Can Social Science Help in Restructuring Energetic and Material Metabolism for Sustainable Development?

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1. THESIS: THE VISIONARY DEFINITION OF SD IS SELF-EVIDENT; ITS ANALYTICAL ARTICULATION NEEDS, HOWEVER, SOCIAL SCIENTIFIC INTERPRETATION

(1) Visionary definition:

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

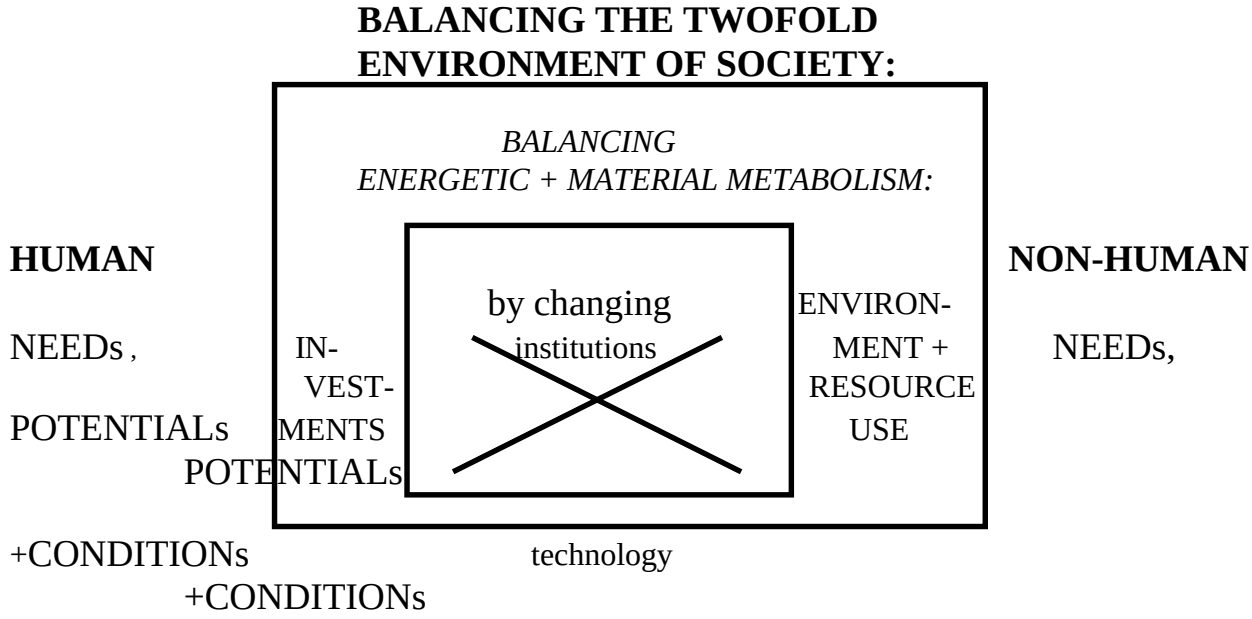
(World Commission for Environment and Development 1987: Our Common Future, p.46)

(2) Analytical articulation:

*"In essence, SD is a process of change in which the exploitation of **resources**, the direction of **investments**, the orientation of **technological development**, and **institutional change** are all in harmony and enhance both **current and future potential** to meet human needs and aspirations"*.

(Conclusion regarding "the concept of SD"; same source, p.46).

The essential question of harmony between the four components of change can be depicted as a system of balances.



Institutions and technology here constitute limiting factors for environmentally and socially SD. This is at difference with studies as the MIT-world model of Limits to Growth (Meadows et al. 1972) and the 1980 US. study Global 2000 (Barney 1980). Both abstracted analytically from their socio-political context. Ironically, Global 2000 was put aside, when the Reagan administration took over (C.-Dupont 1993).

2. THESIS: THE ANALYTICAL ARTICULATION IS PARTIALLY *OPERATIONALIZED* IN LOW ENERGY SCENARIOS

(WITH ENERGY AS BASE OF REDUCTION)

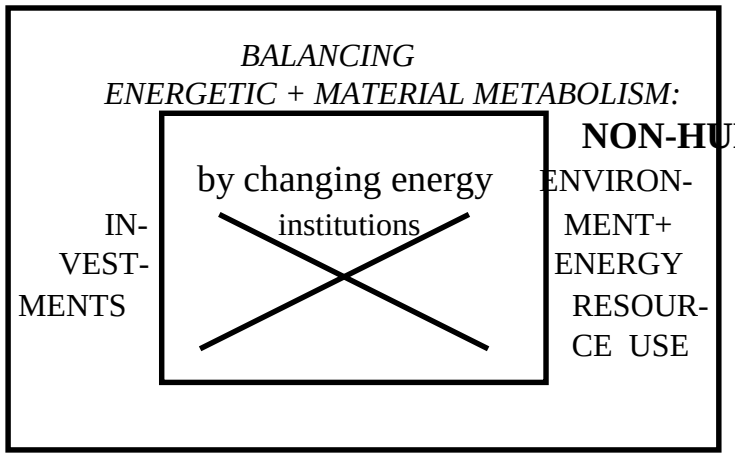
The problem puzzle of interpreting S.D. can be partially solved by
* reducing societal metabolic flows and stocks to their ***energetic base***;
* differentiating marketed ***energy techniques*** from needed ***energy services***.
This can be done by calculating both 1. law efficiencies (reductionist calorimetric) and temperature-sensitive 2. law efficiencies (entropy, exergy); these measures are combined by the "Carnot factor", based upon absolute temperature (°Kelvin), cp. J.Martinez-Alier 1997; P.Schyga 1997; H.Bossel 1981a.

Based upon this methodology, low energy scenarios **operationalize SD** by
* re-orienting *technological development* in energy procurement and end use;
* redirecting financial and real *investment flows* to
* more and better *use of* renewable "*resources*" of energetic potentials.
* *Institutional change* is, however, often not part of the operational definitions - the **scenario method** instead leaves room for different **assumptions** to be introduced externally:

*"It is clear that **a low energy path** is the best way towards a sustainable future. But given efficient and productive uses of primary energy, this need not mean a shortage of essential energy-services. Within the next 50 years, nations have the opportunity to produce the same levels of energy-services with as little as **half the primary supply** currently consumed.*
*This requires profound structural changes in **socio-economic and institutional arrangements** and is an important **challenge** to global society.*

(*World Commission on Environment and Development* 1987: OUR COMMON FUTURE, p.201).

BALANCING THE ENERGY TRANSACTIONS OF SOCIETY:



POTENTIALs technologies
POTENTIALs

+CONDITIONs
+CONDITIONs

Ecological tax reform **might** contribute to such changes of energy **institutions**, but is actually ineffective in a **dual world market system** with massive energy dumping (Massarrat 1998).

3. THESIS: SOCIETAL METABOLISM IS OUT OF ORDER BECAUSE SYSTEMIC RELATIONS ARE UPSIDE DOWN

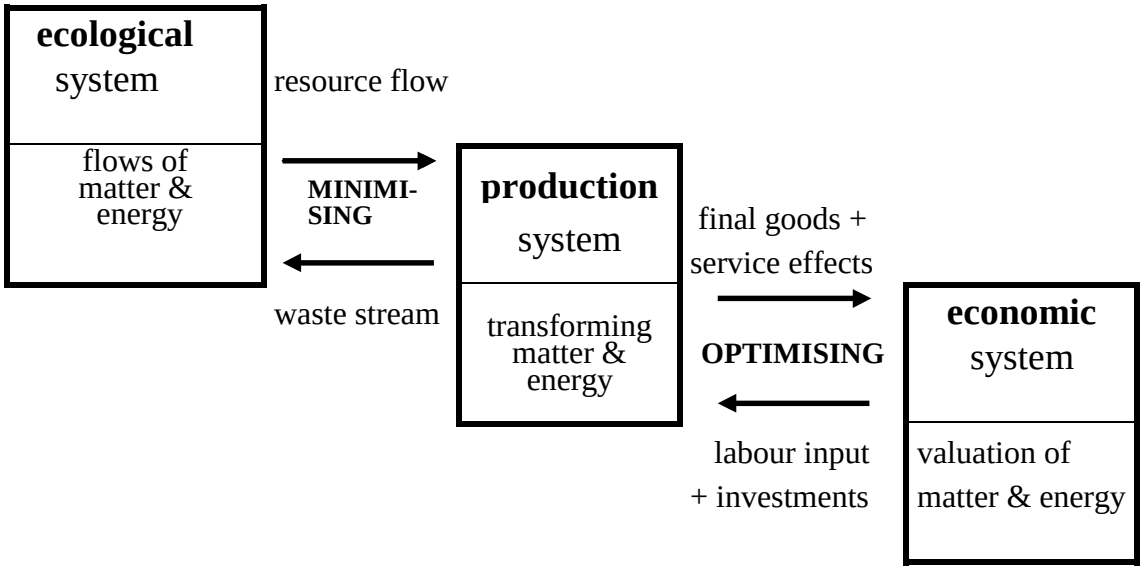
Techniques and institutions are combined in the **system of production** with its technical and social side. Their combination represents an overlap between the societal **economic system** (forms of allocation, distribution and redistribution) and the natural **ecological system** (organisms and their inorganic environment).

How precisely this overlap is articulated with both the ecological system and the wider economical system, is a historical question. Ecologist Barry Commoner looked at it from the **material/energetic side of the metabolism** between man and nature in order to grasp the fundamental logic:

> »Given these dependencies – the economic system on the **wealth** yielded by the production system and the production system on the **resources** provided by the ecosystem – logically the economic system ought to conform to the requirements of the production system, and the production system to the requirements of the ecosystem.The **governing influence** should flow from the ecosystem through the production system to the economic system. This is the rational ideal.«

(Commoner 1976, 2)

Ecologically sustainable mode of production (ideal mode)



Alternative energy scenarios as well as developments of eco-technology follow this substantial eco-logic (Bossel 1981b). Their realisation throughout systems of production presupposes, however, that criteria of investments are **governed by societal valuations** of matter and energy. The logic of the market must, thus, be restricted to distributing final products and services. It ought **not** to be dominating the allocation of the means of production (Commoner 1991), as it is today.

Actually, ***the articulations between the three systems in contemporary society contradict the rational ideal:***

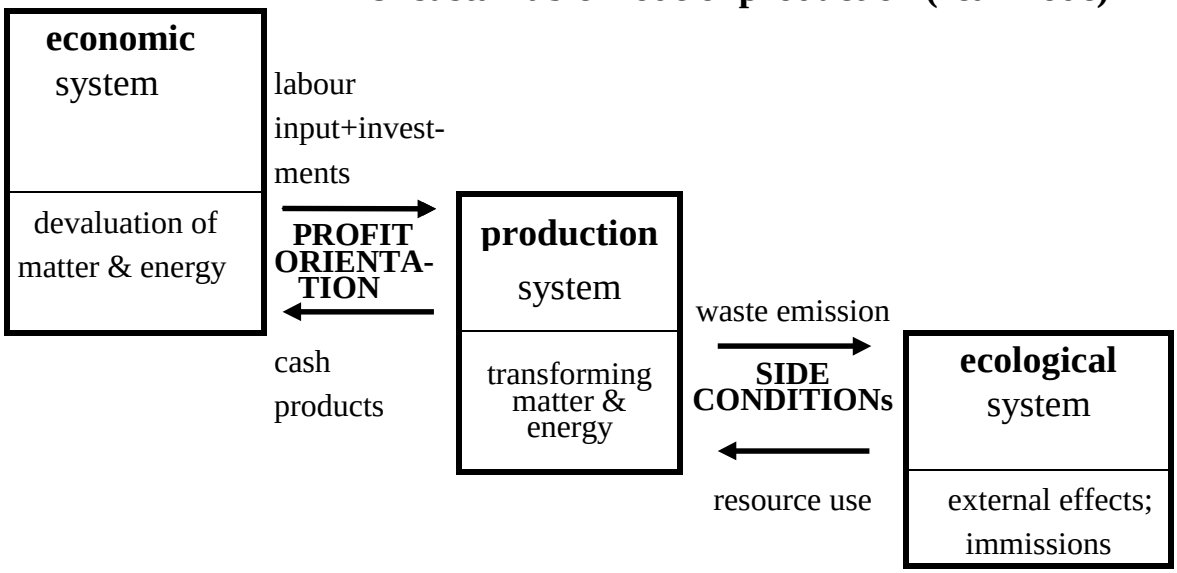
»The **environmental crisis** tells us that the **ecosystem** has been disastrously affected by the design of the **modern production system**, which has been developed with almost **no** regard for compatibility with the environment or for the efficient use of energy:

Gas-gulping cars pollute the environment with smog;
petrochemical factories convert an unrenewable store of petroleum into undegradable or toxic agents.

In turn, the faulty design of the production system has been imposed upon it by the **economic system**, which invests in factories that promise **increased profits** rather than environmental compatibility or efficient use of resources.
The relationships among the great systems on which society depends are upside down.«

(Commoner 1976, 2)

Unsustainable mode of production (real mode)



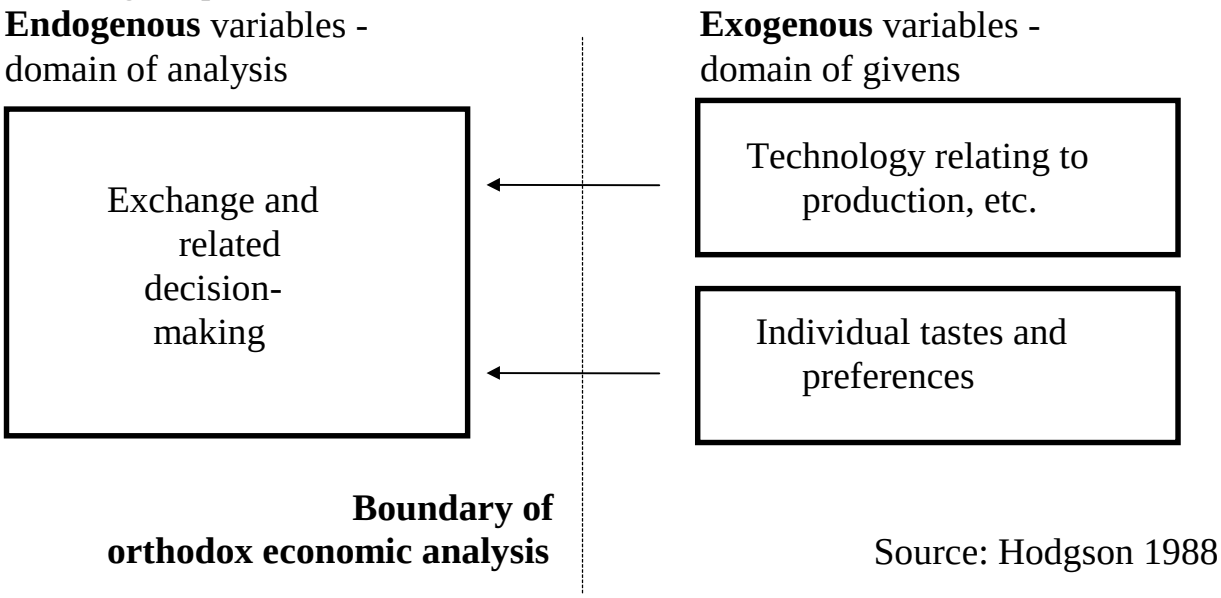
The function of THE MARKET is at stake: In the unsustainable mode, market prospects of profitability regulate, where profits are (re-)invested; technologies and other means of production are designed in order to contribute to maximising/stabilising rates of profit. **Environmental criteria** are set aside, when they don't meet this objective (resulting in negative externalities). They have to be **enforced by social governance** - e.g. by eco-taxes and social norms for cleaner technology to be followed within branches of the economy- **and by industrial democracy.** The latter might serve to internalise standards of best practice.

4. THESIS: MARKET ORTHODOXY IS PART OF THE PROBLEM.

Orthodox economics is constituted by axiomatic reasoning on **perfect markets**. In relation to the analytical articulation of SD, Hodgsons description of its **shortcomings** is valid:

> "Orthodox economics confines its theoretical analysis to the **exchange** or allocation of resources, and the **decision-making** thereby involved, neglecting both the moulding of individual **preferences** by social and economic circumstances and also the continuous transformation of **productive technology** through time."
>
> (Hodgson 1988, 13)

As Hodgson puts it:



Source: Hodgson 1988

More realistic accounts are, thus, eliminated by a utopia of the free market favouring unconditional deregulation:

> "The concept of the **utopian free market** is often used as an ideological basis for (a kind of) **deregulation**, which results in **oligopolistic regulation** of the market". This is a problem, because "**full information** about prices and development plans **disappears** as soon as oligopolistic regulation is established" (Hvelplund 1995, 219).

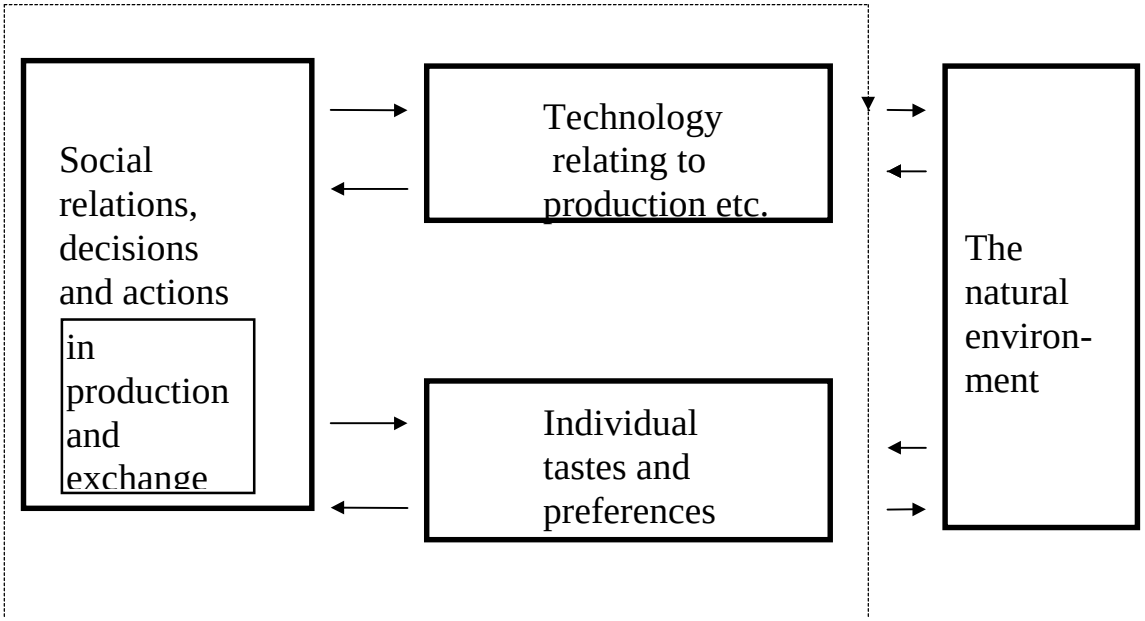
The critical political economist Frede Hvelplund/Aalborg University points at these **counterproductive consequences** from his analysis of Danish energy policy, where low-energy scenarios were instituted as government policy (See also

Krawinkel 1991).

5. THESIS:

INSTITUTIONAL ECONOMICS IS (ONLY) PART OF THE SOLUTION.

Contrary to orthodox economics, technology and psychology are included in **INSTITUTIONAL ECONOMICS**, as conceived of by Hodgson.



Source: Hogson 1988

Institutional economics is, thus **a big leap forward**: As with low energy scenarios, institutional economics is another partial solution to the problem of SD. It stresses the necessity to look at **both production and exchange** - and not exchange only. It, thus, approaches SD from the component of institutional and technological change and can tell its story about criteria of investment.

Yet, it is **partial**, because the natural environment is left outside of the realm of analysis. The fourth component of change comprised within the analytical articulation of SD, the exploitation of resources in the sense of **natural resources**, is thus **not** included in the realm of analysis. The relation of the system of production to the ecological system is, thus, left outside of institutional economics. On a more fundamental level, institutional economics is conceived from the point of view of a **dichotomical conception** of the societal system on the one side and the natural environment on the other.

6. THESIS: THE DUALISM OF SYSTEM VERSUS ENVIRONMENT IS UNCOMPATIBLE WITH SUSTAINABLE DEVELOPMENT.

Theses 1 and 2 suggested that human and non-human needs and potentials rather should be conceived of as a **twofold environment** of the system of society. As implicit in the concept of SD society is, then, regarded as a 'middle' complex which mediates and regulates transactions between the human and non-human extremes of nature (Tjaden 1977).

Without this differentiation, the **tripartite** relations between man, societal system and non-human nature are reduced to **dual** relations between either

(a) **man vs. nature** as an anthropological or geo-ecological problem;

(b) **man vs. society** as a sociological or perhaps deep-ecological problem; or

(c) **society vs. nature** as a dualistic proposition with metaphysical constraints taking process results as categorical givens.

The ambiguity of (c) gives rise to **two related types of faults**:

*__FAULT A:__ Identifying a specific historical social form with the material content which it is mediating;

*__FAULT B:__ Reducing the manifold dimensions of the material content to a few formally more stringent dimensions.

Ad A. **INDUSTRIAL METABOLISM** has been defined as:

"the whole integrated collection of **physical processes** that convert raw materials and energy, plus labour, into finished products and wastes in a (more or less) steady-state condition.

The production (supply) side, by itself, is not self-**regulating**...
The system is stabilised, **at least in its decentralised competitive market form**, by balancing the supply of and demand for both products and labour through the **price** mechanism.

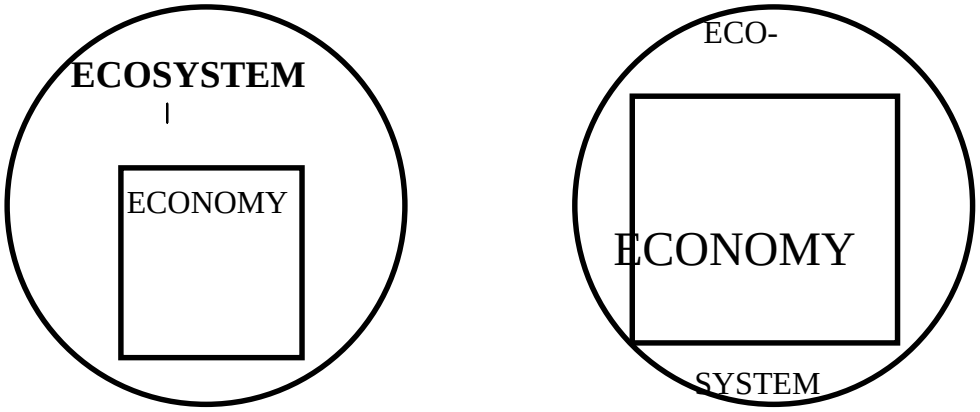
Thus, the **economic system is,** in essence, the **metabolic regulatory mechanism**."

(R.U.Ayres in: Ayres and Simonis 1994)

But is this not a way to take for granted, what should have been proved? Is a macro balance as that of metabolism really guaranteed by micro processes at market level? What about external effects and their accountability? (see above).
Ayres looks as a candidate of fault A - identifying a specific **social form** - market economy - with a general **metabolic function**.

Ad B This type of faulty reasoning is represented by Herman Daly. Also in his latest publication on "*The economics of sustainable development*" (Daly 1996) he presents two stages of development of "the world":

(1) EMPTY WORLD ***(2) FULL WORLD***



The difference between the two states of the world signifies the result of **economic growth** and the consequent approaching of the Limits to Growth as givens from the ecosystem.- Daly does not, however, say what precisely is the **common basis of reduction** for both those quantities measured as economic growth (man-made capital, as he calls it) and the qualitatively manifold components of the ecosystem (natural capital). Is it energy or entropy or what? And what is the justification of reducing the complexity of the material world, of society and nature to just these one or two dimensions? It seems, as if metaphors have replaced analysis.

A comparison with the approach of B.Commoner, introduced above, might be clarifying. Dalys approach is **systematically abstracting from** the very "**technology factor**" which Commoner has shown as being decisive for environmental problems as well as energy and economic problems - and for ways to solve them. So that rational use and/or substitution of problem technologies should be encouraged by social governance (summed up in Commoner 1990). All this is left out by Daly, leaving the field for Malthusian speculations about population dynamics as primary forces of development and an overall naturalisation of societal phenomena. **"Growth"** is, thus, a catch-all phrase instead of a theoretical concept.

At any rate, Daly does not look at the analytical articulation of SD, but only at the visionary definition of it. This would not matter, if he would not - as he does - declare that the concept of SD is only a “pre-analytic vision”. He regards SD as a useful, but vague (“dialectical”, as he takes it) concept “such as money”. - These remarks don’t really qualify Daly’s work as a contribution to the **science of complexity** which is really needed (National Science Foundation 1997).

7. THESIS: IN ORDER TO UNDERSTAND AND GUIDE COMPLEX SOCIETAL DEVELOPMENT SOCIAL SCIENCE HAS TO BE RE-INTEGRATED

A couple of years after the publication in 1867 of Karl **Marx' "Capital. Critique of Political Economy"** various new doctrines of the subjective theory of value or the "marginalist revolution" were put forward as a kind of anti-thesis. They constituted the new radicalised discipline of pure **ECONOMICS**, freeing the thinking about forms of political governance from its economic content - so that **POLITICAL SCIENCE** could emerge as a secondary justification of the "radicalised" discipline of economics.

Immanuel Wallerstein has addressed the cleavages within this core of the social sciences and in its relation to disciplines as law, history, geography and psychology:

> "We know where all these divisions of subject matter came from. They derive intellectually from the dominant **liberal ideology** of the nineteenth century which argued that state and market, **politics** and **economics**, were analytically separate (and largely self-contained) domains, each with their particular rules ('logics'). Society was adjured to keep them separate, and scholars studied them separately.
>
> Since there seemed to be many realities that were apparently neither in the domain of the market nor in that of the state, these realities were placed in a **residual** grab-bag which took on as compensation the grand name of **sociology**. There was a sense, in which sociology was thought to explain the seemingly 'irrational' phenomena that **economics** and **political science** were unable to explain.
>
> Finally, since there were people beyond the realm of the civilised world - remote, and with whom it was difficult to communicate - the study of such peoples encompassed special rules and special training, which took on the somewhat polemical name of **anthropology**."

(Wallerstein 1991, 241)

The three core nomothetic social sciences constituted themselves in isolation against each other and by a fundamental abstraction from the spatial-temporal ways of movement of their field of study, namely society. Instead, they conceived of it in eternal categories and/or by supplementing their universal truths by contingent conditions (stored in the appendices of their main texts).

But this was not sustainable in the long run.

It "is **nonsense** in terms of how the world really works. No one subjectively has three segregated motivations - economic, political, and socio-cultural. And there are no real institutions that are in fact exclusively in one arena...In short, while **economic historians** are laying claim to **replacing economics**, they should insist that the adjective 'economic' be dropped - not in order to forget economic factors but in order to insist on **holistic analysis**."

Therefore, Wallerstein concludes:

"What we need is a fundamental reorganisation of knowledge activity in the **historical social sciences** on a global scale. Economic historians have been the nearest in spirit in the past to the kind of historical social sciences we must create in the future - one in which we build our theory out of the study of reality, that is, out of history. The only reality is a constantly changing one. It is that **historical reality** which **must be theorised**."

(Wallerstein 1991, 265)

As chairman of the interdisciplinary Gulbenkian Commission on Restructuring of the Social Sciences, Wallerstein 1996 edited its report *OPEN THE SOCIAL SCIENCES*.

The Report owes much to newer tendencies within neighbouring realms of science as e.g. the theory of complex systems, which was developed by the member of the Gulbenkian Commission I. Prigogine. And it discusses the emergence of theory in the Humanities. Based upon such considerations, the report demands specific **reorientations** of the social sciences:

* For the first, the aim of freeing social analysis from **Eurocentrism** is addressed. It should be approached by historisation and by a more conscious fusion between economics, political science and sociology.

* Secondly, to enable concrete thinking, **time and space** should be incorporated in the very theoretical approaches, because one cannot usefully abstract from the "arrow" of **irreversible time** nor the fact that the spatial limits of the **territory** of the state no longer defines it as the only and privileged place for the mediation and regulation of social processes.

* Thirdly, in contrast to Max Weber's thesis of a universal tendency towards rationalisation, unavoidably leading to the "disenchantment" of the world, the Commission is in favour of a more complex understanding of the relation between man and nature and does not exclude a **"re-enchantment of the world"**. Computer simulations could be used in order to grasp complexity instead of continuing only to reduce it.

8. THESIS: SOCIAL SCIENCE CAN HELP TO ESTABLISH WAYS OF HARMONIOUS DEVELOPMENT, BUT HAS ITSELF NO BLUEPRINT FOR SURVIVAL

One might hope that the social sciences will be re-integrated in a family of historical and geographical sciences that address the concept of society **as concrete spatio-temporal complexes** (Czeskleba-Dupont 1999). In this way, a theory of society might emerge as a collective effort at mind-mapping landscapes of **possible progress**.

This should not, however, be (mis-)understood as expert scientists having a blueprint for survival, because they - and only they - know the conditions for development as automatic progress (Wallerstein 1999). There are no "one way"-solutions for the problems of SD, as the technocratic argument otherwise is saying. There is **no prestabilized, mechanistic harmony** regarding long-term questions of societal metabolism, as "time-less" equilibrium-assumptions suggested in market orthodoxy as well as in linear programming adopted and developed in centrally planned economies (Freeman and Carchedi 1996).

The science of complexity can also in its social scientific versions only point at **possible ways of progress** by material self-organisation based upon the activity of consciously acting subjects. It can help to strengthen democratic decision-making by screening information critically in the light of existing knowledge and by consolidating it in **scenarios** to be decided upon collectively - that is to say, at places of work and living and in wider institutions of social governance.

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