Czesław Mesjasz
Cracow University of Economics, Cracow, Poland
mesjaszc@uek.krakow.pl

Interpretations of Sustainability: A Few Lessons from Modern Systems Thinking

First Sustainability Transition and Sustainable Peace Workshop
UNAM/CRIM and AFES-PRESS

Morelos, Mexico, 10 – 13 September 2012

AIM OF THE PAPER

The aim of the paper is to identify the impact of complex systems studies upon the idea of sustainability and sustainability transition

Attention will be paid not only to mathematical models of complexity ("hard complexity") but also to analogies and metaphors relating to complexity which are used in sustainability transition theory and practice ("soft complexity")

Assessment of th meaning of sustainability from a systemic point of view

ASSUMPTIONS OF THE PAPER

1. What is sustainability?
2. Why is it applied?
3. Paradoxes of sustainability
4. Complex systems and sustainability
5. Systemic interpretation of sustainability
6. Advantages and disadvantages of the concept of sustainability

ASSUMPTIONS OF THE PAPER

A middle-of-the-road epistemological level

Between objective neopositivist approach and constructivism

Minimal level of precision of discourse

Self-reflexion in the discourse

Effective communication of the idea of sustainability

(Utilitarian approach)

WHAT IS SUSTAINABILITY – GENERAL IDEAS AND DEFINITIONS

Sustainability

In a broad sense - the capacity to endure

Ecology – diversity and productivity of biological systems over time

WHAT IS SUSTAINABILITY – GENERAL IDEAS AND DEFNITIONS

Sustainability

Society - the potential for long-term maintenance of wellbeing, depending on the wellbeing of the natural world and the responsible use of natural resources

Sustainability

Sustainable development has been defined in many ways, but the most frequently quoted definition is from *Our Common Future*, also known as the Brundtland Report:

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

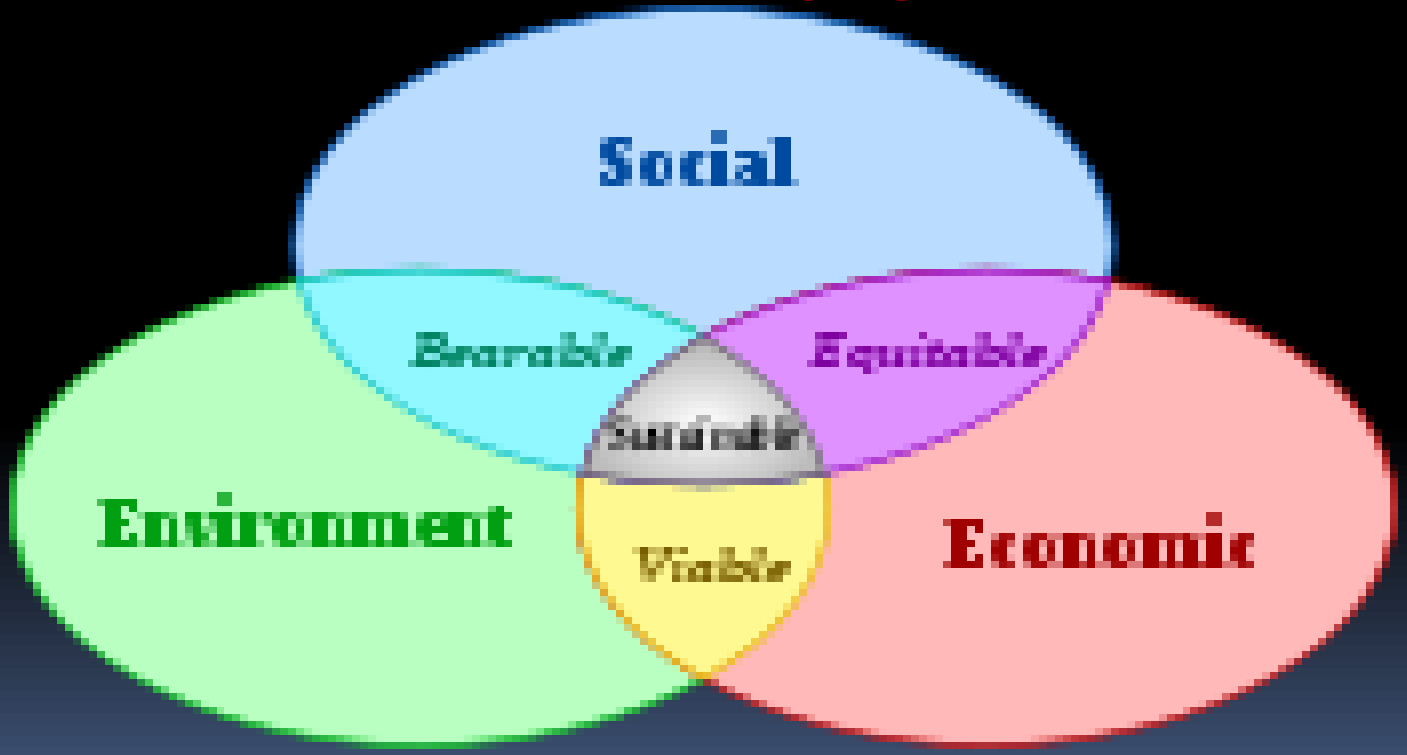
Sustainability

It contains two key concepts:

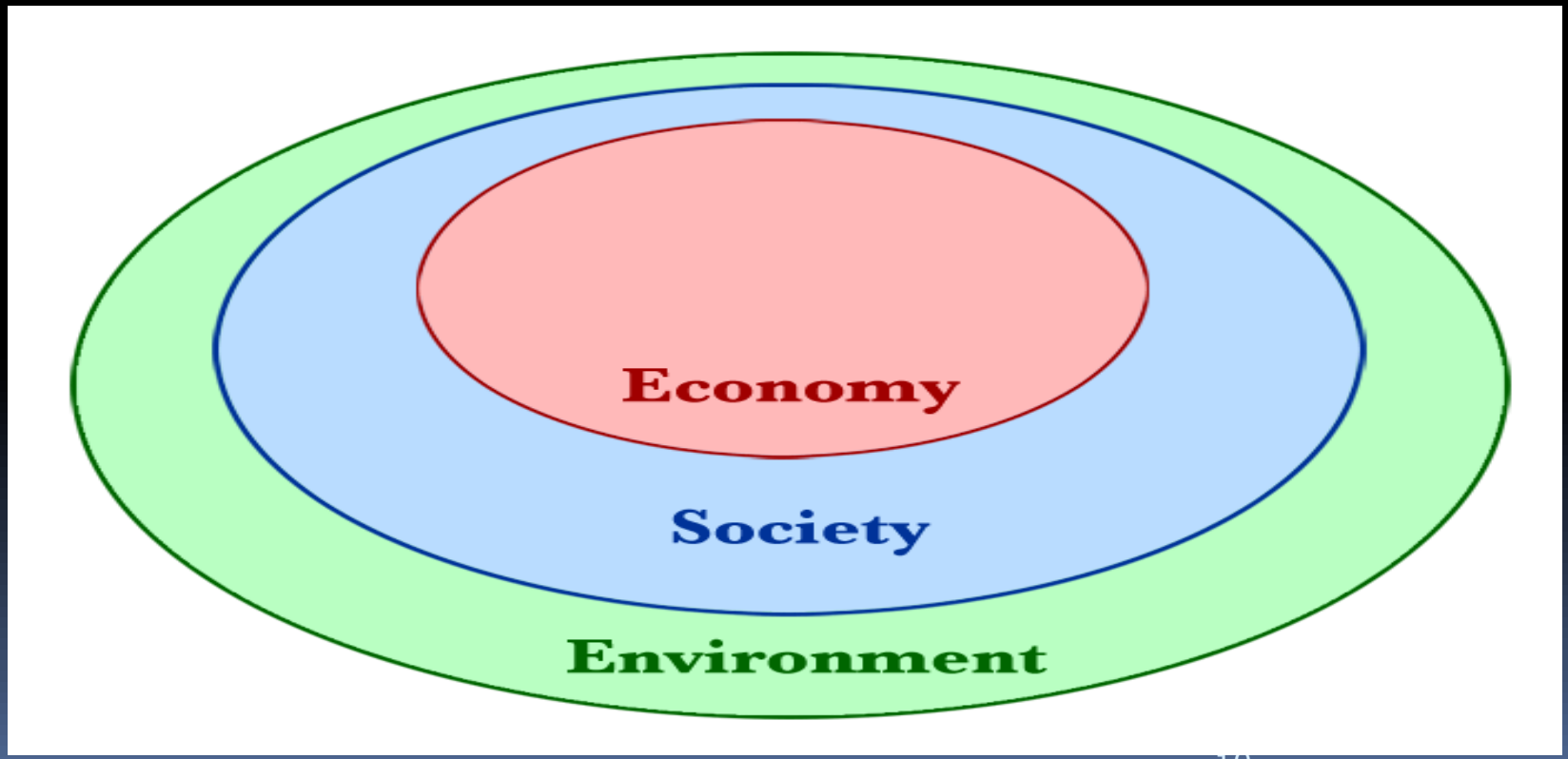
- ***the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given***

- ***the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs***

WHAT IS SUSTAINABILITY – GENERAL IDEAS AND DEFINITIONS



WHAT IS SUSTAINABILITY – GENERAL IDEAS AND DEFINITIONS



WHY SUSTAINABILITY?

Fundamental epistemological questions:

1. In a present form sustainability is a normative (value laden) „scientific" and „systems thinking-based" metaphor with predominantly imprecisely defined characteristics.

2. Difficulties of operationalization - rather a kind of „prophetic" and ideological term.

WHY SUSTAINABILITY?

Fundamental epistemological questions:

The main subject of sustainability?

If broadly defined „humanity” in its environment then:

1. **What about the measures of sustainability – the world population, living conditions?**

WHY SUSTAINABILITY?

Fundamental epistemological questions:

The main subject of sustainability, cont'd

2. Is it possible to define the measures of sustainability, to determine their present value and to predict their future value?
3. Are there any universal measures of sustainability?

WHY SUSTAINABILITY?

Fundamental epistemological questions:

The main subject of sustainability, cont'd

4. Specific measures of sustainability – scale: local, global
5. Functional approach - associated with various domains of human activity
6. Sustainability and elimination of differences of standards of living in the world – how it can be achieved?

WHY SUSTAINABILITY?

Interpretations (examples):

- population
- consumption, technology, resources
- direct and indirect environmental impacts

WHY SUSTAINABILITY?

Interpretations (examples), cont'd:

Environment

- global human impact on biodiversity
- environmental management
- extinctions
- management of human consumption

WHY SUSTAINABILITY?

Interpretations (examples), cont'd:

Economic dimension

- decoupling environmental degradation and economic growth
- nature as an economic externality
- economic opportunity

WHY SUSTAINABILITY?

Interpretations (examples), cont'd:

Social dimension

- peace and security
- social justice
- human relationship to nature

WHY SUSTAINABILITY?

Interpretations (examples), cont'd:

Transition

- less attention given to norms and ultimate objectives
- concentration on the process (social learning)
- focus shifted from structure to functional approach

WHY SUSTAINABILITY?

Interpretations (examples), cont'd:

Measurement (examples)

Happy Planet Index

Triple Bottom Line Accounting

Environmental Sustainability Index

Environmental Performance Index

WHY SUSTAINABILITY?

Three approaches to social/economic systems:

1. Objective – risk, threat, equilibrium, etc.
2. Subjective (constructivist) – risk, threat, equilibrium, as an „act of speech" (performative utterance)
3. Intersubjective – search for (negotiated) meaning), acceptable, allowing for efficient communication

WHY SUSTAINABILITY?

Paradoxes of sustainability and transition:

1. Natural vs. social
2. Local vs. global
3. Sources of norms concerning sustainability
4. The ultimate objectives
5. Contradiction of objectives

WHY SUSTAINABILITY?

Paradoxes of sustainability and transition, cont'd:

6. Subjective vs. objective
7. Predictability vs. unpredictabiity
8. Process vs. final state
9. Spontaneity vs. control

SUSTAINABILITY AND COMPLEX SYSTEMS

- expectations – a strong normative and ethical background
- opportunities
- limitations
- Illusions
- abuses

SUSTAINABILITY AND COMPLEX SYSTEMS

„Hard" complexity: mathematical models

„Soft" complexity: analogies and metaphors deriving from mathematical models along with qualitative ideas of complexity, e.g. concepts of Niklas Luhmann

SUSTAINABILITY AND COMPLEX SYSTEMS

Human systems are characterized by the presence of all sources and types of complexity

Human systems are

"Complexities of complexities"

Models, analogies and metaphors are instruments of theories in social sciences and are applied for:

- description
- explanation of causal relations
- prediction
- anticipation
- normative approach
- prescription
- retrospection
- retrodiction (back-casting)
- control and regulation

SUSTAINABILITY AND COMPLEX SYSTEMS

Conditions of applying complex systems

in studying sustainability

SUSTAINABILITY AND COMPLEX SYSTEMS

Description

Systems thinking as the main instrument of description and analysis (especially complex systems studies)

Definition of system - a constructivist approach

Relations with other entities (systems)

Sources of descriptive information

Structure and relationships - from static relationships to networks

SUSTAINABILITY AND COMPLEX SYSTEMS

Description, cont'd

Main abuse – systems terminology as buzzwords leading to creating „void" or „irrellevant systems"

Systems jargon language as an instrument of increasing „scientific" value of the discourse

SUSTAINABILITY AND COMPLEX SYSTEMS

Explanation

Adequate explanation - causal links vs. correlations

Multicausality

Dynamics of sustainability – causal relationships

Models of dynamics, e.g. Viable System Model by Stafford Beer

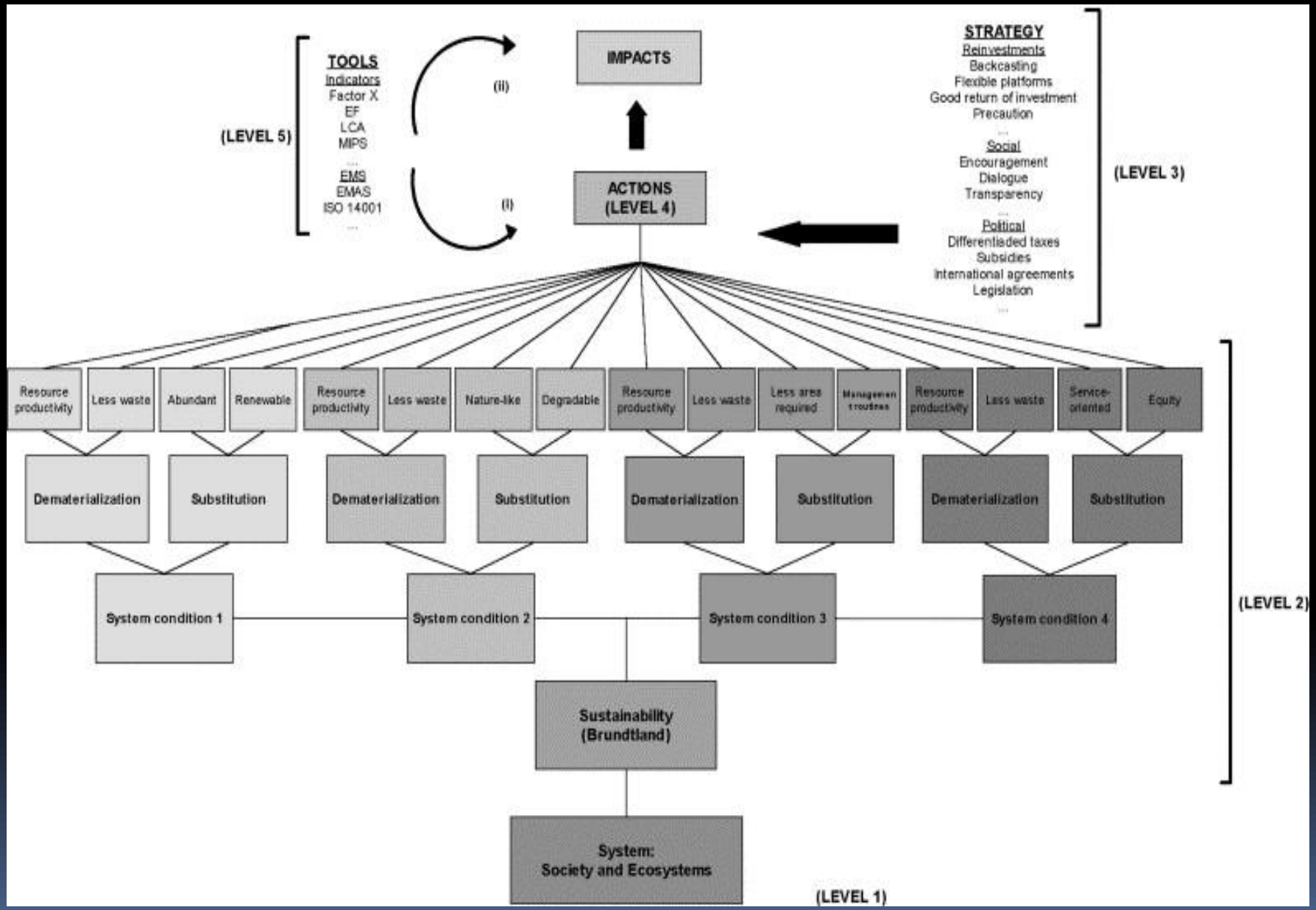
Emerging properties, e.g. Complex Adaptive Systems (also with cognitive capabilities), scale-free networks

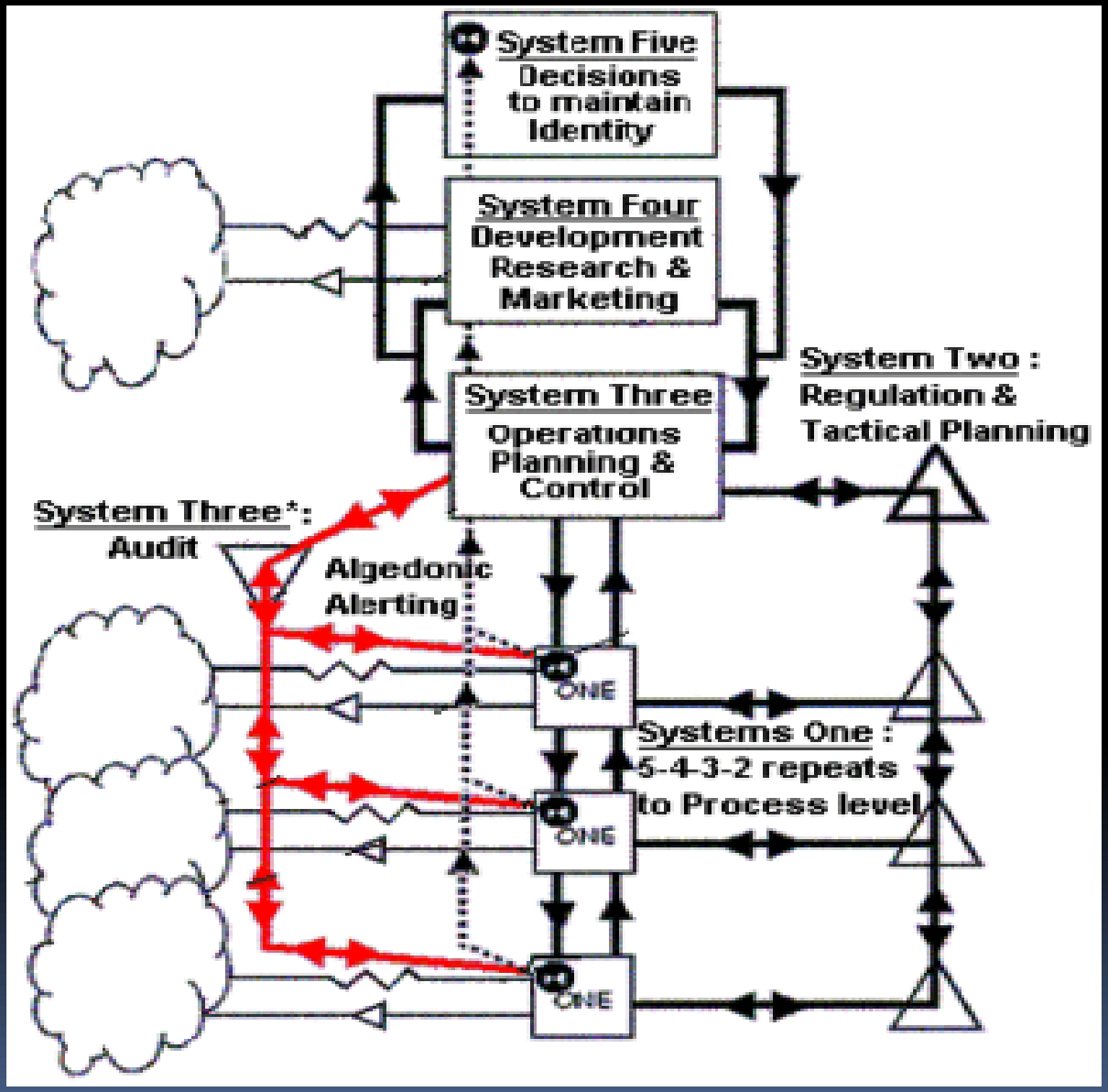
SUSTAINABILITY AND COMPLEX SYSTEMS

Explanation

Causality is interpreted as objective when proved with logical on empirical evidence

At the same time causality has also an intersubjective character. Observers (participants) agree that a specific course of events has led to a specific outcome although it is not certain whether both cause and effect are unique and cannot be replaced


(LEVEL 5)
TOOLS
Indicators
Factor X
EF
LCA
MIPS
...
EMS
EMAS
ISO 14001
...
(II)
(I)
IMPACTS
ACTIONS
(LEVEL 4)
STRATEGY
Reinvestments
Backcasting
Flexible platforms
Good return of investment
Precaution
...
Social
Encouragement
Dialogue
Transparency
...
Political
Differentiated taxes
Subsidies
International agreements
Legislation
...
(LEVEL 3)
Resource productivity
Less waste
Abundant
Renewable
Resource productivity
Less waste
Nature-like
Degradable
Resource productivity
Less waste
Less area required
Management routines
Resource productivity
Less waste
Service-oriented
Equity
Dematerialization
Substitution
Dematerialization
Substitution
Dematerialization
Substitution
Dematerialization
Substitution
System condition 1
System condition 2
System condition 3
System condition 4
(LEVEL 2)
Sustainability
(Brundtland)
System:
Society and Ecosystems
(LEVEL 1)


System Five
Decisions
to maintain
Identity
System Four
Development
Research &
Marketing
System Three
Operations
Planning &
Control
System Two :
Regulation &
Tactical Planning
System Three*:
Audit
Algedonic
Alerting
ONE
ONE
ONE
Systems One :
5-4-3-2 repeats
to Process level

SUSTAINABILITY AND COMPLEX SYSTEMS

Prediction

Definitional remarks

Prediction vs. forecasting

„Scientific" prediction vs. „common sense prediction"

Contingent prediction, (conditional prediction) "if, then"

Non-contingent prediction - future events

are depicted in a straightforward manner

First Sustainability Transition and Sustainable Peace Workshop
UNAM/CRIM and AFES-PRESS

SUSTAINABILITY AND COMPLEX SYSTEMS

Prediction

Sense of prediction (forecasting)

Mathematical modelling – historic data

Constructivist approaches – reflection about reflection about the future (individual and collective)

Social sciences – synthesis of the two above approaches

Two approaches to prediction with mathematical models

A priori model and search for phenomenological interpretations – physics, chemistry,

(theoretical economics?)

Building a "central metaphor" guiding the cognitive process. the metaphor can be decomposed and subsequently parameters can be operationalized as to enable further research – description, prediction, etc.
(Central metaphor results from experiments or theories)

The two above approaches are in fact (almost) similar

SUSTAINABILITY AND COMPLEX SYSTEMS

Prediction

Examples of central metaphors: social system as machine/chaotic system/beehive/learning system, etc.

Equilibrium, stability, turbulence, sustainability

Different central metaphors lead to various interpretations/meaning and to different patterns of control

SUSTAINABILITY AND COMPLEX SYSTEMS

Prediction

Prediction can be interpreted as a selection of one world from infinite number of "potential worlds" which can emerge from any given set of circumstances

Prediction as search for regularities and causality

Prediction in physics
(quantum mechanics excluded)

1. Identification of system – elements, interactions, borders
2. Identification of representative parameters (characteristics)
3. Patterns of change – micro- … and macro-level and their relationships
4. Search for invariants, which can also be dynamic
5. Possibility of „brute force” – numerical methods, number crunching

Nodal points (patterns of change):

(1) connector points, which interpose one into another type of process

(2) branch points, foreclosing certain possible lines of development

(3) jump points, creating a new horizon of possibilities

(4) saddle points, inducing stasis or even regression

Nodal points, cont'd:

(5) break points, actually consisting in or substantively contributing to a rupture of social structures and/or their constellation in a totality;

(6) trigger points, initiating or powerfully augmenting such a transformative process;

(7) predisposing points, securing the satisfaction of the enabling conditions for such a process, e.g. the inception of a (tendentially) auto-subversive tendency.

SUSTAINABILITY AND COMPLEX SYSTEMS

Prediction

Changes, no matter whether positive or negative.

Known and predictable

Known but not predictable

Unknown, sometimes even unthinkable

SUSTAINABILITY AND COMPLEX SYSTEMS

Control

Questions:

1. **Can we develop the sustainability postulates based upon prediction?**

2. **Can we predict how to achieve the sustainability postulates?**

3. **To what extent is it possible to control all systems – natural, social, hybrid, defined in the sustainability discourse?**

SUSTAINABILITY AND COMPLEX SYSTEMS

Control

Questions:

4. **How to apply classical control concepts in sustainability and transition theory and policy?**

5. **How partial control mechanisms are contributing to synergy effects in sustainability and transition?**

6. **Are our goals concerning sustainability too far reaching?**

7. **How can the ideas concerning sustainability be communicated at various levels of societal hierarchy?**

SUSTAINABILITY AND COMPLEX SYSTEMS

Control, cont'd

The answers:

- **Limitations of predictability and controllability undermine the efforts to achieve sustainability**
- **Possibility of achieving global sustainability is very limited, if not possible at all**
- **Only a deep knowledge of complexity of social systems allows for achieving partial solutions related to sustainability, especially in transition theory and policy**

SUSTAINABILITY AND COMPLEX SYSTEMS

Control, cont'd

The answers:

- **Partial solutions – the only goal in sustainability**
- **Importance of transitoin**
- **The value of partial solutions – local achievements**
- **The links between partial solutions and overall sustainability – synergy and dissynergy**

Conclusions:

Complex systems studies as the main method of understanding, development and analysis of partial results and overall sustainability

All functions – description, prediction, etc.

Complex systems studies allow to conclude that the concept of sustainability is of a limited validity

Due to the lack of precision in defining sustainability, it may have a limited impact on the social dicourse

Conclusions:

Only partial results which could be linked to the idea of sustainability are achievable

Transition at the microscale

Deep understanding of all areas of complex systems studies may be helpful in partial sustainability and transition theory as well as practice

Broadly defined complex systems language can be counterproductive in sustainability theory and practice

Muchas gracias!

Thank you very much!

Dziękuję bardzo!