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CAUSER RELATED ENVIRONMENTAL INDICATORS
A Contribution to the Environmental Satellite-System of the Austrian SNA

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Introduction

The Ministry for Environmental Policy has asked our institutes among others to produce a system of environmental indicators for the physical part of the planned Austrian satellite-system.[1] The aim is to devise a consistent set of causer-related indicators to be connected to economic data by means of input-output analysis. The resultant indicators should enable the detection of the negative effects of economic activity.

Three basic considerations had to be taken into account. First, for the sake of practicability, such a set of indicators should be based on data available, or at least on data that could be made available within the next years. The availability of causer-related environmental data in Austria is very limited due to restrictive data-protection legislation (also in comparison to the international standard) and moreover due to the typical Austrian tradition of secrecy-mindedness of private companies and official authorities. With respect to this we regard a "green GNP" as an important contribution to providing the public with better information on the state of the environment.[2]

Secondly, the set of indicators suggested should be able to find wide acceptance both with economists and with ecological scientists resp. environmentally interested experts. Bur for the sake of its medium term applicability it should not just represent the "minimal consensus" between the concerned parties but be open for future developments.

Thirdly, these environmental indicators should be technically compatible to the design of the SNA.

The following tasks are a key preliminary step for setting up the physical part of a satellite-system:

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[1]) Franz A., Grundzüge einer ökologischen Gesamtrechnung für Österreich, in: Österreichs Volkseinkommen 1987, Wien 1988 and Franz A., Ein Bearbeitungsraster für die Ökologische Gesamtrechnung in der VGR, in: Österreichs Volkseinkommen 1988, Wien 1989

[2]) Interuniversitäres Forschungsinstitut für Fenstudien / Österreichisches Ökologie-Institut (Hg.), Umwelt und Öffentlichkeit, Wien 1989; Fischer-Kowalski M. / Kisser M. / Payer H. / Steurer A., Verursacher von Umweltbelastungen, Wien 1990; Fischer-Kowalski M. / Lackner Ch., Amtliche Umweltberichterstattung in Österreich, Wien 1990

- Screening and description of available emission-data in Austria, separated into proper causer-categories (branches of production etc.) and by environmental media in consistent systematics;

- Description and criticism of the quality of the available data (methodological, conceptual and also concerning their ecological relevance) and derived proposals for their improvement with reference to international experience;

- Discussion of the systematics developed and the methodological diagnosis of data quality and availability in an appropriate interdisciplinary public

- Devising a draft for application of a dynamic economic-ecological input-output analysis model

The first three tasks have been achieved within our project, however preliminary, so far. An attempt at the fourth task is taken by R.Dell'mour, P.Fleissner, W.Hofkirchner, A.Steurer, A model for the linkage between economy and environment (see their paper to this meeting).

The main aim of the current international efforts in developing a green GNP in whatever form possible, is to raise the awareness of the social system of its activities at the expense of the environment. It should be understood that awareness about the harm we are doing to nature is only a first step on the way to comprehensive information. It does not give information on lost values or possible backlashes to the social system. The resultant indicators should represent an instrument for social self-observation rather than an instrument for observation of nature by man. If policymakers and public opinion take note of the damages already done and persist in the usual way of production, disaster will be the result. Up to now a large amount of information systems has been established all over the world to provide broad databases concerning complex correlations inside the socio-economic system. Comparing to the quality of those systems a lot of work will have to be done for the establisment of comparably complex environmental information systems.

The evaluation of environmental damage and depleted natural ressources is not only a matter of ideology or casually chosen theories, but depends greatly on the quality of available information on environmental effects caused by human beings. In accordance with the so-called "Verursacherprinzip" high expectations are placed in the possibility of relating certain changes in environmental quality in a direct and continuous mode to the responsible causers. In any case an **institutional** distinction is to be preferred to a **functional** distinction (agriculture, industry, traffic, services, residents) for an official executable classification of damage-causing activities.

Otherwise the link between environmental indicators with economic input-output-matrices has to be given up, which means the loss of the possibility to establish comprehensive connections between different causers and as a result the representation of the intermediate inputs from one branch of production to another and their connected environmental effects.

Eventually, very interesting information can be expected by integrating environmental indicators into input-output analysis models, which will be useful for estimating future courses of economic development and their possible influence on the state of the environment. Such models should be able to give answers, for example on the extent of future emissions of heavy metals into waters in relation to annual growth or decline of the Austrian metallurgical industry and what changes will occur resulting from technological progress. A database like this is to be regarded as an important measure for influencing environmental policy more effectively than in the past.

Our project is focussed on the search and application of emission-related data in Austria and on the application of a strict relation to specific causer-groups. We collect data on emissions, concentrations of toxic materials, disappearances of plant and animal species and some other risks to the quality of life in general in order to examine their usefulness for environmental reporting systems (e.g. satellite-systems) and to gain a response to the feasibility of our indicators. But we are not engaged in the examination of data which is related to immissions or the state and change of natural ressources, the influence of economic activity on the self-regulating capacity of eco-systems, the monetary evaluation of damages done to eco-systems or damages prevented or even the description of eventual backlashes from the burdened environment to the economic system.

Proposed causer-related indicators

Which kind of processes and effects should be regarded as stressors and which economic activities should be regarded as the causing ones is a point of great dispute. Anyway, the discussion is not concerned with simple arguments of cause and effect, and it is worth taking a look at the most important approaches referring to this question.

Since the general start of the environmental debate during the 1970s the definition of environmental damages was dominated by toxicological aspects. Following the traditional chemical approach scientists and policymakers tend to regard only those things which directly harm human health as an environmental damage. That approach only results in ever-growing lists of toxic agents.

A more recent approach is the concept of "sustainable development", which has found widespread acceptance by the report of the World Commission on Environment and Development "Our Common Future" (called the Brundtlandt-Report) in 1987. In contrast to the first studies on the limits to economic growth in the early 1970s, the challenge of the 1990s seems to affirm a certain level of economic growth, but to redefine the structures of growth. The propagated concept of "sustainable development" is still under discussion, but the general consensus is the necessity of ensuring long term survival by providing the necessities of both present and future generations. But there is no consensus on how to manage sustainabilitiy in real economic policy. The concept still moves on a highly abstract level. In the current sense it is strictly related to human utility of nature, but not to the necessities of nature itself. Although sustainable development advocates a qualitative manner of economic growth, it does not really call into question a possible basic contradiction between economic growth and preservation of the natural basis.[3]

Another approach with an older scientific tradition is derived from the entropy-law. Its proponents suggest restructuring economic production according to the physical laws of thermo-dynamics. The entropy-law figures that energy and other materials are not used up in the physical sense, but that a devaluation of energy is taking place, that is to say consumption of synergy or deterioration of quality or utility respectively. The focus of attention is on the aspect of efficiency of the economic system in providing human necessities with a minimalized production of entropy. Sometimes the approach tends to go together with neo-classical reflections on the efficiency of perfect competition and general equilibrium in economic markets. To sum up the entropy-approach surely helps in some aspects to define environmental stressors, but a lot of other aspects (e.g. toxicology) cannot be taken into account.[4]

The last group of approaches to be considered is strongly influenced by sociological, ethical and biological thinking. Among economists they are not as well known, but have tended to gain more attention during the last few years. The common ground of these approaches is their engagement in rejecting the narrow framework of utility-guided calculation of human activities towards nature. The theoretical model of "homo oeconomicus" is dropped completely. The various arguments include criticism of human arrogance towards the rest of the world, call upon more solidarity and respect in the way of dealing with living things, and the analogy of violence towards nature with violence towards man. Between the antipodes of crude anthropocentrism and naturalistic submission to nature another conceptual framework has to be

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[3]) Simonis U.E., Beyond Growth - Elements of Sustainable Development, Bonn 1990; Fischer-Kowalski M. / Haberl H. / Payer H. / Steurer A. / Vymazal R., Verursacherorientierte Umweltinformationen, Wien 1991, p.141pp

[4]) Fischer-Kowalski M. / Haberl H. / Payer H. / Steurer A. / Vymazal R., Verursacherorientierte Umweltinformationen, Wien 1991, p.146pp

applied in order to describe the mentioned processes. It seems to be successful to model it among others on Ivan Illich's works to "conviviality"[5] and conceptions of "empathy for the suffering nature".[6] Some interesting conclusions can be drawn from these approaches for the benefit of researching for stress-indicators, especially for indicators to the broad field of "purposeful interventions into life processes", which will be explained in more detail below.

In view of the diversity and inconsistence of the various approaches we have chosen a more eclectic method by trying to supply those environmental indicators which form an important part of at least one of the mentioned approaches. Thus it should be guaranteed that no essential aspect of the complex meaning of "environmental damage" will be neglected. If you only concentrate on highly consensual indicators otherwise, you could build up a very short list immediately. That list however would not pass a test of ecological reliability and would probably have to be altered after a very short time.

The complete set of causer-related indicators to be connected to the economic data can be distinguished in three subsets:

- a subset of economic-ecological system indicators, such as energy-intensity, transport-intensity, intensity of packaging etc.,
- a subset for emissions (air, water, solid waste, energetic) and
- a subset for what we call "purposeful interventions into life processes" including structural interventions into biotopes, violence towards animals and genetic manipulation.

Economic-ecological system indicators

The idea behind the concept of "economic-ecological system indicators"[7] comes fairly close to the idea of economic efficiency. We try to derive from economy-related data those best able to represent environmental "wastefulness" ("Vergeudung"). Basically we seek for the relationships between material inputs and the resulting

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[5]) Illich Ivan, Selbstbegrenzung - Tools for conviviality, Reinbek b. Hamburg 1986

[6]) more detailed see Miller A., Am Anfang war Erziehung, Frankfurt, 1980; Böhme Gernot, Das Tier in der Moral, in: Merkur 505, 1991

[7]) Fischer-Kowalski M. / Haberl H. / Payer H. / Steurer A. / Vymazal R., Verursacherorientierte Umweltinformationen, Wien 1991, p.164pp

services for human needs.

Such data is mainly mass-data about input or production, for example energy-consumption, steel or cement production and also areas used for different purposes, waste produced and so on. This data, separated into branches are divided by turnover, value added and number of employees. In that way we get specific intensities of every branch.

In short, the intensities are (always per unit of turnover and value added, or per employee):

Energy-intensity: net-energy used, summed up or disaggregated by groups of energy-sources (fossile, renewable, solar etc.)[8]

Transport-intensity: ton-kilometers and person-kilometers consumed, summed up or disaggregated by type of vehicle used (car, tram, bus, rail, truck etc.)[9]

Matter-intensity: net-tons-of-matter used (inputs minus products), summed up or disaggregated by class of material. The concept of matter-intensity is similar to the concept of unit-value.

Packaging-intensity: a special version of matter-intensity

Area-intensity: square-meters occupied, summed up or disaggregated by type of use

Risk-intensity: insurance premiums paid for certain purposes (not as yet developed).

The purpose of such a matrix (say, 40 branches x 30 indicators and sub-indicators) is to measure relative environmental performance of each branch. Sets of pollution are loosely interlinked with these intensities, so from these data we can at least derive trends in environmental performance.

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[8]) see OECD, The state of the environment, Paris 1991, p.54f; OECD, Environmental indicators - a preliminary set, Paris 1991, p.225

[9]) see OECD, Statistical Trends in Transport, Paris 1990

Emissions

Reporting on emissions in the narrow sense is the most established field of causer-related environmental data. Historically seen, emission-reporting is closely connected to that toxicological model mentioned above. During the last few years it has gained a new dimension from the discussion about future climate change.

Emissions are defined as the transmission of toxic and hazardous materials or energy across the systemic lines between society and nature. Emissions are not directly intended effects more or less useful for man. They are always unintentional processes or unavoidable side effects of economic activities. Figuratively speaking, a power plant is not built to emit sulphur dioxide, nitrogen oxides or other air pollutants, but to supply electricity. The simultaneous output of any emissions is like an unpleasant accident. The problem can be solved in a rather simple way by add-on-technologies. Emissions are furthermore defined by their non-utility for economic production. Toxic and hazardous concentrations in goods (e.g. cadmium in toys or residues of pesticides in foods) or in recycled substances (e.g. filter sludges or sulphate alkali) are not handled as emissions.

The subset for emissions is classified by their aggregate state (gaseous, liquid, solid or energetic) at the moment of leaving the economic system. The chosen classification seems to be the best solution to the enormous statistical problem of double-counting. Within the complete systematics of causer-related indicators the emissions are always regarded as net-emissions in order to relate them as far as possible to the factories or branches respectively which actually emit, regardless of whether the released pollutants are disposed of directly into "nature" or waste-processing industries. Otherwise the accounting system will achieve the hugely distorted result of those branches which dispose of the emissions of the others becoming the largest emittents themselves.

Purposeful interventions into life processes

In contrast to emissions as unintentional side-effects of economic production, the so-called purposeful interventions into life processes are just made in favor of a particular social use. Roads for example, are primarily built to overcome natural barriers to mobility. The loss of land, soil, vegetation and wild life is the unavoidable prerequisite of going by car from one point to another. Also most of the environmental effects of agriculture are constituent processes to make use of a regulated nature.

The subset of purposeful interventions into life processes should include the following groups of indicators:

- structural interventions into biotopes,
- violence towards animals and
- genetic manipulation.

It is important to view structural interventions into biotopes from the traditional standpoint of nature conservation, although their relation to identified causers is not strongly stressed within that tradition. Structural interventions could be divided into processes of violent separation or violent concentration of living things and rapid long-distance transportation which destroys the adaptability of eco-systems to new structures.

Violence towards animals is considered as a subject more relating to direct violence than to structural violence. It subsumes the well-known matters of prevention of cruelty to animals.

The consideration of genetic manipulation as a theoretical basis for the resultant construction of environmental indicators is surely the most underdeveloped section in this consensus. But it may contain risks characteristic of increasingly important economic developments (whereas the importance of "emissions" in the more traditional sense may be shrinking).[10]

With this subset of indicators we are having a lot of interesting discussion. Economists tend not to understand what this has to do with their notion of sustainability and nature protectionists tend to view the problem solely from the perspective of nature being destructed, but have no tradition in relating this to specific economic activities. So we have trouble both in the public acceptance of the usefulness of such indicators and in their methodical and empirical construction. But we feel it is very important not just to handle these issues as "ethical problems", but to connect them to defined economic activities and to link them into such an influential system of social reporting such as SNA.

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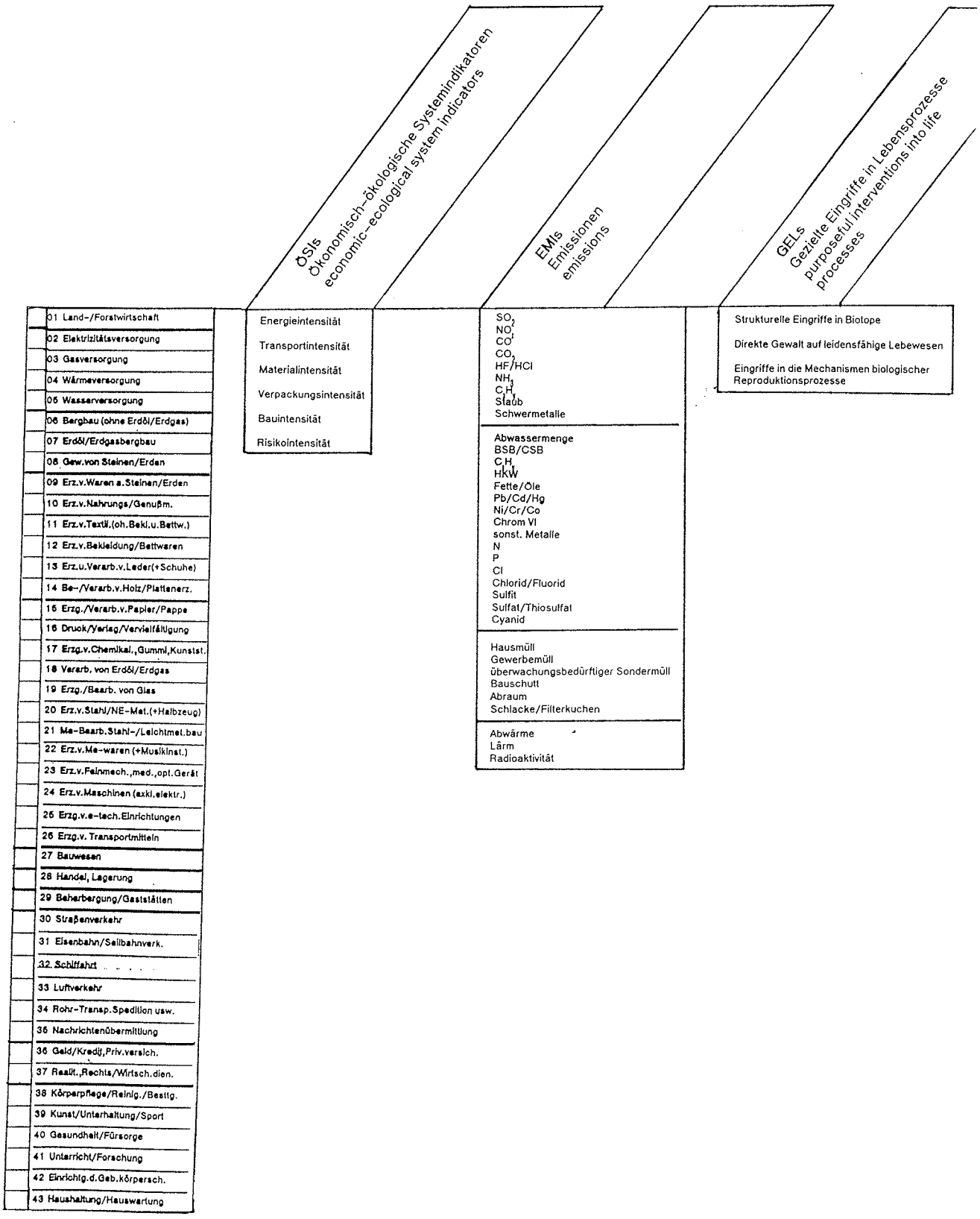
[10]) see Moscovici S., Versuch einer menschlichen Geschichte der Natur, Frankfurt 1990

Matrix :

Branches of Production vs. Environmental Indicators



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