This summary paper has been issued for the attention of experts and institutions that are currently involved in determining and utilizing life-cycle-wide natural resource productivity data of materials, products, services and on aggregate levels. It is also hoped that this paper reaches potential future users of resource productivity data. Comments and suggestions are welcome. Please address yourself to:

Mr. Gert Irgang (Project co-ordination)

Factor 10 Innovation Network, Löwengasse 14, A-6844 Altach/Austria

Phone: + 43 5576-7408

E-mail: gert.irgang@gi.vol.at

Summary presentation of the ongoing study

"PROREGIS - Resource Productivity Registries"

A feasibility study by the Factor 10 Innovation Network for the
German Federal Ministry for Education and Research
and the Austrian Federal Ministry for Traffic, Technologies and Innovation

Willy Bierter, Giebenach/Switzerland
Gert Irgang, Altach/Austria
Christopher Manstein, Klagenfurt/Austria
Friedrich Schmidt-Bleek, Carnoules/France
with inputs by
Christa Liedtke/Germany and Manfred Wirth/Switzerland

Introduction

Massive translocation and removal of natural resources from the earth is the root cause of the ecological non-sustainability of present human economies. Therefore, radically dematerialized processes, products and services need be placed on the market in order to move towards sustainability. As each base/raw material used for constructing, using and recycling technical artifacts has its own geological and technical history, reliable data on their respective total material intensity - or their specific resource productivity from cradle to finished raw material - are indispensable. Similarly, resource productivity data on recycled materials as well as on aggregate national total annual material flows must become available on a routine basis.

The Factor 10 Innovation Network is currently studying conditions for collecting, generating, and validating natural resource productivity data - on behalf of the German research ministry and the Austrian innovation ministry (Factor 10 Innovation Network, 2000). The study is expected to be completed by the end of October, 2000. The results are quite likely the starting point for a European initiative to build up Resource Productivity Registries - PROREGIS centers.

The main tasks of the present feasibility study are:

- the specification of the various routine outputs and the overall tasks of PROREGIS;
- the description of various extra services that PROREGIS could provide;
- the cooperation of PROREGIS with other relevant national and international institutions;
- the estimated financial needs of a typical center;
- options for the organizational structure and legal status of such centers.

Indicators for Sustainability

In order to take directionally safe steps toward sustainability, economic and societal actors need simple and practical navigation instruments that measure the ecological impact potential of human activities, products and services. In order not to hamper international trade, these instruments need to be acknowledged by governments at an international level.

Navigation instruments must reflect the full story of values added and values lost - "from cradle to grave" - if serious errors are to be avoided. This is not a recent discovery. For example, sound purchasing and investment decisions were always based on Life Cycle Analysis (LCA) considerations. And so are education plans for children.

Today, more than 100 million enterprises produce some 6 million different products worldwide and perhaps ten times as many services every day. Products and services change continuously. They are consumed and used by 6 billion people, living in more than 200 countries and territories with different cultural backgrounds and varying geographical conditions. And just one single ecosphere supplies all the resources for humanity.

In order to progress toward sustainability it is therefore unavoidable to measure and compare the resource intensity - or the "ecological price" - of the performance of consumers, enterprises, communities, and countries, and in particular that of processes, products and services. Determining these "ecological prices" should - at least in principle - be as uncomplicated and reliable as putting an economical price tag on them. As long as this is not possible, discussions on sustainability remain academic, because what cannot be measured fast and efficiently cannot be managed, re-designed, and compared either - million and billion times each day.

A practical and widely accepted (set of) indicator(s) for determining ecological stress potentials must meet the following conditions: It should

- apply to all processes, goods and services alike - from cradle to grave;
- be satisfactory from a scientific point of view;
- be easy to handle;
- be cost-effective and time-efficient in its application;
- yield directionally correct answers;
- build a bridge to economic reality and theory;
- be applicable beyond political and geographic boundaries.

Factor 10, MIPS and TMF

To solve the problems before us, a radical cutback in global resource use is unavoidable (Schmidt-Bleek, 1993; Factor 10 Club; Schmidt-Bleek, 2000; Carnoules, 2000). The same is true for energy, as long as it derives from converting natural materials into heat. A Factor 10 increase in resource productivity has been intensively discussed and widely accepted during the past 8 years as a reasonable first "landing place" for the future. Many experiences in industry show that this goal is reachable without loss of end-use satisfaction, probably within one generation (Fussler, 1996; Schmidt-Bleek/Manstein, 1999; Hawken, 1999). The resource intensity of any economic output can be expressed as Material (including energy) Input Per unit of Service or per unit of extracted value, the MIPS. The resource productivity is expressed as S / MI. Since LCA conditions apply, all translocations of natural resources leading to the finished product, its use, maintenance, re-manufacturing, etc. have to be considered. The hidden materials that are not imbedded in the finished product - and yet needed for its production and use - is its "ecological rucksack".

Each base/raw material has its own technical history, involving natural materials that were used up or cast aside in the process - its "rucksack- or MI- factor". Rucksack factors for non-renewable materials reach from 1.2 for natural gas, 7 for steel, 8 for PVC, 85 for aluminum, 140 for nickel, 500 for copper, all the way to 540 000 for gold. With the help of MI-factors, the rucksacks of finished products can be calculated straightforwardly. The ecological stress potential per unit output of functionally equivalent products can be directly compared. With these numbers, too, relative tax rates for natural resources can be constructed as well as custom duties for finished products. MI-factors are indispensable for eco-designing - or re-designing - processes, products and services.

MI and MIPS could be considered as entry points for more elaborate eco-balance computations on the micro level (processes, products, services). And Total (national) Resource Flows - TMF - are required in order to monitor the success of eco-policies on the national, regional, or global level. Rucksacks have to be included in both cases (Bringezu, 1993; WRI, 1997). If rucksacks are not included, the ecological impact potential has not been considered on a cradle to grave basis.

The key to ecological success is to use as little natural resources as possible for producing useful outputs. For this, no technical fixes exist. System solutions, involving for instance the entire value added chain, are often particularly effective. And social choices can often be as valuable in saving resources as technical improvements. For instance, using a towel for three days in a hotel instead for only one day increases the resource productivity by a factor of three.

The Wuppertal Institute, the Factor 10 Innovation Network as well as Dow Europe have determined the system-wide resource productivity (material-input) factors for many base materials and chemicals (see for example: http://www.wupperinst.org/projekte/mipsonline). All of them must be re-evaluated and validated from time to time.

During the past few years, the Factor 10/MIPS-Concept has been applied in far more than 100 small, medium and large enterprises. Software programs have greatly simplified on-the-spot decision making. This has led to new eco-intelligent and in many cases surprising products and services. In addition, astounding synergies in areas such as creativity, communication and cooperation among employees were observed and frequently the management structure changed almost by itself (Lehner/Schmidt-Bleek, 1999; Schmidt-Bleek/Manstein, 1999).

First conclusions

Resource productivity factors for new materials must be established on a continuing basis. Existing resource productivity factors can also change over time because they depend on economic conditions, innovations (dematerialization), processes, transport intensities, as well as on geological and geographic realities. Therefore, they must be periodically re-evaluated.

From a scientific as well as from a practical point of view it appears necessary to establish registries for resource productivity factors. We call them PROREGIS - Centers for Resource Productivity Factors (Factor 10 Innovation Network, 2000). These centers could perform the following tasks:

1. Continued development of the theoretical and practical basis for computing resource productivity information and applying it in practice;
2. Publication of manuals describing the theoretical bases and practical application of resource productivity factors in different languages;
3. Regular re-evaluation of existing and the computation of new material (MI), and area (FI) input factors for raw materials;
4. Anual computation of total material flows (TMF) for countries, and where appropriate, also for other economic units;
5. Publication (e.g. through the internet) of validated resource productivity factors as well as TMF data;
6. Computation and publication of (regional) MI- and FI- factors for standardized food- and feed stuff as well as standardized building parts, intermediate products etc.;
7. Co-operation in and support of activities to evaluate and compare ecological, social, and economic progress of enterprises, communities, countries, and regions;
8. Upon request and payment, computation of ecological rucksacks of services, products, buildings, infrastructures etc.;
9. Upon request and payment, support of designing novel services, products, buildings, infrastructures etc.;
10. Upon request and payment, co-operation with and practical support of consumer groups, communities, enterprises, governments, international organizations, standards organizations and institutions to teach them to apply resource productivity factors in their work;
11. Upon request and payment, carrying out training courses for the computation of resource productivity factors and MIPS values, as well as for the design of advanced products, services and systems solutions;
12. Upon request and payment, the carrying out creativity and innovation workshops;
13. Upon request and payment, carrying out training courses for effective and socially conscious management;
14. Upon request and payment, carrying out studies that generate data for fiscal reforms, custom duties, certificates, labels, R&D priorities etc.;

15. The co-operation and exchange of data with other PROREGIS institutions and with institutions that perform comparable tasks and goals.

As was indicated already, resource productivity factors for identical base/raw materials may differ, depending on regional and local conditions, and they may grow or diminish with time.

For these reasons it seems useful to establish regional PROREGIS centers, well interconnected with all others and exchanging data on a routine basis. It would also seem furthermore appropriate to establish central PROREGIS institutions, for instance for the EU and East Asia, and perhaps later on a global basis. This should ensure an overview of local and regional developments, and prevent unwanted disruptions of international trade.

It may also be desirable, for instance, to agree internationally upon average values for resource productivity factors for the comparison of functionally equivalent goods and services. Deviation from such average values, for instance when high percentages of recycled materials are employed or particularly efficient processes are involved, should be admissible as long as they can be substantiated.

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