Environmental Communication

Systems Analysis of Environmentally Related Information Flows as a Basis for the Popularization of the Framework for Sustainable Development

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Abstract

Umweltkommunikation wird meist mit Umweltbildung, Politik, Umweltinformatik, Beteiligung der Öffentlichkeit und Umweltberatung in Verbindung gebracht. Abweichend davon wird in der vorliegenden Arbeit als „Environmental Communication“ umfassend jede Übertragung umweltrelevanter Informationen angesehen.

Zur Analyse umweltbezogener Kommunikationspfade wird ein Systemmodell vorgestellt, in dem Informationsflüsse zwischen der natürlichen Umwelt, der Forschung, der Wirtschaft und der Gesellschaft strukturiert werden. In dem Modell werden die Systemverbindungen durch Umweltkommunikation hergestellt.

Mit Beispielen, vor allem aus dem Gebiet der digitalen Umweltkommunikation, wird versucht, einen Überblick über den Austausch von Umweltinformation zu geben. Schließlich erfolgt ein Appell zur Popularisierung von Umweltinformation durch kommunikative Prozesse, im Hinblick auf die Schaffung von Umweltwissen und Entscheidungskompetenz in unserer Gesellschaft.

1 Introduction and Definitions

Environmental Communication can be seen as a link process between sources and the recipients of environmental information. In different disciplines there exist various views of “Communication”. From a technical point of view it is the sender-receiver activity through a communication channel. From a historical sociological perspective it is the answer to the question “Who says what to whom through which channel with which effect?” (Lasswell 1948), while marketing defines the communication process primarily as a tool for sales promotion.

The term “Environment” is also used in quite different ways. In general it “is a concept which includes all aspects of the surrounding of humanity, affecting individuals and social groupings” (Gilpin 1996). On a scientific level several aspects

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are defined in the *Umweltgutachten* (1987 and 1996) e.g. “the relationship of living organisms (man, animals, plants) to their surroundings”. The concept of environmental data was discussed and defined in the working group on Environmental Databases of the TC 4.6.1, Computer Science for Environmental Protection, and was published within this series of symposia (Kremers et al. 1990). Fundamental goals of Environmental Informatics were analysed in Friedrich, Page and Rolf (1993).

Environmental Communication (EC) is usually connected with environmental education, public participation and environmental politics. More generally, EC is the communication of environmental data and information between various audiences using different media. Such communication is the foundation for establishing relationships between people and the environment and a means for enhancing environmental literacy and sustainable environmental practices (Environmental Communication Resource Center 2000).

In this paper **Environmental Communication** is defined as any kind of environmentally relevant information flow which involves both communicators and audiences and is achieved through coding, effective message delivery and interactive listening. Types of information flows are, for example, face to face communication, public discussion, debate and mediation, publications, mass media communication, marketing of environment-related information and digital communication through the Web. Environmentally relevant information is considered to be all information related to environmental media (air, climate, water and soil) and to sources of environmental impacts (solid/liquid waste, transport, climate, genetic resources, hazardous substances, nuclear radiation etc.). An attempt to define *digital environmental communication* was made by M. Jelitto: “Digital environmental communication means the use of digital media in the field of environmental communication.” [www.marcjelitto.de/definiti.htm].

Environmental communication is closely connected with sustainable development (SD), which can only be successful if it is based on sufficient, reliable and comparable information, indicators, free access to information and unhindered information flows. A collection of 57 definitions of SD can be found at www.sustainableliving.org/appen-a.htm.

2 Access to Environmental Information

The amount of environmental information available in Europe has increased considerably in recent years. Free access to such environmental information and data was a long-desired aim of the public, dating back to the United Nations Conference on the Human Environment in Stockholm in 1972 and before. It took almost a decade before these ideas were translated into legislation such as Council Directive 90/313/EEC (freedom of access to information on the environment). A further step

with a broader approach was introduced with the *5th Action Programme* of the European Communities and the implementation of the *Rio Declaration on Environment and Development* (Earth Summit '92), including Agenda 21, Chapter 40 and others (Zirm, Pillmann 1996).

A new approach was established in the Convention concerning access to environmental information and public participation in environmental management at the Ministerial Conference in Århus, Denmark, on 23-25 June 1998, including public participation in decision making and access to justice in environmental matters. In the Meetings of the Signatories, there was a decision to further the implementation of the Århus Convention through the use of electronic tools and media, for public assistance, education, awareness building, collection and dissemination of environmental information etc (Committee on Environmental Policy, 2nd meeting Dubrovnik, 3-5 July, 2000).

Several systems are available now in administration, industry and research for the distribution of environmental information. Recently a large number of telematics services have been established, e.g. for measurement purposes, preservation of nature, resource management, awareness building and also link lists (see a list of good practice cases in the paper Mudri, Pillmann in this volume).

3 Availability of Environmental Information on the Net

Several support systems are available as a consequence of the various international activities and in order to give the public access to environmental data. These are in general, search engines (Yahoo, AltaVista et al.), metasearch support e.g. Metacrawler [www.metacrawler.com/], MetaGer [meta.rrzn.uni-hannover.de/] for German language servers and specific environmental data centres on the Web with links from environmental agencies, non-governmental organizations (NGOs) and to specific environmentally related information.

Examples of some environmentally relevant Web addresses are given at the end of this paper. They were treated as though they were literature, but it should be clear that there are fundamental differences. Websites are not stable information sources. They were developed to be temporarily available and only under favourable conditions are they maintained over a longer period. On the other hand, worldwide access to manifold different topics at low cost is a valuable addition which supplements other information resources.

Within the 4th Framework Programme, the European Commission started to support the development of telematics applications. DG XIII in particular entrusts several consortia with elaborating environmental telematics programs. The proceedings volume of the Determine (1998) Conference (Dissemination of Environmental and Transport Telematics Results) gives a view of applications in this field.

An important increase in access to environmental information is directly related to the diffusion of the World Wide Web in all areas of life and the implementation of links on Websites. Activities by the European Environment Agency (EEA) related to Web presence, the further development of the Catalogue of Data Sources (CDS) meta-information system and the Environmental Information and Observation Network (EIONET) developed between European countries and the EEA are described in Bjarnason (1999). Digital Library Systems can also be implemented using meta-information systems (Hicks, Tochtermann, 1998).

4 Modelling Information Flows

4.1 Information Classification/Organization

Early versions of a concept integrating environmental stress and human responses date back to the 50s. A more general model originates in work pioneered by T. Friend and D. Rapport of Statistics Canada (1979, 1989) aimed at organizing environmental statistics. The further development of this framework, having been embraced by UNCSD, the World Bank, OECD and others, is called the "pressure-state-response" (PSR) framework. The PSR model considers that human activities exert pressures on the environment and affect the state of the environment with its quality and quantity of natural resources. Society responds to these changes through sectoral policies, legislation, technology and their implementation.

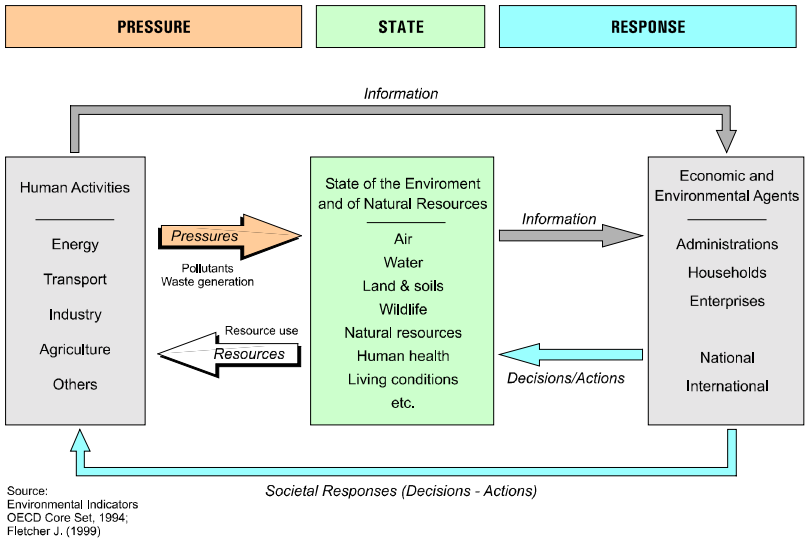

Fig. 1: Graphic representation of the Environmental Indicators OECD Core Set
Fletcher J., Linster M. [euroconfql.arcs.ac.at/Keynote_lectures.html]

Depending on the purpose for which the PSR model is to be used, it can easily be adjusted for greater detail or for specific features. Examples are the Driving force-State-Response model used by the UNCSD in its work on sustainable development indicators, the framework used for OECD sectoral indicators and the Driving force-Pressure-State-Response (DPSIR) model used by the European Environment Agency (Fletcher, Linster 1999).

The PSR model and its extensions are one, if not the dominant conceptual models for sustainable development at the moment (www.sustainableliving. org/appen-e.htm). After long debates between scientists and indicator experts, the DPSIR model has been adopted as the most appropriate way to structure environmental information by most Member States of the European Union and by international organizations dealing with environmental information

4.2 System Modelling

Since the early 1970s models have been used to describe complex systems in nearly all scientific fields. Application of the so-called "System Dynamics" for environmental studies is closely connected with names like N. Wiener, J.W. Forrester, E. Pestel, D.L. & D.H. Meadows, H. Bossel, F. Vester and M. Mesarovic. A survey of the economic/ecological model was given by Fleissner et al. (1993); extensions to the fields of sociology can be found e.g. in Luhmann (1987, 1990).

4.3 Dynamics of Sustainable Development

To analyse the various types of environmental communication, a systems diagram is used. In this model main processes are characterized with (dynamic) Multi-Input/Multi-Output systems, similar to the representation in control theory. The main processes are: the environment, the economy, organizational structures and society (households), coupled through communication structures (Fig. 2). In this model the economic/societal environment (industry, households) is artificially separated from the environmental system to illustrate the effects of production, consumption and resource depletion – the pressures – on the natural environment.

The lines within the diagram show the origin, the transfer and/or the exchange of environmentally relevant information, which can be characterized by a set of basic dimensions. These dimensions are

1. the field of interest/application area (natural/built environment, economic activity, society relevant data, regional structure, material balances, resource conservation, legislation etc.)
2. the spatial dimension (coordinates of point sources, local areas, regions, river basins, states, continents etc.)
3. the temporal dimension (time, date, observation interval, time series etc.)

4. the representation of information (written material, formulation of political demands and objectives from decision makers, teaching, personal communication, digital information: databases, images, multimedia material, Websites; etc.)
5. the sender and receiver of information (scientists, environmental agencies, governments, NGOs, companies, consumer protection agencies, environmentally concerned citizens etc.)

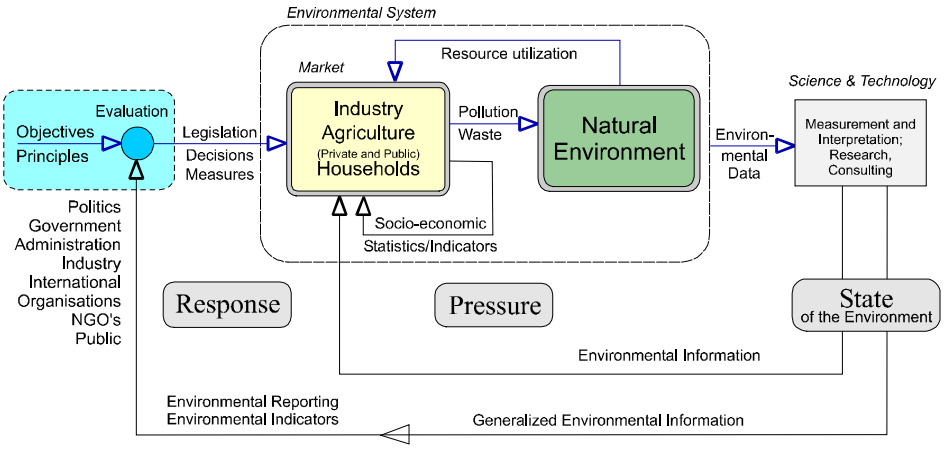

Fig. 2:
Systems diagram for Environmental Communication
with links representing (complex) information flows in various forms

The figure above illustrates the dynamics of activities for environmental protection or for sustainable development in general. The system structure shows a multiple control loop. Environmentally related goals (e.g. pollution reduction, national environmental action plans, Agenda 21, Eco Management and Auditing Scheme - EMAS) influence politics, governments, administrations and enterprises. Through legislation and measures (taxes, promotion of environmental friendly technologies, information, research) the impact on industry and the public as well can lead to positive effects on the environment such as noise/pollution abatement, nutrient reduction in waters, waste avoidance, conservation of biodiversity etc.). This system produces the desired results if it incorporates free and efficient exchange between information providers and the persons/organizations/media/public affected.

4.4 Communication Processes

Environmental communication is the connection between the elements of the system in Fig. 2. A segment of the communication structure, describing the transition from sources of environmental data to information recipients, is depicted in Fig. 3. Data from measurement systems (air/water pollution, meteorology etc.), environmental statistics, publications, remote sensing and mapping, eco-auditing, product information, programmes from governments and political parties, further environmental education (Bosler 1997) etc. are partially organized in information systems. Results were used in research consultation, trials/hearings, licensing procedures, epidemiology and many other fields. Access to these immense fields of specific information can be facilitated through meta-information e.g. the Catalogue of Data Sources (CDS) [www.mu.niedersachsen.de/cds] or national metadata catalogues (Legat 2000).

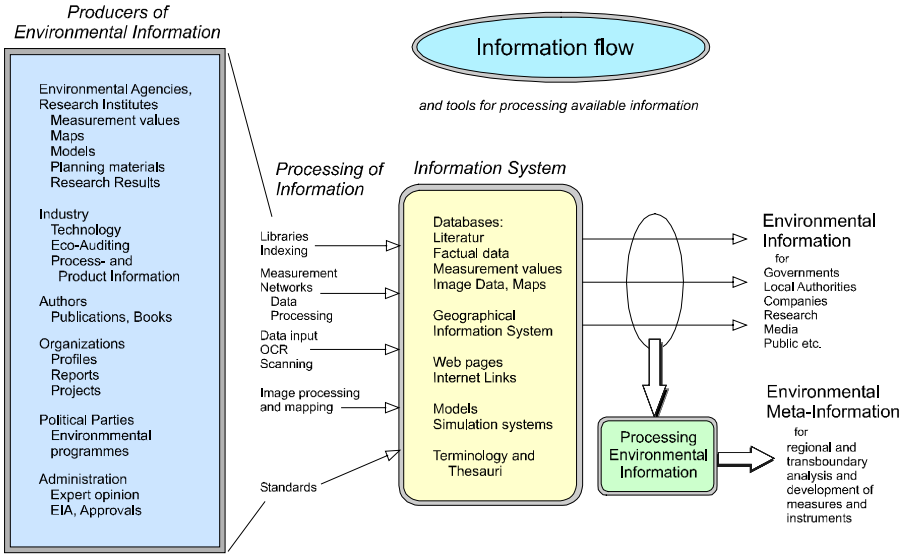

Fig. 3:
Communication segment with sources of environmental information and information system output

5 Application of Environmental Communication

In this section some examples are presented from the viewpoint of applications relevant to environmentally related communication (EC) and the prospective use of information. Earlier systems are described in Pillmann (1995, 1993).

Application fields

Driving forces for **Industrial Environmental Communication** are e.g. pollution limits, increasing costs of energy and waste disposal, downstream investments and image building (Hopfenbeck 1994). In addition the Eco Management and Auditing Scheme **EMAS** and the **ISO 14000** standards series (Environmental Management Systems) stimulate the development of environmental management in enterprises. Examples of new policies and environmental communication in the *Organisation for Economic Cooperation and Development* (OECD) and in companies can be seen in The Sustainable Development Agenda (2000). In-plant environmental information systems (**BUIS**) are discussed in the workshop series of TC 4.6.2. Definitions and benefits of BUIS can be found in Schlatter (2000). Environmental management has also made its way into business administration textbooks (Hopfenbeck 1993).

The United Nations Environment Programme **Unep/Infoterra** is an information exchange network. It focuses on policy, legal, institutional, operational and technological aspects of environmental information access in 177 countries. It facilitates information access by reducing bureaucratic, linguistic and technological barriers in the sense of the-right-to-know principle (Pillmann 1999).

The UN Conference on Environment and Development UNCED (Rio de Janeiro, Brazil 1992) designated the *United Nations' Commission on Sustainable Development* (UNCSD) to coordinate the implementation of its decisions, particularly ***Agenda 21***. The tasks include not only the conservation and management of resources but also social, economic factors and implementation strategies (The Sustainable Development Agenda 2000).

A multilingual environmental terminology and glossaries are the foundation of international expert communication. Examples of such resources are the German Language **Thesaurus des Umweltdatenkatalogs** which has some 8,500 descriptors and 16,000 synonyms [www.isep.at/projects/thes_profile.htm] and the *General Multilingual Environmental Thesaurus* **GEMET** with 6,500 controlled terms (keywords) in 10 languages [org.eea.eu.int/documents/pressreleases/ gemet.shtml].

An example of an environmental information system (Umweltinformationssystem) is the **UIS Baden-Württemberg**. A detailed framework is given by Mayer-Föll (1993). This system serves in some respects as a model for similar regional/countrywide information systems.

The EEA, together with the European Topic Center on Catalogue of Data Sources, established the ***Directory of Information Resources*** (DIR) [http://www.mu.niedersachsen.de/system/cds]. This is a catalogue of environmental locators, pointing to environmental information sources in Europe [www.mu.niedersachsen.de/cds/etc-cds_neu/newslett8.html]. DIR covers subjects like the **EIONET** the Environmental Information and Observation Network, **SERIS**: a list of national 'State of the Environment' reports and EEA publications.

The EEA ***Sustainability Targets And Reference Value*** **Database** (STAR) is An

Inventory of European Policy Environment Targets and Sustainability Reference Values (1998) which apply in the EU and in a range of countries in the European Free Trade Association (EFTA), in Central and Eastern Europe (CEE), and in the Newly Independent States (NIS) [star.eea.eu.int/asp/default.asp]. It covers 14 main environmental themes and is structured on the basis of the DPSIR model (chapter 4.1).

Another important field is the development of **Environmental Indicators and Indices**. Several organizations like OECD, EEA (Environmental Signals 2000), EUROSTAT, UNCSD, WWF continuously develop concepts and retrieve data. A wealth of detail can be found on the Web, using full text search machines.

A very new application on the Web is **GEIN**, the *German Environmental Information Network* (Bilo, Streuff 2000). GEIN consolidates information currently distributed across many different Websites run by public institutions in Germany. It thus acts as an information broker for environmental information, joining together 48 suppliers of environmental information on more than 50,000 Web pages [www.g2k.de/index_en.html].

The important research project support institution, **Deutsche Bundesstiftung Umwelt,** in 1998 started the field of "Umweltkommunikation", integrating environmental education, information and consultation (Jahresbericht 1998).

Finally, an example of **mediation system research** can be found in [set.gmd.de/MS/]. It is a networked computer system supporting deliberation processes, where argumentation and negotiation are used to decide practical planning and design issues in the "Informed Sustainability" application domain [Cristaller, ais.gmd.de/en/ais.html].

Target Groups

In Tab. 1 an overview is given of target groups, generally mistakenly called users. They are involved in communication processes relevant to environmental protection measures but are often not active users. For each "user" group the demand for environmental information and selected examples are listed.

6 Towards a new environmental communication initiative

In the 2nd half of the past century an extraordinary increase in findings occurred in environmental science. The knowledge of external effects on the environment from production and lifestyles produced only weak signals for the development of a comprehensive world draft for technology and economy (Weizsäcker 1992). The 'environmental crisis' is an important challenge to find a way towards sustainability (also Weizsäcker 1995; Schmidt-Bleek 1994, Radermacher WWW reference).

There is a gap between production of environmental information, the use of environmental information and efficient measures with positive effects on the environment. This can be overcome by intensifying communication between all

audiences on environmental matters. This is at the same time an opportunity to support the "European Way to a global sustainable Information Society" [www.ispo.cec.be/policy/isf/i_documents.html].

Persons/Organizations; branches/fields	***Demand for environmental information***	***Examples of needed or wanted information***
Administration; Environment; Nature conservation; Land use; Agriculture, Forestry; Fisheries; Energy; Statistics	Environmental protection standards; Air/water/soil pollution; reporting obligations; Taxes; fees (pollution discharge permits)	Environmental data; emissions concentration of pollutants (SO_2, NO_x, PM, O_3, etc.) waste/waste water quantities; metadata
Politicians	Legal responsibility; policy instruments	Aggregated environmental information; indicators
International bodies	Global warming, ozone depletion	Greenhouse gas emissions (CO_2, N_2O, etc.);
Citizens	Clean air; drinking/bathing water quality; "well being"	Healthy environment (Environment Germany 2000)
"Green" interest groups; NGOs	Nature conservation	All aspects of environmental information
Research institutes, scientists, consultants	Environmental research; Eco-Audit (EMAS, ISO 14000)	Environmental data and information in general
Health administration Doctors	Public health; Environmental health impact assessment; epidemiology	Population at risk: (respiratory diseases, cancer etc.)
Companies, Industry - *technical aspects*	cleaner production; waste reduction; purification	Recycling; best available treatment
- *legal aspects*	Emission standards permits; legal liability (products etc.)	Legislation: national/EU; environmental standards
- *economic aspects*	Planning; investment strategies; emission trading; market-like incentives	Environmental data for cost benefit analysis; financing mechanism etc.
- *environmental effects*	Image building; occupational health and safety, EMAS	Health report; compliance monitoring
Tourism	Nature reserves; Eco-friendly sites; image campaigns	National parks; cultural heritage
Market	Green marketing	understandable information
Computer experts	Improve access to information; visualization	All kinds of environmental data and images
Insurance companies	Risk assessment	Risk/disaster data

Tab. 1: Target groups for environmental information and their various demands

In the European Environment Agency *Expert Corner Report* A New Model of Environmental Communication for Europe from Consumption to use of Information (1998) the *Centre d'Estudis d'Informació Ambiental* (Barcelona) proposed changes in the current environmental communication model, so that information becomes a resource for promoting environmental knowledge and creating decision-making competence, leading towards sustainability. As a conclusion, new efforts should be directed towards the creation of communication structures which are underdeveloped (Strategien der Popularisierung des Leitbildes Nachhaltige Entwicklung 1999). Further investigation of details in the model presented can help to make best use of the work which has been done until now in research and computer applications for environmental protection.

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7.2 **Environmental Information on the Web** (examples: http://)

Agenda 21 and other UNCED agreements	www.igc.apc.org/habitat/agenda21/
Århus Convention	www.mem.dk/aarhus-conference/issues/public-participation/ppartikler.htm
Best Environmental Directories	www.ulb.ac.be/ceese/meta/cdscom.htm
Catalogue of Data Sources: WebCDS	www.mu.niedersachsen.de/system/cds/
Catalogue of Data Sources Austria (Umweltdatenkatalog)	www.ubavie.gv.at/umweltregister/udk/toc.htm
Central European Environment Data Request Facility - Cedar	www.cedar.at
Commission of Sustainable Development	www.un.org/esa/sustdev/csd.htm
Determine Conference Papers	www.rec.org/rec/programs/telematics/determine/default.shtml
Deutsche Bundesstiftung Umwelt	www.dbu.de/

Environment DG (former DG XI)	europa.eu.int/comm/dg11/index_en.htm
Environmental Communication Resource Center; School of Communication	www.nau.edu/~soc-p/ecrc/
Environmental Information on CD-Rom	service.eea.eu.int/envirowindows/cd-rom/ti-index.htm
Environment Protection Agency Austria	www.ubavie.gv.at/
Environmental Action Plan Task Force	www.oecd.org/env/
Environmental Links	www.bmu.de/links/index.htm
European Environment Agency EEA	www.eea.eu.int/
GEIN German Environm. Inform. Network	www.g2k.de/
GRID Arendahl	www.grida.no/baltic/
Information Society DG (former DG XIII)	europa.eu.int/comm/dgs/information_society/index_en.htm
Institut für Umweltkommunikation	www.uni-lueneburg.de/infu/
OECD's inform. on sustainable development	www.oecd.org/subject/sustdev/