The concept of "Sustainability" and Sustainable Innovation:
An attempt to reconceptualize

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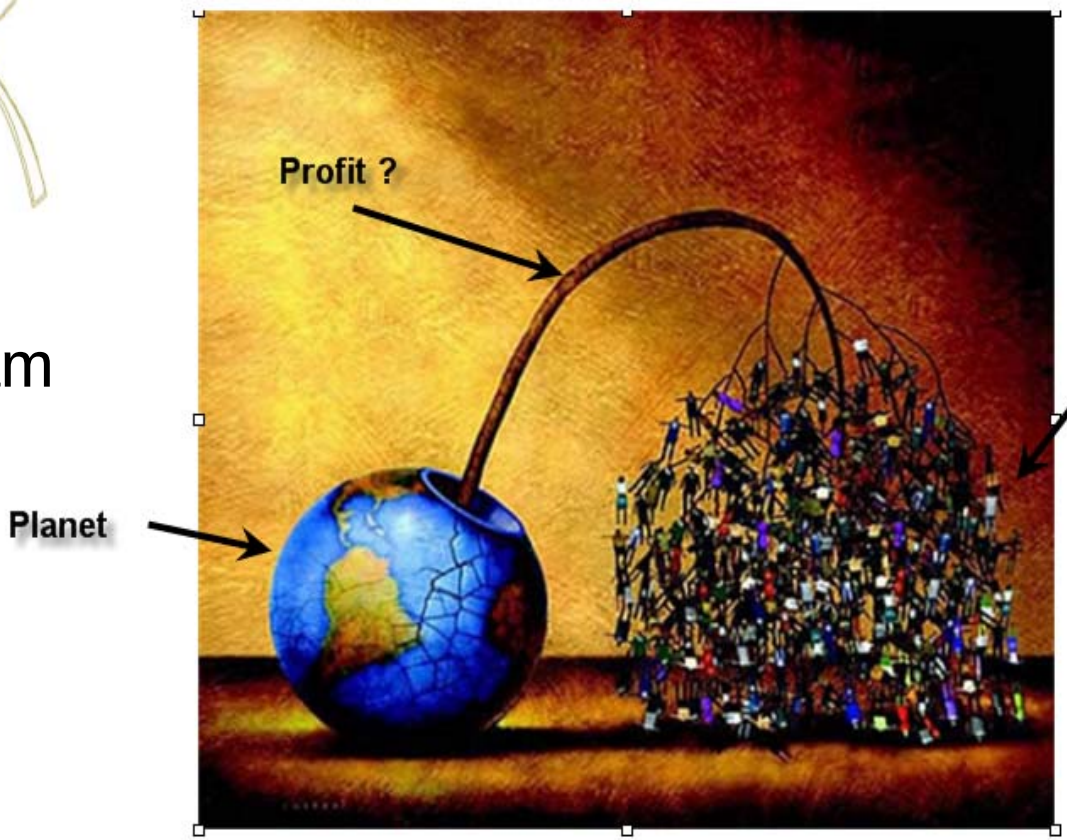
  - Else Boutkan (Something Else)
  - and many others

Structure of lecture

- 1. Introduction
- 2. The concept of “sustainability”
- 3. Sustainability in practice: The NIDO – program
- 4. The operationalization of sustainability
- 5. Conclusions, but also questions

Upstream innovation



Downstream innovation

1. Introduction (facts)

- Some "depressing" facts:
  - More than 800 million people are extremely underfed; 600 children p/h die of hunger?
  - 40% of the world population has never used a telephone (line)
  - Melting of the North pole (and Greenland), will give a water level rise of 50-150 cm in the North Sea
  - NL 2004: to continue 3% growth, 30-50 % decrease of social net (structure) is necessary the next 25 years
  - USA 2004: Until 2008 USA will not participate in any environmental treaty

1. Introduction (NIDO)

- Context of our sustainability research:
  - NIDO: National Initiative Sustainable Development (Stichting); duration promised 1999 - 2007; closed December 31, 2004 (www.nido.nu)
  - 10 programs: on marketing, water, finance, outsourcing, innovation, etc.
  - **Basic assumptions for NIDO**:
    - practice before theory; network organization
    - process, not product; private-public combinations
    - not the usual "environmental" and technology, but knowledge, learning, enhancing knowledge infrastructure

1. Introduction (NIDO-KDI)

- NIDO program: Knowledge creation for Sustainable *Innovation*
  - Innovation: The introduction of something "new" for an organization (organization, product, process, service)(reference group: West & Farr, 1990)
  - Innovation: Creative destruction (Schumpeter)
  - Innovation: invention/creation & implementation (individual and group)

1. Introduction (NIDO-KDI)

- Besides Innovation, also *Sustainability* and *Knowledge*
  - Knowledge of Sustainability and Sustainability of Knowledge (to be explained later)
  - Sustainability: conceptual (theory) and practical
  - 13 different organizations, different innovations
  - 50 researchers and consultants
  - Nov. 2002 - Sept. 2004

2. Sustainability: the concept

- New hype: sustainability? No, since 1750; See Naess, Meadows; but J. Simon, Lomborg;
- What is sustainability? (Dutch: duurzaamheid; Deutsch: nachhaltigkeit; French: durabilité)
- Between 1960 and 2000:
  - Number of conceptual definitions: 35
  - Number of operational definitions (indicators): 580
- Is it possible to find developments in the concept itself?

2. Sustainability: artefact

- "Sustainability" concerns artificial or human-made systems, not natural systems (H.Simon)
  - *Artificial systems*: described in terms of function, objective, and adaptation; are able to imitate natural systems without being natural themselves
- Sustainability is a dynamic systems notion
  - *System*: an assemblage of inter-related elements comprising a unified whole
  - *Dynamic system*: in mathematics a deterministic process in which a value changes over time according to a rule that is defined in terms of the function's current value.

2. Sustainability: definitions

- Some definitions:
  - Sustainable development (WCED, 1987)
    - *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs''*
  - Elkington (1999): Triple P (planet, people, profit)
    - *''Finding a balance between economic prosperity, environmental quality, and - the element which business has tended to overlook - social justice, moves organisations in an absolute state of sustainability''.*
  - Coomer (1979)
    - *"The sustainable society is one that lives within the self-perpetuating limits of its environment.''*
- Question: Why so many definitions?

2. Sustainability: analysis

- Ambiguous domain:
  - biologists, sociologists, economists, philosophers, etc.
- “Sustainability“ can be approached with (logical) foundation of conceptual structures
  - Analytic philosophy; 'Chain of Being' (Lovejoy); 'Article' (Barth); 'Responsibility', 'Perfectibility' (Passmore), 'Association' (Jorna)
  - Analytic, semantic, logical means for a) concept self, b) development, c) concept network, d) moves and counter-moves
  - (Re)interpretation, reconstruction, semantic analysis; Bringing to surface conceptual developments underlying sustainability discussion and distil future course

2. Sustainability: framework (1)

- Conceptualisation
  - **Attempt 1**: Sustainability is a dyadic operator:
    - Sustainability = Equilibrium (Artefact, Environment)
    - Sustainable ≠ Renewable ≠ Enduring/Durable
    - "Enduring", "durable" or "renewable': monadic operator
    - "X = sustainable" is not the same as "X = enduring, durable"

- Conceptual framework, consisting of:
  1. Kind of artefact: entity or construct
  2. Goal orientation: absolute or relative
  3. Behaviour or interaction: static or dynamic

2. Sustainability: artefact (2)

- *Kind of artefact*:
  - Entity (concrete artefact): sustainable car, sustainable house
  - Construct (abstract artefact): sustainable energy, sustainable traffic (system), sustainable health care

2. Sustainability: absolute (1)

- *Goal orientation* (Aristotle‘s principle of the Absolute (Beth, 1959))
  - Absolute: continuum with non-sustainable and sustainable as extremes (ultimate Good); defines a state or purpose that is the ultimate goal achievable by human activity
  - Relative: point of reference is present state of affairs; incremental improvements; small steps instead of a grand design; not the Good, but the less worse or the better

2. Sustainability: absolute (2)

- Aristotle's principle of the Absolute
  - "Working with the notion of an 'absolute' starts with a statement that every activity aims at accomplishing a result that is considered good (or Good), reversely some good (or Good) exists that everything aims at.
  - Three different objectives (Goods) exist:
    - activities that aim at serving a direct purpose;
    - activities that serve a purpose that is subordinate to a higher, probably unconscious, purpose;
    - and the possibility that a higher (unconscious) purpose is again subordinate to an even higher (unconscious) purpose.
  - This last step is expressed by the statement that the aim of all our activities must be the Good and even the Supreme Good" (Beth, 1959).
- Above is line of reasoning dominant in Western philosophy (classless society, free market and rationality)

2. Sustainability: interaction

- *Behavior/interaction* between artefacts and environments (inner/ outer part of system)
  - Static: the artefact is dynamic or static, the environment only static (model of Club of Rome)
  - Dynamic: exogenous and endogenous forces act both on artefact and environment to change, thereby influencing the (sustainability) equilibrium

2. Sustainability: framework (2)

- Artefact

Entity — Construct

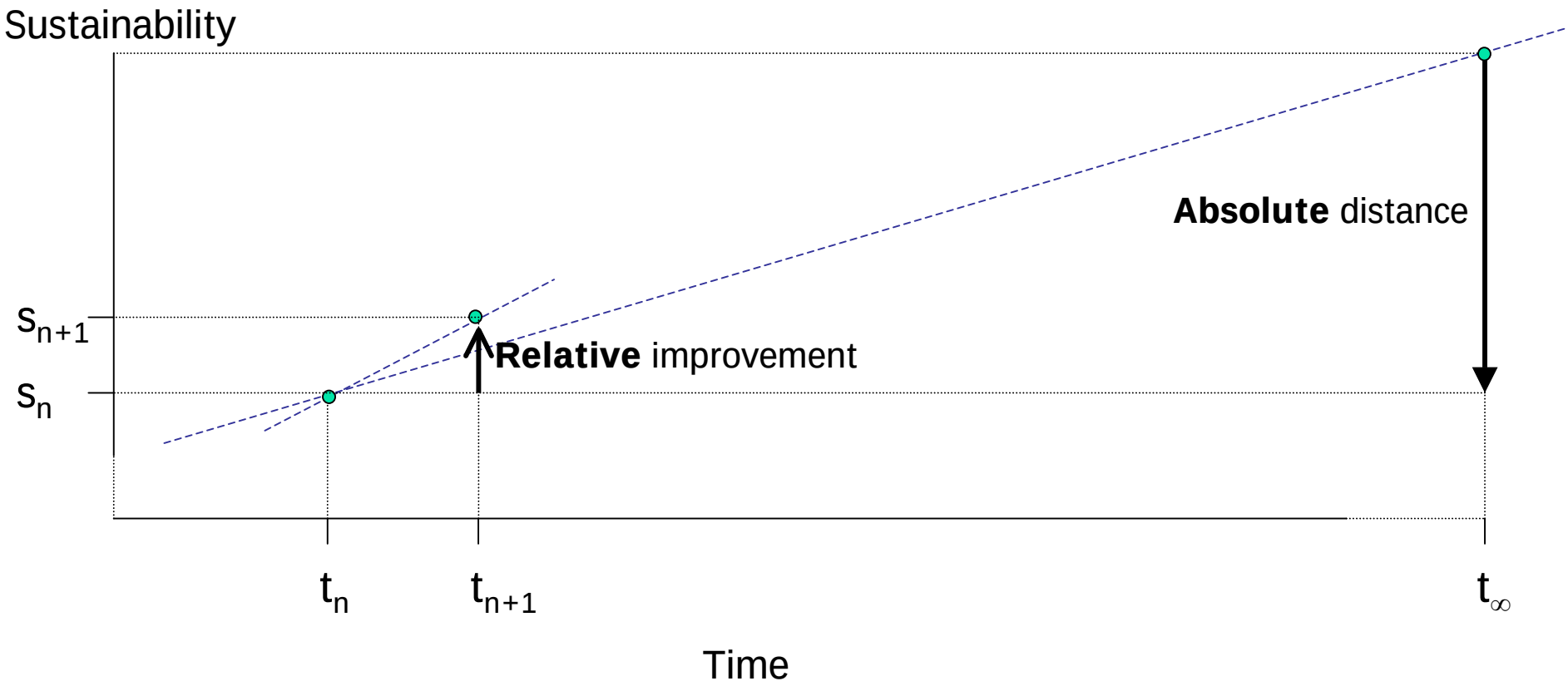
- Goal orientation

Absolute — Relative

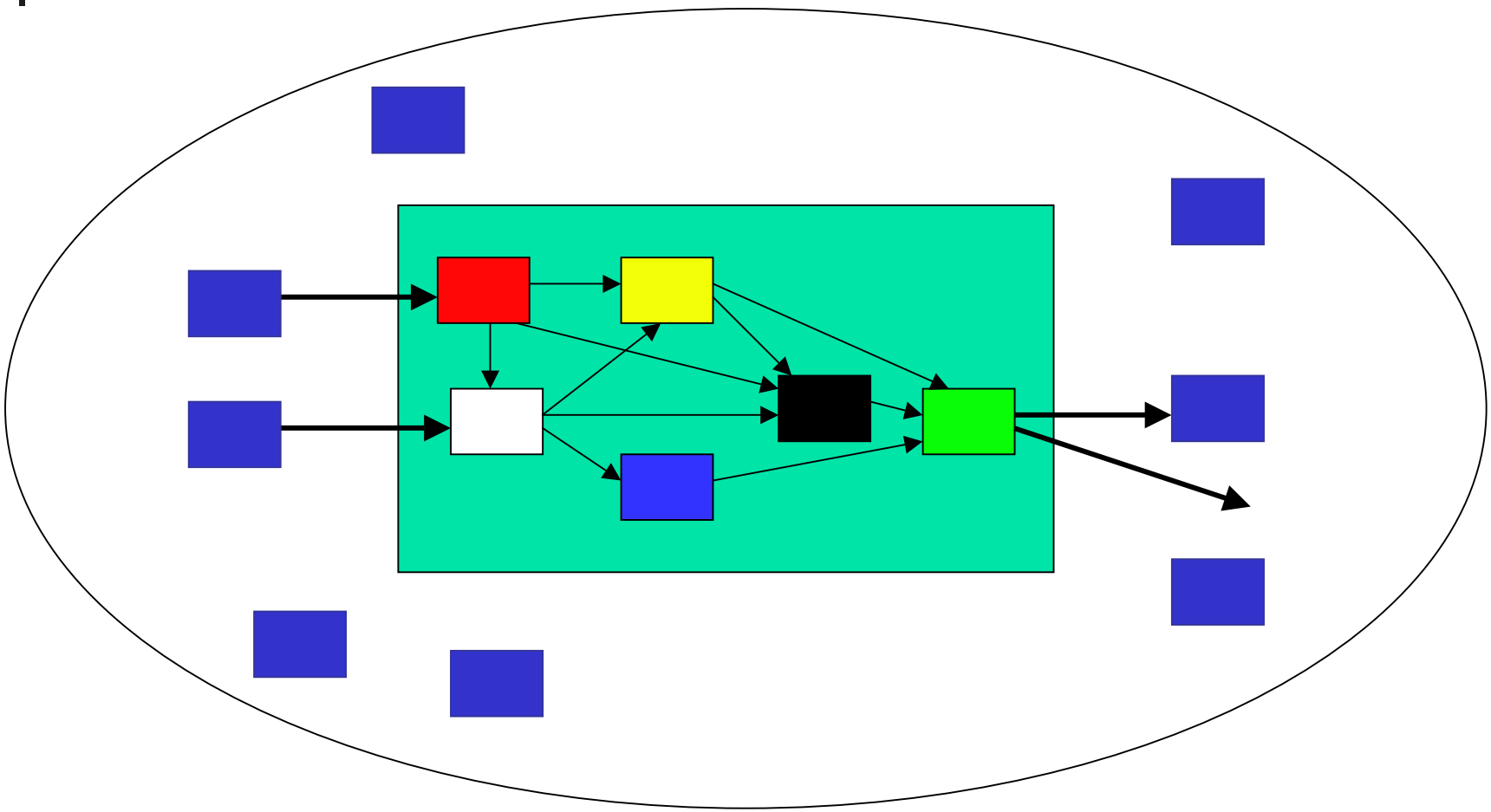
- Behaviour, interaction

Static — Dynamic

2. Sustainability: the concept



2. Sustainability: the concept



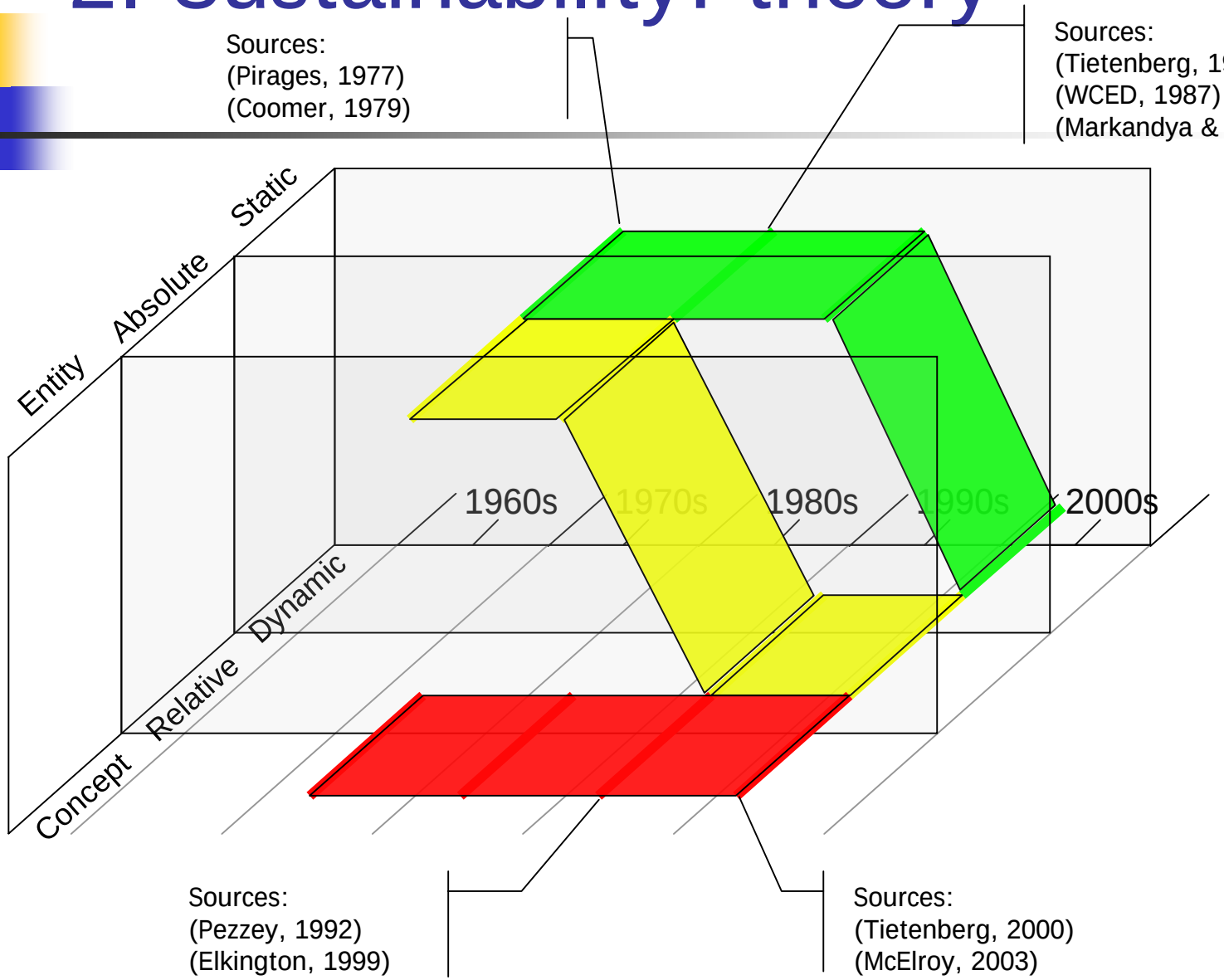
2. Sustainability: materials

- Material used for analysis and classification
  - We analyzed and classified more than 30 definitions of sustainability (theory)
  - We analyzed and classified many indicator lists and sustainability initiatives, used in investment companies and pension funds (www.pggm.nl; www.globalreporting.org; www.abp.nl (practice))

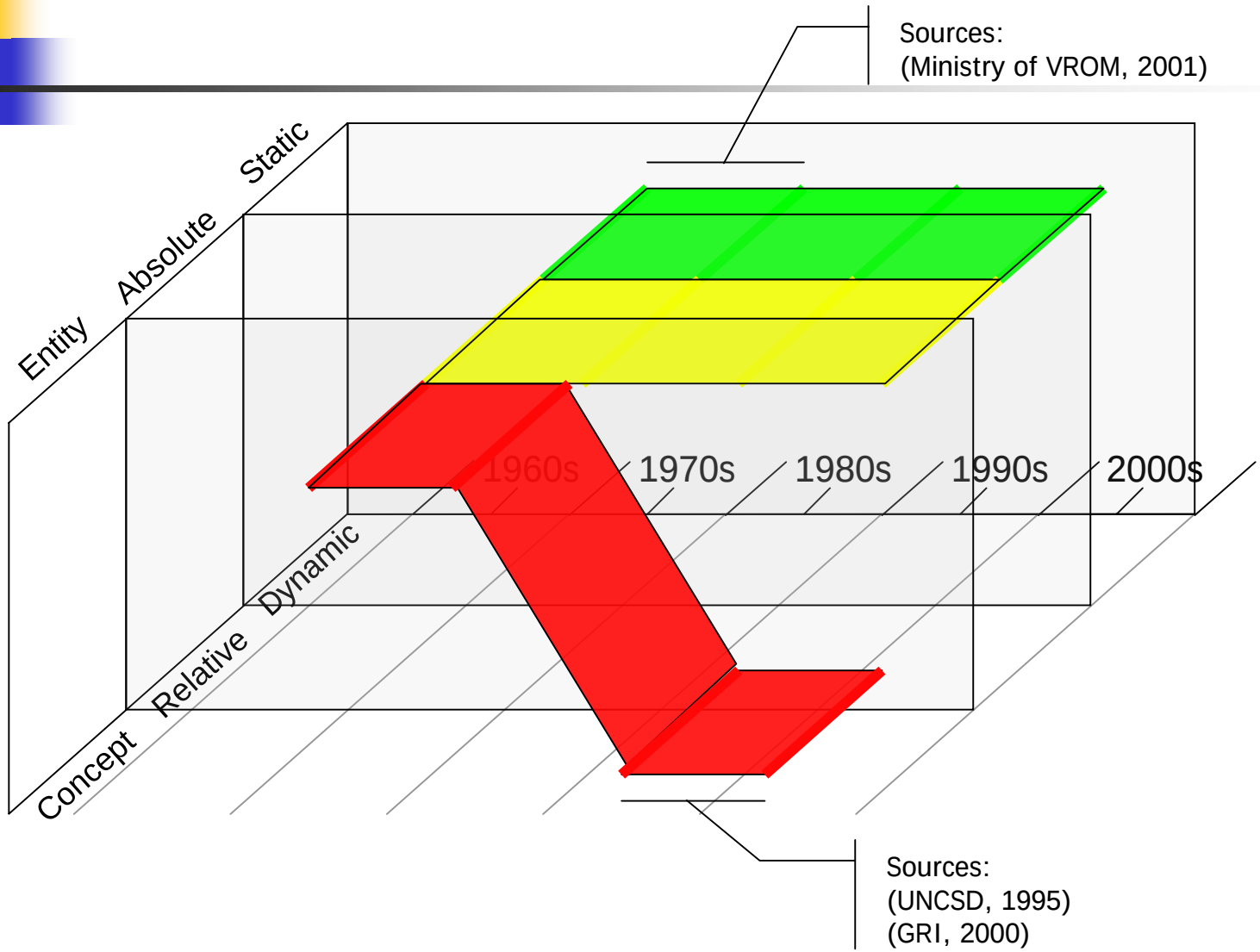
2. Sustainability: management

- To compare sustainability with management concepts Bolwijn & Kumpe's (1992) classification:
  - 1960s: Efficient firm: price
  - 1970s: Quality firm: price, quality
  - 1980s: Flexible firm: price, quality, product line
  - 1990s: Innovative firm: price, quality, product line, uniqueness
- Our extension:
  - 2000s: Knowledge based firm: price, quality, product line, uniqueness, customer, open

2. Sustainability: theory



2. Sustainability: indicators



2. Sustainability: conclusions

- Conclusion: developments between 1960 - 2000
  - Change from
    - entity to construct (more complex)
    - absolute to relative (more complex)
    - static to dynamic (more complex)
  - The above makes the commons dilemma (self-interest versus public interest) more prominent
  - Conceptual definitions: last $\approx$ *10 – 15 years*
  - Operational definitions: last $\approx$ *20 years*
  - Operationalizations later than conceptualisations

3. Practice: NIDO

- NIDO-program: Knowledge creation for sustainable innovation.
  - Innovation (*innovation is not only technology*):
    - From creation/invention to implementation;
    - Process, product, service, organization, etc.
  - Knowledge: input, throughput, output of innovation
  - Sustainability: Planet, People, Profit (Elkington)
    - Within innovations enhance the **people** component in the sense of more interest for knowledge and organizations
      - Knowledge: less spill over, more knowledge access, sharing, control and use
      - Organization: better organizational forms (clan, bureaucracy, etc.), better coordination mechanisms (standardization, etc.)

3. Practice: sustainability

- Sustainability is an issue:
  - As booster or trigger for innovation
    - Planet and Profit
  - During the process of innovation
    - Planet, Profit; very little People, knowledge and organizations
  - As result from an innovation
    - Planet and Profit

3. Practice: innovation

- Sustainable innovation can mean:
  - 1. Innovation of/with more sustainable techniques, materials, less energy consumption, etc.
  - 2. Design, organize innovations such that they keep going, continue, that they sustain (are in dynamic equilibrium with)

3. Practice: innovation

Innovation → ↓ Renewal	Radical	Really new	Dis-continuous	Incremental	Imitative
Science / Technology	X				
Product / Service	X	X	X		
Company surrounding	X	X		X	
Company itself	X	X	X	X	X

3. Practice: 1st and 2nd KM

- Sustainable innovation as we used it equals 2nd generation knowledge management (KM)
  - 1st generation KM: control, constrain and structure ("practice should follow policy")
  - 2nd generation KM: create, discover and open (("policy should follow practice"), see McElroy, 2003, Policy Synchronization Method = PSM)
- Emphasis on knowledge and organization: stimulate "knowledge of sustainability" with as a result "sustainability of knowledge"

3. Practice: knowledge

- Innovation: chain of knowledge

	Knowledge creation	Knowledge encoding	Knowledge storage	Knowledge sharing	Knowledge maintenance	Knowledge use
Organization X	X	X	X	X	X	X
Organization Y			x	x		x

- However, knowledge is not information

3. Practice: partners

- Participating companies, organizations (NIDO-KDI)

  - Academic Hospital Groningen
  - Alfacollege (ROC)
  - ATOL
  - AVEBE
  - BiG-River/TNO in Optichem
  - **BioSoil**
  - GGZ/JKS/Leones
  - **GGZ-Drenthe**
  - GGZ/Trimbos
  - Grontmij
  - Incontext
  - Kunststoffenhuis
  - Philips
  - Reekx

3. Practice: example Biosoil

- Core business:
  - in situ and on-site remediation (soil treatment) by means of natural biological decomposition processes in combination with classical techniques such as filtering, separation, etc.
- Advantages:
  - Contamination is demolished into harmless residues
  - More sustainable and cost effective in the long run
  - Soil is the bioreactor, better for environment
  - May lead to a better soil policy

bioSoil

3. Practice: example Biosoil

- Examples of techniques:
  - Aerobe demolition of carbon hydrogen, such as fuel products in gas stations and refineries
  - Anaerobe demolition of chlorous solvents, e.g., in chemical laundries, metallurgical industries
- Some problems for the future:
  - Most larger cities have vast contaminated terrains
  - Policy makers know a lot of budgeting and sentiments, but have no knowledge of sustainability

bioSoil

3. Practice: example Biosoil

- Sustainable innovation issue:
  - How to compare soil as bioreactor with traditional techniques:
    - a) dig up, excavate contamination and fill up with sand
    - b) ground topsoil and then sand or other materials
  - For local and national policy makers sustainable means: to do it quick and with low cost
  - In reviewing (approach and tender) used techniques are leading, no experiments, budget period
  - Government regulations explicitly forbid more sustainable solutions; legislation of 15 years ago

bioSoil

3. Practice: example Biosoil

- Remarkable:
  - In 2003 new national soil policy: remediation possible if goal is stable end state (impossible !!)
  - Next decade: large shortage of “level up sand”, energy problem (price of fossil energy)
  - National government is limiting budget for soil treatment and transfers it to local governments
  - Research (end 2003): 600.000 polluted locations in the Netherlands, **at least 60.000** are urgent

bioSoil

3. Practice: example GGZ

- How do we change mental and somatic health care?
- To improve patients care!
- To make it more pleasant for all workers in health care
- What is the role of innovation, sustainability and knowledge?

- BECAUSE……

nederland

3. Practice: example GGZ

- Medical care has become prohibitive for 1 million Dutchman (next year ???)
- 3 million Dutchman do not check their teeth
- TBS'ers often unjustly in clinic
- Nursing homes provide minimal care
- And so on and on

- Above are not technological or medical problems, but organizational problems

nederland

3. Practice: example GGZ

- Some important problems in health care
  - The way we provide care (over, under, abuse)
  - The way we organize care (throughput time, shortage, communication problems, etc.)
  - The way we care (attitude, who control, empathy)
- An enormous gap exists between health care that we want and that we need
- In health care offload is “name of the game”

GGZ nederland

3. Practice: example GGZ

- Concrete problem in GGZ-Drenthe:
  - Within primary and secondary processes more and more knowledge has to be shared, however …
  - Professionals do not structurally share knowledge
  - Very little sharing between Clinic and Academia
  - Different knowledge of psychiatrists/psychologists and socio-therapists dealing with same patient
- Under what conditions may a to be developed KM-system be able to solve some of the above knowledge problems?

GGZ nederland

3. Practice: conclusions (1)

	Biosoil	KSH	Optichem	Philips	AVEBE	Trimbos	CasusCons.	GGZ	AZG	Reekx	Grontmij	Atol	Incontext
'Planet'	5	2	6	2	5	0	0	0	0	0	4	0	0
'Profit'	2	3	2	3	2	1	3	3	3	5	3	3	5
'People'	3	5	2	5	3	9	7	7	7	5	3	7	5
Total	10	10	10	10	10	10	10	10	10	10	10	10	10

Sustainability valuations for 13 organizations for three P's (10 = 100%)

3. Practice: conclusions (2)

	Biosoil	KSH	Optichem	Philips	AVEBE	Trimbos	CasusCons.	GGZ	AZG	Reekx	Grontmij	Atol	Incontext
Sustainability of "what" (D/C)	c	c	c	d	c	c	c	c	c	c	c	c	c
A: Absolute - R: Relative	a	a/r	a	a	a	r	r	r	r	r	a/r	r	r
S: Static - D: Dynamic	d	d	d	d	d	d	d	d	d	d	d	d	d

Valuation for 13 organizations on aspects of framework

4. Operationalization: examples 1

- Non sustainable = to devolve, to offload, burden transfer
- Examples:
  - Fossil energy: offload of emission, exhaustion to environment
  - Pet-bottle; offload of waste to environment (re-fill or recycle)
  - WAO-discussion (disability) NL in the 80's offload of unemployment as disability to whole society

4. Operationalization: offload 1

- Operational definition of sustainability
  - **Attempt 2**: Reduction in offload; offload is a four-place predicate {A, B, X, t}
  - A, B are actors at same or different ontological levels
  - X is the "what": entity or construct
  - t is time horizon
  - To start reduction the various "arguments" of offload have to be determined
  - Reduction can be directed at A, B, X, t or a combination of them

4. Operationalization: ontology

- Levels of aggregation (ontological):
  - Society/Community
  - Networks
  - Organization
  - Team, Group, Unit
  - INDIVIDUAL, PERSON
  - Information processing system, CNS, senses
  - Organ systems and organs
  - Cells, Cell structures, DNA

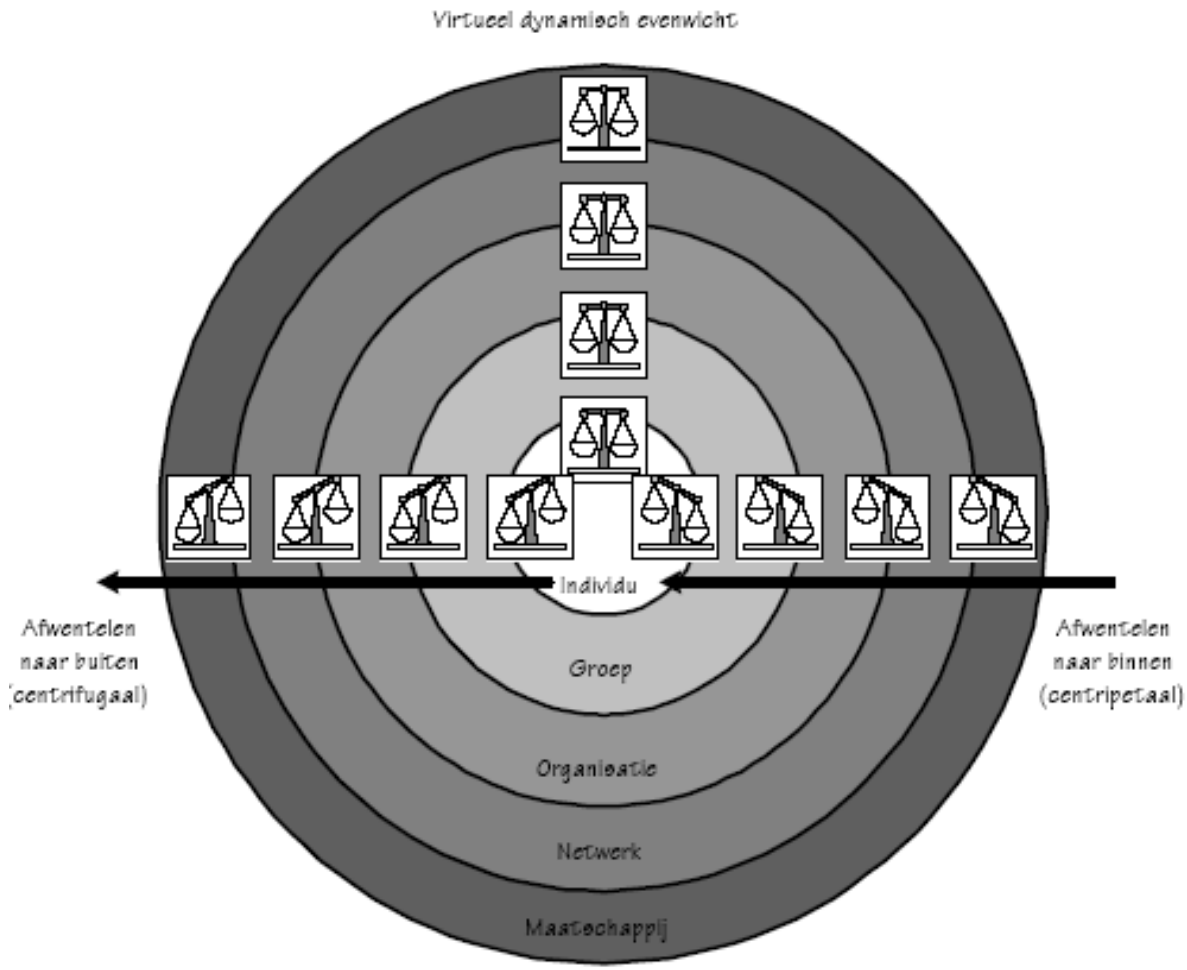
4. Operationalization: offload 2

- (Reduction In) Offload ((RI)O) is not same as
  - Negative externalities: in economics spillover from economic activity (social cost > private cost)
    - Objection: only prices; market failure, takes market model for correct (imperfection of markets)
  - Multi-criteria decision making: e.g., Simple Multi Attribute Rating Technique (SMART, Edwards) alternatives, attributes, valuations, weighted functions, sensitivity analysis.
    - Objection: processes, interdependencies, various actors are missing

4. Operationalization: examples 2

- Offload means that a system acts with detrimental effects on the same system in future
- Examples of (reduction in) offload
  - Car driver (A) devolves on inhabitants of Delft (B) emission (X) with time horizon (t) 20 year
    - A = individual; B = group of actors; X = entity; t = years
  - Society (A) devolves on chronic patients (B) contribution increase (X) with time horizon (t) 1 year
    - A = group; B = group; X = construct; t = years

4. Operationalization: balance



4. Operationalization: questions

- There are two issues/questions
  - 1. Determination and analysis of offload: involves determination and analysis of A, B, X and t.
    - **Can be done !**
  - 2. Reduction in offload: change A, B , X and/or t.
    - **Some important problems to solve, e.g.,**
      - What criteria to use for reduction?
      - Criteria should be epistemological, ontological, not ethical, because then not "decidable" (quantifiable)
      - How to better incorporate relational thinking as Arne Naess (1989) has suggested?

5. Conclusions

- Sustainability
  - There is and will be no well-defined definition
  - Although claimed to be superfluous, is necessary
  - “People” not (only) fairness (social resp.), but also knowledge, organization and human behavior
- Innovation
  - Every technological innovation has major human and organizational aspects and consequences
  - Innovation has to start bottom-up, not top-down
  - Sustainable innovation = 2nd generation KM
  - We need more upstream innovation

5. Conclusions

- Methodology
  - A quasi-logical analysis of “sustainability” is useful
  - Notion of “offload” gives insight, but does not cure
  - Dimensions and criteria are not solved
  - Can a devolvement instrument for companies, organizations and government be developed?

Sustainable Innovation

Uitgekomen:

September 2004;

Van Gorcum, Assen