditions that undermine people's capacity to meet their basic human needs (for example, unsafe working conditions and not enough pay to live on).

At first reading, the system conditions and basic principles might

more! (Montreal, QC)
Monday, August 22, 2011

Open House at The Natural Step Canada
Monday, September 12, 2011

IMPACT! Youth Conference for Sustainability Leadership (Guelph, ON)
Thursday, September 15, 2011

Introduction to The Natural Step (Webinar)
Thursday, September 22, 2011

Finitedness of resources

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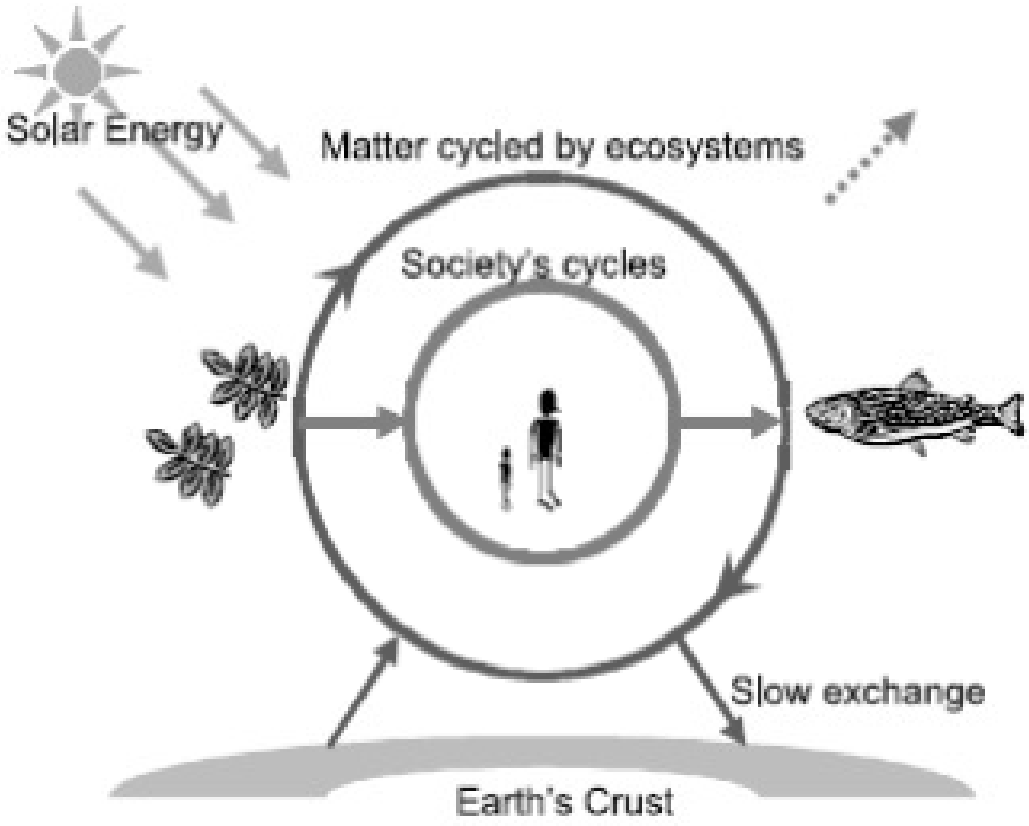

Fig. 2. The TNS systems model of resource cycles.

TNS framework

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Fundamental human needs that are consistent across time and cultures:

1.subsistence, 2.protection, 3.affection, 4.understanding, 5. participation,

6. leisure, 7.creation, 8.identity, 9.freedom.

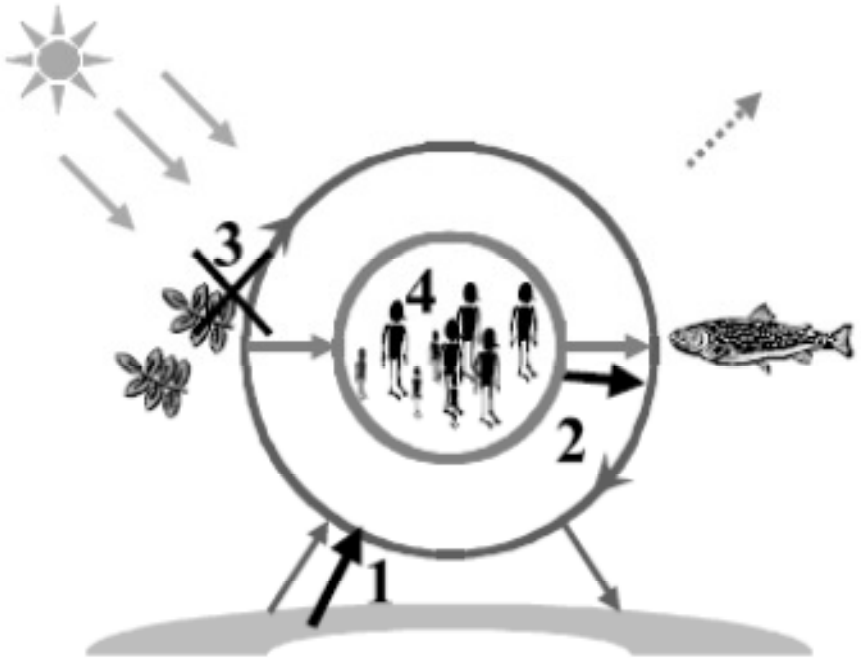
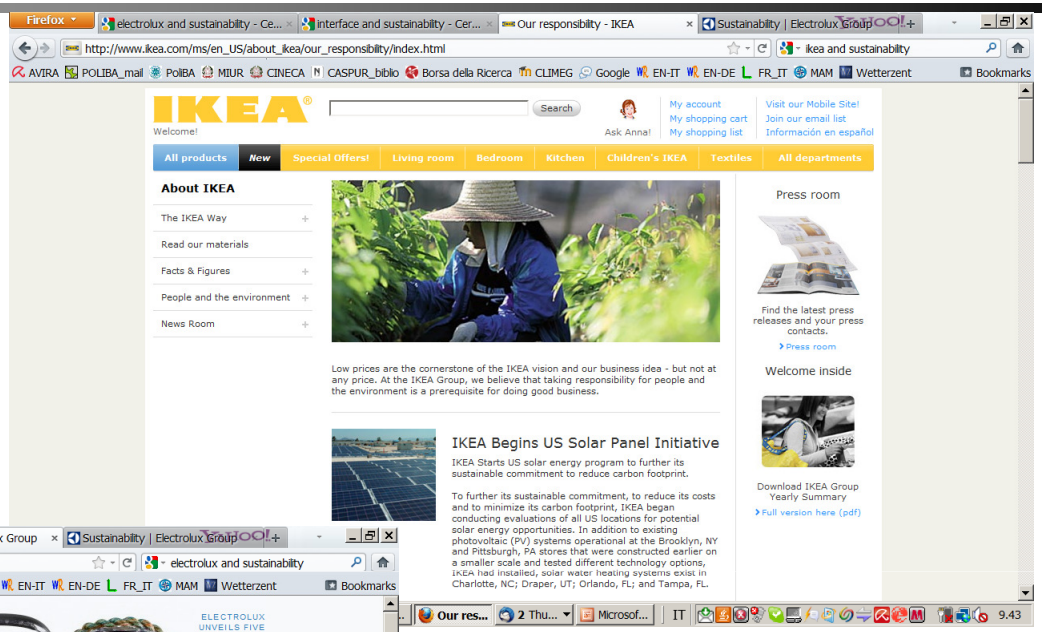
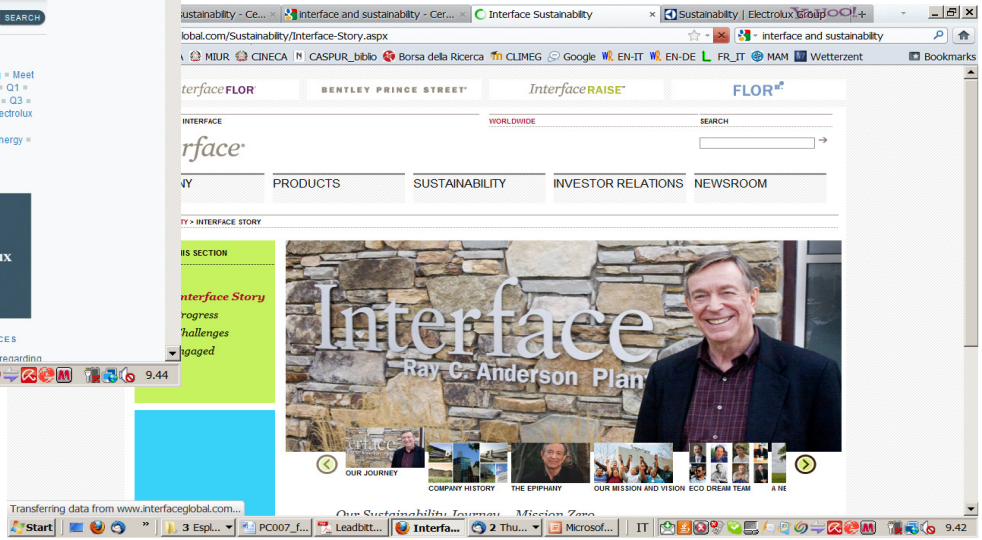


Fig. 3. The four TNS system conditions.

The Natural step: the brave companies





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TNS: The case of PVC production

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No.1: The industry should commit itself long-term to becoming carbon-neutral

- Achieve major improvements in energy efficiency in manufacturing plants
- Improve generation efficiency, for example by increased use of Combine Heat and Power systems
- Develop programmes for a progressive increase in the use of renewable energy sources for generation of electricity
- Set targets for substantial reductions in transport energy use by improved efficiency, backloading, rationalisation and selection of optimum mode
- Analyse the feasibility and carry out a life-cycle analysis (LCA) of changing feedstocks from hydrocarbons to biomass or other sources

TNS: The case of PVC production

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- Set targets for substantial reductions in transport energy use by improved efficiency, backloading, rationalisation and selection of optimum mode
- Analyse the feasibility and carry out a life-cycle analysis (LCA) of changing feedstocks from hydrocarbons to biomass or other sources
- Develop co-operative programmes to substantially increase the recycling of waste products including a major effort to work with other agencies and users
- Agree specific targets for adopting carbon sequestration schemes

TNS: The case of PVC production

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No.2: The industry should commit itself long term to a closed-loop system of PVC waste management

Design for recycling

- Enhance joint efforts with stakeholders to increase the amount of recycling and reuse of PVC
- Set specific targets for the above increasing progressively over time
- Continue investigations into the potential toxicity problems arising from PVC in landfill and, where required, ban substances from landfill
- Analyse the sustainability implications of the extent of continued use of landfill and alternative waste disposal routes, including incineration
- Develop the pilot plant for PVC feedstock recycling to full-scale production

TNS: The case of PVC production

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No.3: The industry should commit itself long-term to ensuring that releases of persistent organic compounds from the whole life-cycle do not result in systematic increases in concentration in nature.

- Identify sources and emission/leakage levels of persistent organic pollutants across the whole life-cycle
- Define mechanisms for achieving emissions to a level that results in no systematic accumulation in nature
- Refrigerants and fire fighting chemicals
- Mercury emissions

TNS: The case of PVC production

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No.4: The industry should review the use of all additives consistent with attaining full sustainability, and especially commit to phasing out all persistent compounds foreign to nature, as well as chemicals for which there is reasonable doubt regarding toxic effects.

- determine in which applications it would be prudent to review the use of plasticised PVC, and other potentially problematic additives
- where there is reasonable doubt about the safety of phthalates, research alternative plasticisers and other additives that do not result in systematic accumulation in nature or toxic effects. It is important to note that alternatives should not be assumed to be more sustainable than known problematic substances in the absence of a sustainability analysis.

TNS: The case of PVC production

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No.5: The industry should commit to the raising of awareness about sustainable development across the industry, and the inclusion of all participants in its achievement.

- Engaging stakeholders *(setting priorities with main interest groups)*
- Socially beneficial products *(Future attention to products in the market will also be measured by their social contribution to society)*

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Product design criteria

3

ACT: what will be done?

- As a consequence, long before devoting efforts in eco-design, the first questions should be if we need those functions we are asking from products; then to search the best way to design it and manufacture under the sustainable capabilities constraints.

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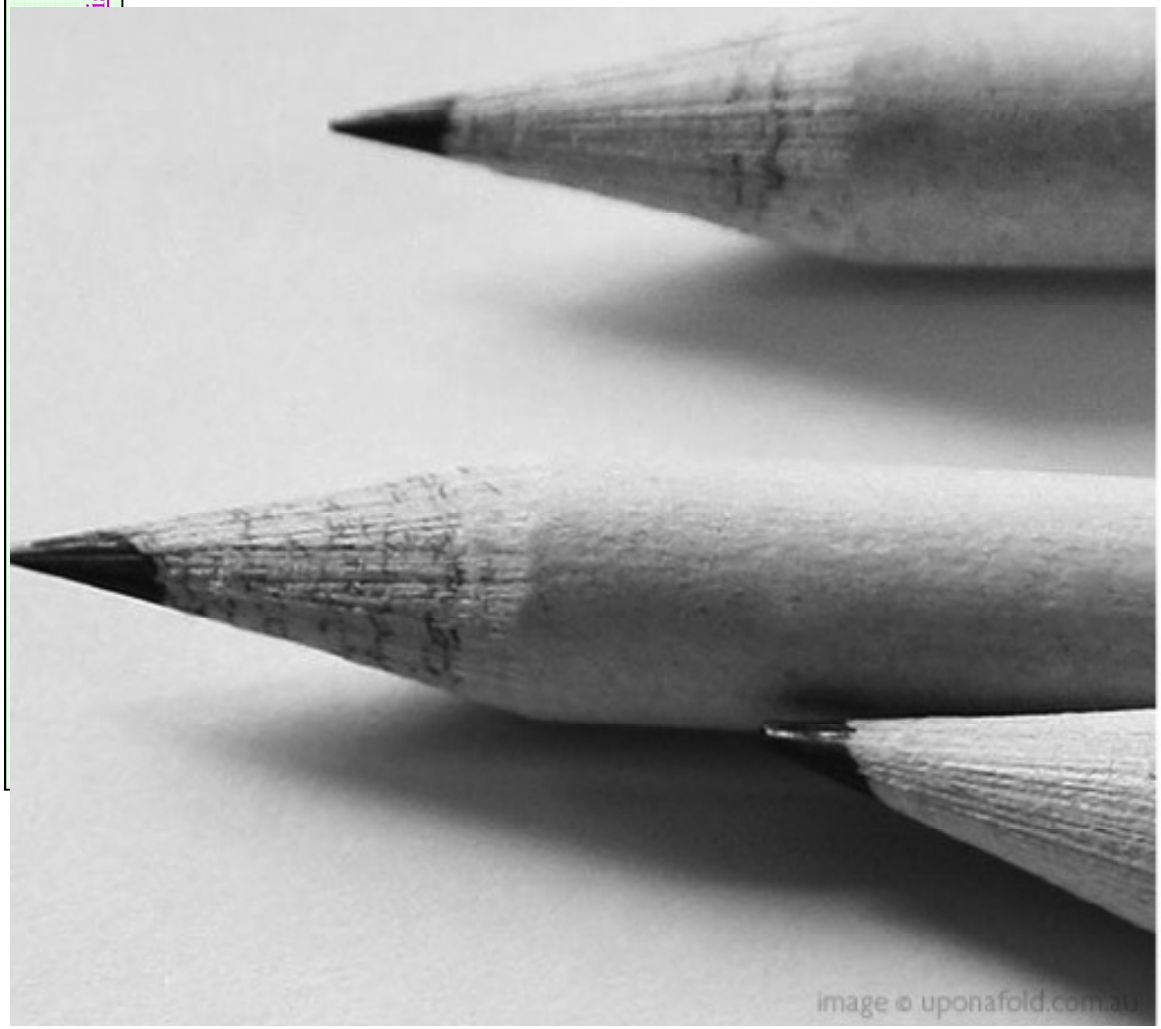
- *<< Eco-redesigns (E-) consist of short-term, low-functional-change...*
- *Eco-innovations (E+) are a longer-term, high-functional change group of approaches that focus on reinventing...*
- *Sustainable technology innovations (E++) utilize emerging/ unproven technology to provide customer benefits ...>>* *Appleton, 2006*

SEEP 2010

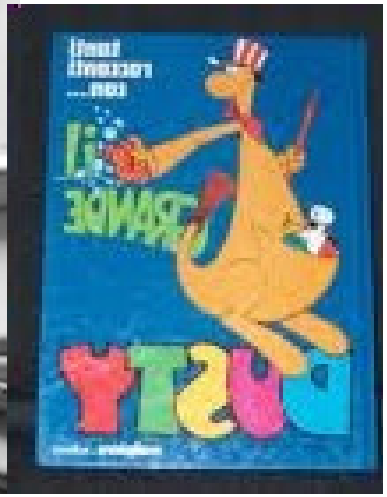
The infinite cycle of materials

4th International Conference on
Sustainable Energy & Environmental Protection

June 29/July 02, 2010
Politecnico di Bari, BARI - ITALY



"Stop Global Warming" paper pencils set .....



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Misapor [16] is produced from recycled glass and pure mineral additives in a thermal process: this is a 100% natural material

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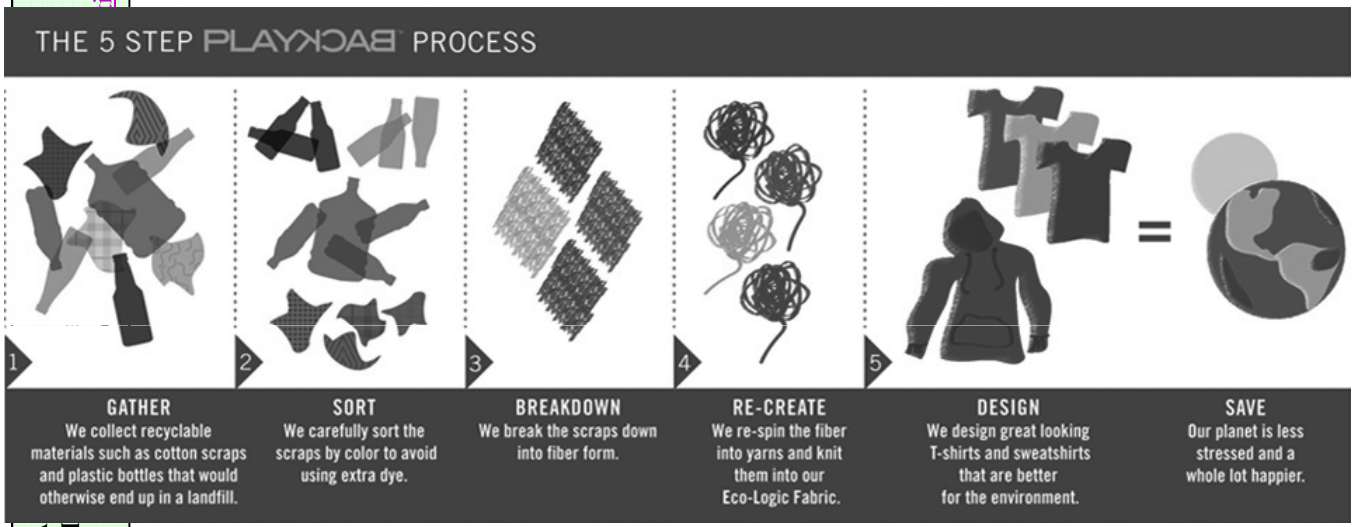
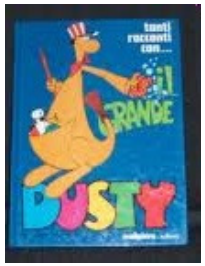


Plastic shirt?
SI GRAZIE

From sewage……



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PRODUCT-SERVICE SYSTEMS:

"A marketable set of products and services capable of jointly fulfilling a user's need.

The product/service ratio in this set can vary, either in terms of function fulfillment or economic value"

Fig. 3 Iceberg model of service business

Lee,2011

PSS:to understand!

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Designed and marketed to provide customers with a particular result or function—clean clothes, mobility, warmth, etc.—without them necessarily having to own or buy physical products

Behavioural change!

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FUNCTION:

i.e. the capability to satisfy needs

- Manufacture a good: Are all its functions necessary?

- Volume
- Insulate
- Glossy aspect
- Hygenic
- Non-toxic
- Easy to handle
- "Sip oriented"
- ……

PSS:good rules!

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- the sale of the use of the product instead of the product itself;
- the change to a 'leasing society'
- the substitution of goods by means of service machines
- a repair-society instead of a throw-away society
- the change in consumer attitudes from sales to service orientation.

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Closed loop manufacturing!

As for the products, Yoshikawa states that

- what people value is not a product itself, but its functionality;
- functionality of a product is service embedded in the product. (People receive the service someone embedded in the product when they use the product);
- latent functionality appears as service when the product is used;
- functionality of a product decreases when it is used. Functionality = SUM services (life of a product terminates when services embedded are exhausted).

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From “Customer’s attribute” to “Functional Requirements” to “Design Parameters” to “Process Variables”

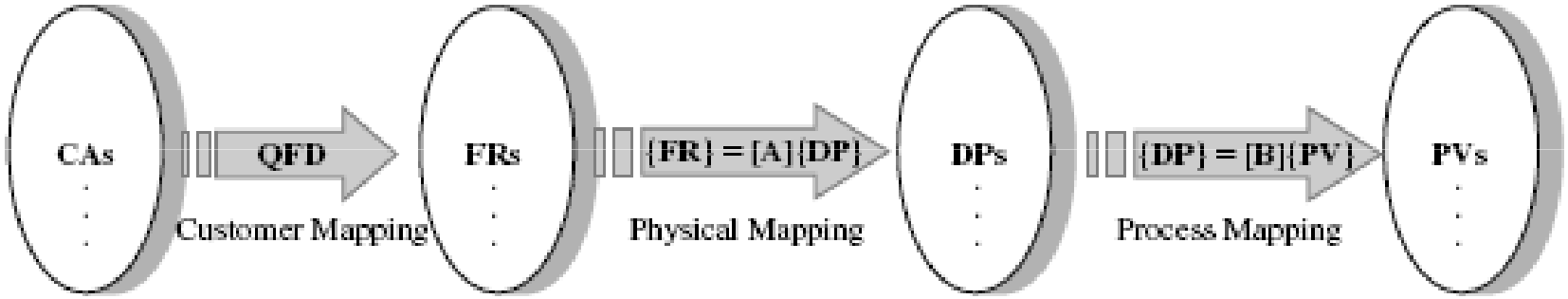

Figure 1.1 Design mapping process.

Acclaro DFSS Light®, a limited version of Acclaro Designer® software provided by Axiomatic Design Solutions, Inc., via free download from the Wiley ftp site *ftp://ftp.wiley.com/public/sci tech med/axiomatic quality/*

Axiomatic Quality

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Figure P.1 Axiomatic quality ingredients.

Starting with the voice of the customer, axiomatic quality focuses on establishing a ***comprehensive design process*** *that utilizes ingredients of Axiomatic Design, Robust Design and Design for Six Sigma from comparative tools: quality engineering, axiomatic design, theory of inventive problem solving, deterministic optimization, and in the absence of quantitative data, fuzzy set theory.*

Coupling /incoupling desing: how to arrange sustianable constraints

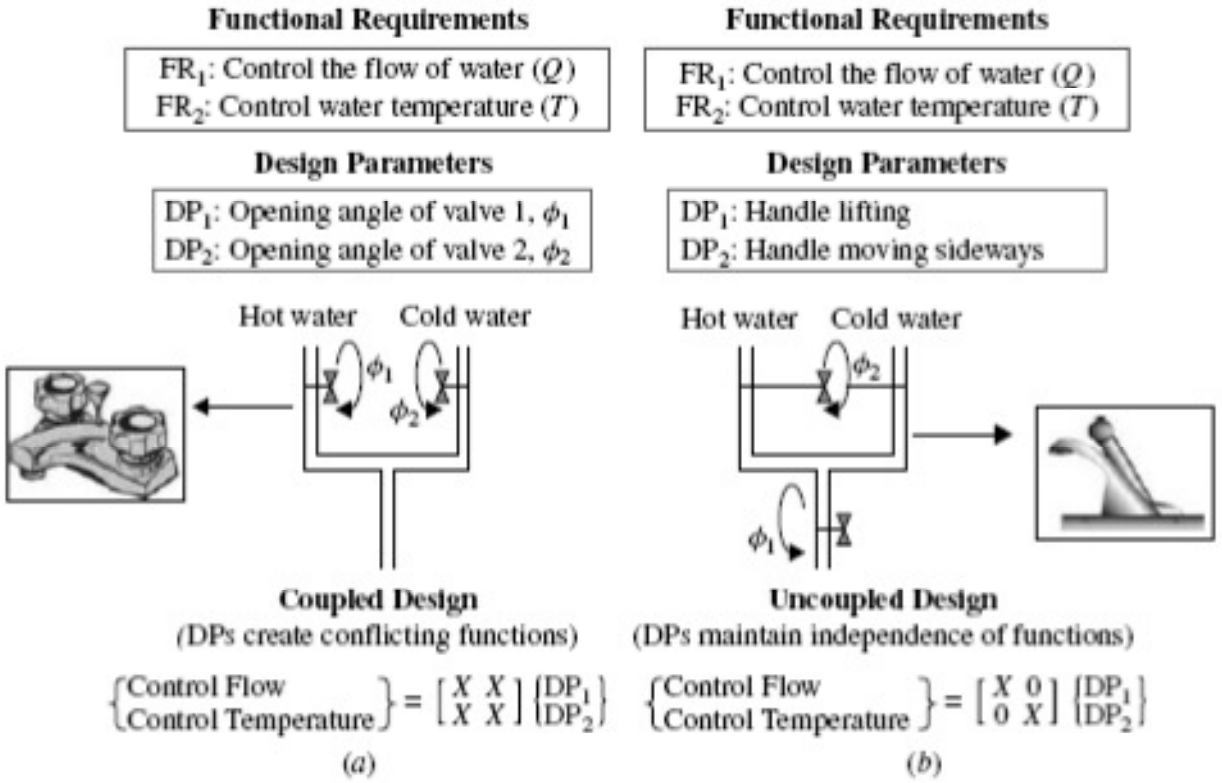

Figure 1.3 Faucet coupling example.

El-Haik, Basem. Axiomatic quality: integrating axiomatic design with six-sigma, reliability, and quality engineering / by Basem Said El-Haik. p. cm. "Wiley-Interscience publication." Includes bibliographical references and index. ISBN 0-471-68273-X (cloth : alk. paper)

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Life-cycle perspective

4

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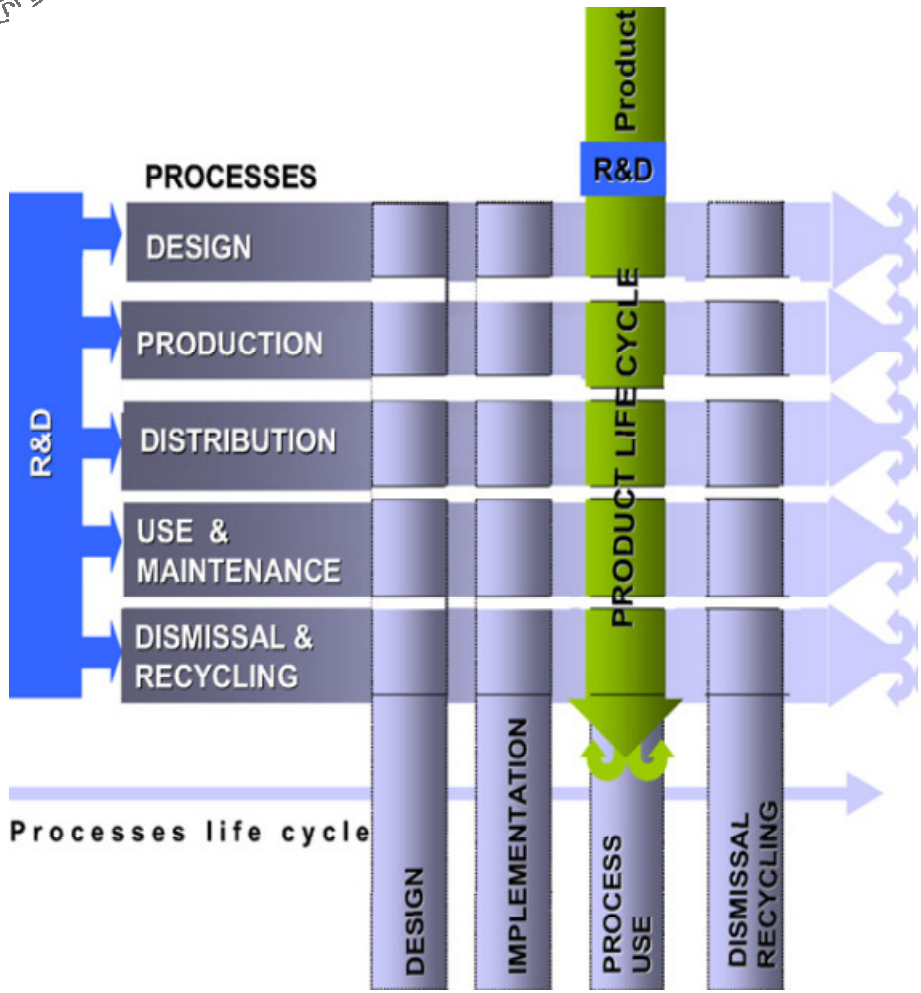
Life cycle approach



•Processes must be designed and operated so that wastes and ecologically incompatible by-products are continuously reduced, eliminated or recycled on-site;

• chemical substances or physical agents and conditions that present hazards to human health or the environment are continuously eliminated;

• energy and materials are conserved, and the forms of energy and materials used are most appropriate for the desired ends;

• work spaces are designed to continuously minimize or eliminate chemical,ergonomic and physical hazards.

Jovane,2008

LCA: the third tool

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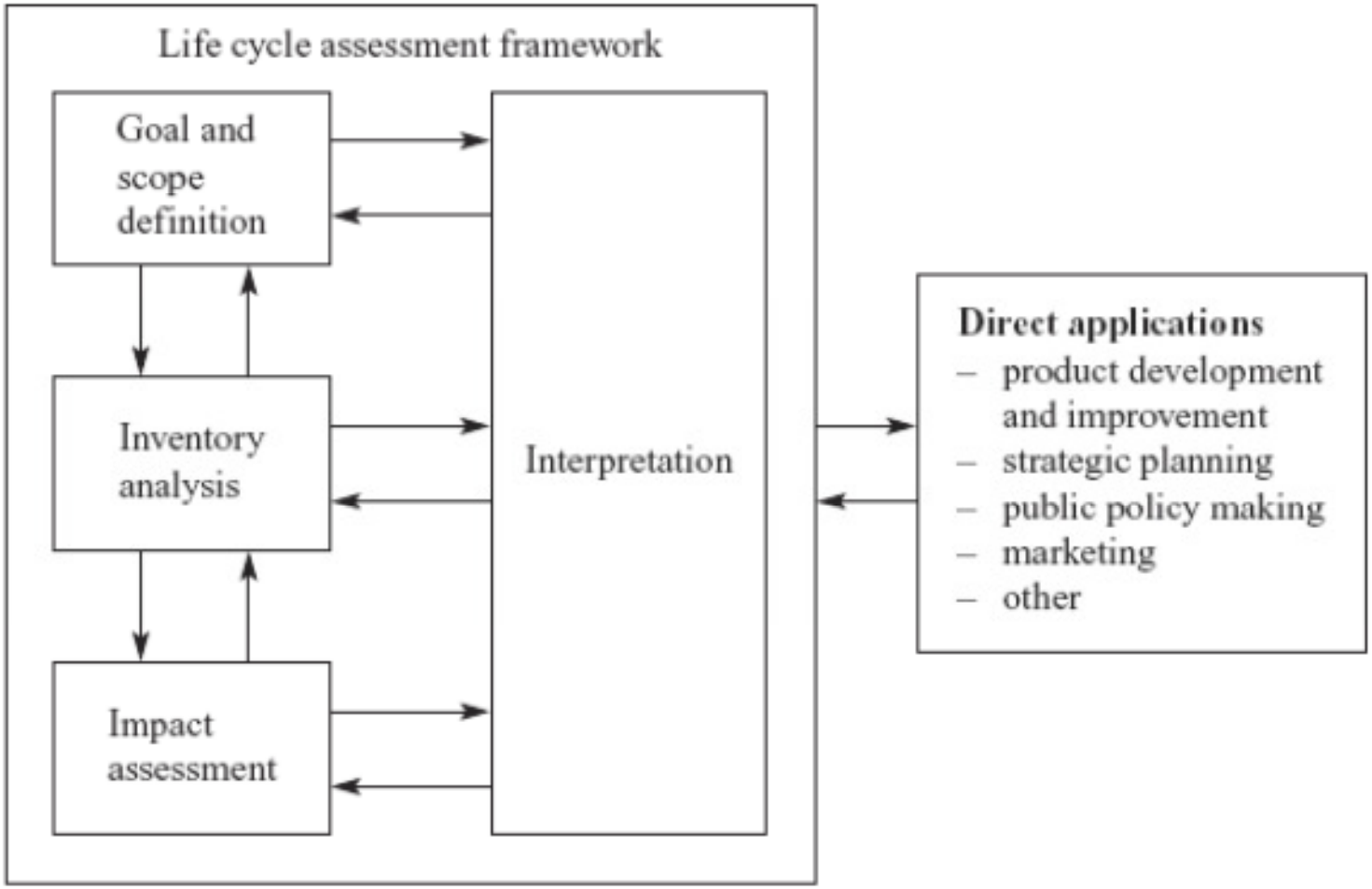

Source: ISO (1996).

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System boundaries

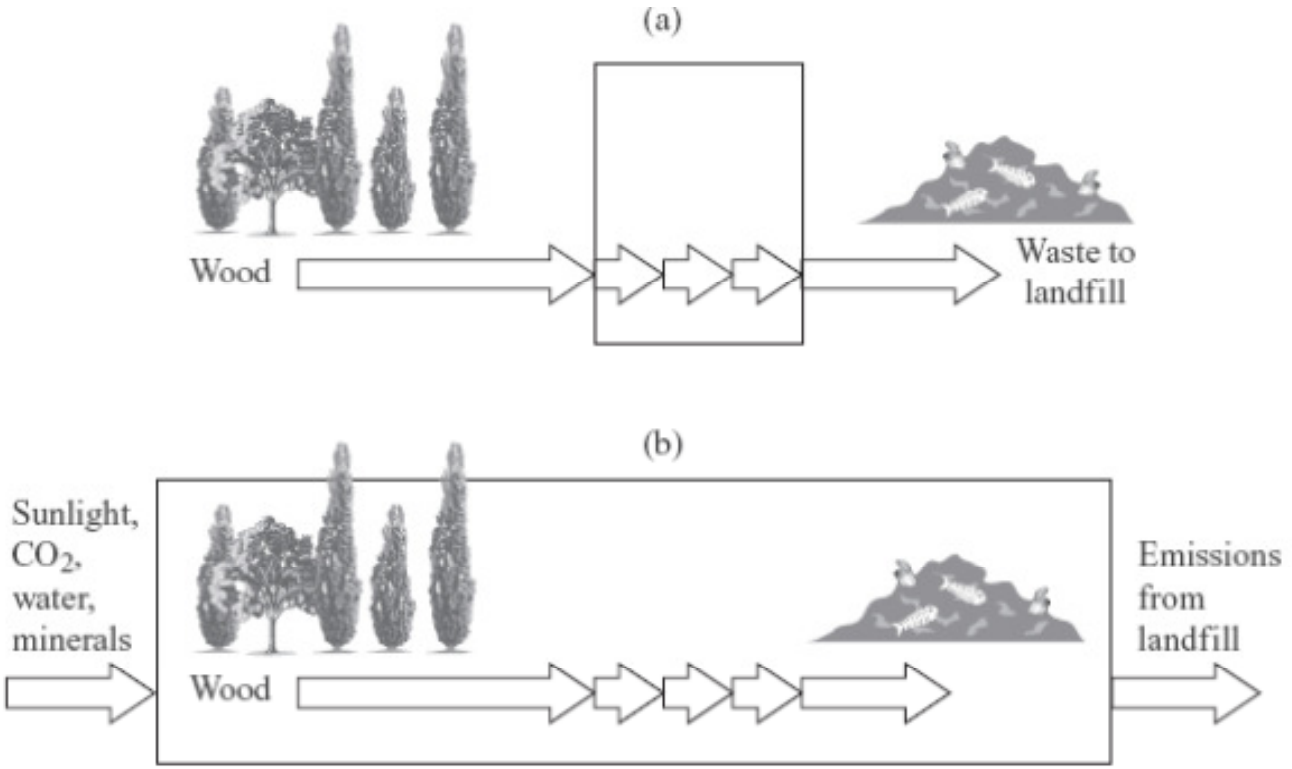
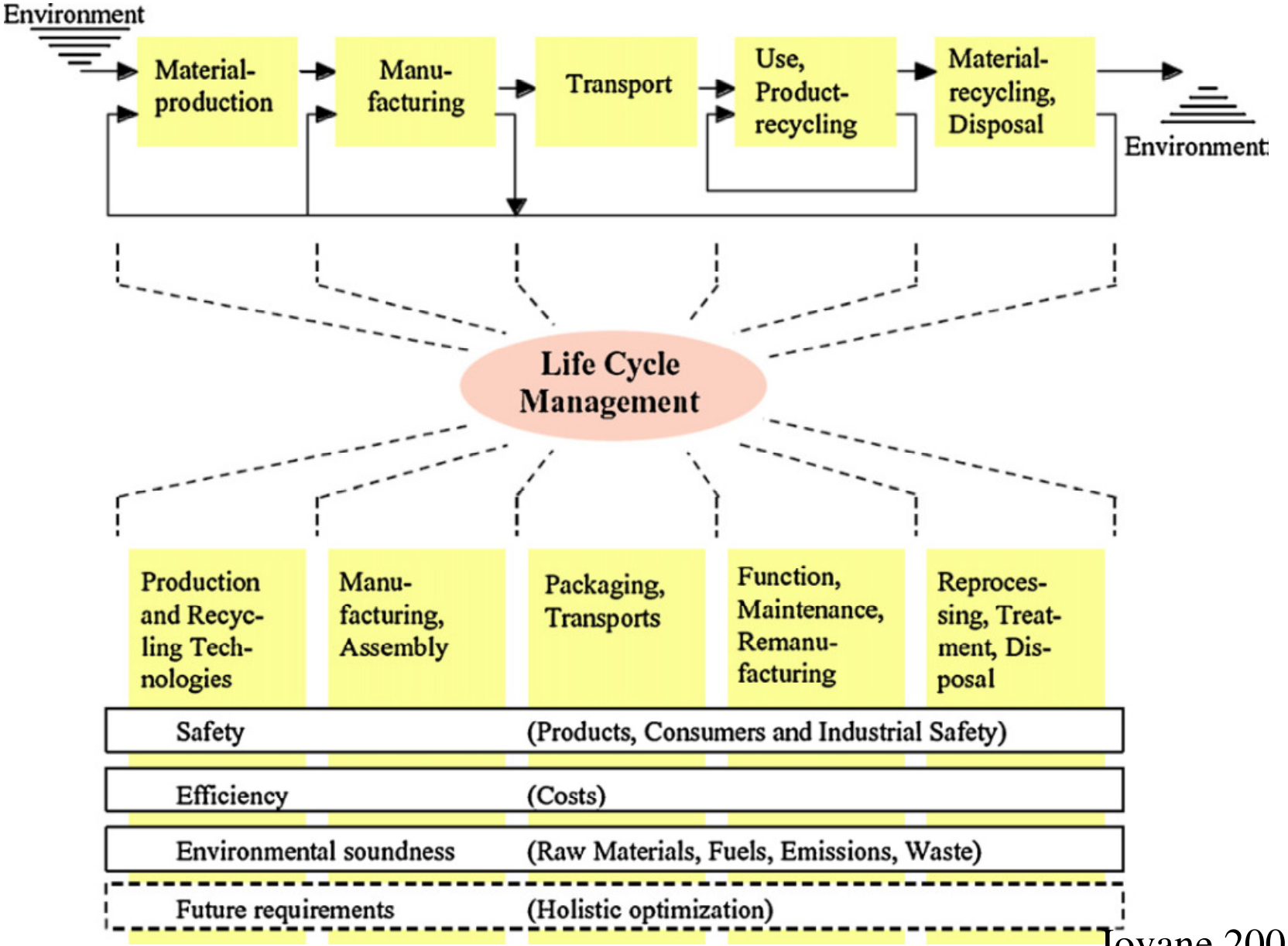


Figure 12.2 *Two ways of defining system boundaries between physical economy and environment in LCA: (a) with narrow system boundaries, (b) with extended boundaries*

Product life cycle



Jovane,2008

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LCA: Eco_efficiency

- Eco-efficiency (EE) is among the most commonly used concepts in sustainability policies and management discussions.

By definition, eco-efficiency does not include a vision, a goal or a direction.

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Life-Cycle Sustainability Assessment

Planet

L-C Assessment: addresses analytically the environmental impacts relating to the whole production chain of a good>>

Profit

-C Costing: summarizes all costs associated with the life cycle of a good that are directly covered in that life cycle

People

<< L-C Societal Assessment: societal impacts but from different aspects: S-responsible investments; product improvement potentials >>

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Benchmarking

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Comparing solutions according to a given context

and for a given scope

based on the best practices and/or performances

The benchmarking frame

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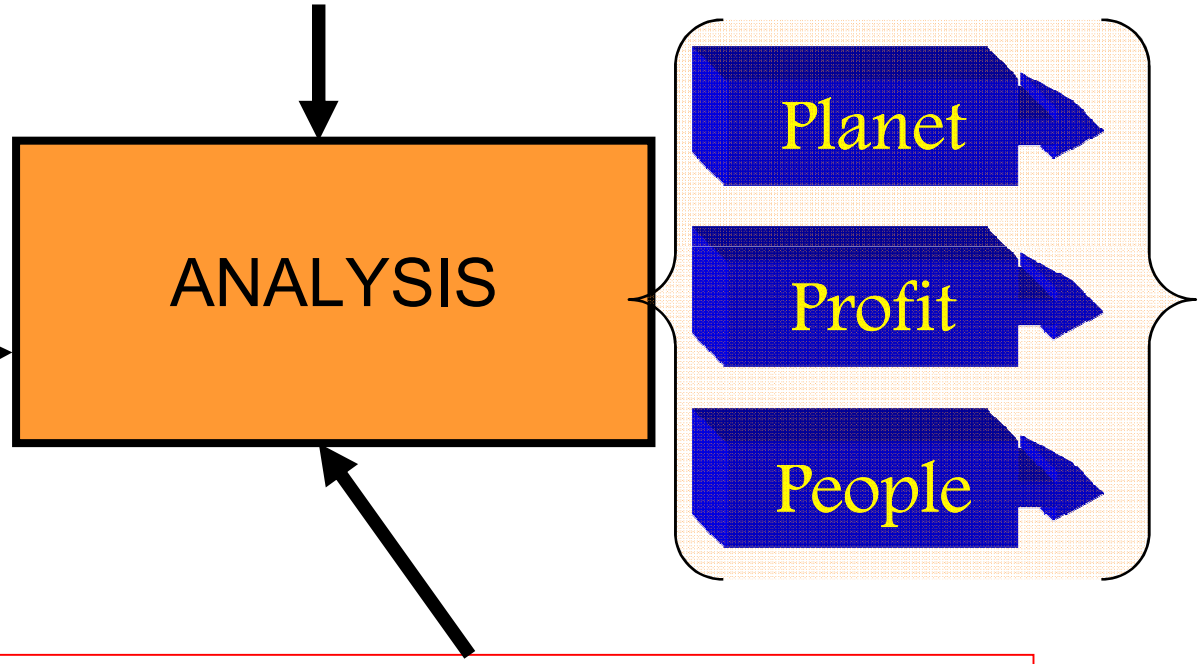
RULE 1:

SPECIFICATION on PHYSICAL TRANSFORMATIONS

RULE 3:

DATA SOUNDNESS



RULE 2:

SPATIAL and TEMPORAL CONSISTENCY

Renewable is sustainable?

III. Renewable energy sources are often presented as "clean". A more correct definition hopefully is that they are "cleaner" than ones based on fossil fuel conversion.

IV. If it is agreed that humankind has no chance to survive on this planet (and, thus, nowhere else), unless a sustainable development is achieved, sustainability has to be established at all levels.

V. ……

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LCA: PV panels

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- First generation:
  cristalline (mono- / poli-) silicon and ribbon silicon
- Second generation :
  amorphous silicon (a-Si), Cadmium Tellurure (CdTe), CIS, CIGS
- Third generation :
  organic cells (DSSC), solar concentrators, ecc.

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ASSOCIATION PV CYCLE

Operator	Procedure	Size/Stage of development	PV technology
Deutsche Solar AG	Thermal separation, processing	Pilot production ecological consideration	Crystalline, Thin film in laboratory
First Solar	Thermal decomposition in Inert Gas	Laboratory	Crystalline
Isofoton	Cell recycling Swelling Shredding Reparable module	Laboratory	Crystalline
AIST, Sharp, Asahi	Wafer recycling with mineral acids Solvent swelling Reparaible module	Laboratory	Crystalline
Photovoltech	Reparaible module	Laboratory	Crystalline
BP Solar, Soltech, Seghers	Wafer recycling with mineral acids Wafer recycling in fluidized bed	Laboratory/technical college	Crystalline
Pilkington Solar International	Thermal separation	Laboratory	Crystalline
Siemens SolaR, Shell Solar, Showa Shell	Ferro silicon production High pressure water jet	Laboratory	Crystalline, Thin film
Other	Module shredder Mechanical separation Acid treatment Smelter MWI Concrete aggregates Road construction	Laboratory	Crystalline, Thin film
Disposer	Removal of frame and cable	Production	all

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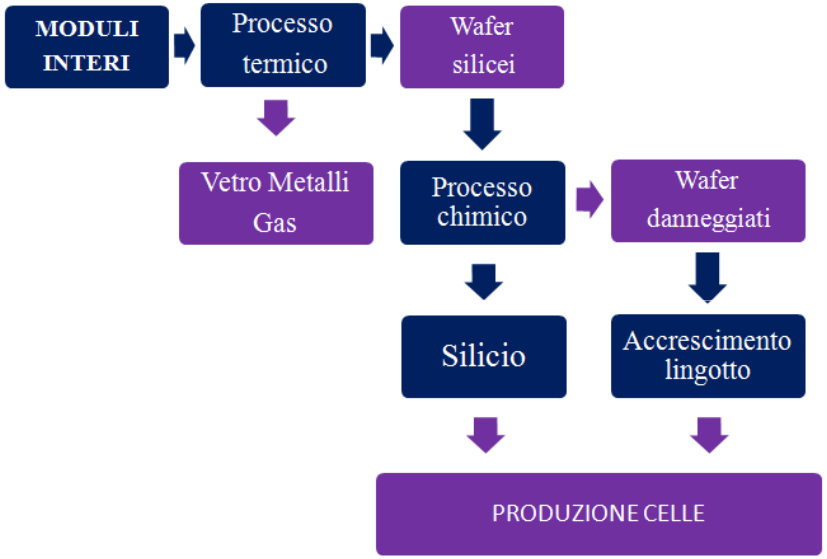
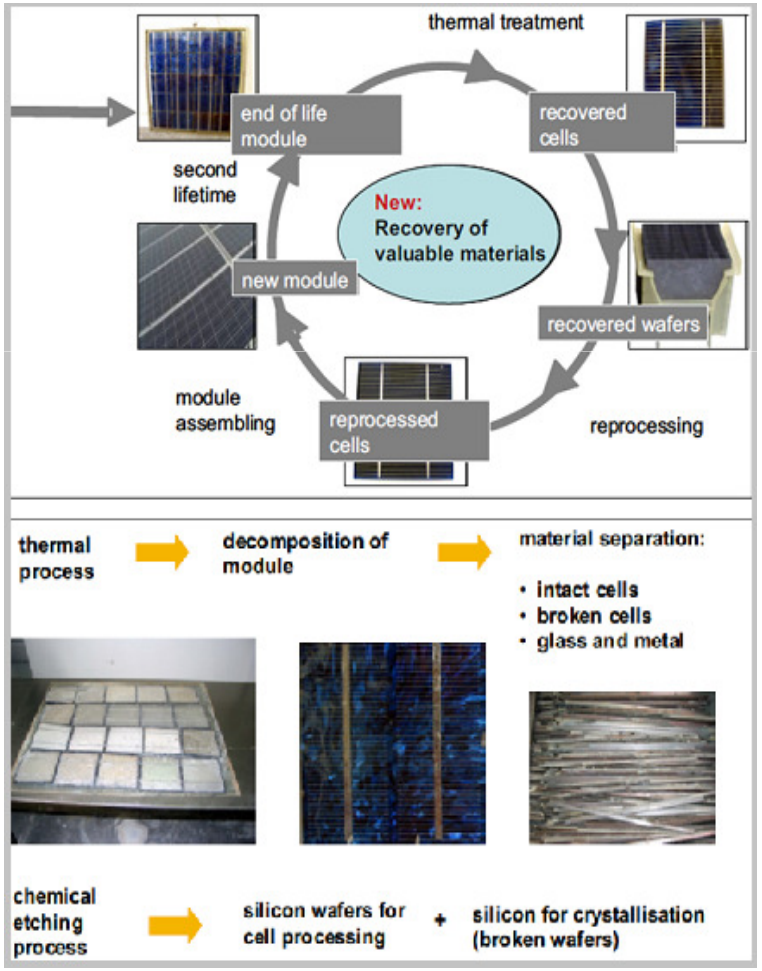
Schematic process of recycling of PV modules in Si-C



Schematic process of recycling Deutsche Solar AG



Structure of PV panels

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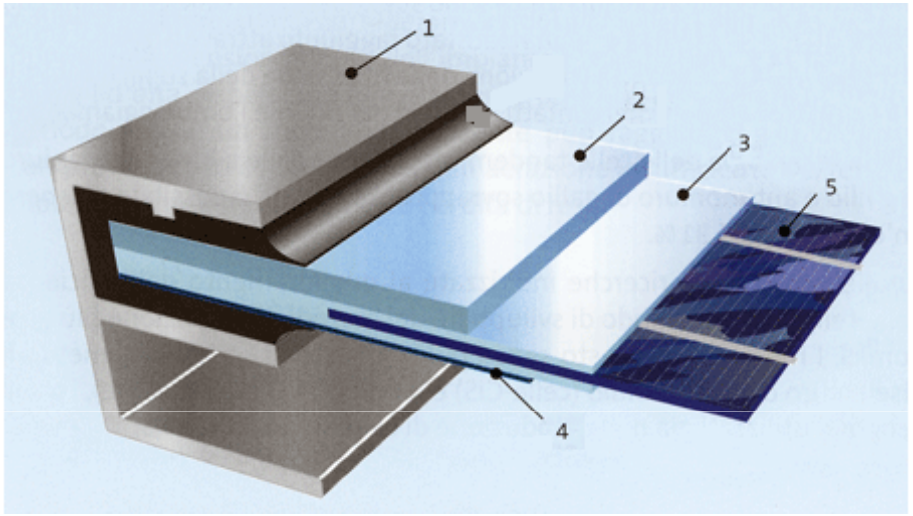
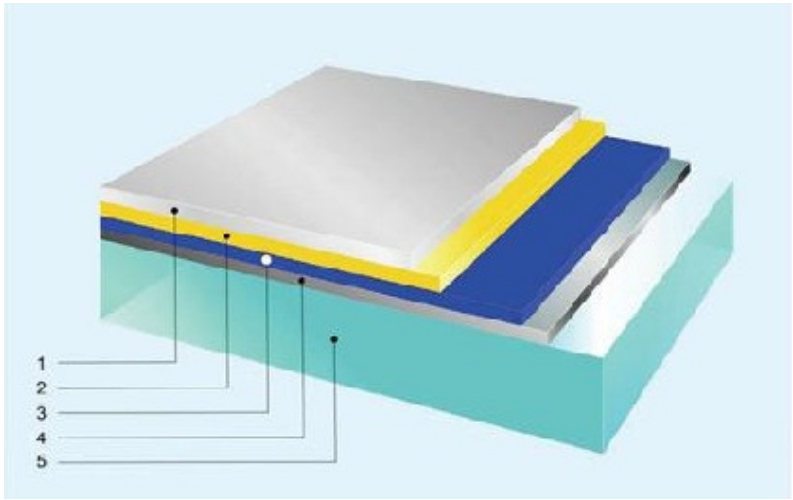
- *1^ generation:*
  1) Al;
  2) Glass;
  3) EVA;
  4) Tedlar;
  5) Solar cells;



- 2^ generation:
  1) ZnO;
  2) CdS;
  3) CIS;
  4) Rear metallic contact;
  5) Glass;



PV's_:End of Life

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- Operative end-of-life after 25-30 years:
  - *Physical degradation of Balance of System*
  - *Delamination, degradation of interconnections, semiconductors…*

BENCHMARKING RECYCLING SOLUTIONS

Benchmarking EOL

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FIRST SOLAR

- Mechanical-chimical process
- CdTe Modules
- Recycle crunched materials
- Yield: 90-95%

DEUTSCHE SOLAR

- Thermo-chimical process
- SiC modules
- Wafer as good as news
- High Temperatures ⟶

Benchmarking EOL

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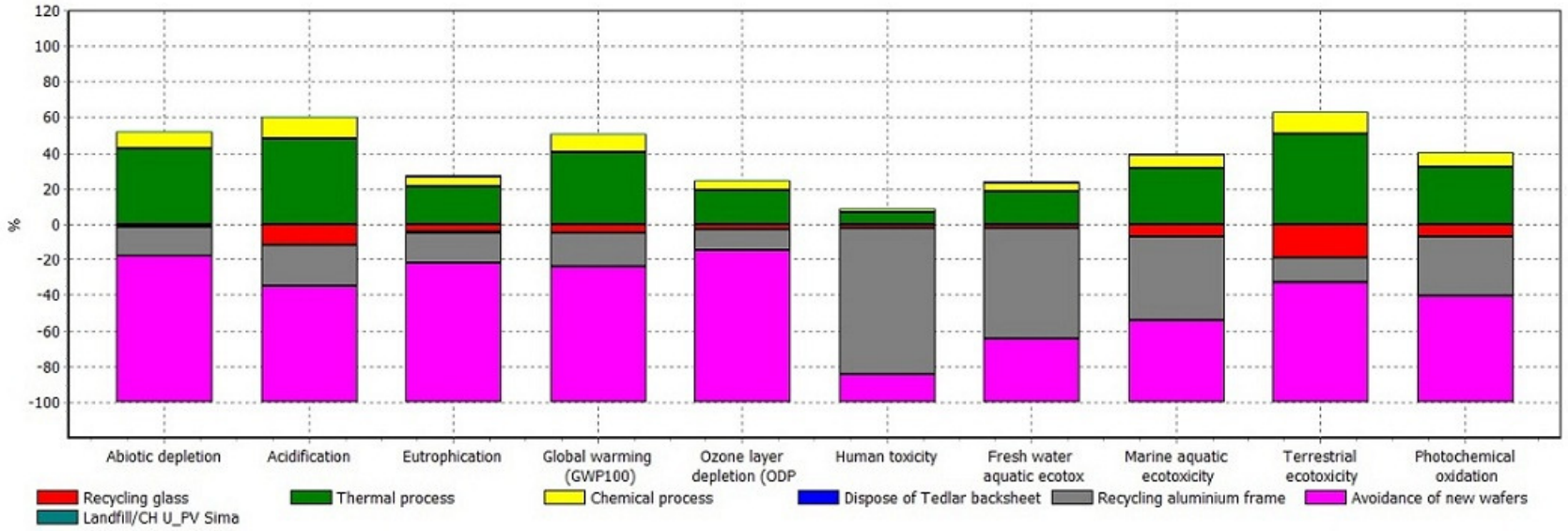
LCA = Life Cycle Assessment ➡ *Impact Assessment*



Recycling phase and disassembly Deutsche Solar

[CML 2 baseline 2000 / West Europe 1995]

Cryogenic disassembly patent

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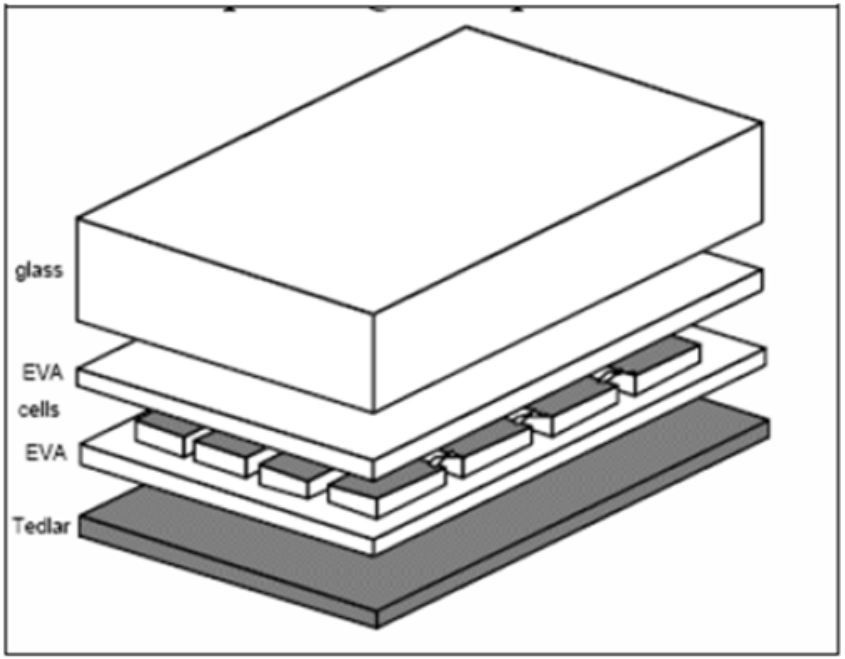
Disassembly with the like-new material extraction



Comparing two EOL scenarious

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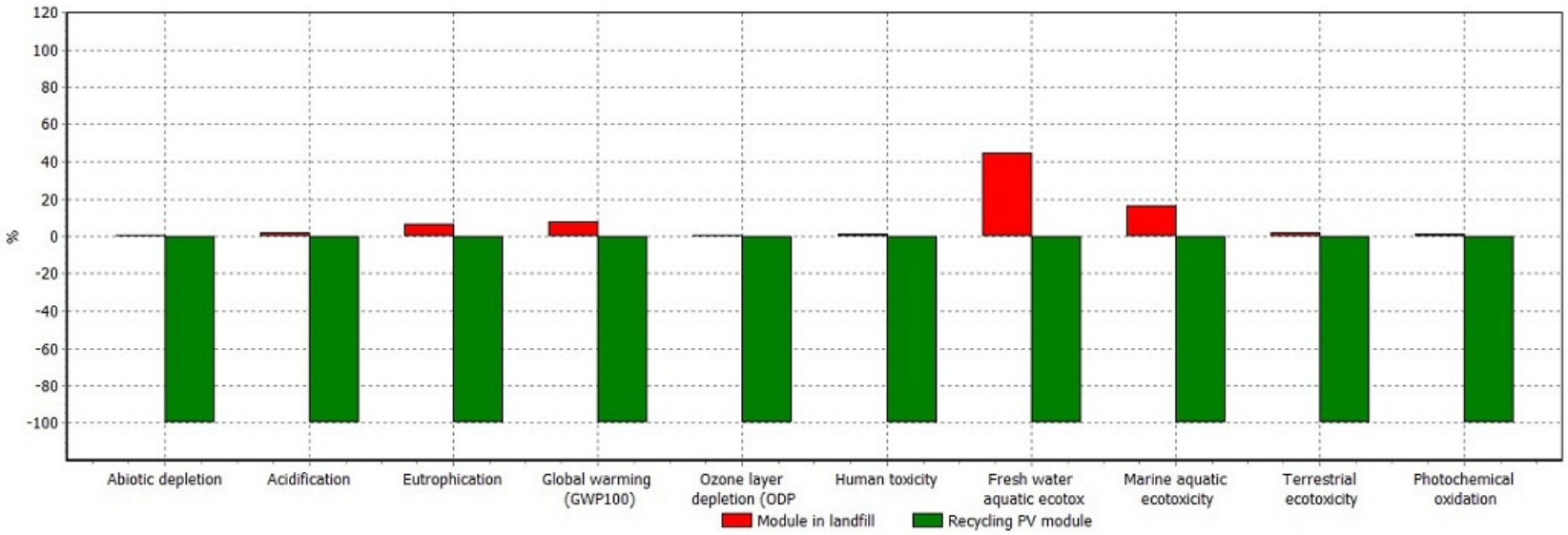
Deutsche Solar (high value) vs landfill scenarious for 1 Sic monochristalline modulus:

RECYCLING CONVENIENCE



SEEP 2010

Infinite cycle of energy

4th International Conference on
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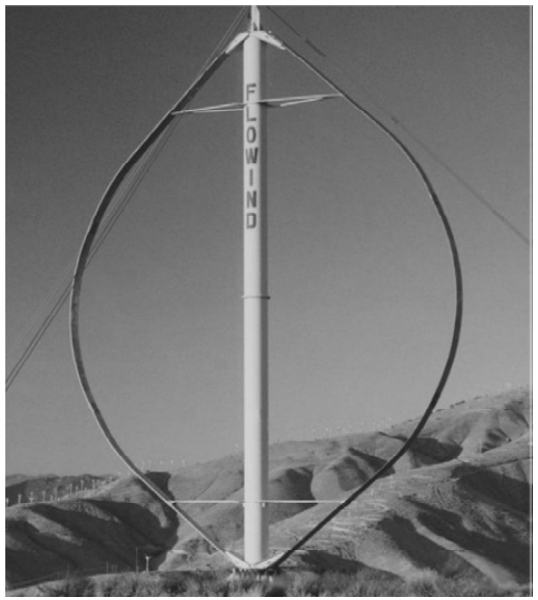


Does
DON CHISCIOTTE
Be in the truth????

LCA: An example from literature

CONTEXT: on-shore;
20 year scenario

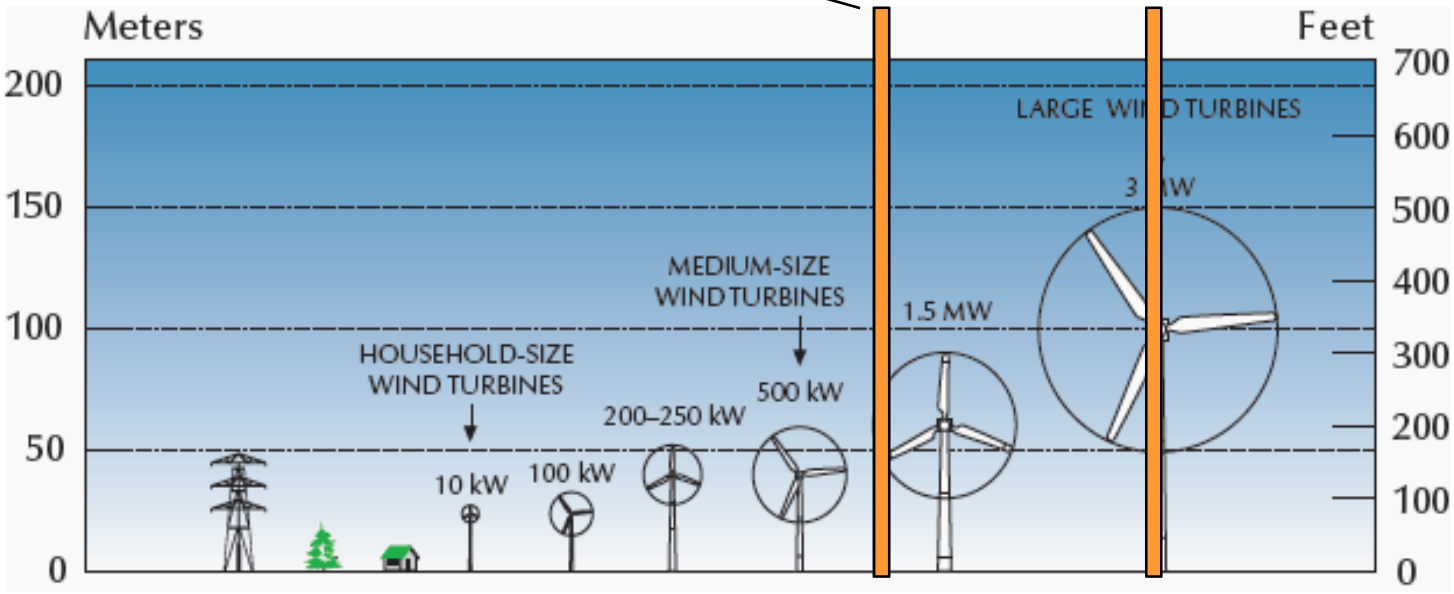
SCOPE: assess sustainability of electricity production

850 kW

➢a rotor diameter of 52 m

3 MW

➢rotor diameter of 90 m



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The benchmarked turbines

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Component	Item	Wind turbine (3.0 MW)		Wind turbine (850 kW)	
		WEIGHT	MATERIALS	WEIGHT	MATERIALS
Foundation	Reinforced concrete	1220 t	1200 t concrete	495 t	480 t concrete
			20 t steel		15 t steel
Tower	Painted steel	276 t	275 t steel	70 t	69.07 t steel
			1 t paint		0.93 t paint
Nacelle	Generator	8,5 t	5,525 t steel	1.84 t	1.47 t steel
			2,975 t copper		0.37 t copper
	Gearbox	23 t	22,54 t steel	6.2 t	6.08 t steel
			0,23 t copper		0.062 t copper
			0,23 t aluminium		0.062 t aluminium
	Frame, Machinery & Shell	37 t	31,45 t steel	13,9 t	12,644 t steel
			2,96 t aluminium		0,6 t aluminium
			1,258 t copper		0,537 t copper
			0,011 t glass fibre		0,18 t glass fibre
Rotor	Hub	8,5 t	8,5 t cast iron	4.8 t	4.8 t steel
	Nose cone	11,5 t	11,5 t glass fibre	5,6 t	5,6 t glass fibre
	Blade (3 per rotor)	6,6 t	4,35 t glass fibre	5.02 t	3.01 t glass fibre
			2,25 t epoxy		2.01 t epoxy

Application of the frame

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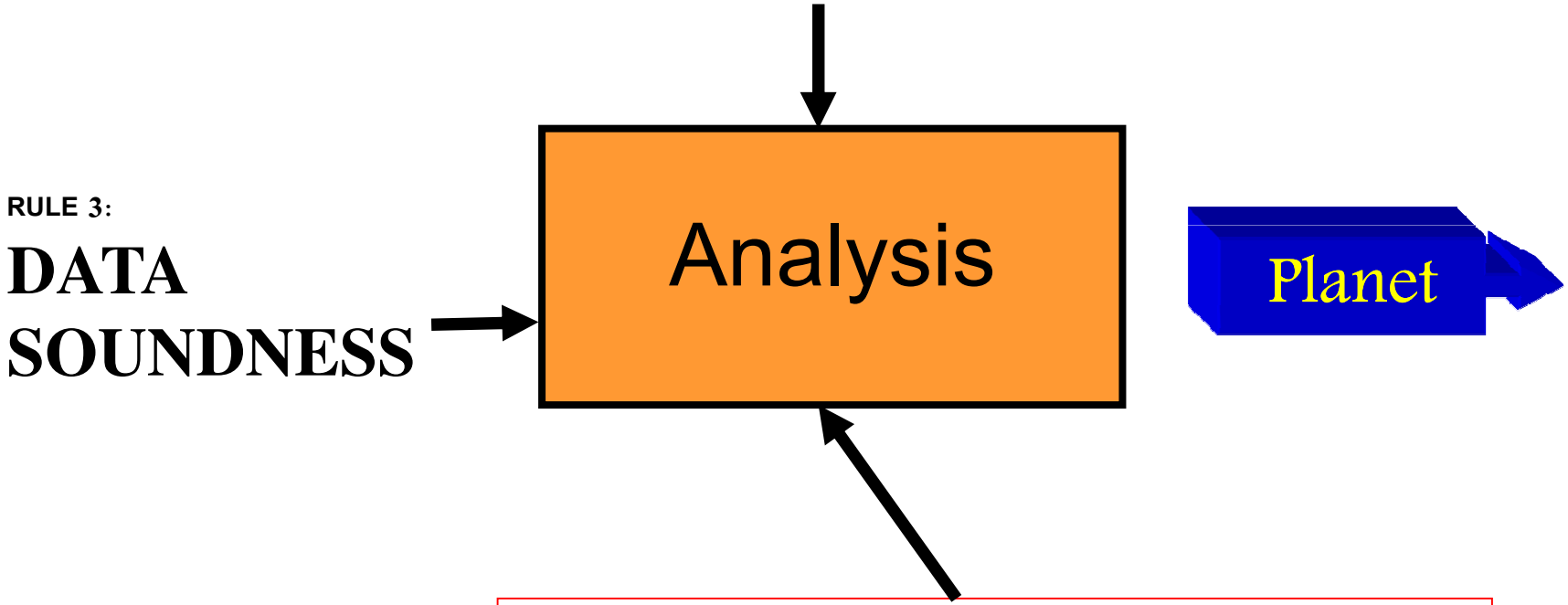
RULE 1:

SPECIFICATION on PHYSICAL TRANSFORMATIONS



RULE 2:

SPATIAL AND TEMPORAL CONSISTENCY

PLANET: LCA (Ecoinvent Database): R1 & R2&R3

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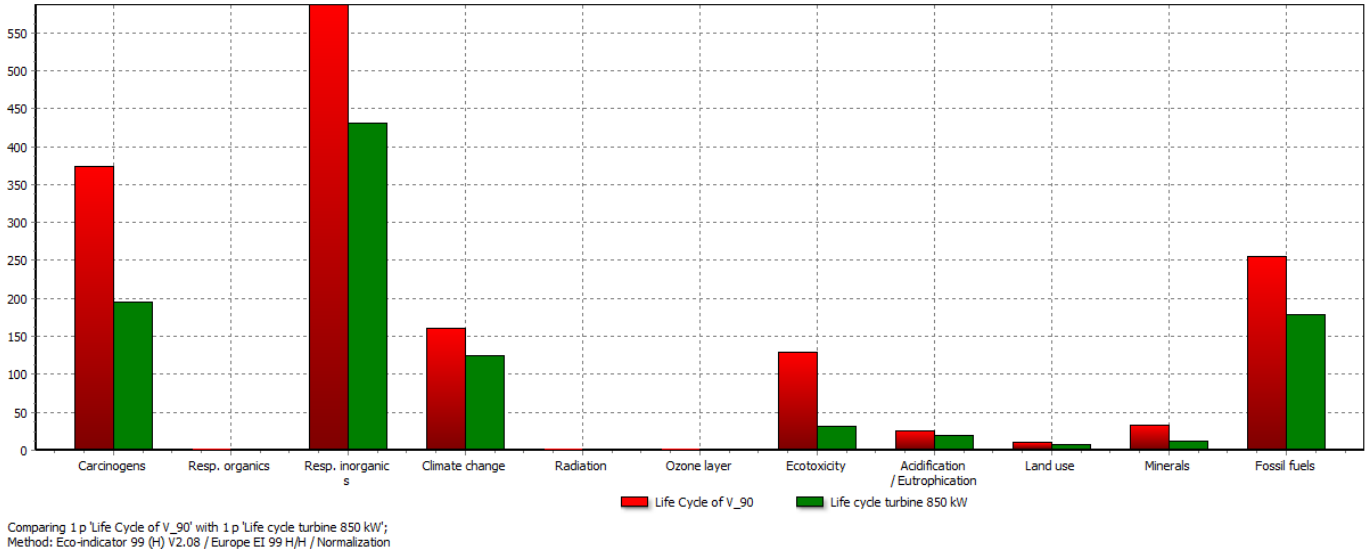
- **Manufacturing and erection** ('Environmental Statement 2004' of Vestas and from the Australian National Accounts) + mainly fuel (diesel) [24]. Transportation distances have been considered equal to 100 km.

- **Operation and maintenance** (personnel is transported by diesel car)+ (Gear and gearbox are assumed to be replaced once during this period)

- **Disposal scenario** (90% of steel, cast iron and copper are recycled while the remaining parts are sent to landfill) + (Transportation distances are assumed to be, in average, equal to 200 km.)



*Normalized comparison between 3MW wind turbine and a 850 kW wind turbine life cycles (*SIMA-PRO(R) *v.7.3 - Eco Indicator 99)*

LCA: Life cycle of the wind turbine in SimaPro 7.3

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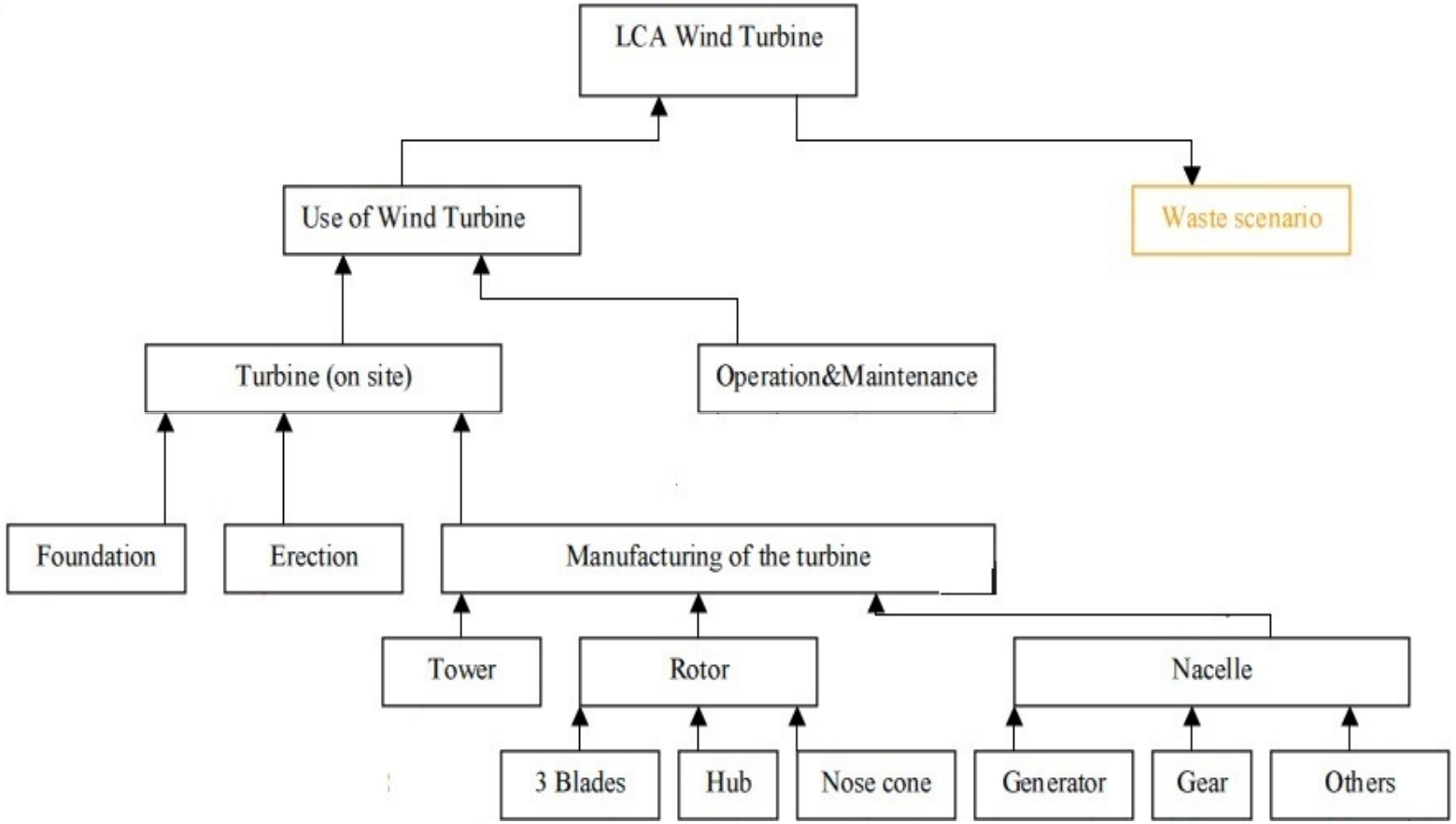

LCA: Network of the life cycle of the 3MW turbine

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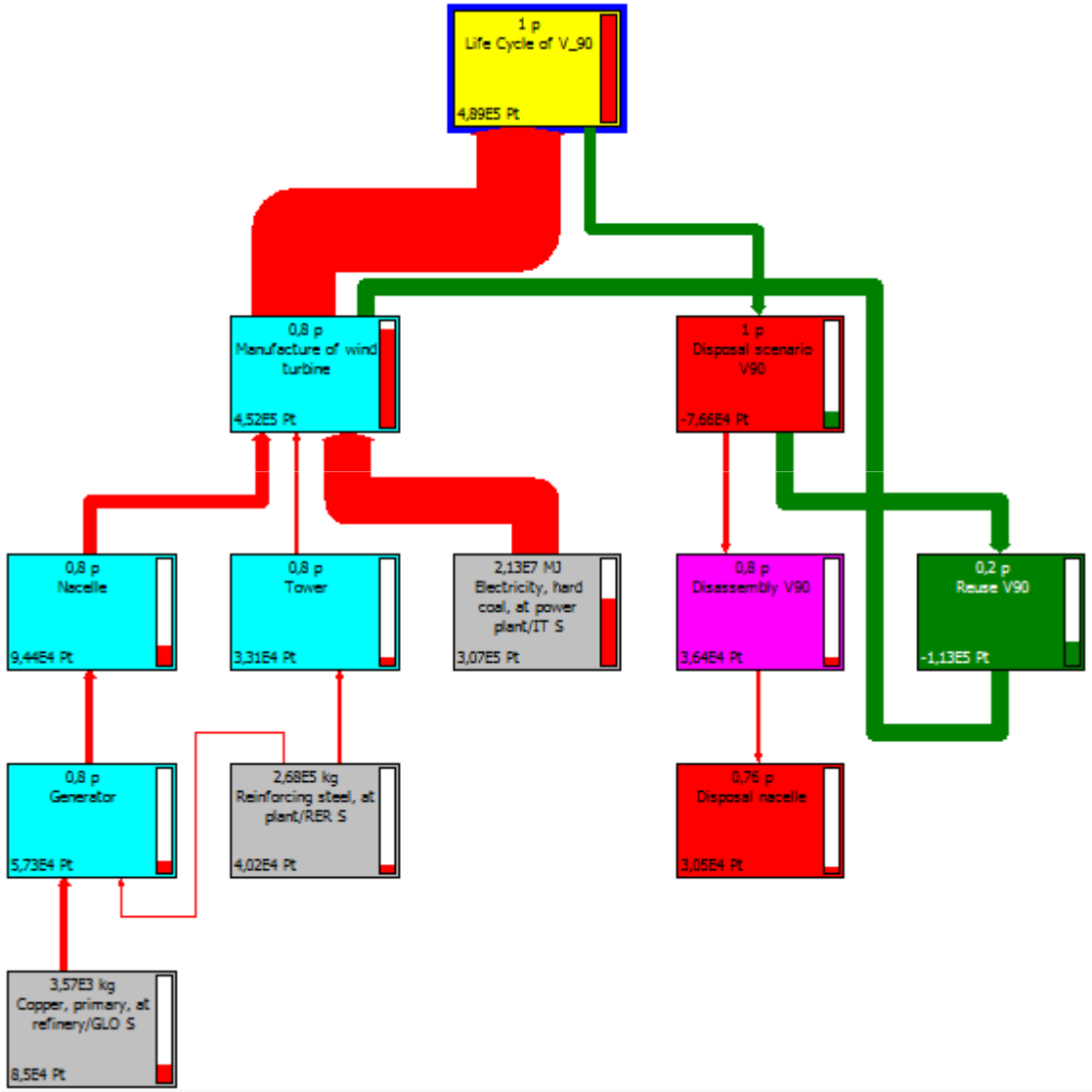

PROFIT & PEOPLE: missing!

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- Vestas, "General Specification V90 – 3.0 MW 60 Hz Variable Speed Turbine." 2004

As well as in

- G. Stonge, "Energy Development." 2011.

Partial Conclusions: missings

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- The 850 kW has a lower negative influence on the environment. (Nevertheless, it must be also taken into account that in favorable weather and wind conditions the output energy of the turbine of 3 MW is greater than that of the turbine of 850 kW.)

- The waste scenario is very important to the environmental profile of the wind power
(The benefits come, above all, from the almost complete recycling of the steel (90%), the cast iron (90%) and the copper (90%)

- The most sensitive scenario is the manufacturing phase, in particular the use of the electricity mix used for the production of the materials

Why a frame…

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I. The frame needs to be applied to have a wider view of problems: more data and efforts are thus required to do so otherwise……

II. Benchmarking frame is easy to use and congruent

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Assessing sustainability

5

Paradox :

Uniqueness of measurement

- When searching for the uniformity of views about eco-approaches (UNIVOCAL UNDERSTANDING) , i.e. by adopting a top-down approach
- We are (NOT UNDERSTANDING) the sytem which is characterised by variety

- *<<Any attempt to impose uniform solutions of global environmental problems will threaten the diversity of the earth's regions and cultures in the same way that economic globalization does now..>>*

Komiyama, 2006

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OFFICIAL PERFORMANCES

By Electrolux – Sustainability Repor, 2006

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Investors rank Electrolux

Several socially responsible investment indices include the Electrolux Group as a constituent company, including Dow Jones STOXX Sustainability Index and the FTSE4Good Series. The Group is also ranked highly by Oekom Research in Germany, KLD Research and Analytics Inc. which has ranked Electrolux among its Global Climate 100 Index. In 2006 Electrolux topped an environmental performance review of the companies listed on the Stockholm Stock Exchange that was conducted by one of Sweden's most prominent sustainability fund managers, Banco Fonder. Electrolux was recognized for integrating environmental thinking in all aspects of operations, for reporting practices and striving to be transparent about performance.

PLAN: the analysis of sustainability

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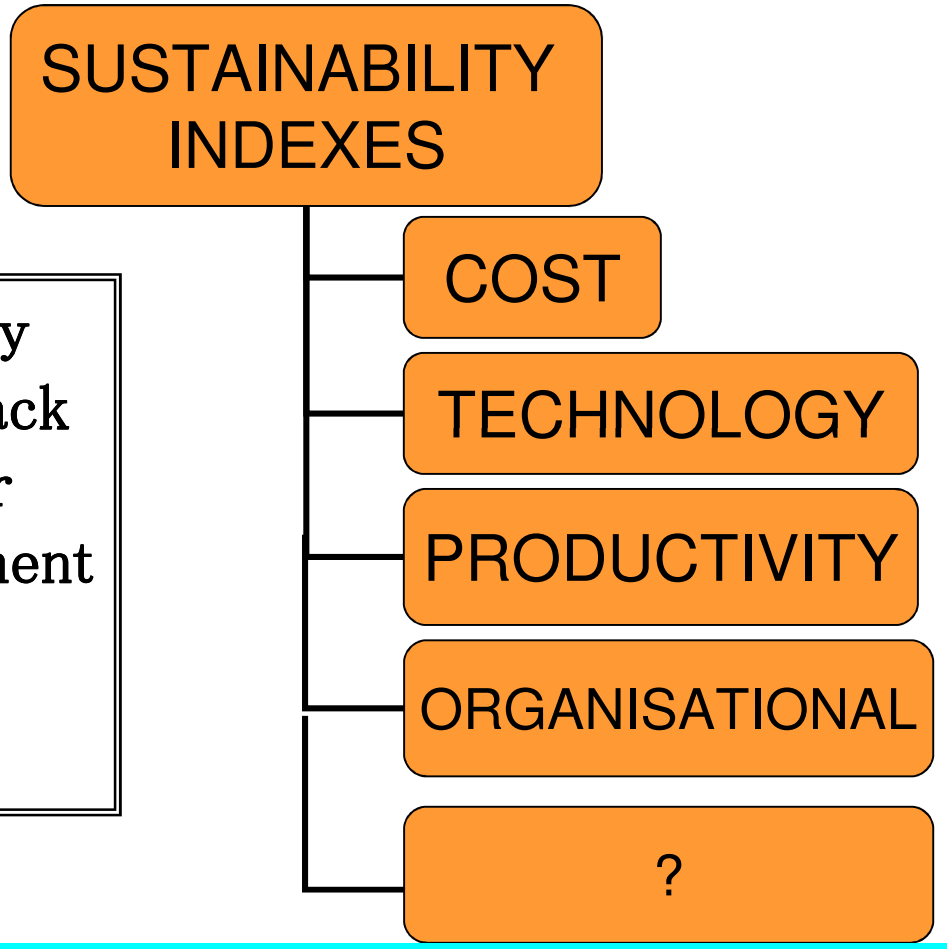
This practice is relatively new, so that there is a lack of commonly accepted or mandated eco-measurement standards



- *<<there appears to be a view that any move towards sustainability assessment will axiomatically be a 'good thing' . . . .>> Popea, 2004*

PLAN: the measures

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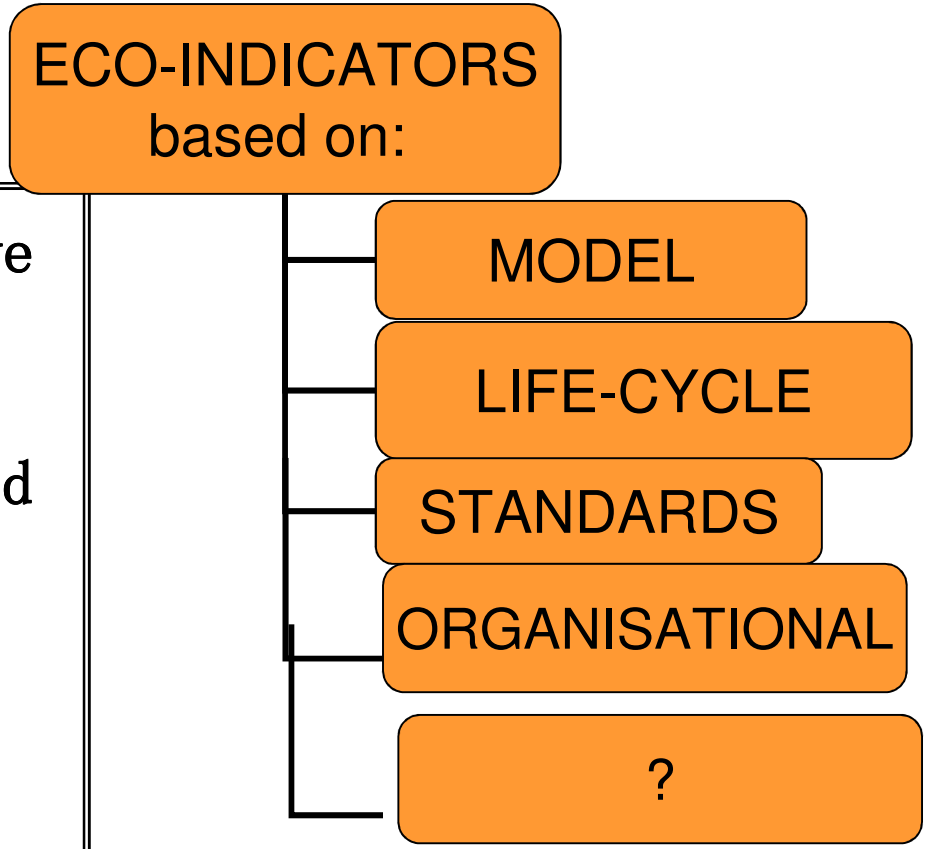
- Provided we do not have an unique definition of sustainability and that hopefully it is multifaceted because of diversity of world, what does then it means to measure sustainability?



- *<<…while these criteria and indicators (related to sustainability) must conform to scientific standards of objectivity, they must not be expected to yield a singular solution to any given problem. ….>> Komiyama, 2006*

Sensitivity analysis

- In SETAC's 'Code of practice' (1993) sensitivity and uncertainty analysis are recommended, but the methodology is not very well developed.
- In the ISO 14040 sensitivity analysis is requested (ISO 1997a).

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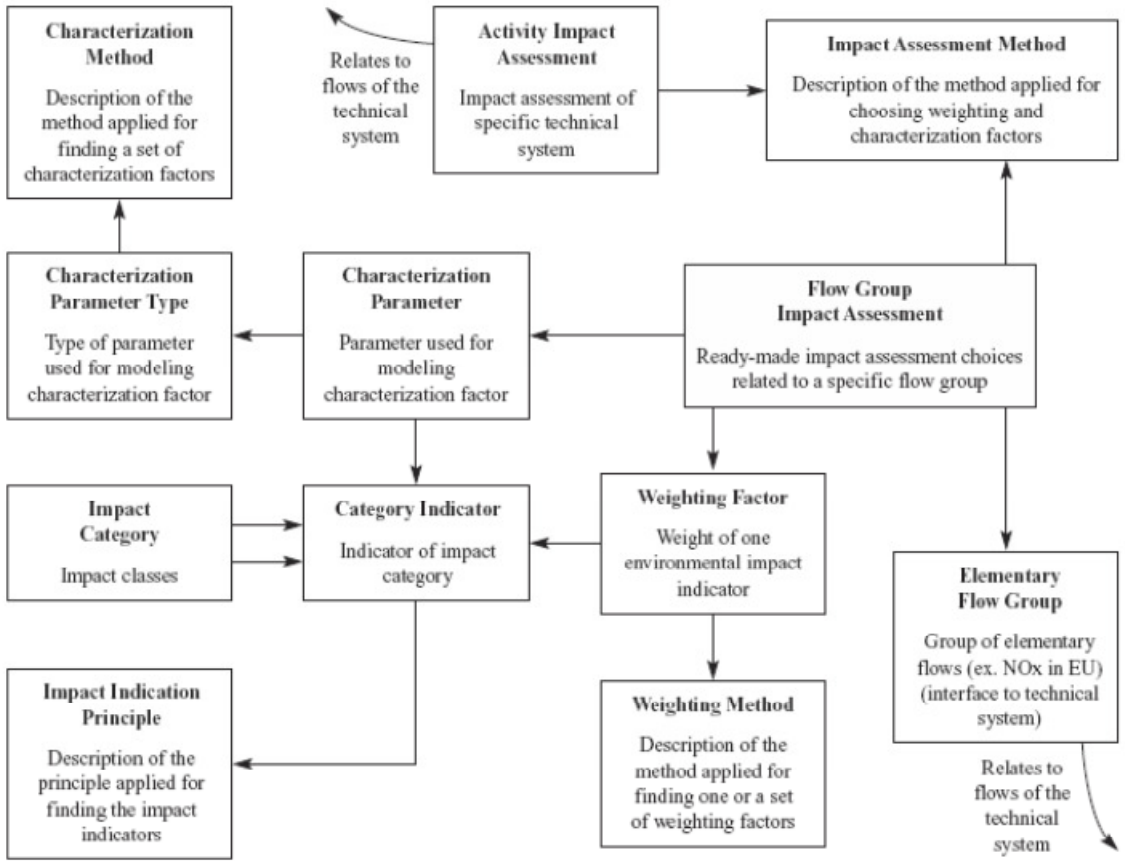
Sensitivity analysis

Analysis of uncertainty and sensitivity is important but too seldom carried out. Life cycle assessments are normally made without quantitative estimations of accuracy or precision.



Eco_efficiency: criticisms

- One cannot use efficiency or the conventional Pareto optimal efficiency as the goal or overall vision of sustainable development.

1. because of path dependency and technological lock-in, inefficient technologies and management practices may become the dominant ones

2. efficiency in production reduces costs and eventually prices of end-products. This can boost up demand and eventually the overall macroeconomic growth environmental impacts

3. even if the most efficient environmental solution is known, it risks the space needed for future sustainability. Due to uncertainty, it is impossible to know what will be required in the future

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Eco_efficiency

- Eco-efficiency (EE) EE is defined as reduced resource use and/or waste and emission generation per unit of output of production
- Or as Brattebo puts it “units of value generation per unit of environmental influence”

The basic notion of efficiency has been and continues to be central for the dominant economics theory of neoclassical economics.
In neoclassical economics, efficiency is applied in the ‘maximum power’ sense

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6

Manufacturing

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- Manufacturing industry has great relevance in modern history.
- The first industrial revolution – based on the manufacturing industry – was a divide between ‘‘ancient and new worlds’’.
- And, as such, it is a fundamental part of the first Kondratiev long wave that depicts economic development related, but not exclusively, to technological innovations.

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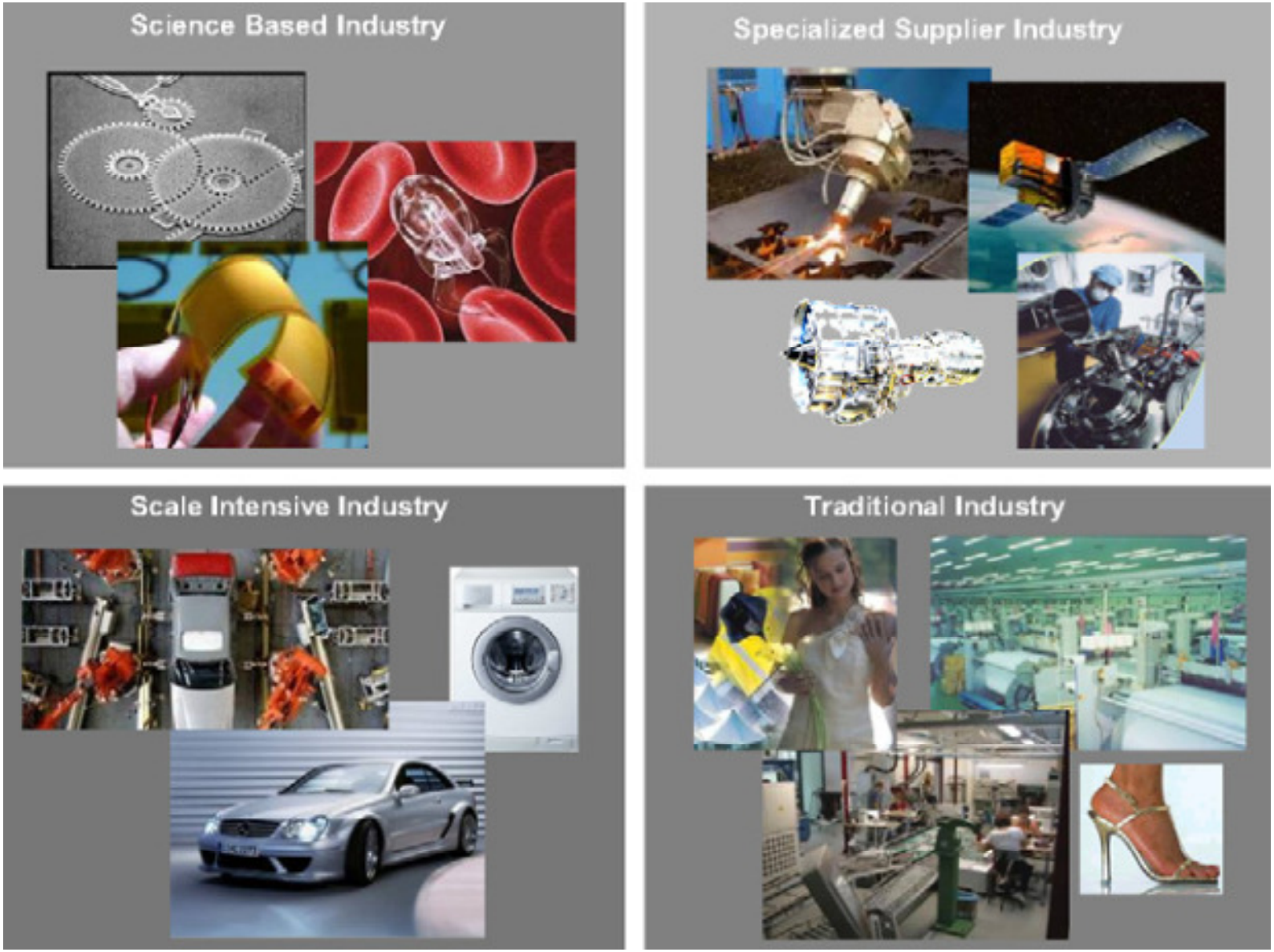
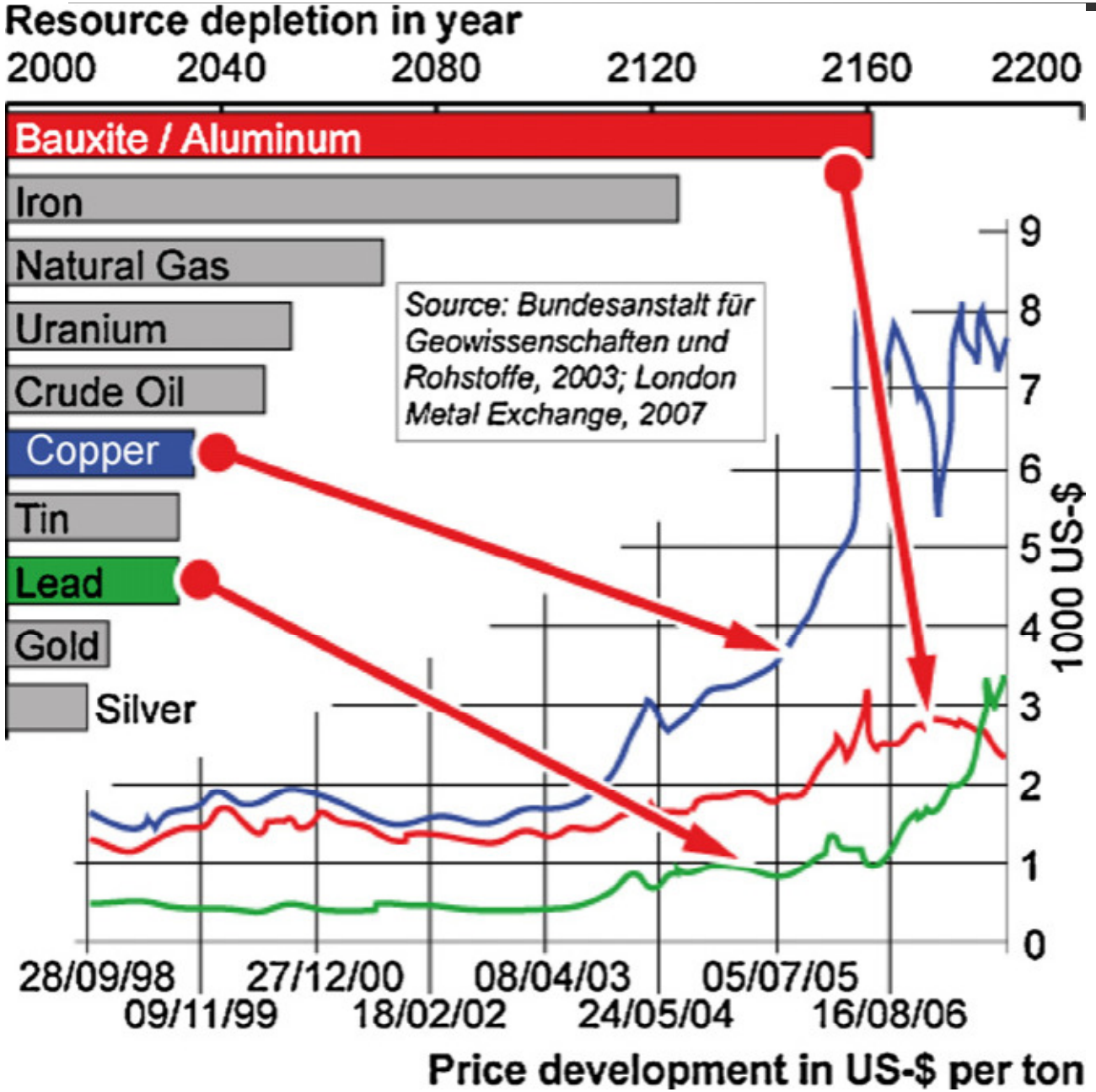
Manufacturing



Jovane,2008

Finitedness of resources



Jovane,2008

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Manufacturing Sustainability

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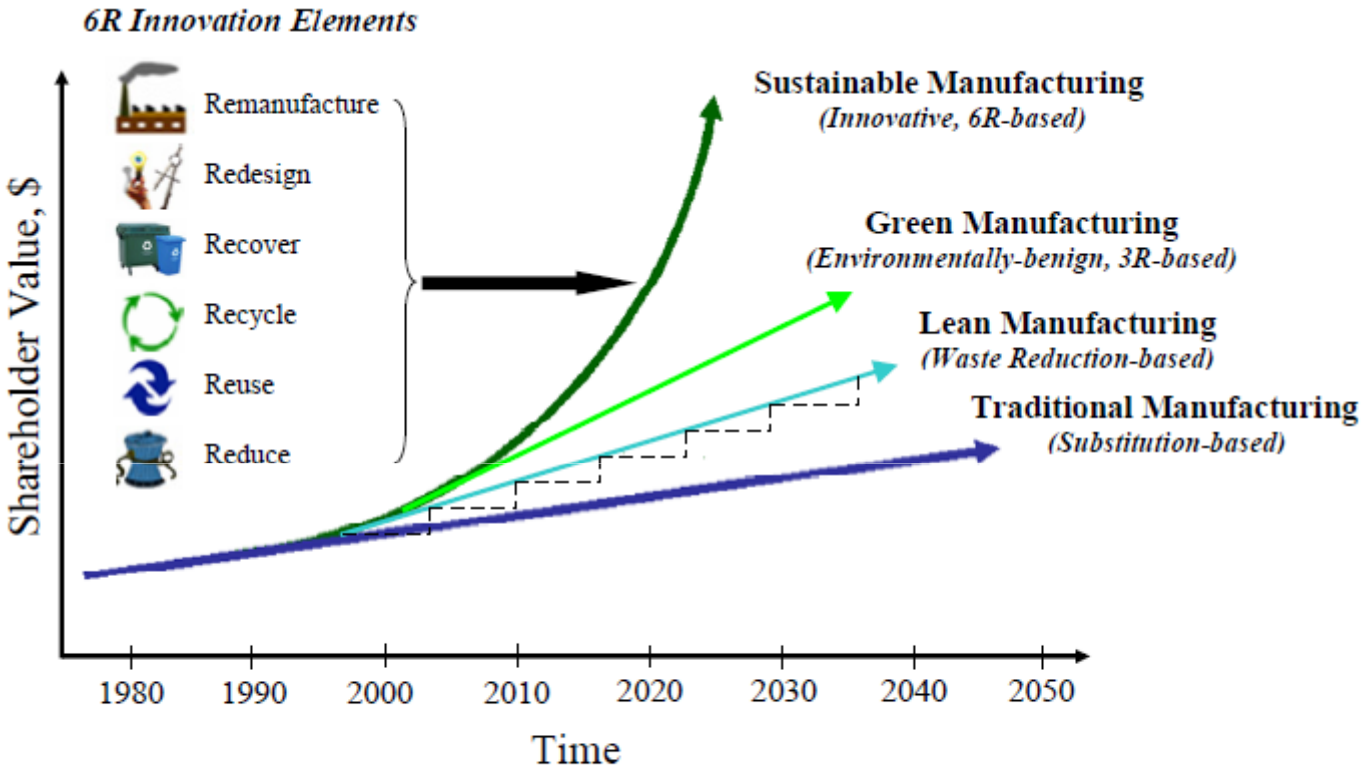

Figure 2 *The evolution of sustainable manufacturing for the 21st century*

I.S. Jawahir,2007

Sustainable manufacturing

- *Creation of manufactured products that use processes that are non-polluting, conserve energy and natural resources, and are economically sound and safe for employees, communities, and consumers.”* *USA- Dept. Of Commerce*

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The lesser the better??
LINEAR THINKING

Competitive Sustainable Manufacturing

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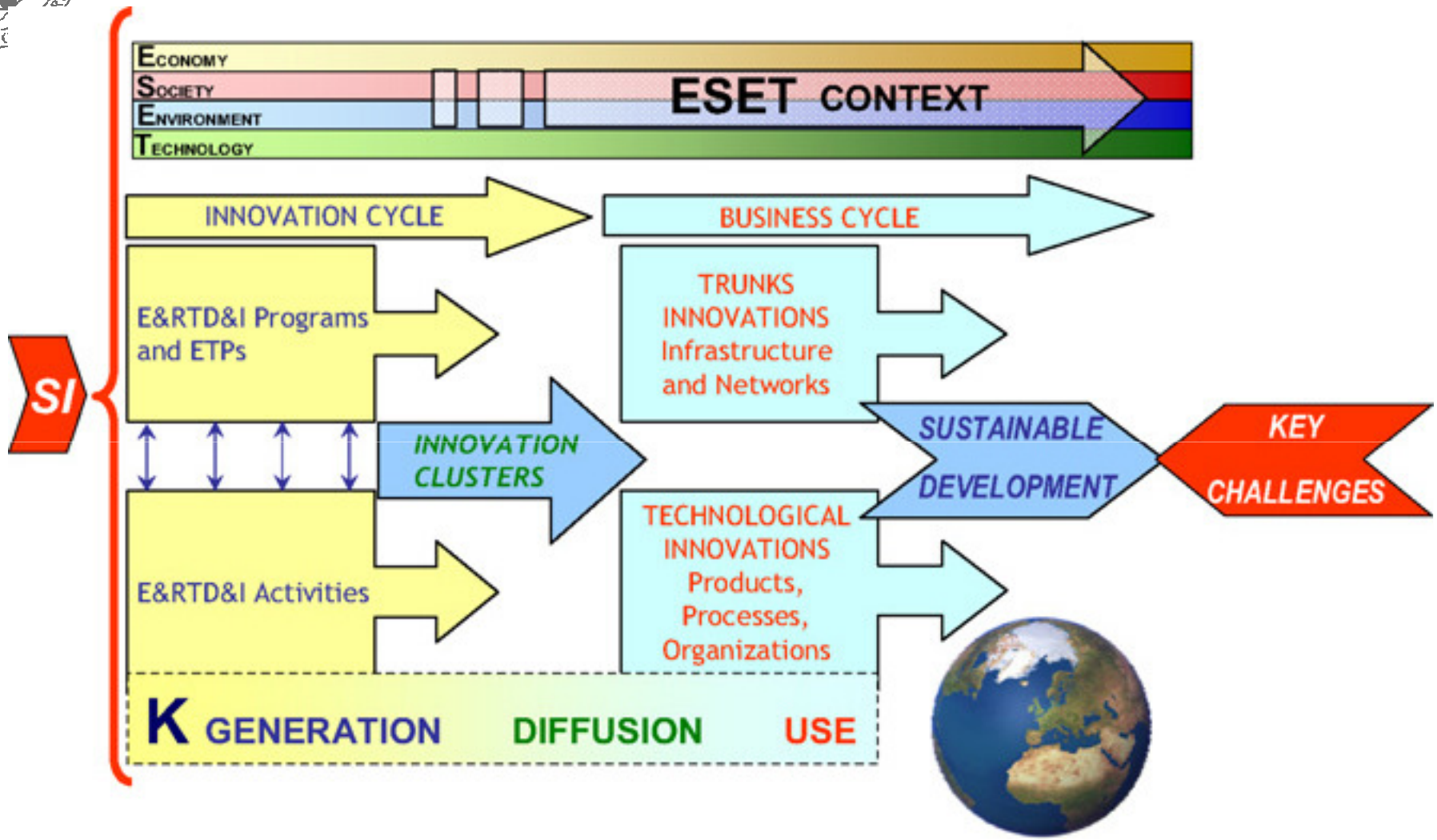
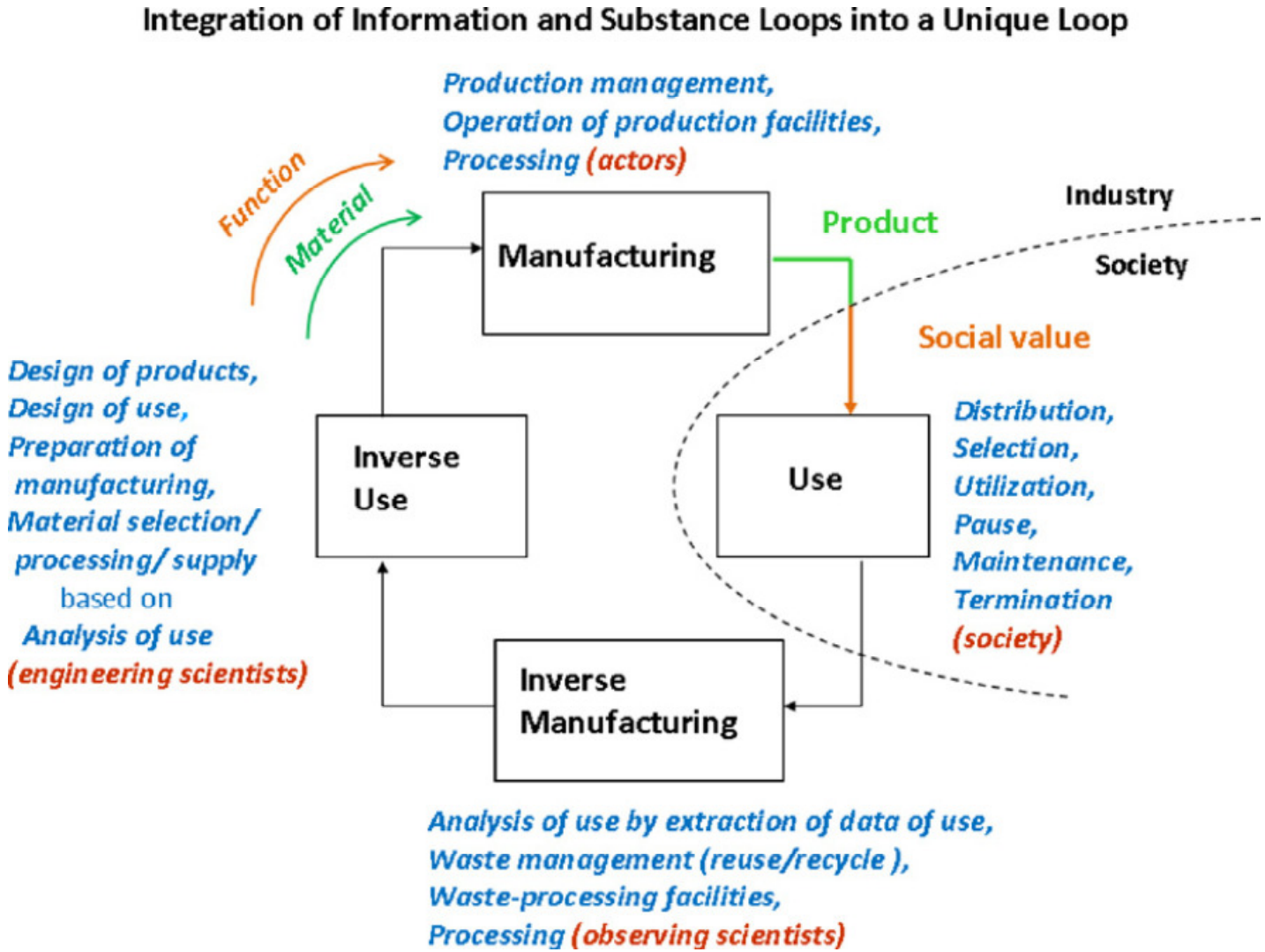


education, research and technological development and innovation (E&RTD&I) [Jovane,2008]

Function: the main issues

sustainability requires integration of manufacturing and inverse manufacturing, i.e. closed loop manufacturing



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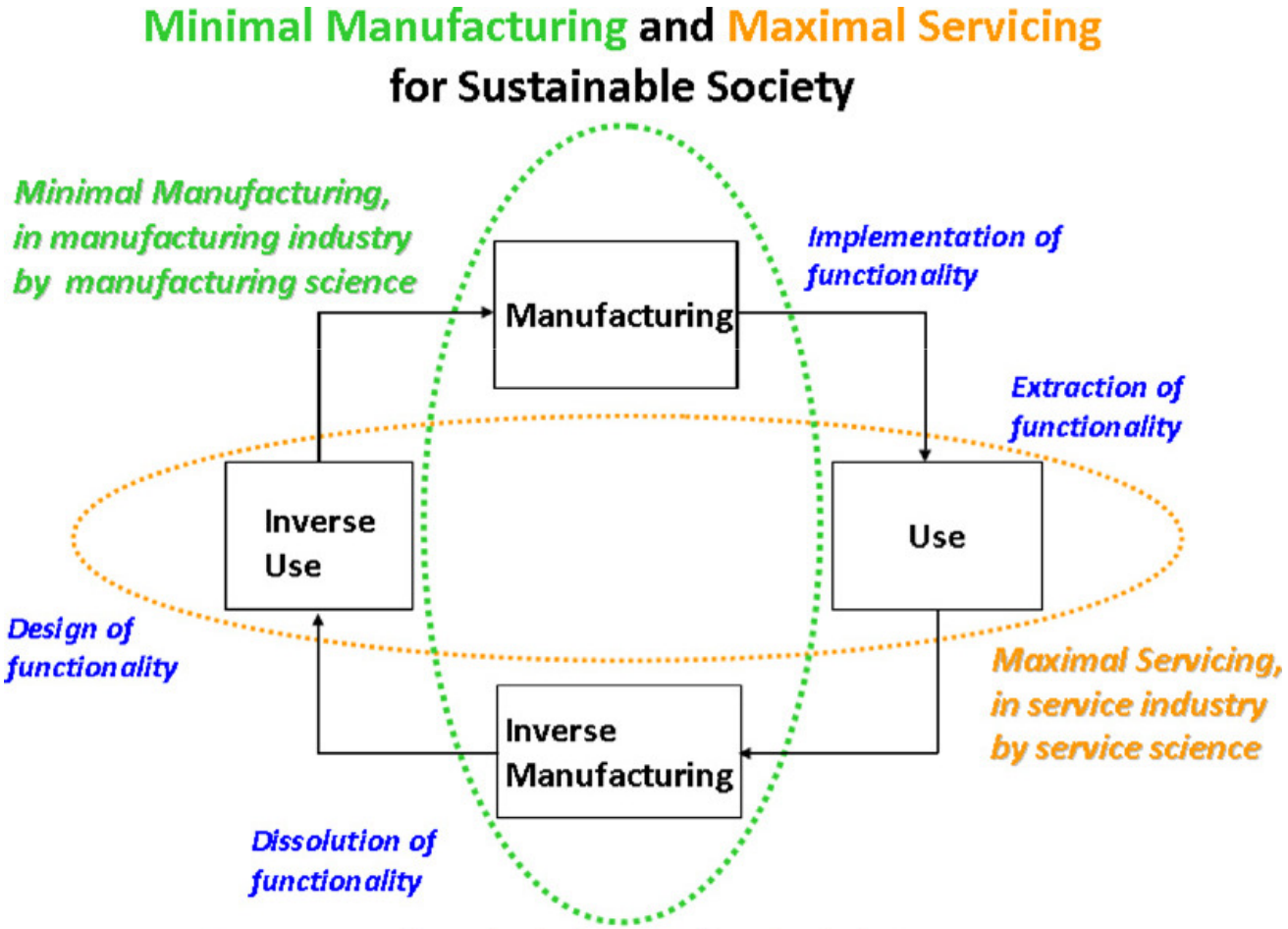
Closed-loop manufacturing

Yoshikawa introduces the minimal manufacturing and maximal servicing paradigm for sustainability



Sustainable value-creating modules in a global network

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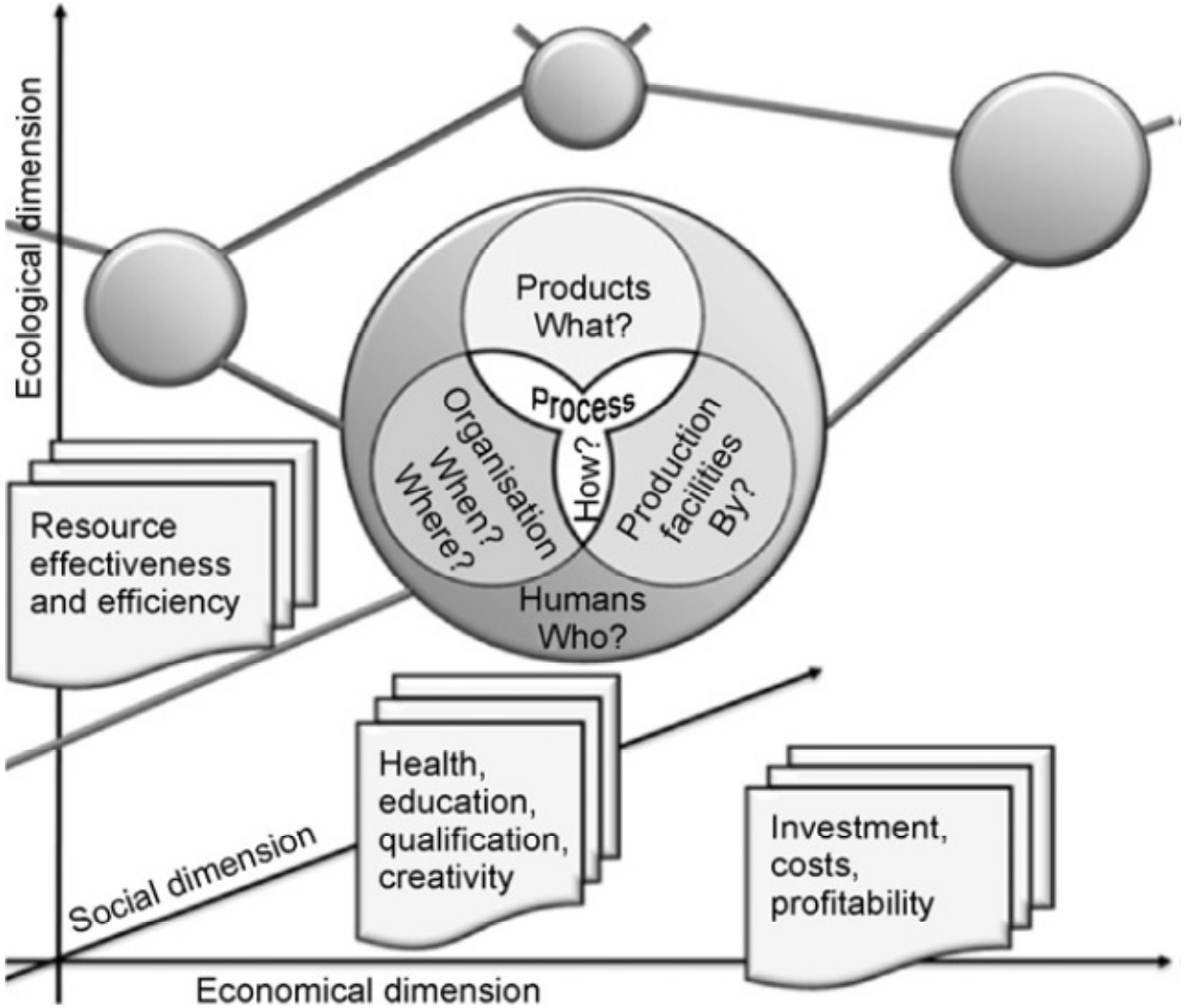

Jovane,2008

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"Sustainable manufacturing adds value to materials, components, or products while maintaining the availability of natural resources and environmental quality for future generations. "

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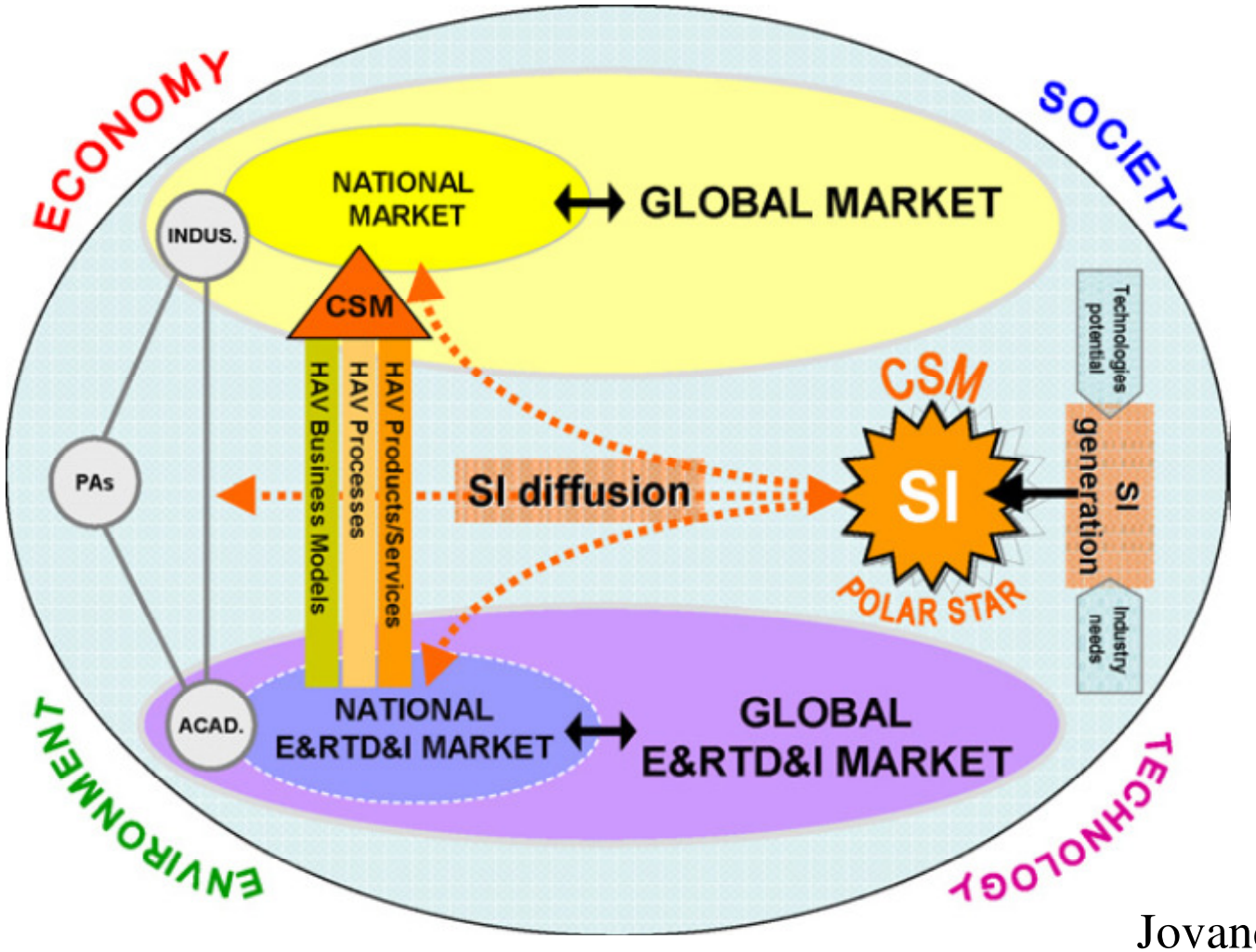
MANUFUTURE framework®

Strategic Intelligence & Competitive Sustainable Manufacturing



Jovane,2008

Technologies for sustainability

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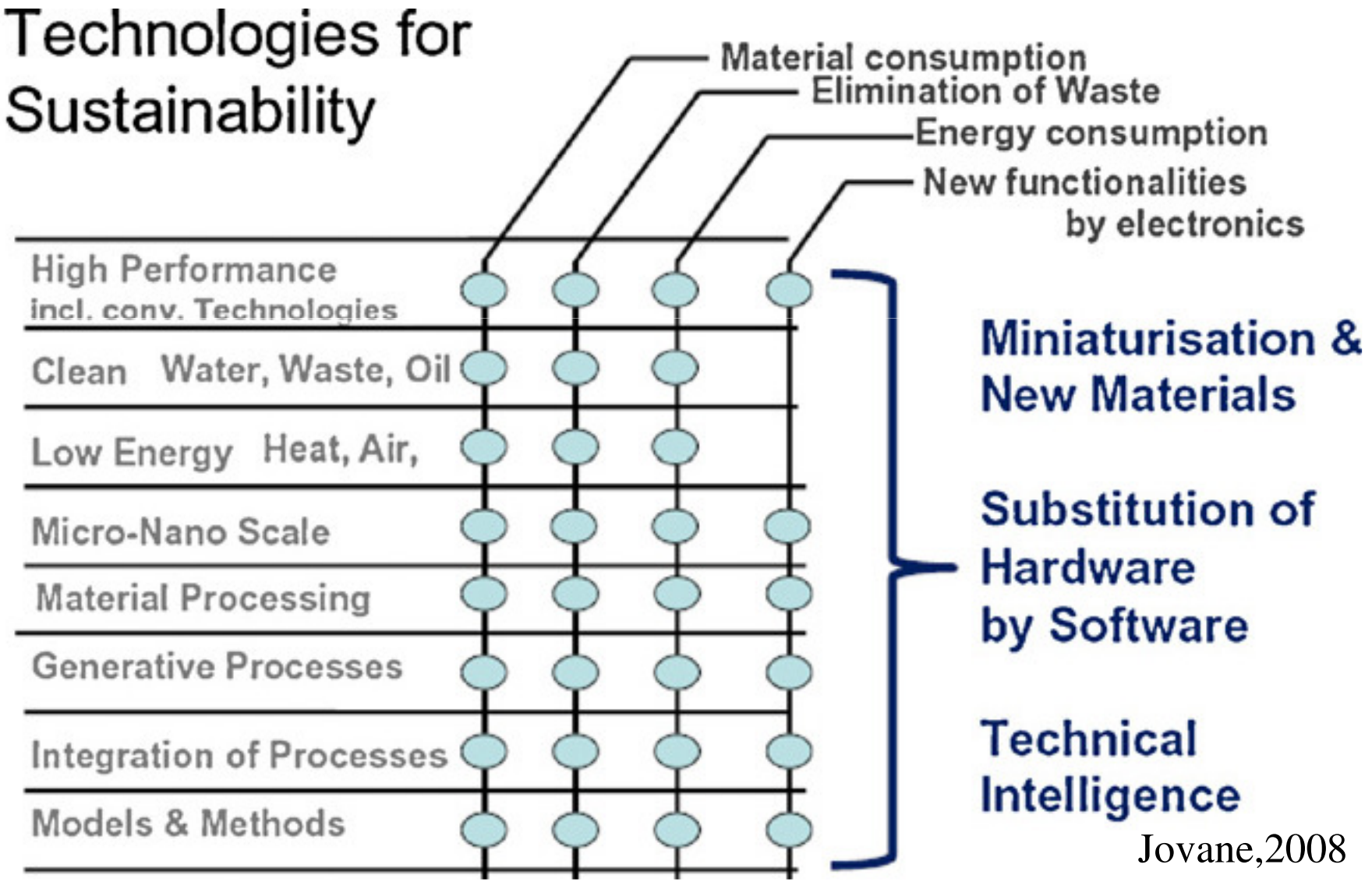

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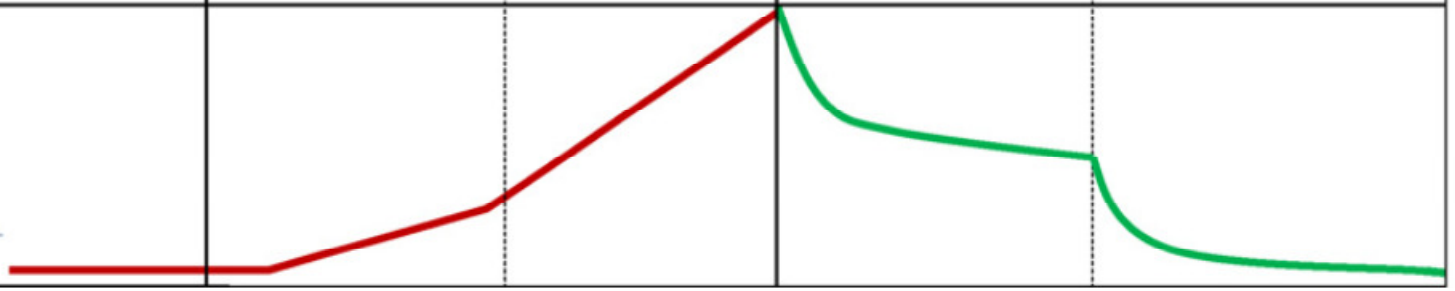
Years	~ 17c	18c ~ 20c		21c ~	
Name of Age	Age of survival	Age of development		Age of sustainability	
	Manual works	Mechanization	Intelligent mechanization	Green IT (A)	Green IT (B)
Works in factory	Muscle works by human	Muscle works by power machinery		Energy conservation of power machines	
	Brain works by human		Brain works by information machinery		Energy conservation of information machinery
Technology	Manual tools	Power machinery	IT control	Energy conserving design of machine and systems with IT control	Energy conserving element, device and systems
Energy consumption					

Jovane,2008

DO: the Re-X wave

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- 6 R's: Reduce, Reuse, Recycle, Redesign (or Rethinking), Recover and Remanufacture
- The 7th R: Regulation (systemic view..)

- *<< Sustainable manufacturing processes are those which*
- *demonstrate improved energy efficiency, and environmental*
- *impact, reduced manufacturing cost, producing minimum*
- *wastes and providing enhanced personal health and*
- *operational safety. >>* *Jawahir, 2007*

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Paradox: zero limit

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- when extending this idea of minimization (ACTION) according also to the input/output analysis applied to manufacture up to its extreme consequences: it is obvious to think it is possible to have a zero-waste industrial cycle (NOT ACTION), hopefully by creating symbiotic chains between industries (null negative gradient).

- *<<many well-meaning environmentalists seem to imagine that the biosphere is a perfect recycler …. i.e., to achieve `zero emissions´ in the industrial landscape by recycling all wastes.. The idea of `zero emissions´ is based on the (false) idea that every biological waste is `food´ for some other organism…..* >>

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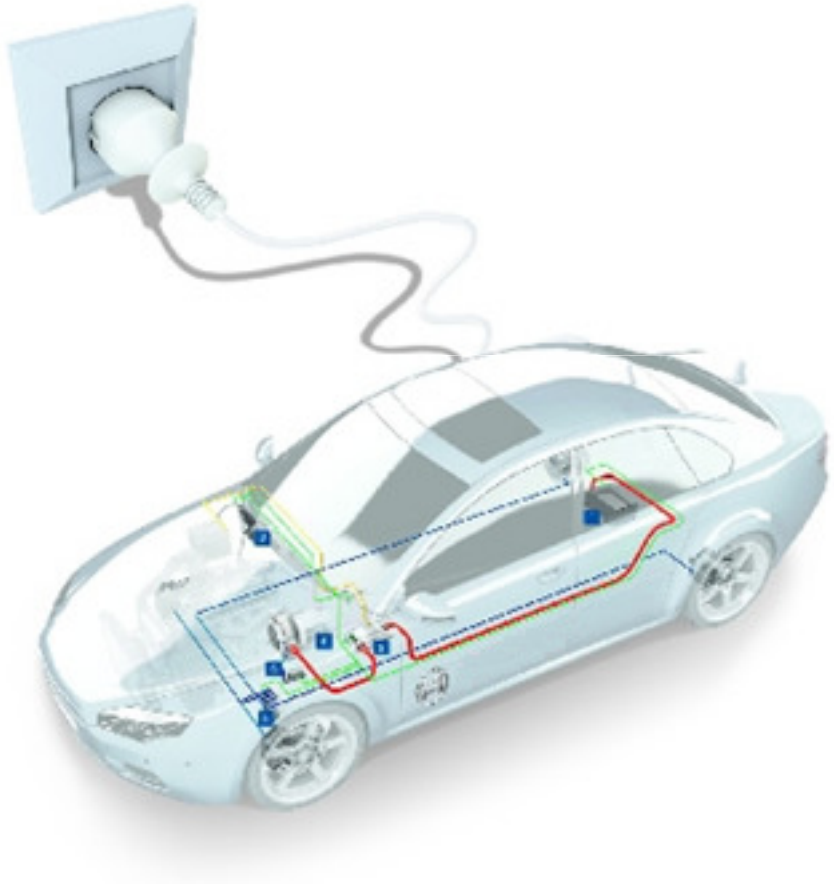

Main tendency in the automotive design:environment

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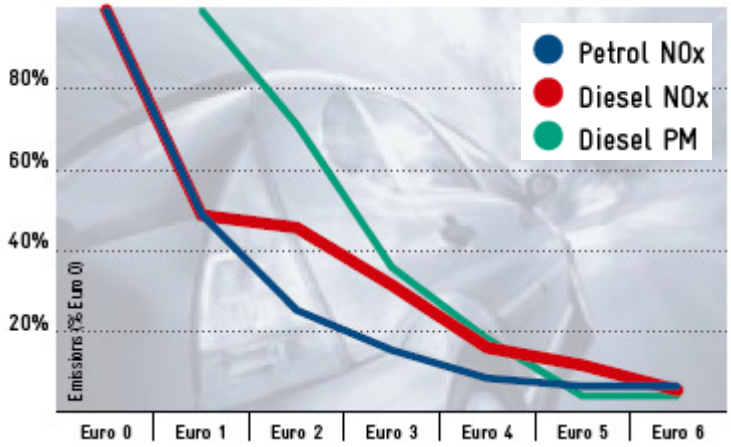
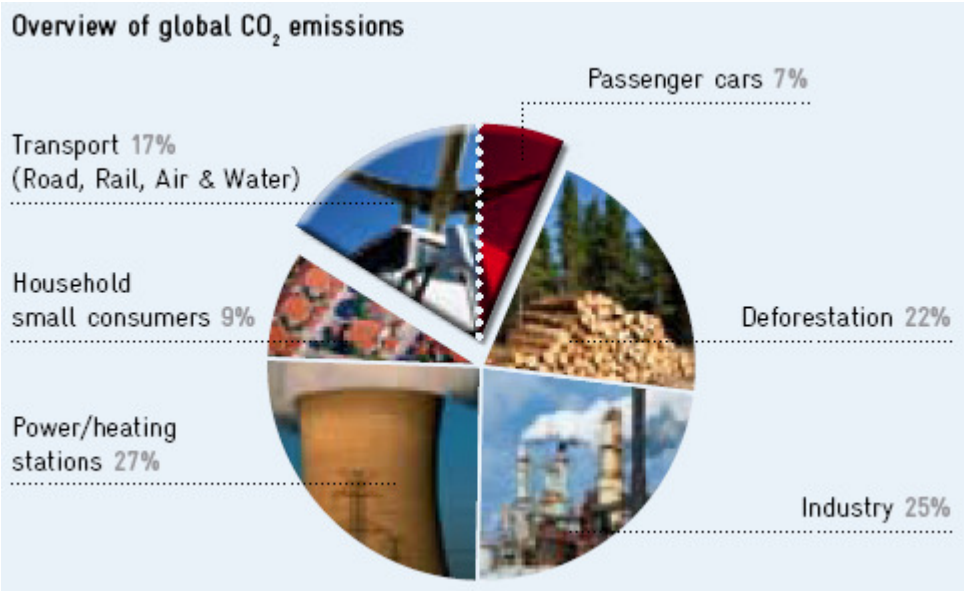
Vehicles are an important source of pollution:

- Pollutant exhaust (NO_X, CO, HC, PM_X)
- **CO_2 emission: a key priority**
- Recycling at the end of life
- Noise





Light recyclable materials

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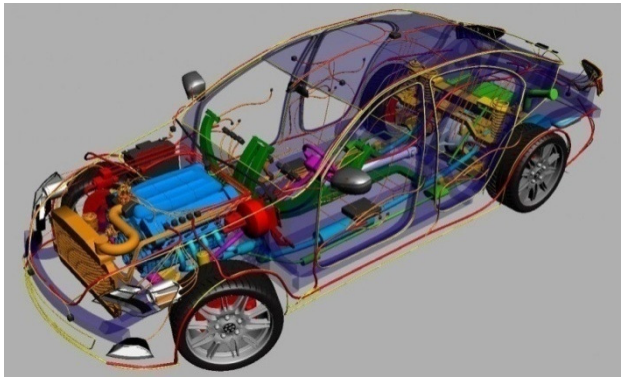
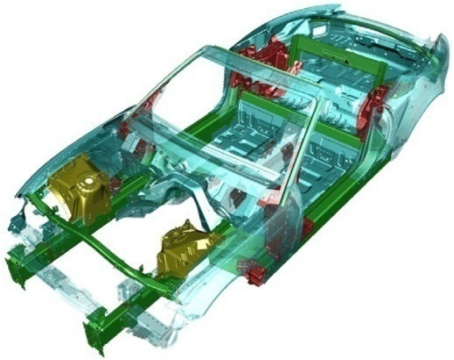
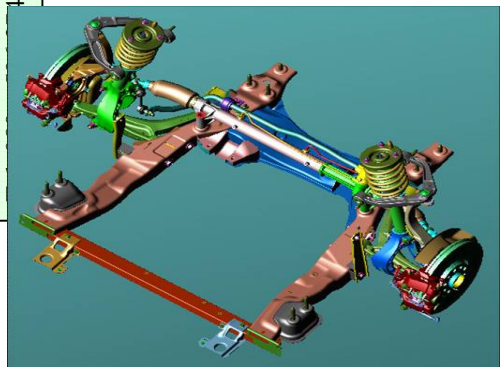
Bumpers





Chassis

Springs



Plastics

Chassis

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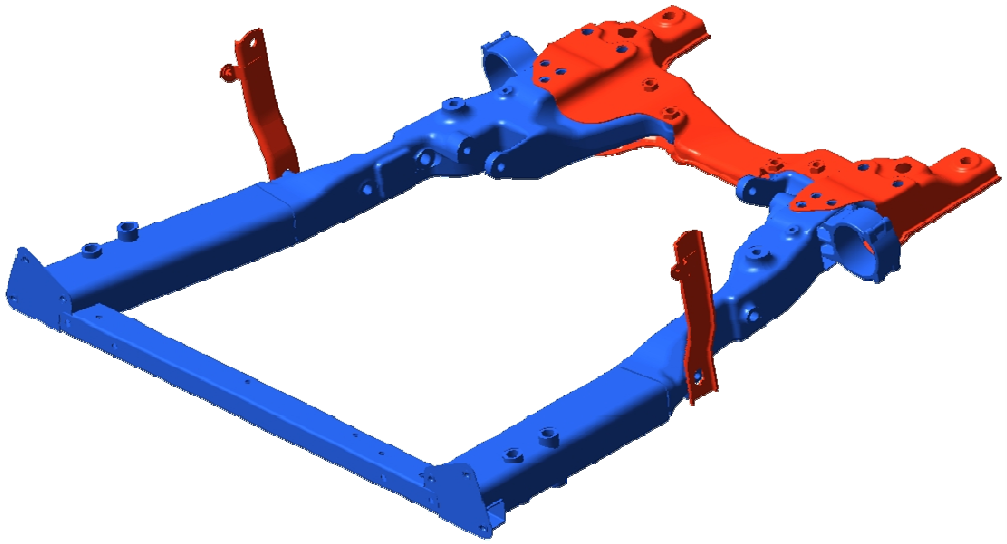
- *Hybrid architecture*

multi-material approach , internal body in thermoplastics (PA,PP) , metallic structure outside (Al,steel)

✓Weight reduction 30%
✓Cost reduction 5,3%
✓Modular Design



Aluminium

Steel

Lightweight engine subframe: Thickness optimization

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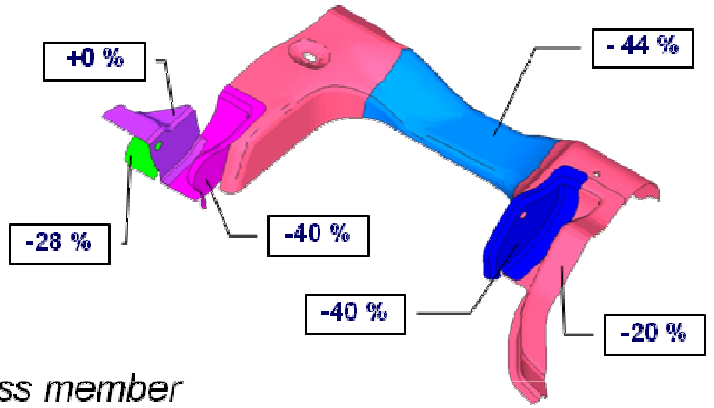
Thickness optimization on the current stamped sheet frame, the existing die could be maintained using tailored blanks

Results:

+ Weight reduction of 8%

+ Low investments

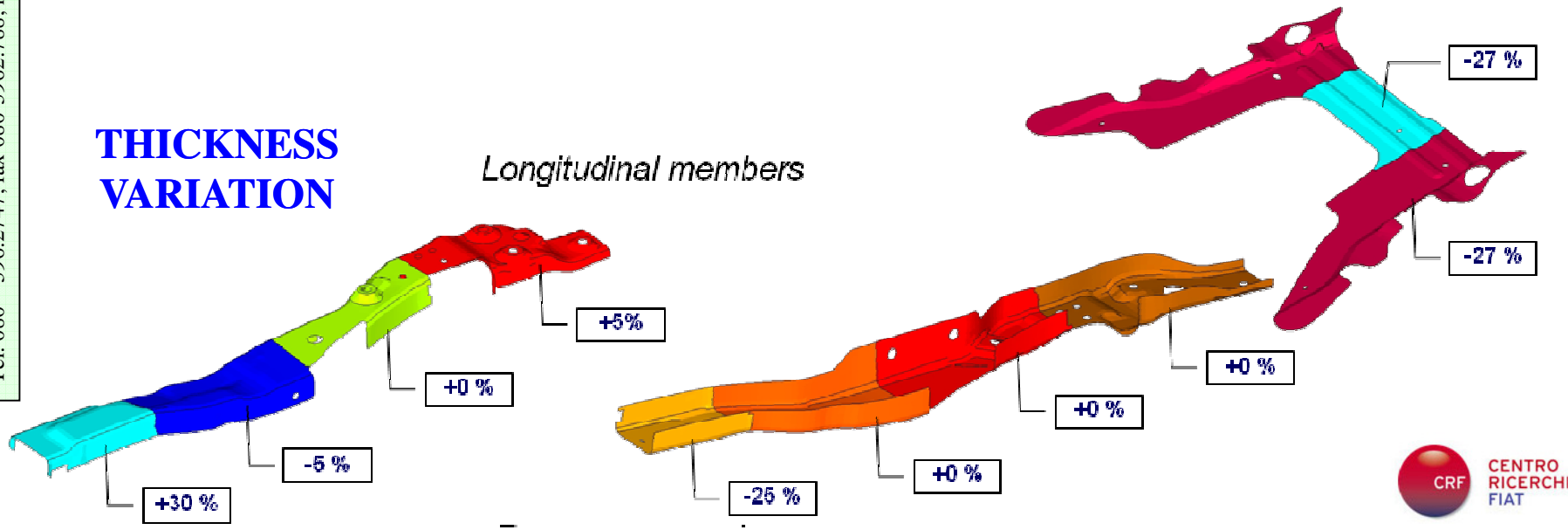
- Technological feasibility is still to be assessed



Rear cross member

THICKNESS VARIATION

Longitudinal members



CRF CENTRO RICERCHE FIAT

Lightweight engine subframe

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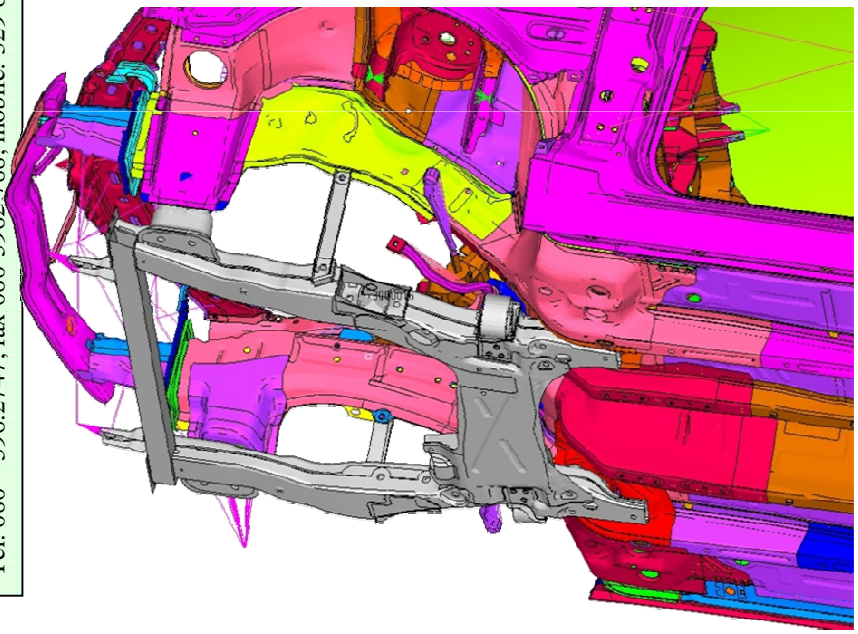
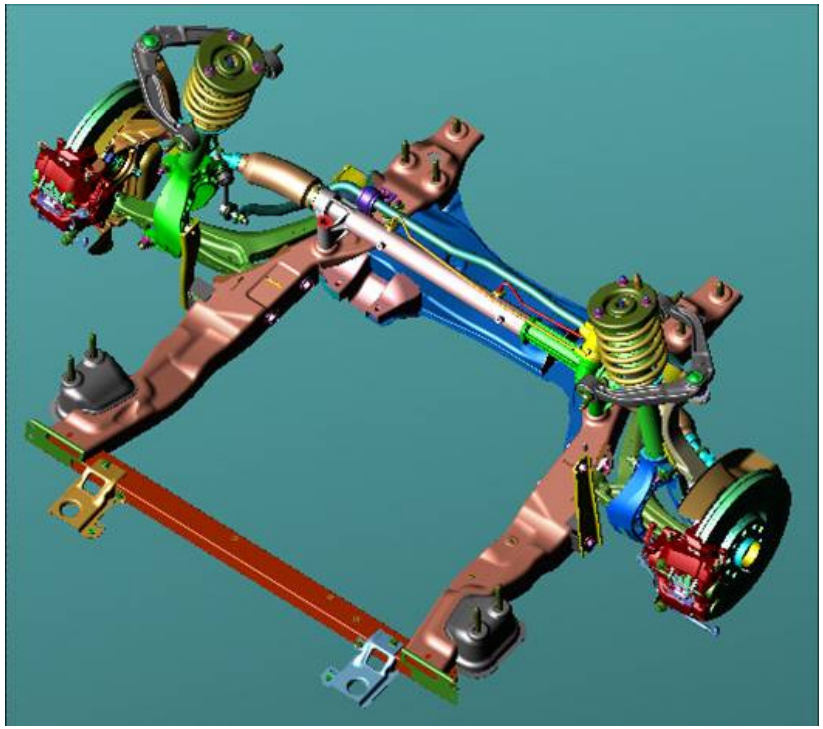
Target: to develop a front engine subframe with the same performance (static and dynamic stiffness, crash behaviour) but lighter (30%) than the existing one; the lightening cost efficiency is required to be better than those typical of “full aluminium” solution





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How it is possible to make the lightweight

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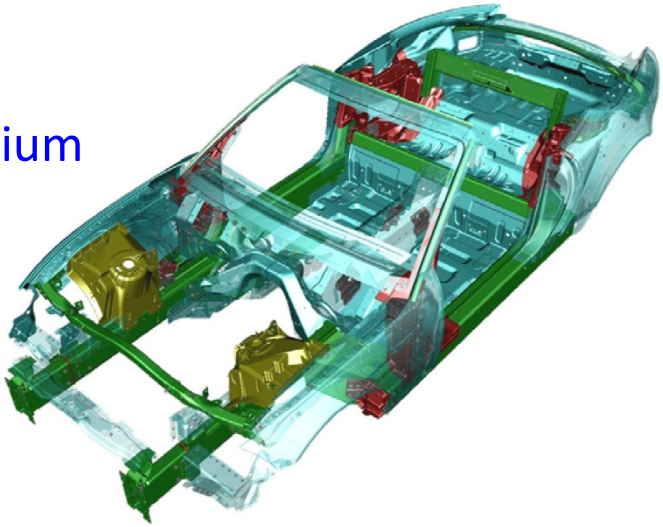
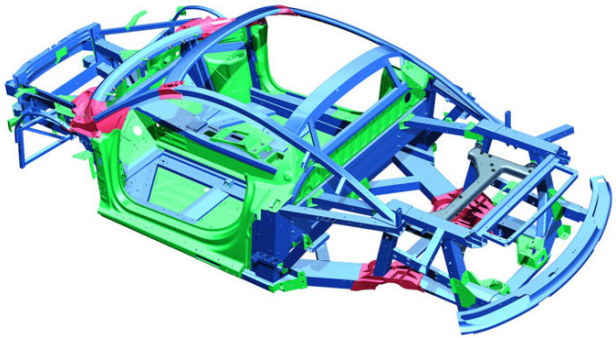
- Materials
  - Ultra High Strength Steel
  - Lightweight metal: **Aluminium**, Magnesium
  - **Plastics**, Composites, Nanoreinforced materials, Biomaterials
- Joining technology
  - Laser welding
  - Riveting, clinching
  - Adhesive bonding
- Optimization
  - Topology optimization
  - Space frame structures





Eco-design for Solving Recycling Problems

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Automotive steel/copper contamination on automotive shredder residues –ARS-affects the quality of recycled steel and do not to allow the reuse of this material on new automotive parts.

There are many ways of dealing with the problem:

1. diluting the recycled scrap with virgin metal;
2. treating Cu-bearing steel in the furnace to remove the Cu;
3. Increasing the tolerance of sheet steel for Cu by adding P;
4. Upgrading Cu-bearing steel severely into new mill shapes;
5. Using the scrap for other possible applications;
6. Hot roll in a reducing atmosphere to avoid the oxide formation;
7. Divert the steel scrap to iron casting, where the Cu content can be used as a graphitizer …and so on.

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The expected technological developments are:

Nanomaterials & nanotechnologies promoting:

dematerialization, cleaner superficial treatment, and new treatments for industrial residues and effluents as well.

Near net shape techniques, in which the initial production of the item is very close to the final :

superplastic forming for plastics and composites;
sintering for metals and metals composites molded injection;
rapid prototyping to simulate by computer aided design (CAD) and to produce by computer aided manufacture (CAM) complex shapes in a melting-pot of materials.

Ecomaterials for strucutral uses (bodyshop) - more recylcable and free from toxic substances

Eco-design fostering cars recyclability: The case of Renault Modus

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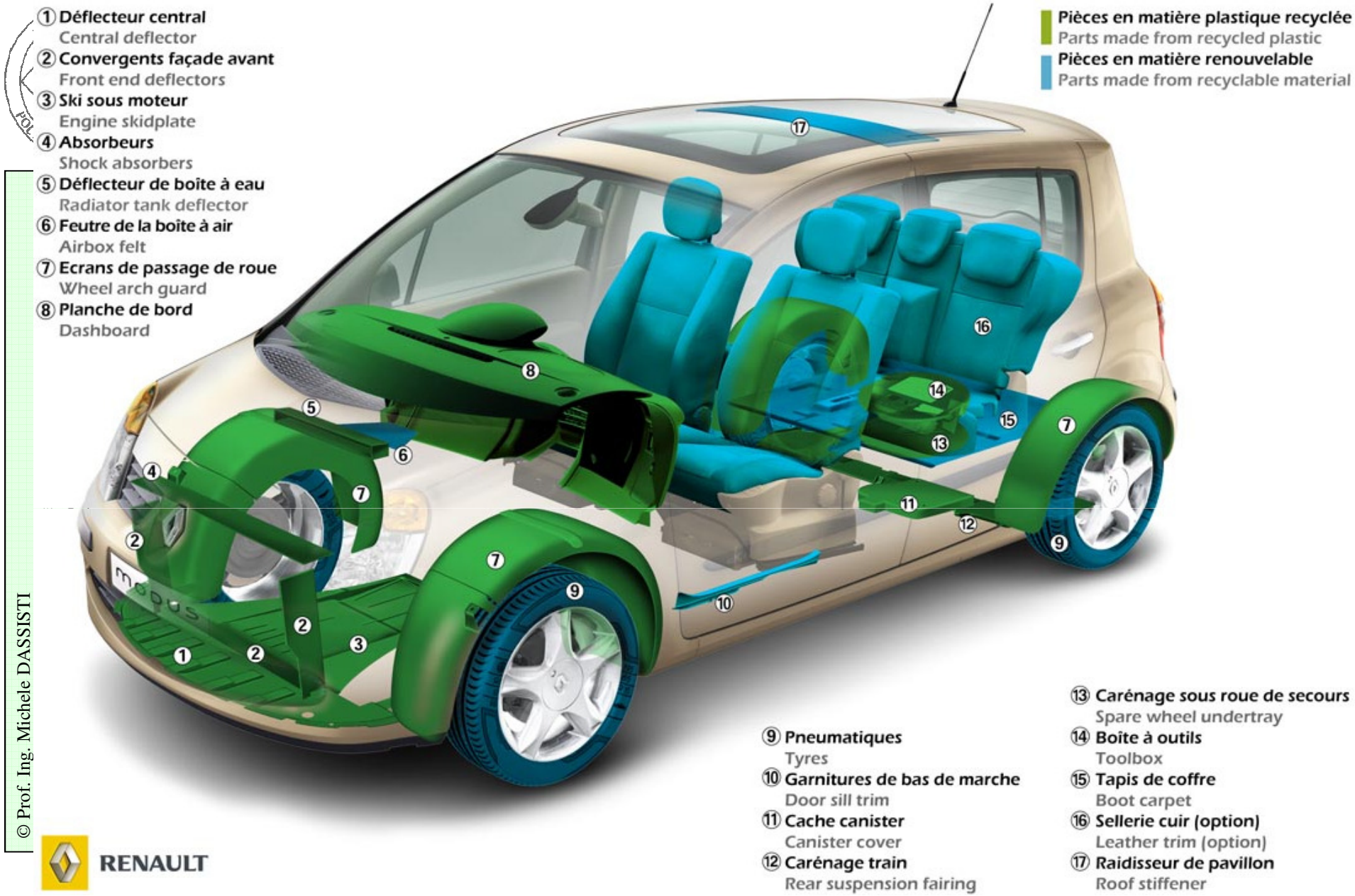
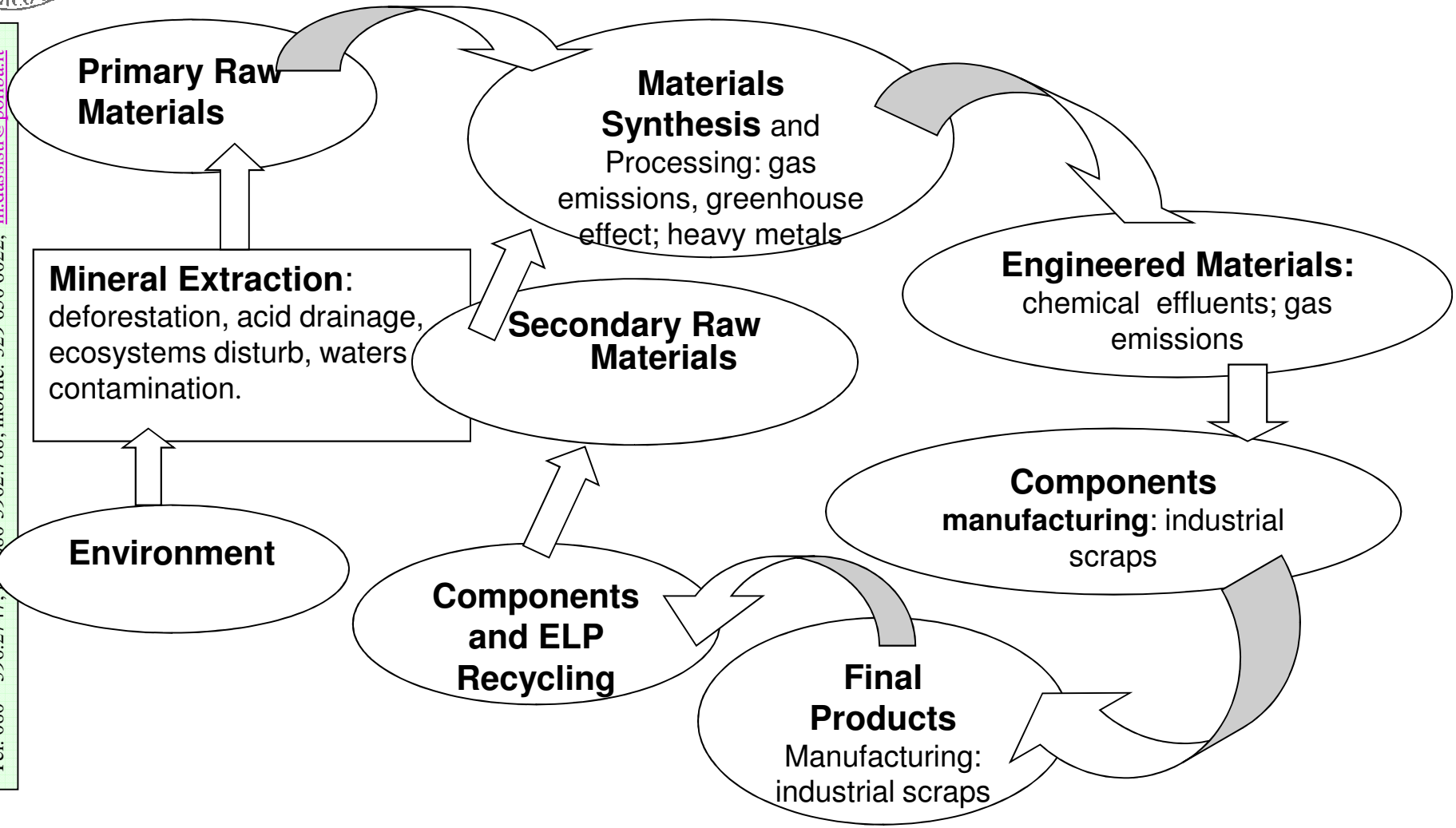
- **Modus** inaugurated a new segment of the compact mono-space., **95 % recyclable**, and was the first Renault model totally **eco-designed by the software OPERA** -Overseas Program for Economic Recycling Analyses–.
- Its interior has numerous storage compartments in the dashboard, the front floor and doors, where we can find the environmental thought of eco-designed parts.
- **Its dashboard incorporates around 50% of recycled PP corresponding to almost 5 kg.**
- The OPERA is expected to be speeded the recycled PP evolution in Renault vehicles helping them to reach their goal of 50 Kg per vehicle in 2016.

CETEM
CENTRO DE TECNOLOGIA MINERAL



Closing Life Cycle Materials loop by Recycling



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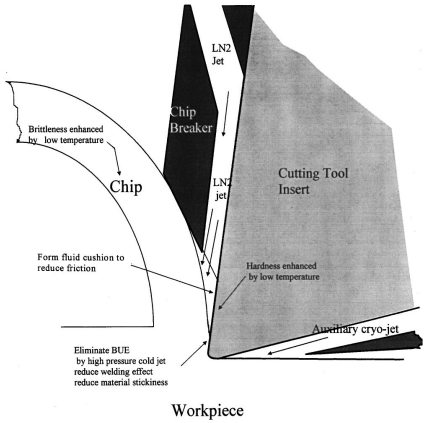
An example…

Metalworking Fluids (MWFs) have a history of harming the environment and the health of workers, resulting in pressures to re-design them in accordance with sustainable manufacturing principles.



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Another research example: unusual working conditions?

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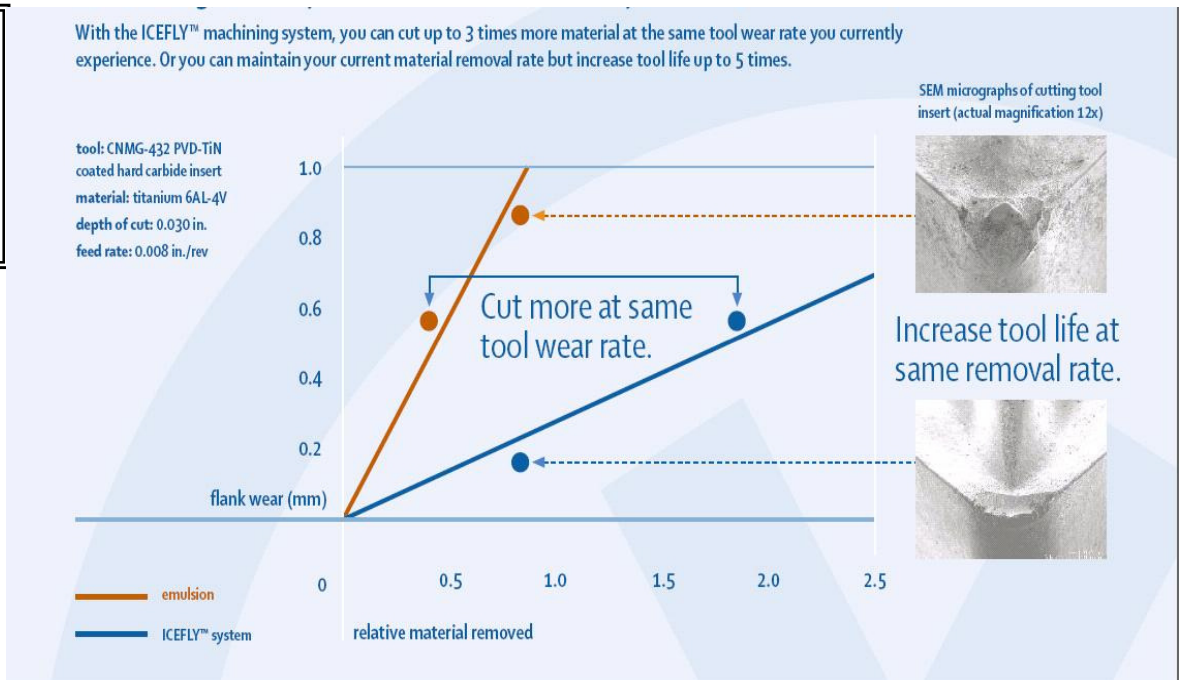
- Politecnico di Bari
- University of Kentucky

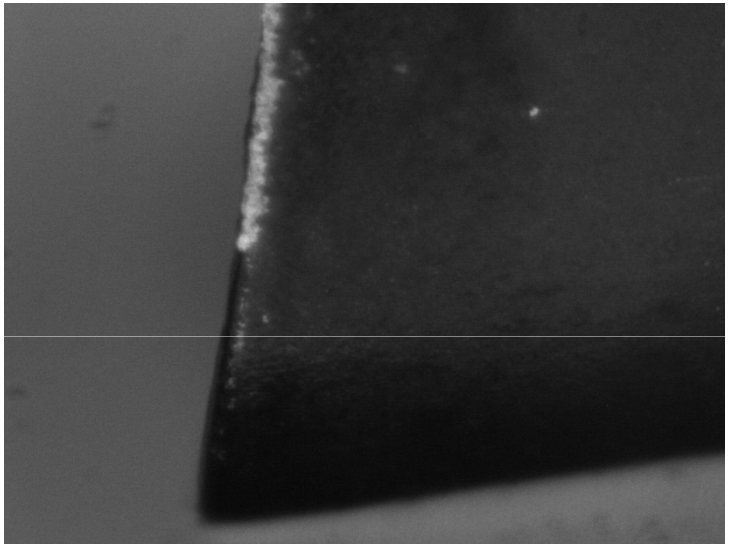
Cryogenic

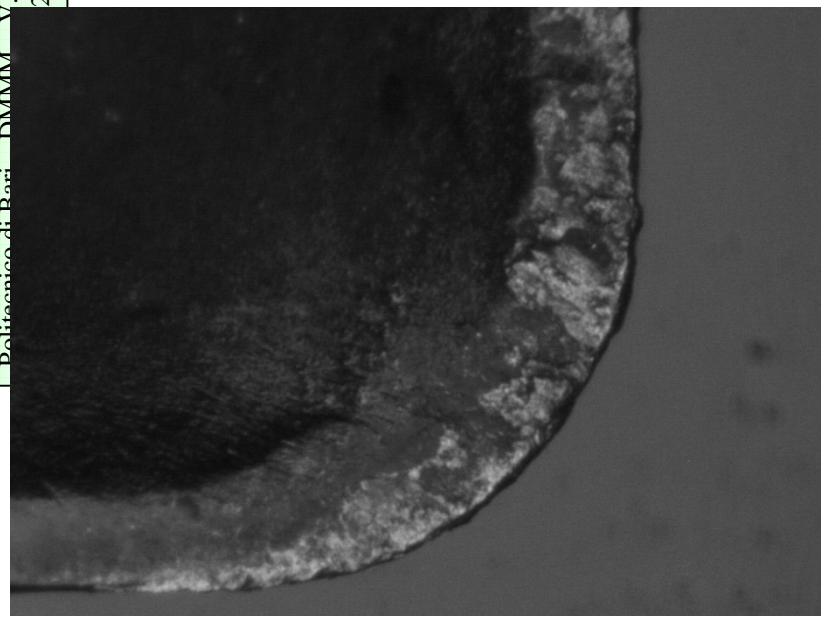


- *<<To achieve this goal, scientists and engineers cooperate in international and multidisciplinary groups and organisations. They utilise imagination, judgement and take initiative to apply science, technologies and practical experience to shape competitive processes and products.>> Seliger, 2008*

Cryo-cutting

- Freezing process (–)
- Setting (––)





- Manufacturing process (+)
- Material processing (++)

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7

New opportunities for synergies?”

ICT

vs

Sustainability

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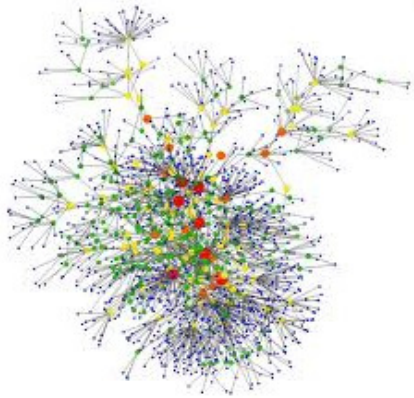
ONTOLOGY:

setting our common model



Knowledge main issues

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Objective:

to realize a common reference for the meaning of terms (semantics) adopted by different systems in order to allow them to interoperate

Ontology

(e.g., for business and enterprises: *Enterprise Ontology*)

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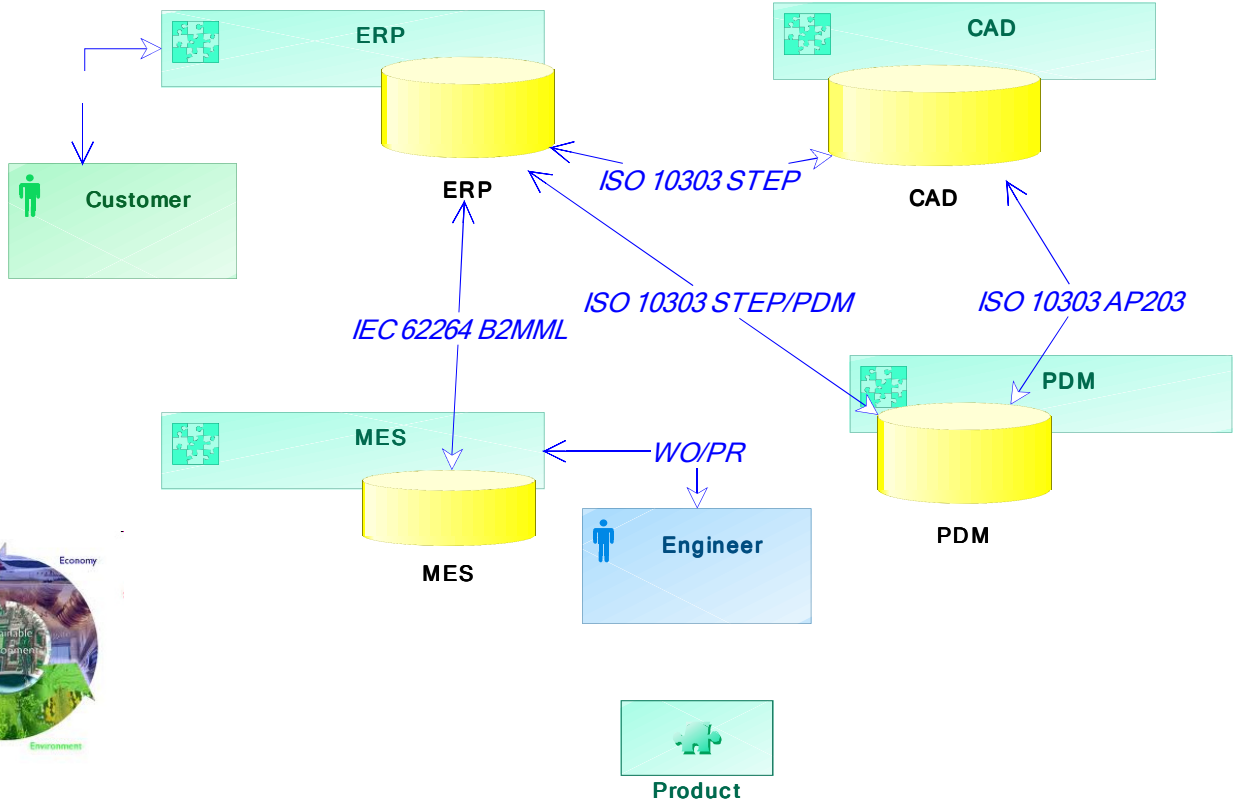
SUSTAINABILITY AS A PART OF THE GOAL…



Sustainability & ontology

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- To share ***common understanding*** of the structure of information among people or software agents
- To enable ***reuse*** of domain knowledge
- To make ***domain assumptions*** explicit
- To ***analyze*** domain knowledge
- To ***separate*** domain knowledge from the operational knowledge

[Noy&McGuinness 2001]

DISAMBIGUATION: a common widget

- What is a spinde, without a context?

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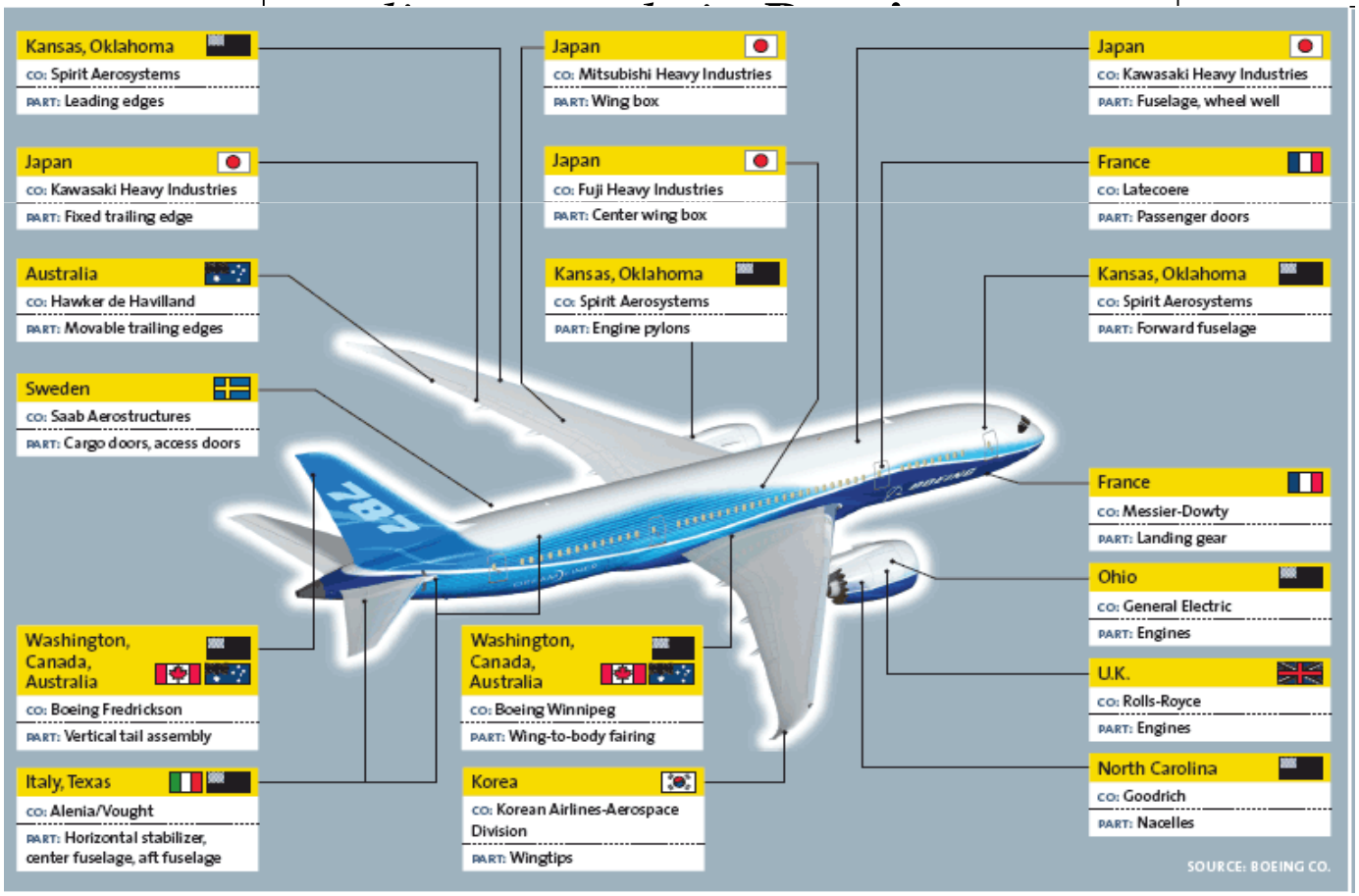
"Babel tower" effect

*Sketch it in the **USA***
*Design in **India***
*Feed materials from **Australia***
*Produce components in **China***
*soft components in **Singapore***
*Assemble in **Europe***



Interoperability:

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- from Oxford Dictionary: *"…able to operate in conjunction"*
- from the IEEE Std 610.12 *"…is the ability of two or more **systems** or components to **exchange** and use **information**"* [IEEE 1990]
- From software point of view *"… is the ability of different types of computers, networks, operating systems, and applications to work together effectively, without prior communication, in order to exchange information in a useful and meaningful manner"*. [Panetto 2007]

Interoperability ≠ Cloning

Interoperability ≠ Compatibility

Profitability of interoperability!

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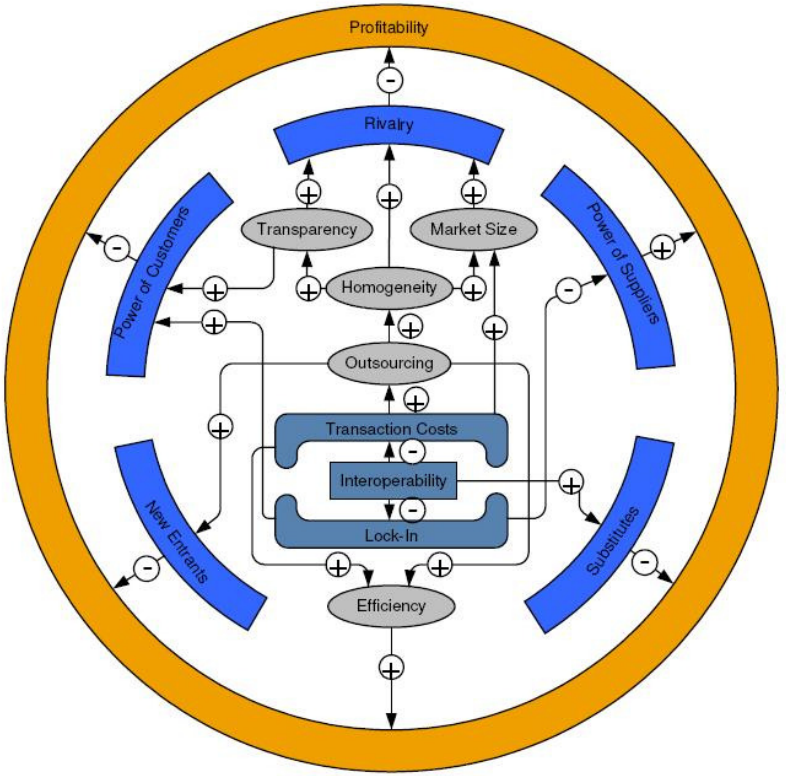
- It is expected Iop Increases profitabilit
- *….<<we estimate that imperfect interoperability costs th US automobile industry approx. $1billion per year and delays in itrnoduction of new models by at least two months>>*

Brunneimer, 2002



Source: Athena, 2006

Interoperability → Sustainability?

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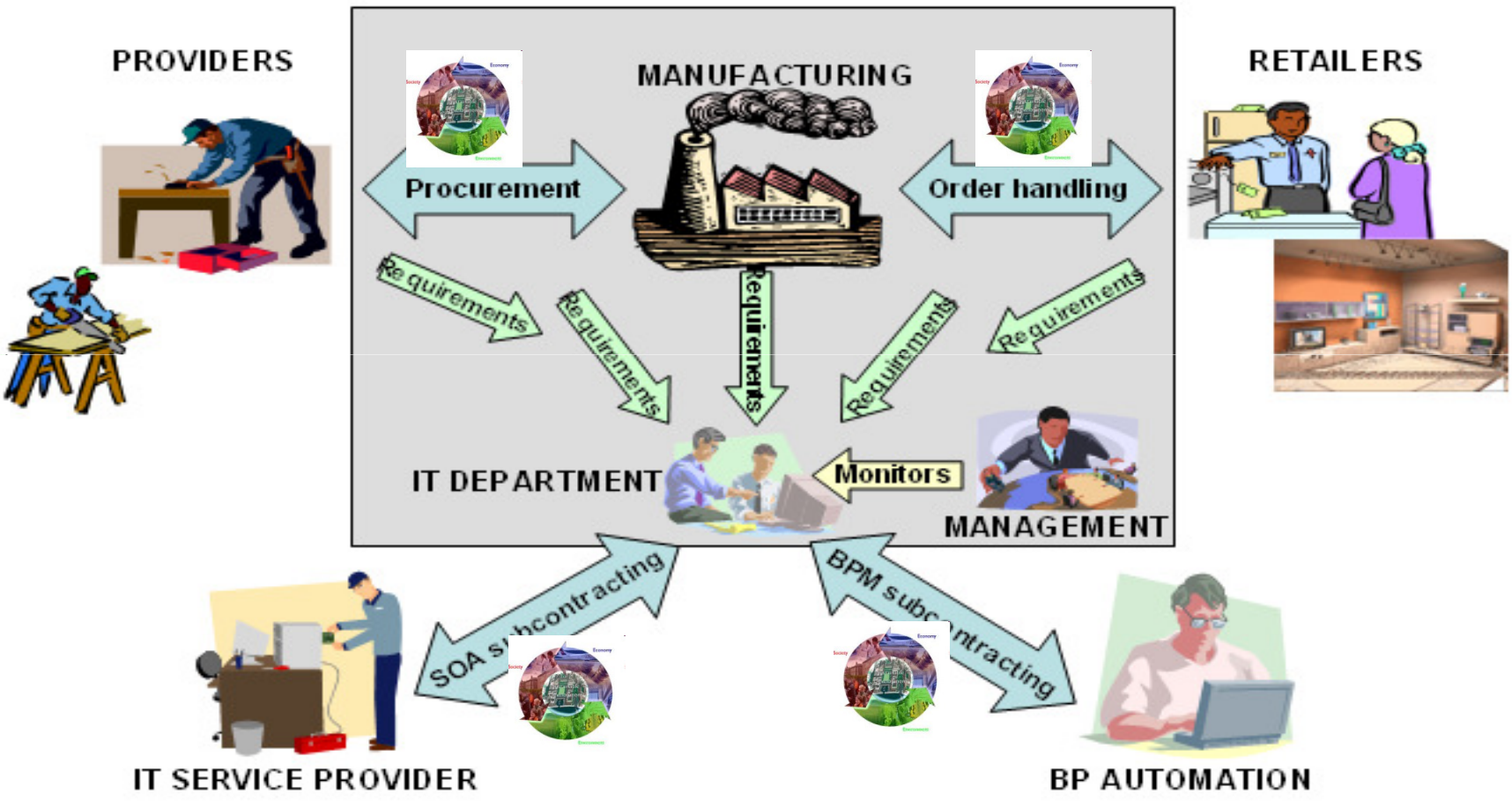

Interoperability & Sustainability: knowledge sharing

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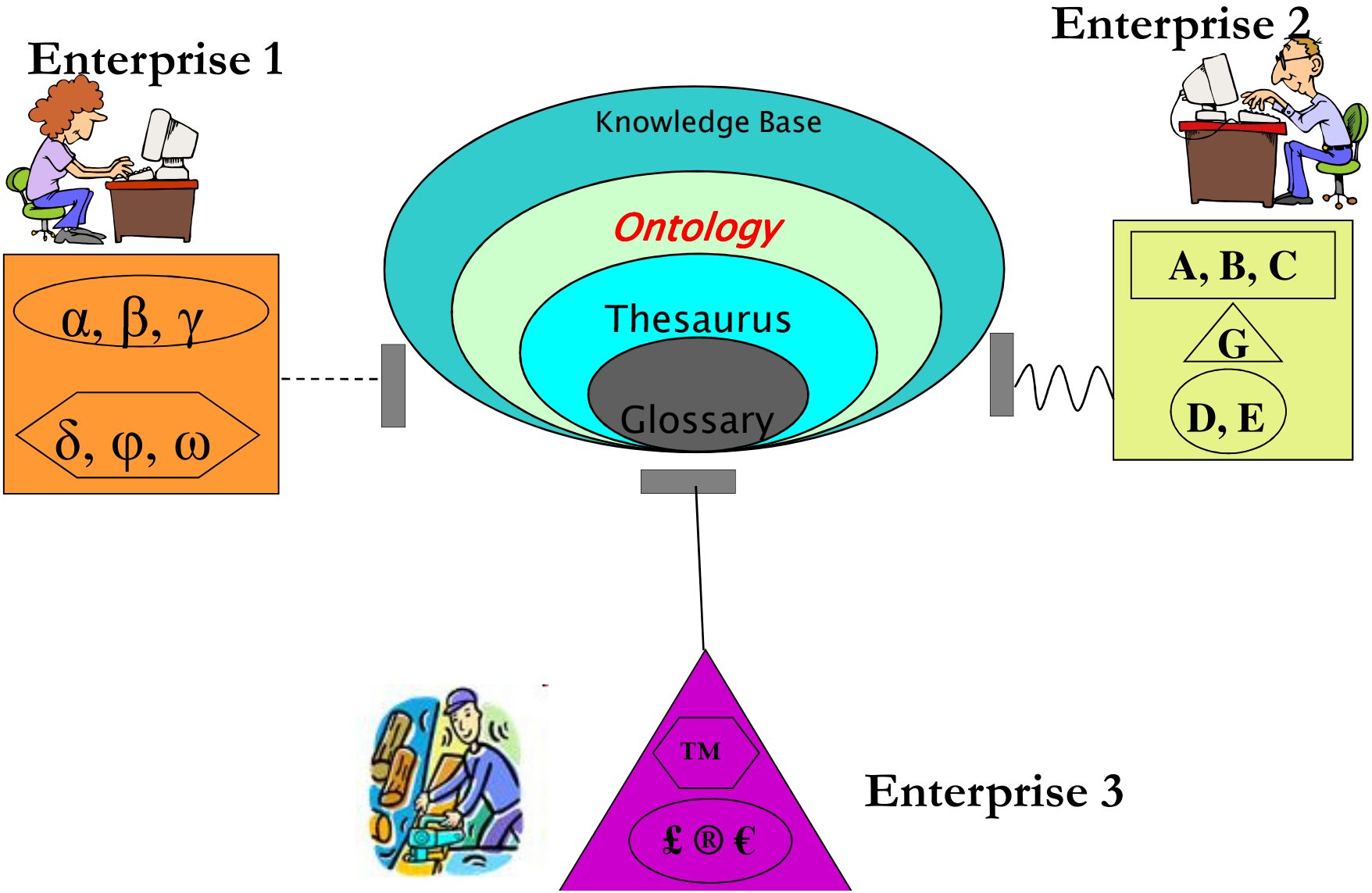

Interoperability: recomposing the fragmentation!

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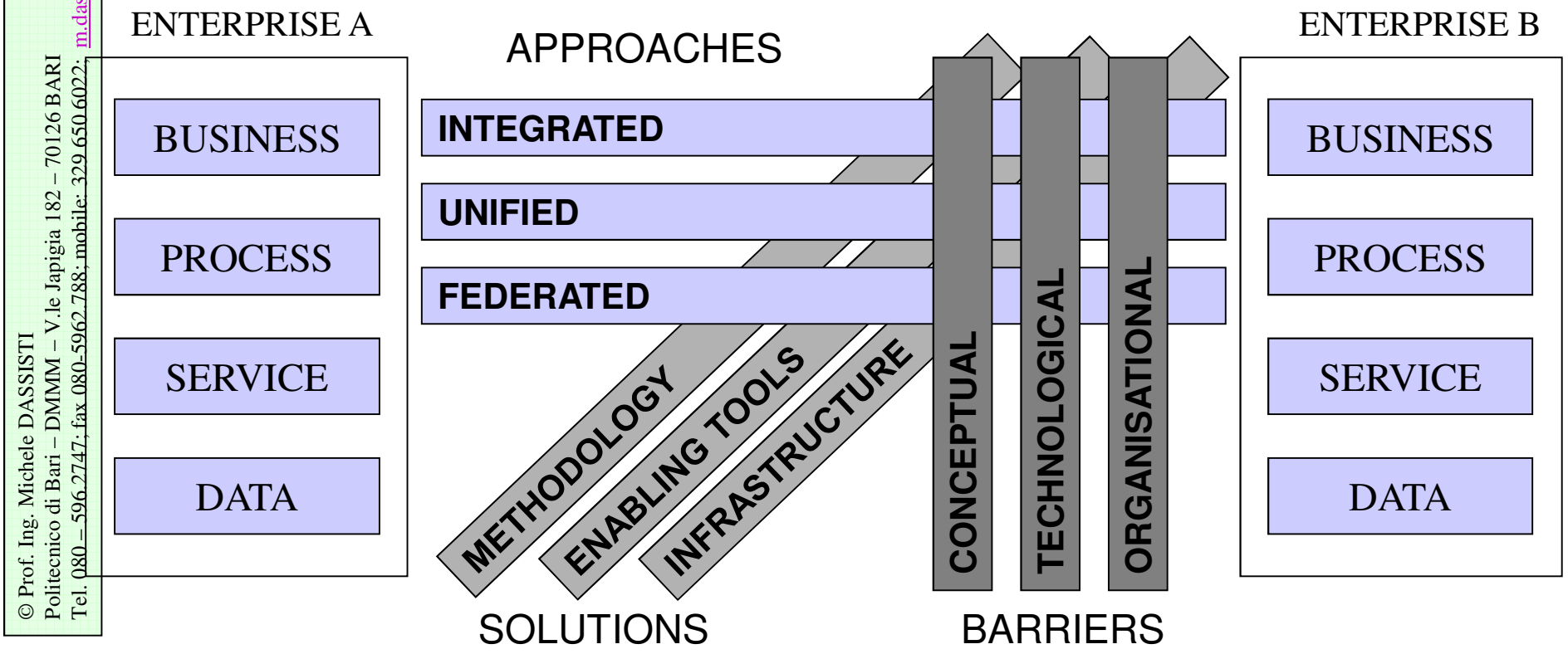

Source: **Enterprise Interoperability Framework (EIF)** Interop Network

SHARE THE SAME GOAL

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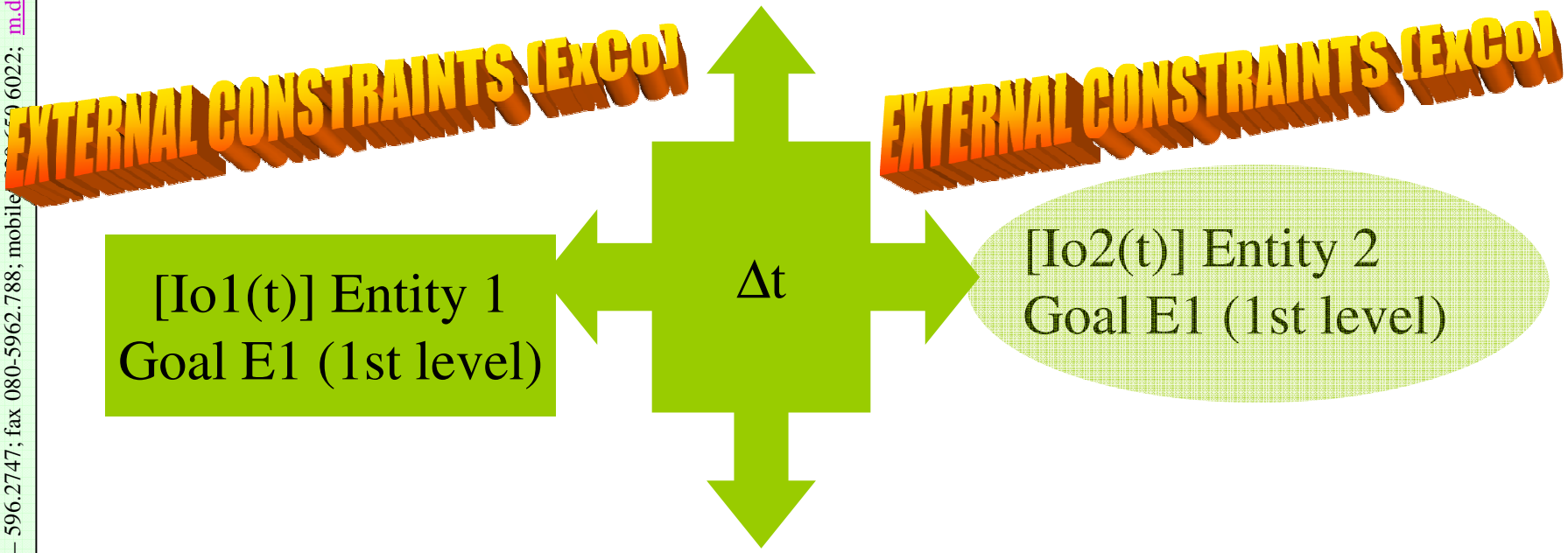
2nd level cooperation goal - CG2



$$CG2 = f$$

$$[Io1(\Delta t), Io2(\Delta t), ExCo, G_{E1}(\Delta t), G_{E2}(\Delta t)]$$

Intercultural merging

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Enterprise 1

α, β, γ

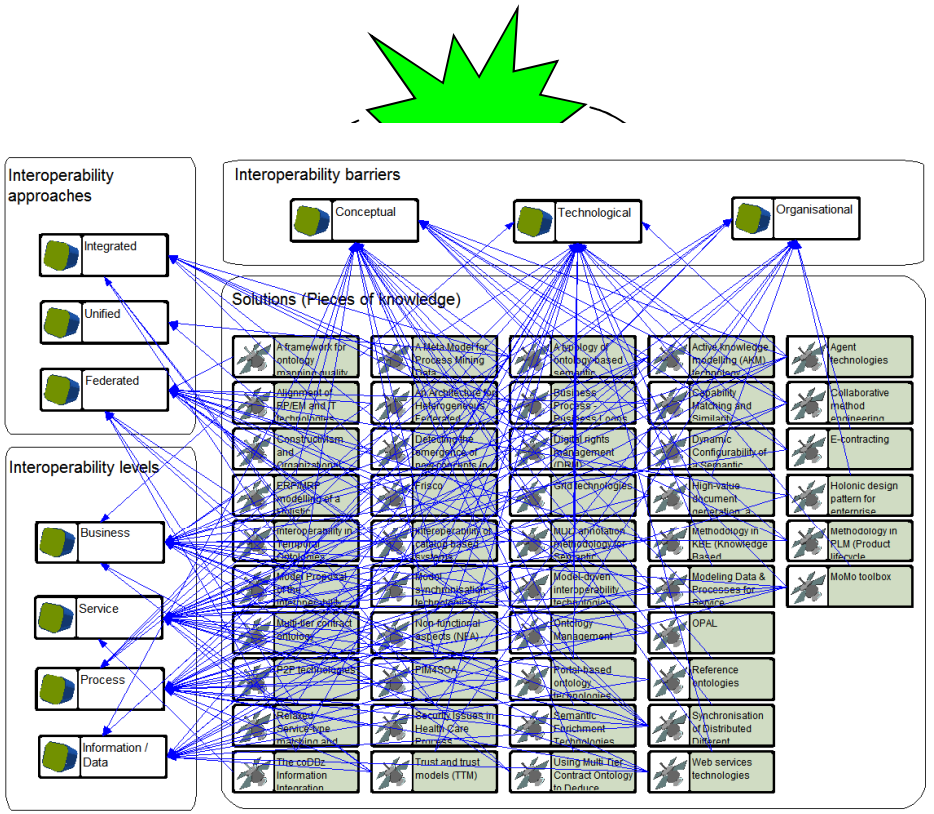
δ, φ, ω

Enterprise 2

A, B, C

G

D, E



TM

£ ® €

Enterprise 3

- *<< epistemology has to be included explicitly in the description of natural phenomena…>> F. Capra*

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Continuous Improvement

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Always optimising

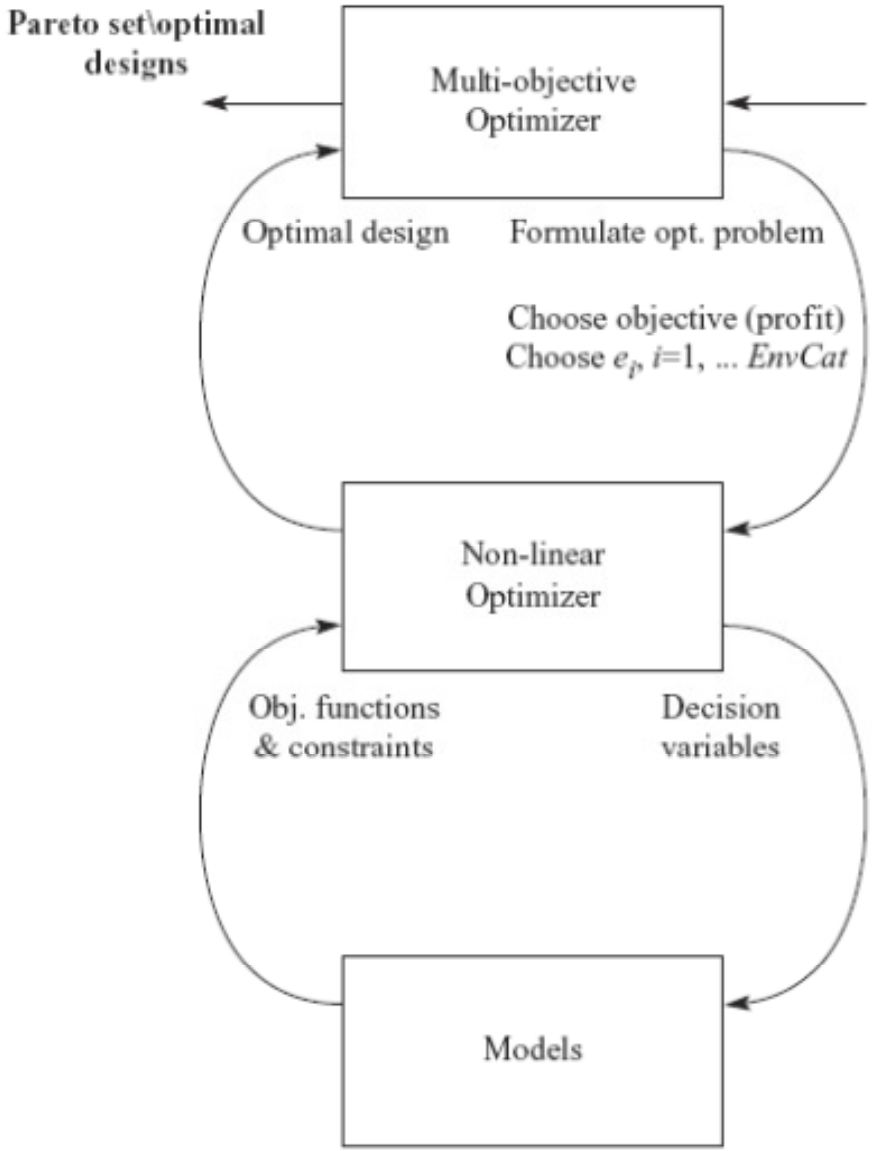

Figure 11.4 A generalized multi-objective optimization framework

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Process analysis approach

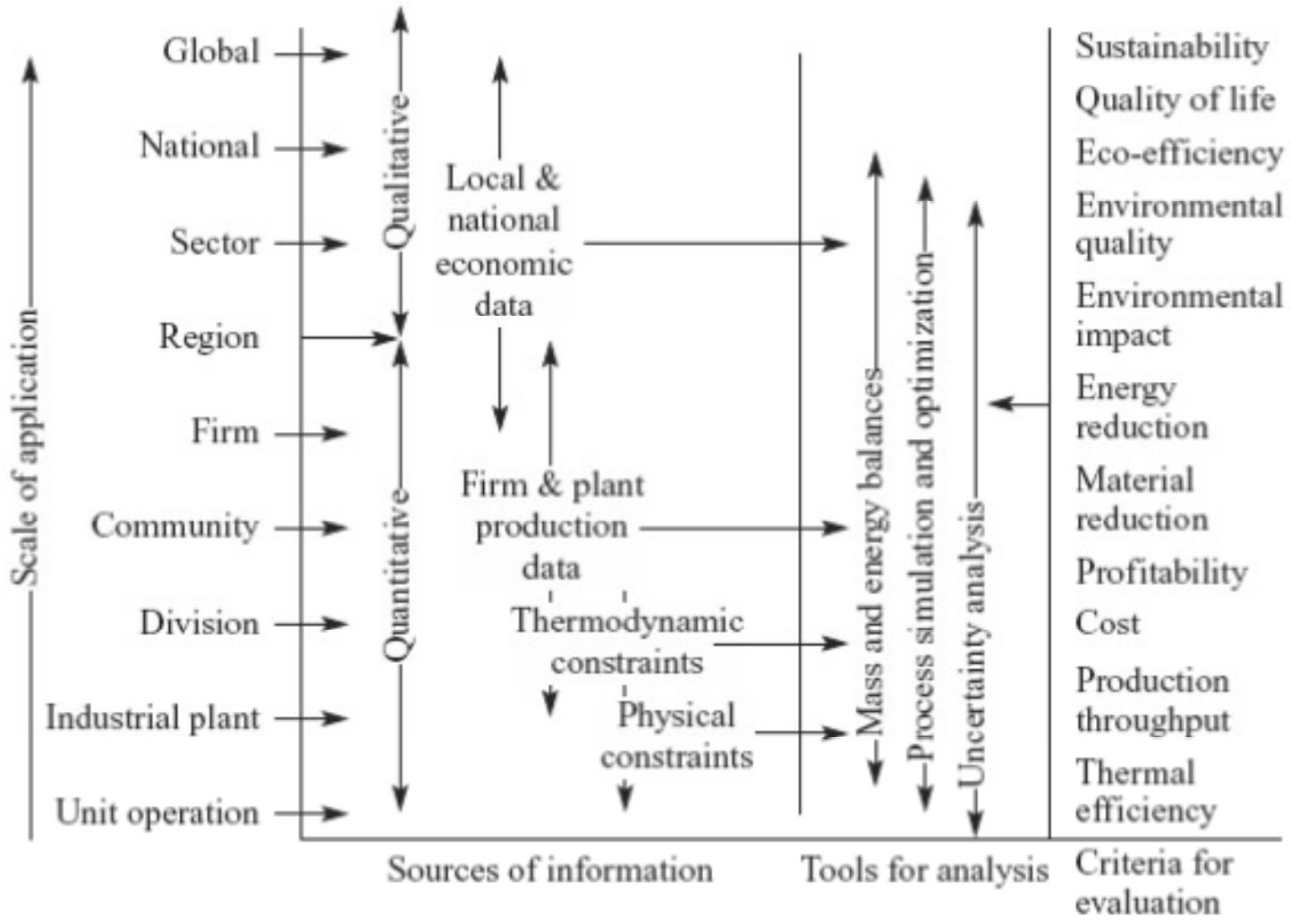

Figure 11.1 A conceptual framework for a process analysis approach to industrial ecology

Process simulation approach

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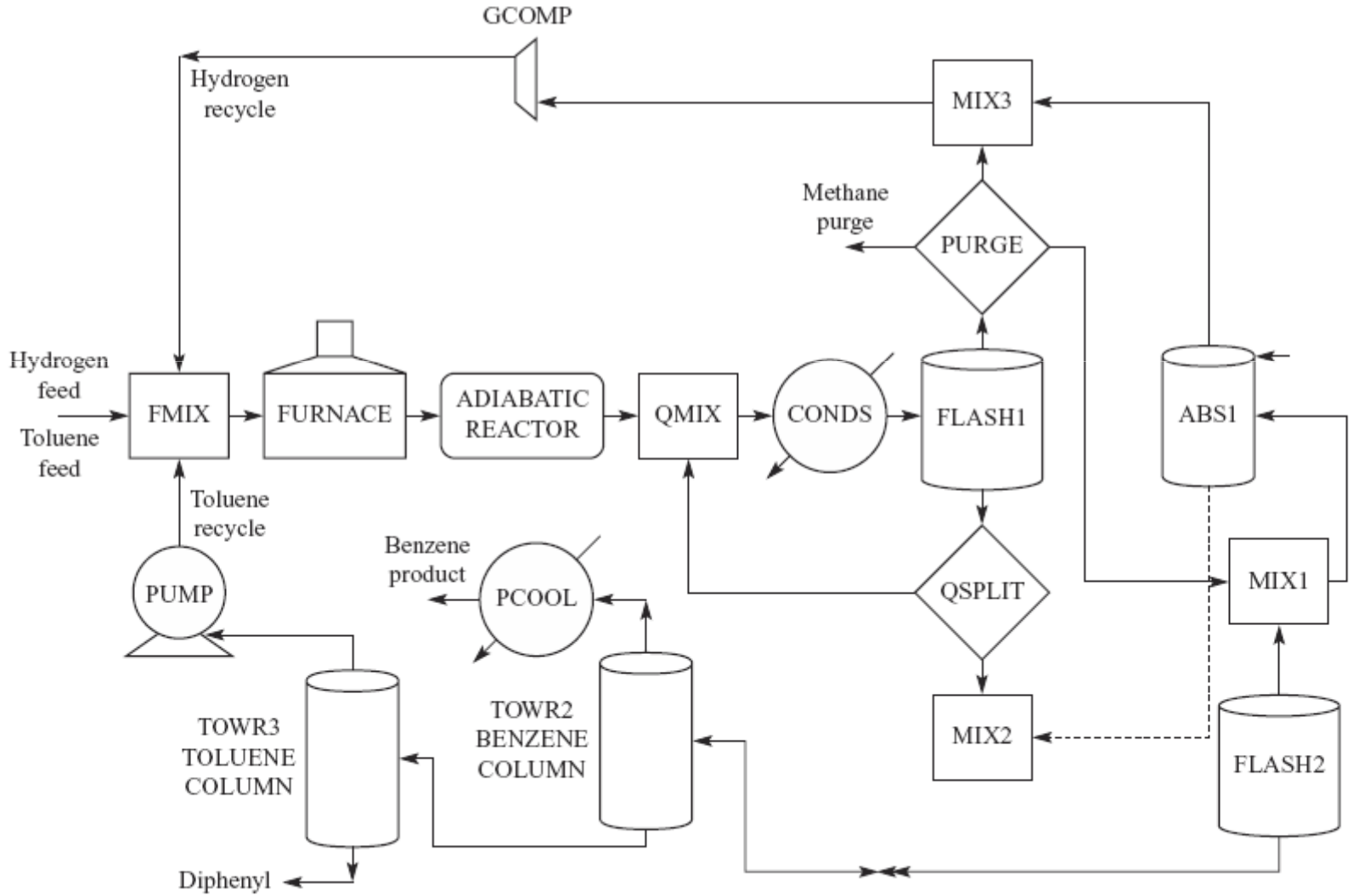

Figure 11.2 The process flowsheet for the production of benzene through the hydrodealkylation of toluene

Process simulation approach

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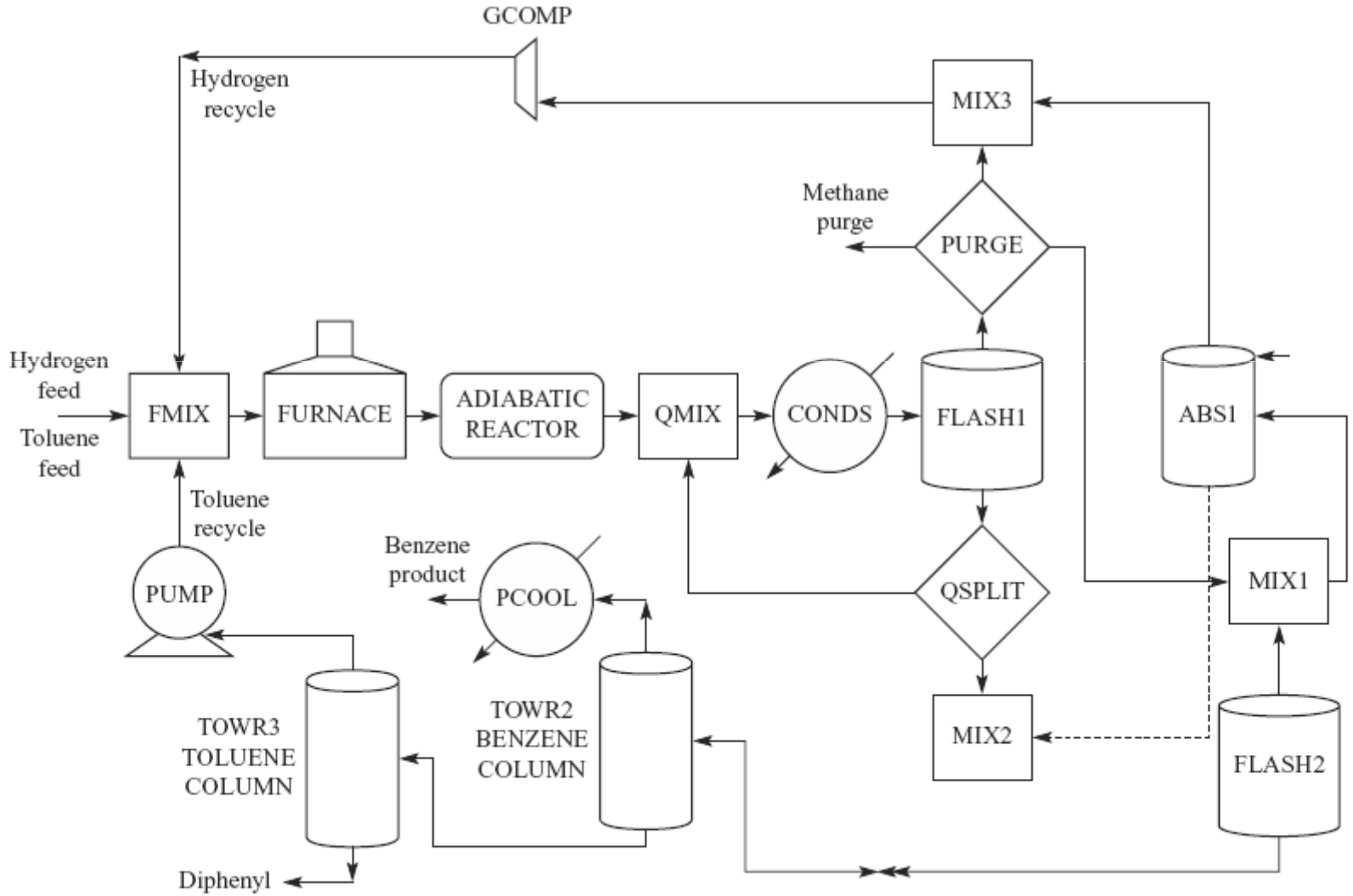

Figure 11.2 The process flowsheet for the production of benzene through the hydrodealkylation of toluene

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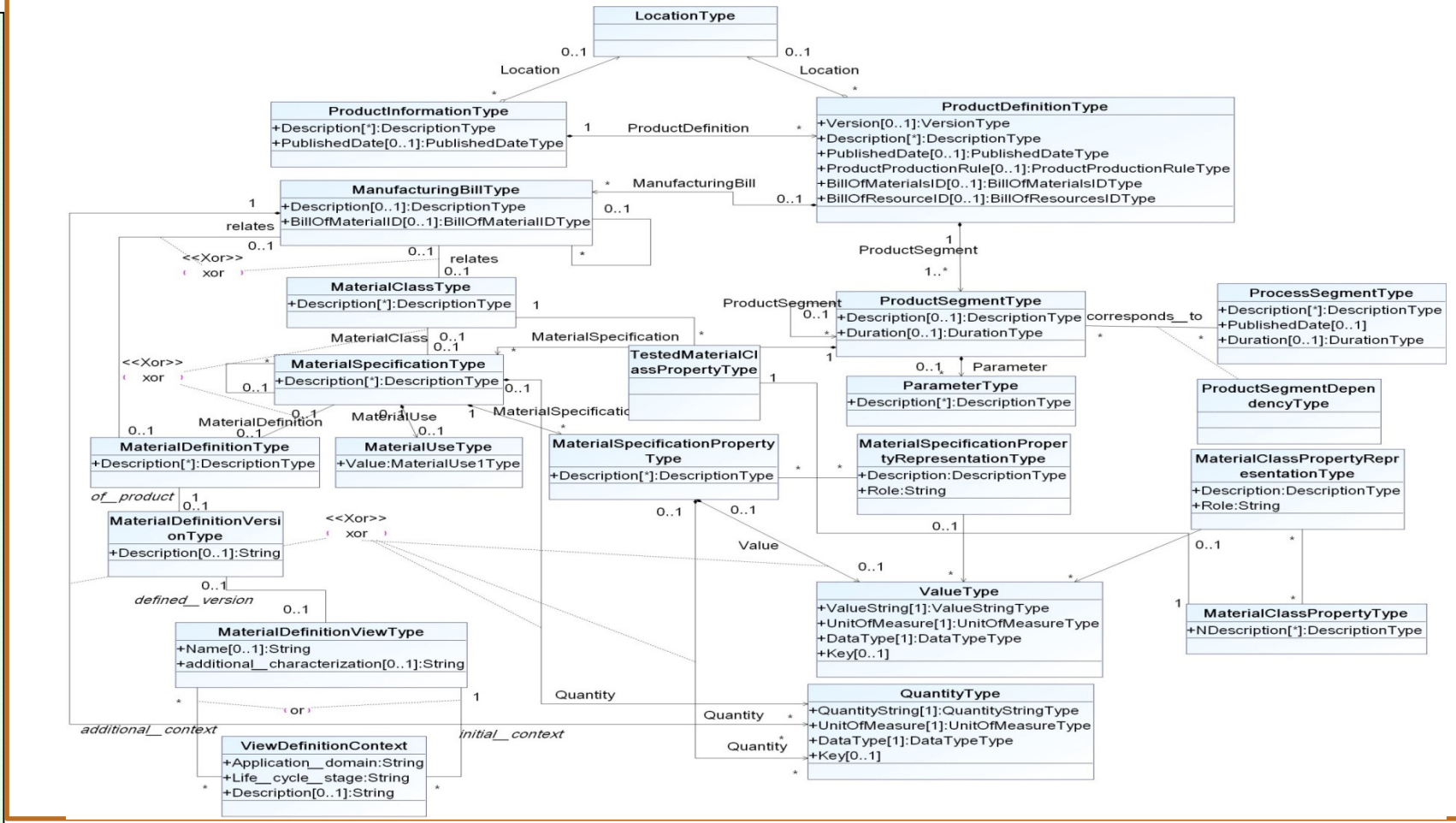
Process simulation approach

Mass and Energy Balance

Conventional components		In	Out	Relative diff.
H_2	LBMOL/HR	2047.48	2047.41	3.66387e-05
CH_4	LBMOL/HR	2414.51	2414.54	−1.39574e-05
C_6H_6	LBMOL/HR	374.131	374.139	−2.16750e-05
C_7H_8	LBMOL/HR	227.842	227.837	2.21647e-05
$C_{12}H_{10}$	LBMOL/HR	16.8401	16.8394	4.22304e-05
Total balance				
MOLE	LBMOL/HR	5080.8	5080.76	7.66967e-06
MASS	LB/HR	95679.1	95679.5	−4.68125e-06
ENTHALPY	BTU/HR	−6.60813e+07	−6.60813e+07	1.48284e-05
Stream results				
Stream ID		S01	S02	S03
From:		CONDS	FLASH	FLASH
To:		FLASH	PURGE	QSPLIT
H_2	LBMOLE/HR	2047.4828	2046.7644	0.6433
CH_4	LBMOLE/HR	2414.5081	2390.8028	23.7389
C_6H_6	LBMOLE/HR	374.1306	17.8004	356.3382
C_7H_8	LBMOLE/HR	227.8422	3.5885	224.2486
$C_{12}H_{10}$	LBMOLE/HR	16.84	0.096816	16.8336
TOTAL	LBMOLE/HR	5080.8038	4458.9569	621.8079
TEMP	DEGREES F	100	100	100
PRES	PSIA	465	465	465
ENTHALPY	BTU/LBMOLE	−13006	−16927	15105
V	FRACTION	0.8776	1.0	0.0
L	FRACTION	0.1223	0.0	1.0
ENTROPY	BTU/LBMOLE-R	−21.6285	−15.6219	−64.704
DENSITY	LBMOLE/CUFT	0.0463	0.0774	0.6473
AVG MW		18.8314	9.9133	82.785

MODELLING THE REALITY



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"There is no a better model of a cat than the cat, better if it is the same cat "

Product as information system

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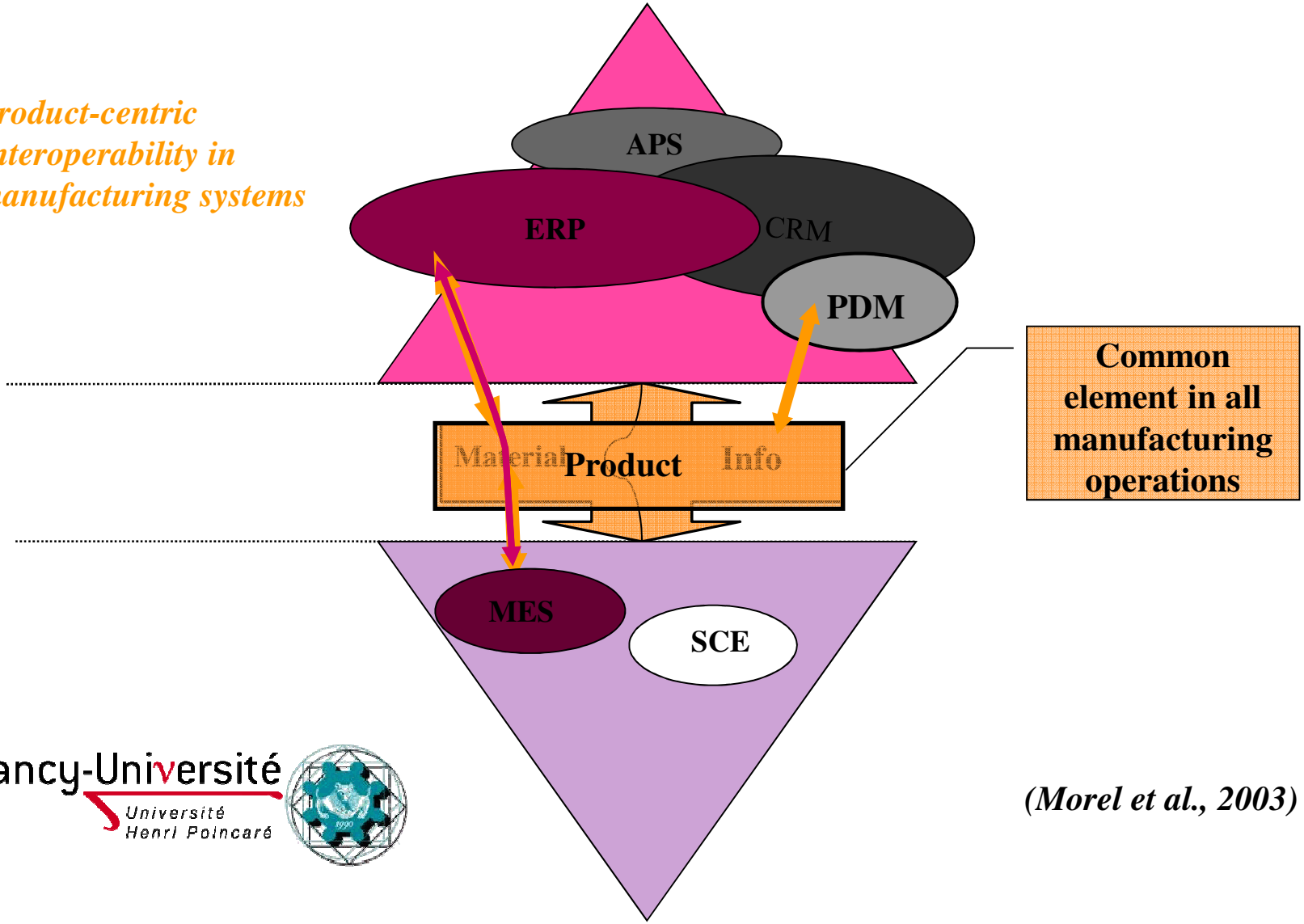
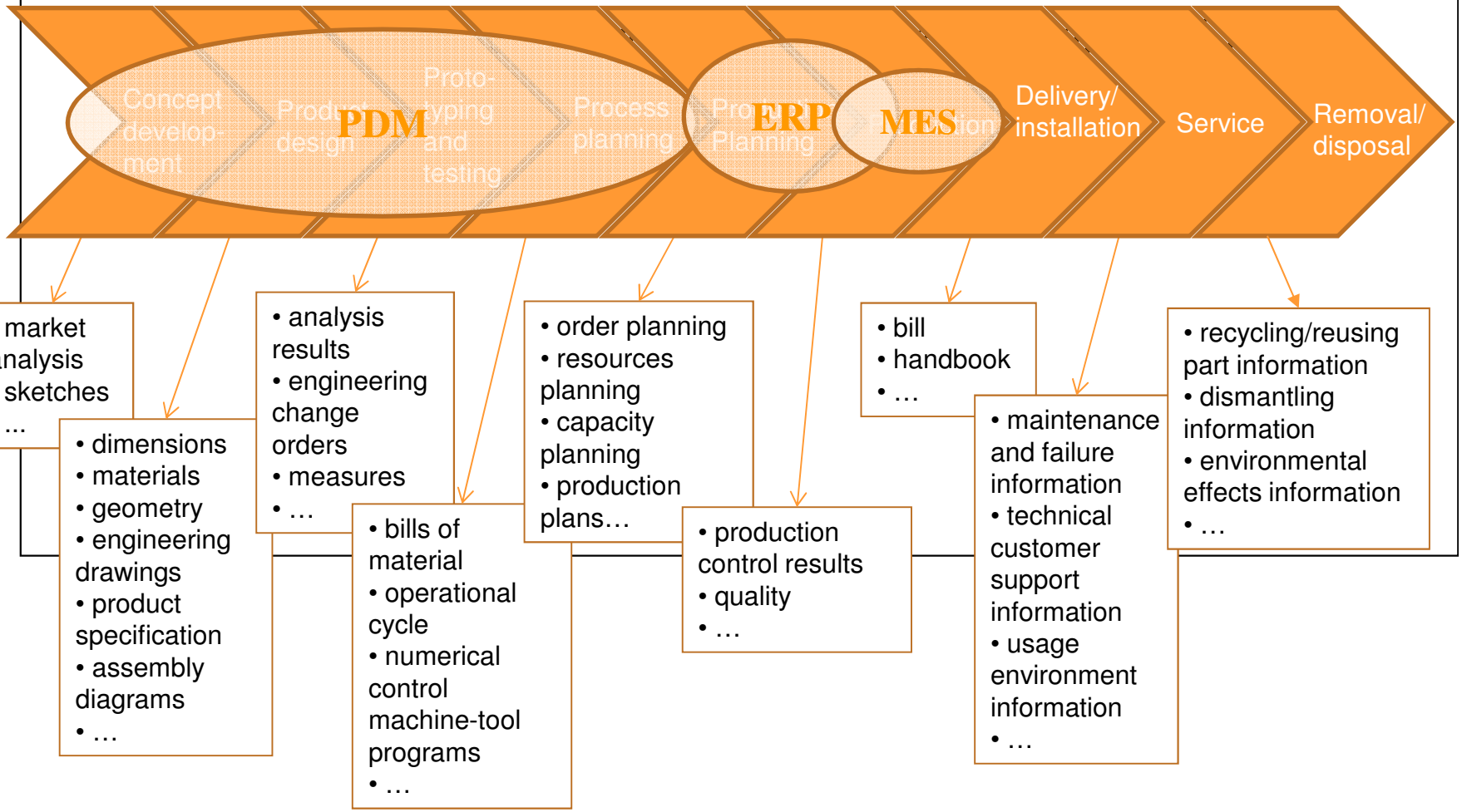
Product-centric Interoperability in manufacturing systems



(Morel et al., 2003)

1. PRODUCT-DRIVEN INTEROPERABILITY FOR MANUFACTURING SYSTEMS



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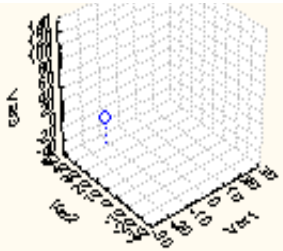
Sustainable signature (footprint?)



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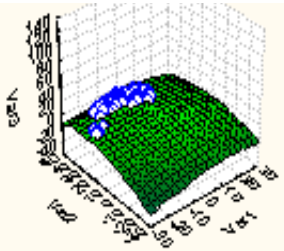

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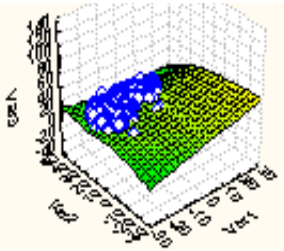

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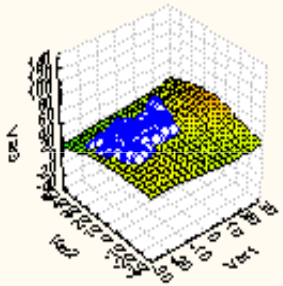

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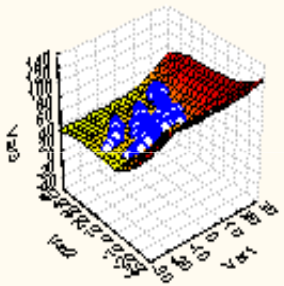

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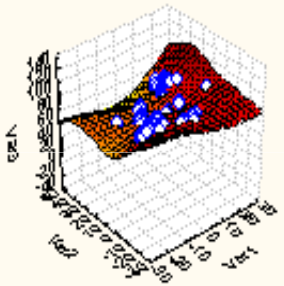

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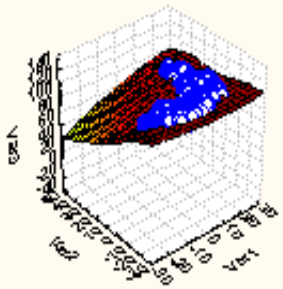

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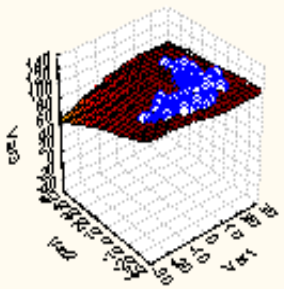

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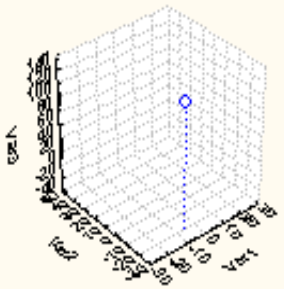

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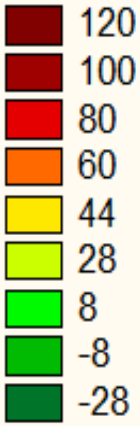

METRICS CAN BE IMPROVED

Tool Management System Model

Improvement Model

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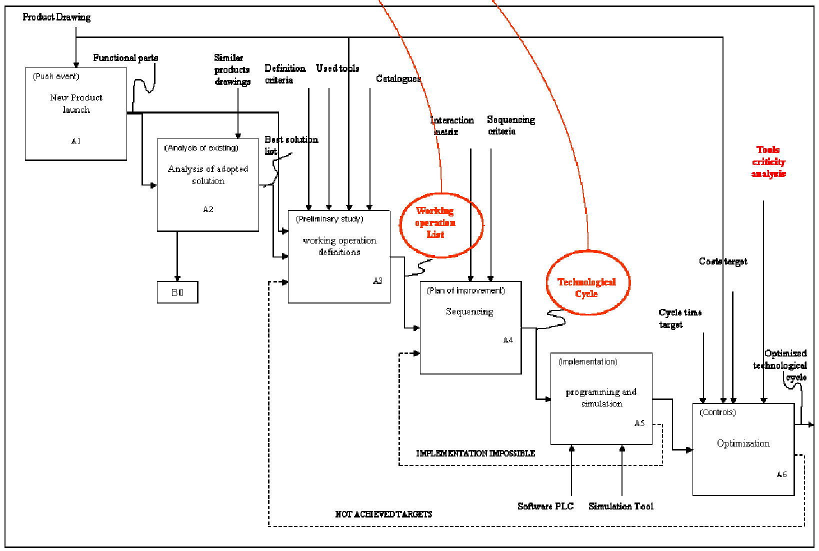
Complete product traceability by technological cycle formal structure

DIMeG POLITECNICO di BARI	FOGLIO ANALISI OPERAZIONE	Operazione N° OP20.2	Ciclo N°
	Denominazione elemento	Corpo Pompa CP1H variante PSA-Facelift	
STUDI DI FABBRICAZIONE	Descrizione operazione		

N	Utensili-Attrezzi	Codice Bosch	vita [pz]	Macchina	Compilatore	Data maggio 2007
10	Fresa Ø 32	FS 70070	65			
20	Fresa Ø 50	FS 70071	300			
30	Fresa Ø 100	FS 70076	1000			
40	Fresa di finitura Ø 32	FS 70081	120			
50	P.ta a più diametri Ø21,5/21,8/2	BG 70313	600			
60	P.ta Ø6,8 (preforo M8)	BG 70234	1500			
70	P.ta Ø 4	BA 70292	3000			
80	Fresa Ø 9,35	BG 70233	3000			
90	Alesatore Ø 6,05/11	RC 70043	1500			
100	fresa sferica Ø3,05	BQ 70005	1500			
110	Centrino sferico Ø3,02	BQ 70002	1500			
120	P.ta Ø3	BA 70293	1500			
130	P.ta Ø2,5/2,98	BG 70235	1500			
140	Punta a più diametri Ø 4 22	BG 70320				
150	Maschio M5	GL 70048	1200			
160	Maschio M8	GL 70047	1200			
170	Fresa Ø 17	BH 70028	3000			
				Tempo preparazione macchina tpm:		

	DESCRIZIONI DELLE FASI	CONDIZIONI DI TAGLIO						TEMPI [min]			
								OPERATORE			MAC.
		S giri/1'	Vr m/1'	p mm	F (Vr) mm/1'	corsa mm	n° passate	ta	tml	tmm	tm
10.0	Sgrossatura superficie #7100 (targhetta)	3000			2100						
10.1	sgrossatura superficie #4000	3000			2100						
10.2	sgrossatura superficie #8000	3000			2100	31					
10.3	sgrossatura superficie #3000	3000			2100						
10.4	sgrossatura superficie #6000	3000			2100						
10.5	sgrossatura superficie #5000	3000			2100						
20.1	Sgrossatura superficie #7000	3000			3500	88					
20.2	Sgrossatura superficie #2000	3000			2250	256,1					
20.3	Sgrossatura superficie #2100	2500			2500	27					
30.	fresatura di finitura #2000	955			2600						
30.1	Finitura superficie#4000	3100			2500/5000						
30.2	Finitura superficie #3000	3100			2500/5000						
30.3	Finitura superficie #5000	3100			2500/5000						
40.1	Foratura sede pistoncino #5001	2000		18	250						
40.2	Foratura sede pistoncino #3001	2000		18	250						
40.3	Foratura sede pistoncino #4001	2000		18	250						
50.1	Preforo #4002	6000		10,9	1500						0,436
50.2	Preforo #4003	6000		10,9	1500						0,436

Tool Management system Model using a BPR approach IDEF0-based



BOSCH

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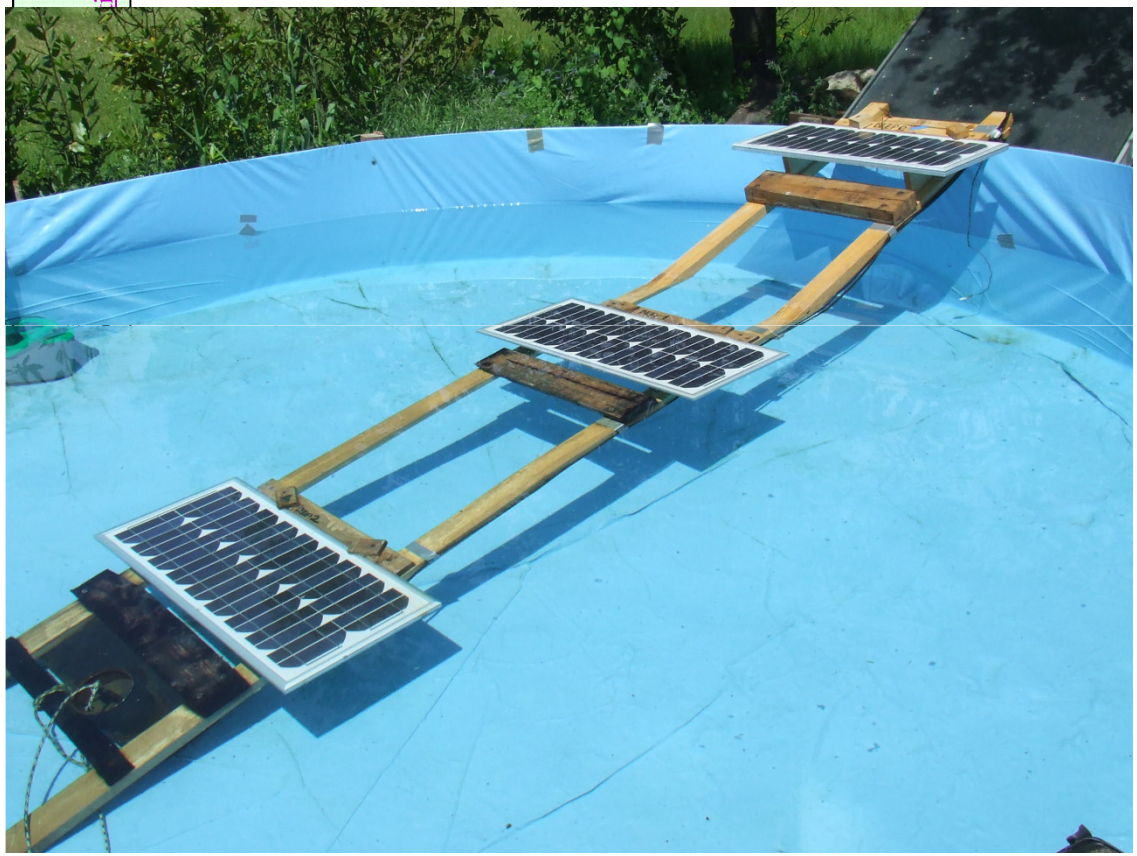
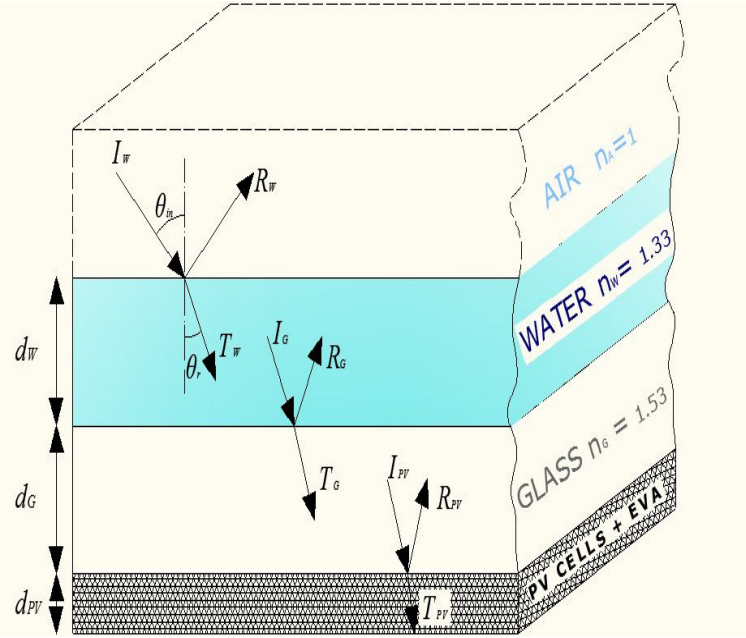
9



New solutions



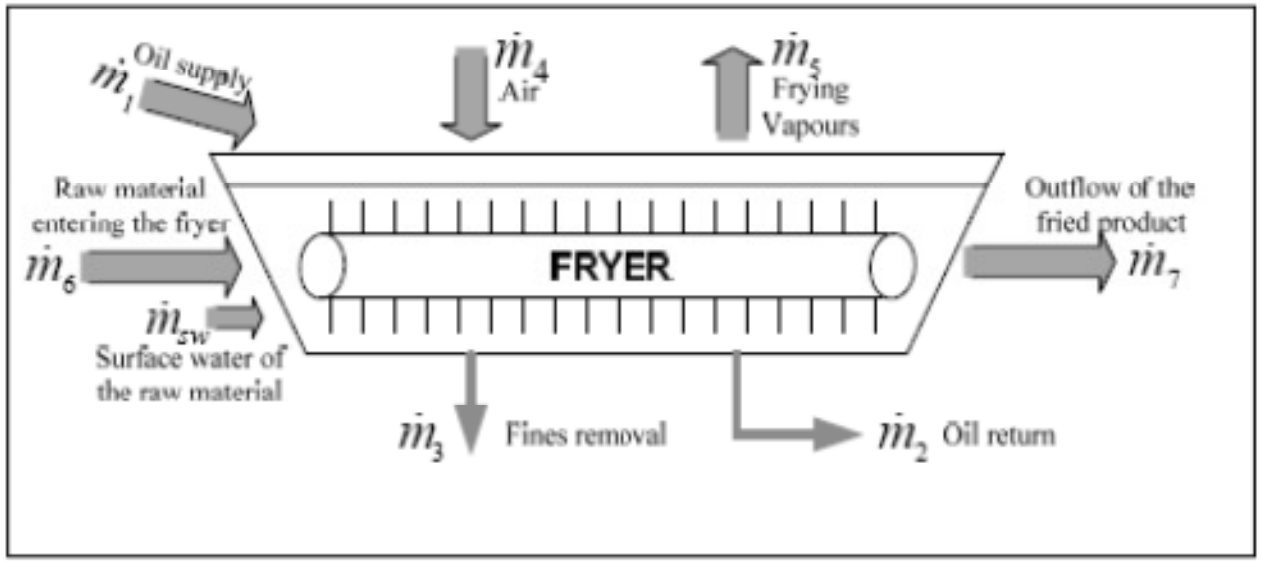
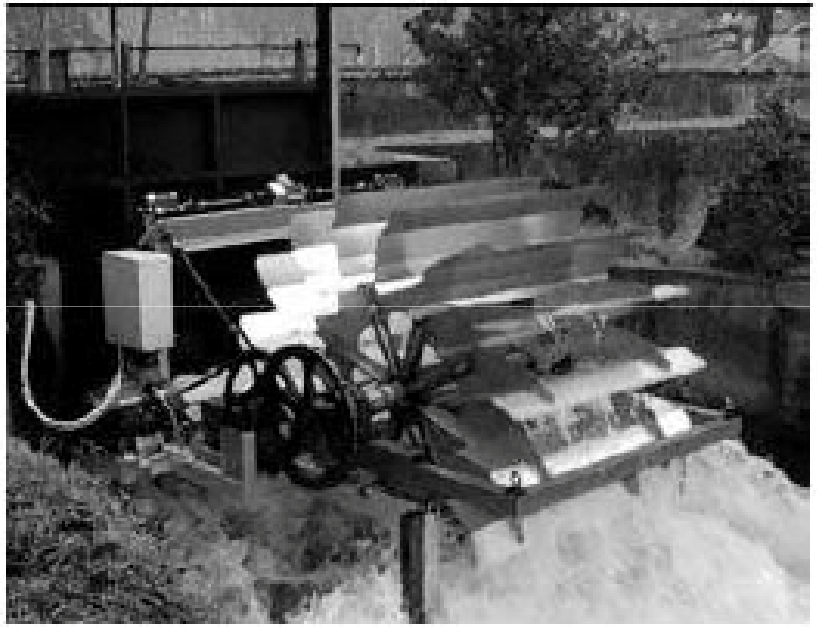


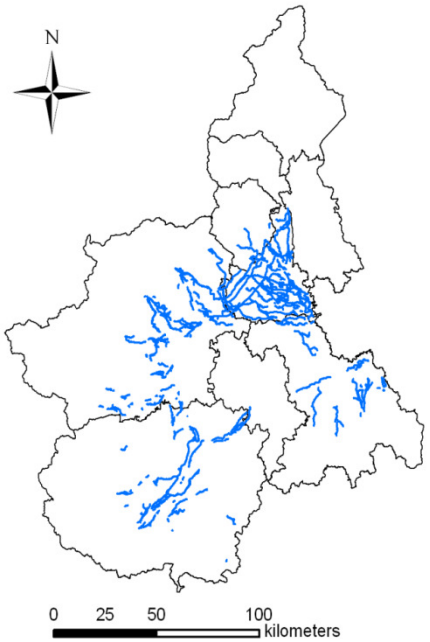
Figure 2. Mass flow balance in the industrial frying process.

From kitchen……



Water flows……

Gravity forces



But not only in Italy

PLANTS AND STRUCTURES – Photovoltaic Roofs

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Our structures for the **photovoltaic roofs** allow exploiting completely the coverings, even if in presence of skylights and obstacles of various kinds.

The conceived fixing systems allow acquiring the total integration for the almost totality of the roofs and obtaining so a best tariff.

KAD3 GROUP

PLANTS AND STRUCTURES – Photovoltaic Canopies

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The **photovoltaic** parking canopies allow carrying out at the same time the requalification of parking areas and the production of electric energy.

Our canopies have been developed in various dimensions to comply with the particular requirements of the already built parking areas, by being so, extremely versatile for the realization of coverings for parking surfaces to be carried ex-novo.

We also make wooden shelters.

kad3 SRL — aLIA INNOVAZIONE TECNOLOGICA — HORUS sostenibilità e sviluppo

KAD3 GROUP

COGENERATION AND TRIGENERATION

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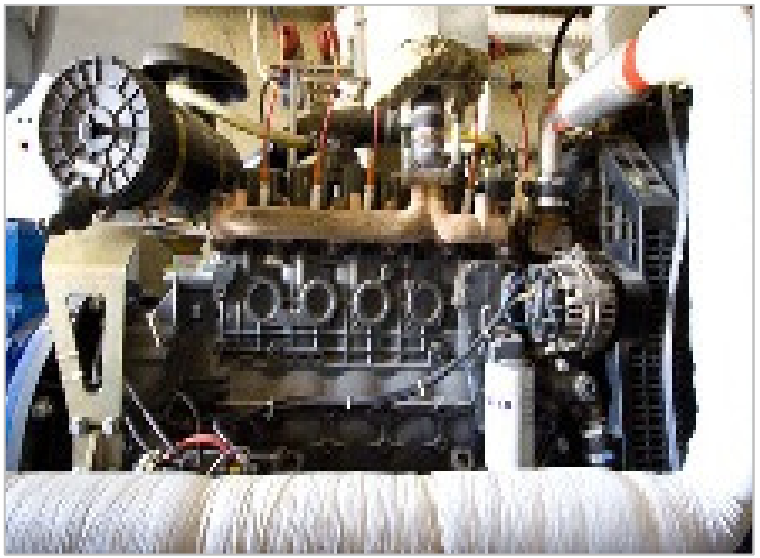
The **cogeneration** is the joint and contemporary production of electric energy and heat starting from a single energy source, actuated in a unique integrated system, with consequent economical and environmental benefits for the Client with respect to the separated electricity and heat production.

The **trigeneration** is the contemporary production of electric energy, heat and cooling power.



KAD3 GROUP

Hybrid RE systems: research networks

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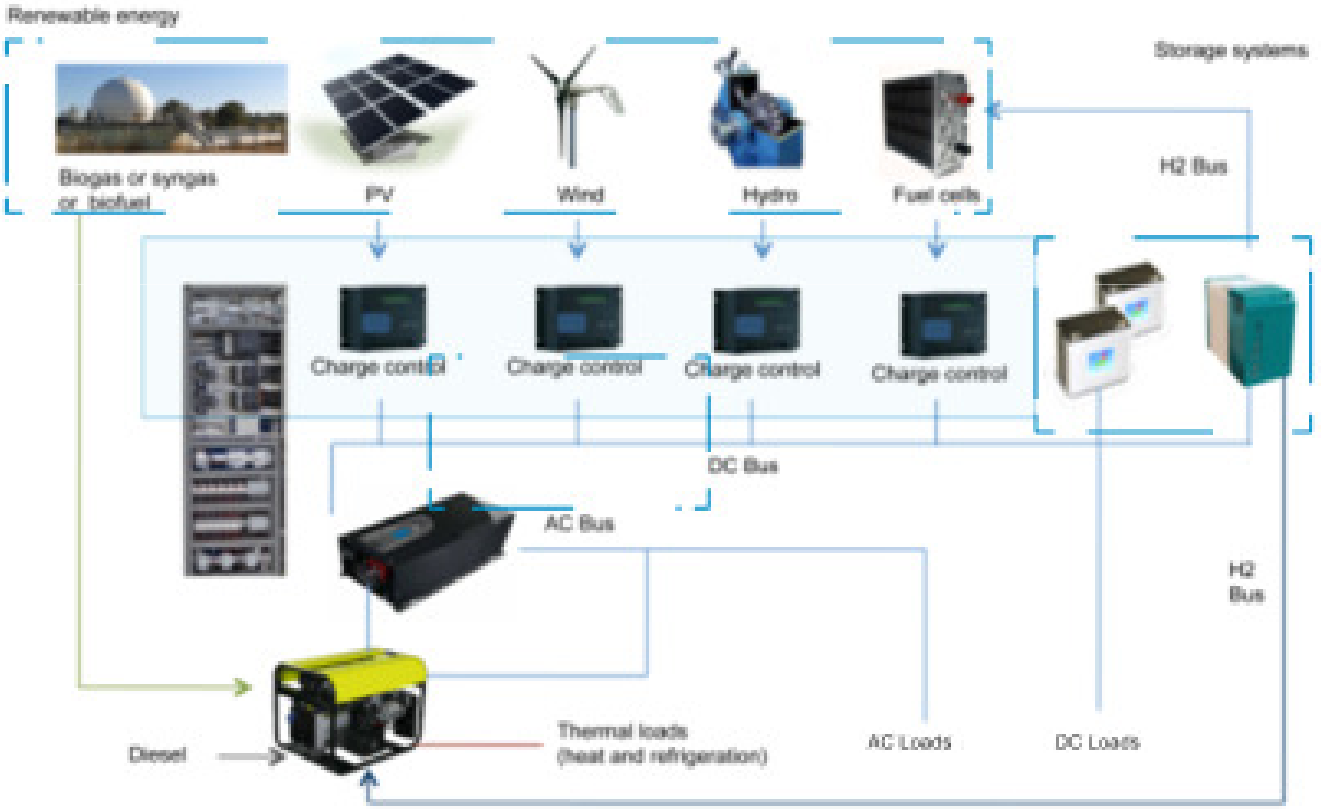
Reliable Modular Hybrid System for Off-Grid or Grid Supported application



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Hybrid RE systems

COGENERATION
BIOMASSEES
WIND GENERATORS
SUSTAINABLE MOBILITY
ROBOTICS

DATA SHEET 5 kW

Leonardo Smart Control Unit is an Hybrid Energy System born to satisfy the needs of Off-Grid of even Grid Supported loads

The main skills of Leonardo are:

• Continuous power AC (not interruptible loads):	5 kW (2 kW);
• Peak power AC:	10 kW;
• Continuous power DC:	2 kW;
• Peak power DC:	5 kW;
• Available RE sources (max Power):	PV (5 kWp); Wind (5 kWp); Hydro (10 kWp); Fuel cells (2 kW);
• Genset power:	13 kVA;
• Cogenerator (as optional) thermal power:	10 kW;
• Multifuel genset (as optional):	Biogas Syngas Vegetable oil Bioethanol

Hybrid RE systems

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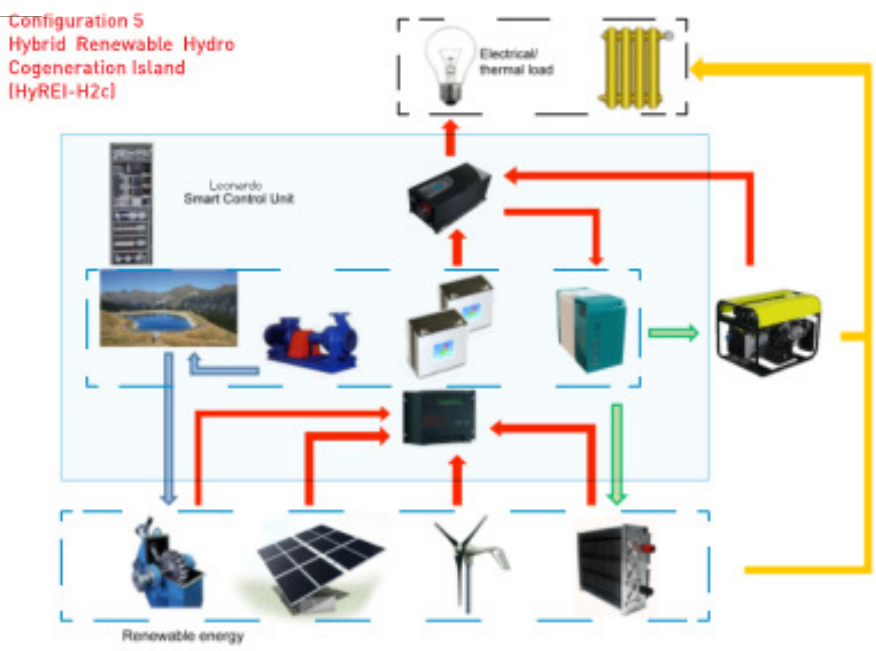

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Woodchips

Gasifier from woodchips

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Gasifier from woodchips

Combustion Engine

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10

Innnovation in tradition

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.Fronteer Research at Politecnico di Bari.

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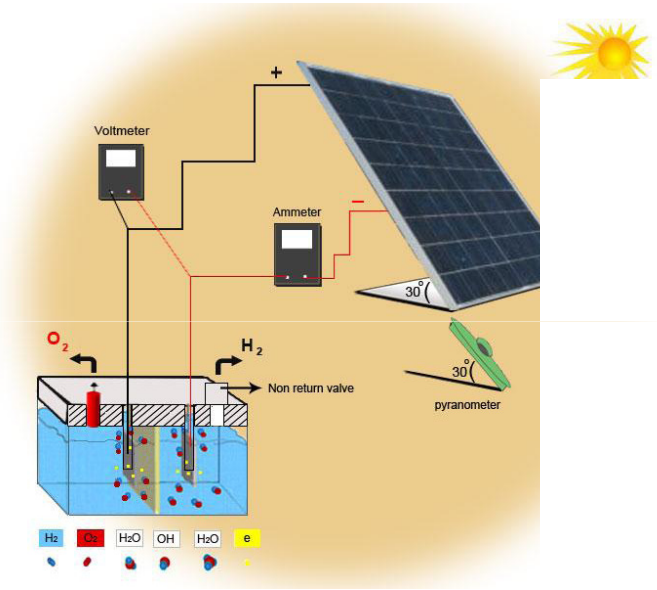

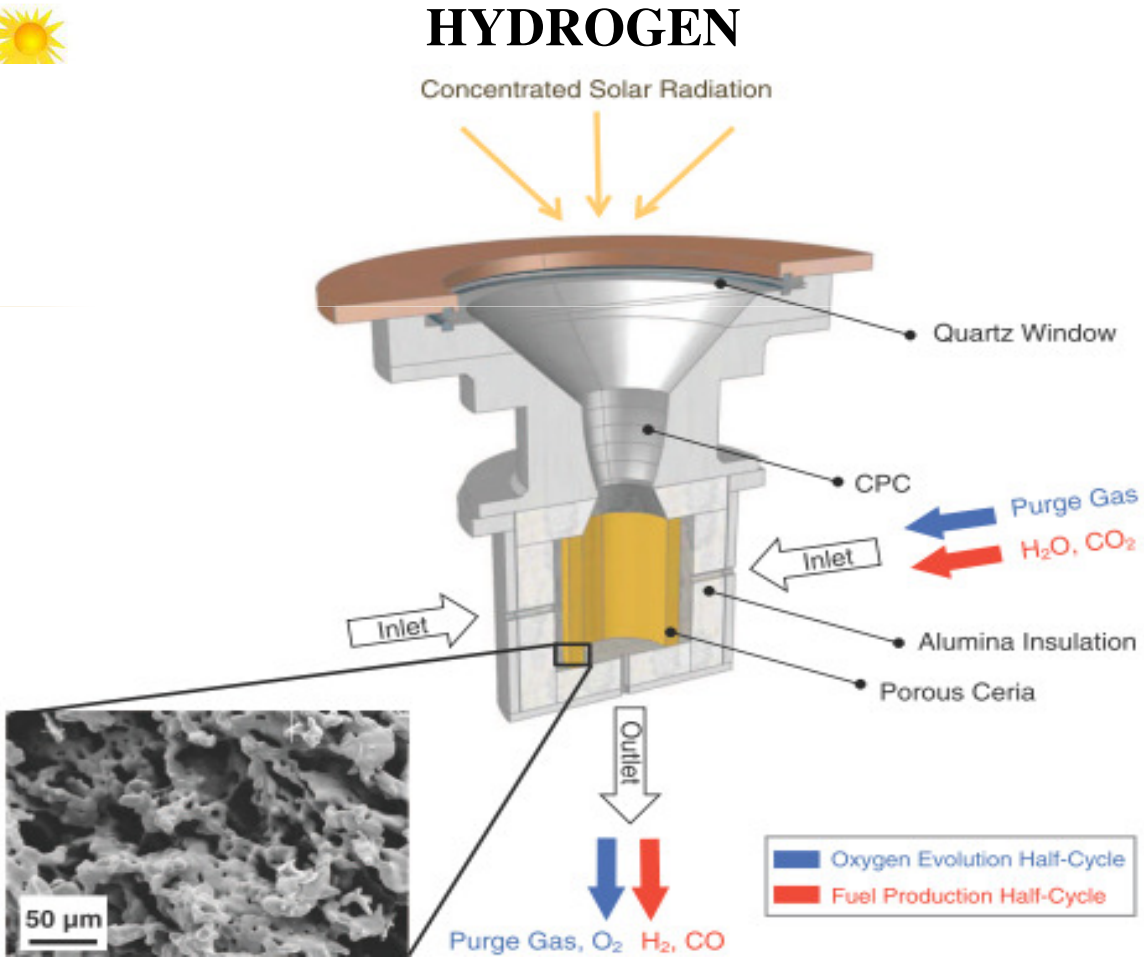

SEEP 2010

..innovazione e tradizione..

4th International Conference on
Sustainable Energy & Environmental Protection

June 29/July 02, 2010
Politecnico di Bari, BARI - ITALY

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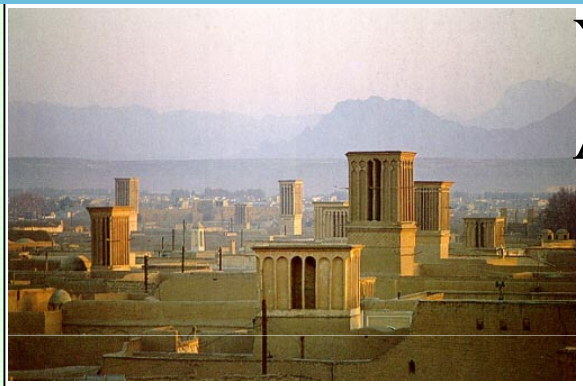


Yadz (Iran):
At desert border's

Wind catcher: natural thermoregulation

<<Home design was different in past for many cities, but new architects and engineers have not been using passive solar issues for their designs>>

Old walls : oltre 1m di thickness,,,

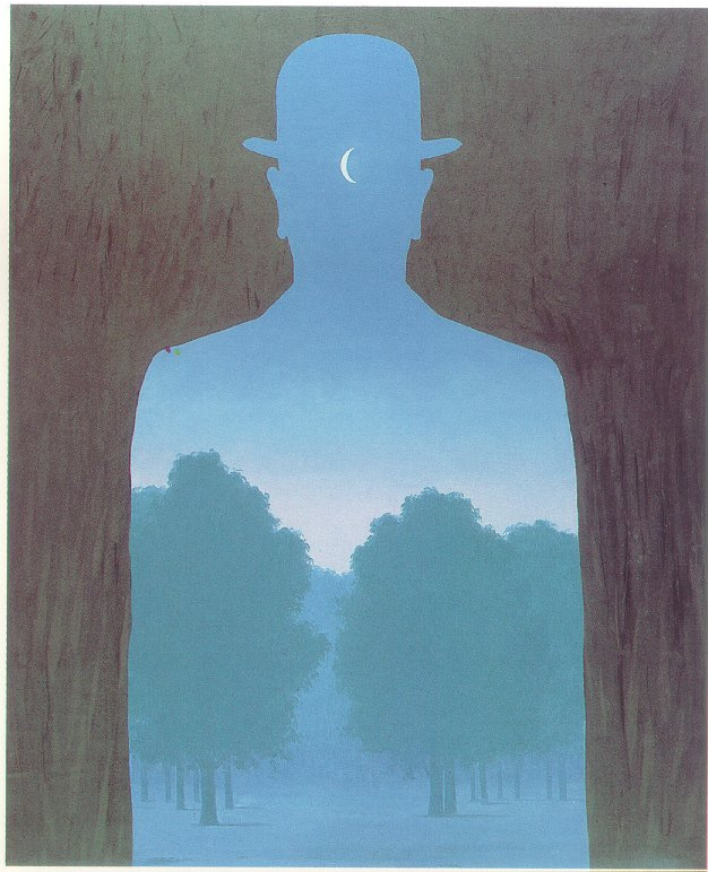
Natural refrigeration: from water

SUSTAINABILITY: it is a business?

- New approach with old habits?
- Attempt to preserve the present?

6-R's:

Reduce, Reuse, Recycle, Redesign (or Rethinking), Recover , Remanufacture,



LINEAR THINKING!

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SEEP 2010

.sustainable manufacturing.

4th International Conference on
Sustainable Energy & Environmental Protection

June 29/July 02, 2010
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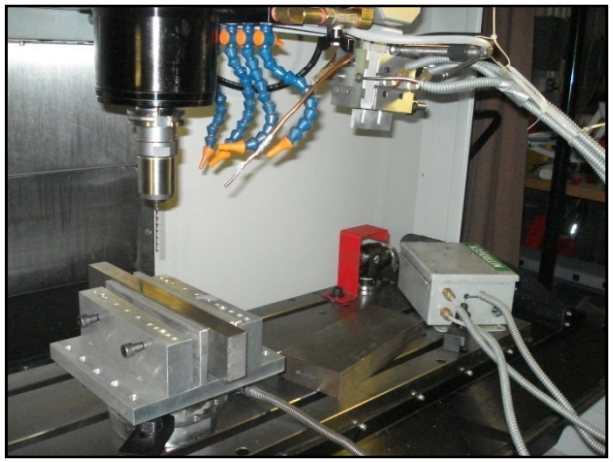
Recycled Aluminum

Optimise, minimize,…but is is always resource tranf.!!



Drilling of Ti-6Al-4V with 3mm diameter carbide uncoated drills and aspect ratio of 15

Minimum quantity lubrication

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Eco-X syntagms: codification or real solutions?

- X= design, redesign, innovation, conception, QFD, labelling, optimization, balance, centric sustainability, development planning, advantage strategy, magination, tracking, technology, restructuring,.. .

- *<<the eco-support system for life on the planet (e.g.*
- *biodiversity), a factor of recognising the regional carrying-*
- *capacity of nature with regard to human populations*
- *and human lifestyles, going back to Jean-Jacques Rousseau (1712-1778)... >> Stahel 2007*

7th R's rule: Regulation

- ISO14040
- SETAC
- UNEP
- OECD
- US Department of Commerce
- …

- *<<. Nearly allgovernments have committed themselves to sustainable development by integrating economic welfare, environmental quality and social coherence>> Boringer & Jochem, 2007*

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8^{th} R's rule: Reversibility

- This principle brings to the extreme the idea of recycle, reuse, recover and remanufacture., all sharing the idea of prolonging the useful functions of artifacts as longer as possible in the future, by introducing the challenge to avoid the losses of cycling effects that is intrinsic in the other R's

- *<<The law of entropy should be replaced by the law of regeneration. The present law does not make sense for the world we need to create.'' ..>>* Cohen-Rosenthal, 2004

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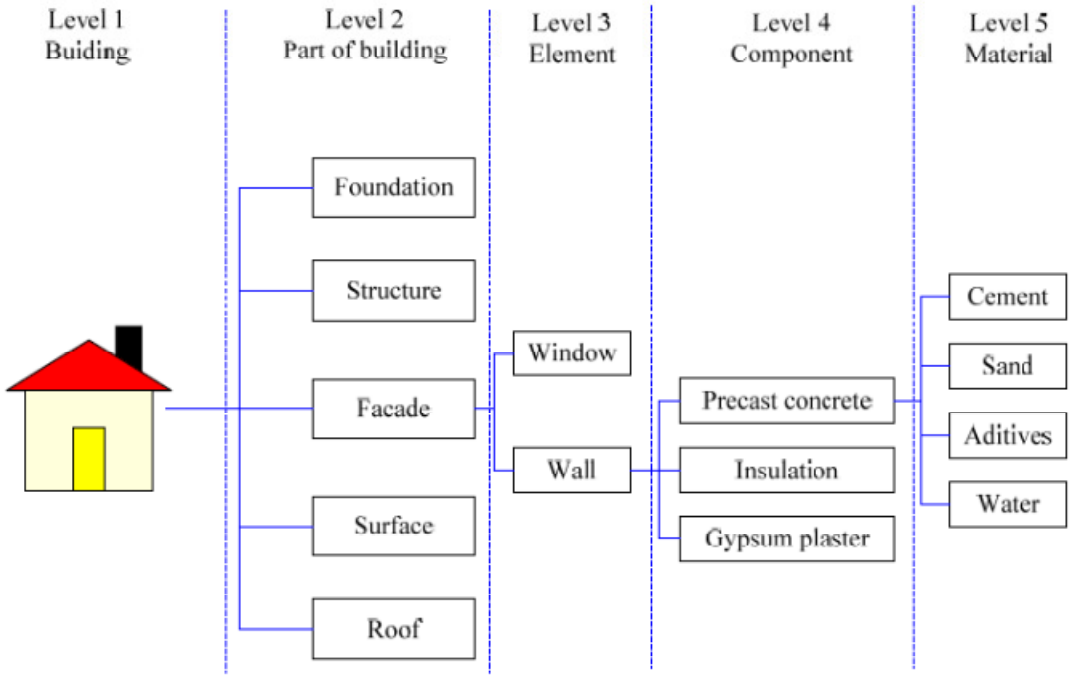

Figure 1. Levels of the construction product life cycle

Ventilated Trombe wall adapted to the site of the town of Bechar (south-west of Algeria)

Sustainable Buildings: LCA

Cuture and training

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10

Cultural struggle...

- **<<Sustainability is in our own responsibility either as perception (as IO) or as actors (inducing transformations): it is strictly related to <u>our needs</u>.**
- **The best eco-design strategy cannot afford a crazy need!>> Dassisti, 2009**

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Alternatives to our current wasteful product paradigm

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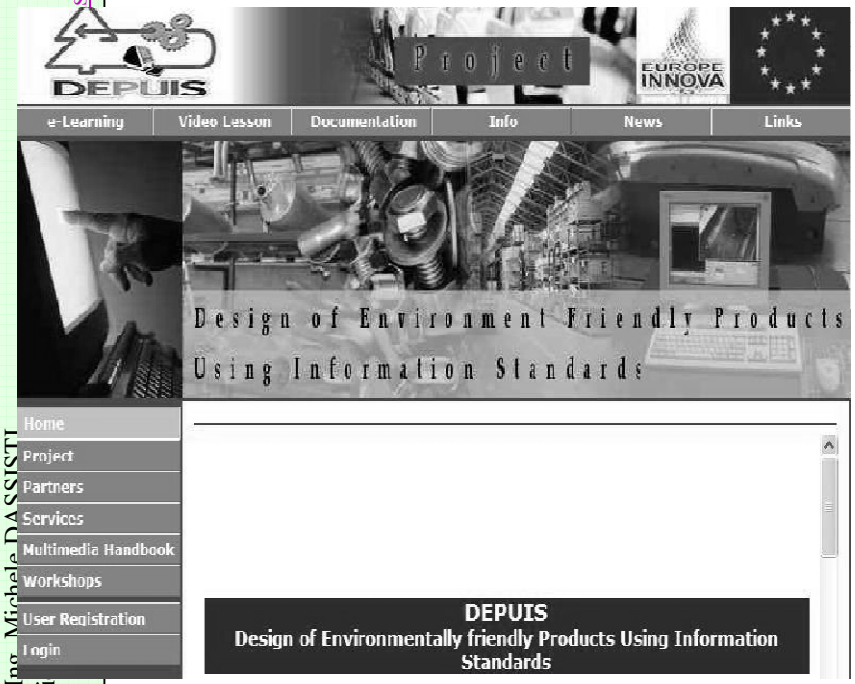
4th International Conference on
Sustainable Energy & Environmental Protection
June 29/July 02, 2010
Politecnico di Bari, BARI - ITALY



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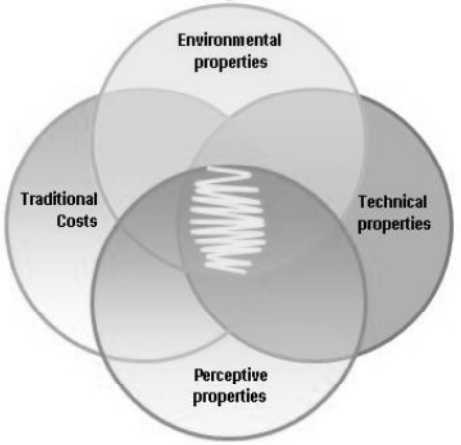
La conoscenza e la formazione sono
ficacia

MATto

The material library of the Course of Industrial Design Studies at the Politecnico di Torino, which, today, stores approximately 500 samples of innovative material particularly used in the field of design and architecture.



One didactical example:
new generations challenges

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- Wood sail boats at Politecnico di Bari

MilleUnaVela

One didactical example: ecological materials

- Challenge: at least 85% in weight of wood

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One didactical example: ecological materials

- Wood processing (–)
- Adhesives (––)

- Wood end–of–life (+)
- Propulsion (++)

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WHEN's

Can we change abruptly?

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The manufacturing industry has generated wealth, jobs and quality of life, while promoting and sustaining services, education, research and development

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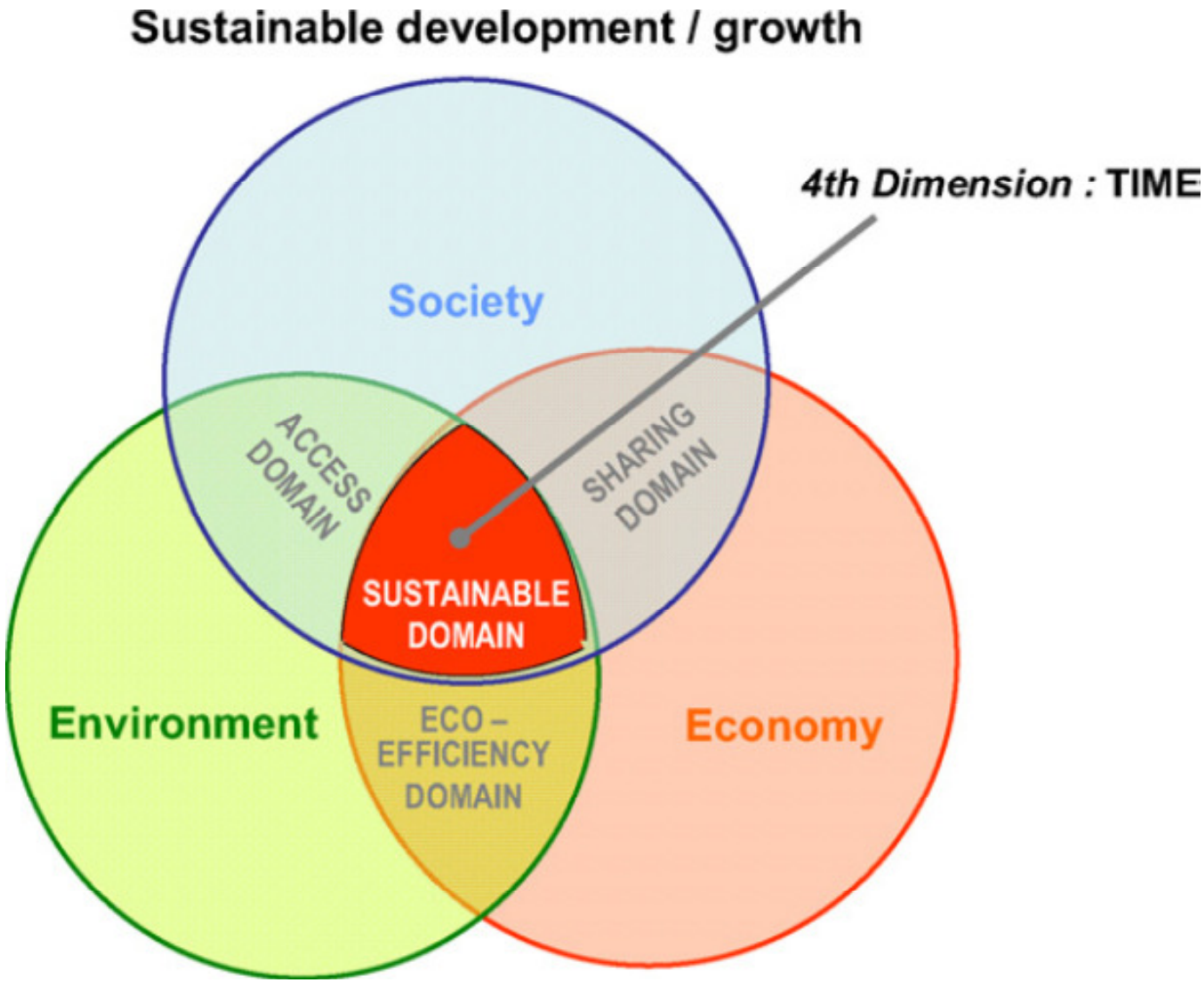
Another pillar?



Finitedness of resources

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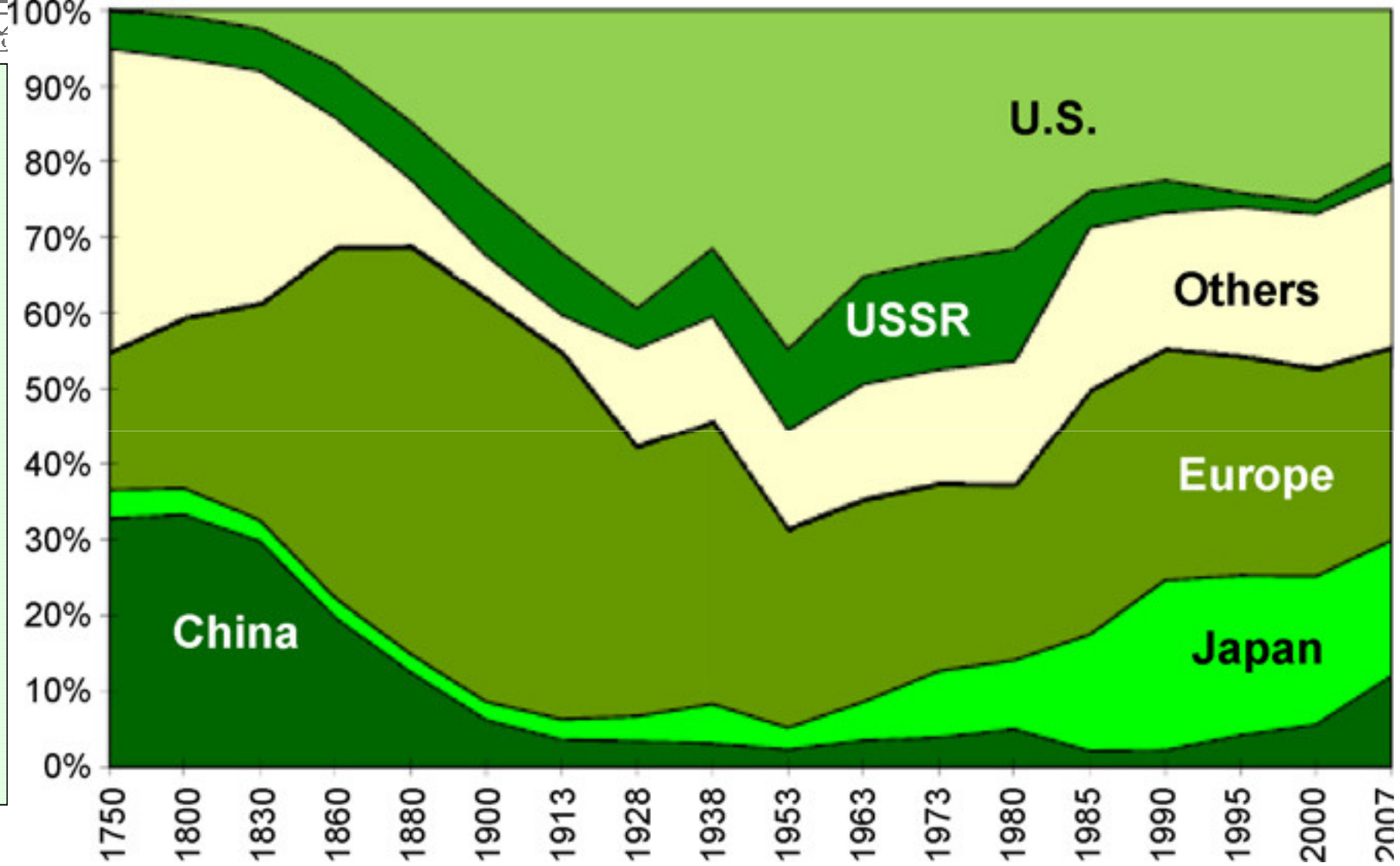

A different perspective of industrial outputs….

MANUFACTURING: its non-reversible effects on the world

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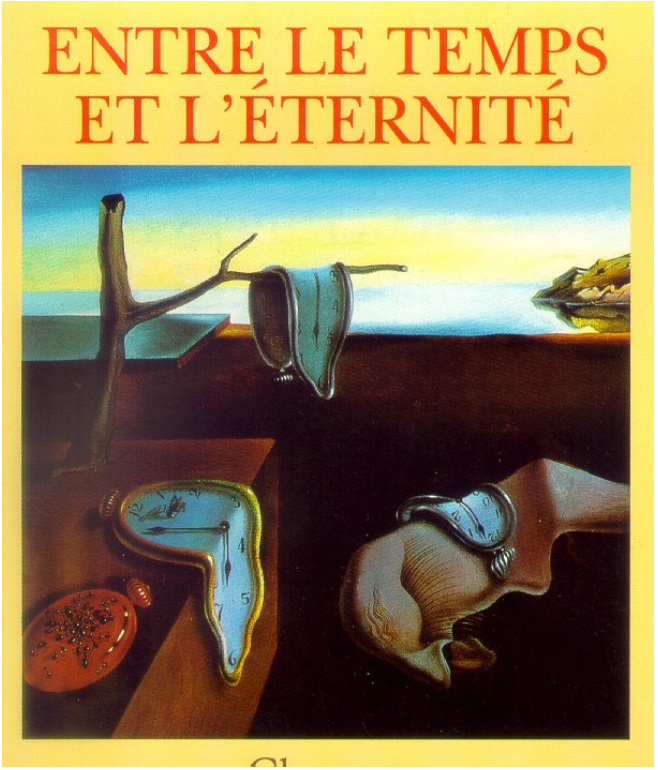
- So we humankind have an hysteresis in behavioral changes while experiencing almost immediate reactions in the mutations of our world.

Manufacturing might have non-linear effects on our way of living



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CONCLUSIONS

Oximoros?

- **Innovation in tradition**
- **Chaos and harmony**
- **Industrial ecology**
- **Sustainability and production**

> *<<The ideal ecosystem, in which the use of energy and materials is optimized, wastes and pollution are minimized and there is an economically viable role for every product of a manufacturing process, will not be attained soon.>> Frosch, 1989*

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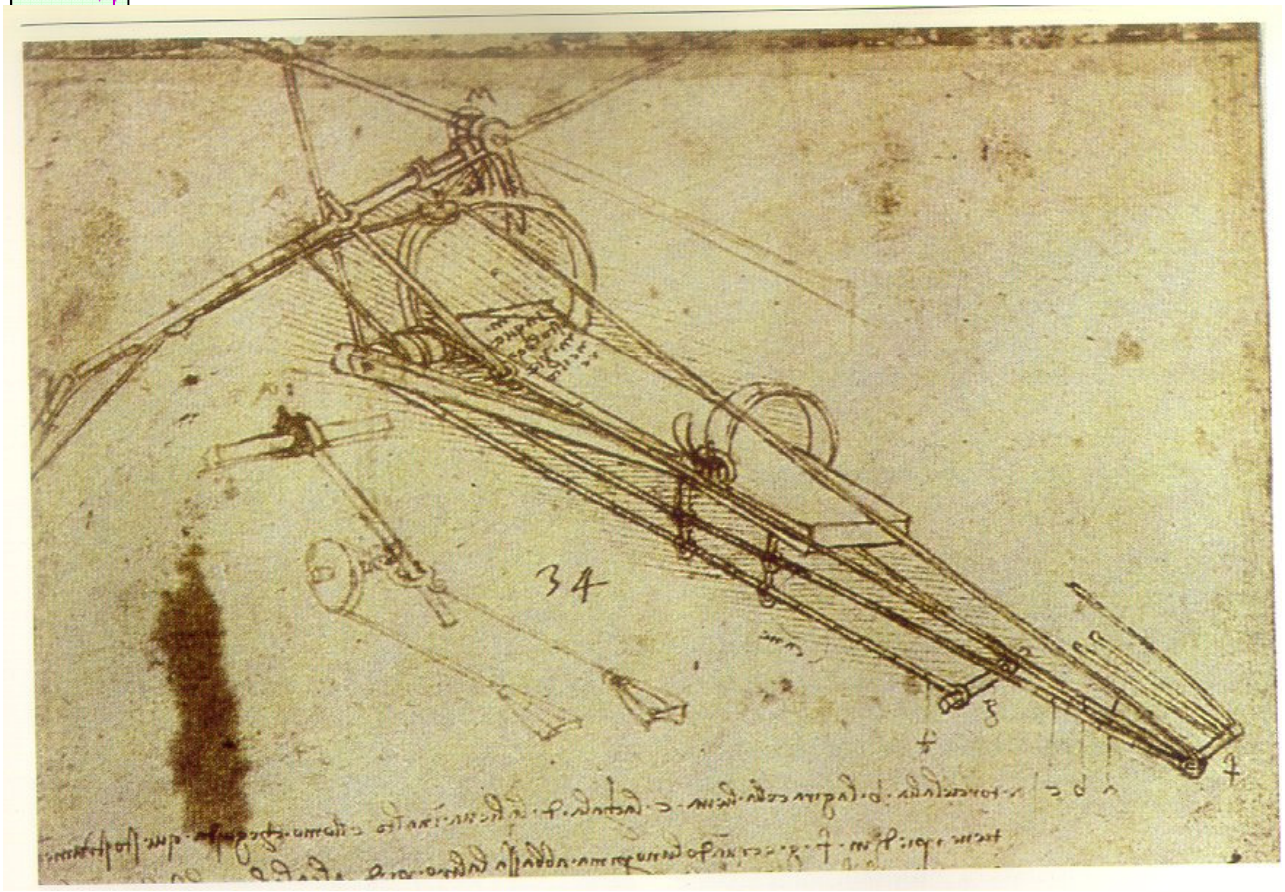
Best practice diffusion

poliba.it



New Job Opportunities

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CAREER

Graduated Industrial Ecologists will be able to analyse sustainability dilemmas in real life, to create and initiate innovative technological solutions, and to come up with tools and strategies for management and policy in the field of Industrial Ecology. Industrial Ecology is a new scientific field that provide graduates promising opportunities in different fields:

- **Intermediate functions in large companies considering sustainability issues**
- **System design functions in companies and governments**
- **Initiators of innovation in industry and (non) governmental organizations**
- **Scientific research in the field of industrial ecology or related fields like green engineering, environmental sciences, or innovation and transition management.**

Until now almost all graduates of the programme find a suitable job within a year after graduation. Alumni of the programme can be found in industry, consultancy firms and governmental agencies.A small fraction ends up as Industrial Ecology scientists working at universities and research institutes, developing the field.

New Job Opportunities

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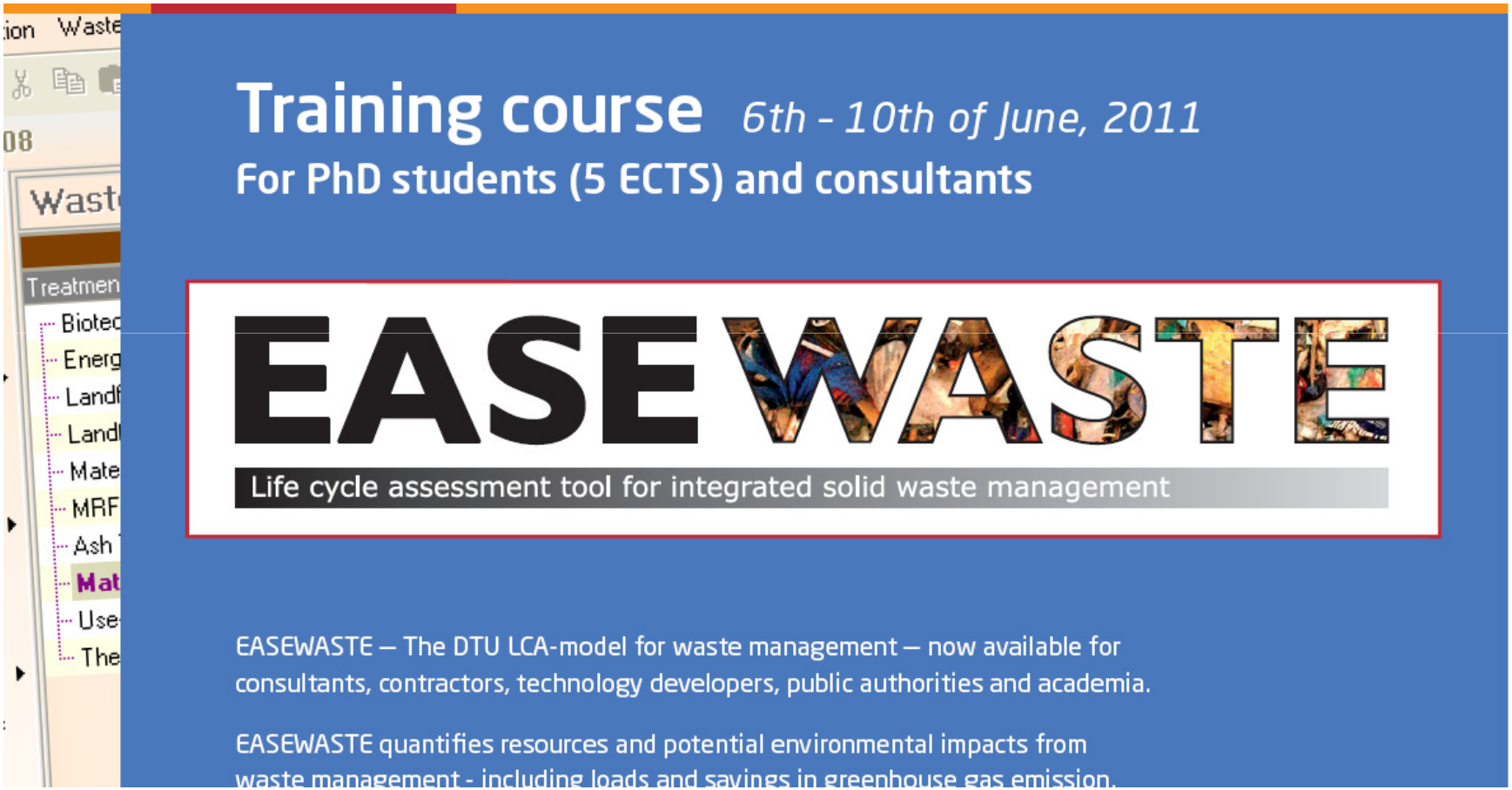

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Waste-to-Energykursus2011.pdf (PROTETTO) - Adobe Reader

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68,2% Trova

Phd Course *07th-11th November, 2011*

Advanced Environmental Assessment of Waste-to-Energy Technologies

DTU Environment
Department of Environmental Engineering

Access to the course

- Application should be sent to 3r@env.dtu.dk. Application form is available at www.3r.env.dtu.dk.
- Deadline for applications is *August 31st 2011.*
- The course is restricted to 25 participants. In case more than 25 applications are received, participants will be selected based on relevance, participant diversity, and according to the application submitted.
- Acceptance will be comunicated by September 10th, 2011
- For more information, please visit www.3r.env.dtu.dk or write an e-mail to 3r@env.dtu.dk.

Course prerequisites:

Participants should document intermediate/advanced knowledge about waste management and LCA (preferably if related to waste management). Basic information about LCA and/or waste management is not provided during the course.

Fee:

Academic participants: 100€ .

The course includes:

- 5 days of intensive course (9-18), with lectures, group work, discussion sessions, exercises, presentation by the participants.
- Materials, lunches, coffee, refreshments during the day.
- Consultation on research activities regarding LCA of WtE systems.
- Social dinner

The course does not include:

- Hotels/accommodation
- Transportation from and to the hotel

Course evaluation:

The participant is evaluated on a pass/fail basis. The course requires full participation in the five days programme with active contribution in the discussion. Completion of reading material prior to the course is evaluated by delivery of two pre-assignments and completion of exercises in the class during the course.

DTU Environment
Department of Environmental Engineering

PhD Course – *4 ECTS*

ADVANCED ENVIRONMENTAL ASSESSMENT OF WASTE-TO-ENERGY TECHNOLOGIES

07th - 11th November, 2011

Waste incineration is a well established technology and an important component of modern waste management systems. Incineration is currently used to treat about 20% of the waste in Europe and represents the most commonly employed WtE technology. However, a variety of different thermal treatment technologies are available and even more will arrive in the near future because of the rapidly evolving research in the field.

The course consists of an overview of the most important waste-to-energy technologies, with special focus on operative conditions and feedstock to the different technologies. The course will highlight important issues to focus on during data collection and system boundary definitions. A broad range of case studies will be presented covering many of the important aspects.

At the end of the course, participants will have a broader understanding of different thermal treatment options and how they are integrated into the energy system. Furthermore, participants will be able to assess and discuss critical assumptions made in LCA studies on waste-to-energy technologies.

3R

Thank you

Michele DASSISTI

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http://hychange-lab.poliba.it/

Most of the images have been taken from free access on Google the Sept.16, 2010

DEBATES

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What is sustainability?

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- <<To maintain the quality. All the machines that are producing nowadays to be asable after a longtome after that.>> ***Ilia Stanchev***.
- <<Way to protect the quality of life for humanity in the time>> ***Alexander Ecanomau.***
- <<Ability to save the balance nature and technical progress, as long as we can>> ***Emil Mihaglov***
- <<Ability or property of a system to be optimised in a beginning of project and this will save the idea, the same system in time>> ***Nedko Perchemliev***
- <<It has to do with a balaced life>> ***Denise Beskou***
- <<TO assure to our children and grandchildren good life. We have to save the balance in nature>> ***Mirela Georgieva***
- <<Don't know>> ***Mourtzikou Argyroula &Andigoni Aposfolopoulou & Mirto Micholou***
- <<Petrouleum man will die>> ***Francesco Del Vecchio***
- <<Wel development from every point of view: environmental, economical and political>> ***A. Penchev***
- <<The way to make Earth a better place to be. Change the way we live and consume in a most ECO-friendly way>> ***Dimosthenis Boeklagis***
- <<Property of a product to preserve highest quality of itself through longest possible period of time>> ***Dobromora Lekova***
- <<Ability to maintain a certain level of rate, for example, conserving balance by avoiding depletion of natural resources>> ***Vareli Styliani***
- <<It is the same timng as life. We must protect our environment for life>> ***Alexopullous Argyrios***