ENVIRONMENTAL ACCOUNTING

SUSTAINABLE DEVELOPMENT INDICATORS

25 - 27 September 2005, Prague

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Abstracts

Introduction

Dear reader,

The book you have before you is a compilation of the Abstracts of the papers that will be presented at the international conference "**Environmental Accounting – Sustainable Development Indicators,**" organised by Jan Evangelista Purkyně University and Charles University in Prague on 25 - 27 September 2005.

This book includes the abstracts of the 3 keynote speeches and the 48 papers that will be presented in working groups during the conference under the following four themes:
1. Environmental expenditures and transactions
2. Resource and emission accounting and relevant indicators
3. Measurement of decoupling and relevant indicators
4. Environmental accounting and reporting at the micro level

The primary objective of the conference is to provide research results and highlight current practices that assist in the harmonization of the economic development of society with effective environmental protection. Achieving sustainable growth of society is considered as one of the highest priorities for most countries. Achieving this goal requires, in addition to other mechanisms, tools that assist in the analysis of the current environmental-economic situation and contribute to more effective environmental protection. Environmental accounting at both the national and firm levels and indicators belong to this set of emerging tools.

From the list of abstracts, it is possible to see how multidimensional are the challenges related to both topics -- environmental accounting and environmental indicators. We hope that the conference and its proceedings will contribute to further understanding of these topics and to the development of tools that will help to bring societies closer to achieving the objectives of sustainable development.

The work leading up to this conference would not have been completed without the financial support of project sponsors. Specifically, thanks are owed to the support received from a project funded by the Ministry of the Environment of the Czech Republic and from a project funded by the European Commission. Thanks belong as well to the Czech Statistical Office that actively participated in the conference organisation.

Iva Ritschelová
Conference chairperson
25 September, 2005

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Indicators and Sustainable Development

Bedřich Moldan

To develop indicators as appropriate measuring sticks for assessing progress toward sustainability was already recommended by Agenda 21 of Rio (Chapter 40). Since then the call for good indicators he has been a part of conclusions of virtually all the major conferences and other events. As the recent SCOPE workshop (Prague, April 2004) stated, the task is far from being completed.

The objective of this presentation is to highlight some important findings: First, the progress towards sustainability and development of indicators goes in parallel. As an example, the recent Interim Report of the Czech National Sustainable Development Strategy consisting entirely of indicators could serve. Second, the clarification of the purpose and meaning of any indicator represents an important step. Third, the contextual aspects (time and spatial scale, stakeholders, public education and awareness) are examined. Fourth, some methodological and technical questions including uncertainty and feasibility of data acquisition are discussed. As an illustrative example for these issues various types of indicators used in the context of climate change namely concerning greenhouse gases are compared.

Strengthening environmental information for sustainable development

Christian Avérous

Strengthened environmental information and indicators are seen as necessary for sustainable development, including at the interface of its social, economic and environmental dimensions: for progress in environmental democracy (provision of information, access to information, participation and access to justice) and in environmental management. This entails improved knowledge of environmental realities (i.e. on the state of the environment as it results from economic pressures and responses from administrations, enterprises and households, and on environmental challenges as identified on the basis of scientific information). This also entails information to support environmental actions, concerning the range of public policy activities at strategic, planning, programming of investments, budgeting and project levels. Indicators are particularly necessary to monitor environmental progress, to assess policy implementation and to structure sets of objectives, with focus on transparency and accountability concerns. Data have to be structured around sound frameworks (e.g. pressure-state-response, economic, ecological or accounting frameworks).

In the context of underlined sustainable development, current OECD efforts focus on i) measuring decoupling of environmental pressures from economic growth, ii) measuring environmental expenditure (public and private, investment and current, concerning pollution, nature protection and water supply), iii) material flows analysis (establishing a common methodology to measure domestic and international material flows, developing related indicators), as well as on basic progress i) on environmental statistics quality and harmonisation and ii) on environmental accounting. OECD continues to publish regularly environmental data and indicators. This has to be related to the top policy priorities concerning energy and climate, material and waste, agriculture and water, biodiversity, taxation and subsidies issues, and international commitments. Important programmes at OECD concerning country environmental performance reviews, cost of inaction (or of delayed action), partnership, are in progress to achieve strategic goals concerning globalisation and the environment, effective and efficient environmental policies and sectoral environmental integration.

Looking ahead these efforts are keys to accompany the further construction of an international institutional architecture, relating to the environment and sustainable development. They are also keys to face major evolutions such as the development of more energy efficient economies (including transitions toward lower dependency from oil), more material efficient economies ("circular" economies), focus on water as an economic resource with social and ecological dimensions, biodiversity as an ecological and economic asset, and improved human health as a basic dimension of human capital.

Environmental Accounting and Sustainable Development Indicators - Current situation and future development at Eurostat

Christian Ravets

Eurostat's role in the field of environmental accounts is to meet the data needs at EU, national and industry levels of policy makers. The ongoing work in the different areas of environmental accounts will presented.

In the context of EU sustainable development strategy, Eurostat has put in place a pyramid of indicators, each of them being related to at least one of the three pillars: economy, social and environment.

Working Group 1

Environmental expenditures

and

transactions

Statistics and Sustainable Development

Stanislav Drápal

Among major tasks of statistics as a useful activity is the coverage of various fields of life using statistical indicators and the use of this predominantly quantitative information for analysis of facts, causes and effects of phenomena and processes and for prediction of expected development.

Should statistics cover the ongoing reality as trustworthily as possible, they need to adapt, i.e. to use new procedures, tools and methods and to respond to qualitative changes in the life of society as a whole and in its individual areas.

The key documents of the present State Statistical Service of the Czech Republic say that this service carries out statistical surveys and makes analyses aimed at economic, social, demographic and environmental developments. These four basic areas are understood as relatively independent and analysed usually separately. For a number of reasons, these areas are not analysed as closely linked where each phenomenon or process can be assessed from the point of view of its economic, social, demographic and environmental dimensions. On the contrary, a really impartial assessment of phenomena and processes requires just a multi-spatial assessment like this. A successfully assessed economic process may have negative social, demographic and environmental impacts and vice versa. Statistics are still not sufficiently able to evaluate the complex costs of economic development in terms of impacts on various fields of social conditions of people's lives and impacts on the quality of various environmental aspects. What is often missing is assessment of effects in dependence on time. Societies sometimes pay for a short-lived economic success by negative social and environmental impacts that come usually with a delay.

It is also hard for statistics to cope with the outcomes of economic globalisation. Whereas real execution of production processes or providing of services and their impact on people's health and living conditions are tied to a particular place, their use and use of the financial results may by tied to places that are very far. This also applies to decision-making processes, which with increasing frequency take place quite elsewhere than effects of production and services on social and environmental living conditions are felt.

Statistical service in the Czech Republic and worldwide needs to deal with the qualitatively new conditions of not only data acquisition, but in particular with seeking new scientific techniques in the assessment of a complex of mutually linked economic, social, demographic and environmental aspects of a single life.

Key words: Statistics, statistical service, statistical surveys, indicators.

Environmental expenditure and the environmental industry in the EU

Nancy Olsson

This paper describes the demand and supply of environmental products and services. The demand side, coming from industry and the public sector's regulatory activities are measured through the Joint Questionnaire of Eurostat/OECD. The supply of environmental goods and services comes from the so called environmental industry. The paper first broadly describes the concepts and the methodology of environmental protection expenditures. In the second part the paper describes the compilation of statistics for the environmental industry. Finally the paper presents the future work planned within Eurostat.

Key words: Environmental protection expenditures, environmental industry, statistical methodologies.

Sustainable Development Strategy and Environmental-Economic Accounting in Germany

Karl Schoer

The central subject of a policy for sustainable development is the co-ordination of different sector policies with the objective of finding a balance between conflicting economic, ecological and social goals. The headline indicators for sustainable development itself are mainly a communication tool directed at the general public and the media. They are used for describing important problems in a sustainability perspective and they serve as an instrument for controlling the general performance of political measures. But more detailed data are required for the analysis of the underlying mechanisms and reasons for changes in the indicator values, as well as for the formulation of measures and the assessment of the effects of these measures. Therefore, the individual indicators should be consistently embedded into an underlying database from which they can be derived by aggregation. Further, the underlying data for individual indicators should be part of a comprehensive framework that ideally integrates all relevant topics, in order to take account of the interdependencies between the different indicators. The accounting system with its three principle parts, the National Accounts (SNA) and the satellite systems Environmental-Economic Accounting (EEA) and the Socio-economic Accounting (SEA) provides an ideal framework to meet these data requirements. In Germany, more than half of the 21 headline indicators of the national Strategy on Sustainable Development are embedded in the accounting system. The paper will describe a number of practical approaches of an integrated SD-analysis on the basis of the accounting data.

Key words: German sustainable development strategy, sustainable development indicators, Environmental-Economic Accounting, National Accounting, Socio-Economic Accounting, environmental-economic modelling, interlinkages between indicators.

Environmental protection expenditure account for the CR

Iva Ritschelová, Anton Steurer

This paper describes the implementation of an Environmental Protection Expenditure Account (EPEA) for the Czech Republic. An EPEA is constructed in the same way as the national accounts are constructed for the whole economy. The aggregate of national environmental protection expenditure is therefore consistent with the gross domestic product. The paper first describes the concepts and the methodology of the creation of an EPEA. In the second part, the paper describes the compilation of an EPEA for the CR. This results in a first time series of national expenditure for environmental protection for the period 1997 - 2003. In this context, the different data sources on environmental expenditure available for the CR are described. Finally, the paper explores the possibilities of comparing environmental expenditure data from statistical surveys and from the expenditure account for 2003.

Key words: National accounting, Environmental Protection Expenditure Account, EPEA, statistical survey.

Data collection on environmental expenditures in the Czech Republic

Eva Krumpová

The paper presents a basic overview about statistical survey on environmental expenditure provided by the Czech Statistical Office. It includes basic information about the development of this survey, about methodological changes, sets of respondents, outputs etc. Special emphasis is put on the statistical environmental expenditures survey in the year 2003 and its results.

Key words: Environmental expenditure, environmental investment, environment, environmental domain.

Possible use of analyses of environmental expenses of territorial budgets

Miroslav Hájek

The structure of environmental expenses from public budgets provides a number of pieces of information both on the nationwide level and for individual municipalities or regions. Analyses of these expenses should be used for evaluation of the objectives of environmental policy at all levels. When assessing the objectives of environmental policy, it is important to evaluate the implementation of individual measures and their impact on expenses. At the municipality level the analyses of environmental expenses can be used for decision making, particularly together with the use of environmental managerial accounting.

Key words: environmental expenses, public budgets, environmental policy, environmental managerial accounting.

Selected aspects of the financing of environmental projects supported from public and EU financial resources

Erik Geuss

The paper is focused on contemporary problems of the financing of environmental projects that are supported from public financial resources (national budget, regional budgets, municipal budgets, and off-budgetary statutory funds) and from the funds of the European Union.

The relevance of the paper is further enhanced by the increasing pressure on economically effective solutions under conditions of permanently limited financial resources. In the sphere of the environment a postulate is respected that says it is very difficult to achieve a balance between increasing and financially intensive needs, and consistent and economically rational ways of support for these measures.

The paper focuses on:
- ☞ Current mechanisms of the selection and economic evaluation of environmental projects.
- ☞ Approaches within the selection of projects applying for support from public resources.
- ☞ Methods for the evaluation of project effectiveness (ex ante) from the point of view of the state, investors and those who apply for public support.
- ☞ Methods for an ex post evaluation of projects (from the point of view of the provider of financial support).
- ☞ Critical points of current methodologies, and an outline of the future solution.

Development of eco-industry in the Czech Republic with the stress on employment

Eva Tošovská, Iva Ritschelová

In the paper, the main methodological obstacles connected with the identification and classification of environmental activities and environmental goods are summarized. These two environmental components represent a relevant part of the development of satellite environmental accounts. One of the purposes of identifying environmental activities and products is to make it possible to construct accounts showing the supply of the relevant products and the nature of the expenditures on them. The final goal will be the mapping of the development of environmental industry in the CR.

However, when we wish to identify those industries and products that are characteristic of the environment, simple industry and product classifications are not sufficient. We need to extend classifications in order to describe the purpose of the products and the industries that make them, and make it possible to discriminate between those that are of specific environmental interest and those that represent the rest of the economy. On the way to doing this, there are many open questions and methodological problems.

Accounting and Indicators based on Environmental Related Taxes and Charges

Milan Ščasný

Environmentally related taxes and charges are represented by any tax, charge or fee whose base is a physical unit (or a proxy of it) of something that has a proven, specific negative impact on the environment. The paper firstly identifies all such taxes and charges that have been introduced within the Czech legislation. Following Eurostat and SEEA-2003 accounting guidelines, these taxes and charges are clustered into groups --- levies on energy, transport, pollution, natural resource use, rent based --- then the revenues of each of them enter the database that covers the period 1993-2003/4. At the top, revenue from VAT on energies is estimated. We find that environmentally related taxes and charges have been contributing to total public revenues by about 7%, respectively to tax revenues by 8% and to GDP by 3% with a falling trend. The revenues are dominated by excise tax on motor fuels, while ecological charges represent only a minor part.

Following national accounts and SEEA-2003 classification, environmental related taxes and charges have been reclassified into taxes on products, other taxes on production and other current taxes on income or wealth, while groups consisting of capital taxes are not relevant for this exercise. Lastly, we test whether the current statistical and information system allows us to allocate their revenues to economic sectors in order to provide an appropriate information matrix for further quantitative exercises. So far, we have found such revenue reallocation for excise tax on energies or fees on extracted reserves of subsoil assets and mining space area is feasible; on the other hand, such reallocation for ecological charges hardly works or in certain cases is unfeasible, charges on air emission seeming to be particularly unfeasible. Lastly, eco-taxes and fees can be allocated to sectors by using data on energy consumption. A summary on possible implementation of the SEEA-2003 accounting framework in this area and further possible research concludes the paper.

Key words: Environment, environmental taxes, environmental charges, public revenues, SEEA.

Construction of indicators for environmental tax reform in Flanders, Belgium

Kris Bachus, Luc Van Ootegem, Bart Defloor

Over the last ten years, a number of OECD-countries have implemented Environmental Tax Reforms. An ETR is a reform of the tax system, shifting labour taxation to environmental goods taxation. In most international comparisons, Belgium illustrates the case of an economy gradually implementing an ETR. In Belgium, a greening of taxes is observed, an evolution in which either more tax income is generated from environmentally related taxation (ERT) or in which environmentally harmful behaviour is taxed more heavily. As such, greening of taxes is a prerequisite for, but is not necessarily sufficient for, a (real) ETR.

Due to successive state reforms in the eighties and nineties, Belgian fiscal competences are spread over several governmental levels. The bulk of tax authorities (direct income taxes, direct corporate taxes, VTA, energy taxes, product taxes) are situated at the federal level. Yet, regional governments are competent in issuing specific environmental taxes, such as the wastewater tax, the waste tax, and the manure tax... Even at the municipal level, some environmental taxes exist. The complex Belgian state structure makes it a challenging task to make an inventory of all the existing environmentally related taxes. It is often an even more challenging task to construct indicators.

In the conference paper we report on the main conclusions of an empirical study of this subject carried out in Flanders. More in particular, we focus on the problem of measuring the greening of taxes.

Starting from a time series of tax income and tariffs of environmental taxes, two types of indicators (tariff based and income based indicators) are constructed for the period 1970-2004. These indicators will be a mix of federal, Flemish and municipal environmental taxes. Special attention is devoted to the weights attached to different taxes; some environmental taxes deserve more attention than others. The subject is elaborated from a conceptual and methodological point of view. The concluding section of the paper will put into perspective the relevance of the indicators from the point of view of ecological (policy) objectives.

Key words: Environmental taxes, environmental accounting, SEEA, indicators, sectoral analysis.

Effectiveness of charge instruments for environmental protection from the viewpoint of administrative cost

Jan Pavel

The use of charge instruments for environmental protection brings about additional costs for both the public and private sectors. With regard to the low fiscal significance of a number of such charges, there arises a question of to what extent these instruments are effective from the point of view of administrative costs, i.e. from the viewpoint of costs to be paid by the public sector. The paper analyses the value of these costs connected with collected charges and excise taxes in the Czech Republic, and it identifies factors influencing their volume. The basic method for analysis of the size of costs is the method of the so-called equivalent worker whose application within the framework of the whole tax system enables comparison with other "tax" instruments that are not focused on environmental protection.

Key words: Administrative cost, environmental charges, public sector.

Environment Monitoring in the Framework of Regional Development

Armen Keshishyan

The paper describes the needs for statistical data, including environmental, in the framework of Armenia Regional Development Programme (ARDEP) funded by the UK Department for International Development. The programme is implemented in Armenia in the framework of poverty reduction strategy of Armenia. Regional development concept in Armenia is in its early stage of development, and institutional, reporting, cooperation, coordination and monitoring systems are decisive when establishing new approaches to the regional development.

Both regions where the Programme operates are environmentally vulnerable, one having a serious problem of forest preservation and maintenance, in the other Lake Sevan is situated with all inherent problems of water losses and marsh areas, preservation of water fauna and flora, etc.

Although there are many donor organisations operating in the country focusing on environment problems, however, the current level of regional planning and coordination is far from perfect and there is a need for modern technologies and practices to be installed in the regions to make sure proper surveillance is effective.

The idea of framing relevant efforts into a Regional Development Plans is already accepted and owned by the regional authorities, and there are good preconditions to introduce modern knowledge and experience in these regions.

An approach of designing a proper model for environmental monitoring at regional level and then feeding it up to the central authorities is in perfect concert with the ideology of the ARDEP project. Among the objectives of the Programme is the replication of approaches and institutional solutions to other regions of Armenia. If environmental monitoring, accounting and approaches prove to be relevant, effective and efficient, then they might certainly form the basis for application across the country.

It is decisive to push forward the idea of creating an operational system of administrative statistics, since governmental affiliation of the stakeholders involved in providing environmental data is rather diverse and unregulated. Establishment of meaningful and clear systems within which various players would play clearly allocated tasks would have a substantial input for advancing environmental monitoring and evaluation.

Key words: Regional development and planning, institutional solutions, cooperation with donors, sectoral analysis, monitoring and evaluation framework, roles of stakeholders, poverty reduction.

Working Group 2

Resource and emission accounting and relevant indicators

Towards material flow accounts: progress in Hungary

Márton Herczeg

The proposed presentation aims to give an overview of state of the art Material Flow Accounting (MFA) in Hungary.

Material Flow Accounts are part of official statistics e.g., in Austria, Denmark, Finland, Germany, Italy, Japan and the Netherlands. Economy-Wide Material Flow Accounts (EW-MFA) can be used to derive indicators on the metabolic performance of national economies, for instance, resource inputs, and the efficiency of resource use.

In the case of Hungary, MFA is not included in the official statistics yet. Although most of the data needed for compiling input and output side flows are recorded by the official Hungarian statistics, setting the full set of accounts (the material balance, literally) is hindered by several difficulties on both input and output sides.

Main MFA indicators have already earlier been estimated for certain years (e.g. 1999) by western consultancies (SERI), but accounts are not comprehensively recorded annually. Currently, a small research group, consisting of experts from the Department of Environmental Economics at the Budapest University of Technology and Economics and the Hungarian Central Statistical Office, is working on the compilation of MFAs for the years 2000-2003. The group aims to adapt the recommendations of Economy-wide material flow accounts and derived indicators – A methodological guide (prepared by Eurostat in 2001) in order to be able to establish a harmonized system of MFA.

Activities cover a broad area of the input and output side of MFA: we compile the data tables of Emissions and wastes of Hungary. Our objective is also to determine the Dissipative use of products and dissipative losses among the material outputs of Economy-Wide Material Flow Accounts. Current activities cover information and data collection and identification of general data availability in Hungary for the selected time period of 2000-2003 as well as the compilation of data tables for Emissions to air and water, land filled Waste, Dissipative use of products and Dissipative losses to the widest possible extent.

Expected outcomes cover the identified state of data availability in Hungary, a methodology developed to provide the most (possible) comprehensive figures of Emissions and wastes and Dissipative use of products and dissipative losses. These figures will enable the compilation of derived indicators and assess the material intensity of the Hungarian economy.

Key words: Statistics, accounting, MFA, indicators.

Environmental accounts compilation within the CZSO

Katarína Markošová

The paper presents an overview about the main and priority modules of environmental accounts. The modules being solved within the CZSO are mentioned in the text. Attention is paid especially to the economy-wide MFA and to the NAMEA for air emissions. At present, these two modules are being solved in the framework of MB Phare 2003 Data Collection Project. In the paper, the preliminary results of the project are presented. Finally the future steps of the CZSO in the area of environmental accounts are mentioned in the paper.

Key words: Environmental accounts modules, economy-wide MFA, NAMEA for air emissions.

Development of economy-wide material flow indicators in the Czech Republic in 1990-2003 with the focus on sectoral decomposition of output flows

Jan Kovanda

Economy-wide material flow accounting in the Czech Republic has been carried out since 2000 within the R & D projects of the Czech Ministry of the Environment. This paper presents indicators based on this accounting, which were compiled for the Czech Republic for 1990-2003. The results show that indicators of economy-wide material flows decreased by approximately 30-50 % during the whole period studied. The reasons for the recorded decrease of these indicators are discussed. The indicators are also used for material intensity and decoupling analysis, which indicate both increases in the efficiency of the transformation of input and consumption material flows into economic output and the decoupling of environmental pressure from economic growth.

Special attention is paid to output material flow indicators such as domestic processed output (DPO) and total domestic output (TDO). These indicators are disaggregated according to economic sectors, namely agriculture, industry, energy supply, transportation and households in order to show the contributions of these sectors to output material flows in the Czech Republic. The changes in these contributions are analysed over 1990-2003 and the reasons for these changes are discussed. The results show that most DPO comes from energy supply, above all due to CO_2 emissions from coal-fired power plants. On the other hand, the TDO is dominated by material flows from industry due to enormous overburden from brown coal mining. However, the share of both energy supply in DPO and industry in TDO went down in 1990-2003. The output indicators are also disaggregated according to the environmental media they head to.

These media are air, water and soil. It is demonstrated that the majority of DPO heads to the air, which is followed by soil and water. In the case of TDO, the order is reversed for air and soil, while water remains in third position. Concerning the ratios of these environmental media, they are quite stable for both DPO and TDO over the whole period studied.

Key words: Material flow analysis and indicators, environmental accounting, decoupling, material intensity, sectoral output flows.

DMC as an indicator for sustainable use of resources and its different interpretations

Nina Eisenmenger, Helga Weisz, Fridolin Krausmann

Material Flow Accounting (MFA) provides data for discussing the sustainable use of resources and related policy targets. Of the different MFA indicators we want to propose Domestic Material Consumption (DMC) as a headline indicator. DMC equals domestically extracted raw materials plus imported commodities minus exported commodities.

We will discuss DMC and its meaning for environmental problems, economic performance and policy relevance by using MFA data for the former EU-15 countries (1970-2000). For interpretation we will use different denominators that provide reference scales for DMC. Besides population and GDP we introduce land area as a denominator and will argue that this ratio offers information on the intensity of use of the available land area and the resulting environmental pressure on ecosystems.

For analysing the environmental relevance, DMC has to be discussed along its different fractions. The largest fractions in DMC hold biomass and construction minerals, both materials that are closely related to land area and thus the intensity of its use. Minerals, ores and fossil fuels, on the other hand, are a small part of total DMC and play a very different role in terms of sustainability. These materials are scarce resources of high economic value that are important resources traded on world markets. The use of these materials causes environmental problems mainly by pollution through wastes and emissions.

The economic relevance of DMC is given in its relation to GDP, an indicator for material efficiency. We will show different resource use patterns across different economic structures and across time. A comparison for GDP and DMC development for the former EU-15 countries shows an interesting correspondence between economic growth and resource use. Considering the growing importance of international trade we will introduce an indicator called "domestic resource dependency" (DE/DMC).

This indicator shows the importance of trade flows in relation to domestically extracted materials and thus illustrates how much an economy depends on foreign resources.

To be applicable in political discussions an indicator has to meet certain criteria such as: policy relevance, theoretical soundness, comparability across time, scales and world regions, additivity across scales, and feasibility in establishment. We will argue how DMC meets these criteria and thus conclude by showing the strengths of DMC as a headline indicator for sustainable resource use.

The material basis of the global economy: implications for sustainable resource use policies in the north and south

Arno Behrens, Stefan Giljum, Jan Kovanda, Samuel Niza

Over the past 15 years, material flow accounting and analysis (MFA) has been established as an influential framework for policy-oriented assessments of anthropogenic use of natural resources. In the course of an ongoing EU project entitled "Modelling opportunities and limits for restructuring Europe towards sustainability (MOSUS)", total (used and unused) material extraction has been assessed for all countries of the world.

This paper presents the first comprehensive quantification of the material basis of the global economy in a time series from 1980 to 2002. We analyse time trends for major material groups (fossil fuels, metals, industrial and construction minerals, and biomass) disaggregated into seven world regions. This allows for (a) an illustration of the global economy's physical growth driven by world-wide processes of economic integration over the past 25 years, and (b) an indication of the world-wide distribution of environmental pressures associated with material extraction. Furthermore, we link physical extraction data with socio-economic indicators such as GDP and population. Thereby we can assess different patterns of resource productivities and inequalities in per capita resource extraction between industrialised and developing economies.

The results presented in this paper hold important implications for the formulation of policy strategies towards a more sustainable use of natural resources in both industrialised regions such as Europe and countries serving as resource suppliers, which are mainly located in the global South. In many industrialised (and newly industrialised) countries, a relative de-coupling of domestic material extraction from GDP growth has been observed. In some developing countries, on the other hand, domestic resource extraction grows even faster than economic performance, owing to the fact that a substantial share of material extraction is linked to export activities.

This highlights the importance of including trade aspects in international environmental policy. While Europe will need to implement policy measures to further reduce overall primary material extraction (both at home and abroad) in order to achieve more sustainable production and consumption patterns, policies in developing countries need to focus on vertical and horizontal diversification of economic structures in order to reduce their dependence on primary commodity exports.

Quantifying indirect natural resource requirements with a global input-output model

Stefan Giljum, Arno Behrens, Friedrich Hinterberger, Christian Lutz, Ingo Wolter

With increasing international trade in an ever more globalised economy, the inclusion of resource requirements of traded products is gaining growing importance, when domestic production and consumption patterns are evaluated from the perspective of global sustainable development. In order to assess world-wide environmental consequences, it is necessary to include – in addition to direct imports (and exports) – all upstream material requirements (indirect flows associated with imports and exports) necessary to produce the traded goods. Only thereby can one illustrate possible shifts of environmental burden associated with the extraction and processing of materials due to changing global patterns of production and trade.

In most MFA studies on the national and EU level, indirect flows have so far been calculated by applying a life-cycle assessment (LCA)-oriented methodology developed at the Wuppertal Institute. In this approach, direct imports are multiplied by rucksack factors, reflecting – in theory – all resource requirements of extraction, processing and transport. However, due to great efforts in data collection of material inputs along international production chains, no hidden flows have so far been able to be calculated for a large number of processed biotic and abiotic products.

An alternative method for calculating indirect material flows on the macro level is to apply extended input-output (IO) analysis using environmental-economic models, allowing comprehensive accounting of direct and indirect resource extraction (accounted as Raw Material Equivalents, RME) activated by domestic and foreign demand. This approach is also recommended by the authors of the methodological handbook for economy-wide material flow accounting published by EUROSTAT in 2001.

In the course of an EU research project (Modelling opportunities and limits for restructuring Europe towards sustainability, MOSUS), global data sets were compiled concerning economic data (input-output tables and national account data linked by international trade, all in monetary terms) and material inputs (resource extraction of all countries of the world, in physical units). Combining these data sets into one comprehensive global economic-environmental model allows the application of input-output analysis to calculate indirect material flows within one global and consistent framework. By adding these comprehensive trade flows to domestic resource extraction, comprehensive MFA indicators such as TMR and TMC can be calculated.

This paper presents methodological guidelines for calculating indirect material flows with global economic-environmental models applying input-output analysis on the international level. In the first part, we review existing input-output based approaches on the national level and provide a detailed description of the possibilities and limitations of a global economic model extended by material input models for the calculation of indirect material flows. We also describe options for extending this approach to other environmental categories, such as land use and emissions. The second part contains example calculations for selected European countries (for both the national level and specific economic sectors), evaluating deviations from the numbers calculated using the LCA-oriented approach. We conclude the paper with recommendations to EUROSTAT and other European institutions (such as the EEA) for further steps towards a harmonised methodology and the establishment of an international database for indirect material flows.

Key words: Ecological rucksacks, indirect material flows, input-output analysis, international trade.

Integrated economic-ecological carbon accounting

Karlheinz Erb, Helmut Haberl, Matthias Jonas

In our presentation we argue the need for an advanced economic-environmental accounting scheme which allows for analyses of the links between economic development, structural and technological change, changes in consumption levels and in socio-economic material and energy flows. To these ends, we propose a methodology for the integration of economic models and carbon accountings. Our attempt is based on systematic linkage between socio-economic parameters (monetary accounts) and socio-economic and natural material and energy flows, by combining two existing accounting methods: (a) Full Carbon Accountings (FCA) and (b) Material Flow Accountings (MFA). FCA represents an accounting scheme considering all carbon flows, natural and socio-economic, between the territory of a nation state and the atmosphere. MFA traces the materials, energy (or carbon) throughput of an economy in a way that is consistent with socio-economic data, statistics, and accounting systems (such as the System of National Accounts, SNA).

This integration of FCA and MFA aims at the development of coupled ecological-economic models and of integrated indicators, because it (a) considers all carbon flows between the national territory and the atmosphere, (b) consistently links socio-economic data and carbon flows, (c) explicitly considers direct and indirect carbon flows related to foreign trade and (d) allows for the consistent treatment of uncertainties.

Key words: Carbon flows, carbon accounting, full carbon accounting, Input-Output modelling, Material Flow Analysis (MFA), coupled ecological-economic models.

National inventory of greenhouse gas emissions

Pavel Fott, Dušan Vácha

International conventions adopted for the purpose of controlling greenhouse gas emissions (United Nations Frame Convention on Climate Change and its Kyoto Protocol) require uniform, transparent and inspectable monitoring of greenhouse gas emissions (i.e. national inventory) at the level of countries – parties to the above-mentioned international conventions. For this purpose, there was adopted, and by international agreements prescribed, unified IPCC (Intergovernmental Panel on Climate Change) methodology. According to this methodology, the sources (or reservoirs) of emissions are divided into seven sectors: 1. Power engineering, 2. Industrial processes (without combustion), 3. Use of solvents, 4. Agriculture, 5. Changes in landscape use and forestry, 6. Waste materials, 7. Others. All of the sectors are further divided into partial categories and subcategories.

In national inventories, the greatest attention is paid to the determination of CO_2 emissions. According to the methodology, the only anthropogenic sources are (i) combustion of fossil fuel, (ii) cement manufacture or decomposition of limestone and other carbonate-based minerals (unless they are compensated by the following deficit) – e.g. glass melting, soil liming, lime used for desulphurising, etc., and the last (iii) source of emissions or deficits is the changes in carbon reserves in nature caused by human activity (particularly the wood reserves in forests). That is why other CO_2 emissions released, e.g. by combustion or anaerobic decomposition of wood or other biomass, are included in the entire emission balance.

Combustion of fossil fuels usually represents the most significant group of sources in most countries. To determine CO_2 from the combustion of fossil fuels, the IPCC methodology requires two independent procedures based on the national energy balance. The less complicated of these procedures, called referential (Reference Approach), determines in principal the total quantity of incinerated carbon on the basis of balance calculation of the apparent consumption of individual kinds of fuels on the territory of the Czech Republic (mining (logging) + import – import – change of reserves).

The other procedure, called sectoral (Sectoral Approach), is based on the actual consumption of fuels in individual sectors (e.g. production of energy, industry, etc.).

In the case of the methane and N_2O inventory, one starts from statistical data (e.g. total consumption of nitrogenous fertilizers, number of farm animals, and generation of waste materials). In calculations, emission factors (EF) or other similar parameters are used.

The methodology specifies 3 levels of emission calculations according to requirements for input data. In accordance with this approach, emission factors are divided into default, country-specific, site specific, and technology-specific ones.. According to the methodology, higher level procedures should be used for key sources, which are categories of sources contributing more than 95 % to the total national aggregated emission.

Key words: National inventory, greenhouse gas emissions.

Linking land use and social metabolism: concepts, indicators and empirical applications

Fridolin Krausmann, Karl-Heinz Erb

Socio-economic material and energy flows are related to land use and land cover in many ways: The extraction of resources (e.g., mining, agriculture), the deliberate application of materials in construction or agriculture as well as the depositing of wastes and emissions are not only demanding as far as land, but can be considered driving forces of land use change and considerably affect terrestrial ecosystems.

The paper critically reviews established and new accounting frameworks such as the ecological footprint (EF), the actual land demand, human appropriation of net primary production (HANPP) and area-related material flow indicators. It discusses the strengths and shortcomings of these concepts and derived indicators and presents empirical examples of their application in both monitoring changes over time and cross-country comparisons.

Key words: Material flows, energy flows, ecological footprint, human appropriation of NPP, land use.

Long-term industrial transformation study for the area of the Czechoslovak Republic

Petra Kušková

This work is part of a comparative study of the "long-term industrial transformation" of Austria and the Czechoslovak Republic conducted by the IFF Social Ecology team in Vienna. The study is based on the concept of social metabolism and the methods of material and energy flow analyses (Ayres and Simonis 1994; Fischer-Kowalski and Haberl 1997).

The first step of the work, which was carried out recently, is the compilation of a dataset with respect to the development of land use and socio-economic material flows: domestic extraction, foreign trade, biomass and fossil fuels; and a socioeconomic parameter: population. The database is being worked out for the territory of the former Czechoslovak Republic from its very beginning (1918) to the present and for other state formations that occurred during this area on the defined territory.

Today's Austria, and Czech and Slovakia (till 1993 Czechoslovakia) are successor countries of the Austro-Hungarian Monarchy, which covered Austria, Czech, Slovakia, Slovenia, Hungary and Croatia from 1867 to 1918. The Czechoslovak Republic, as the most industrialized part of the Empire, had the prerequisite to be a country with a high volume of flows of materials from its very beginning. Moreover, the post-war period was characterized by further development of heavy industry, coal extraction and massive agricultural intensification. This was projected into volumes of material flows of both biomass and fossil fuels on which our work is mainly focused.

Due to a tradition of data collection in the old monarchy, for the so-called First Republic period (1918-1938) many reports and statistical yearbooks periodically published by The Statistical Office of the Czechoslovak Republic are available. Most of the missing data are for the war and post-war period. The Statistical Yearbook in more or less its present appearance and size has been issued since 1957, as well as more detailed statistical reports.

The first, preliminary results – time series of data on biomass extraction and fossil fuels – will be presented and discussed.

Key words: Industrial metabolism, material flow analysis, land use, domestic extraction the material basis of the global economy.

Environmental accounts and related present and future work at the Statistical Office of the Republic of Slovenia

Vida Butina, Danica Bizjak

The aim of the paper is to define the implementation of the SEEA (System of Economic and Environmental Accounts) in environmental accounts for Slovenia and to discuss the present and future work at the Statistical Office of the Republic of Slovenia.

The environmental and economic data must fit the same conceptual framework i.e. the framework of national accounts because the main purpose of environmental accounts is to facilitate a direct linkage between various economic activities and environmental influences in physical and monetary terms. The SEEA is a satellite system of the SNA (System of National Accounts) and is the general international standard for compiling environmental accounts.

In EU countries work has largely focused on developing and testing frameworks and methodologies for different areas of environmental accounting. The Statistical Office of the Republic of Slovenia compiles data on gross fixed capital formation and current expenditure for environmental protection, and other environment-related expenditure. The data is used by several institutions, mainly by researchers and decision-makers for environment-related decisions. Due to the fact that environmental protection activities are linked to all aspects of production and social issues, we have noticed great interest from the public in this data. The main users of gathered data are the Institute of RS of Macroeconomic Analysis and Development and EUROSTAT. We are also participating in the pilot project concerning NAMEA (National Accounts Matrix including Environmental Accounts) air emissions and we are preparing a feasibility study of data availability of water accounts data. We intend to start the work on material flow accounts next year in coordination with the Ministry of Environment and Spatial Planning.

Key words: Environmental accounts, SEEA - System of economic and environmental accounts, emission accounts, gross fixed capital formation, current expenditure, NAMEA - National accounts matrix including environmental accounts.

Energy flow analysis in the Czech Republic

Miroslav Havránek

The methodology of energy flow analysis (EFA) was developed in the Institute of Interdisciplinary Studies in Vienna. Its concept is based on the same philosophy as the material flow analysis.

The aim is to evaluate, with the use of energy units (Joule), all inputs and outputs of energy into and from the economic system. Unlike conventional energy balance, EFA comprises inputs of materials rich in energy that can be used for purposes other than energy generation (biomass, wood for the building industry, for paper production, furniture, etc.), and energy inputs derived from the work of people and farm animals.

Similarly to MFA (Material Flow Analysis), EFA provides an important database from which a number of indicators of sustainable development can be derived. DEI – Direct Energy Input on the input side - is the equivalent of DMI. It includes domestic mining and import of energy rich materials. Items not included are not only fossil fuels and wood but also other energy rich materials, particularly biomass and energy inputs of a nonmaterial basis as electric power and heat.

Inputs of a material nature are recalculated on the basis of their gross caloric value. The equivalent of the DMC indicator is DEC – Direct Energy Consumption, which is equal to DEI reduced by the export of gross caloric value of energy rich materials and energies of a nonmaterial nature. On the output side, indicators having no direct equivalent in material flow analysis are defined. One of them is the Final Energy Use – FEU indicator. This indicator is also generally used in the case of conventional energy balances, where it is defined as energy sold to final consumers (therefore, energy of primary energy carriers reduced by losses connected with transformation to useful energy). In the case of EFA, its calculation somewhat differs due to the inclusion of biomass and other materials rich in energy extending the concept of primary energy carriers. Another output indicator of energy flow analysis is Useful Energy – UE. UE represents the actual energy contribution connected with the final use of energy. Results of research into the EFA field will enable one to evaluate energy flows in the Czech Republic. The paper will discuss the whole EFA methodology, individual steps necessary for the creation of a database of energy flows, and preliminary results for the Czech Republic, which is also very important.

Key words: Energy flows**,** social metabolism**,** power engineering.

Physical Sustainability Indicators, Scientific Observation and Institutional Design

Rafael Ziegler

The paper places the development of physical sustainability indicators such as material flows accounting and ecological footprint accounting in the history of scientific observation. Physical sustainability indicators are treated as a scientific-technical innovation, and need to be understood in their distinctness as well as in their relation and complementarity to existing types of statistical observation, particularly monetary macro-economic indicators.

It is suggested that this kind of reflection on physical sustainability indicators can provide insights and historical experience for the further development of these indicators (this work itself is part of a larger project on the history of scientific observation at the Max Planck Institute, Berlin). In particular, it is important to understand the role of indicators for monitoring, but also for democratic accountability. To this end, a case study on the Canadian experience with the National Roundtable on the Economy and the Environment (NRTEE) and its proposal of indicators for the environment and sustainable development is offered. It will be argued that due to the particular circumstances of the production of sustainability indicators, it is worthwhile reflecting on the design of the institutions producing this type of scientific observation. It is suggested that when seeing their important role in monitoring and democratic accountability, they can be understood as an important type of accountability institution. The hybrid function of the latter is insufficiently recognised, and raises questions of institutional design that will be addressed based on the case study and the historical perspective offered in the paper.

Key words: Physical sustainability indicators, monetary indicators, accountability, institutional, design, scientific observation.

Working Group 3

Measurement of decoupling and relevant indicators

Measurement of decoupling in transition economies: some issues and preliminary findings

Jaromir Cekota

Measurement of the decoupling of environmental and economic trends in transition economies (TEs) is impeded by a lack of long-term series of comparable production data and environmental indicators. GDP data are available in the UNECE database from the early 1990s for 25 TEs, including 8 countries of the Central European and Baltic region (CEB), 5 countries of southeast Europe (SEE) and 12 CIS countries. Economic analysis of these data reveals that reported GDP growth rates are plausible for only 12 countries. If one shifts the initial year to 1995, the number of countries covered increases to 27 (due to the addition of 2 SEE states) while the reported aggregate output levels are plausible for 24 of them, including 8 CEB, 5 SEE and 11 CIS economies. The numbers of reporting countries with plausible production (value-added) structure is, however, significantly lower. This considerably complicates the measurement of structural change and its impact on environmental pressures. Annual energy and air emission indicators are available from the IEA for most TEs for the time period 1992-2002. The availability of other sustainable development indicators (e.g. water pollution and waste measures) varies considerably across countries; the quality and quantity of such indicators tend to be better for the new EU states and candidate countries than other TEs. The evolution of sustainable development indicators and related GDP levels over time implies that a decoupling of energy use and some other environmental pressures from economic growth has taken place in most of the economies investigated. This finding is consistent with the OECD and UNECE environmental performance reviews of new EU member states from the CEB region as well as some CIS and SEES economies. However, the paper also identifies some unusual patterns of decoupling in some TEs that have not been observed elsewhere. In a few cases, counterintuitive "reverse" decoupling has been detected. However, such exceptional results can be explained with the aid of national data pertaining to GDP, environmental revenues, and profitability in sectors that generate growing environmental pressures.

Key words: Decoupling in transition economies, environmental performance, environmental revenues, sustainable development indicators.

Measurement of de-coupling of economic growth from nature & landscape consumption

Josef Seják

Biodiversity (variability among living organisms from all sources: CBD, 1992) is a valuable asset for human generations. Biodiversity is intricately tied to the territorial framework.

That is why the evaluation of the ecological quality of a territory is a better approach to biodiversity valuation than any other approach not tied to the territorial dimension. For the economic evaluation of environmental assets and their life-supporting quality, an approach through combining the ecological functions and the revitalisation costs of respective biotopes has recently been developed in the Czech Republic. The fundamentals of this method of interdisciplinary economic valuation of biotopes will be described and its contribution to measuring the rates of de-coupling in the Czech economy of the 1990s will be explained.

The biotope valuation method brings a new dimension to economic value that reflects the biotope's life-supporting potential and it evaluates the intrinsic value of nature in monetary terms. In connection with the land cover approach, the results obtained through this method enable us to express and quantify the concept of national natural capital. The development of natural capital stock can be identified. Such information is crucial for environmentally correcting traditional macroeconomic indicators like GDP and others. Such information is also useful for measuring the rate of de-coupling of economic growth from nature and landscape consumption.

Key words: Biodiversity valuation, intrinsic value, national natural capital development.

Energy externalities as an indicator of sustainable development

Jan Melichar, Miroslav Havránek

Air pollution caused by electricity and heat generation causes serious damage on human health, building materials, crops and ecosystems. Conversion of energy also contributes to the climate change. Economic theory describes these impacts as external costs which are born by society and are not included in the production functions of energy producers. All these external costs are not reflected in the prices of goods and services, e. g. in the price of electricity and heat produced. The aim of the paper is examine use of estimated external costs for composition of sustainable development indicators and policy practice.

The paper is divided into four parts. Firstly, the ExternE method -- based on the bottom-up approach and impact pathway analysis – for external costs estimation is briefly described. By using EcoSense software, the external costs due to airborne pollution for several energy generation/transformation technologies are calculated for the Czech Republic, Hungary, Poland and Romania. The external costs amount 3.12 €c/kWh generated from hard coal power plant, and 3.70 €c/kWh from brown coal and 5.90 €c/kWh from lignite in the Czech Republic. External costs for Poland are slightly higher (6.30 €c/kWh from hard coal, 6.45 €c/kWh from brown coal), while the energy external costs for Hungary and Romania are one order higher.

External cost value is then divided into part associated with impacts on human health, building materials, crops and impact caused by global warming and up-stream processes. The third part describes the energy sectors and suggests a possible way for energy external costs aggregation. Forth part concludes – indicators of sustainable development are derived in terms of ratio on GDP, per capita and energy prices. While, the external costs per kWh generated are one of the highest in Hungary among the examined countries, its relative energy externalities per unit of GDP or per capita are one of the smallest ones. The energy externalities ranged between 130€ to 220€ per capita, or about 4.0% of GDP in Poland, 2.5% in the Czech Republic, and 2.0% in Hungary. The difference and thus the damage magnitude depend on fuel mix structure, technology used, and the geographical location of the plant and the country.

Key words: Externality; energy sector; ExternE; technology assessment; indicators; environment.

The index of sustainable economic welfare (ISEW): review and case-study for Belgium

Brent Bleys

This paper reviews the Index of Sustainable Economic Welfare (ISEW) and includes the preliminary results of a case study in Belgium. First, the index is placed in a framework of different types of QOL-indicators: as the index has mainly an economic focus and uses monetary aggregation to combine its different components, the ISEW can be categorized as an alternative economic welfare measure. Second, the theoretical underpinnings and the methodology of the ISEW are discussed. Attention is paid to the four essential elements in the underlying framework of the index: the income concept of Fisher, the extension of the capital concept, the inclusion of non-market flows and the notion of defensive expenditures. The third part of the paper reviews the origins of the index as well as its implementation in different countries. Next, a critical evaluation of the ISEW is presented. Finally, the preliminary results of the calculation of a Belgian ISEW for the period 1970-2000 are included.

This effort builds upon earlier studies in other countries and supports the "threshold hypothesis" that has been put forward by these studies. However, some reservations are made regarding this conclusion.

Key words: Sustainability, economic welfare, ISEW, extended national accounting.

The statistical benefits of using an Individual Transferable Quota System for valuing natural resources

Kent Hammond

The economic valuation of natural resources is a fundamental element of environmental accounts. Environmental assets are often valued, in principle, using market values. In many cases there are no active markets for the trading of natural resources and market values of environmental resources are estimated using Net Present Value-type approaches. These approaches are very sensitive to assumptions made around discount rates, rates of return to fixed capital and the estimation of capital stocks in National Accounts and therefore potentially may not truly reflect the market value of the resource.

New Zealand's commercial fisheries are unique in that they are managed under a comprehensive Quota Management System (QMS). This system allocates property rights to fishermen through Individual Transferable Quotas (ITQs) which provide the right to fish in perpetuity. Since these quotas are freely traded, it is possible to calculate the value of the fish resource from the market prices of these entitlements. Given that commercial fishers are currently the only players in the ITQ market; the value of the ITQs measured at market price reflects the commercial fisher's value of the fish stock and their associated resource rent.

For national environmental accounts, the benefit of an Individual Transferable Quota System is that it provides a bottom-up approach to calculating market values for natural resources. The QMS therefore provides the means to not only calculate the total value of the fish resource, but also a breakdown by species. For example, New Zealand's commercial päua (abalone) resource is valued at $328m, which is 9 percent of the total value. The information from the QMS also allows for the calculation of species values at regional levels. This is particularly important for New Zealand's environmental accounts as decision makers want information at the regional level. Historically, this data has not been available in such a readily available format that is comparable to national assets.

Statistics New Zealand's Fish Monetary Stock Account provides the means to monitor the economic performance of the New Zealand's QMS. This account also shows the benefits of an ITQS when valuing natural resources.

Key words: Economic valuation, environmental assets, QMS, ITQs.

What is the contribution of mining sector to macro aggregates in the Czech Republic?

Milan Ščasný

The paper aims at the development and application of appropriate accounting methods and approaches for environmental assets, particularly subsoil assets. Firstly, physical accounting for subsoil assets is applied. Flows and stock accounts for subsoil assets for the Czech Republic are reported. By using data of national accounts, qualitative analysis of mining and quarrying sector is provided and relevant indicators describing its share on selected macro aggregates are compiled. Innovative part of the paper presents a calculation of resource rent.

Firstly, appropriate methods doing that are under debate. Current practise in accounting for environmental assets used in the standard systems of national accounts such as SNA 1993 or ESA 1995, then, the SEEA-2003 framework are discussed. Total resource rent counts 0.5 mil. CZK yearly, or 0.03% of GDP respectively, for the entire mining sector by using so called "appropriation" method that is based on revenues from royalty tax or fees. Resource rent would be, however, one order magnitude higher, if PIM method or the method based on capital service flow were used. The amount of resource rent varies according to a discount rate used. Lastly, by using derived aggregate resource rent, depletion is estimated in order to compose indicators of depletion-adjusted relevant aggregates of national accounts.

Key words: Subsoil assets; resource rent; depletion; national accounts; environmental accounting; SEEA; green GDP; structural analysis.

Methodology designed to allocate changes in environmental impacts to the appropriate sectors

Rocky Harris

How do we measure the impact of changes on our consumption activities? The actions that end users take directly affect the environment, but the activities of others higher up in the supply chain also have an impact. Thus, electricity emissions relating to electricity generation may increase because of an increasing demand for electrical energy, or because of changes in the fuel mix used by electricity generating companies. We need a means of clearly identifying the responsibilities of the various players.

This paper explores the implications of this perspective for indicators based on environmental accounts data. It concludes that neither the direct impacts derived from physical emission accounts (such as the NAMEA), nor the indirect impacts attributed to final demand categories through input-output analysis, properly identify which sectors are responsible for changes in the levels of emissions.

The paper proposes a standard methodology designed to allocate changes in environmental impacts to the appropriate sectors.

Key words: Decoupling, driving forces, structural changes, transition, air pollution, Environmental Kuznets Curve.

Sectoral air emission development in the Czech Republic during 1990-2003

Pavel Machálek

Economic changes in the Czech Republic as well as in neighbourough countries during nineties influenced the emission produced by economic sectors. We illustrate legislation impacts and production growth or loss in sectors on the groups of certain industrial sources – these impacts could be supplementary (textile and wood industry) but also need to be mutually interlinked each other (metallic and non-metallic industrial processes). By using REZZO database (Register on air emission and sources), we compiled tables that compare emission levels, fuel consumption and production (value added) during the period 1993-2003. We look at the trends in order to analyse interlinkages between particular sectors and the sector development and enforcement of new legislation in the air quality area. Despite certain data problems, REZZO database can be used for an assessment of development in economic indicators.

Key words: Air emission, emission sources, economic sectors.

Contexts of economic, environmental and social development

Slavoj Czesaný, Michaela Spejchalová

In 2004, the Czech government approved a document dealing with the strategy of sustainable development. Its starting points include a new extended concept of sustainable development. In the modified approach, the starting point of the strategy is the need to ensure a balance in economic, social and environmental development.

In this connection an important task is to form an adequate set of indicators that would map the character of contexts and risks of development sustainability among its main pillars. Based on this challenge, two sets of indicators have been composed. The first set of indicators is mapping the connections between the development of economic and social pillars. These are relation-type indicators, where the economic pillar represents the movement of VAT or work productivity, to which indicators characterising social development are allocated. The purpose is to determine the degree of discrepancy or risk of sustainability in prevailing tendencies. Relevancy and data availability were criteria for the selection of indicators. In the set of indicators there are presented particularly the characteristics of the standard of living, e.g. household consumption, real wages, social expenses, and the rate of unemployment, which are measured against the sufficiency of economic output. Attention is also focused on long-term trends in the development of relations between incomes and expenses of pension and health care systems. In some examples, the position of the Czech Republic is again given as it issues from international comparisons. The other set of indicators is intended for monitoring the influence of economic growth on the environment. The purpose is to determine the nature of the deviation of the curve of economic development from the curve of the degree of air and water pollution. In the set, sector indicators are also represented showing environmental load by means of characteristics of energy, material and transport intensity. To complement the knowledge about development trends in the Czech Republic, information on international comparisons is also allocated that enables one to signal the position of the Czech Republic, and at the same time the degree of deviations from the standard achieved within the EU.

Key words: Sustainable development, indicators, pillar linkages.

Decomposition analysis of air pollution reduction in the Czech Republic: focused on driving forces of environmental pressure changes during the transition

Jan Brůha, Milan Ščasný, Pavel Machálek

This paper focuses on the quantitative assessment of the main possible driving forces of changes in environmental pressure due to air pollution in the Czech Republic during the transition. We focus on the relation between economic performance and main air quality indicators – SO_2, NO_x, C_xH_y, CO, particulates, and GHG emissions – at a macro and sector level in 1992-2003 in the Czech Republic. Firstly, we provide a brief qualitative assessment of air pollution and the main driving forces, particularly structural, economic and legislative changes possibly influencing emission levels. Then, we do a quantitative exercise in order to explain changes in air emission levels. Doing that, we decompose the change in three effects: "scale", "composition" and "intensity".

We find that after controlling for the scale effect, changes in emission levels were firstly caused mainly due to a change in economic structure, and then followed by the intensity effect. The change in the composition of economic performance led to non-GHG emissions reduction in almost all years, except for the years 1996 and 2002, while reduction in SOx and particulates was driven mostly by the intensity effect during the years 1997-2000. This drop was at least in the energy sector influenced by environmental regulations. Next we aim to provide an explanation of the main driving factors behind the change in intensities within selected sectors. We focus particularly on factors such as end-of-pipe installation, change in (energy) inputs and/or change in process. Using economic, energy and environmental (emission) data, we thus perform an econometric exercise to infer (model) the impacts of economic variables such as environmental and total investment, factor (labour and capital) productivity and autonomous technology diffusion and energy consumption on the intensity effect in selected sectors. We find that environmental investments in manufacturing mattered only for a part of emissions, and for those with a limited impact only. The fall in emission intensities was associated with an increase in capital or labour productivity (or both), suggesting that the productivity increase experienced by Czech industry has been resource-saving rather than resource-using, while the potential of autonomous technology diffusion to reduce emission has been almost exhausted.

Key words: Decoupling, driving forces, structural changes, transition, air pollution, Environmental Kuznets curve.

Linking indicators between levels of government: Sustainable development indicators with a regional perspective

Peter Meadows

Sustainable development indicators are often focused entirely on the national perspective. One remaining question is how to link national indicators and regional indicators. Statistics New Zealand undertook to align key national and sub-national interests to develop a set of indicators to holistically measure the components of sustainable development.

National and sub-national outcomes are similar in a very broad sense, though the perceptions are quite often diverse in what they mean. The perception is that a national indicator such as GDP is not useful at a sub-national level unless some efforts are made to 'regionalise' that indicator. Recent legislative changes within New Zealand have necessitated some urgency in conducting this exercise as district and regional councils need to report on their progress towards sustainable based outcomes by June 2006.

Statistics New Zealand led a series of workshops with central and local based government in 2005 to determine which national indicators were relevant at a sub-national level. Some of the obstacles in this process were bringing different perspectives together, coordinating silo based efforts to measure particular well-being in an all sustainable development context, and what to do about those indicators that could not be disaggregated to regions using the current methods.

The solution resulted in a reporting framework designed around local government outcomes that was framed in a similar context to the United Nations Sustainable Development Indicators Framework. This initiated a range of programmes designed to enhance the listed set, developed analogues for those indicators that were characteristically national, and aided the development of concepts around monitoring sustainable development in a broad sense.

This paper will discuss some of the key issues facing New Zealand in monitoring sustainable development in a regional context. Some discussion will focus on the development of a regional set of progress-based sustainable development indicators and outline some of the work that is still needed to complete the set.

Key words: SDI, regional policy, alternative measures, well-being.

Relationship between lifestyle and municipal waste discharge based on material accounting in households

Naohiro Goto, Michio Ubaura, Junzo Tachibana, Chiho Oyabu, Toshiharu Sugihara

One of the problems of a sustainable society is to reduce municipal waste. Municipal waste is difficult to recycle because it is not very uniform and is discharged in a wide-spread manner. So, to reduce municipal waste discharge from individual houses is required. Countermeasures for such a reduction depend on the individual's lifestyle, but lifestyles are difficult to change. The objective of this research is to find out the effect of some countermeasures on waste discharge reduction. We especially focus on input-output relations in households. The relation is one indicator to explain the quality of life and sustainable development.

We surveyed product input and waste output in 500 families for two weeks in the Aichi prefecture, Japan. In the first week we asked the families to spend as usual. In the second week we divided the families into two groups and asked them to take two countermeasures, respectively. One was to check what food was in their refrigerator before shopping (Refrigerator check group) and another was to cook ecologically, which means cooking with less waste (Eco-cooking group).

The results show the two countermeasures have an effect on reducing municipal waste. The refrigerator check group reduced waste from 385 g/day family to 354 g/day family. They also reduced purchased amounts from 1365 g/day person to 1155 g/day person. The ratio of waste discharge to product purchase changed from 28% to 30%. We analysed the relationship between material input to the family and waste discharge from the household. On the other hand, the Eco-cooking group reduced it from 365 g/day family to 336 g/day per family. The reason why Eco-cooking has an effect is that a reduction in cooking waste is mostly compared with leftovers and expired use by dates.

Though 60% families succeeded in reducing waste, 40% failed. Apart from the material measurement survey, we asked the families to answer quaternary. A question of which answer is the most different between the successful group and failed group is whether the family tries to have a meal together. When a family has a meal together, preparation and washing up could be done effectively. So the family was able to reduce kitchen waste.

We conclude that material accounting in households could be an indicator which explains sustainability in the household.

Key words: Municipal waste, household, material accounting, refrigerator check, eco-cooking.

Working Group 4

Environmental accounting and reporting at the micro level

Paradigms, strategies and stages of environmental reporting

Jette Egelund Holgaard, Tine Herreborg Jørgensen

The aim of this article is to analyse the concept of environmental reporting and develop some strategies for putting the concept into practise. First, the conceptual development of environmental reporting and its relation to financial and social reporting will be elaborated. This is done by introducing three paradigms of environmental reporting: marginalised environmental information, standalone environmental reports and holistic reports relating environmental issues to economic and social aspects of sustainability. After that, different strategies for standalone environmental reporting are presented to illustrate variations in companies' perspectives on environmental communication, e.g. as a reaction to specific demands from the outside, as an integrated activity of environmental management and/or as a means to strengthen stakeholder relations. The three strategies present different levels of ambition in a company's environmental reporting practise, and the stages of achieving these levels of ambition will finally be discussed in relation to the reach, form and content of environmental reports.

Key words: Environmental reporting, business strategies and levels of ambition.

Standardization of environmental reporting in the Czech Republic

Jiří Hřebíček, Lukáš Kokrment

This paper is devoted to the standardization of environmental communication. Corporate environmental reporting is the part of environmental communication that is directed from the company to various target groups. Nowadays, corporate environmental reporting has evolved into sustainability reporting, which covers a wider area of the company's performance, including economic and social aspects. This paper describes what corporate environmental and sustainability reporting is, it mentions some standards in this area and also the benefits of reporting for companies. Some new trends in the area of corporate reporting are presented – Internet and cross-media reporting, customization and standardization. We would like to pay special attention to the situation in the Czech Republic. Next we present an information system, its structure, design and implementation, which should simplify the process of corporate reporting for both companies and report readers with respect to the trends mentioned before.

Key words: Communication, environmental and sustainability reporting, information system, standardization.

Evaluation of sustainable development at the corporate level

Jiří Študent

The paper informs about science and research project no. VaV-1C/4/13/04 being solved by CEMC and CENIA entitled „*Application of environmental accounting at the microeconomic and macroeconomic level"* It is aimed at a segment of research dealing with the evaluation of sustainable development at the level of an organisation. Current methods of evaluation are based on generally accepted definitions on the theorem of limited resources, and according to the author's meaning, this method does not enable an objective view of the significance of entrepreneurial activities on sustainable development. That is why the Simonian concept is used, which extends the traditional evaluation of sustainable development by the factor of human potential embodied in the competitive ability in business.

Key words: Environmental accounting, sustainable development.

Using information and communication technologies in enterprise unified reporting

Josef Fiala, Jan Ministr, Jiří Hřebíček

Conditions of information support for the system within unified reporting can be divided into two basic areas: *external*, which ensures communication of the organisation as a whole with its environment, and *internal,* which ensures communication of the implemented information subsystems and the people within the organisation itself. The field of environmental information of an organisation is a privileged and protected special sphere with respect to the nature of trade secrets and know-how. Nevertheless, it is a part of its sustainable development, and also a part of the development of a region in which the organisation operates, as well as of the whole Czech Republic.

The EU policy in the ICT area is formulated in the EU action plan „Electronic Europe – an Information Society for Everybody", and together with the action plan of the Czech Republic for the use of information and communication of technologies, it supports the greatest possible use of contemporary information and communication technologies (particularly Internet and Intranet technologies) as well as the implementation of standardised information subsystems of EMS and EMA, and with the assistance of these, one can determine and evaluate suitable EP indicators that will be e.g. inputs in the managerial subsystem of a given company. This will enable the company management to better fulfil EP criteria, and continuously improve the environmental behaviour of the company at the same time.

Providing information about the environmental profile (EP) has been voluntary so far, nevertheless it can significantly support environmental democracy and the company's competitive ability on the market.

Key words: Information, EMS, EMA, EP indicators.

Contribution to the problems of environmental accounting in Czech enterprises

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The work is based on the evaluation of approaches to the use of environmental accounting in our country and abroad. Research results that had been obtained so far are analysed, as well as methods suitable for the conditions of Czech enterprises. The research proper is aimed particularly at environmental managerial accounting (EMA) as a tool for corporate managerial decisions. The work presents the results of a pilot research project and questionnaire enquiry in Czech enterprises of different orientation, and targeted at small and medium-sized enterprises. These companies need special assistance for EMA formation as a tool for environmental management system, which must be created for particular the company and industrial sector, not as a general solution only. A formal framework for the system of environmental management is ISO 14 000 and EMAS standards, but numerous companies, particularly SME, have a number or reasons for not accepting these concepts for the time being. If EMA is intended to support environmental management, then it is necessary to analyse the reasons for low SME interest in management according to ISO or EMAS standards. Critical assessment of the reasons of insufficient implementation of environmental accounting elements is presented with regard to the needs of environmental protection as well as in connection with the effectiveness of manufacture and the competitive ability of SME. There have been formulated possible kinds of relief for companies with established EMS in connection with requirements of the state administration (inspection and reporting duties). Research works are combined with verification of the possibility of the application of UMBERTO software. This is used particularly for material and energy balances, and it has been used in analyses in the field of environmental accounting.

Key words: Environmental accounting, enterprises, environmental management systems.

Using environmental managerial accounting (EMA) within the framework of investment projects

Jaroslava Hyršlová, Miroslav Hájek

Evaluation of investment (therefore the phase of financial evaluation of investment projects) represents one of the most important managerial activities. Because investments often predetermine the development of an enterprise for many years to come, making these decisions is a strategic matter. Omitting to do so or not doing so in time, e.g. investment connected with prevention of pollution, can result in increased costs in the future. It can be seen from historical development that environmental problems often arise very quickly, and can be connected with significant changes in the entrepreneurial environment, which move development towards higher eco-efficiency. Particularly the speed of these changes gives the strategic importance to environmental projects for enterprises. Within the framework of investment decisions, it is therefore necessary to take into consideration all potential and strategically relevant aspects of investment. The decision making must also include the opportune cost of unrealised environmental protection that represents a loss of benefit arising from environmental protection, which is particularly connected with corporate costs. Projects connected with environmental protection can induce additional effects that may be difficult to measure. They can be linked to future benefits that are strategically relevant, and which can be many times higher than benefits in the sphere of environmentally induced costs. Information about the economic consequences of an impact of enterprise activity on the environment (provided by EMA system) plays an important role in decisions about investment. Evaluation of investment projects must comprise information about all costs, possible cost savings and other benefits directly connected with the evaluated project. Cost allocation is a factor of great importance for investment decision-making. In case a wrong approach to project evaluation is taken, and if particularly long term effects are not correctly assessed, then a project can be rejected that could bring the enterprise effects in the economic area as well as in improvement in its environmental profile.

Key words: Environmental managerial accounting, investment projects, investment decision making.

EMS and EMA in practice

Petra Mísařová

At present, the responsible approach of the enterprise towards the environment is nearly a must for entrepreneurial success. EMS is used for the interconnection of different activities into one, and if possible, a complete system of control processes, operating procedures, documentation and records in such a way that the system of management as a whole ensures a constant reduction of environmental risks.

The decision to implement and to have certified the system of environmental management according to ISO 14001 or to verify it pursuant to EMAS programme requirements, must not be seen only from the point of view of the improved image of the enterprise but it should be considered as an environmental investment. The basic idea of these ISO 14000 international standards is to encourage and direct enterprises in all spheres to active and independent behaviour in all environmental matters. The European EMAS programme was prepared on the basis of Council Directive (ES) no. 1836/93, and came into force in April 1995. One of the many requirements that enterprises must fulfil to satisfy all of the EMAS rules is implementation of the monitoring of environmental finance flows. The organisation must create and maintain procedures for monitoring environmental finance flows with the aim of implementing environmental managerial accounting. EMA can be defined as the identification, collection, analyses, and use of information about material and energy flows, environmental cost information and other information about costs for environmental decision making in an enterprise.

ŽS Brno, a. s. – a joint stock company - is the successor to state enterprise Železniční stavitelství Brno. Now, ŽS Brno, a.s. is the most important subsidiary of ŽPSV Uherský Ostroh a.s., which is now controlled by a significant Spanish entrepreneurial group, OHL. Following the changes in the organisational structure of ŽS Brno a.s., the company is organised in the form of specialised enterprises, and all of the enterprises have a validated EMAS and are registered in the register of Czech organisations with EMAS:
☞　Železniční stavitelství (Railway Building) (registration 24.6.2004),
☞　Mostní, silniční a inženýrské stavitelství (Bridge, Road and Underground Services Building) (24.6.2004),
☞　Civil engineering (24.6.2004).

This organisational change is aimed at company rationalisation, increased effectiveness, reduction of overhead expenses, increase in individual enterprises' authority, and responsibility for the effectiveness of management. At present, the company monitors and assesses environmental costs and revenues. During the implementation of EMAS II, the company implemented in its internal information system, according to approved methodology, the monitoring of environmental costs and revenues - so-called environmental accounting. The company has accounts for the monitoring of environmental costs included in the chart of accounts. Within the whole joint stock company a uniform chart of accounts is used. The company management considers information about environmental costs as useful, particularly in connection with the systems of environmental management.

Key words: EMS, EMA, EMAS, ŽS Brno, a.s.

Mass and energy flows in consequences of company environmental accounting

Miroslav Farský, Martin Neruda, Roman Neruda

During the implementation of an environmental accounting system in a company, one of the most important pieces of information to obtain is a detailed understanding about material flows (raw materials, semi-finished products, final products and wastes) and flows of different types of energy inputs (buying, selling and wastage) when thinking about the consequences on the company. The authors, in the article: 1) study the question of the quantification of the flows, and the accuracy of their measurement, 2) provide an environmental accounting statement, with help of standards and indices, statistical trends analysis.

Key words: Material flows, energy inputs, environmental accounting, enterprise.

Tracing material flows on industrial sites: advantages, possibilities and linkages – a case study of the largest exporter in Hungary, the AUDI HUNGARIA MOTOR Kft

András Torma

The aim of Material Flow Analysis (MFA) is to reveal and analyse the interrelationship between the economic and the environmental sphere, so-called „industrial-" or „societal metabolism" in an accurate way. This analysis could be carried out at the micro- and macro-level, too. Of course the different levels assume different approaches and data demands, but the same methodology. The economy-wide MFA offers the possibility for decision-makers to reveal the structure of „industrial-metabolism", the changes in this structure and to quantify environmental burdens. Another possibility is to build up new environmental and economical/environmental indicators and to compare these generated indicators with other aggregated indicators such as GDP or the unemployment rate. With the help of this informational basis, decisions affecting the economy could be grounded more adequate. An MFA on a micro-level offers the possibility for decision-makers of the company to ground the decisions affecting the company-operation and the company-environment interface in a specialist way. The aim of this study to verify that the MFA could be applied effectively on an industrial level and its methodology is the same as the logic of the economy-wide MFA. In the course of the analysis the „bottom – up" approach could be applied, which logical order is the following. The lowest level touchable with MFA is the level of individual processes. The mapping of material flows at this level could contribute to judging the operation and efficiency of these processes.

Material flows can be defined on the level of the products, which are also the outcomes of the processes mentioned above. This material flow could be quantified with the help of the Life Cycle Assessment (LCA). This analysis is wider than the normal action of a company because it evaluates the material flows throughout the whole life cycle (from cradle to grave). The individual processes and product-lines could be classified into technologies (for example: engine production, vehicle manufacturing, etc.) with material flows arising from the multiplication of material flows of individual processes and on a parallel way from the multiplication of material flows of individual products. One level higher per multiplication of the material flows of the technologies, the Input – Output account of the whole factory, which is the best indicator of the company operation and effectiveness, could be quantified. On the other hand, the possibility is available to trace and quantify the flows of individual substances in production, too. Multiplying this information on the level of the national economy, an economy-wide MFA could be obtained. In other words, the material flows of the process- or site-level of the several economic elements form the grounds of the analysis on the macro-level.

The information evaluated this way could be used in several fields, namely planning, development, process organizing, resource-efficiency, building up the company strategy, and it could also be integrated into the accounting system, possibly into the green-accounting system of the company. Other relations could be defined with other management systems, which use the outcome of such analysis as an information base and could also form an information basis for such analysis.

The MFA, as the former analysis shows, is a very efficiently applicable tool which gives more adequate knowledge of the operation and fitting into the environmental system of the individual economic elements, and could even help to ground the decisions related to the economy-ecology interrelationship on a professional and quantified way.

The basis of this study is the analysis of the practical application of this methodology at AUDI HUNGARIA MOTOR Kft., the company with the greatest level of exports in Hungary, on the company indicator-system which the base of such an analysis is, the weighting of the outcomes and the proportioning of outcomes into the environmental and sustainability goals of the company.

Key words: MFA, environmental indicators, LCA.

Participative and integrative techniques to improve multidisciplinary communication: a precursor to producing sustainability profile indicators

Stefanos Dodouras, Peter James

Multidisciplinary approaches are a prerequisite for identifying sustainability profile indicators. Real-world situations are often ill-defined and involve vast amounts of vague data; factors which together weaken communication between players and stakeholders and make their management even more complex. Available data can vary in quantity and quality, and are often vague and empirically un-testable even though they are considered to be essential to accurately reflect the state of the different components of sustainable development. Given that sustainable development requires the integration of different strands of knowledge, and that sustainability frameworks do not always reflect the complexity of real world situations, it follows that there is a need to create a flexible integrated appraisal process in order to utilise imprecise information. This in turn will result in more efficient multidisciplinary communication and hence more informed decision-making processes. However, the real world is full of irregularities and complexities and the main point might not be whether the real world is complex, but how to communicate the knowledge gained from different sciences. Using a case study based on the 2004 Olympiad, the authors reveal that the concept of sustainable development can become even more knotty when complex real world relationships are to be modelled. The employment of fuzzy concepts, as a soft systems methodology, was followed in the case study. The results obtained emphasised the importance of the continuing efforts to integrate multidisciplinary issues into the decision-making process. The fuzzy concepts employed added to the understanding of integrated assessment tools and contributed to the development of a new integrated appraisal system which considers real world situations and takes account of inherent uncertainty and leads to improved communication.

Key words: Sustainability profile indicators, complexity, communication, fuzzy concepts, integrated appraisal system.

New approaches in the evaluation of public investment projects in the environment

Jana Soukupová

Evaluation of environmental public investment projects has its specific aspects that are associated with the problems of sustainability, which are studied by environmental economics. Methods of evaluation of public projects analysis always meet with a basic problem, which consists in the pricing of environmental public goods.

In the paper, there are discussed special uni-criterial cost methods for the evaluation of investment projects taking into consideration environmental aspects particularly in the corporate sphere. It is important to state that the terms used in these methods are related to environmental accounting at the micro-level.

Key words: Environmental accounting, evaluation of investment projects, valuation of cost and benefit.

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