ECONOMIC SUSTAINABILITY CAN ONLY BE REACHED IF THE PRODUCTIVITY OF NATURAL RESOURCES IS RADICALLY INCREASED

by F. Schmidt-Bleek

(1)About Achievers

The collectors and hunters of the post ice age needed some 2-3 hours daily for meeting their needs. In spite of uncertain and occasionally dangerous circumstances they can be counted among the well-nourished human beings. They had much more free time than we have today. For them time was life, not money. They could not become unemployed. They had only few enemies. But they did not live very long, and many succumbed to lack of health care and the uncertainties of nature.

The pro-active ones among them – the achievers – felt some 12 000 years ago that they had to improve the conditions provided by nature. They began to harness animal power, to build shelters and produce food. They began to invent increasingly sophisticated technology - service delivery machines so to speak - like plows, and wheels for transporting heavy objects and for irrigating fields.

Increasingly they "subdued the earth", as the German translation of the Bible demands [1]. They claimed the right to transform the surface of the earth according to their desires and hopes. To be or not to be they thought was their decision for all creatures and plants surrounding them. Thus they began to alter the competition among nature's constituents and exert influence upon the evolution of the biosphere.

Is'nt it wondrously remarkable that economic success in our competitive economy today has at its root the suppression of competition in nature?

The urge of the "achievers" never abated. In fact, it quickly rose with the inventions of Watt, Diesel and Benz more than 100 years ago. It seems as if their success keeps spawning want for more and ever more. Today, one of five among a still growing world population enjoys an astoundingly healthy, secure, and materially rich quality of life.

The gap between rich and poor, however, widens.

(2)About Life-Sustaining Services and Functions

Protecting the environment means to preserve the eco-system services and functions of the ecosphere that are essential for all life on earth. These functions and services include for instance the availability of liquid fresh water and unpolluted air; of a range of elements, minerals, and metals; of a high level of biodiversity; of edible plants and animals; of productive seeds, sperms, and soil; of a moderate temperature range on the surface of the earth; and of the protection against radiation from outer space.

Services of nature cannot be generated by technology on any noticeable scale. Services of nature are indivisible and cost-free available to all humans around the globe. If they could be traded on the market, they would obviously carry an infinitely high price.

But services of nature are vulnerable to human economic activities. The root cause for these changes is the indiscriminate and pernicious use of natural resources [2]. Already today, consequences thereof can be observed, e.g. massive soil erosion, water shortages, desertification, loss of species, and climatic changes, including increasing catastrophic events like hurricanes and floods. All humans suffer the consequences of eco-system changes, and a few gain, irrespective whether they caused them or others.

On average, Germans consume some 60 tons of natural material per year, including fossil energy carriers and uranium ore, and about ten times more water. Japanese do with 40 tons per year and others, like the USA and Finland, range among the top "achievers". Western countries have developed a style of life that can survive only for a limited time on our limited planet earth. Globalization the western style of life would require the existence of more than two planets earth as resource bases. Obviously, sustainability of civil society and viability of industry are possible only if we learn to produce more with less nature.

Some equate the worldwide need for „producing more with less" with a "Green Growth/Low Carbon Economy" [3]. As material growth on our limited planet earth has already passed the ecological safety limit, it would be useful if these authors defined the kind of growth they have in mind. Perhaps they should also note that a "low carbon economy" is not a sufficient condition for a sustainable economy. Already today the threshold of ecological risks has been passed while some resources become scarce. The number of natural disasters increases, biodiversity suffers huge losses, fertile soil erodes at a speed never observed before, climatic change is becoming a global experience, agricultural land is being lost due to sinking ground water levels, desertification and the construction of buildings and infrastructures. The Sahara has arrived in southern Spain and the dunes of desert 70 km north of Beijing.

Comparable changes as those observed today are known to have occurred during earth's history. With few exceptions, however, they developed over millions of years and the biosphere had millions of years to adapt. While we are powerless vis à vis great natural shifts and events, we should have the wisdom to protect the environment as we are used to from wanton human activities with unknown consequences.

(3)Policies That have Failed Us

Traditional economic, finance and environmental protection policies have not been able to protect the life-sustaining eco-system services and functions. And they cannot be expected to be more successful in this regard in the future. The framework conditions of our economy are not designed to fit within the laws of nature. The politically influenced powers of the market lead in the wrong direction, not only in the world of finance [4]. Leaders of civil society worldwide have so far chosen to ignore the urgent need to adjust the framework conditions of the economy.

With today's policies, sustainability cannot be reached.

And yet we should not forget that our traditional environmental protection has brought about essential improvements in the past 40 years: clean lakes and rivers, effective waste disposal technologies, clean air, healthy drinking water, fewer toxic substances, and more. And beyond any doubt we will depend on some cleaning up policies also in the future, particularly in cases of unexpected toxic or eco-toxic episodes. However, such measures tend to be expensive and have nothing to do with precaution. And quite a few require the investment of additional natural materials and energy.

The following story indicates why traditional policies cannot lead to a sustainable economy:

During New Years Eve of 1998 I tried to convince Stash Shatalin, chief economic advisor of president Gorbachev, to introduce our western approach to environmental protection to the Soviet Union. "Nyet" was his answer. And he reasoned that it would be better for

his country to get rich first through introducing a market economy, and then take care of the environment "just as you have done in the west".
This meant that if the relatively rich Soviet Union could not afford to protect the environment, some 150 other countries would have similar problems. They would have to produce more pollution, wastes and toxics first in order to be able to then afford the introduction of "environmentally friendly" measures. Modern China is a typical example. And this in the face of the "sustainability declaration" of the United Nations Rio Conference in 1991! [5]
Apparently we had developed in the west a less than convincing strategy for producing wealth in harmony with nature.
And yet, the official environment protection policy in western countries has essentially not been changed since its beginnings. We still haste from one emission problem and waste recycling ordinance to another without seeking to clarify first the basic, the systemic inter-dependencies between the economy and the ecosphere. We still treat symptoms instead of beginning to eliminate the root cause for the fact that today's main stream economic model makes human beings prisoners of a civilization that more or less forces us to destroy the ecosphere in order to live.
Take climatic change for example. Yes, it is a very serious threat to our future and must be slowed down or stopped as quickly as possible. But to approach it largely as an energy (CO_2) problem is a scientifically indefensible shortcut and cannot lead to sustainable solutions. The roots of climate change rest with the simple fact that we are putting into motion huge streams of natural materials, vast quantities of water and using much land for everything we produce, and in particular for generating, transporting and saving energy. Moreover, climatic change is also related to other human activities, for instance to the food we prefer, its production and preservation, its packaging and transportation.
The real task is to generate desired wealth and wellbeing with a minimum input of natural resources.
Climatic change is not the only serious consequence of our economic preferences. The worldwide growing consumption of megatons of short-lived products due to wrong price architectures, and as a consequence of perverse subsidies, the massive losses of top soil through man-made erosion, gigantic pollution of oceans with plastic packaging materials, the disappearance of fish populations and rain forests, the wide-spread shortages of water due to its indiscriminate and pernicious use are among the other worries.

To put it in simple words: even if the nations of this world would agree to control climatic change - in spite of the Copenhagen disaster involving tens of Thousands "experts" -, we would not have reached sustainability by a large margin. Correcting the signals send to the market by our present economic model is the most urgent task, not investing resources in fighting additional symptoms of its failures. The damages to the environment imposed by our economic system are not externalities of a well-conceived wealth production machine. The machine in its present form is itself a destructive externality to the natural system on which it depends.
Before I suggest ways to reign in the pernicious use of nature, I will turn to the question of how to measure consumption of nature and how much we have to increase the material productivity in order to approach sustainability.

(4)Of Rucksacks and MIPS
20 years ago I pioneered the model of switching our attention away from solving isolated environmental problems at the exit side of the economy but rather focus instead on what and how much we put into the industrial metabolism. One of the keys to reaching sustainability, I claimed, was to drastically reduce the overall quantity of resources taken from nature, and thus the improvement of the resource productivity of each product, process, and service in the technosphere [6].
I believed from the beginning that the following conditions were paramount for the models' success:
Wellbeing in the future must be comparable to that enjoyed in advanced societies today;
Reliable indicators must be available to gauge success and failure worldwide, and in particular the ecological quality of all processes, goods and services;
A reasonable goal for increasing the productivity of natural resources in physical terms should be agreed to;
Governments must act to adjust the price architecture and incentive structure on the market in such a way that eco-friendly decisions by producers and consumers became profitable options.
We know now that the first condition can be met by existing and advanced technology [7]. The EU has responded meanwhile with the following definition of eco-innovation: It „means the creation of novel and competitively priced goods, processes, systems, services, and procedures that can satisfy human needs and bring quality of life to all people with a life-cycle-wide minimal use of natural resources (material including energy carriers, water, and surface area) per unit output, and a minimal release of toxic substances". (Reid, Alasdair, Miedzinski, Michal (2008), EUROPE INNOVA, Final Report for the EU Sectoral Innovation Watch Panel on Eco-Innovation, www.europe-innova.org).
For fulfilling the second condition above, I proposed in 1990 the "ecological rucksack", MIPS [8], and TMF, the Total yearly Material Flow passing through an economy. These units were analyzed, detailed and developed further by my very competent coworkers at the Wuppertal Institute beginning in 1992 [9]. The Factor 10 Club with its internationally highly acclaimed Members agreed to the basics of the model and published accordingly [10]. World known individuals like Gro Harlem Brundtland and Nelson Mendela consented as "listeners" to the voice of the Club.
The ecological rucksack of a product contains the complete material input MI (including energy) needed for its manufacturing from "the cradle to the point of sale", minus its own weight (own mass). The amount of water consumed is counted separately. The rucksack of a product could be taken as the ecological equivalent in Kg of its price in monetary units. The prices on the market are not now in tune with ecological rucksacks, they „do not speak the ecological truth" (Weizsäcker). Considering the respective rucksacks (without considering water), one kg of a mid-sized car for instance is sold for about 50 cents/Kg of natural material, a simple GPS system for about 3 cents/Kg, a gold ring for about 1.7 cents/Kg, and gravel for about 0.01 cents/Kg. According to this selection of products on the market, an hourly wage of 8 Euro is worth from 16 to 800 Kg of natural material.
MIPS is the life-cycle-wide Material Input Per unit of Service (value

or utility) consumed in Kg. MIPS includes the total amount of energy consumed in kg fuels, or calculated by MIPS in kg for electricity, biomass, and geo-thermal energy.
For example, MIPS for a mid-sized car per Km amounts to about 500 grams (water not counted), of which less than 20% is due to fuel consumption. The major part of MIPS derives from the cars' production, maintenance, and spare parts. Thus it becomes clear that the "CO2 Footprint" is not a reliable ecological quality indicator [11], particularly, because a multitude of marketed products depends little on the emission of CO2, such as a carpet, a football field, a super highway, or the cathedral Notre Dame de Paris [12]. Car-makers – indeed producers of goods and service providers in general - should obviously utilize MIPS, the "material-footprint" [13], when designing advanced goods and services. Laws, regulations, levies, and subsidies etc based on "CO2 Footprints" may not be supportive of the environment, as the skewed arguments in favor of nuclear power plants for "CO2 free" electricity generation demonstrate. Already in 1994 Christopher Manstein (manstein@chello.at), a former coworker of mine at the Wuppertal Institute, computed MIPS for close to 20 different electricity generation systems and found that MIPS for electricity from nuclear power plants corresponds roughly to that of hard coal fired plants, without even considering the resource intensity of nuclear waste disposal.
Material productivity can be expressed as the inverse of MIPS, namely S/MI. It is the unit of good or service (value or utility) that is obtained trough the life-cycle-wide sum of all material inputs for producing the good generating a service, including those masses needed for providing the energy.
The magnitude of MIPS for a specific S does not depend upon the choice of any particular technology, it is "technology blind". Eco-innovation, focusing on providing s u s t a i n a b l e welfare, therefore goes beyond improving existing technical, social, and economic solutions. It opens the door to a whole new technical world and life styles.
The desirability of a specific product, service, value or utility S, depends upon the cultural and historical background, education and experience of people in various parts of the world, and it may change over time. On the other hand, the quantity of nature invested for each S is universally measurable and concerns the whole limited planet earth as the common resource base for all people.
There is a little story that should show the reader that she or he, too, can influence the magnitude of MIPS, even without any technical help: Living in a hotel for 3 days you can decide whether you will use the towels provided for 3 days, or get fresh ones every day (for which you actually pay). If you keep them, you have increased the productivity of using these towels by a factor of 3, that is by 300%! This simple example should also convince the reader that it is well worth considering to hold on to functioning equipment etc as long as repair cost do not begin to be seriously affecting its "COPS", the "real COsts Per unit Service from cradle to cradle".
On assuming their offices, the President and the Chancellor of Germany take the following oath: "I swear that I will dedicate my efforts to the well-being of the German people, promote their welfare, protect them from harm, ……., and do justice to all." [14] Because the promotion of sustainable welfare S is possible only when simultaneously lowering MI, the basic law of Germany calls for dematerializing the economy to the extent that the Government pursues

sustainable economic conditions.
NOTE I: Radically dematerializing the human economy yields a high reduction of energy needs "as a side effect". For this reason, dematerialization policies should be considered at least as urgent as the present efforts to lower CO2 emissions.
NOTE II: Todays' environmental policies that focus predominantly on energy and CO2 emissions are hard to justify from an ecological or economical point of view.
NOTE III: Solving technology-caused long-term environmental problems by installing additional technology should be limited to cases of actual or imminent emergencies. New ways to meet human needs with low-MIPS technology and minimal toxic emissions should be designed and installed with highest priority instead. Just the total expected "repair"-costs following the BP Oil disaster in the Golf of Mexico (up to 100 billion $) would go a long way to develop the technology for decoupling the economy from the need for fossils as energy carriers.
NOTE IV: Rucksack and MIPS (the "material footprint") are the units for de-coupling technology from the use of nature.

(5)Factor 10
Earlier in this paper I said that I was convinced from the beginning of my efforts to establish a new kind of environmental protection policy, that it was important to identify a reasonable long term goal for increasing the productivity of natural resources. In 1990, my deductions let me to an average Factor 10 for the technology of western countries.
Since then, other factors have been suggested, in particular factor 4 or 5. Aren't these enough for approaching sustainability?
They are not.
Ernst Ulrich von Weizsäcker has introduced the discount factor 4 because he believed that my original "Factor 10" was too shocking for industry. He recently upped his factor to 5, because the number 4 brings bad luck according to Asian cultural history. Ernst himself says often that factor 10 is indeed needed in the long term.
Factor 10 (90%) less material resources in absolute terms for obtaining the same or even a better result seems extreme. However, the average rucksack of industrial products, is about 30 Kg pro Kg, without counting water. For information and communication technology [ICT] the input needs are roughly 10 – 20 times higher. In most cases, there is also need for additional material (and energy) input for putting the "service delivery machine" to use. And finally, entirely new approaches and ways will be invented in the future to satisfy human needs.
In 1990 I estimated that the global resource consumption would have to be cut in half, in order to have a chance for approaching sustainable economic conditions. This estimate was never disputed. At that time, and still today (2010), some 80% of the resources were claimed by only 20 % of the world population. Considering equity for a growing number of people, "Factor 10" seemed a reasonable average goal for western technology – and it still is.
In 2008 I suggested that the world-wide yearly per capita consumption should not exceed 6 - 8 tons by 2050, a goal that would allow developing countries to increase their current per capita resource consumption [15]. For Japan, 6 - 8 tons/capita-year would imply a Factor 6.6 - 5 dematerialization, for the USA about 15 – 11.
From a technical point of view, there is little that would prevent

reaching this goal. However, without proper encouragement for eco-innovation through deliberate government measures, industry will fail to deliver.
Increasing scarcities of natural resources should by themselves stimulate dematerialization efforts in industry. However, the initial reaction by industry to resource scarcity will most likely be the attempt to maintain supplies for established procedures and markets by developing "bigger machines, and bigger holes in the ground". This, of course, can be only a temporary solution on a limited planet, and constitutes exactly the opposite of protecting eco-systemic services and functions.

(6)Achieving a Suitable Economic Framework
The fourth condition I stated above for reaching sustainable conditions was that governments must act to adjust the price architecture and incentive structure on the market in such a way that eco-friendly decisions by producers and consumers became the more profitable options.
In other words, the human economy must be constrained to function within the limits of the environment and its resources and in such a way that it works with the grain of, rather than against, natural laws and processes. This is the key challenge for the techno-economic development of the next decades because with increasing consumption pressures we have no more time to waste [16].
The key driver for economic decision-making is the market price of goods and services. Henceforth the "ecological truth" must be reflected in the price architecture of the market, rewarding the production and use of goods and services with the highest resource productivity. A courageous tax shift is in order, lowering the cost of labor and increasing the costs of consuming natural resources. Emissions will fall as policies reduce extractions, but there is no guarantee that reducing emissions will reduce extractions, and the impacts associated with them, and may in fact increase them. Policies to reduce extractions will seek to increase resource productivity through all stages of production, and to reduce resource use in consumption.
Not only would resources become worth saving, but discarding waste would also be discouraged through the market, and labor would become less expensive, inviting the creation of new jobs. Moving in this direction requires the introduction of system policies.
In addition to tax shifts, there is a host of additional policy options to support the saving of natural resources: e.g. Favoring dematerialized goods and services in governmental purchasing; avoiding subsidies that lead to un-necessary investments in materials and land use; adjusting standards and norms; reviewing the freedom of moving and investing capital world-wide; restricting short term planning and profit taking; reviewing the environmental implications of personal property and property use rights.
On the international level, a process is needed to define and harmonize time paths of targets for the consumption of natural resources, measured in tons per capita (similar to the greenhouse gas reduction commitments that are being sought under the UN Framework Convention on Climate Change), and the use of land, measured in square meters.
Perhaps the best international policy approach would be to introduce internationally marketable permits for use of natural resources, with the number set to decline by 2050 to the per capita limit 6 -8 tons

per year, as mentioned above. The permits would be traded only between countries. Countries would be invited to join this system as soon as their resource use exceeded the average per person global allowance on the declining trajectory to 2050. The group of countries deciding in favor of participation in the system, will tax all import goods from non-participating countries to avoid distortions in international trade, provided that these countries have a use of raw materials per capita that is above the average of those countries in the system. The tax would also be applied to those countries that had failed to develop an adequate system for the measurement of resource use in their territory.
On the national level, countries would be free to choose their policy mix that is in line with the countries economic constitutions, cultural and trading conditions. But a central part of the policy mix should be the use of economic instruments in the tradition of the "economic- environmental tax reform". What is needed now is that some countries would volunteer for pioneering to implement this new policy framework. Those countries, no doubt, could gain enormous benefit by building the future model of sustainable society, thus attracting enormous public attention.
Such a scheme would doubtlessly need much elaboration to cope with the complexities of the real world. It will also be necessary, in parallel with the broad scheme of resource taxation and the trading of resource use permits, to maintain the local regulation of specific substances according to their hazardous properties.
In this way the resource and environmental policy framework would both regulate and reduce the macro-material impacts which are currently so threatening the future of humanity, while continuing to control the local environmental hazards of pollution.
NOTE V: Policies for stabilizing the relation between the economy and the ecosphere should be targeted on material mobilization and extractions, and not on emissions or residuals.
NOTE VI: Full cost prices of resources must be introduced, e.g. by cost-neutrally shifting taxes and levies from labor to natural resources, thus letting the market drive the competitive process of resource saving, and by curbing perverse subsidies.

(7)System Policies
Traditional policies have not been able to prevent the life-threatening deterioration of the eco-system services and functions. Neither have they been able to avoid the near collapse of the banking system. They are in principle not pre-cautionary because they are based on reacting to developments after they were recognized to be deleterious. Traditional policies tend to prevent, delay and increase the cost of solving problems that are not in the limelight of public attention. Traditional policies have thus given cause to enormous repair costs that can eventually far exceed the costs of changing course (Stern Report). Traditional policies are not capable of ascertaining sustainable conditions. Business as usual threatens the very survival of humans on earth. Nobody knows, how close we have already come to this. Recent studies show that cost of mitigation could be radically reduced if acted early on[17].
Future-oriented system-policies shall no longer focus preferentially - leave alone exclusively - on the solution of individual symptoms stemming from systemic problems. System policies are as essential for measures designed to protect the environment, as they are needed when attempting to seek improvements in pursuing social, economic and

institutional improvements.
For instance, calling for "growth" without simultaneous dematerialization of goods and services, increases the environmental crisis. It is doubtful, whether taxing profits from financial transactions alone will prevent the financial sector from rocking the world economy again by frivolous behavior of bank officials. Attempting to improve the employment situation by stimulating consumption has negative impacts on the stability of the ecosphere because of the commensurate increased consumption of natural resources and energy. Subsidizing the sale of Millions of new cars with billions of euros under condition of forcing the destruction of millions of tons of natural resource investments in existing vehicles is not only ecologically counterproductive, it is as well likely the wrong measure for economic reasons, not to speak of the fact that it prevents urgently needed investments in educational facilities.
System Policies aim to improve happiness, welfare and wellbeing of people by optimizing the efficiency and precautionary nature of measures through eliminating root causes of harmful developments, rather than separately repairing their symptoms, which regularly provokes the risk of delaying, increasing the costs of, and even preventing the solution of others. System policies reduce the risks associated with taking actions.
Recent research shows that system policies can rely solidly on the emergence of increasingly postmaterial values. Representative surveys in four key industrialized countries (Germany, Italy, France and USA) showed that there are four key consumer trends: Search for more transparency, willingness to gain control over ones' life, downshifting the search for value for money while welcoming an "Age of Less", and willingness to consume more consciously. These consumer trends underline the realistic chances of moving toward system policies.
System policies take into account that dematerialization is not the only pre-requisite for approaching sustainability. Excessive use of water and land are others, as well as introducing eco-toxic substances into nature.
System policies must reach beyond ecologically harmful developments, because continued happiness and wellbeing of people also depend on other factors. For instance, Denial of human rights can be the root cause for social instability. These rights include: access to healthy food, water and other natural resources; dignity; justice; gainful employment; health care and education; liberty; security; freedom of speech; and fair distribution of wealth and income (not necessarily in this order).
NOTE VII: Policies preventing harmful developments must become the norm because policies seeking to solve individual environmental, societal, economic, and institutional problems one at a time cannot lead to a sustained human economy.
NOTE VIII: The creation of centrally placed "System Policy Units" in government, administration, and industry is urgent. Their principal charter is to ascertain that each envisioned action is consistent with minimizing overall risks.
NOTE IX: The creation of a publicly accessible institution that generates, collects, verifies, reviews, and analyzes data and information related to the availability, mobilization and use of natural resources; an institution that supports training and education, eco-design, and the work of "System Policy". It reports regularly on the resource intensity of GDP, and the performance of important sectors of the economy, employing the indicators mentioned

below. Some experts believe that such an institution may eventually rival the importance of central banks.

(8)Global Responsibility

The weakening and destruction of the eco-systemic services and functions through present economic preferences is probably the most serious threat facing humankind. The way of life of the "rich" countries is not only the major cause of this situation, these nations are also the big winners of it in financial terms at this time, while at the same time people in all countries are exposed to the consequences – in some cases good, but mostly bad.

To me it is deeply worrying and discouraging that so many contemporary humans seem to have forgotten the horrors of the Hitler and Stalin time with its murderous disrespect for and lack of protecting the dignity of human beings, and their basic right to enjoy happy and healthy lives. Fortunately, only few concentration camps exist today. But man-made pollution, floods, desertification, lack of drinking water and shortages of food on all continents, triggered by the life style and the economic preferences of a minority of the world population, are now destroying the dignity and lives of hundreds of million human beings, and in particular that of children.

Just as a reminder:

Articles 1 – 3 of the Universal Declaration of Human Rights state:

„All human beings are born free and equal in dignity and rights ..... without distinction of any kind, such as ..... national or social origin,.....No distinction shall be made on the basis of the political, jurisdictional or international status of the country or territory to which a person belongs..... Everyone has the right to life, liberty and security of person. And Article 25 states:

„Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, ... All children.....shall enjoy the same social protection".

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Carnoules/Provence, August 2010